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Retailers' promotions: What role do they play in household food purchases by degree of deprivation?

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Retailers' Promotions: What Role Do They Play in Household Food Purchases by Degree of Deprivation?

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Retailers' Promotions: What Role Do They Play in Household Food Purchases by Degree of Deprivation?ⁱ

Abstract:

Purpose: 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.

Design/methodology/approach: This is achieved by analysing a representative scanner panel dataset for the period 2006-13. The methodology consists of exploring the impact of promotions on food expenditure and allocation within households' food purchases, using expenditure regressions and estimations of the linear version the Almost Ideal Demand System.

Findings: The results indicate that whilst promotions have differentiated effects by category, they have similar results by SIMD. The effect of the promotions on the total expenditure is positive for all the quintiles. However, the effect of promotions on each food category is complex because of the cross effects between categories. As regards the effect of prices, the results provide a picture that see5279ms to indicate that typical economic measures such as specific taxes applied to substances which, e.g., encourage obesity, might have limited impact on the diet given the inelasticity of the demand to changes in prices.

Originality/value: A contribution of this paper has been to focus on the effect of promotions on all the food products consumed by Scottish households, instead of analysing promotional influences on a single or reduced number of products within a category.

1. Introduction

Scotland has one of the worst overweight and obesity records within the OECD countries, with 29% of males and 30% of females being obese. These conditions are also prevalent in children where over 16% of children aged 7-11 and 15% of children aged 12-15 are obese (Baker, 2017). While there have been some small improvements in population level dietary intakes (e.g., increases in fruit and vegetable consumption), none of the targets set by the Scottish Government have been met (Scottish Government 2013). Evidence by the Food Standard Scotland (FSS, 2014) indicates that this situation is still prevalent and worse among the most deprived.

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 sales promotions used by retailers with non-perishable foods. In Scotland, the importance of sales promotions in food purchase has been highlighted by Food Standards Scotland which indicates that in 2013/2014 a higher proportion of foods with high levels of fat, salt and sugar were sold on promotion (FSS, 2014). Moreover, Hawkes (2008) found that the dietary implications of supermarket development 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 and highly-processed foods.

This paper will contribute to our understanding of the effect of retailers' promotions on consumers' purchases in Scotland, where little evidence exists. A notable exception is FSS (2015). 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) or focused on assessing the existence of the so-called food deserts (Cummins and Macintyre, 2002). Thus, the main purpose of this paper is to analyse the overall effect of promotions on consumers' food purchases in Scotland considering all their food and drink purchases and the implications of the findings for food and health policy. The paper also investigate the differences by area of deprivation.

2. Literature review

The literature on the effects of sales promotions is substantial, therefore, we focused on two topics in this section: (1) the effect of sales promotions on consumer behaviour and (2) the implications of its use on consumers' choices of healthy and less healthy foods.

Sales promotions have been found to have short-term effects (i.e. immediate effects) and long-term effects (i.e. cumulative effects) depending on whether the promotions are monetary or nonmonetary. Monetary promotions (e.g., price discounts, coupons), were found to be the most effective type of promotions to increase sales in the short term (Alvarez and Casielles, 2005), whilst nonmonetary promotions (e.g., free sample) are more effective for obtaining long-term results (Yi and Yoo, 2011),

On the short-term effect of sales promotions on consumers' behaviour, Satini et al. (2016) performed a meta-analysis based on 221 studies. They found a positive correlation between

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3 monetary promotions and sales volume. Their findings consolidated the results from previous
4 studies that showed that monetary promotions increase the sales of stored products (Alvarez
5 and Casielles, 2005) and encourage consumers to try new products (Oly Ndubisi and Tang
6 Moi, 2005), Furthermore, most of the papers on short-term effects of sales promotions
7 focused on single-unit price promotions such as “% off” and “£ off” (e.g., McKechnie et al.,
8 2012; Mishra and Mishra, 2011), However, there is a growing literature showing that multi-
9 unit price promotions (e.g., “X units for £Y”) actually achieve greater sales than single-unit
10 price promotions (Blattberg and Neslin, 1990), For instance, Akaichi et al. (2016) examined
11 the effect of different distributions of price discounts on consumers’ willingness to pay
12 (WTP), They found that an increasing price discount in the number of units (“5% on 1st unit,
13 10% on 2nd unit” etc.) was the most effective type of price discount in increasing consumers’
14 WTP. Recently, Drechsler et al. (2017) found that “X units for €Y” outperforms “X+Nfree”
15 price promotions in terms of purchase quantity of functional product categories but not
16 hedonic categories.
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20 Regarding the long-term effect of sales promotions, Satini et al’ s (2016) meta-analysis
21 confirmed results from previous studies that showed that sales promotions have a positive
22 long-term effect on the perception of quality (e.g. Chandon et al., 2000), brand loyalty (e.g.
23 Empen et al., 2015) and consumers’ attitudes (e.g. Esteban-Bravo et al. ,2009), Furthermore,
24 it has been found that nonmonetary sales promotions (e.g. free sample) are more effective in
25 reinforcing loyalty than monetary sales promotion (Darke and Chung, 2005),
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29 Finally, it is noteworthy that there is considerable evidence that sales promotions have
30 negative effects. For instance, frequent use of price reductions were found to render
31 consumers price sensitive and, hence, make it difficult for companies to increase their prices
32 after a price promotion campaign has ended (Yoo et al., 2000), Chandon (1995) suggested
33 that, in the long-term, the use of price promotions may result in the devaluation of the
34 promoted brand in consumers’ mind, especially after the end of the promotion. Furthermore,
35 price discounts are likely to reduce consumption enjoyment by diminishing consumers’
36 attention during the purchase and consumption of the discounted product (Hsee and Tsai,
37 2008)
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41 As aforementioned, price promotions are likely to increase food consumption and decrease
42 consumers’ attention when buying and consuming discounted food products. But, does this
43 imply that the use of price promotions may contribute to poor dietary intake? Mishra and
44 Mishra (2011) found that consumers prefer price discounts to bonus packs for guilt-inducing
45 unhealthy foods, but preferred bonus packs to price discounts for healthy foods because it is
46 easy to justify buying them in bulk.
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49
50 In the UK, the National Consumer Council reported that price promotions accounted for over
51 half of all spending on alcohol and soft drinks and they were also extensively used on ready
52 meals, confectionery, snacks, meat, sauces, and yoghurts (Yates, 2008), Dobson (2011)
53 showed that in 2009 and 2010 the percentage of soft drinks bought under promotions was
54 48% and 52% of the total expenditure on the category. For confectionery those percentages
55 were 40% and 45%, respectively. On the positive side, they found that supermarkets also
56 carried offers on healthy products.
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More recently, Nakamura et al. (2015) found that after controlling for reference price, price discount rate, and brand-specific effects, the increase in sales associated with price promotions was larger in less-healthy than healthier food categories. They argued that since less-healthy products (e.g., confectionary products) were often less perishable than healthier products (e.g., fruits and vegetables), they were more stockpiled as a result of price promotions. In Scotland, Food Standard Scotland reported that, in 2013/2014, 54% of crisps and savoury snacks, confectionary and regular soft drinks were sold on promotions, while only 28% and 30% of the purchases of fruits and vegetables, respectively, were sold on promotions (FSS, 2015),

The analysis of the effect price promotions on healthy and less healthy products in the UK has focused on individual product categories rather than on the entire households' food and drink basket. Therefore, they do not analyse the effect that price promotions in one category may have on another one, which is a point well documented in the literature and may have effect on the impact of sales promotions on final households' purchases. This is the major contribution of this paper.

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. For each product in the dataset, information is available on a number of attributes such as brand, supermarket and origin. The dataset also contains information about prices paid, whether the price was affected by a promotion and the quantities purchased by the household.

The KWDS provides information on all the purchased products which can be aggregated into 2,460 categories. These categories were aggregated into ten broad categories. 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 $Y_{gt}^{(h)}$

$$Y_{gt}^{(h)} = \sum_{s=1}^s p_{st} \cdot q_{st}^{(h)} \quad (1)$$

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

$$P_{gt}^{(h)} = \sum_{s=1}^s p_{st} \cdot w_s^{(h)} \quad (2)$$

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

$$Pm_{gt}^{(h)} = \sum_{s=1}^s pm_{st} \cdot w_s^{(h)} \quad (3)$$

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 $1 \dots T$

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

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

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 (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. 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 (e.g., income, health, education)

3.3. Analysis of household expenditure

The methodology used 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 goes here

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

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

where $r_t^{(h)} = H^{(h)} + u_t$, $u_t \sim i.i.d. N(0, \sigma_u^2)$ and for each product category $g = 1, 2, \dots, n$, and $P_{gt}^{(h)}$ and Pm_{gt} are the price and promotion; a_0 , b_g , and c_g are the regression coefficients. 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):

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

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

3.4. Expenditure allocation decision

We estimated the linear version of the Almost Ideal Demand System (AIDS), (Deaton and Muellbauer, 1980) which is the most widely used model of demand in the literature due its flexibility to include parametric restrictions required for consistency with economic theory (Deaton and Muellbauer, 1980), The demand functions are obtained in share of consumer's budget spent on category g in time t (W_{gt}), The budget shares are obtained by logarithmic differentiation of the expenditure function with respect to prices. The equations to be estimated are given by:

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

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 $\bar{P}_t^{(h)}$ is a price index.

To accommodate the unobserved heterogeneity across households, a fixed-effects specification $\pi_g^{(h)}$ was used. Furthermore, the price index $\bar{P}_t^{(h)}$ 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:

$$\sum_{g=1}^{10} \alpha_g = 1; \sum_{g=1}^{10} \beta_{gj} = 0; \sum_{g=1}^{10} \theta_g = 0; \sum_{g=1}^{10} \delta_{gj} = 0 \quad (8)$$

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:

$$E_g = 1 + \frac{\theta_g}{w_g} \quad (9)$$

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

$$e_{gj} = \frac{\beta_{gj}}{w_g} - \frac{\theta_g w_j}{w_g} - \delta_{gj} \quad (10)$$

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):

$$e_{gj} = \frac{\delta_{gj} P m_g}{w_g} \quad (11)$$

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, the results show that increases in prices have a significant positive effect on households' expenditure on the 10 food categories. 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 also 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. The positive effect of price promotions on purchases was also found in the meta analysis carried out by Satini et al., (2016). Furthermore, results in table 2 show that trend in expenditure on all the food categories in Scotland, the 1st and 4th quintile remained quite stable over all the period. However, the expenditure increased between 2006 and 2013 in the 2nd quintile and decreased in the 3rd and 5th quintile.

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. More research work using primary data is needed to understand why households in most deprived area are less responsive to price promotions (e.g., buying from discounters such as Aldi and Lidl that generally use "everyday low prices" strategy),

Table 2 goes here

The results on the effect of price promotions on total expenditure by category are displayed in Table 3. As the results by quintile were similar, 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. 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. This results are in line with the findings in Andreyeva et al. (2010) who reviewed 160 studies on the price elasticity of the major food

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2
3 categories and found that the demand for food and drinks is inelastic and that soft drinks are
4 the most responsive to price changes.
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7 In line with Dreze et al. (2004), Table 3 shows that promotions have a positive effect on
8 expenditure by category. In this respect, there was no difference between the aggregated
9 results and those for each one of the SIMD quintiles; not even for the first quintile (most
10 deprived), which was the one that showed no effect of promotions on meat and fish, sugar
11 and preserves and sweet confectionary on the total expenditure. The results indicate that
12 sweet confectionery (0.10) (i.e. a 10% rise in expenditure in response to promotion),
13 beverages (0.09) and sugar and preserves (0.08) are the highest responders to promotional
14 activity. It remains to determine in future research whether this increase in expenditure, as a
15 result of price promotions use, is actually leading to a significant change in consumers diet.
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19 Finally, the results show that the trend in demand for meat and fish, sugar and preserves,
20 grains, sweet and confectionary and beverages remained quite stable over all the period.
21 Interestingly, the expenditure on fruits and vegetables and soft drinks, however, decreased
22 significantly.
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26 *Table 3 goes here*
27

28 29 **4.2. Effects on allocation** 30

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32 The results of the augmented AIDS model for Scotland and their corresponding elasticities
33 are presented in Tables 4 and 5. The estimates of the AIDS model by SIMD quintile are not
34 reported here but they are available from the authors upon request. The price and expenditure
35 elasticities for Scotland are close to those estimated by Santarossa and Mainland (2002),
36 which show that all the food price elasticities are inelastic and the expenditure elasticities are
37 around one.
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41 *Table 4 and 5 go here*
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44 Although, the results from the AIDS models are interesting, it is easier to get insights from
45 the results once they have been transformed into demand elasticities (price, promotion and
46 expenditure elasticities), The own-price, own-promotion and expenditure elasticities are
47 presented in Figures 1, 2 and 4. The full set of the Marshallian and Hicksian elasticities by
48 quintile were computed but are not presented in the articleⁱⁱ; however, they are also available
49 from the authors upon request.
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52 Figure 1 shows that all the price elasticities are inelastic and their range fluctuates between -
53 0.8 and -0.5 (excluding the numeraire category), In addition, there are no significant
54 differences between the different quintiles. The most inelastic groups are sugar and preserves
55 together with beverages, while dairy products, fats and eggs and sweet confectionery show
56 higher elasticities.
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60 As regards promotions, these seem to have effects mostly on the category where they are
applied but there are some cross effect that are negative and significant suggesting that there

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3 is a cross-category effect of price promotion (e.g., soft drinks and dairy, fruits and vegetables
4 and sweet confectionery),
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7 *Figure 1 goes here*
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10 Figure 2 shows differences in the effectiveness of promotions on the quantity demanded by
11 category, although the value of the elasticities is relatively small. Thus, sweet confectionary,
12 beverages and soft drinks and juices have higher elasticities than the other categories and the
13 differences are not substantive by SIMD quintile (except the purchases of beverages by the
14 2nd quintile), It is interesting to note that the 1st quintile (most deprived) reacts less to
15 promotions of fruits and vegetables than the other quintiles, which seems to coincide with the
16 observation that this group is the one with the lowest progress on the consumption of fruits
17 and vegetables (FSS, 2014),
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21 *Figure 2 goes here*
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24 Despite the generally small size of the promotion elasticities, an increasing proportion of food
25 for most of the categories is being sold using them, as is shown by Figure 3. The widespread
26 increase in the growth of promotion-related sales is readily apparent across the food
27 categories with most recording 35-45% of sales expenditure through product sold under
28 promotion in 2013. Of particular importance are the increases in promotion-related sales of
29 soft drinks and juices as well as sweet confectionary. These results are in line with the
30 findings of FSA (2015),
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36 *Figure 3 goes here*
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39 Figure 4 shows that with very few exceptions most of the expenditure elasticities are around
40 unity. The highest expenditure elasticities are observed for soft drink and juices, which are
41 between 1 and 1.2 and the lowest for beverages (between 0.5 and 0.8), The differences
42 between quintiles are not major except for the 5th quintile (least deprived) for soft drinks and
43 juices and beverages, for which the figure shows a higher expenditure elasticity than for the
44 other quintiles. These elasticities do not indicate important substitutions as a result of an
45 increase of income translated into greater expenditure; or in other words, one would not
46 expect that changes in income would affect significantly the quality of the diet.
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50
51 *Figure 4 goes here*
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53
54 The results in terms of allocations of expenditure provide a picture that seems to indicate that
55 typical economic measures such as taxes might not have a strong impact on the diet due to
56 the inelasticity of demand to changes in prices. Furthermore, changes in income (translated
57 into expenditure) might not alter the composition of the diet by increasing the purchases of
58 some categories over others. Nevertheless, promotions seem to have differentiated effects by
59 category and it would be advisable to keep those on unhealthy products, such as sugary soft
60 drinks, controlled as they seem to affect the demand.

5. Conclusions and Implications

In contrast with other contributions, this paper assessed the effect of promotions on the Scottish diet, i.e., instead of analysing the effect of promotions on a single or reduced number of products within a category it considered all the household food and drink purchases. Two issues have been studied: first, the impact of promotions on consumers' expenditure 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. The analysis has also showed that there are high and growing proportions of food sold under promotion, being the highest for soft drinks and juices, beverages and sweet confectionary (in descending order). Furthermore, sweet confectionary, beverages and soft drinks and juices were found to have higher promotion elasticities than the other categories, thereby providing some understanding of why they are promoted so heavily. Promotions seem to have differentiated effects by category and it would be advisable to keep controlled those applied to unhealthy products such as products high in saturated fats, sugar and salt as they do affect the quality of the diet.

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 diet 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

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 nutrients which encourage obesity or have other potentially deleterious consequences for health, 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.

Finally, the overall implication of these findings is that solving 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 foods with respect to a healthier diet, such as high sugar drinks and high fat products, but also other initiatives such as child and adult education, as well as 'supply side' actions such as product reformulation. These are all areas recognised by Scotland's Food and Drink Policy (Scottish Government, 2009),

As far as research limitations, future work should aim at further disaggregating the categories used in this paper and also the type of promotion in order to provide a more detail analysis (e.g. separating healthier and less healthy products within the same category) . Also, future research could investigate the use of promotions at the store level so that consumers' responses to price promotions were analysed within the same marketing strategy and variety of food products.

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Endnotes:

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ⁱⁱ The tables were removed from the original version of the paper to comply with the journal requirements regarding the maximum length of the paper.

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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
Numeaire 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
Numeaire 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.

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% or less.

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 confectionery	-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 confectionery	-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% or less.

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 confectionery	-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 confectionery	-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% or less.

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 confectionery	-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 confectionery	-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% or less.

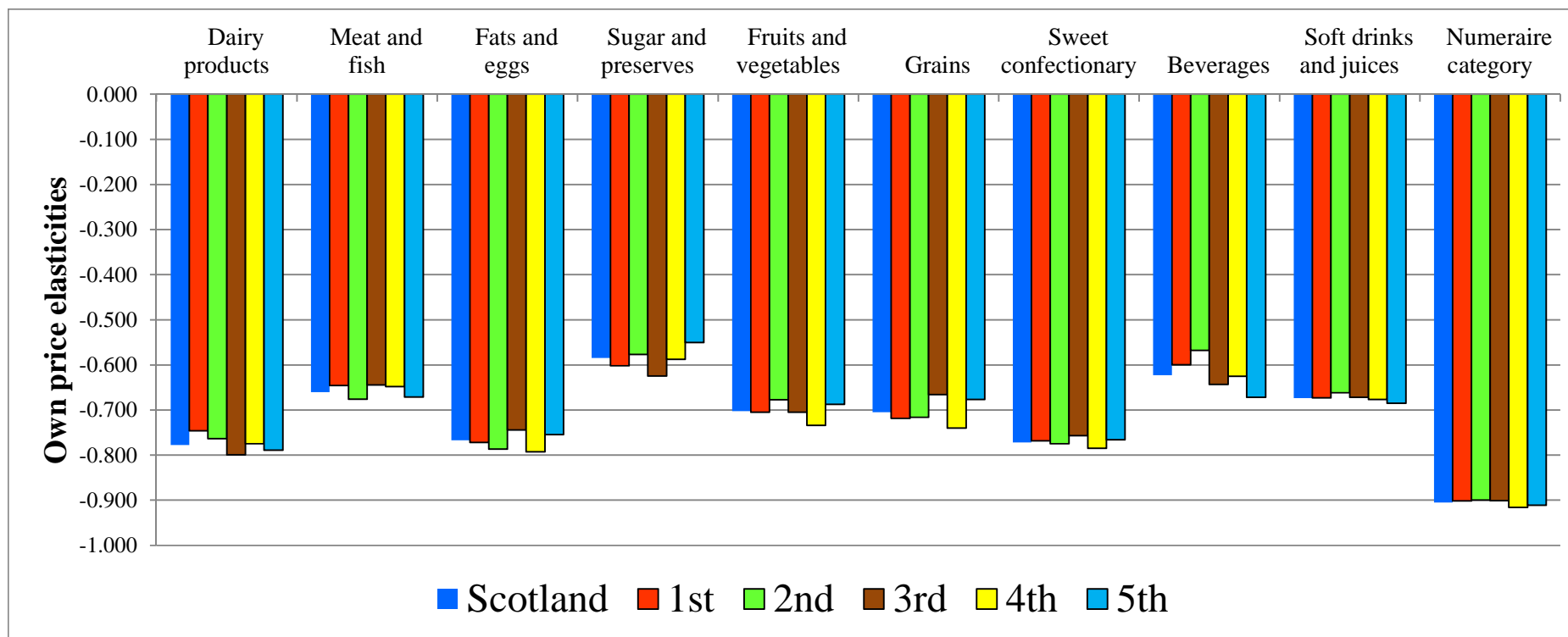


Figure 1. Own Price Elasticities by SIMD Quintile and Category

Source: Own elaboration based on Kantar Worldpanel data.

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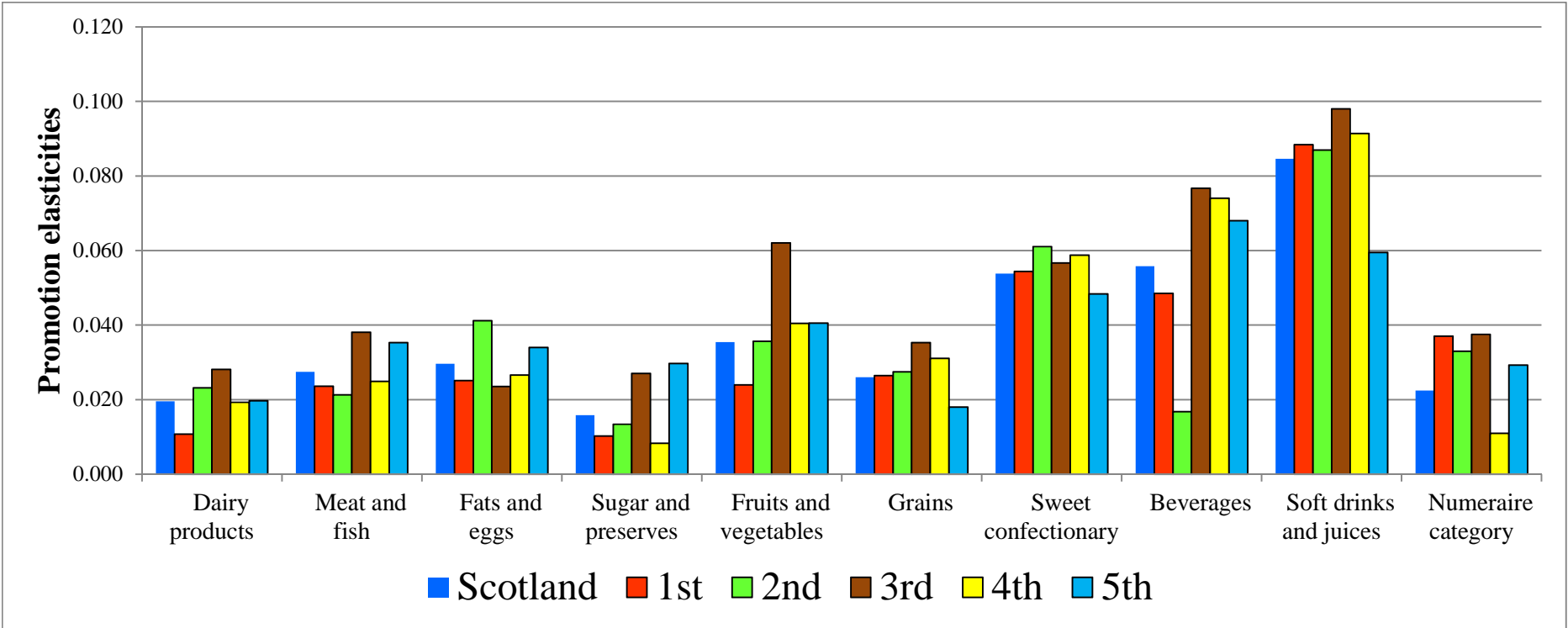


Figure 2. Own Promotion Elasticities by SIMD Quintile and Category

Source: Own elaboration based on Kantar Worldpanel data.

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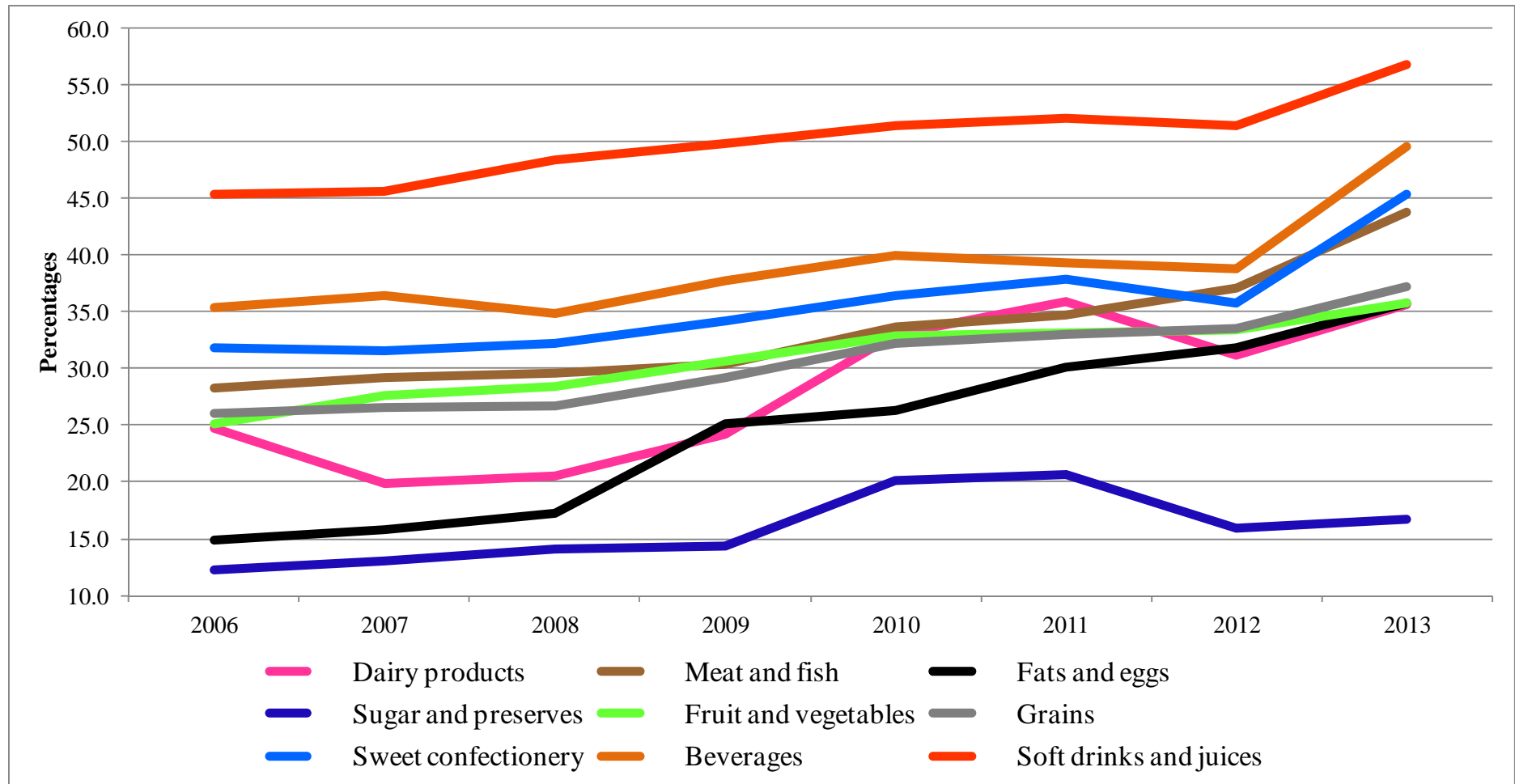


Figure 3. Expenditure Shares of Food Sold under Promotions by Category: Scotland 2006-2010

Source: Own elaboration based on Kantar Worldpanel data.

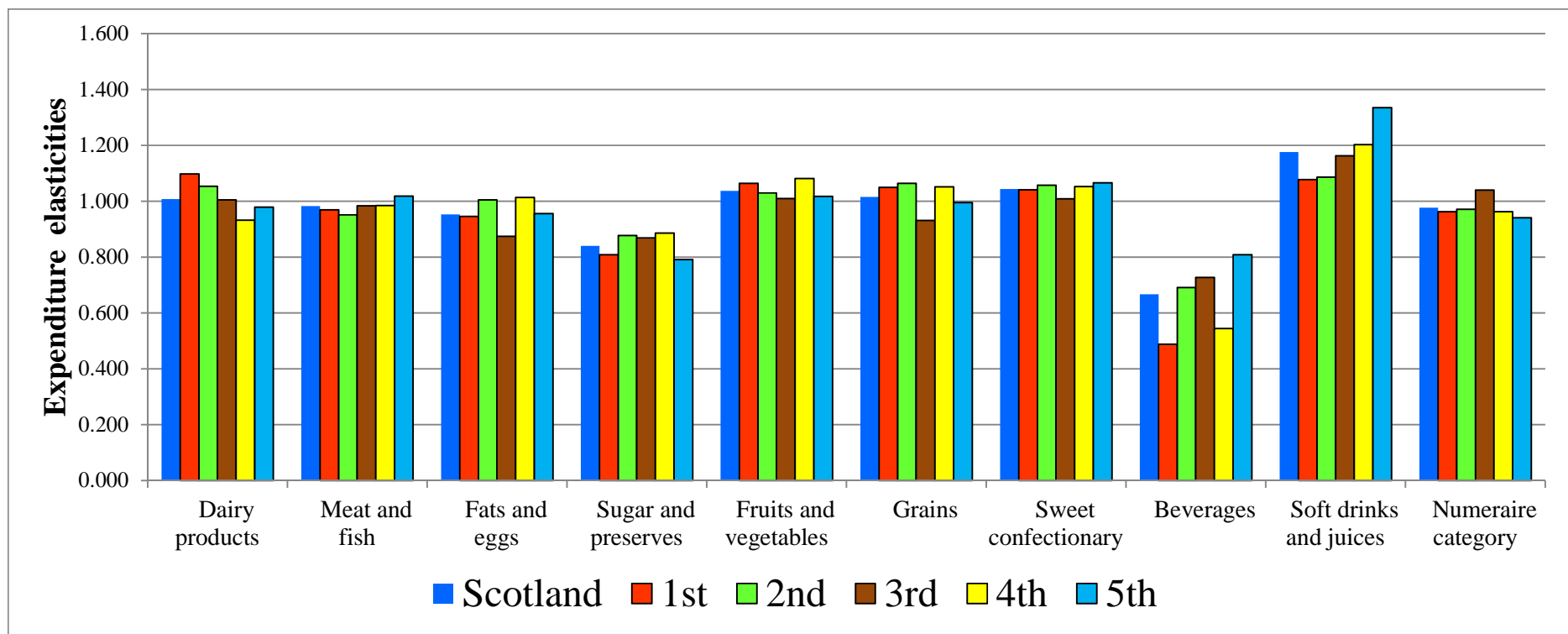


Figure 4. Expenditure Elasticities by SIMD Quintile and Category

Source: Own elaboration based on Kantar Worldpanel data.

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