Assessing the Effect of the Rise in Food Prices on the Purchasing Power of Consumers in Scotland

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

Executive Summary

The purpose of this report is to present an analysis of the effect of the rise of food prices on the purchasing power of Scottish consumers. It should be noted from the start that the fact that no aggregate consumer price index is computed for Scotland, forces us to use indirect estimates. Due to this, the analysis is divided into two parts.

The first part combines UK price information by items, the average household expenditure for all items for Scotland from the Expenditure and Food Survey, the expenditure distribution by deciles for the UK and information about the evolution of household income categorised by gross income deciles, in order to explore how the rise in prices has affected the real income (i.e. purchasing power) of the different Scottish income groups.

The second part of the report explores the question of how different is the evolution of Scottish prices from average UK prices (as the first part of the study assumes that Scottish and UK prices evolve in similar ways), using information from the dunnhumby database (representative supermarket data). As it is not possible to compare the evolution of all prices for all the goods and services that comprise the UK aggregate consumer price indices (i.e., Consumer Price Index or Retail Price Index), the analysis considers 12 selected food categories: brown and white bread, skimmed, semi-skimmed and whole milk, salmon (fresh and chilled), white fish, fresh apples, fresh eggs, fresh new potatoes, minced beef and whole fresh chicken.

The results from the first part of the study try to answer the question of whether the real income of Scottish consumers decreased in 2007/08 due to the increase in food prices. They indicate that prices in general (i.e., not only food prices) will have affected significantly the real income of the different income groups, especially the first decile group (i.e., the poorest group). It should be noted that the extent of welfare loss is dependent on the income level and the developments in other prices.

Both cases - before and after housing are taken into consideration - show similar results as regards the decrease in real income, indicating that the

increase in the inflation rate has had greatest impact on the real income of the poorest group (zero real income growth before housing, and negative income growth (-2.44 per cent) once housing is brought into the calculation). This is due not only to the fact of the high rate of inflation faced (2.27 per cent), but also because their nominal income since 2003/04 has been growing at a slower pace than the other groups (2.28 per cent) – if no housing costs are considered, or has been decreasing (-0.22 per cent) if these costs are taken into account. It should be noted that all other decile groups, although not showing negative income growth rates, also suffer from slower rates of growth due to inflation.

Together with food, housing and energy and transport have also contributed to the increase in the inflation rate (therefore it is important to analyse the price inflation of the whole consumer basket and not only the inflation of the food basket). In fact, since July 2006 'housing, fuel and power' and 'transport' have been the main contributors to overall inflation and only recently (since June 2008) has 'food and non-alcoholic drinks' surpassed them. Nevertheless, in contrast with the other two categories, the contribution of food and non alcoholic drinks to inflation, which on average has been 25 per cent of the overall inflation rate (i.e., between 17 and 35 per cent) has grown steadily over the period. As shown by the decomposition of the July 2008 inflation, some items such as clothing and footwear have only partially compensated the situation with negative contributions (-0.31 percent) to the overall inflation due to decreases in their prices.

The fact that 'food and non-alcoholic beverages' and 'housing, fuel and energy prices' have an important share in the expenditures of the 1st decile, makes this group more vulnerable to the effects of inflation, as the possibilities to substitute products in these important categories are rather limited.

The second part of the work showed that except for the cases of white fish and apples; Scottish prices present an increasing trend, similar to that observed for the UK. For white fish and apples no evident trend was found. In addition, for most of the food categories analysed, Scottish prices were found to increase less than UK prices, except in the case of milk, where Scottish price increases were slightly above UK levels. It should be noted that these differences cannot be assessed due to the fact that the components of the UK average prices are unknown.

Two sets of elasticities were estimated: one considered individual products, considering only obvious substitutes, and another for the case of all meats (salmon, white fish, minced beef and whole fresh chicken).

The results of the first set of elasticities showed that several of the categories were price responsive although not all of them with elasticities greater than 1. White bread, fresh new potatoes, minced beef and whole fresh chicken presented statistically significant own price elasticities above 1. Own price elasticities for salmon and apples were significant but below 1. The elasticities for the remaining products were not statistically different from zero. This indicates that rises in their prices give rise to an increase in their expenditure. Of all the estimated cross-price elasticities, only the one for white bread with

respect to brown bread was significant. The expenditure elasticities were all significant with a value around 0.5, indicating that these are normal products.

The results when considering the substitution of all the meats (i.e., salmon, white fish, mince beef and whole fresh chicken) appear less robust than when each product is considered to belong to an independent market. The only exception is the case of whole fresh chicken which showed strong own and cross price elasticities.

Keywords: Food prices, Scottish consumers, purchasing power, demand elasticities.

I. Introduction

All over the world there is growing concern about increasing food prices and how this affects consumers' purchasing power, and access to and affordability of food, and ultimately consumers' well being.

Recent official figures for UK inflation (National Statistics, 2008) indicate that the largest contribution to the change in the consumer price index (CPI) over the past year comes from the food and non-alcoholic beverages category, with the largest single effect coming from meat, particularly bacon, ham and poultry. Also, other products contributing to higher inflation are bread and cereals, and vegetables including potatoes. Smaller upward effects were recorded for fish and fruit.

As regards the causes behind the increase in food prices, there is little agreement about which is the most important. Amongst the most mentioned ones are (without any order of importance) the following. First, the increasing food demand due to the improvement in economic conditions in countries such as China and India, which seems to affect meat and dairy products in particular. Second, the high cost of oil, which has continued growing since 2001 and has a significant impact on the prices of all food products. Third, in the case of cereals, the combination of the growth of cereals for biofuels, the subsequent pressure on other cereal users, the lower world cereal stocks and drought in some parts of the world, such as Australia, all seem to be affecting cereal prices. It should be noted that meat and dairy production depend heavily on grain, as it takes eight kilograms of grain to produce a single kilogram of beef (Ellis, 2008).

In this context, the purpose of this study is twofold. First, to analyse the effect that the increase in food prices is having on the purchasing power of Scottish consumers and second, to explore the behaviour in the purchases and prices of some specific food products in Scotland using information from the dunnhumby database.

The structure of the report is as follows. It starts with a review of recent publications on UK and Scottish food purchase trends and the price impact on the structure of the food basket. This is followed by two parts: first, an analysis of the evolution of the cost of the Scottish consumption basket and second, an analysis of the evolution of selected Scottish food prices.

II. Literature review

Many recent articles in academic and industry press report and comment upon increases of real food prices in the EU and UK. Significant food price rises in the last two years have been reported by both commercial and academic bodies, raising concern amongst all actors across all levels of the food supply chain.

Recent reports and studies have focused on inflation and the overall increase in food prices in the UK and EU. The rise in food prices can also be observed across the world. In the U.S., the food CPI in 1998 dollars has risen from 1.26 (in 2007) to 1.35 (in August 2008), an increase of 7.1 per cent in nominal terms and 0.94 per cent in real terms (Christian and Rashad, 2008). According to a USDA forecast in 2008 the all food CPI per cent change will be 5 to 6 per cent.[2]

Although there are geographical differences in average food prices, the pattern of food prices in Scotland is similar to that observed in the UK as a whole, as the market is characterised by the domination of the "big four" multiples[3] (see e.g. Renwick and Revoredo, 2008). Published by Scottish Retail Consortium, a comparison of the Shop Price Index for Scotland and the UK demonstrates that in 2008 retail prices increased more (year on year) in Scotland that in the UK as a whole. It is, however, difficult to assess to what extent these changes pertain to food and specifically to individual food categories.

The UK retail food market structure brings about a strong reliance by multiples on promotions, and although some indicate Tesco as a price leader (Lloyd, 2008), the overall price differential amongst the big four is balanced within different food product categories (Renwick and Revoredo, op. cit.).

According to TNS Worldpanel (2008), between August and October UK food price inflation increased 9 per cent on the same period last year. A major change in the food market, caused by both the price increase and "credit crunch" impact, has been the increase in discounters' market shares with Aldi and Lidl recording 20.8 per cent and 11.1 per cent growth in sales respectively. Iceland also achieved its highest ever growth of 12.9 per cent in comparison with last year figures. Other consumer research sources also indicate a shift towards stores offering discounted products – see Figure 1 below.

With the cost of a basic basket of food (according to mySupermarket.co.uk, October 2008) with milk, rice, minced meat, cheese, fruit and vegetables

---

[2] See the link http://www.ers.usda.gov/Briefing/CPIFoodAndExpenditures/Data/cpiforecasts.htm, November 2008.

[3] Tesco, Asda, Sainsbury and Morrisons currently account for 75 per cent of the grocery market, with the largest retailer, Tesco, having almost twice the share of the next competitor (31.3 per cent versus the 16.7 per cent of ASDA - TNS Worldpanel, 2008, data for last 12 weeks ending 04/11/08).

increasing on average by 14.3 per cent in October 2008 over the same period in 2007, the search for cheaper food outlets is understandable.

Even categories traditionally not associated with discounter shopping show an increase due to price pressures. According to an AHDB Meat Services report, cash-strapped shoppers are increasingly turning to the discounters to buy fresh meat. In the 12-week period to 10 August 2008, purchases of fresh meat from discounters were up 17 per cent by volume year-on-year. Consumer spending on fresh meat in discount stores increased 25 per cent to £14.5 million (AHDB, 2008).

Figure 1: Net change in retail customers by outlet in the UK (self-reported), July 2008
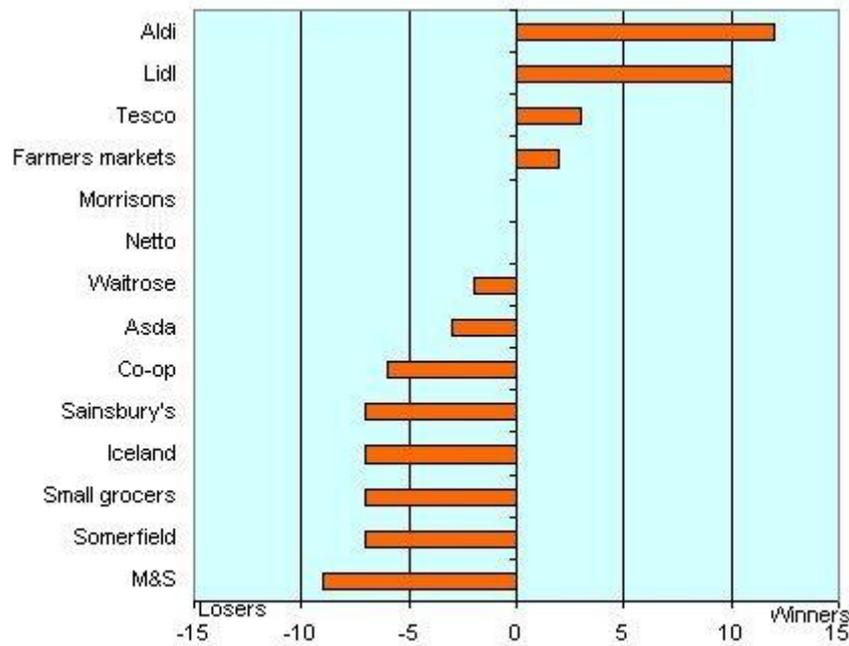
Note: Based on 2,073 online users aged 16 and over. Figures show the difference between those saying they use a supermarket 'more' and those saying 'less' as a proportion of total users

Source: Mintel 2008 (a).

In response to the slight decrease in its market share (0.2 per cent) in September 2008, Tesco introduced 'discounter price match' for over 2000 products (i.e. matching the prices of Aldi and Lidl) as well as introducing a range of no frills products, thereby bringing down the prices of some of their offerings. The impact of these changes will be seen in the next few weeks.

According to a survey carried out for Keynote[4] (Keynote, 2008) a wide range of choice and low prices were the main reported determinants of a food outlet's performance. Scottish consumers were very demanding with regards

---

[4] Based on 1,003 adults representative for Great Britain.

to both of these factors, with 88 per cent mentioning wide choice of food (GB average 86 per cent) and 86 per cent low price (GB average 80 per cent) as major issues affecting their store choice. As far as price sensitivity is concerned, Scotland together with Northern England was the most price sensitive region of Great Britain.

The food price inflation has started to have an impact on UK consumers' buying habits within stores. For example, MINTEL consumer research has revealed that in the last 12 months alone, 41 per cent of shoppers have switched to cheaper brands and three in ten (34 per cent) have cut down on the premium ranges, such as Tesco Finest and Sainsbury's Taste the difference. According to TNS, in Scotland the decrease in quality own label sales between March and October 2008 was almost 20 per cent, whereas the sales of value own label products increased by almost 25 per cent. Sales of organic food went down as well, and the standard quality own label category sales stayed the same. As the total own label sales did not change, it is clear that consumers are looking for savings and that the drop in the higher quality purchases is compensated by purchases of value products.

On the other hand, the price rises are now affecting other food categories, previously considered as cheap and affordable. According to Grocer's 33 price survey, the "big four" in the UK increased prices of own-label canned food in the past month. Branded canned food also increased in price, but this increase was not so sharp as in case of the own label alternative (Grocer, 2008). Increasing costs of production are causing increases in prices in many other categories. For example, suppliers of sandwiches and ready meals to Asda and Sainsbury's, announced that it will pass on rising material costs to retail customers, due to the decrease in profits achieved in the second quarter of 2008 (7.5 per cent decrease in relation to the previous year) (Marketing, 2008).

Cheapest on display food (COD)[5], according to the analysts, is becoming the most attractive set, appealing to consumers with limited purchasing power. Recent store checks indicate that COD food occupies more shelf space, especially in the ambient product category, as most consumers want to buy their staple food cheaply. Deepening recession and price increases, create visible demand for this product category (Mintel 2008b). Top COD categories (by percentage of stock-keeping-units) include gravy, stock and stuffing, cheese – cheddar, butter and margarine, desserts, milk and custard, biscuits, jam, honey and spreads, breakfast cereals, flour and suet, frozen fish and seafood, sliced bread, chicken, yoghurts and dairy desserts, sausages tinned meat and pies, tinned tomatoes and vegetables, ketchup and sauces, crisps, crackers, and snacks. Due to the price pressures, more luxury products such as cheese are visible in the COD group of products. On the other hand, some

---

[5] According to Mintel (2008b), 'cheapest on display' foods are defined as those which, "at recommended retail price, are the cheapest of their category available in a given store or group of stores. Other descriptors include budget and economy, but the products are generally recognisable by basic pack design, consistent across a wide variety of product types, and uncomplicated product information – baked beans, cheese, or cola, for example".

consumers react badly to increased prices of food considered as better quality. For example, increased prices of red meat have caused change in its perceptions – now some consumers see red meat as not one for everyday consumption (Mintel, 2008c).

The UK, and therefore Scotland, are seen as countries with very high food prices (Patrick and Macdonald, 2008), and the UK is one with a low level of self-sufficiency (in 2008 the UK produced 60 per cent of its food as opposed to 80 per cent in 1984 and runs a 1 per cent of GDP trade deficit in food). UK food prices are also highly dependent on the pound and its exchange rate against the euro, which reached its lowest rate of 1.17 in November 2008.

The potential effect that food prices may have on the diet of the Scottish population should be investigated, particularly as the above evidence indicates that rising food prices will have an impact on the purchasing behaviour of consumers. To facilitate such a study, the various types of foods and their quality (as measured, for example, by how processed the foods are) should be taken into account when estimating the effect of prices on the health of the population. In a more detailed analysis, price elasticities should be included to measure the actual response of consumers to price changes.

III. The cost of the Scottish food consumption basket

III.1 Methodology [6]

Key elements of the methodology

The analysis in this part of the report consisted of studying the evolution since 2005 of the cost of the Scottish consumption basket as measured by the 2006 Expenditure and Food Survey (EFS). The choice of 2005 as the starting point for the analysis is due to the fact that several studies use it as their initial year in their analyses of the rise in nominal commodity prices (e.g., OECD-FAO, 2008). In addition to the evolution of the cost of the basket, the contributions of the different categories to the cost of the basket are also identified.

It is important to note that every consumer has a different basket of goods and services, and therefore, each one experiences a different inflation rate. Therefore, for analysing consumers' purchasing power we need to consider not only food prices but also all other expenses and changes in income.

The purpose of this methodology comprises the following three points.

- To measure the inflation rate for Scotland and the contribution of food prices.
- To measure the inflation faced by different income groups (deciles).
- To simulate the change in consumers' purchasing power for the period 2007/08.

---

[6] A more detailed methodology is presented in the annex 1.

It should be noted that data availability imposes limitations on the scope of the analysis in the following respects.

- As regards prices, the consumer price index (CPI) is only constructed for the UK. There is not information about consumer prices in Scotland.
- There is not a price index by socio-economic group (e.g., gross income groups) for Scotland.
- The Expenditure and Food Survey (EFS) only publishes overall average expenditure for Scotland, not by decile, because the sample is too small.
- Scottish household income information by decile is available only up to the fiscal year 2006/07.

Given the aforementioned limitations, in order to analyse the purchasing power of Scottish consumers, some assumptions are required.

- Prices in Scotland and in the UK evolve in a similar way (i.e., UK average prices are a good approximation of Scottish prices).
- The expenditure structure for Scotland has not changed much in the last two years. Thus, the 2006 expenditure information from the EFS can be used to construct expenditure weights.
- The observed UK distribution of expenditure by gross income deciles from the EFS, is a good approximation for the Scottish distribution.

Based on the stated assumptions, the methodology consisted of the following steps.

- To construct a CPI for Scotland using expenditure weights based on the 2006 EFS and UK average prices. The price indices used in the analysis were from the UK average Consumer Price Index (CPI) data series, which measures the changes from month to month in the cost of a representative 'basket' of goods and services bought by consumers within the United Kingdom. The CPI covers the expenditure within the UK made by private households, residents of institutional households (such as University halls of residence or nursing homes) and tourists across the UK.
- To estimate expenditure weights by decile in Scotland by combining Scotland's average expenditure for 2006 (EFS) and the 2006 UK expenditure distribution by decile (EFS).
- To construct a CPI for each Scottish decile using the aforementioned weights.
- To simulate the growth in real income (change in purchasing power) in 2007/08 by decile group, by combining a nominal income growth assumption with the estimated rates of inflation. As regards the income, we used the median equivalised[7] net income (before and after housing costs) by decile for the period 1994/95 - 2006/07 from the Family Resources Survey, which is collected by the UK Department for Work and Pensions.

---

[7] The term 'equivalised' means that the household income has been adjusted to take into account the number of persons that comprise each household.

8

Validity of the approach

It is important to note that since there are no comparable Scottish data, it is not fully possible to know how good the approximation described in the previous paragraphs is. However, some degree of confidence in the estimation can be gained from Figures 2 and 3.

In the analysis it is assumed that we can consider the effect of inflation by considering a constant (fixed) basket, i.e., that of 2006. The problem with a fixed basket is that as prices change, consumers make substitutions in their baskets and therefore, a fixed basket quickly becomes obsolete as a representative basket. The fact that the Office of National Statistics adjusts the consumption basket every year allows us to compare the effect of a fixed basket versus a flexible one on the resulting inflation at the UK level. Figure 2 presents inflation for the UK considering 'all items' using the actual CPI, which adjusts the basket every year, and the UK CPI with the 2006 basket.

Figure 2: UK - How good is the measure of inflation using the 2006 basket – all items?
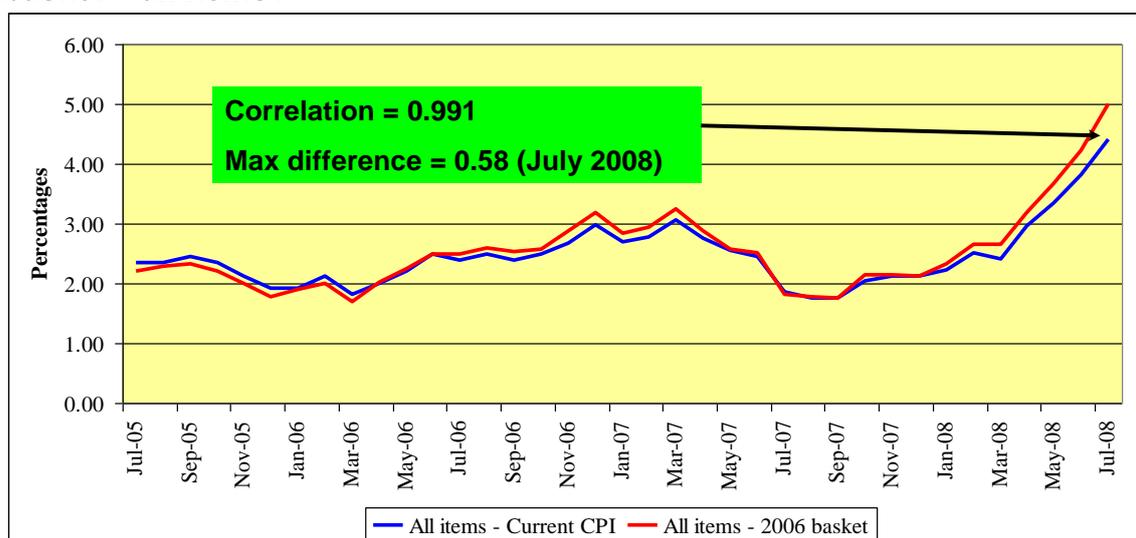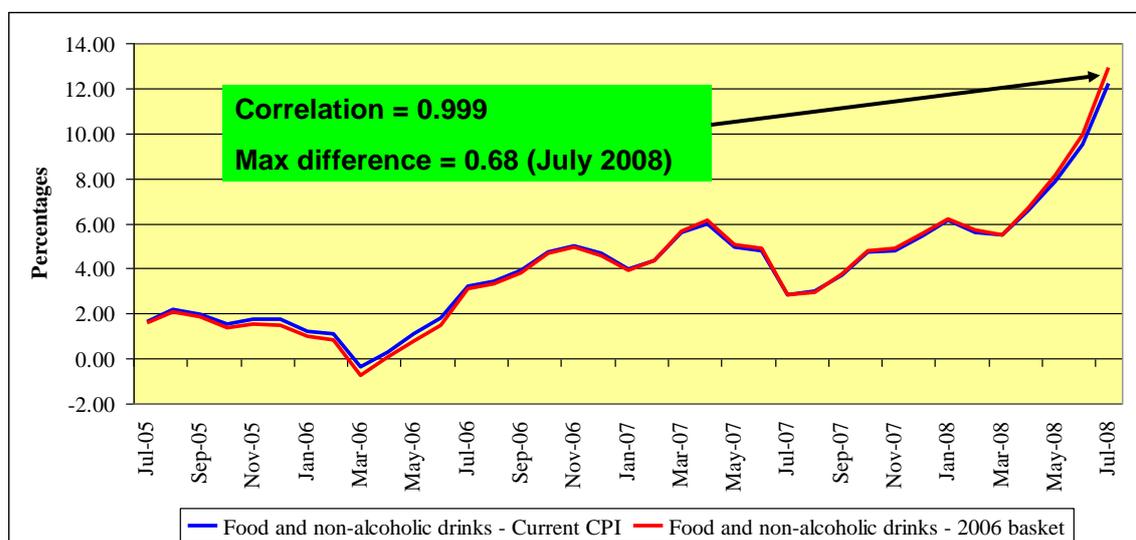

Source: Own elaboration based on National Statistics Office data.

As shown in Figure 2, inflation for the UK considering 'all items' and using the actual CPI, which adjusts the basket every year, and the UK CPI with the 2006 basket are quite close, with the correlation between both series being 0.991 and the maximum difference being at the end of the sample period, reflecting the effect of good substitution due to the rise in prices. Therefore, to use a constant basket is not a major problem and it should work also for Scotland.

Figure 3, which is similar to Figure 2, analyses the case of food inflation alone for the UK. In this case the correlation is even higher (0.999) and again the maximum difference occurs at the end of the series. It should be mentioned that on average Scotland's share of expenditure on food is the closest to the UK average for 2006 (i.e. closer than that for Wales or Northern Ireland).

Thus, the share of food and non-alcoholic drinks for the UK was 12.4 per cent and for 12.5 per cent for Scotland.

Figure 3: UK - How good is the measure of inflation using the 2006 basket – food and non-alcoholic drinks?

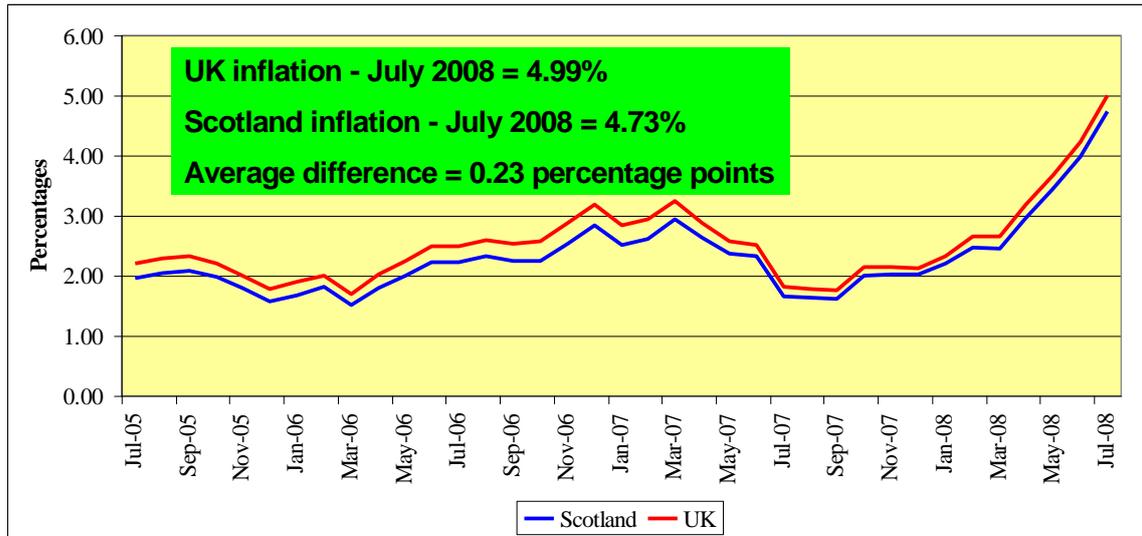Source: Own elaboration based on National Statistics Office data.

III.2 Results

The following section presents three major results from the analysis, namely: the inflation implied by the 2006 Scottish basket in Scotland; the effect of inflation on the cost of the basket of the poorest decile (1st decile); and, the effect of the inflation on the real income of Scottish households by gross income decile.

Inflation in Scotland

Figure 4 compares the inflation for Scotland with the average for the UK, in both cases using 2006 baskets. As shown, the Scottish basket implies an annual inflation that is lower than the UK. On average for the sample period, Scottish inflation is found to be 0.23 percentage points less than the UK.

Since both the Scottish and UK price series were constructed using the same basic prices, the differences between the UK and Scottish aggregated inflation rates can be understood by observing the different structures of expenditure. Figure 5 presents a comparison of the expenditure structures. In order to help the comparison, the expenditure for Scotland is presented as a proportion of the UK expenditure. Thus, the central red line represents the UK expenditure indexed as 100 and the bars represent the ratio (in percentages) of the Scottish expenditure to UK. Thus, Scottish figures show markedly less expenditure on health, education, and housing (categories that explain the lower inflation) but rather more expenditure on clothing and alcoholic drinks, and as mentioned, quite similar in terms of food expenditures.

10

Figure 4: Inflation (all items): UK versus Scotland

UK inflation - July 2008 = 4.99%

Scotland inflation - July 2008 = 4.73%

Average difference = 0.23 percentage points

Source: Own elaboration based on National Statistics Office data.

As regards the categories that explain lower inflation, in the case of health, both components 'medical products, appliances and equipment' and 'hospital services' are below the UK average weekly expenditure (£2 versus £3.1 and £1.2 versus £2.7, respectively). In education, it is explained by the lower education fees (£5.4 versus £6.9) and in housing it is due to the lower rents (£19.5 versus £27.9). It should be noted that the UK figures in the aforementioned categories are higher because they follow England's expenditures, which are higher than the other countries.

Figure 5: Comparison UK (=100) versus Scotland's expenditure - 2006
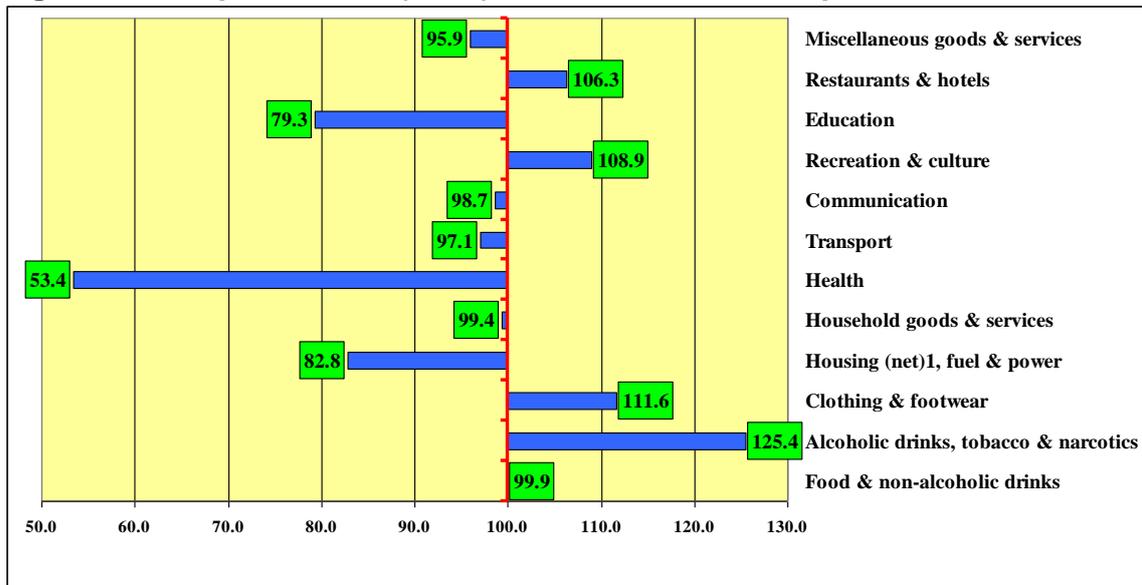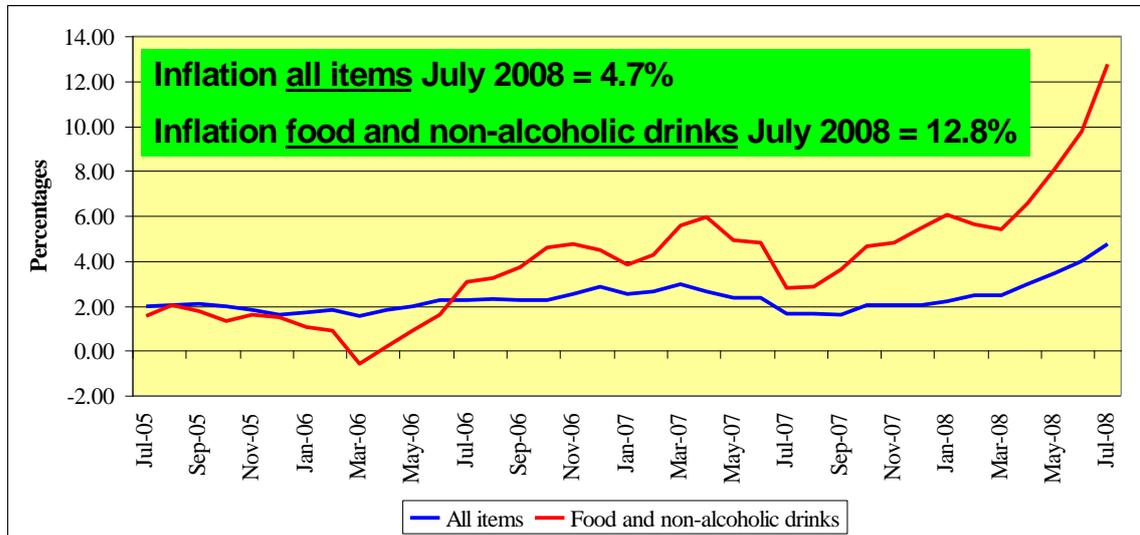

Source: Own elaboration based on National Statistics Office data.

Figure 6 presents the inflation for Scotland considering 'all items' and only 'food and non-alcoholic drinks'. It shows the high rate of inflation in 'food and

11

non-alcoholic drinks' in the summer of 2008 with the July figure reaching 12.8 per cent. The pattern followed by 'all items' and 'food and non-alcoholic drinks' inflation in Scotland closely resembles the UK inflation pattern.

**Figure 6: Scotland: CPI – All items versus food and non-alcoholic drinks**

Source: Own elaboration based on National Statistics Office data.

It is possible to analyse the contribution of the major components of the Scottish basket to the overall inflation. This is done in Figure 7, which presents the contribution to overall inflation of the three main contributors to the inflation rate, namely, 'food and non-alcoholic drinks', 'housing, fuel and power' and 'transport'.

As highlighted by the three ellipses, during most of the analysed period 'housing, fuel and power' and 'transport' have been the main contributors to overall inflation and only recently has 'food and non-alcoholic drinks' surpassed them (far right ellipse). Nevertheless, in contrast with the other two categories, the contribution of food and non alcoholic drinks, which on average has been 25 per cent (i.e., between 17 per cent and 35 per cent) has grown steadily during the period.

Figure 7: Scotland – Percentage contribution to overall inflation rate since July 2006
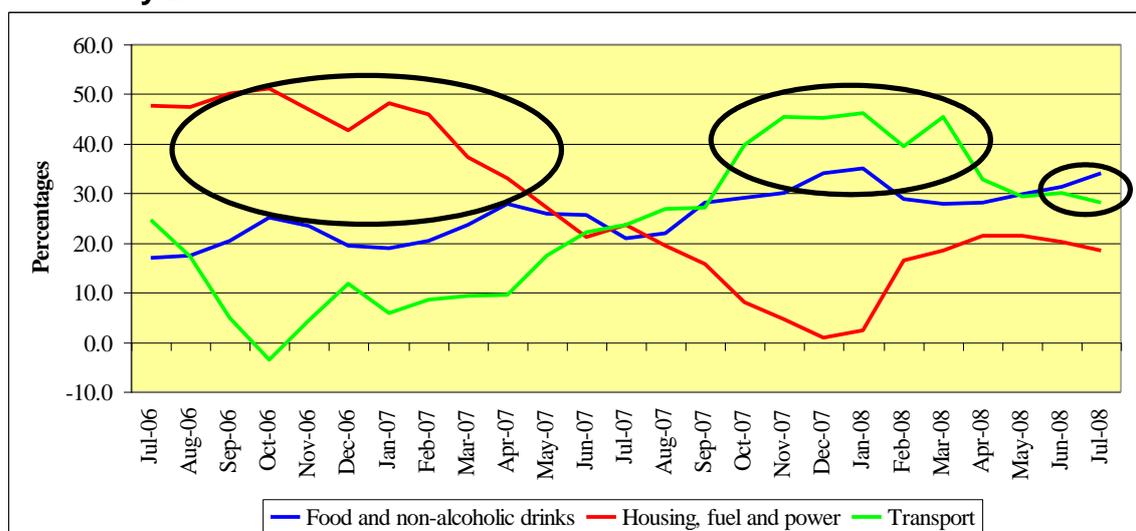
Source: Own elaboration based on National Statistics Office data.

Purchasing power of different gross income decile groups

The incidence of inflation for the different income groups depends on the share of the different expenditure components in their total expenditure. This is presented in Table 1, which provides information for the poorest and the richest groups (1st and 10th deciles, respectively). In the Table those categories which are significantly higher for the poorest group (and therefore this group is sensitive to increases in inflation in those categories) are highlighted with orange. As shown 'food and non-alcoholic drinks' (17.9 per cent) and 'housing, fuel and power' (19.6 per cent) are key components of the 1st decile's (poorest) expenditure. Thus the 1st decile is particularly hard hit by food and housing, fuel and power inflation. Green is used in the Table to highlight the category where the richest decile shows the highest share. This is case of transport, with a share equal to 19.9 per cent.

Figure 8 explores whether the inflation faced by the 1st decile for 'all items' (i.e., overall inflation) and 'food and non-alcoholic beverages' shows a similar pattern to Scotland's average. As shown, the pattern is the same, however, the 'all items' inflation for the 1st decile is above the overall Scottish figure (5.53 per cent instead of 4.7 per cent in July 2008) due to the fact that the prices of 'food and non-alcoholic drinks' and 'housing, fuel and power' are amongst the ones that have increased significantly, and these items are particularly important for this lowest income group.

It should also be noted that when comparing 'food and non-alcoholic drink' inflation, the difference between the average for Scotland and the Scottish 1st decile is reduced (12.8 per cent versus 12.9 per cent, respectively). This fact points out that food does not explain all the inflation faced by the group.

Table 1: How different is the expenditure structure of the poorest and the richest deciles?

Average weekly household expenditure (£)
(2006 data from EFS)

	Poorest	Share (%)	Richest	Share (%)
Food & non-alcoholic drinks	24.50	**17.90**	71.90	**9.40**
Alcoholic drinks, tobacco & narcotics	6.60	4.90	19.00	2.50
Clothing & footwear	7.40	5.40	56.40	7.40
Housing, fuel & power	26.80	**19.60**	61.60	**8.10**
Household goods & services	11.10	8.20	64.00	8.40
Health	1.00	0.70	8.50	1.10
Transport	13.50	**9.90**	151.70	**19.90**
Communication	5.60	4.10	17.50	2.30
Recreation & culture	18.70	13.70	125.80	16.50
Education	1.30	1.00	25.80	3.40
Restaurants & hotels	10.70	7.80	90.20	11.80
Miscellaneous goods & services	9.40	6.90	70.80	9.30
Total	**136.53**	**100.00**	**763.00**	**100.00**

Source: Own elaboration based on National Statistics Office data.

Figure 8: Scotland - 1st decile - All items versus food and non-alcoholic drinks inflation
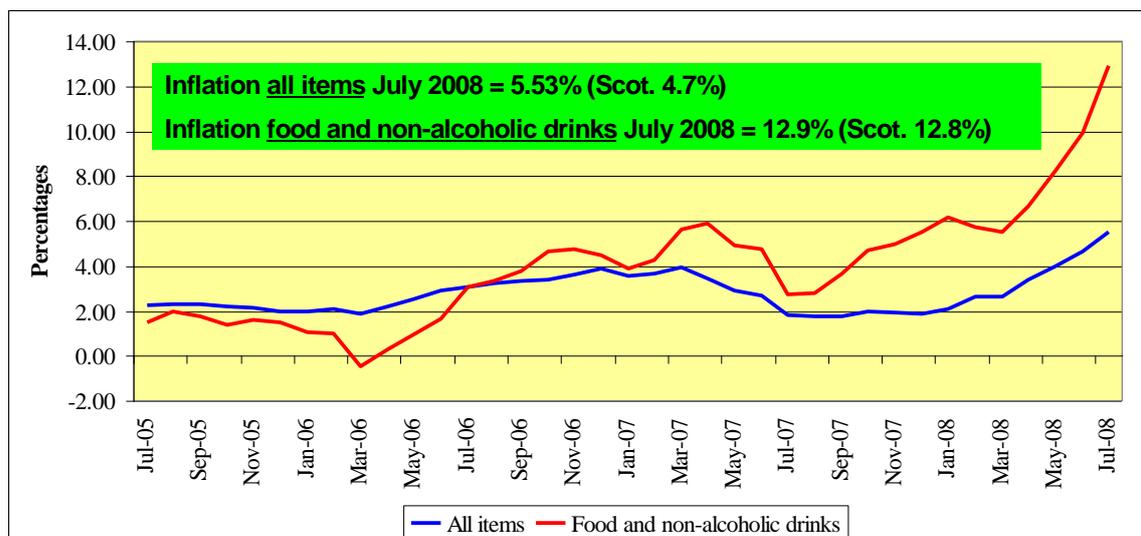
Source: Own elaboration based on National Statistics Office data.

Figure 9 compares the inflation faced by the poorest and the richest groups in the cost of their consumption basket. The figure shows that the 1st decile is more vulnerable to rises in prices of 'food and non-alcoholic beverages' and also to 'housing, fuel and energy prices' and this reflects in the inflation rate they face.

14

Figure 9: Scotland - Inflation: 1st (poorest) versus 10th (richest)
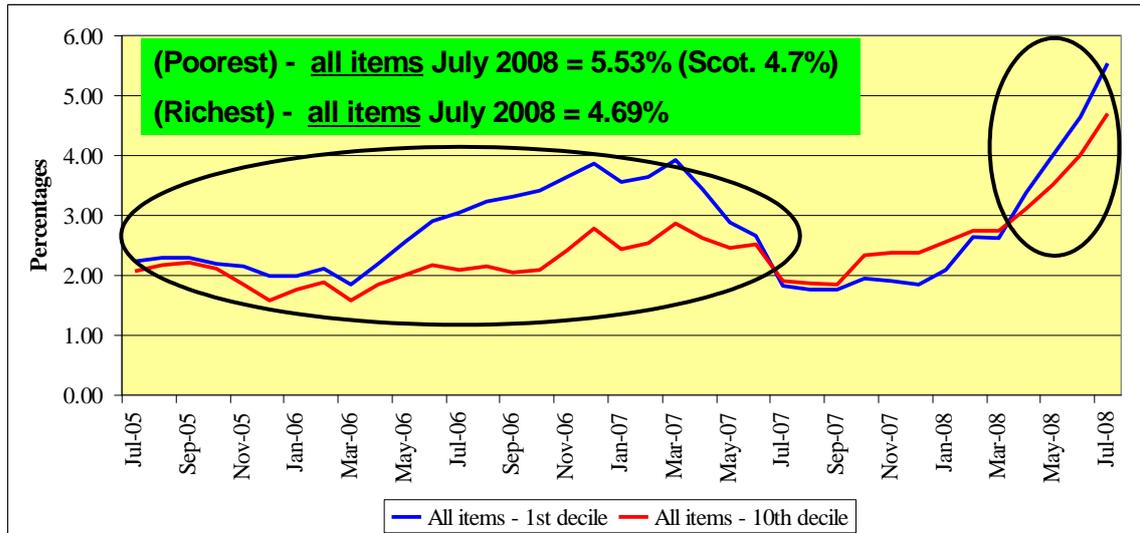
Source: Own elaboration based on National Statistics Office data.

In July 2008 the inflation faced by the 1st decile was 5.53 per cent. Figure 10 complements the information presented by Figure 9 by providing a decomposition of the inflation faced by the 1st decile by category. As mentioned and shown in the figure, the 1st decile is more vulnerable to rises in prices of 'food and non-alcoholic beverages' and 'house, fuel and energy prices'.[8]
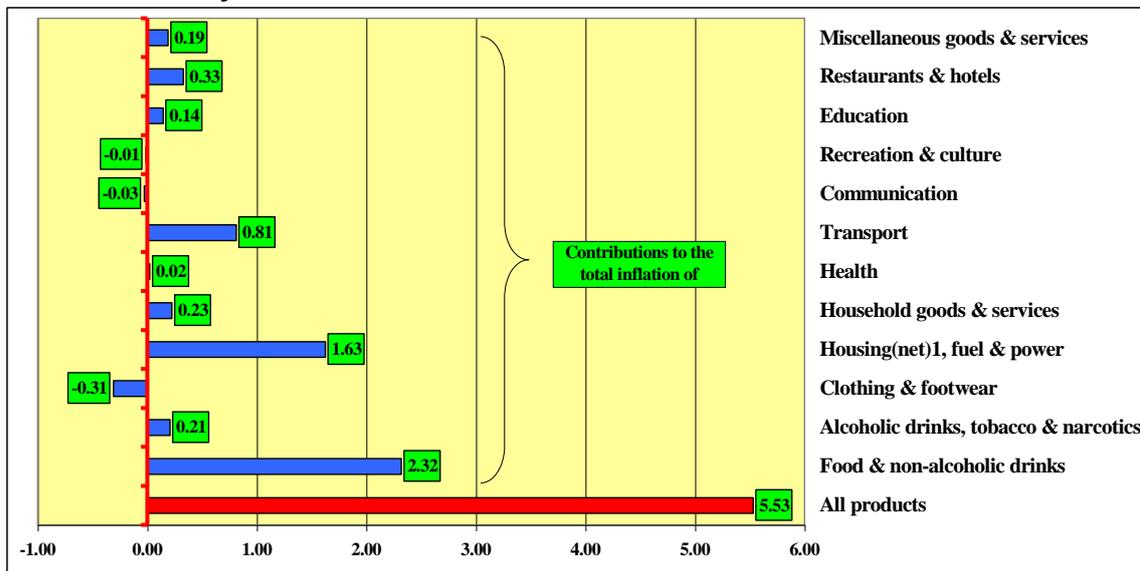
Figure 10: Scotland - 1st decile – Contribution to 'all items' annual inflation in July 2008

Source: Own elaboration based on National Statistics Office data.

----

[8] Although only data for July 2008 is presented, the analysis was performed for the period starting January 2006 on a monthly basis and is available from the authors upon request.

Changes in purchasing power by decile

Two tables (2 and 3) are presented measuring the impact of prices and also the change in nominal income on real income (i.e., consumers' purchasing power).

Table 2: Scotland - Change in purchasing power (before housing)

Decile	Annual Income (£) 1/			Annual income growth (%) 2/		Scottish Inflation 3/	Real income growth in 2007/08	
	1994/95	2003/04	2006/07	Since 1994/95 A	Since 2003/04 B	2007/08	Using A	Using B
1	4,869	7,403	7,920	4.14	2.28	2.27	1.82	0.00
2	6,263	9,740	11,390	5.11	5.36	2.11	2.94	3.18
3	7,503	12,031	13,550	5.05	4.04	2.14	2.84	1.86
4	9,066	14,359	15,770	4.72	3.17	2.09	2.57	1.06
5	10,653	16,531	18,100	4.52	3.07	1.99	2.47	1.05
6	12,460	18,640	20,600	4.28	3.39	2.01	2.22	1.35
7	14,171	21,269	23,590	4.34	3.51	1.95	2.34	1.53
8	16,267	24,245	27,310	4.41	4.05	2.00	2.36	2.00
9	19,778	29,429	32,970	4.35	3.86	2.12	2.18	1.70
10	26,521	40,182	45,190	4.54	3.99	2.35	2.14	1.60
All	11,390	17,481	19,200	4.45	3.18	2.12	2.28	1.04

Notes:

1/ Median annual equivalised net income (before housing costs) for each income decile (in nominal terms)

2/ Average annual growth rates from the indicated period tol 2006/07.

3/ Average growth rate in prices for the fiscal year (April 2007 to March 2008). The inflation rate used was derived in this study.

Source: Own elaboration based on National Statistics Office and Scottish Government data.

Table 2 presents income information before the inclusion of housing costs, and Table 3 presents information after the inclusion of housing costs (i.e. considering deductions for rent, water rates, mortgage interest payments, buildings insurance and ground rent). Note that the table is constructed using the specific inflation for the group.

Both Tables show similar results, indicating that the rise in the inflation rate has had greatest impact on the real income of the poorest group (zero real income growth before housing, and negative income growth once housing is brought into the calculation). The real income growth rates for both scenarios and 'before' and 'after' housing are plotted in Figure 11.

Table 3: Scotland - Change in purchasing power (after housing)

Decile	Annual Income (£) 1/			Annual income growth (%) 2/		Scottish Inflation 3/	Real income growth in 2007/08	
	1994/95	2003/04	2006/07	Since 1994/95 A	Since 2003/04 B	2007/08	Using A	Using B
1	3,170	5,152	5,118	4.07	-0.22	2.27	1.76	-2.44
2	4,683	7,700	9,159	5.75	5.95	2.11	3.56	3.76
3	5,607	9,855	11,284	6.00	4.62	2.14	3.78	2.42
4	7,074	12,094	13,474	5.52	3.67	2.09	3.35	1.54
5	8,468	14,200	15,724	5.29	3.46	1.99	3.23	1.43
6	9,940	16,181	18,044	5.09	3.70	2.01	3.02	1.66
7	11,350	18,476	20,837	5.19	4.09	1.95	3.18	2.10
8	13,407	21,279	24,347	5.10	4.59	2.00	3.03	2.54
9	15,977	25,574	29,557	5.26	4.94	2.12	3.07	2.76
10	21,486	36,150	40,821	5.49	4.13	2.35	3.07	1.74
All	9,176	15,221	16,704	5.12	3.15	2.12	2.94	1.01

Notes:

1/ Median annual equivalised net income (after housing costs) for each income decile (in nominal terms)

2/ Average annual growth rates from the indicated period tol 2006/07.

3/ Average growth rate in prices for the fiscal year (April 2007 to March 2008). The inflation rate used was derived in this study.

Source: Own elaboration based on National Statistics Office and Scottish Government data.

Figure 11: Scotland – Estimated real income grow rates
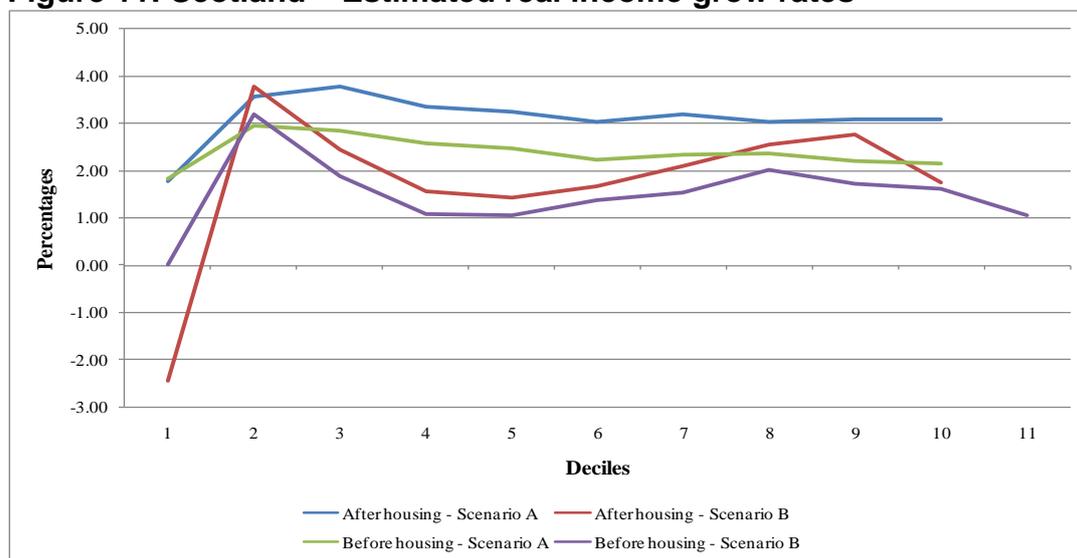
Source: See Table 2 and Table 3.

III.3 Conclusions

The main points reached in this part of the report are related to the question: Has the real income of Scottish consumers decreased in 2007/08 due to the rise in food prices?

The results indicate a positive answer to the above question, but the extent of welfare loss is dependent on the income level and the other prices. Thus, both cases - before and after housing - show similar results, indicating that the rise in the inflation rate has had greatest impact on the real income of the poorest group (zero real income growth before housing, and negative income growth (-2.44 per cent) once housing is brought into the calculation). This is due not only to the fact of the high rate of inflation faced (2.27 per cent), but also because their nominal income since 2003/04 has been growing at a slower pace than the other groups (2.28 per cent) – if no housing costs are considered, or has been decreasing (-0.22 per cent) if these costs are taken into account. It should be noted that all the other decile groups, though not showing negative income growth rates, also suffer from slower rates of growth due to inflation.

Together with food, housing and energy and transport have also contributed to the rise in the inflation rate (therefore highlighting the importance of analysing the price inflation of the whole consumer basket and not only the inflation of the food basket). In fact, since July 2006 'housing, fuel and power' and 'transport' have been the main contributors to overall inflation and only recently (since June 2008) has 'food and non-alcoholic drinks' surpassed them. Nevertheless, in contrast with the other two categories, the contribution of food and non alcoholic drinks, which on average has been 25 per cent (i.e., between 17 and 35 per cent), has grown steadily during the period. As shown by the decomposition of the July 2008 inflation, some items such as clothing and footwear have only partially compensated the situation, with a negative contribution (-0.31 percent) to the overall inflation due to decreases in their prices.

The fact that 'food and non-alcoholic beverages' and 'housing, fuel and energy prices' have an important share in the expenditures of the 1st decile, makes this group more vulnerable to the effects of inflation as the possibilities to substitute products in these categories are rather limited.

IV. Analysis of some specific products within the Scottish food consumption basket

The purpose of this second section of the report is twofold. First, to explore the price behaviour of twelve selected food categories, which are important in terms of their share in the expenditure of Scottish consumers. Second, to explore the effect that the rise in prices might have on the quantities purchased of these products, by estimating their price elasticities.

IV.1 Methodology[9]

As mentioned, one of the aims of this part of the report is to study the evolution of the prices and purchases of twelve selected food categories. This section briefly presents the methodology used to work with supermarket data.

The selected products were brown and white bread, skimmed, semi-skimmed and whole milk, salmon (fresh and chilled), white fish, fresh apples, fresh eggs, fresh new potatoes, minced beef and whole fresh chicken.

The twelve aforementioned food categories were extracted from the dunnhumby database, which provides data on the evolution of weekly purchases by representative supermarket shoppers for the last two years.

This information was analysed separately for the three Scottish regions provided by the database (Borders, Central and North Scotland)[10] and within socio-economic groupings (using CAMEO-UK, a geo-demographic classification system for assessing the socio-economic and demographic characteristics of residential neighbourhoods), in order to see whether there were price patterns that were different to those observed for the UK.

Before proceeding to show the results, it is necessary to mention that the comparison between Scottish and UK prices should be taken cautiously due to the differences in the products across the UK. Furthermore, there is no available information about the products that the Office of National Statistics uses to produce their basic average price per product. Thus, for instance, they report in their publication 'Focus on Consumer Price Indices' on the product 'White loaf, sliced, 800g', however, it is not reported how many varieties they average when computing the price of the product.

Finally, in order to study the reaction of purchasers to changes in prices, average elasticities were estimated by food product category for the whole of Scotland, using the weekly two year span provided by the data. The estimated equations are presented later in the respective section.

IV.2 Results

Table 4 compares the cumulative price inflation for Scotland and its regions with the cumulative price inflation in the UK during the period October 2006 to September 2008 (i.e., the period for which the dunnhumby data are available). Note that this is the total inflation accumulated during the aforementioned period.

Overall, the price series show similar increases to the ones for the UK, except for those highlighted in yellow (white fish and apples), where the Scottish

---

[9] A more detailed methodology is presented in Annex 2.
[10] The regions are based on the independent television broadcasting areas, so that the Borders region also includes a small part of the North of England and the Isle of Man.

series do not show any significant increase during the period. Whilst these differences might be due to the effect of the specific choice of products from the dunnhumby database, as well as the differences in the expenditure shares (as pointed out in the methodology); the fact that all the Scottish regions shows similar trends to those of the Scottish average indicates that this result is not the product of an anomalous behaviour in prices in one of the Scottish regions but it is consistent throughout Scotland.

As regards those prices that show a positive increase during the sample period, excepting the case of milk, salmon and minced beef where the growth in the Scottish prices was slightly above the UK, all the other prices show lower cumulative growth (especially in the case of white bread, fresh apples, fresh eggs and new potatoes).

Table 4: Cumulative Inflation by Product and Scottish Region, 9-Oct-2006 to 22-Sep-2008 (Percentages)

Category	Regions			Scotland	UK
	Borders	Central Scotland	North Scotland		
Brown bread	42.4	37.2	35.4	38.3	38.5
White bread	39.0	36.1	37.0	37.0	53.0
Skimmed milk	28.1	29.7	29.6	28.7	
Semi skimmed milk	29.8	28.8	30.1	29.5	20.0
Whole milk	25.1	25.1	26.6	25.3	
Salmon (fresh and chilled)	-8.7	1.8	3.3	0.1	-1.6
White fish	-3.7	2.5	-3.1	-0.8	7.1
Fresh apples	3.3	1.7	3.1	2.2	20.3
Fresh eggs	39.5	39.6	41.8	40.4	56.7
Fresh new potatoes	36.2	..	28.9	29.9	60.8
Minced beef	41.6	25.8	22.7	26.1	19.8
Whole fresh chicken	20.8	28.4	26.1	27.6	39.6

Source: Own elaboration based on dunnhumby data
Notes:
".." not enough purchases to establish a price

Table 5 is similar to Table 4, with the difference that the analysis is performed by the CAMEO Geo-Demographic Groups. It is important to mention that a caveat with these tables is that not all the CAMEO groups were well represented (pointing to the need to aggregate groups in future work), in the sense, that in some cases there were only a few customers or none from specific groups purchasing a determined food product.

Those products highlighted in yellow show price changes for the period that are close to the average.

Figures 12 to 23 complement the information provided by Tables 4 and 5 by showing the evolution of the prices for the selected food categories for the period 9 October 2006 to 22 October 2008. For comparison purposes the figures also show the trend in the UK prices.

Figure 12 and 13 show the evolution of prices of brown bread (including wholemeal bread) and white bread. Both series show a more or less steady increase during the entire period, which accords with the increase in the price of cereals during the period. Whilst both series appear to increase in a steady way, white bread prices seem to increase with some modest but discrete jumps (i.e., with discrete adjustments). As regards regional differences, all the series seem to move following the same trend.

Table 5: Cumulative Inflation in Scotland by Geo-Demographic Group and Product, 9-Oct-2006 to 22-Sep-2008

Category	CAMEO - Geo-demographic groups					All
	Affluent Home Owners	Comfortable Mixed Neighbourhoods	Less Affluent Families	Less Affluent Singles and Students	Poorer Council Tenants Many Single Parents	the groups together (Scotland)
Brown bread	35.2	39.8	32.0	41.3	38.0	38.3
White bread	39.1	35.9	38.3	38.4	39.0	37.0
Skimmed milk	25.1	30.1	26.8	26.4	30.1	28.7
Semi skimmed milk	27.9	30.1	29.4	31.2	29.4	29.5
Whole milk	24.4	25.2	29.2	23.7	25.8	25.3
Salmon (fresh and chilled)	-3.7	2.5	-12.9	2.0	6.5	0.1
White fish	-12.0	0.4	-40.5	9.0	-6.0	-0.8
Fresh apples	0.1	4.0	2.9	-8.6	-1.6	2.2
Fresh eggs	39.5	42.5	39.5	38.5	39.2	40.4
Fresh new potatoes	29.7	27.9	29.7	14.2	29.7	29.9
Minced beef	27.0	23.5	27.8	30.9	29.0	26.1
Whole fresh chicken	30.0	23.9	46.3	14.9	25.6	27.6

| Category	CAMEO - Geo-demographic groups					All
	Poorer Family and Single Parent Households	Poorer White and Blue Collar Workers	Smaller Private Family Homes	Wealthy Retired Neighbourhoods	Young and Affluent Singles	the groups together (Scotland)
Brown bread	40.8	29.4	32.1	36.3	31.0	38.3
White bread	37.1	34.1	32.5	34.9	39.4	37.0
Skimmed milk	28.9	28.2	28.8	31.8	24.6	28.7
Semi skimmed milk	28.5	29.5	28.4	27.9	25.3	29.5
Whole milk	25.6	25.8	21.9	26.3	17.4	25.3
Salmon (fresh and chilled)	0.2	-21.8	-0.5	15.3	-75.7	0.1
White fish	15.9	101.8	13.6	19.2	..	-0.8
Fresh apples	2.2	0.9	6.3	-1.0	-18.3	2.2
Fresh eggs	39.5	37.9	40.0	42.4	31.7	40.4
Fresh new potatoes	34.2	19.8	31.3	54.1	19.5	29.9
Minced beef	29.0	22.8	24.6	21.4	11.8	26.1
Whole fresh chicken	37.8	-7.0	25.5	32.2	..	27.6

Source: Own elaboration based on dunnhumby data.

Figure 12: Brown Bread Price Index (Base 9-Oct-2006=1)
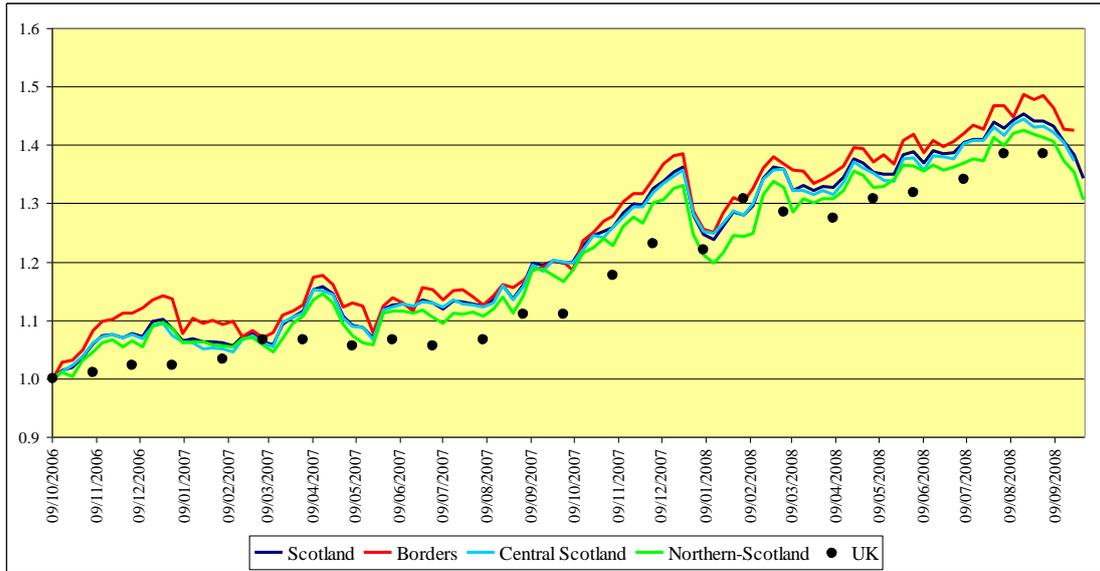
Source: Own elaboration based on dunnhumby data.

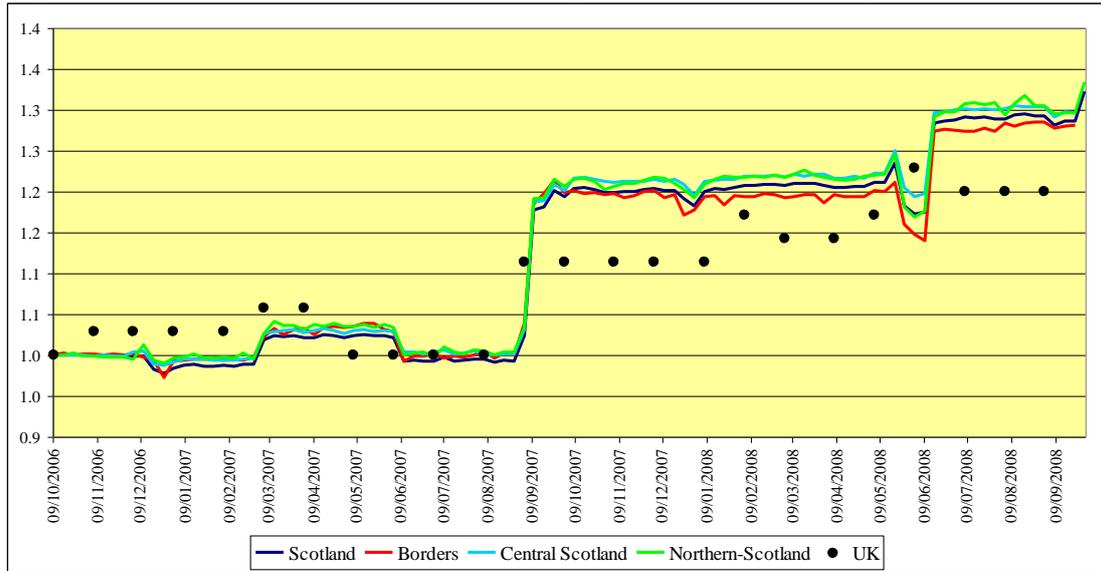**Figure 13: White Bread Price Index (Base 9-Oct-2006=1)**
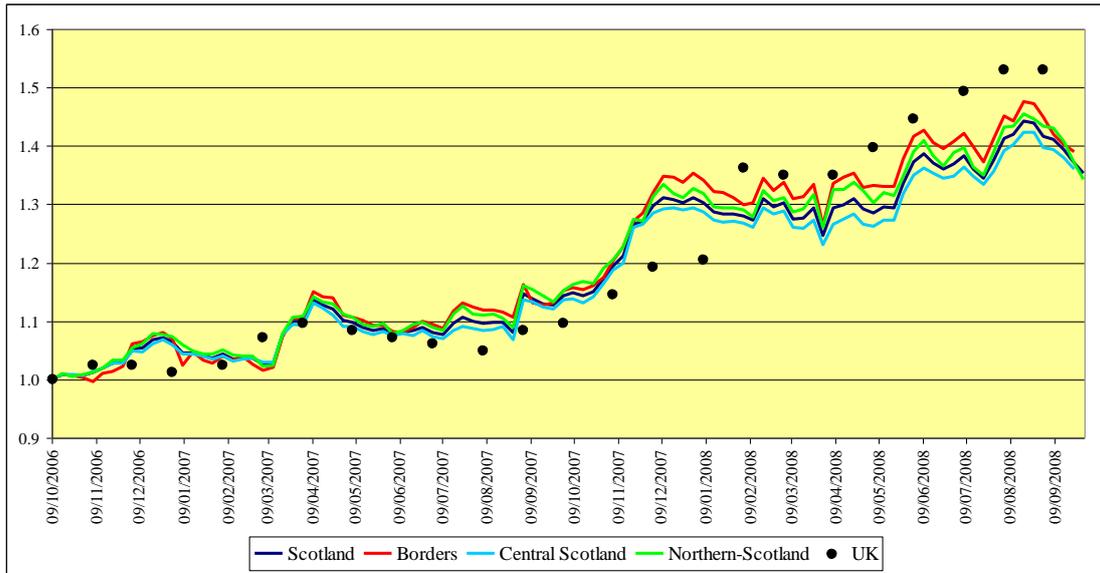
Source: Own elaboration based on dunnhumby data.

Figures 14 to 16 present the evolution of milk prices: skimmed, semi-skimmed and whole milk prices.

The evolution of the prices of the three products is quite close and indicates that prices change in a discrete way, i.e., with sudden jumps (except with a decrease in price in June-July 2008, possibly due to a discount policy). It is interesting to note that this pattern contrasts with the one observed for UK milk prices from the ONS (not shown here), which presents a steady increase but without the discrete jumps, most surely due to the averaging of different milk products and regions in the UK.

22

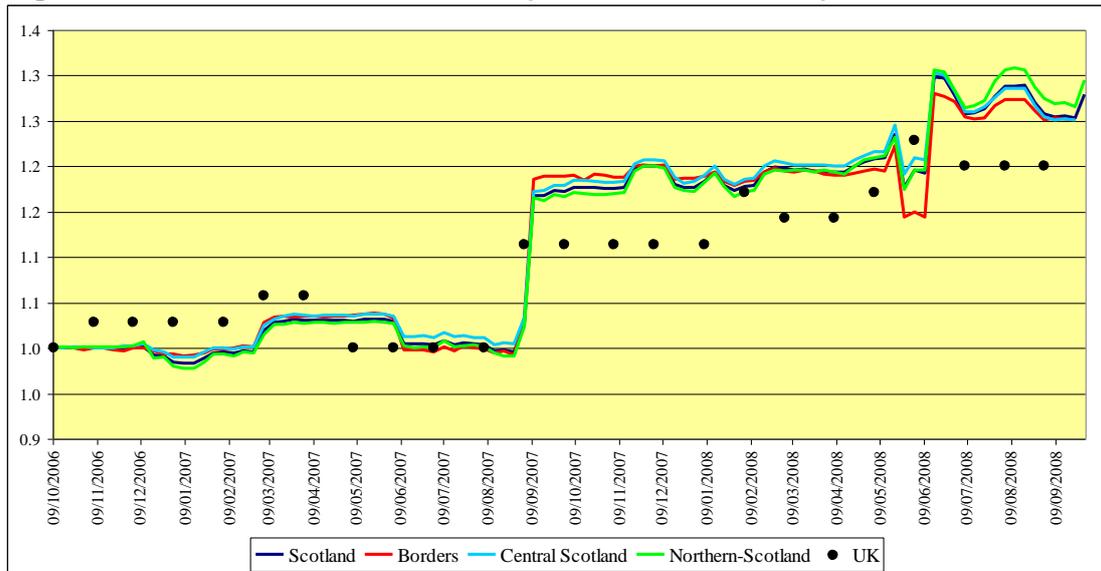**Figure 14: Skimmed Milk Price Index (Base 9-Oct-2006=1)**

Source: Own elaboration based on dunnhumby data.

Figure 15: Semi-Skimmed Milk Price Index (Base 9-Oct-2006=1)
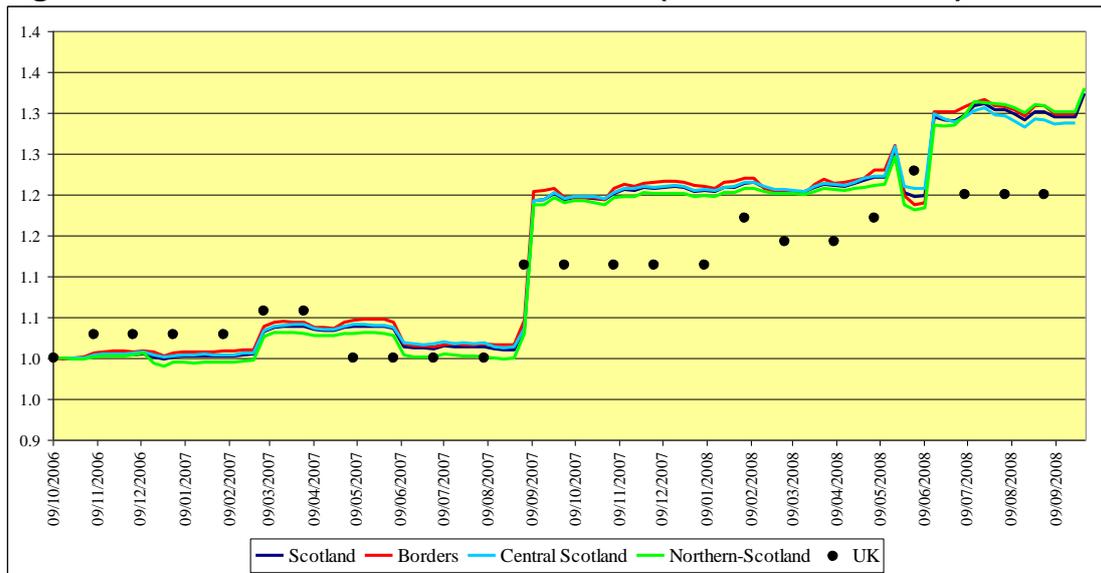
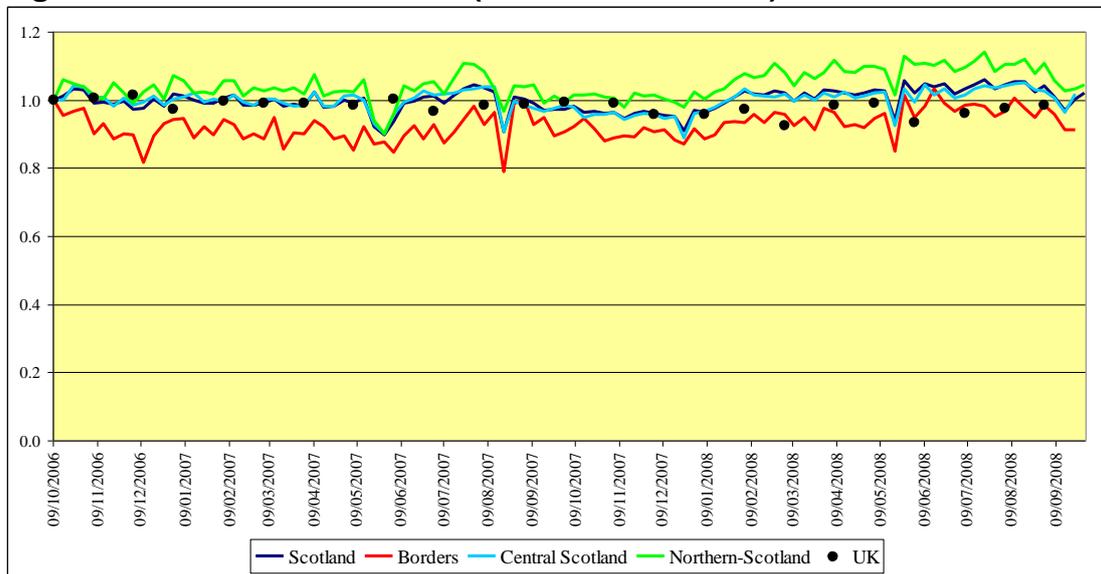Source: Own elaboration based on dunnhumby data.

Figure 16: Whole Milk Price Index (Base 9-Oct-2006=1)

Source: Own elaboration based on dunnhumby data.

Figures 17 and 18 present the evolution of fish prices (salmon and white fish respectively). As shown, none of these price series present any increasing trend and they fluctuate around the base value. As mentioned in the case of white fish, the UK average price shows a slight upward trend in contrast to the Scottish prices, which do not show any increase.

Figure 17: Salmon Price Index (Base 9-Oct-2006=1)

Source: Own elaboration based on dunnhumby data.

Figure 18: White Fish Price Index (Base 9-Oct-2006=1)
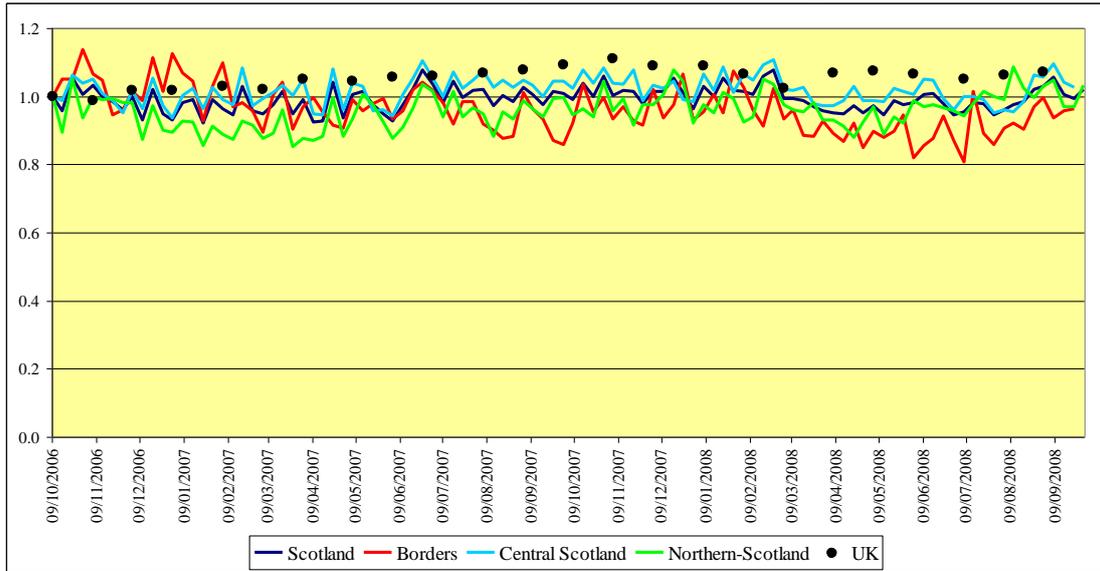

Source: Own elaboration based on dunnhumby data.

Figure 19 shows the fresh apples price index. Similar to the fish price, no increasing trend can be perceived and the behaviour in all the regions seems to be quite similar.

Figure 19: Fresh Apples Price Index (Base 9-Oct-2006=1)
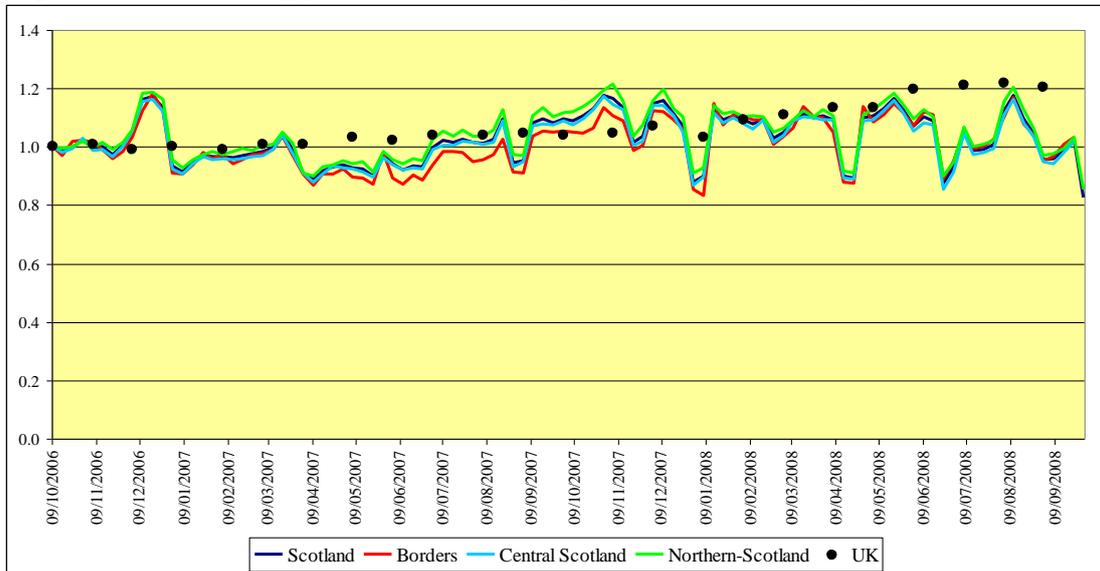
Source: Own elaboration based on dunnhumby data.

Figure 20, which presents the evolution of egg prices, shows a behaviour that is similar to that of milk prices, i.e., adjustments through discrete jumps (instead of steady increases), especially in the last year of the sample. The lift in prices from autumn 2007 will probably have been associated with the rise in feed-grain prices at that time.

Figure 20: Fresh Eggs Price Index (Base 9-Oct-2006=1)

Source: Own elaboration based on dunnhumby data.

In the case of new potatoes, i.e., Figure 21, the increase in most of the series seems to be steady throughout the period, similar to the behaviour in the UK series.

Figure 21: Fresh New Potatoes Price Index (Base 9-Oct-2006=1)
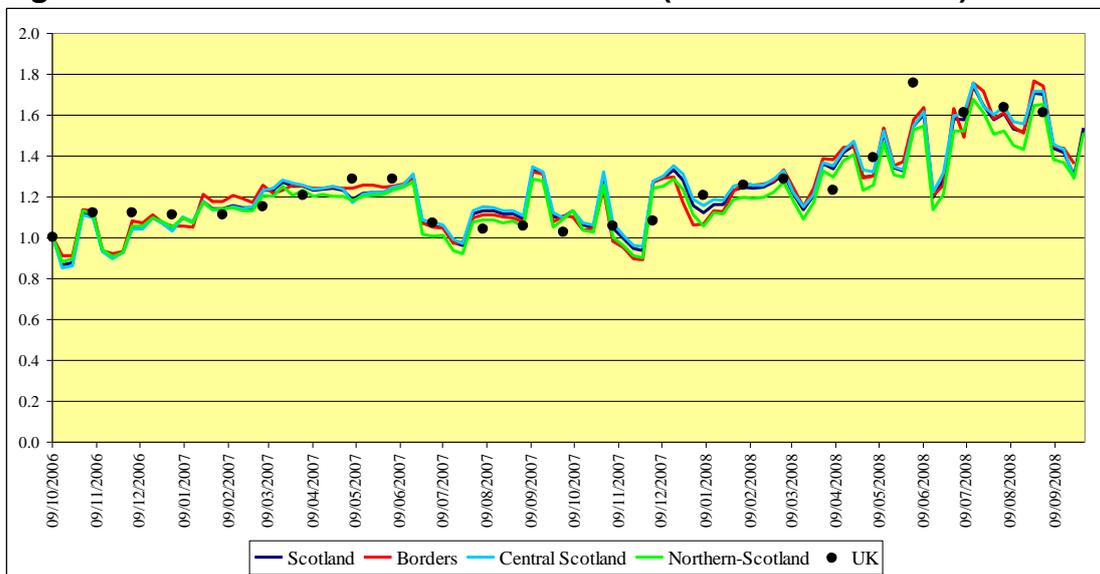
Source: Own elaboration based on dunnhumby data.

Figure 22 shows the minced beef price, with a similar trend for each region. The UK average price is slightly above Scottish levels during most of the period, except at the end, where the Scottish prices show a steep rise.

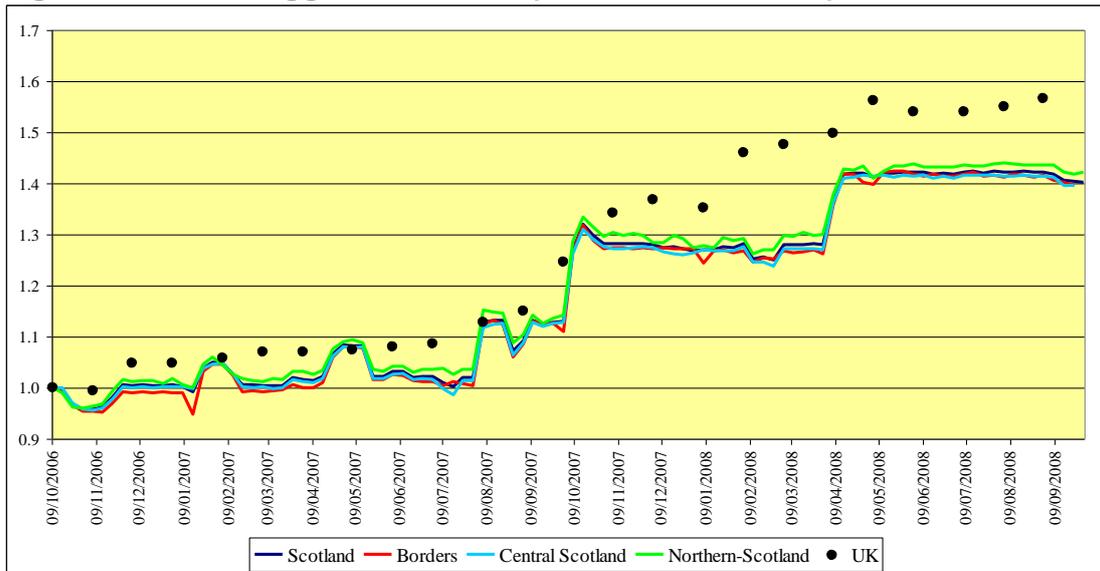**Figure 22: Minced Beef Price Index (Base 9-Oct-2006=1)**
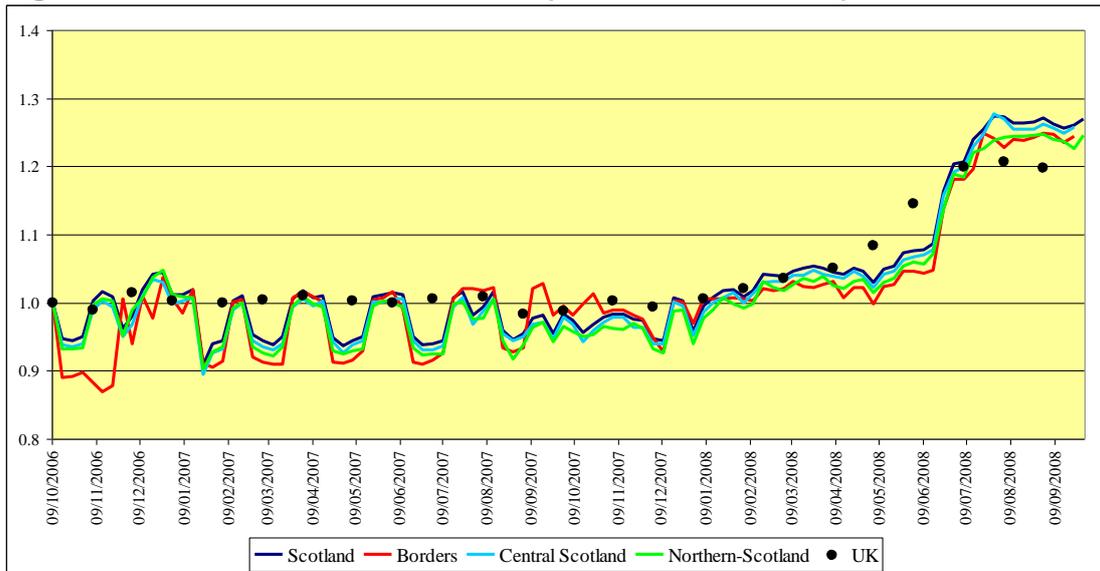
Source: Own elaboration based on dunnhumby data.

Figure 23 presents the series for fresh whole chicken. All the series show a steady rise over the entire sample period (although the UK average index is above the Scottish indices), with the exception of a short decrease in price in June 2007, due probably to a price promotion.

Figure 23: Whole Fresh Chicken Price Index (Base 9-Oct-2006=1)
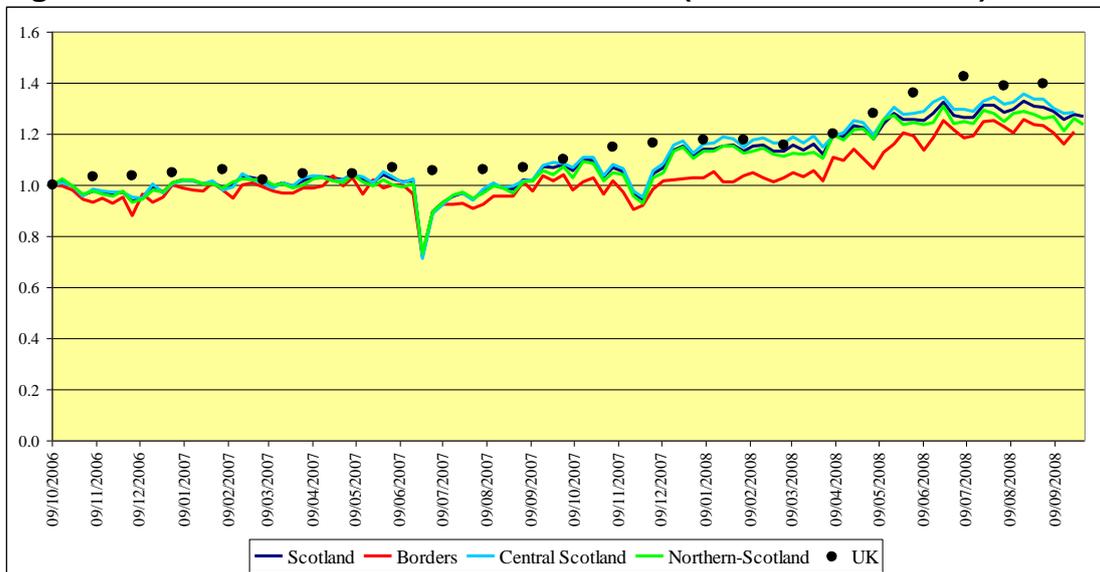
Source: Own elaboration based on dunnhumby data.

IV.3 Estimation of elasticities

The purpose of this section is to analyse the impact that the rise in prices in the selected analysed food categories may have on the purchases of consumers.

The model used to compute the elasticities[11] was the log-linear model (Deaton and Muellbauer, 1991, p. 61) due to the fact that we are not estimating a full demand system, and also because it directly produces average elasticities instead of an elasticity around the mean values. The model is given by:

$$\log Q_1 = \alpha_0 + \alpha_1 \cdot \log P_1 + \alpha_2 \cdot \log P_2 + \alpha_3 \cdot \log E + \mu$$

Where the α's are the parameters of the demand, Q_1 is the quantity purchased of good 1, P_1 is the price of good 1, P_2 is the price of good 2, a possible substitute or complement good (assumed in the equation to be only one product), E is the expenditure in the category (as an approximation for the income destined for the category) and µ is the error term. Thus, α_1 is the own-price elasticity of quantity demanded, α_2 is the cross price elasticity and α_3 is the expenditure elasticity. [12]

Table 6 presents the results of the estimations. It should be noted that all the estimations required a correction for first order autocorrelation, which was performed using the Cochrane-Orcutt procedure (Greene, 1990). This can be easily understood by the fact that the data are weekly and may present some inertia or adjustment behaviour. All the estimated 'rho' coefficients were found to be between 0.4 and 0.9, indicating that all the equations have a dynamic stable trajectory.

Two sets of estimations were performed: one considered equations for individual products and considered only obvious substitutes; and another for the case of all meats (salmon, white fish, minced beef and whole fresh chicken).

---

[11] Elasticity is a number that indicates the change in percentage terms in one quantity due to the change in percentage terms in another quantity. For instance, the own-price elasticity of demand of a product is the percentage change in the quantity demanded of one product (say bread) in relation to the percentage change in the price of the product (price of bread). A cross price elasticity is similar, but it measures the change in demand with respect to the change in a related product price (e.g., change in the demand for white bread due to the change in price of brown bread).

[12] Note that in the absence of all the products that comprise the consumer's basket, in order to study the demand for a selected number of products we rely on the assumption that the consumption decision is broken down into two stages. In the first stage the consumer decided how much income to allocate to the category (e.g., total expenditure in bread) and in the second stage the consumer decides how allocate the total expenditure for the category amongst the product that comprise the category (e.g., in the second stage the total decided expenditure in bread is allocated between brown or white bread). Thus, the 'expenditure elasticity' of a product is the change in the demand for a product due to change in the income allocated to the category. For more information see Deaton and Muellbauer, 1991.

The overall results measured by the adjusted R^2 by the degrees of freedom, rank from 0.5 to 0.8, indicating that all the equations, despite their simplicity, explain a significant part of the variance observed in the purchased quantities.

As regards the first set of estimations, the equations for bread, brown and white, show that that only white bread is price elastic (-1.091) and that it also has a significant cross price elasticity with respect to brown bread, which appears as a substitute (1.296). Brown bread appears to have an elasticity that is not significantly different than 0. This result is interesting because given the steady increase in the price of bread; consumers buying brown bread are increasing their expenditure (since their consumed quantities do not react/change due to prices). On the other hand, white bread consumers are subject to two influences (own price and cross price). As regards the expenditure elasticity, both products show that this is approximately 0.5, which indicates that an increase in the expenditure in the category by 1 per cent only increases consumption of the product by 0.5 per cent, indicating that these are normal goods.

The demand equations for milk (skimmed, semi-skimmed and whole milk) show that there is little relation between them, i.e., for the consumers these are apparently separate categories. The fact that none of these are price elastic means that the increase in prices increases the expenditure in milk. Similar to the case of bread, the expenditure elasticities are also in the range of 0.5.

The equations for fish categories show that only salmon is price responsive (although not elastic, i.e., -0.775). Therefore, an increase in the price for salmon would have not carried a 1 to 1 decrease in the consumption of salmon, and therefore, a slight increase in the expenditure. White fish, on the other hand, does not appear price responsive. As regards the relationship between salmon and white fish, the cross elasticities were statistically zero, indicating that consumers see these two products as independent ones. The expenditure elasticities are also in the range of 0.5.

For the remaining products, i.e., fresh apples, eggs, new potatoes, minced beef and fresh chicken, no cross price elasticities were estimated. With the exception of fresh eggs, which showed no reaction to price changes, and therefore an increase in price would produce an increase in expenditures, all the other products were shown to be price responsive. Of these, apples appeared to be price inelastic (-0.848) and the last three price elastic (-1.272, -1.623, -1.362 respectively), showing that the increase observed in prices has carried through to a proportionately greater decrease in the demanded quantities for these products. Similar to the other categories, the expenditure elasticities were around 0.5.

Finally, the last four regressions of Table 6 present estimations of elasticities for salmon, white fish, minced meat and whole fresh chicken. The difference between these regressions and the previous ones for the same products is that in the last set of equations, cross price elasticities for all the products are considered.

Table 6: Estimation of demand elasticities for the selected products

Demand equation	Own price elasticities			Cross price elasticities				Expenditure elasticities 1/			Adj. R²	Rho 2/	
	Coeff.	t-stat	Signif.	Coeff.	t-stat	Signif.	Variable	Coeff.	t-stat	Signif.		Coeff.	t-stat
Brown bread	-0.273	-1.4	0.16	-0.145	-0.8	0.45	White bread	0.555	15.7	0.00	0.83	0.683	9.5
White bread	-1.091	-4.1	0.00	1.296	4.8	0.00	Brown bread	0.504	11.2	0.00	0.70	0.812	14.2
Skimmed milk	-0.021	0.0	0.98	-0.685	-0.8	0.41	Semi skimmed milk	0.532	15.0	0.00	0.67	0.664	9.0
				0.709	1.2	0.22	Whole milk						
Semi skimmed milk	0.087	0.1	0.92	-0.683	-0.8	0.43	Skimmed milk	0.472	10.4	0.00	0.52	0.473	5.5
				0.753	1.2	0.23	Whole milk						
Whole milk	-0.543	-0.9	0.36	-0.973	-1.2	0.23	Skimmed milk	0.474	10.7	0.00	0.51	0.438	5.0
				1.542	1.9	0.07	Semi skimmed milk						
Salmon (fresh and chilled)	-0.775	-3.8	0.00	0.001	0.0	1.00	White fish	0.508	10.0	0.00	0.78	0.870	18.0
White fish	-0.009	0.0	0.96	-0.069	-0.3	0.80	Salmon (fresh and chilled)	0.401	5.8	0.00	0.59	0.754	11.7
Fresh apples	-0.848	-7.1	0.00					0.517	13.3	0.00	0.81	0.779	12.7
Fresh eggs	0.000	0.0	1.00					0.482	12.9	0.00	0.55	0.518	6.2
Fresh new potatoes	-1.272	-10.0	0.00					0.482	10.5	0.00	0.85	0.925	24.8
Minced beef	-1.623	-7.6	0.00					0.466	10.5	0.00	0.81	0.971	41.4
Whole fresh chicken	-1.362	-10.9	0.00					0.475	13.7	0.00	0.86	0.687	9.6
All the meats													
Salmon (fresh and chilled)	-0.445	-1.7	0.09	0.070	0.4	0.71	White fish	0.331	5.0	0.00	0.65	0.768	12.2
				-0.004	0.0	0.99	Minced beef						
				0.338	2.2	0.03	Whole fresh chicken						
White fish	0.042	0.2	0.84	0.177	0.6	0.53	Salmon (fresh and chilled)	0.322	4.4	0.00	0.56	0.727	10.8
				-0.388	-1.6	0.11	Minced beef						
				0.456	2.8	0.01	Whole fresh chicken						
Minced beef	-2.206	-8.6	0.00	0.426	1.8	0.07	Salmon (fresh and chilled)	0.325	5.5	0.00	0.71	0.965	37.7
				0.304	1.8	0.07	White fish						
				0.261	1.7	0.09	Whole fresh chicken						
Whole fresh chicken	-1.876	-13.1	0.00	-0.635	-2.7	0.01	Salmon (fresh and chilled)	0.776	12.7	0.00	0.86	0.786	13.0
				0.498	2.9	0.00	White fish						
				0.742	3.4	0.00	Minced beef						

Source: Own elaboration based on dunnhumby data.

Notes:

1/ Elasticity with respect to the expenditure within the category. For instance, in the case of brown and white bread it corresponds to the expenditure in bread.

2/ Autocorrelation coefficient. All the equations have been corrected for first order autocorrelation using the Cochrane-Orcutt procedure.

The results for salmon are not robust, it appears price inelastic but the coefficient is not statistically significant at 1 percent. However, the equation indicates that salmon and chicken might be substitutes given the positive value of the cross price elasticity. In the case of white fish it does not appear to be price responsive, but similar to salmon it seems to be a substitute for chicken. Minced beef, according to the estimation, is price elastic and none of its cross price elasticities were found to be statistically significant at 1 per cent. Finally, all the elasticities for chicken are significant, indicating that it is highly responsive to price changes and it appears to be a complement with respect to salmon, and substitute for white fish and minced beef.

IV.4 Conclusions

The purpose of section IV has been to analyse the behaviour of prices and quantities purchased for selected food categories using Scottish data from the dunnhumby database. Two analyses were produced: first, to explore whether the Scottish prices (at least for the selected products) evolve in a similar way to the average prices for the UK. Second, the reaction of the quantities purchased to changes in prices (i.e., estimation of demand elasticities).

As regards the first analysis, results show that except for the cases of white fish and apples; Scottish prices present an increasing trend, similar to that observed for the UK. For white fish and apples no evident trend was found. In addition, for most of the food categories analysed, Scottish prices were found to increase less than UK prices, except in the case of milk, where Scottish price increases were slightly above UK levels. It should be noted that this difference cannot be assessed due to the fact that the components of the UK average prices are unknown.

Two sets of elasticities were estimated: one considered individual products considering only obvious substitutes and another for the case of all meats (salmon, white fish, minced beef and whole fresh chicken). The results of the first set of estimations showed that several of the categories were price responsive, although not all of them, with elasticities greater than 1. White bread, fresh new potatoes, minced beef and whole fresh chicken presented statistically significant own price elasticities above 1. Own price elasticities for salmon and apples were significant but below 1. The elasticities for the remaining products were not statistically different from zero. This indicates that rises in their prices give rise to an increase in their expenditure. In addition, of all the estimated cross-price elasticities, only the one for white bread with respect to brown bread was significant. The expenditure elasticities were all significant with a value around 0.5, indicating that these are normal products.

As regards the second set of results, i.e., when considering the substitution of all the meats, they appear less robust (own price elasticities have greater standard deviations) than when each product is considered to belong to an independent market. The only exception is the case of whole fresh chicken which showed strong own and cross price elasticities.

V. Final Remarks

The purpose of this report has been to explore the situation of the purchasing power of Scottish consumers, against the background of rising food prices. In order to do so, due to the lack of specific information for Scotland, the methodology employed consisted of using indirect indicators to provide the required assessment.

The first part of the analysis studied the evolution of the cost of the 2006 average Scottish consumption basket during the period of July 2005 to July 2008, considering all products (i.e., food and non-food), and also estimated the consequence of the increase in prices on the different income groups.

The results indicate that prices in general (i.e., not only food prices) will affect significantly the real income of the different groups, especially the first decile group (i.e., the poorest group). It should be noted that the extent of welfare loss is dependent on the income level and the movement in other prices.

Both cases - before and after housing - show similar results as regards the decrease in real income since 2003/04, indicating that the rise in the inflation rate has had greatest impact on the real income of the poorest group (zero real income growth before housing, and negative income growth (-2.44 per cent) once housing is brought into the calculation). This is due not only to the high rate of inflation faced (2.27 per cent) but also because their nominal income since 2003/04 has been growing at a slower pace than the other groups (2.28 per cent) - if no housing costs are considered - or has been decreasing (-0.22 per cent) if these costs are taken into account. It should be noted that all the other decile groups, though not showing negative income growth rates, also suffer from slower rates of growth due to inflation.

Together with food, housing and energy and transport have also contributed to the rise in the inflation rate (thus emphasising the importance of analysing the price inflation in the whole consumer basket and not only the inflation of the food basket). In fact, since July 2006 'housing, fuel and power' and 'transport' have been the main contributors to overall inflation and only recently (since June 2008) has 'food and non-alcoholic drinks' surpassed them. Nevertheless, in contrast with the other two categories, the contribution of food and non alcoholic drinks to inflation, which on average has been 25 per cent (i.e., between 17 and 35 per cent), has grown steadily during the period. As shown by the decomposition of the July 2008 inflation, some items such as clothing and footwear have only partially compensated the situation with a negative contribution (-0.31 percent) to the overall inflation situation, due to decrease in their prices.

The fact that 'food and non-alcoholic beverages' and 'housing, fuel and energy prices' have an important share in the expenditures of the 1st decile, makes this group more vulnerable to the effects of inflation, as the possibilities to substitute products in these categories are rather limited. These results indicate that there may be specific groups at risk which need to be identified and their situation assessed.

The second part of the report tries to provide information about the evolution of Scottish prices for specific food categories and their impact on consumers' purchases. The results showed that except for the cases of white fish and apples, Scottish prices present an increasing trend, similar to that observed for the UK. In addition, for most of the food categories analysed, Scottish prices were found to increase less than UK prices, except in the case of milk, where Scottish price increases were slightly above UK levels. It should be noted that these differences cannot be assessed due to the fact that the components of the UK average prices are unknown.

Two sets of elasticities were estimated: one considered individual products considering only obvious substitutes; and another for the case of all meats (salmon, white fish, minced beef and whole fresh chicken).

The results for the first set of estimates showed that several of the categories were price responsive although not all of them with elasticities greater than 1. White bread, fresh new potatoes, minced beef and whole fresh chicken presented statistically significant own price elasticities above 1. Own price elasticities for salmon and apples were significant but below 1. The elasticities for the remaining products were not statistically different from zero. This indicates that rises in their prices give rise to an increase in their expenditure.

Of all the estimated cross-price elasticities in the first set of estimations, only the one for white bread with respect to brown bread was significant. The expenditure elasticities were all significant with a value around 0.5, indicating that these are normal products.

The results when considering the substitution of all the meats (i.e., salmon, white fish, mince beef and whole fresh chicken) appear less robust than when each product is considered to belong to an independent market. The only exception is the case of whole fresh chicken which showed strong own and cross price elasticities.

VI. References

AHDB Meat Services (2008). Meat Demand Trends, September.

Balk, B. (2008). Price and Quantity Index Numbers: Models for Measuring Aggregate Change and Difference. Cambridge University Press: Cambridge.

Chevalier, M. (2003). Chain Fisher Volume Index Methodology. Research Paper No. 42 – Income and Expenditure Accounts technical series. Statistics Canada: Ottawa.

Christian, T. and Rashad, I. (2008). Trends in U.S. Food Prices, 1950-2007, Economics and Human Biology, In press.

Deaton, A. and Muellbauer, J. (1991). Economics and consumer behaviour. Cambridge University Press: New York.

Ellis, H. (2008). Food Prices, BBC News – Food, 2 September.

Greene, W. (1990). Econometric Analysis. Prentice Hall: New Jersey.

Grocer (2008). Grocer 33 survey 08/11/2008.

Keynote (2008). Trends in Food Shopping, May.

Lloyd, T. (2008). Price Leadership in UK Food Retailing: Time Series Representation and Evidence. 82 AES Annual Conference, Cirencester, April.

Marketing (2008). Greencore results.

Mintel (2008a). Food Retailing, November 2008.

Mintel (2008b). Cheapest on display food, August 2008.

Mintel (2008c). Red Meat October 2008

OECD-FAO (2008). Agricultural Outlook 2008-2017, OECD-Paris.

Office for National Statistics (2008). Focus on Consumer Price Indices - Data for July 2008, August 18th.

Patrick, A. O. and Macdonald, A. (2008). U.K.'s Rising Food Prices Hamper Economic Policy. Wall Street Journal, 15 Oct 2008.

Renwick, A. and Revoredo-Giha, C. (2008). Retailers' Price Behaviour in the UK Fresh Fruit and Vegetable Market, 82 AES Annual Conference, Cirencester, April.

TNS Worldpanel (2008) in Retail Week 15/11/2008.

Annex 1: Methodology used in section III

Using the 2006 information for Scotland from the EFS, construct weights to produce a Scottish price index (I). The price index for the case of a 2-goods basket (where ω_1 and ω_2 are weights that are used to aggregate individual price indices $I_{1,t}$ and $I_{2,t}$, which are given by $I_{1,t} = {p_{1,t}}/{p_{1,0}}$ and $I_{2,t} = {p_{2,t}}/{p_{2,0}}$.

$$I_t = \omega_1 \cdot I_{1,t} + \omega_2 \cdot I_{2,t}$$

Based on the formula it is possible to compute the contribution of each component to the change in the price index.

$$\frac{I_t - I_{t-1}}{I_{t-1}} = \omega_1 \cdot \left(\frac{I_{1,t-1}}{I_{t-1}} \right) \cdot \frac{\left(I_{1,t} - I_{1,t-1} \right)}{I_{1,t-1}} + \omega_2 \cdot \left(\frac{I_{2,t-1}}{I_{t-1}} \right) \cdot \frac{\left(I_{2,t} - I_{2,t-1} \right)}{I_{2,t-1}}$$

Note that not all the increase in, say food prices, is fully passed to the total change in prices.

$$\underbrace{\omega_1}_{\substack{\text{Group} \\ \text{weight}}} \cdot \underbrace{\left(\frac{I_{1,t-1}}{I_{t-1}} \right)}_{\text{Relative price at t-1}} \cdot \underbrace{\frac{\left(I_{1,t} - I_{1,t-1} \right)}{I_{1,t-1}}}_{\text{Increase in the group price}}$$

As regards the analysis by gross income deciles, the expenditure for each decile in Scotland was estimated using the following formula:

$$\text{Expenditure}_{i,j}^{\text{Scotland}} = \left(\frac{\text{Expenditure}_{i,j}^{\text{UK}}}{\text{Expenditure}_i^{\text{UK}}} \right) \cdot \left(\text{Expenditure}_i^{\text{Scotland}} \right)$$

$$i = \text{product}, j = \text{decile}$$

To simulate the change in the purchasing power we assume that in 2007/08 the average nominal growth rate of income will continue.

We simulate two growth rates of income for 2007/08:

- Same as the average 1994/95 to 2006/07
- Same as the average 2003/04 to 2006/07

$$\underset{\substack{(\text{Change in real income}) \quad i}}{\text{Change in purchasing power}} = \frac{\left(1 + \text{nominal income growth}_i \right)}{\left(1 + \text{change in prices}_i \right)}$$

Annex 2: Computation of the prices indices using dunnhumby data

The analysis of supermarket data involves working with a high number of products. The quantities purchased of these products change from period to period as the number of customers changes. This creates problems for establishing a base period and both Laspeyres and Paasche price indices, the typical formulae for price indices, have shortcomings. The former assumes a base year in the first period that becomes obsolete as time elapses, and the latter assumes a base year in the last period of the series, which is inappropriate for the early periods of the series.

A more adequate methodology can be found in the chained Fisher indices for prices and quantities, which are used by statistical offices around the world when working with aggregates of prices and volume (Chevalier, 2003; Balk, 2008). The price indices computed here using the dunnhumby data follow such formulae. The formula for the chained Fisher price index (FP) for the period n, starting in period 0 and with intermediate period t, is given by (where p are prices per unit of purchase and q are the units purchased):

$$FP_n = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times ... \times \sqrt{\frac{\sum p_t q_{t-1}}{\sum p_{t-1} q_{t-1}} \times \frac{\sum p_t q_t}{\sum p_{t-1} q_t}} \times ... \times \sqrt{\frac{\sum p_n q_{n-1}}{\sum p_{n-1} q_{n-1}} \times \frac{\sum p_n q_n}{\sum p_{n-1} q_n}}$$

The quantity index, also called volume index is given by FQ below:

$$FQ_n = \sqrt{\frac{\sum p_0 q_1}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_1 q_0}} \times ... \times \sqrt{\frac{\sum p_{t-1} q_t}{\sum p_{t-1} q_{t-1}} \times \frac{\sum p_t q_t}{\sum p_t q_{t-1}}} \times ... \times \sqrt{\frac{\sum p_{n-1} q_n}{\sum p_{n-1} q_{n-1}} \times \frac{\sum p_n q_n}{\sum p_n q_{n-1}}}$$

An advantage of the Fisher indices is that the multiplication of the index of quantities by the index of prices provides an index of values. All the food categories prices and quantities were computed using Fisher indices of prices and quantities.