Retailers' Promotions: What Role Do They Play in Household Food Purchases by Degree of Food Access in Scotland?[1]

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Retailers' Promotions: What Role Do They Play in Household Food Purchases by Degree of Food Access in Scotland?[2]

1. Background

The links between non-communicable diseases (NCDs), such as heart disease and diabetes, and food consumption are now well established. Numerous studies have shown that, in combination with sedentary lifestyles and tobacco use, diets that contain excessive salt, sugar or fat are associated with higher risks of NCDs. These causes are expressed through the intermediate risk factors of raised blood pressure, raised glucose levels, abnormal blood lipids, overweight and obesity (WHO 2005). The effects of NCDs are well known and range from their impact on economic aspects (e.g. public budget and productive lives) to citizens' wellbeing.

A poor diet, fostered by a rapid increase in the supply of affordable and processed food, has been mentioned as one of the major contributors to obesity (Boyd et al. 2011). Associated to increases in affordability are the promotions used by retailers with such foods. Their impact is controversial because, on the one hand, retail promotions (e.g., price promotions, vouchers, in-store product placement, direct mail marketing and multiple-buy offers) have been pointed to as a key factor in expanding the expenditure on caloric-rich processed foods; and on the other hand, promotions are also used by retailers for selling fruit and vegetables. However, limited research has been undertaken in this area. Hawkes (2009) undertook an extensive, global review of English language research and trade literature on the influence of sales promotions on food consumption. She identified that between 1980 and 2008 there were no studies explicitly aimed at measuring the effects of sales promotions on the consumption of energy-dense, nutrient-poor foods, relative to more nutritious foods like fruit and vegetables. Moreover, Hawkes (2008) in reviewing literature on the dietary implications of supermarket development and their pricing and promotional strategies found that the implications are both positive and negative. They can make a more diverse diet available and accessible to more people, whilst in contrast they can reduce the ability of marginalised populations to purchase a high quality diet, and encourage the consumption of energy-dense, nutrient poor highly-processed foods. French (2003), in examining pricing effects on food choices, concluded that reducing prices on healthful products is a public health strategy that should be implemented through policy initiatives and industry collaborations.

According to Dobson (2011), retailers might use promotions to sell less-healthy food for a number of reasons such as: (1) to sell higher value-added products, e.g., selling

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processed foods high in fat and/or sugar rather than healthier unprocessed foods; (2) to encourage bulk buying by promoting storable processed foods and drinks high in fat and/or sugar aimed at large households with storage capacity; (3) to segment consumers, targeting price promotions at price-conscious 'tempted' consumers rather than health-conscious 'disciplined' consumers or (4) to encourage repeat purchases and store loyalty. Hawkes (2009) found that while sales promotions lead to significant sale increases over the short-term, this doesn't necessarily lead to changes in food consumption patterns. Nevertheless, she found that there is evidence from econometric modelling studies indicating that sales promotions can affect consumption patterns by influencing the purchasing choices of consumers and encouraging them to eat more.

At a UK level food promotion has recently (April 2015) become a political issue with the Consumer Association lodging a 'super complaint'[3] with the Competition and Markets Authority concerning misleading and opaque pricing policies that exaggerate discounts related to various forms of food promotion[4]. In Scotland the importance of food promotions in food purchase has been highlighted by on-going monitoring work by Food Standards Agency Scotland which indicates that in 2013 a higher proportion of high fat, high salt and high sugar foods were sold on promotion than the proportion of more healthy products (plain bread, plain starchy carbohydrates, oil rich fish, plain vegetables, plain fruit) sold on promotion (FSAS, 2014).

In Scotland, the focus of this article, the Scottish Government has long supported the improvement of diets with numerous plans and Scottish Dietary Targets were set as far back as 1996 in the Scottish Diet Action Plan (Scottish Government, 1996). The 1996 report on the Scottish Diet, "Scotland's Health – A Challenge to Us All", called the Scottish diet "particularly unhealthy". The study observed that "all ages are disadvantaged by a diet low in cereals, vegetables and fruit, and rich in confectionery, fat-enriched meat products, sweet and salty snacks, baked good and excessive amounts of sugary drink and alcohol" (The Scottish Office, 1996). Since 1996 the targets have been reframed, updated and recently renamed as Dietary Goals in the National Food and Drink Policy "Recipe for Success" (Scottish Government, 2009) recognising that they should be strategic in nature. 'Dietary Goals' describe, in nutritional terms, the diet that will improve and support the health of the Scottish population, indicate the direction of travel, and assist policy development to reduce the burden of obesity and diet-related disease. Furthermore, these targets or goals have been monitored since 2001. In 2013 the Dietary Goals were revised (Scottish Government, 2013).

[3] A 'super complaint' in UK law is one submitted by certain consumer bodies over issues that appear to 'significantly harm the interests of consumers'.

[4] "UK supermarket sector to face major grocery pricing probe by CMA", https://uk.finance.yahoo.com/news/uk-supermarket-sector-face-major-154100393.html (accessed 21/04/2015).

Part of the food retailing industry in Scotland has also sought to play a part in guiding food promotion towards healthy living with the Scottish Grocers Federation (SGF) Healthy Living Programme which was established in 2004 by the Scottish Government to encourage the sale of fruit and vegetables through convenience stores. In 2014 there were over 1400 stores that had joined the programme with the majority in low income areas. The programme provides advice, training and materials to help improve the presentation and promotion of fruit and vegetables (Scottish Government, 2014).

Despite the aforementioned work, Scotland has one of the worst overweight and obesity records within the OECD countries, with 68% of males and 62% of females being overweight or obese. These conditions are also prevalent in children where over 15% of boys and almost 13% of girls under the age of 16 are obese and 30% of children are overweight (Keenan et al. 2011, see also Scottish Government, 2010). Furthermore, while there have been some small improvements in population level dietary intakes, such as increases in fruit and vegetable consumption and small decreases in non-milk extrinsic sugars (NMES) and saturated fat, none of the targets set have been met (Barton et al. 2012; Scottish Government 2013). Recent evidence by the Food Standard Agency in Scotland (FSAS 2014) indicates that this situation is still prevalent and it is worse among the most deprived.

As pointed out by Dreze et al. (2004) in their study on the effect of promotions on consumer purchases, most of the studies on the topic have been based on a single or reduced number of products, instead of a basket of products (e.g., a diet). Thus, the purpose of this paper is to analyse the overall effect of promotions on consumers' food purchases in Scotland and to consider the implications of the findings for food and health policy. Moreover, the paper will also contribute to our understanding of the effect of retailers' promotions on consumers' purchases in the United Kingdom, where little evidence exists. Notable exceptions are the work by Yates (2008) and Dobson (2011).

The aforementioned goal is achieved by analysing a representative scanner panel dataset for Scotland which covers the period 2006-2013 and contains information at the household level about prices paid, whether it was purchased under promotion, the quantities purchased, as well as socioeconomic and demographic characteristics of the households concerned. In the context of this study we specify promotions as any form of temporary price reduction, various forms of quantity adjustment (larger sizes or greater quantities) and multi-buy arrangements. The period covered by the dataset is relevant for the analysis as it includes a recessionary period during which retailers were trying all types of promotions to maintain sales and households were becoming more price-conscious as they endeavoured to cope with difficult budgetary decisions when shopping.

The structure of the paper is as follows: it starts with a literature review on the effect of promotions on consumers' food choice and is followed by the empirical part of the paper, which comprises a description of the variables used for the analysis and a

description of the methods used. The next section presents and discusses the results. The final section presents some conclusions and consideration of their implications for policy development and further research.

2. Literature review: the effect of promotions on food choice

This section reviews recent literature on two topics. First, how promotions may influence consumers' food purchases and consumption, and second, trends in the use of promotions by retailers in the UK.

2.1. How food retail promotions affect consumers' purchases

The effect of retailers' promotions (as part of several other marketing tools) on food choice has been widely studied in the literature. Chandon and Wansink (2012), in a recent comprehensive review of the effect of food marketing on consumption of less-healthy foods, stated that contrary to previous beliefs that price promotions simply shifted sales across brands or across time, it has now become clear that temporary sales promotions can lead to a significant increase in consumption, Chandon and Wansink (2012, p.573). They cited, as the best example of this, a study by Ni Mhurchu et al. (2010) which consisted of a randomized controlled field experiment involving 1,104 shoppers. They found that a 12.5% temporary price discount on healthier foods increased the purchase volume of these foods by 11% among the low income consumers who received the price discount coupons. The effect was not temporary, as it persisted even 6 months after the promotion had ended. In comparison, nutrition education and suggestions for substituting healthier food for less healthy food had no effect (i.e., provision of information), whether alone or combined with the price discounts.

Ni Mhurchu et al. (2010) also found that discounts on healthy food did not reduce purchases of unhealthy food. This point seems to confirm the findings by Dreze et al. (2004), using a European panel dataset, which showed that promotions not only induce households to spend more, but also their effects vary across different product groups. For example, promotions on alcoholic products have greater expenditure effects than promotions on bakery goods. Furthermore, they also found that the increase in spending was not limited to the promoted category but pertained to the overall basket with spillover effects to other categories.

Another point made by Chandon and Wansink in their review is that price deals can influence the speed of consumption even when the food has already been purchased (for example by another family member). Although it would not necessarily influence consumption due to the fact that it is an irreversible sunk cost, studies such as Assunçao and Meyer (1993), Wansink (1996) and Chandon and Wansink (2002) found that people accelerate the consumption of products perceived to have been purchased at a lower price. This was explained by either the fact that people expected that the product would be discounted again in the future (Assunçao and Meyer 1993)

or because due to the low expenditure on the product, consumers feel they would not need to wait for a special occasion to consume it.

Another device used by retailers when marketing food is to reduce the relative price of food by offering quantity discounts with larger package sizes or multi-unit packs, which is a powerful driver of supersizing (Vermeer et al. 2010a). It has been found that quantity discounts generally led to stockpiling and increased consumption, especially for overweight consumers (Neslin et al. 2009; Vermeer et al. 2010b). Furthermore, Chandon and Wansink (2002) found that during weeks in which multi-unit packages were purchased, consumption of orange juice increased by 100% and cookies by 92%, but there was no change in consumption of non-edible products. The authors replicated this effect in a field experiment in which the quantity of food was randomly manipulated while keeping its price constant; they found that large purchase quantities increased consumption by making the food salient in the pantry or fridge, and not just by reducing its price. Manning and Sprott (2007) also found that multi-unit price promotions led to higher sales volume. Furthermore, they found that increasing the quantity specified in multi-unit price promotions (i.e., from '2 units for $2' to '8 units for $8') had a positive effect on sales volume. They explained the positive effect of multi-unit price promotions with the so-called 'anchoring effect' (i.e., multi-unit price promotions can stimulate consumers to think about the possibilities of using and stocking a quantity of the product higher than they usually would use and stock).

Chandon and Wansink (2012) pointed out that the payment mechanism used for the promotion may also influence energy intake. They cite a Mishra and Mishra (2011) study, which suggested that consumers prefer price discounts to bonus packs for guilt-inducing unhealthy foods, but preferred bonus packs to price discounts for healthy foods because it is easy to justify buying them in larger quantity.

Overall, the aforementioned evidence suggests that retailers' promotions in their different form have a positive impact on consumers' purchases and they can be used to increase the demand for both healthy and unhealthy products. The next section briefly reviews studies about promotions use in the UK.

2.2. Use of promotions on the retailing of food in the United Kingdom (UK)

To our knowledge there are no studies on the use of retailers' promotions specifically for Scotland. This is why we focus this section on the use of promotions in the UK. Moreover, as pointed out in Revoredo-Giha and Renwick (2012) retailers tend to operate a national policy in the UK, therefore the UK evidence could be considered valid for Scotland.

In a series of studies covering 2004 to 2008, the UK National Consumer Council (NCC) explored the use of promotions by retailers to market food products. Their method consisted of comparing promotions by supermarkets by means of a survey in a specific city (one per year). In 2008, the review was in Sheffield (Yates 2008) and they surveyed eight supermarkets. Supermarkets were rated based on the salt content

of supermarkets' own-brand foods, front and back-of-pack nutrition labelling, price promotions, prevalence of sweets at the checkout, and the information and advice that supermarkets make available.

NCC's results in 2008 showed 17% more in-store promotions than in 2006, and 83% more than in 2005. More importantly, 54% of in-store promotions in supermarkets advertised sugary and fatty foods. In addition, the results showed that the number of unhealthy food promotions had nearly doubled since 2006. They also found that price promotions accounted for over half of all spending on alcohol and soft drinks and they were also extensively used on ready meals, confectionery, snacks, meat, sauces, and yoghurts. In contrast, only one in eight promotions featured fruit and vegetables. Morrisons supermarket was reported as the one with the highest number of promotions for unhealthy foods (63% of the total number of promotions). In contrast, Sainsbury's was rated best out of eight retailers.

The snapshot produced by the NCC surveys was criticized by the British Retail Consortium (BRC) as misleading with unfair comparisons, containing inaccuracies and being a largely subjective assessment (Dobson 2011).

Additional information about the use of promotions in the UK comes from a recent UK Economic and Social Research Council (ESRC) sponsored project: 'The Impact of Retail Pricing on Overeating and Food Waste' (Dobson 2011). It studied price and nutrition data on goods sold in leading UK supermarkets and examined the (un)healthiness of products using the 'traffic lights' classification, which labels products according to the levels of fat, saturated fat, sugar and salt by low (green), medium (amber) and high (red). Four retailers were studied: Tesco, Sainsbury's, Ocado and Asda, and the project collected weekly price data over a full year (August 2010 to August 2011). In addition, the project used aggregated information from the Nielsen Homescan.

Great Britain (i.e., UK excluding Northern Ireland) data from the Nielsen Homescan on multiple retailers' groceries showed that in 2009 and 2010 the percentage of soft drinks bought under promotion was 48% and 52% of the total expenditure on the category. For confectionary those percentages were 40% and 45%, respectively (Dobson 2011). For the two aforementioned categories the most typical promotion was multi-buy promotions with 69% of the total expenditure on soft drinks made under promotion and 51% for confectionary.

The project also found a wide range of special promotions, differing by bundle size and discount amount. Purchases made under promotions were not on average unhealthier than non-offers, except for sugar levels. However, straight discounts were found on average to be more skewed towards unhealthy items, in contrast with multi-buys, which on average were more skewed towards healthier items. The "buy one and get one free" promotions were skewed towards red traffic lights (i.e., unhealthy). It concluded that price promotions are extensively used by all major retailers and for all product categories. On the positive side, supermarkets also carried offers on healthy products.

It is important to note that while observing the use of promotions at supermarkets provides an idea of the "supply" of promotions, it does not say anything about their incidence, i.e., whether consumers are being affected by the promotions, which requires either information of supermarket sales or consumers' purchases.

In Scotland, the available analyses of the retailing sector have been focused on assessing the existence of so-called food deserts (e.g., Cummins and Macintyre 2002) and the relationship between neighbourhood deprivation and the price and availability of food (e.g., Cummins et al. 2010). Furthermore, their analyses were on sampling stores collecting information on price and food availability. The contribution of this paper is in studying the effects of promotions on purchases of food categories by Scottish consumers and analysing whether they have a different effect for consumers living in areas with differing degrees of deprivation.

3. Empirical work

This section starts by presenting the data used in the analysis and the definition of created variables. It also provides an overview of the Scottish Index of Multiple Deprivation (SIMD) used to classify the sample households according to area of deprivation. It ends with a brief description of the methods used.

3.1. Data

The dataset used in the analysis was the Kantar Worldpanel dataset for Scotland (KWDS), which contains weekly purchasing data of food and drink purchases for consumption at home, covering the period 2006 to 2013. The panel is representative of the Scottish population and covers about 3,694 households, however not all of them are observed every year as it is a rotating panel dataset (Hsiao, 2003) and households remain in the sample for a maximum of three years.

Participating households are issued with a hand-held scanner with which they record every single item brought home. Till receipts are also used to provide information on prices and place of purchase. Formatted data gives therefore accurate quantity, expenditure and summary description information of every item purchased.

For each product in the dataset, information is available on a number of attributes such as brand, whether it is a private label, organic, fair-trade or animal friendly product. The dataset also contains information about prices paid, whether the price was affected by a promotion and the quantities purchased by the household.

In order to consider the influence of the environment surrounding the households, the KWDS was expanded by matching it with information from the Scottish Neighbourhood Statistics (SNS, 2014). This allowed the inclusion of information for each household about whether they live in a rural or urban area, the identity of the local authority, and the level of deprivation of the area where the household was located.

The KWDS provides information at the level of actual retail products and they can be aggregated into 2,460 categories. These categories were aggregated into ten broad categories approximately based on the categories used by Santarossa and Mainland (2002). These were dairy products, meat and fish, fats and eggs, sugar and preserves, fruits and vegetables, grains, sweet confectionary, beverages, soft drinks and juices and a numeraire category including all the other products (e.g., alcohol and non-food products). The aggregation was carried out so as to reach a compromise between product disaggregation and an adequate representation of the Scottish diet. Similarly, the data were aggregated into periods of 26 weeks.

For the analysis, the expenditure, price, and promotion of each category were computed. Category prices and promotions were computed using a weighted-average of the prices and promotions of the individual products in each category, following Dreze et al. (2004). The exact formulation of the weighted prices and promotion variables are as follows:

Category Expenditure $Y_{gt}^{(h)}$

$$Y_{gt}^{(h)} = \sum_{s=1}^{s} p_{st}.\, q_{st}^{(h)} \tag{1}$$

Category Price $P_{gt}^{(h)}$

$$P_{gt}^{(h)} = \sum_{s=1}^{s} p_{st}.\, w_{s}^{(h)} \tag{2}$$

Category Promotion $Pm_{gt}^{(h)}$

$$Pm_{gt}^{(h)} = \sum_{s=1}^{s} pm_{st}.\, w_{s}^{(h)} \tag{3}$$

Where:

pm_{st} = 1 if product s was on promotion at time t; 0 otherwise.

p_{st} = price of product s during time t.

$q_{st}^{(h)}$ = quantity of product s bought by household h at time t.

S = number of individual products in category g.

T = time from 1...T

The weights associated with product s, $w_{s}^{(h)}$, were calculated as follow:

$$W_s^{(h)} = \frac{\sum_{t=1}^{T} p_{st} q_{st}^{(h)}}{\sum_{t=1}^{T} \sum_{k=1}^{S} p_{kt} q_{kt}^{(h)}} \tag{4}$$

As T is the maximum period that a household is observed in the sample, which varies by households, these weights can be considered as long term weights. Table 1 presents descriptive statistics for the sample.

3.2. Approximating accessibility

The Scottish Index of Multiple Deprivation (SIMD) is the Scottish Government's official tool for identifying those places in Scotland suffering from deprivation. The SIMD is part of the Scottish Neighbourhood Statistics (SNS, 2014). It incorporates several different aspects of deprivation, combining them into a single index. It divides Scotland into 6,505 small areas, called datazones, each containing around 350 households. Each datazone has on average 800 people living in it. Because they are population-based, datazones can vary hugely in area. For example, in towns and cities where people live close together, datazones may contain only a few streets, while in rural areas that are sparsely populated, they may cover many square miles.

The index provides a relative ranking for each datazone, from 1 (most deprived) to 6,505 (least deprived). By identifying small areas where there are concentrations of multiple deprivation, the SIMD can be used to target policies and resources at the places with greatest need.

While the terms 'deprivation' and 'poverty' are sometimes used interchangeably, in the context of SIMD, deprivation is defined more widely as the range of problems that arise due to a lack of resources or opportunities, covering a number of aspects. The SIMD considers seven different aspects to produce the index, namely: employment, income, health, education, skills, and training, geographic access to services, crime and housing.

3.3. Methods

The methodology used, which follows Dreze et al. (2004), consisted of analysing two issues: first, assessing the effect of promotion on household expenditure (total and by category) and second, the effect of promotions on the expenditure allocation decision. Both analyses were carried out for the entire sample (Scotland) and by SIMD quintile.

Table 1. Descriptive statistics

Variable	Mean	St. Dev.	Minimum	Maximum
Prices (£)				
Dairy products	0.0864	0.0378	0.0005	0.3074
Meat and fish	0.1969	0.0690	0.0026	0.5318
Fats and eggs	0.0282	0.0159	0.0004	0.1383
Sugar and preserves	0.0081	0.0077	0.0001	0.1003
Fruits and vegetables	0.1394	0.0546	0.0063	0.5438
Grains	0.0909	0.0350	0.0014	0.3307
Sweet confectionary	0.1086	0.0532	0.0006	0.4669
Beverages	0.0200	0.0166	0.0001	0.3831
Soft drinks and juices	0.0414	0.0304	0.0001	0.3040
Numeraire category	0.2802	0.1098	0.0181	0.7706
Promotions 1/				
Dairy products	1.3622	2.1417	0.0000	24.1100
Meat and fish	0.6722	0.7187	0.0000	14.9700
Fats and eggs	0.8121	1.0956	0.0000	12.6500
Sugar and preserves	0.2639	0.5781	0.0000	13.3400
Fruits and vegetables	0.8199	0.8973	0.0000	24.8600
Grains	0.8830	1.0665	0.0000	18.3700
Sweet confectionary	0.6342	0.6807	0.0000	11.9600
Beverages	0.7116	1.0375	0.0000	19.7000
Soft drinks and juices	1.8052	2.4594	0.0000	23.7100
Numeraire category	0.5877	0.8305	0.0000	21.1000
Total expenditure (£) 2/	1,472.1	665.3	179.2	6,219.1

Source: Own elaboration based on Kantar Worldpanel data.
Notes: Sample size was 16,500 observations, corresponding to a total of 2,427 households. 1/ Promotions definition is given in equation (3). 2/ Six month average.

3.4. Analysis of household expenditure

A regression model was specified to assess the effect prices and promotions have on household expenditures ($X_t^{(h)}$):

$$\ln X_t^{(h)} = a_0 + \sum_{g=1}^{n} b_g \ln P_{gt}^{(h)} + \sum_{g=1}^{n} c_g Pm_{gt} + r_t^{(h)} \qquad (5)$$

where $r_t^{(h)} = H^{(h)} + u_t, u_t \sim i.i.d.\ N(0, \sigma_u^2)$ and for each product category g = 1,2,..,n, and $P_{gt}^{(h)}$, Pm_{gt} and $Z_l^{(h)}$ are the price and promotion; a_0, b_g, and c_g are the regression coefficients, and 'ln' denotes natural logarithm. We use a fixed-effects ($H^{(h)}$) specification to accommodate the unobserved heterogeneity across households.

In addition, a similar formulation to (5) was used to estimate the impact of prices and promotions on expenditures by category (6):

$$\ln X_{gt}^{(h)} = a'_0 + \sum_{g=1}^{n} b'_g \ln P_{gt}^{(h)} + \sum_{g=1}^{n} c'_g Pm_{gt} + d'_g \ln Y_t + r_t'^{(h)} \qquad (6)$$

Where a'_0, b'_g, c'_g and d'_g are the regression coefficients and $\ln Y_t$ is logarithm of the total expenditure.

3.5. Expenditure allocation decision

The linear version of the almost ideal demand system (AIDS) model (Deaton and Muellbauer 1980) was used to analyse the impact of promotions on expenditure allocation:

$$w_{gt}^{(h)} = \alpha_g + \sum_{j=1}^{n} \beta_{gj} \ln P_{jt}^{(h)} + \theta_g \ln\left(\frac{X_t^{(h)}}{\overline{P}_t^{(h)}}\right) + \sum_{j=1}^{n} \delta_{gj} Pm_{jt}^{(h)} + \pi_g^{(h)} + \varepsilon_{gt}^{(h)} \qquad (7)$$

where $w_{gt}^{(h)}$ is the expenditure share allocated to category g by household h, $P_{jt}^{(h)}$ are the prices encountered by household h for each of the n groups (j=1..n), $X_t^{(h)}$ is the expenditure of household h and $\overline{P}_t^{(h)}$ is a price index.

To accommodate the unobserved heterogeneity across households, a fixed-effects specification $\pi_g^{(h)}$was used. Furthermore, the price index $\overline{P}_t^{(h)}$ was approximated by the Stone price index (i.e. $\ln \sum_{g=1}^{n} w_{gt}^{(h)} \ln P_{gt}$), making the budget share equation to be linear in the parameters. The system (7) was estimated by iterative seemingly unrelated regressions and imposing constraints related to adding up, homogeneity and symmetry.

The estimated parameters of the AIDS model were then used to compute the different types of elasticities. The expenditure elasticity (E_g) of product category g evaluated at the given budget share w_g is given by:

$$E_g = 1 + \frac{\theta_g}{w_g} \qquad (8)$$

The Marshallians own and cross price elasticity of demand for product category g is given by:

$$e_{gj} = \frac{\beta_{gj}}{w_g} - \frac{\theta_g w_j}{w_g} - \delta gj \qquad (9)$$

Where δ_{gj} is the Kronecker delta that takes the value of 0 when g=j and 1 otherwise. The promotion elasticities were computed based on Zheng and Kaiser (2008). They are given by (10):

$$e_{gj} = \frac{\delta_{gj} Pm_g}{w_g} \quad (10)$$

4. Results and discussion

This section presents and discusses the results of the analysis starting with the assessment of the effect of promotion on household expenditure. This is followed by the analysis of whether promotions affect the allocation of total expenditure across the 10 food categories at the level of Scotland and by SIMD quintile.

4.1. Effects on household expenditure

Table 2 presents the regressions of total expenditure on prices and promotions for the entire sample (Scotland) and by SIMD quintile. The results are very similar between Scotland and each quintile. In the top half of the table all of the values show that increases in prices have a positive effect on the total amount spent by the households and most of the coefficients are statistically significant. The results indicate that the underlying demand price elasticities are lower than unity and consumers do not change their basket of food purchases much due to price changes.

The results in the lower part of Table 2 indicate that promotions have a positive effect on the total expenditure of the households and this is also observed in all of the SIMD quintiles. On the positive side, all the quintiles respond positively to promotions on fruits and vegetables, however, the response in the first quintile (living in the most deprived areas) is smaller than the fifth quintile (least deprived). On the potentially negative side, a similar positive effect of promotions is found for soft drinks and juices and fats and eggs.

It should be noted that there are some further notable differences among the quintiles. For instance, total expenditure for the first quintile (most deprived areas) seemed almost unaffected by promotions applied to sugar and preserves and sweet confectionary. In contrast, for sweet confectionary, small but larger responses are observed for the other, less deprived, quintiles. Moreover, those outside the first quintile were more responsive to meat promotions than those in the most deprived areas, with those living in the least deprived areas being most responsive.

Table 3 presents the findings on the effect that promotions have on total expenditure by category. As the results by quintile were similar to those for Scotland, we present only those for Scotland. The results by quintile are available from the authors upon request.

As shown in the table, increases in the price of each category raise the expenditure on the category. The expenditure elasticities (on the primary diagonal) fluctuate from 0.10 for the numeraire category to 0.69 for soft drinks and juices. Note that the closer the expenditure elasticity with respect to its own price is to 1, the more price inelastic is the demand for the product. The elasticities for sugar and preserves (0.62) and meat and fish (0.52) were also relatively close to soft drinks and juices (0.69). Dairy, fruits and vegetable and grains show much lower values (0.27, 0.38, and 0.36, respectively). The relatively high values for meat and fish, sugar and preserves, beverages and soft drinks and juices indicate that it may be relatively difficult to shift consumers from these components of their consumption pattern.

Table 3 also shows in the lower half that promotions have a positive effect on expenditure by category. This was found for all the categories. In this respect, there was no difference between the aggregated results and those for each one of the SIMD quintiles; not even for the first quintile (most deprived), which was the one that showed no effect of promotions on meat and fish, sugar and preserves and sweet confectionary on the total expenditure. The results indicate that sweet confectionery (0.10) (i.e. a 10% rise in expenditure in response to promotion), bevereages (0.09) and sugar and preserves (0.08) are the highest responders to promotional activity.

Table 2. Results of estimation of total expenditure equation (equation 5) - Scotland and SIMD quintile

Variables	Equations																	
	Scotland			1st quintile			2nd quintile			3rd quintile			4th quintile			5th quintile		
	Coef.	St. Dev.	Sig.	Coef.	St. Dev.	Sig.	Coef.	St. Dev.	Sig.	Coef.	St. Dev.	Sig.	Coef.	St. Dev.	Sig.	Coef.	St. Dev.	Sig.
Intercept	0.0202	0.0045	*	0.0111	0.0116		-0.0003	0.0099		0.0404	0.0097	*	0.0178	0.0092		0.0290	0.0102	*
Prices 1/																		
Dairy products	0.0778	0.0063	*	0.0950	0.0164	*	0.0654	0.0134	*	0.0715	0.0131	*	0.0697	0.0142	*	0.0957	0.0132	*
Meat and fish	0.2253	0.0081	*	0.2309	0.0205	*	0.2219	0.0158	*	0.2321	0.0193	*	0.2371	0.0152	*	0.1924	0.0192	*
Fats and eggs	0.0272	0.0040	*	0.0354	0.0097	*	0.0325	0.0089	*	0.0126	0.0097		0.0317	0.0076	*	0.0283	0.0083	*
Sugar and preserves	0.0135	0.0021	*	0.0214	0.0051	*	0.0199	0.0041	*	0.0059	0.0052		0.0087	0.0045		0.0135	0.0044	*
Fruits and vegetables	0.1094	0.0072	*	0.1228	0.0174	*	0.1313	0.0156	*	0.0958	0.0157	*	0.0904	0.0150	*	0.1072	0.0167	*
Grains	0.0943	0.0061	*	0.0698	0.0153	*	0.0613	0.0144	*	0.1162	0.0150	*	0.0987	0.0115	*	0.1051	0.0127	*
Sweet confectionary	0.0601	0.0037	*	0.0655	0.0095	*	0.0679	0.0077	*	0.0406	0.0084	*	0.0646	0.0073	*	0.0668	0.0080	*
Beverages	0.0203	0.0027	*	0.0186	0.0061	*	0.0157	0.0054	*	0.0239	0.0060	*	0.0209	0.0059	*	0.0188	0.0061	*
Soft drinks and juices	0.0431	0.0039	*	0.0409	0.0094	*	0.0436	0.0103	*	0.0362	0.0080	*	0.0492	0.0076	*	0.0443	0.0082	*
Numeraire category	0.0564	0.0026	*	0.0564	0.0066	*	0.0514	0.0056	*	0.0605	0.0058	*	0.0657	0.0055	*	0.0475	0.0051	*
Promotions 1/																		
Dairy products	0.0036	0.0007	*	0.0048	0.0015	*	0.0059	0.0019	*	0.0073	0.0017	*	-0.0024	0.0018		0.0013	0.0015	
Meat and fish	0.0265	0.0036	*	0.0127	0.0102		0.0277	0.0063	*	0.0255	0.0058	*	0.0250	0.0059	*	0.0394	0.0092	*
Fats and eggs	0.0124	0.0016	*	0.0117	0.0044	*	0.0087	0.0031	*	0.0149	0.0029	*	0.0142	0.0031	*	0.0115	0.0040	*
Sugar and preserves	0.0049	0.0027		0.0063	0.0057		-0.0047	0.0053		0.0022	0.0054		0.0128	0.0054	*	0.0090	0.0071	
Fruits and vegetables	0.0199	0.0027	*	0.0195	0.0047	*	0.0066	0.0030	*	0.0461	0.0076	*	0.0129	0.0061	*	0.0371	0.0060	*
Grains	0.0121	0.0018	*	0.0165	0.0049	*	0.0150	0.0032	*	0.0146	0.0041	*	0.0149	0.0036	*	0.0047	0.0028	
Sweet confectionary	0.0261	0.0032	*	0.0063	0.0096		0.0253	0.0048	*	0.0318	0.0069	*	0.0351	0.0066	*	0.0263	0.0062	*
Beverages	0.0114	0.0016	*	0.0101	0.0044	*	0.0120	0.0027	*	0.0086	0.0035	*	0.0163	0.0038	*	0.0127	0.0038	*
Soft drinks and juices	0.0135	0.0009	*	0.0175	0.0022	*	0.0119	0.0017	*	0.0136	0.0020	*	0.0128	0.0019	*	0.0116	0.0018	*
Numeraire category	0.0252	0.0054	*	0.0452	0.0087	*	0.0427	0.0064	*	0.0479	0.0071	*	0.0110	0.0038	*	0.0337	0.0116	*
Trend	0.0013	0.0012		0.0040	0.0030		0.0067	0.0025	*	-0.0054	0.0024	*	0.0024	0.0024		-0.0003	0.0026	
Squared trend	-0.0003	0.0001	*	-0.0005	0.0002	*	-0.0006	0.0001	*	0.0001	0.0001		-0.0004	0.0001	*	-0.0003	0.0001	
Adj. R^2	0.40			0.41			0.41			0.41			0.41			0.40		
Obs.	16,500			2,518			3,494			3,540			3,582			3,366		

Source: Own elaboration based on Kantar Worldpanel data.

Notes: 1/ Prices are in logarithms, while promotions are as in equation (3). (*) stands for statistically significant at 5 percent.

Table 3. Results of estimation of expenditure by category equations (equation 6) - Scotland

Variables	Equations																					
	Dairy products		Meat and fish		Fats and eggs		Sugar and preserves		Fruit and vegetables		Grains		Sweet confectionery		Beverages		Soft drinks and juices		Numeraire category	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-0.0113		0.0093		-0.0928	*	0.0040		0.0221	*	0.0052		-0.0126		-0.0254	*	0.0786	*	0.0085	
Prices 1/																				
Dairy products	0.2699	*	-0.0420	*	0.0110		-0.0400	*	-0.0164	*	-0.0130		-0.0339	*	-0.0455	*	-0.0210		-0.0172	*
Meat and fish	-0.0799	*	0.5248	*	-0.0234		-0.1029	*	-0.0463	*	-0.0898	*	-0.0592	*	-0.0937	*	-0.1460	*	-0.1325	*
Fats and eggs	-0.0040		-0.0236	*	0.3095	*	0.0326	*	-0.0088		0.0049		0.0044		0.0275	*	-0.0337	*	-0.0041	
Sugar and preserves	0.0011		-0.0097	*	0.0152	*	0.6174	*	-0.0004		0.0014		0.0015		-0.0036		-0.0167	*	-0.0058	*
Fruits and vegetables	-0.0445	*	-0.0945	*	-0.0514	*	-0.0854	*	0.3849	*	-0.0788	*	-0.0355	*	-0.0685	*	-0.0789	*	-0.0563	*
Grains	-0.0311	*	-0.0763	*	-0.0986	*	-0.1200	*	-0.0581	*	0.3596	*	0.0133		-0.0331	*	-0.0178		-0.0080	
Sweet confectionary	-0.0368	*	-0.0515	*	-0.0200	*	0.0234	*	-0.0509	*	-0.0424	*	0.3092	*	-0.0112		-0.0436	*	-0.0005	
Beverages	-0.0153	*	-0.0191	*	-0.0123	*	0.0013		-0.0027		-0.0081	*	-0.0132	*	0.6052	*	-0.0152	*	-0.0025	
Soft drinks and juices	-0.0249	*	-0.0274	*	-0.0074		-0.0303	*	-0.0183	*	-0.0177	*	0.0084		-0.0194	*	0.6929	*	-0.0069	
Numeraire category	-0.0303	*	-0.0377	*	-0.0379	*	-0.0322	*	-0.0386	*	-0.0357	*	-0.0252	*	-0.0297	*	-0.0252	*	0.1020	*
Total expenditure	0.8625	*	1.0019	*	0.8271	*	0.6966	*	0.9103	*	0.8646	*	0.9142	*	0.7021	*	0.9535	*	1.1735	*
Promotions 1/																				
Dairy products	0.0165	*	-0.0021	*	0.0020		0.0027		-0.0001		0.0011		-0.0030	*	0.0057	*	-0.0038	*	-0.0031	*
Meat and fish	-0.0032		0.0476	*	-0.0083		-0.0040		-0.0012		-0.0068	*	-0.0225	*	0.0051		-0.0249	*	-0.0155	*
Fats and eggs	0.0024		-0.0001		0.0425	*	0.0117	*	-0.0002		0.0028		0.0023		0.0039		-0.0106	*	-0.0086	*
Sugar and preserves	-0.0062		0.0051		0.0107	*	0.0763	*	-0.0056		-0.0128	*	-0.0040		0.0068		0.0038		-0.0002	
Fruits and vegetables	0.0066	*	-0.0034		-0.0031		-0.0020		0.0457	*	0.0023		-0.0170	*	0.0063		-0.0124	*	-0.0115	*
Grains	0.0023		-0.0042	*	0.0058	*	0.0035		0.0019		0.0324	*	-0.0034		-0.0034		-0.0147	*	-0.0079	*
Sweet confectionary	-0.0035		-0.0252	*	-0.0070		0.0094		-0.0064		-0.0002		0.0990	*	-0.0088		-0.0177	*	-0.0168	*
Beverages	0.0042	*	-0.0008		0.0031		0.0070		0.0031		0.0035		-0.0075	*	0.0899	*	-0.0045		-0.0058	*
Soft drinks and juices	-0.0021		-0.0010		0.0003		-0.0029		-0.0026		-0.0004		0.0004		-0.0012		0.0546	*	-0.0029	*
Numeraire category	-0.0143	*	-0.0122	*	-0.0022		-0.0150	*	-0.0158	*	-0.0117	*	-0.0161	*	-0.0054		-0.0307	*	0.0285	*
Trend	0.0113	*	-0.0002		0.0229	*	-0.0028		-0.0107	*	0.0015		0.0020		0.0010		-0.0100	*	-0.0004	
Squared trend	-0.0009	*	-0.0001		-0.0011	*	0.0002		0.0007	*	-0.0002	*	-0.0001		0.0002		0.0001		0.0000	
Adj. R^2	0.43		0.65		0.39		0.50		0.59		0.56		0.54		0.48		0.50		0.68	
Obs.	16,500		16,500		16,500		16,500		16,500		16,500		16,500		16,500		16,500		16,500	

Source: Own elaboration based on Kantar Worldpanel data.

Notes: 1/ Prices and expenditure are in logarithms, while promotions are as in equation (3). (*) stands for statistically significant at 5 percent.

4.2. Effects on allocation

The results of the augmented AIDS model for Scotland and their corresponding elasticities are presented in Tables 4 and 5. The estimates of the AIDS model by SIMD quintile are not reported here but they are available from the authors upon request. The price and expenditure elasticities for Scotland are close to those estimated by Santarossa and Mainland (2002), which show that all the food price elasticities are inelastic and the expenditure elasticities are around one.

Although, the results from the AIDS models are interesting, it is easier to get insights from the results once they have been transformed into demand elasticities (price, promotion and expenditures). Hicksian elasticities for Scotland and by quintile were computed but are not presented in the article; however, they are also available from the authors upon request. Table A1 to A6 in the annex present the full set of elasticities by SIMD quintile.

Figures 1, 2 and 4 help the comparison of the own-price, own-promotion and expenditure elasticities for Scotland and by quintile. Figure 1 shows that all the price elasticities are inelastic and their range fluctuates between -0.5 and -0.8 (excluding the numeraire category). In addition, there are no significant differences between the different quintiles. The most inelastic groups are sugar and preserves together with beverages, while dairy products, fats and eggs and sweet confectionery show higher elasticities.

As regards promotions, as shown in tables A1 to A6, these seem to have effects only on the category where they are applied, i.e. we do not observe strong cross category effects. This might be partly due to the fact that one of the categories that seems to have these sort of effects, namely alcoholic beverages, is included in the numeraire category (e.g., for instance, Dreze (2004) reports that promotions on alcohol are associated with increases in the demand for bakery products).

Figure 2 shows differences in the effectiveness of promotions on affecting the quantity demanded by category, although the value of the elasticities is relatively small. Thus, sweet confectionary, beverages and soft drinks and juices have higher elasticities than the other categories and the differences are not substantive by SIMD quintile (except the purchases of beverages by the 2nd quintile). It is interesting to note that the 1st quintile (most deprived) reacts less to promotions of fruits and vegetables than the other quintiles, which seems to coincide with the observation that this group is the one with the lowest progress on the consumption of fruits and vegetables (FSAS, 2014).

Despite the generally small size of the promotion elasticities, an increasing proportion of food for most of the categories is being sold using them, as is shown by Figure 3. The widespread increase in the growth of promotion-related sales is readily apparent across the food categories with most recording 35-45% of sales expenditure through product sold under promotion in 2013. Of particular importance are the increases in promotion-related sales of soft drinks and juices as well as sweet confectionary as

they are associated to the consumption of NMES, which affects families with children as shown in Revoredo-Giha and Akaichi (2014).

Figure 4 shows that with very few exceptions most of the expenditure elasticities are around unity. The highest expenditure elasticities are observed for soft drink and juices, which are between 1 and 1.2 and the lowest for beverages (between 0.5 and 0.8). The differences between quintiles are not major except for the 5th quintile (least deprived) for soft drinks and juices and beverages, for which the figure shows a higher expenditure elasticity than for the other quintiles. These elasticities do not indicate important substitutions as a result of an increase of income translated into greater expenditure; or in other words, one would not expect that changes in income would affect significantly the quality of the diet.

The results in terms of allocations of expenditure provide a picture that seems to indicate that typical economic measures such as taxes might not have a strong impact on the diet due to the inelasticity of demand to changes in prices. Furthermore, changes in income (translated into expenditure) might not alter the composition of the diet by increasing the purchases of some categories over others. Nevertheless, promotions seem to have differentiated effects by category and it would be advisable to keep those on unhealthy products, such as sugary soft drinks, controlled as they seem to affect the demand.

Table 4. Results of estimation of augmented-with-promotions AIDS model - Scotland

Variables	Share equations																			
	Dairy products		Meat and fish		Fats and eggs		Sugar and preserves		Fruit and vegetables		Grains		Sweet confectionery		Beverages		Soft drinks and juices		Numeraire category	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.0854	*	0.1980	*	0.0246	*	0.0084	*	0.1440	*	0.0909	*	0.1054	*	0.0190	*	0.0421	*	0.2821	*
Prices 1/																				
Dairy products	0.0193	*	-0.0087	*	0.0004		-0.0002		-0.0030	*	-0.0006		-0.0029	*	-0.0004		-0.0012	*	-0.0025	*
Meat and fish	-0.0087	*	0.0662	*	-0.0019	*	-0.0013	*	-0.0160	*	-0.0113	*	-0.0090	*	-0.0027	*	-0.0062	*	-0.0090	*
Fats and eggs	0.0004		-0.0019	*	0.0065	*	0.0003	*	-0.0014	*	-0.0011	*	-0.0009	*	0.0001		-0.0005		-0.0016	*
Sugar and preserves	-0.0002		-0.0013	*	0.0003	*	0.0033	*	-0.0007	*	-0.0007	*	0.0004	*	0.0000		-0.0004	*	-0.0007	*
Fruits and vegetables	-0.0030	*	-0.0160	*	-0.0014	*	-0.0007	*	0.0422	*	-0.0062	*	-0.0068	*	-0.0005		-0.0030	*	-0.0047	*
Grains	-0.0006		-0.0113	*	-0.0011	*	-0.0007	*	-0.0062	*	0.0270	*	-0.0026	*	-0.0002		-0.0013	*	-0.0030	*
Sweet confectionary	-0.0029	*	-0.0090	*	-0.0009	*	0.0004	*	-0.0068	*	-0.0026	*	0.0253	*	-0.0009	*	-0.0012	*	-0.0014	
Beverages	-0.0004		-0.0027	*	0.0001		0.0000		-0.0005		-0.0002		-0.0009	*	0.0074	*	-0.0005		-0.0024	*
Soft drinks and juices	-0.0012	*	-0.0062	*	-0.0005		-0.0004	*	-0.0030	*	-0.0013	*	-0.0012	*	-0.0005		0.0138	*	0.0007	
Numeraire category	-0.0025	*	-0.0090	*	-0.0016	*	-0.0007	*	-0.0047	*	-0.0030	*	-0.0014		-0.0024	*	0.0007		0.0247	*
Total expenditure	0.0006		-0.0034		-0.0013		-0.0013	*	0.0052		0.0013		0.0048		-0.0067	*	0.0073	*	-0.0065	
Promotions 1/																				
Dairy products	0.0012	*	-0.0003		0.0001		0.0000		-0.0001		0.0000		-0.0003		0.0002		-0.0001		-0.0007	
Meat and fish	-0.0002		0.0080	*	-0.0003		-0.0002		-0.0006		-0.0008		-0.0024	*	-0.0003		-0.0006		-0.0027	
Fats and eggs	0.0000		0.0002		0.0010	*	0.0000		-0.0001		-0.0001		0.0003		-0.0002		-0.0003		-0.0009	
Sugar and preserves	0.0000		0.0001		0.0000		0.0005	*	-0.0005		-0.0001		-0.0006		-0.0002		0.0007		0.0002	
Fruits and vegetables	0.0003		-0.0006		0.0000		-0.0001		0.0060	*	0.0001		-0.0024	*	-0.0002		-0.0005		-0.0026	
Grains	0.0002		-0.0009		0.0001		0.0001		0.0001		0.0027	*	-0.0003		0.0000		-0.0006	*	-0.0012	
Sweet confectionary	-0.0001		-0.0038	*	-0.0004		-0.0001		-0.0020	*	-0.0005		0.0092	*	-0.0006	*	0.0003		-0.0021	
Beverages	0.0003		-0.0002		-0.0001		0.0000		0.0002		0.0000		-0.0010		0.0016	*	0.0000		-0.0007	
Soft drinks and juices	-0.0005	*	-0.0002		-0.0001		0.0000		-0.0006	*	-0.0002		-0.0002		0.0000		0.0019	*	0.0000	
Numeraire category	-0.0012	*	-0.0022	*	-0.0003		-0.0002	*	-0.0024	*	-0.0010	*	-0.0023	*	-0.0004		-0.0007		0.0107	*
Trend	0.0011	*	-0.0002		0.0008	*	-0.0002	*	-0.0029	*	-0.0002		0.0006		0.0000		-0.0002		0.0011	
Squared trend	-0.0001	*	0.0000		0.0000	*	0.0000	*	0.0002	*	0.0000		0.0000		0.0000		0.0000		-0.0001	
Log-Likelihood	321,370																			
Obs.	16,500																			

Source: Own elaboration based on Kantar Worldpanel data.

Notes: 1/ Prices are in logarithms, while promotions are as in equation (3). (*) stands for statistically significant at 5 percent.

Table 5. Demand elasticities by category - Scotland

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.778 *	-0.102 *	0.004	-0.003	-0.036 *	-0.007	-0.035 *	-0.005	-0.015	-0.031 *
Meat and fish	-0.043 *	-0.660 *	-0.009 *	-0.006 *	-0.079 *	-0.056 *	-0.044 *	-0.013 *	-0.031 *	-0.041 *
Fats and eggs	0.018	-0.059 *	-0.767 *	0.011	-0.041	-0.033	-0.027	0.003	-0.015	-0.043 *
Sugar and preserves	-0.013	-0.130 *	0.043 *	-0.585 *	-0.062	-0.073 *	0.065 *	0.009	-0.048	-0.047 *
Fruits and vegetables	-0.025 *	-0.122 *	-0.011 *	-0.005 *	-0.702 *	-0.048 *	-0.052 *	-0.004	-0.023 *	-0.044 *
Grains	-0.008	-0.128 *	-0.012 *	-0.008 *	-0.069 *	-0.705 *	-0.030 *	-0.002	-0.015	-0.037 *
Sweet confectionary	-0.031 *	-0.092 *	-0.009 *	0.003	-0.068 *	-0.028 *	-0.772 *	-0.009 *	-0.013	-0.026 *
Beverages	0.009	-0.071	0.013	0.005	0.023	0.021	-0.007	-0.623 *	-0.012	-0.026
Soft drinks and juices	-0.045 *	-0.184 *	-0.017	-0.012 *	-0.098 *	-0.048 *	-0.049 *	-0.016	-0.674 *	-0.033 *
Numeraire category	-0.007	-0.027 *	-0.005 *	-0.002 *	-0.013 *	-0.009 *	-0.003	-0.008 *	0.003	-0.905 *
Promotion elasticities										
Dairy products	0.020 *	-0.002	0.000	0.000	0.003	0.002	-0.001	0.002	-0.010	-0.008
Meat and fish	-0.002	0.027 *	0.001	0.000	-0.003	-0.004	-0.012 *	-0.001	-0.002	-0.007 *
Fats and eggs	0.004	-0.007	0.030 *	0.000	-0.001	0.002	-0.010	-0.003	-0.004	-0.006
Sugar and preserves	0.001	-0.013	0.004	0.016 *	-0.012	0.006	-0.004	-0.002	-0.007	-0.015
Fruits and vegetables	-0.001	-0.003	-0.001	-0.001	0.035 *	0.000	-0.009	0.001	-0.008	-0.010 *
Grains	0.000	-0.006	-0.001	0.000	0.001	0.026 *	-0.003	0.000	-0.005	-0.006
Sweet confectionary	-0.004	-0.015 *	0.002	-0.001	-0.018 *	-0.002	0.054 *	-0.006	-0.003	-0.013 *
Beverages	0.010	-0.009	-0.006	-0.002	-0.006	-0.001	-0.018	0.056 *	-0.002	-0.011
Soft drinks and juices	-0.003	-0.010	-0.006	0.005	-0.010	-0.014	0.004	-0.001	0.085 *	-0.010
Numeraire category	-0.003	-0.006	-0.002	0.000	-0.008	-0.004	-0.005	-0.002	0.000	0.022 *

Source: Own elaboration based on Kantar Worldpanel data.
Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

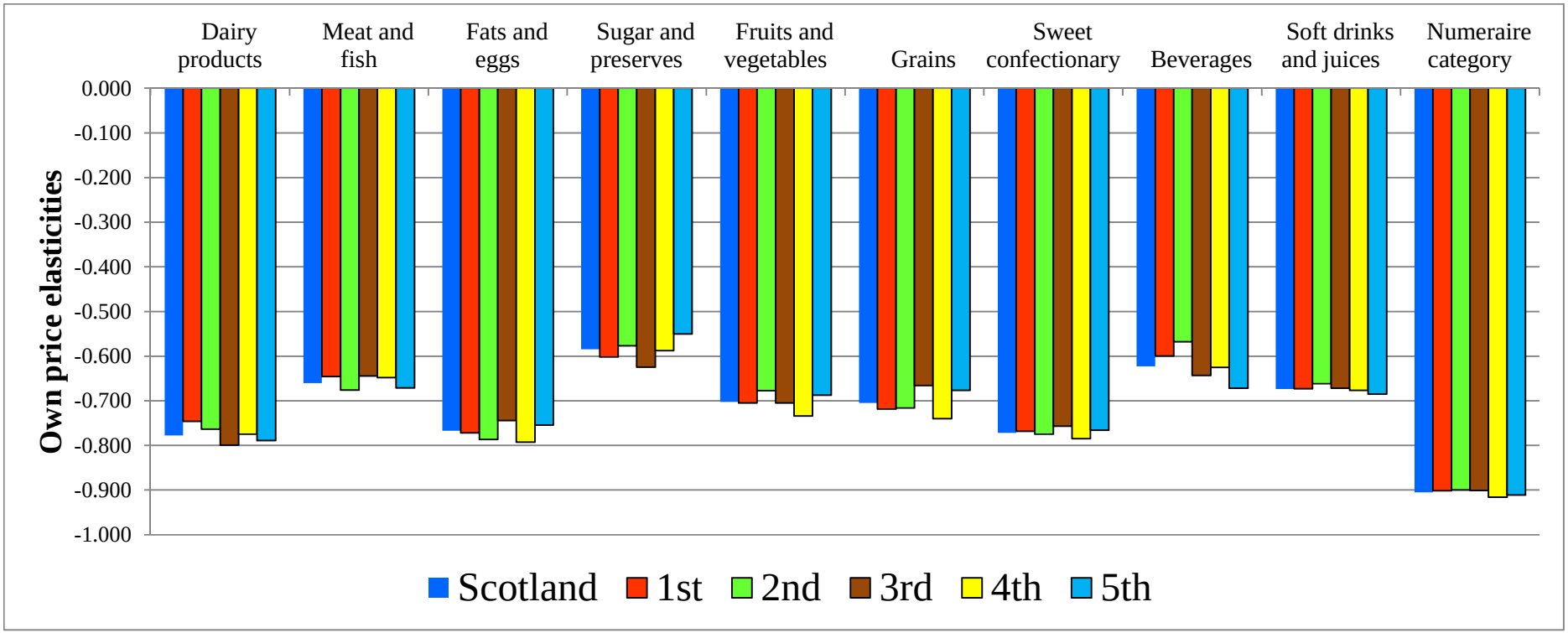

Figure 1. Own Price Elasticities by SIMD Quintile and Category
Source: Own elaboration based on Kantar Worldpanel data.

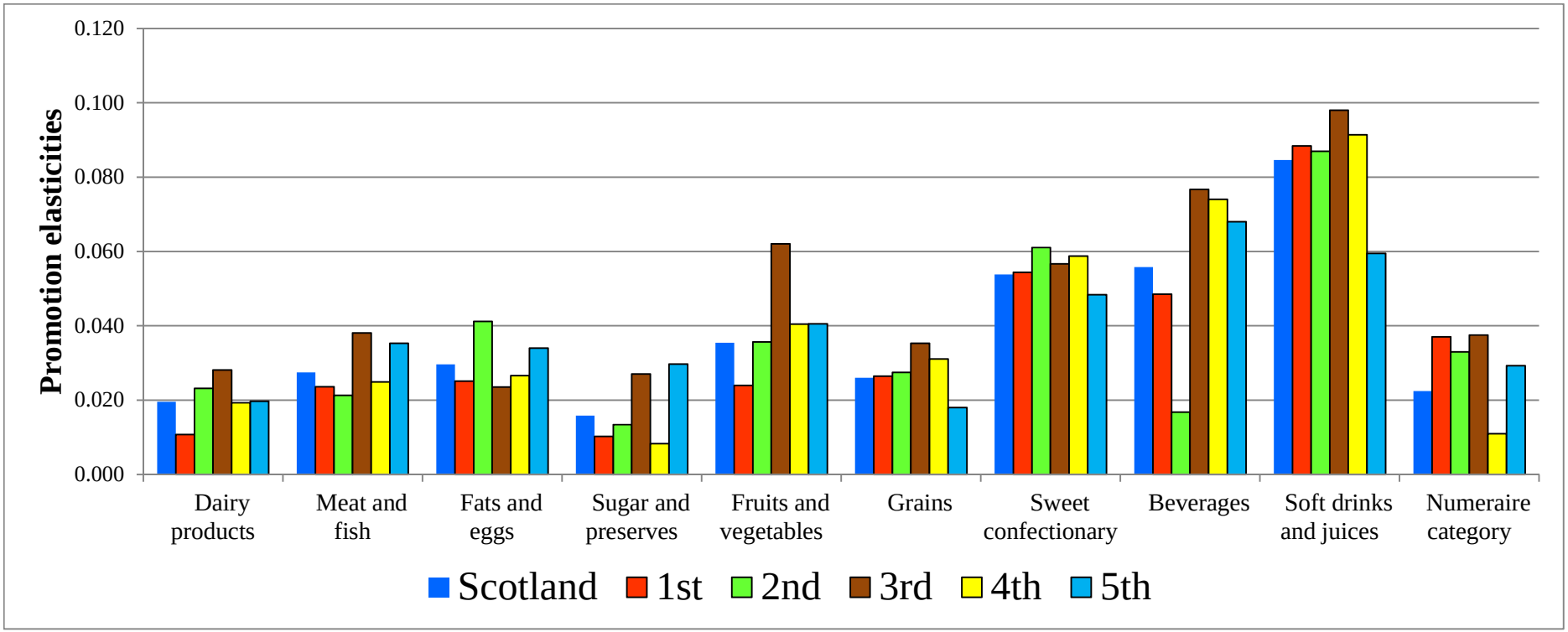

Figure 2. Own Promotion Elasticities by SIMD Quintile and Category
Source: Own elaboration based on Kantar Worldpanel data.

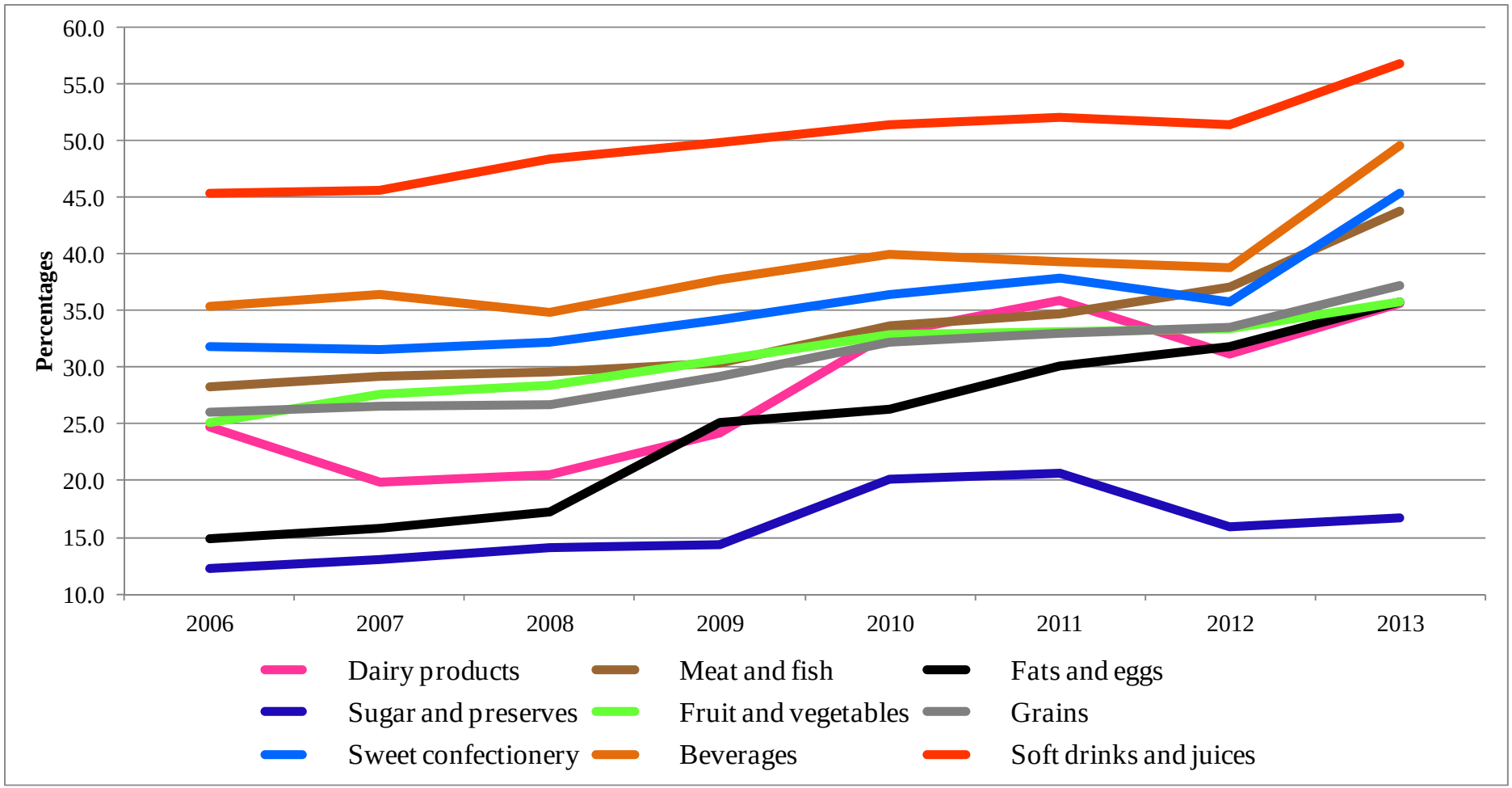

Figure 3. Expenditure Shares of Food Sold under Promotions by Category: Scotland 2006-2010
Source: Own elaboration based on Kantar Worldpanel data.

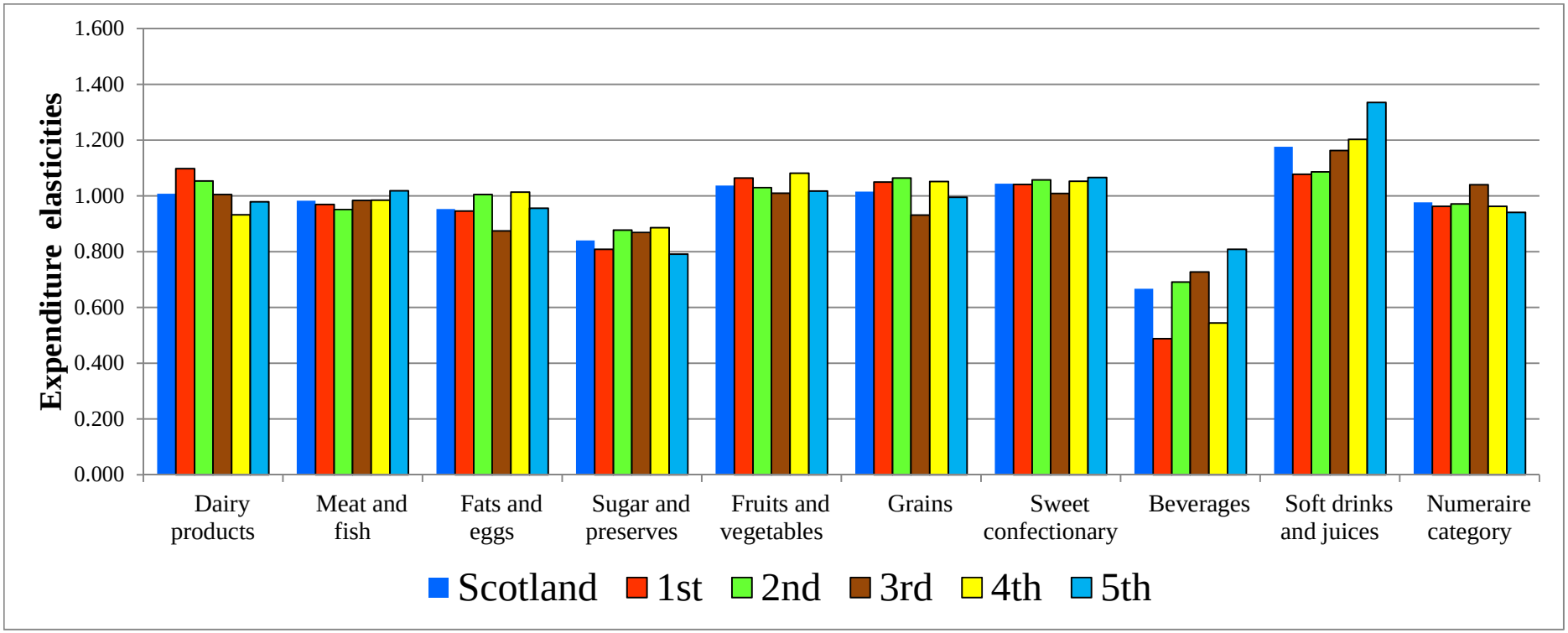

Figure 4. Expenditure Elasticities by SIMD Quintile and Category
Source: Own elaboration based on Kantar Worldpanel data.

5. Conclusions and Implications

A poor diet fostered by a rapid increase in the supply of affordable, processed food has been mentioned as one of the major contributors to obesity and non-communicable diseases in Scotland. Associated to increases in affordability are the promotions used by retailers with such foods. Their impact is controversial because retail promotions have been pointed to as a key factor in expanding the expenditure on caloric-rich processed foods, but they are also used by retailers for selling fruit and vegetables and other foods that are important as part of a healthy diet.

The purpose of this paper has been to explore to what extent retail promotions influence the Scottish diet, which is important because Scotland has one of the worst overweight and obesity records within the OECD countries both in adults and children, and moreover, plans to improve the quality of the diet are having little effect. In order to control by food accessibility, the analysis has been carried out by Scottish Index of Multiple Deprivation (SIMD) quintiles, which measure the degree of deprivation by area.

A contribution of this paper has been to focus on the effect of promotions on the Scottish diet, instead of analysing promotional influences on a single or reduced number of products within a category. Two issues have been studied: first, the impact of promotions on consumers' expenditure, i.e., whether promotions increase the total expenditure of the families and also by category; and second, the impact that they have on the allocation of expenditure.

The results indicate that promotions have a positive effect on the total expenditure of households and this is observed when the data are aggregated at the level of Scotland and by SIMD quintiles. Furthermore, promotions have a positive effect on the expenditure by category. This was found for all the categories. In this respect, there was no difference between the aggregated results and those of each one of the SIMD quintiles.

As regards the own price elasticities of the categories, the results showed that all of them are inelastic, fluctuating between -0.5 and -0.8 (excluding the numeraire category). In addition, there were no significant differences between the different quintiles. The most inelastic groups are sugar and preserves together with beverages, while dairy products, fats and eggs and sweet confectionery show higher elasticities. The overall picture is that consumers do not change their purchases much in response to price changes and that consumption patterns would be hard to shift by price related means.

The analysis has also illustrated the high and growing proportions of food sold under promotion and that the proportion of consumer spend connected with promotions are highest for soft drinks and juices, beverages and sweet confectionary (in descending order). With respect to the effect of promotions, they are different by category. Thus, sweet confectionary, beverages and soft drinks and juices have higher elasticities than the other categories, thereby providing some understanding of why they are promoted so heavily. However, the differences by quintile are not substantive. Sweet confectionary and soft drinks are two potential contributors to obesity problems and their heavy promotion, whilst understandable, probably exacerbates the diet-health problem for some consumers.

It was also found that the 1st quintile (most deprived) appears to react less to promotions on fruits and vegetables than the other groups which again highlights the challenge faced in relation to healthy diets for the most deprived in Scottish society. It also re-enforces the notion that dietary improvement for poorer families will require a broad approach which embraces adult and child education with respect to food, healthy school meals, and efforts to encourage healthier offerings and choices through caterers and fast food outlets

With very few exceptions, most of the expenditure elasticities are around unity. The highest expenditure elasticities are observed for soft drink and juices, which are between 1 and 1.2, and the lowest for beverages (between 0.5 and 0.8) and again there were not major differences by quintile.

Overall, the results in terms of expenditure allocation provide a picture that seems to indicate that typical economic measures such as specific taxes applied to substances which encourage obesity or have other potentially deleterious consequences for health when eaten in excessive quantities (e.g., applied to fats or soft drinks), might not have a strong impact on the diet given the inelasticity of the demand to changes in prices. Furthermore, changes in income (when translated into food expenditure) might not alter the composition of the diet significantly by increasing the purchases of some food categories over others.

Promotions seem to have differentiated effects by category and it would be advisable to keep those applied to unhealthy products such as those applied to products high in saturated fats, sugar and salt controlled as they do affect the quality of the diet.

Finally, the overall implication of these findings is that solving of Scotland's overweight and obesity problems will require a broad fronted approach which not only involves restrictions on the promotion of some of the most damaging products with respect to a healthier diet, such as high sugar drinks and high fat products, but also other initiatives. These might include much stronger emphasis on food and dietary matters in child and adult education, as well as 'supply side' actions such as stronger engagement with the food industry on product reformulation and what is acceptable regarding out of store promotion, and further improvement in the area of institutional catering including that of school meals. These are all areas recognised by Scotland's Food and Drink Policy (Scottish Government, 2009).

As far as the research implications of the work are concerned, a logical step would be to examine the influence of food promotion changes in some of the most deprived areas looking at the influence of additional and reduced promotions on the purchasing of products which make a positive and negative contribution to a healthy diet. A further particularly interesting scenario would be to examine the effects of a withdrawal of food promotions altogether for a period of time but that is unlikely to happen. However, it might be rewarding to do a comparative study of the purchasing patterns of consumers in stores that use frequent promotions as opposed to those which have rather more stable pricing and promotion policies.

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Annex A. Price, promotion and expenditure elasticities by SIMD quintile

Table A1. Demand elasticities – SIMD 1st quintile

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.746 *	-0.128 *	-0.004	-0.001	-0.076	-0.041	-0.040	-0.004	-0.023	-0.035
Meat and fish	-0.042 *	-0.645 *	-0.007	-0.011 *	-0.047	-0.066 *	-0.051 *	-0.016	-0.037 *	-0.047 *
Fats and eggs	0.000	-0.045	-0.772 *	0.012	-0.031	-0.023	-0.042	0.005	0.003	-0.054
Sugar and preserves	0.018	-0.239	0.046	-0.602 *	-0.044	-0.004	0.080	0.041	-0.065	-0.038
Fruits and vegetables	-0.047	-0.094 *	-0.010	-0.005	-0.705 *	-0.055 *	-0.076 *	-0.008	-0.018	-0.045 *
Grains	-0.030	-0.152 *	-0.010	-0.002	-0.068 *	-0.719 *	-0.025	0.010	-0.008	-0.042 *
Sweet confectionary	-0.023	-0.101 *	-0.013	0.004	-0.077 *	-0.020	-0.768 *	-0.011	-0.015	-0.017
Beverages	0.032	-0.074	0.021	0.020	0.017	0.105	-0.005	-0.600 *	-0.009	0.004
Soft drinks and juices	-0.040	-0.186 *	-0.002	-0.014	-0.052	-0.021	-0.045	-0.015	-0.673 *	-0.031
Numeraire category	0.001	-0.033	-0.006	-0.002	-0.008	-0.006	0.002	-0.008 *	0.000	-0.901 *
Promotion elasticities										
Dairy products	0.011	0.014	0.004	-0.001	0.010	-0.001	-0.014	0.009	-0.014	-0.014
Meat and fish	-0.002	0.024	0.003	0.003	0.001	0.001	-0.018	0.002	-0.001	-0.013
Fats and eggs	0.004	-0.011	0.025	0.000	0.012	-0.004	-0.013	0.000	0.003	-0.006
Sugar and preserves	-0.005	-0.010	0.009	0.010	-0.005	-0.005	0.042	-0.019	-0.013	-0.026
Fruits and vegetables	0.000	0.014	-0.007	-0.003	0.024 *	0.008	-0.013	0.005	-0.013	-0.010
Grains	0.001	0.000	0.001	0.000	0.005	0.026 *	-0.007	0.007	-0.005	-0.019
Sweet confectionary	-0.005	-0.004	-0.002	0.005	-0.022	-0.014	0.054 *	-0.006	-0.002	-0.019
Beverages	0.006	-0.003	-0.013	-0.005	0.004	-0.004	-0.015	0.049 *	0.008	-0.012
Soft drinks and juices	0.004	-0.017	0.005	-0.003	-0.007	-0.031	0.028	-0.003	0.088 *	-0.011
Numeraire category	-0.001	-0.022	-0.003	-0.002	-0.007	-0.001	-0.001	-0.008	-0.001	0.037 *

Source: Own elaboration based on Kantar Worldpanel data

Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

Table A2. Demand elasticities – SIMD 2nd quintile

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.763 *	-0.118 *	-0.001	-0.013	-0.021	-0.010	-0.048	-0.020	-0.018	-0.042 *
Meat and fish	-0.042 *	-0.676 *	-0.008	-0.003	-0.070 *	-0.045 *	-0.041 *	-0.014	-0.017	-0.034 *
Fats and eggs	0.002	-0.063	-0.787 *	0.008	-0.048	-0.040	-0.033	0.006	-0.016	-0.033
Sugar and preserves	-0.123	-0.057	0.034	-0.577 *	-0.068	-0.070	0.053	0.016	-0.043	-0.043
Fruits and vegetables	-0.011	-0.117 *	-0.011	-0.005	-0.677 *	-0.052 *	-0.064 *	-0.006	-0.036 *	-0.050 *
Grains	-0.010	-0.118 *	-0.014	-0.007	-0.079 *	-0.716 *	-0.026	-0.007	-0.031	-0.052 *
Sweet confectionary	-0.036	-0.093 *	-0.010	0.002	-0.082 *	-0.021	-0.775 *	-0.004	-0.015	-0.024
Beverages	-0.056	-0.094	0.017	0.008	0.004	0.003	0.021	-0.568 *	0.008	-0.033
Soft drinks and juices	-0.037	-0.104	-0.013	-0.009	-0.120 *	-0.068	-0.042	-0.004	-0.662 *	-0.028
Numeraire category	-0.006	-0.029	-0.002	-0.002	-0.017	-0.009	0.000	-0.008 *	0.001	-0.900 *
Promotion elasticities										
Dairy products	0.023 *	0.000	-0.006	-0.001	0.005	0.007	0.000	0.000	-0.011	-0.009
Meat and fish	-0.003	0.021 *	0.005	0.001	-0.002	-0.004	-0.010	0.001	-0.002	-0.011
Fats and eggs	0.007	-0.009	0.041 *	-0.001	-0.003	0.007	-0.004	-0.005	-0.004	-0.016
Sugar and preserves	0.011	-0.009	-0.002	0.013	-0.013	0.007	0.006	0.006	-0.013	-0.029
Fruits and vegetables	0.002	-0.003	0.000	0.000	0.036 *	0.004	-0.007	0.002	-0.014	-0.017
Grains	-0.001	-0.003	-0.002	0.002	-0.005	0.027 *	-0.008	0.001	-0.006	-0.005
Sweet confectionary	-0.007	-0.013	-0.001	-0.004	-0.014	-0.003	0.061 *	-0.005	-0.006	-0.018
Beverages	0.012	-0.013	0.005	0.002	-0.009	0.012	0.011	0.017	0.003	-0.028
Soft drinks and juices	0.002	-0.011	0.002	0.006	-0.020	-0.009	-0.003	-0.003	0.087 *	-0.006
Numeraire category	-0.005	-0.003	-0.005	-0.001	-0.006	-0.010	-0.012	0.000	0.003	0.033 *

Source: Own elaboration based on Kantar Worldpanel data

Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

Table A3. Demand elasticities – SIMD 3rd quintile

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.799 *	-0.094 *	0.014	-0.002	-0.048	0.007	-0.039	0.001	-0.018	-0.025
Meat and fish	-0.038 *	-0.644 *	-0.014	-0.008	-0.079 *	-0.063 *	-0.041 *	-0.017 *	-0.032 *	-0.047 *
Fats and eggs	0.052	-0.071	-0.744 *	0.009	0.000	-0.007	-0.018	0.004	-0.042	-0.056 *
Sugar and preserves	-0.006	-0.166	0.031	-0.625 *	-0.051	-0.038	0.083	-0.003	-0.045	-0.049
Fruits and vegetables	-0.030	-0.120 *	-0.004	-0.004	-0.705 *	-0.053 *	-0.046 *	-0.003	-0.008	-0.036 *
Grains	0.012	-0.129 *	-0.004	-0.004	-0.074 *	-0.666 *	-0.022	-0.005	-0.006	-0.037 *
Sweet confectionary	-0.031	-0.082 *	-0.009	0.005	-0.058 *	-0.026	-0.757 *	-0.003	-0.011	-0.037
Beverages	0.026	-0.116	0.009	0.000	0.019	-0.004	0.013	-0.643 *	-0.024	-0.008
Soft drinks and juices	-0.054	-0.198 *	-0.040	-0.012	-0.048	-0.036	-0.046	-0.022	-0.672 *	-0.035
Numeraire category	-0.011	-0.046 *	-0.011 *	-0.003	-0.022	-0.022 *	-0.018	-0.007 *	0.000	-0.901 *
Promotion elasticities										
Dairy products	0.028 *	-0.006	0.002	0.002	0.008	-0.007	0.001	0.007	-0.012	-0.015
Meat and fish	-0.004	0.038 *	0.000	-0.001	-0.005	-0.005	-0.009	-0.001	-0.008	-0.009
Fats and eggs	0.003	0.005	0.024	0.001	-0.012	-0.001	-0.006	0.001	-0.013	-0.006
Sugar and preserves	0.006	-0.005	-0.001	0.027 *	-0.032	0.018	-0.026	0.001	-0.009	-0.017
Fruits and vegetables	-0.007	-0.003	0.000	-0.001	0.062 *	-0.011	-0.017	-0.001	-0.005	-0.016
Grains	0.000	-0.009	0.000	-0.003	0.006	0.035 *	0.002	-0.004	-0.005	-0.011
Sweet confectionary	-0.008	-0.017	0.007	0.000	-0.019	0.004	0.057 *	-0.005	-0.004	-0.023
Beverages	0.014	0.011	-0.009	-0.002	-0.042	0.001	-0.025	0.077 *	-0.003	-0.009
Soft drinks and juices	-0.009	-0.018	-0.011	0.007	0.002	-0.016	0.015	0.004	0.098 *	-0.030
Numeraire category	0.000	-0.013	-0.003	0.000	-0.019	0.000	-0.007	-0.004	0.003	0.038 *

Source: Own elaboration based on Kantar Worldpanel data

Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

Table A4. Demand elasticities – SIMD 4th quintile

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.775 *	-0.098 *	0.013	0.002	-0.025	0.003	-0.031	0.006	-0.003	-0.024
Meat and fish	-0.050 *	-0.648 *	-0.012	-0.012 *	-0.088 *	-0.052 *	-0.043 *	-0.010	-0.033 *	-0.037 *
Fats and eggs	0.034	-0.088	-0.793 *	0.014	-0.062	-0.040	-0.014	0.001	-0.012	-0.052
Sugar and preserves	0.024	-0.252 *	0.050	-0.588 *	-0.008	-0.104	0.110	0.005	-0.038	-0.085
Fruits and vegetables	-0.029	-0.137 *	-0.014	-0.002	-0.734 *	-0.037	-0.047 *	0.001	-0.036 *	-0.046 *
Grains	-0.008	-0.124 *	-0.013	-0.011	-0.052	-0.740 *	-0.040 *	-0.010	-0.017	-0.033
Sweet confectionary	-0.037	-0.092 *	-0.005	0.007	-0.061 *	-0.035	-0.785 *	-0.015	-0.012	-0.020
Beverages	0.061	-0.007	0.014	0.005	0.082	0.001	-0.021	-0.625 *	-0.020	-0.035
Soft drinks and juices	-0.030	-0.192 *	-0.013	-0.010	-0.139 *	-0.051	-0.045	-0.023	-0.677 *	-0.024
Numeraire category	-0.010	-0.020	-0.004	-0.003	-0.006	-0.002	0.002	-0.011 *	0.007	-0.916 *
Promotion elasticities										
Dairy products	0.019 *	0.000	0.002	-0.003	0.003	0.002	0.002	-0.002	-0.008	-0.006
Meat and fish	0.002	0.025 *	0.000	0.001	-0.010	0.005	-0.020	0.000	0.001	-0.002
Fats and eggs	0.005	-0.005	0.027	0.002	-0.008	0.002	-0.008	-0.006	0.000	-0.004
Sugar and preserves	-0.001	0.013	0.013	0.008	-0.015	-0.010	-0.014	0.002	-0.004	-0.009
Fruits and vegetables	0.001	-0.004	0.006	-0.001	0.040 *	-0.009	-0.016	0.007	-0.016	-0.006
Grains	0.002	-0.014	-0.004	0.000	0.007	0.031 *	-0.008	-0.003	-0.001	-0.003
Sweet confectionary	0.002	-0.030	0.002	-0.002	-0.011	-0.008	0.059 *	-0.010	-0.008	-0.006
Beverages	0.012	0.002	-0.006	-0.006	0.018	-0.031	-0.037	0.074 *	-0.004	-0.003
Soft drinks and juices	-0.016	0.001	-0.003	0.007	0.000	-0.015	-0.013	-0.010	0.091 *	-0.008
Numeraire category	-0.008	0.000	-0.005	0.000	-0.012	-0.002	0.007	-0.002	0.000	0.011 *

Source: Own elaboration based on Kantar Worldpanel data
Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

Table A5. Demand elasticities – SIMD 5th quintile

Food category demand	Dairy products	Meat and fish	Fats and eggs	Sugar and preserves	Fruit and vegetables	Grains	Sweet confectionery	Beverages	Soft drinks and juices	Numeraire category
Marshallian elasticities										
Dairy products	-0.789 *	-0.086	-0.004	-0.001	-0.012	-0.009	-0.027	-0.008	-0.013	-0.030
Meat and fish	-0.043 *	-0.671 *	-0.005	0.000	-0.113 *	-0.053 *	-0.047 *	-0.013	-0.034 *	-0.038 *
Fats and eggs	-0.010	-0.022	-0.754 *	0.009	-0.062	-0.054	-0.033	-0.005	-0.002	-0.022
Sugar and preserves	0.002	0.041	0.034	-0.550 *	-0.125	-0.132	0.008	-0.007	-0.043	-0.019
Fruits and vegetables	-0.011	-0.145 *	-0.013	-0.008	-0.687 *	-0.050 *	-0.039	-0.002	-0.024	-0.038 *
Grains	-0.011	-0.116 *	-0.018	-0.014 *	-0.085 *	-0.677 *	-0.037	0.002	-0.013	-0.026
Sweet confectionary	-0.031	-0.100 *	-0.012	-0.002	-0.066 *	-0.038 *	-0.766 *	-0.009	-0.014	-0.028
Beverages	-0.020	-0.082	-0.002	-0.003	0.016	0.023	-0.020	-0.672 *	-0.001	-0.047
Soft drinks and juices	-0.062	-0.238 *	-0.011	-0.013	-0.142 *	-0.059	-0.065	-0.012	-0.685 *	-0.046
Numeraire category	-0.006	-0.012	-0.002	-0.002	-0.009	-0.004	0.002	-0.006	0.009	-0.911 *
Promotion elasticities										
Dairy products	0.020 *	-0.016	0.001	0.006	-0.013	0.004	0.005	0.002	-0.008	-0.005
Meat and fish	-0.003	0.035 *	-0.001	-0.004	0.008	-0.010	-0.008	-0.003	0.002	-0.011
Fats and eggs	0.004	-0.012	0.034 *	0.000	-0.001	0.001	-0.012	-0.002	-0.007	-0.003
Sugar and preserves	-0.003	-0.048	0.005	0.030 *	-0.002	0.012	-0.008	-0.009	-0.002	-0.020
Fruits and vegetables	-0.002	-0.014	0.000	-0.002	0.041 *	0.005	0.002	-0.002	0.002	-0.013
Grains	-0.001	-0.006	0.000	0.001	0.000	0.018 *	0.002	0.003	-0.004	-0.010
Sweet confectionary	0.000	-0.002	0.005	-0.004	-0.020	0.004	0.048 *	-0.006	0.007	-0.018
Beverages	0.012	-0.034	-0.003	0.005	-0.008	0.003	-0.024	0.068 *	-0.006	-0.014
Soft drinks and juices	-0.001	0.012	-0.023	0.005	-0.012	-0.006	-0.008	0.004	0.060 *	-0.008
Numeraire category	-0.004	-0.006	-0.001	0.001	-0.014	-0.004	-0.012	-0.002	-0.008	0.029 *

Source: Own elaboration based on Kantar Worldpanel data
Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.

Table A6. Expenditure elasticities

Food category demand	Scotland	SIMD quintiles				
		1st	2nd	3rd	4th	5th
Dairy products	1.007 *	1.098 *	1.053 *	1.005 *	0.932 *	0.978 *
Meat and fish	0.983 *	0.969 *	0.951 *	0.983 *	0.985 *	1.018 *
Fats and eggs	0.952 *	0.945 *	1.004 *	0.875 *	1.013 *	0.956 *
Sugar and preserves	0.840 *	0.809 *	0.878 *	0.869 *	0.886 *	0.791 *
Fruits and vegetables	1.037 *	1.064 *	1.029 *	1.009 *	1.081 *	1.017 *
Grains	1.015 *	1.049 *	1.064 *	0.931 *	1.052 *	0.995 *
Sweet confectionary	1.044 *	1.041 *	1.057 *	1.008 *	1.052 *	1.066 *
Beverages	0.667 *	0.488 *	0.690 *	0.727 *	0.544 *	0.808 *
Soft drinks and juices	1.176 *	1.077 *	1.086 *	1.162 *	1.202 *	1.334 *
Numeraire category	0.977 *	0.962 *	0.971 *	1.040 *	0.962 *	0.941 *

Source: Own elaboration based on Kantar Worldpanel data
Notes: Elasticities computed at the mean values of the variables. (*) stands for statistically significant at 5 percent.