



Contribution of economic versus non-economic drivers of UK household expenditure

by

Mona Chitnis and Lester C. Hunt

RESOLVE Working Paper 03-10



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Abstract

This paper reports on work that follows from previous research published in the RESOLVE working paper series. It attempts to quantify the annual contributions from economic factors i.e. income and price as well as non-economic factors to driving changes in consumer expenditure for 16 categories of goods and services (COICOP). The results suggest that the contribution of the exogenous non-economic factors (ExNEF) to household expenditure is relatively higher for 'gas', 'other housing', 'health', 'vehicle fuels and lubricants', communication', 'recreation and culture' and 'miscellaneous goods and services'. Furthermore, ExNEF has a role to play in all categories even though this may be small. Therefore, if policy makers aim to control future expenditure of households, they might apply policies which attempt to influence non-economic factors such as lifestyles and behaviours in addition to economic incentives such as taxes.

Key Words: Household demand, Household expenditure, Exogenous non-economic factors, COICOP.

1. Introduction

Previous RESOLVE research (Chitnis and Hunt, 2009a, 2009b and 2010) explored the importance of indentifying the relative size of income, price and Exogenous Non-Economic factors (ExNEF) contributions to changes in household expenditure. This was undertaken in order to try and shed some light on policy decisions that might move households towards lower expenditure and therefore more sustainable future consumption. UK household expenditure functions for 12 COICOP categories of goods and services were econometrically estimated by applying the Structural Time Series Model (STSM); using quarterly time series data from 1964:q1 to 2006:q1. From this the relative contributions of the economic factors (price and income) and ExNEF to driving changes in household expenditure for each of the 12 COICOP categories were estimated.

This paper updates this earlier RESOLVE research and discusses in detail the relative contributions from economic and non-economic drivers of household expenditure. To update the figures, household expenditure functions for 12 COIOP categories are re-estimated using the quarterly time series data from 1964:q1 to 2009:q1 with 2005 base year for real variables (constant term). The results of updated estimations are shown in Table 1 in the appendix.¹ Here, the contribution figures are converted from quarterly data series to annual data series as well as being updated to 2008 in order to give a better, and clearer, understanding of the relative contributions over time.

Furthermore, due to the importance of direct energy use and its associated emissions, direct energy expenditure by household that was previously included in 'housing, water, electricity, gas and other fuels' and 'transport' categories is now disaggregated and estimated separately. Consequently, two categories are replaced by six individual categories i.e.: 'electricity', 'gas', 'other fuels', 'other housing' ('housing' excluding 'electricity', 'gas' and 'other fuels'), 'vehicle fuels and lubricants' and 'other transport' ('transport' excluding 'vehicle fuels and lubricants').

The next section of this paper, presents the contribution of income, price and ExNEF to changes in expenditure for 16 COICOP categories followed by a summary and brief conclusion in section 3.

¹ It should be noted that 'gas' expenditure estimation is not completely satisfactory and a number of different experiments were undertaken and the presented estimated equation is the 'best' that could be obtained; hence, these regarded as being less reliable than the other categories.

2. Contribution of income, price and ExNEF to changes in expenditure²

In this section, for each of the 16 COICOP categories the following are presented:

- i) A Figure presenting the annual relative contribution³ of income (Dy), price (Dp), ExNEF (Dtrend), and temperature (Dtemp) - where it applies - to changes in UK household expenditure (Dexp) over the period of 1980 to 2008;
- ii) A Table presenting a summary of the contribution to the average percentage per annum change in household expenditure during above period and three sub-periods; i.e. 1979-1992, 1992-1997 and 1997-2008.⁴ The chosen years for the different periods in this Table roughly coincides with the oil price hikes (and subsequent recessions) in the 1970s, the recession of the early 1990s and recovery of the late 1990s (fall in unemployment) in the UK; and
- iii) a brief explanation of the related Figure and Table, with a discussion of the relative importance of the factors in driving expenditure and in places suggestions of how policy makers might consider intervening if they wish to attempt to curtail future expenditure.

² As stated this work is part of on-going research attempting to quantify the impact of ExNEF on consumer demand and expenditure, building upon Chitnis and Hunt (2009a, 2009b and 2010) and Broadstock and Hunt (2010).

³ See Chitnis and Hunt (2009a and 2010) for further details and methodology used to estimate the contributions. The annual contributions are constructed by taking the average contribution of four quarters in each year.

⁴ Following from Equation (9) in Chitnis and Hunt (2009a and 2010), the annual changes per annum contributions are approximated as follows:

$$l \sum_{i=1}^n \frac{1}{4} \sum_{j=1}^4 D'(L)(\hat{\mu}_{i,j} - \hat{\mu}_{i,j-4}) / n' \quad l \sum_{i=1}^n \frac{1}{4} \sum_{j=1}^4 \hat{B}'(L)(p_{i,j} - p_{i,j-4}) / n' \quad l \sum_{i=1}^n \frac{1}{4} \sum_{j=1}^4 \hat{C}'(L)(y_{i,j} - y_{i,j-4}) / n$$

for the contributions of Exogenous Non-economic Factors (ExNEF), price (p) and household disposable income (y) respectively (similar calculation applies for average annual contribution for temperature when temperature is added to equation (8) in Chitnis and Hunt (2010). The total change in expenditure is approximated by $l \sum_{i=1}^n \frac{1}{4} \sum_{j=1}^4 \exp_{i,j} - \exp_{i,j-4} / n$. Where n is the span of years that the change is calculated and i represents the quarters.

2.1. Food and non-alcoholic beverages:

The contribution of income in driving the change in ‘food and non-alcoholic beverages’ was important and relatively stable over time and in all periods as identified in Table 1. However, the contribution of price fell from high to very low in recent years, in particular the period 1997-2008. In contrast, ExNEF had a less important negative impact until the early 1990s but since 1992 ExNEF dominated the contribution to the change in household expenditure. In addition, the generally negative contribution of ExNEF up to 1992 reversed thereafter. Changes in food diet, choosing to be a vegetarian or buying organic food as a result of environmental awareness as well as health related issues could be some reasons for the importance of ExNEF in recent periods. Thus there appears to be important ‘behaviour’ change over this latest period reflecting changes in household lifestyle.

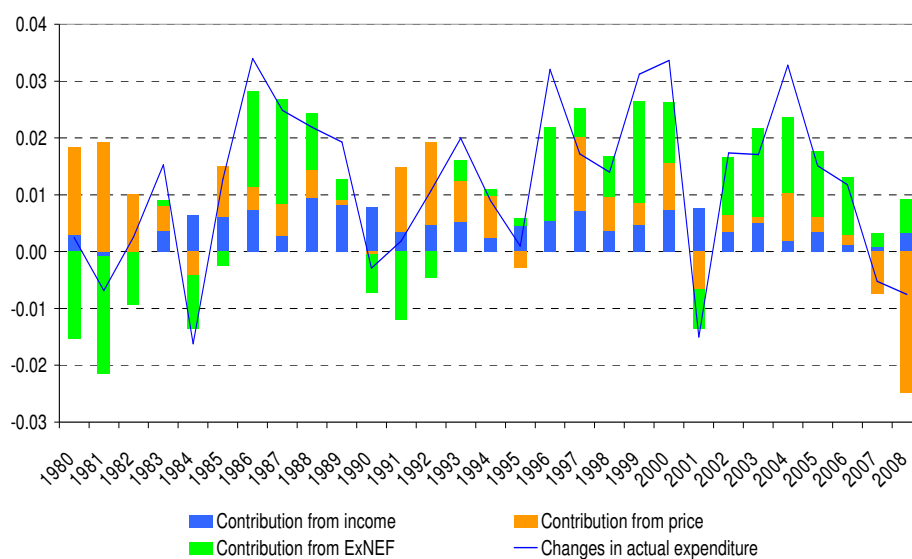


Figure 1: Contribution of income, price and ExNEF to changes in ‘food and non-alcoholic beverages’ expenditure

Table 1: Summary of the contribution to the average percentage per annum change in ‘food and non-alcoholic beverages’ expenditure (in logs)

Period	Contribution from:(%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.48	0.73	-0.24	0.92
1992-1997	0.49	0.50	0.55	1.58
1997-2008	0.39	-0.04	0.89	1.32
1979-2008	0.45	0.40	0.33	1.19

2.2. Alcoholic beverages, tobacco and narcotics

The contribution of income to changes in 'alcoholic beverages, tobacco and narcotics' expenditure was relatively stable and important during all sub-periods in Table 2; however, this fell between 1997 and 2008. The contribution of price which was relatively high and stable until 1997 fell during 1997 to 2008. The ExNEF contribution, which was relatively high and negative in the period 1979-1992, fell sharply in period 1992-1997 and became almost negligible during the period 1997-2008. Alcoholic beverages and cigarettes are consumed when people socialise and gather with friends (this category includes consumption at home) as well as being addictive goods. On the other hand, new regulations regarding smoking and advertisements to make people aware of the disadvantages of high consumption of alcoholic beverages and tobacco could all be represented in ExNEF. However, the estimation suggests that there was no noteworthy lifestyle and 'behaviour' change over the latest two periods. As a result, changes in expenditure were much less compared to the 1979-1992 period and the major contribution came from the economic factors, income and price.

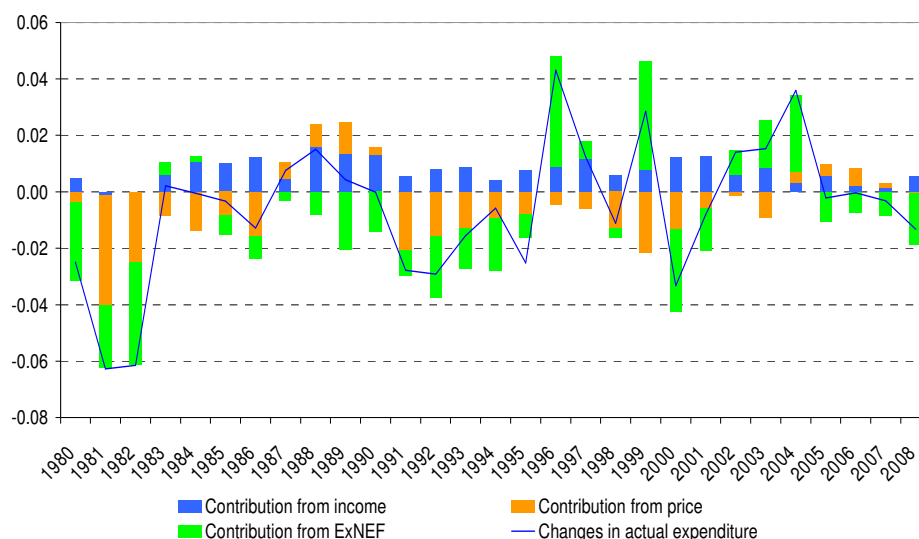


Figure 2: Contribution of income, price and ExNEF to changes in alcoholic beverages, tobacco and narcotics expenditure

Table 2: Summary of the contribution to the average percentage per annum change in 'alcoholic beverages, tobacco and narcotics' expenditure (in logs)

Period	Contribution from:(%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.79	-0.94	-1.32	-1.49
1992-1997	0.81	-0.81	0.09	0.18
1997-2008	0.64	-0.43	-0.01	0.20
1979-2008	0.74	-0.73	-0.58	-0.56

2.3. Clothing and footwear

Income contribution to changes in ‘clothing and footwear’ expenditure was almost stable over all periods shown in Table 3. The positive contribution from price was very high at all times and was even more important and higher over different periods. The highly increasing positive contribution of price to changes in expenditure in this category might be due to entry of stores with low and affordable prices into the ‘clothing and footwear’ market in the UK which encourages consumers to spend more on these. ExNEF had a relatively small contribution until the early 1990s. From 1992 to 1997, ExNEF contribution increased by a large amount and after price it appeared to have a relatively high contribution to the change in ‘clothing and footwear’ expenditure - being the main reason for the strong growth during this period. Fashion and different age groups are important factors which could influence expenditure through ExNEF. The rather strong positive contribution of ExNEF continued in the next period of 1997-2008, however price still had a high and positive dominant impact on expenditure. Therefore, it appears to be a marked ‘behaviour’ or lifestyle change in recent periods which might be a factor to be considered in addition to economic incentives e.g. taxes in order to lower expenditure.

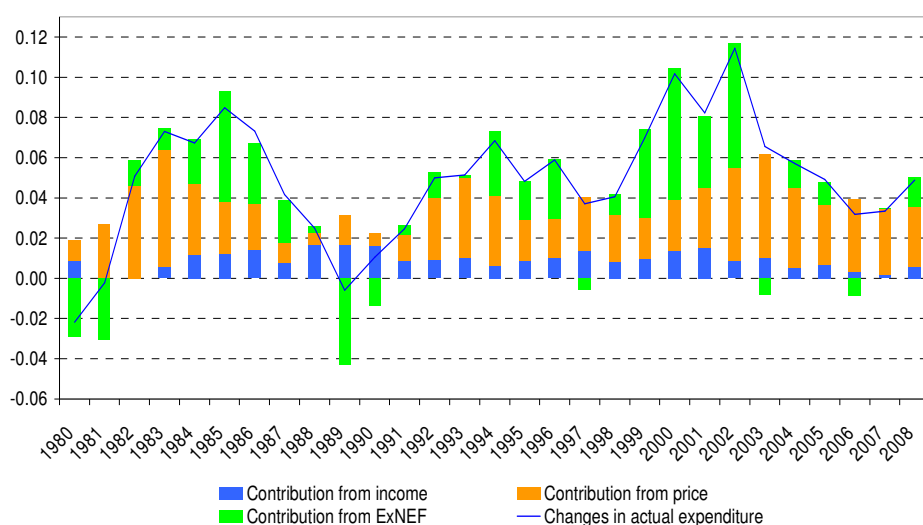


Figure 3: Contribution of income, price and ExNEF to changes in ‘clothing and footwear’ expenditure

Table 3: Summary of the contribution to the average percentage per annum change in ‘clothing and footwear’ expenditure (in logs)

Period	Contribution from:(%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.99	2.34	0.43	3.62
1992-1997	0.98	2.83	1.52	5.28
1997-2008	0.81	3.32	2.19	6.32
1979-2008	0.92	2.80	1.29	4.93

2.4. Electricity

Income had a relatively stable and high contribution to changes in ‘electricity’ expenditure during all sub-periods defined in Table 4. In contrast, the small negative price contribution in period 1979-1992 increased to a relatively small positive contribution in 1992-1997 but changed to a negative contribution over the period 1992-1997. Instead, the ExNEF had a relatively small contribution in all periods and its contribution even decreased over subsequent periods. Within ExNEF, efficiency of electric appliances used in the home and improvements in the production technology of these appliances is highly important in electricity consumption by households. Contribution from temperature to changes in expenditure was negative at all times; however after an increase in temperature impact (in absolute terms) in 1992-1997 this fell sharply over the 1997-2008 period; having the least contribution relative to the other factors. In general, there seems to be some ‘behaviour’ and lifestyle change over the whole period but a weaker impact in the last two periods. Therefore, influencing lifestyle still might be considered as a way to restrain ‘electricity’ expenditure.

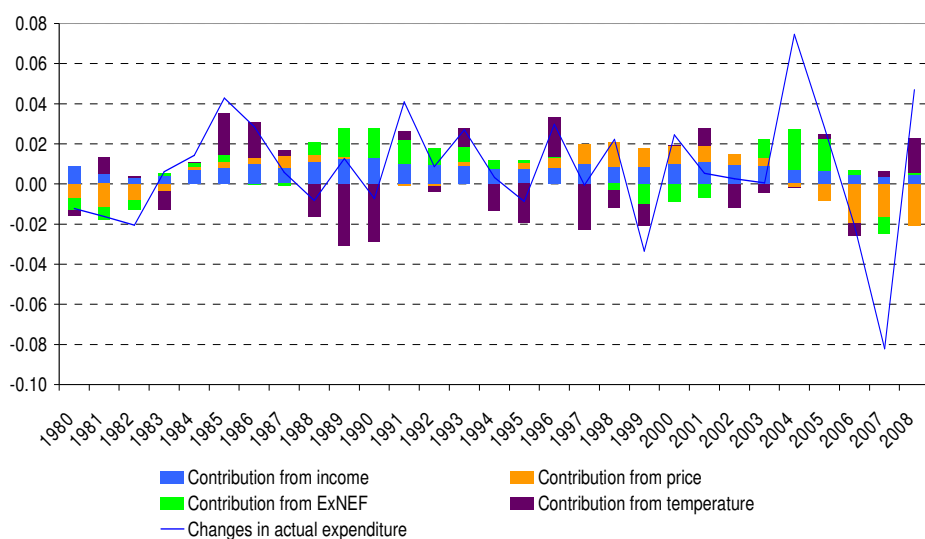


Figure 4: Contribution of income, price and ExNEF to changes in ‘electricity’ expenditure

Table 4: Summary of the contribution to the average percentage per annum change in ‘electricity’ expenditure (in logs)

Period	Contribution from: (%)				Change in expenditure
	Income	Price	ExNEF	Temperature	
1979-1992	0.85	-0.11	0.33	-0.27	0.73
1992-1997	0.83	0.41	0.26	-0.53	1.01
1997-2008	0.75	-0.17	0.10	-0.09	0.62
1979-2008	0.81	-0.04	0.23	-0.25	0.74

2.5. Gas⁵

For ‘gas’ expenditure, income is not included as one of the expenditure drivers in the estimated equation given it was not found to be significant; therefore income has no contribution to the changes in ‘gas’ expenditure. A possible reason being that gas is mainly used for heating houses and therefore weather and temperature dominates. The price contribution during the period 1992-1997 was relatively low and negative but increased considerably becoming positive during the period 1992-1997 but turned negative again in the period 1997-2008. Due to the deterministic nature of the underlying trend for ‘gas’ expenditure the ExNEF contribution was constant for all periods, being relatively high. The contribution from temperature was negative in all periods; however increased (in absolute terms) in the period 1992-1997 followed by a rather sharp fall (in absolute terms) in the last period 1997-2008 almost returning to its contribution seen during the period 1979-1992. Despite the relative strong positive increase from price contribution during the period 1992-1997, the actual growth in ‘gas’ expenditure slowed down considerably, driven primarily by the negative contribution from temperature.

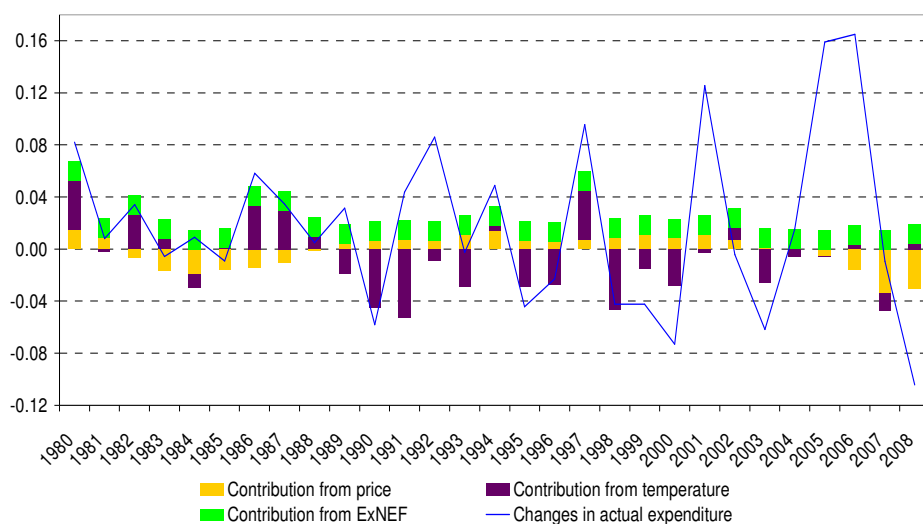


Figure 5: Contribution of income, price and ExNEF to changes in ‘gas’ expenditure

Table 5: Summary of the contribution to the average percentage per annum change in ‘gas’ expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Price	ExNEF	Temperature	
1979-1992	-0.30	1.48	-0.45	1.81
1992-1997	0.85	1.48	-1.23	0.69
1997-2008	-0.77	1.48	-0.41	1.46
1979-2008	-0.28	1.48	-0.57	1.48

⁵ The results for ‘gas’ should be treated with some caution; see footnote 1 above.

2.6. Other fuels

The contribution of income to changes in 'other fuels' expenditure was relatively important during all sub-periods as shown in Table 6; however this fell since the early 1990s and remained almost constant thereafter. Price had a very small positive contribution to changes in expenditure until 1997; but the contribution of price has changed to be negative and relatively large from 1997 to 2008. The negative contribution from ExNEF was very high over the period 1979-1992. In contrast, the ExNEF contribution was small but still negative during the period 1992-1997 causing a small positive change in expenditure during this period. The negative contribution from ExNEF was again relatively high during the period 1997-2008 followed by a considerable negative change in expenditure (with a smaller contribution from price). The temperature contribution to changes in 'other fuels' expenditure was negative until 1997 but turned to be positive since then. This reversed over the period 1997-2008 when the temperature contribution was positive but less important. Given that policy makers cannot control temperature and that income, price and ExNEF had important impacts on expenditure in the past, intervention through both economic and non-economic factors could be considered to achieve changes in consumer expenditure for this category.

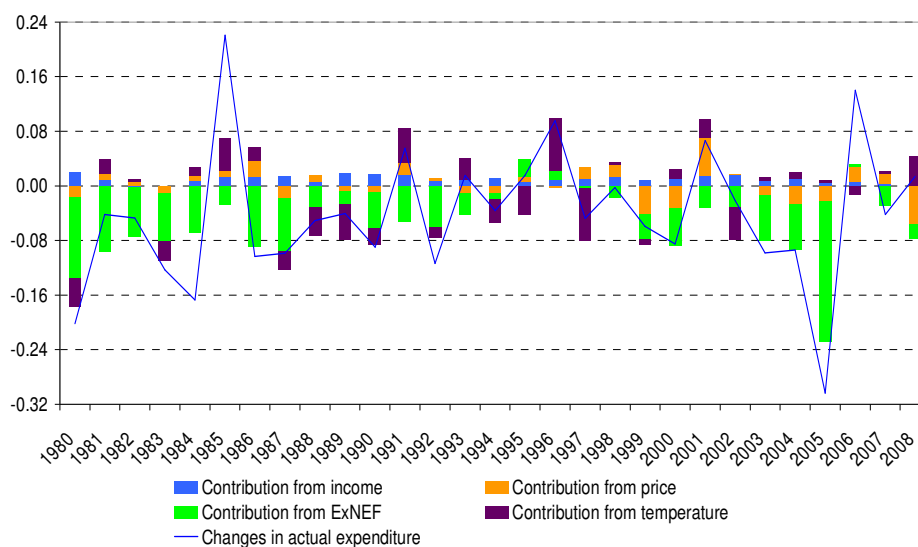


Figure 6: Contribution of income, price and ExNEF to changes in 'other fuels' expenditure

Table 6: Summary of the contribution to the average percentage per annum change in 'other fuels' expenditure (in logs)

Period	Contribution from: (%)				Change in expenditure
	Income	Price	ExNEF	Temperature	
1979-1992	1.05	0.22	-6.42	-0.59	-6.18
1992-1997	0.89	0.01	-0.08	-0.92	0.83
1997-2008	0.85	-0.77	-5.04	0.38	-4.42
1979-2008	0.95	-0.19	-4.81	-0.28	-4.30

2.7. Other housing

It is clear from Figure 7 and Table 7 that the income contribution to changes in 'other housing' expenditure was relatively small. The contribution of price was negative and relatively important; but was lower in absolute terms during the period 1992-1997. The ExNEF positive contribution to changes in expenditure was relatively high over all periods, although lower during the period 1992-1997. Announcements and presenting ways to save water consumption at home which could lead to considerable 'behaviour' change is among the components that might be captured by ExNEF. The message for policy makers in this case is that in addition to possible changes in price and income (although they might not want to reduce disposable income), changes in other non-economic factors such as lifestyle and 'behaviours' could be considered if they wish to restrain household expenditure for this group of goods and services.

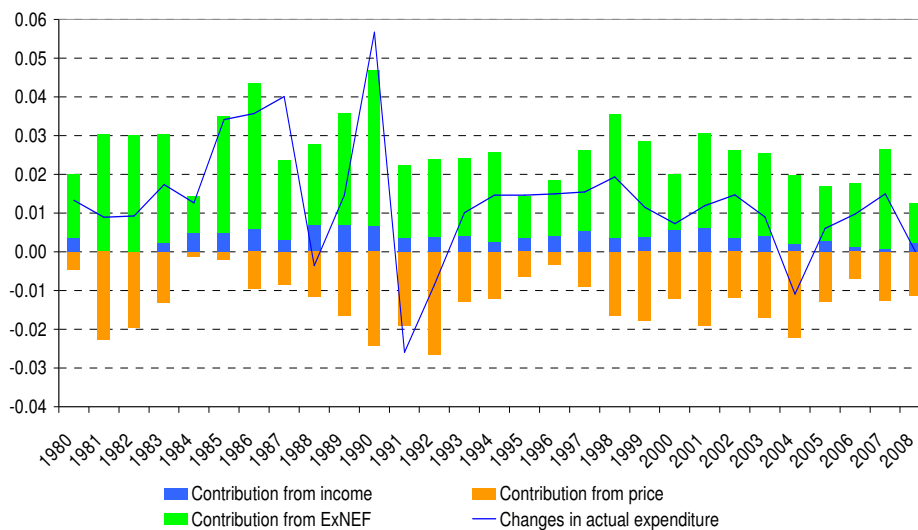


Figure 7: Contribution of income, price and ExNEF to changes in 'other housing' expenditure

Table 7: Summary of the contribution to the average percentage per annum change in 'other housing' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.41	-1.38	2.54	1.57
1992-1997	0.40	-0.87	1.78	1.39
1997-2008	0.33	-1.46	2.03	0.85
1979-2008	0.38	-1.32	2.22	1.27

2.8. Furnishings; household equipment and routine maintenance of the house

As shown in Figure 8, the positive contribution of income and price to changes in 'furnishings' expenditure was relatively high (with a higher contribution from income) and important during all sub-periods in Table 8; however this fell in the last period 1997 to 2008. The contribution of ExNEF was also important, although it was smaller than price and income. This turned from a negative impact over the period 1979-1992 to a positive one during 1992-1997 and fell in the last period 1997-2008; similar to the economic factors discussed above. Replacement of more efficient appliances at home, changes in household taste and fashion and the size of the house could be reflected by ExNEF. Obviously in this case, economic factors had a more noteworthy role in influencing changes in expenditure than non-economic factors; however the effect of ExNEF can not be ignored especially during times with high prices or recession as seen in Figure 8.

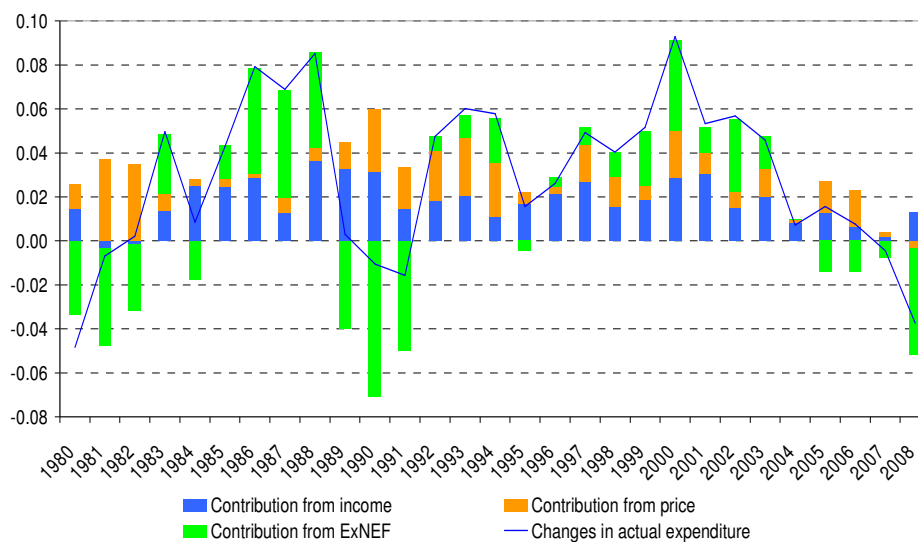


Figure 8: Contribution of income, price and ExNEF to changes in 'furnishings; household equipment and routine maintenance of the house' expenditure

Table 8: Summary of the contribution to the average percentage per annum change in 'furnishings; household equipment and routine maintenance of the house' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	1.91	1.49	-0.74	2.35
1992-1997	1.93	1.52	0.77	4.18
1997-2008	1.56	0.92	0.47	2.99
1979-2008	1.78	1.28	-0.02	2.91

2.9. Health

The contribution of income to changes in 'health' expenditure was relatively small and stable during all sub-periods in Table 9; and fell slightly in the last period 1997-2008. The negative contribution of price was relatively more important than income but this was decreasing over time (in absolute terms). In contrast, ExNEF had a relatively high positive contribution to changes in expenditure until 1992 followed by a sharp fall during the period 1992-1997 which apparently caused a sudden decrease in expenditure changes in the same period. The ExNEF contribution increased again in the period 1997-2008; leaving it a dominant factor affecting expenditure in all periods which might be expected for 'health'. Age, spread of viruses and degree of illness are of important factors which might have impact on consumption via the ExNEF component. Therefore, if policy makers want to intervene in the 'health' sector, which is arguable, then non-economic factors would appear to be the most important way to change consumer expenditure. Although, the contribution of price cannot be ignored; however again, it is debatable whether policy makers would want to actively be seen to increasing the price for this category.

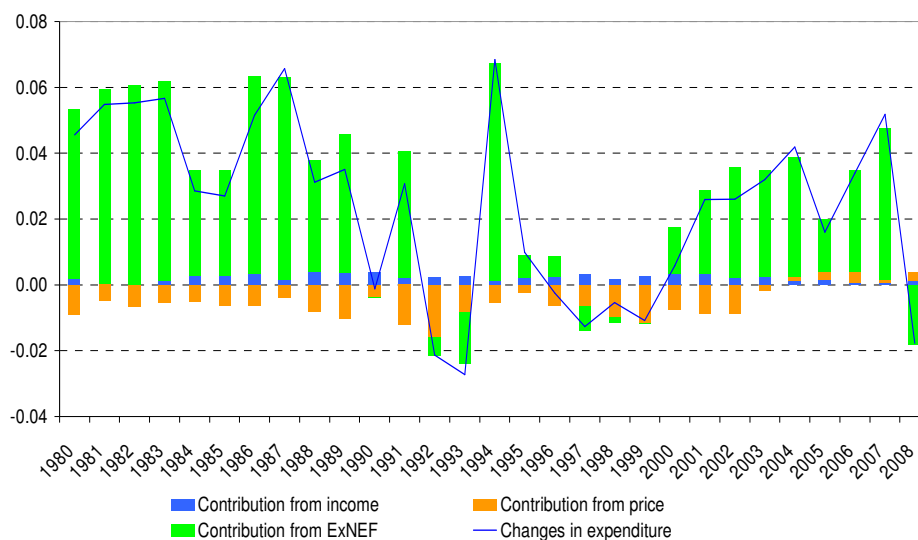


Figure 9: Contribution of income, price and ExNEF to changes in 'health' expenditure

Table 9: Summary of the contribution to the average percentage per annum change in 'health' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.23	-0.75	4.04	3.53
1992-1997	0.23	-0.57	1.12	0.72
1997-2008	0.19	-0.34	1.95	1.81
1979-2008	0.21	-0.56	2.75	2.40

2.10. Vehicle fuels and lubricants

Income had a rather small and slightly decreasing contribution to changes in 'vehicle fuels and lubricants' expenditure as shown in Figure 10 and Table 10. Although the positive contribution of price was very small in the period 1979-1992, this was reversed from 1992 to 1997 having an important negative impact which was even more important during the period 1997-2008. ExNEF had relatively high and important positive impact until 1992 which dominated the contribution to the changes in expenditure. However, from 1992 to 2008, ExNEF still remained a dominant contributing factor but with less impact than it had before. The main important factors reflected by ExNEF are technology of production and the efficiency of private vehicles which could affect expenditure; however improvements in these factors could have a rebound effect as well. Also, infrastructures and facilities of public transportation together with their price are likely to affect 'vehicle fuels' expenditure. All in all, there appears to be a considerable change in non-economic factors such as lifestyle but on the other hand the effect of price became more important in recent years; hence both of these factors might be considered by policy makers if any reduction in expenditure is to be achieved.

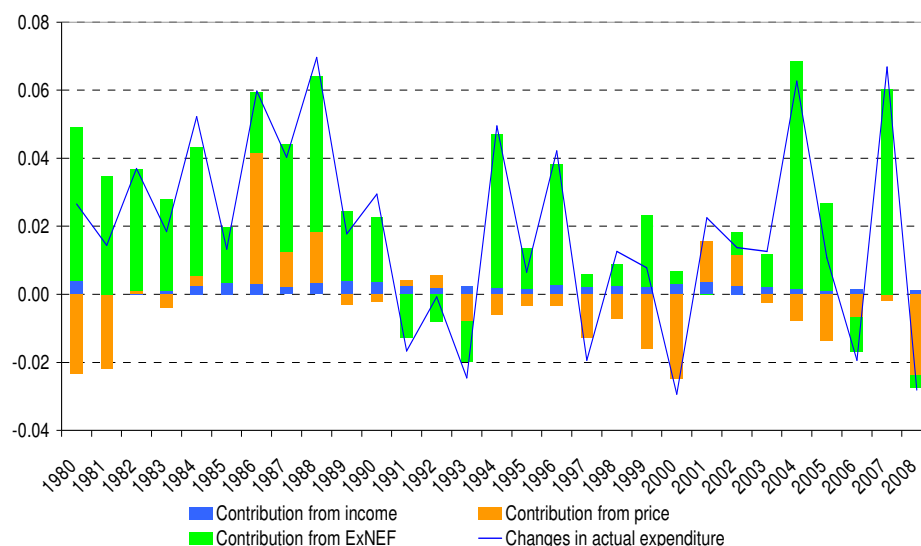


Figure 10: Contribution of income, price and ExNEF to changes in 'vehicle fuels and lubricants' expenditure

Table 10: Summary of the contribution to the average percentage per annum change in 'vehicle fuels and lubricants' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.24	0.14	2.39	2.78
1992-1997	0.22	-0.66	1.68	1.09
1997-2008	0.20	-0.75	1.69	1.21
1979-2008	0.22	-0.34	2.00	1.89

2.11. Other transport

The positive contribution of income to changes in 'other transport' expenditure was almost stable and relatively important during all the sub-periods in Table 11, although this fell in the period 1997-2008. Price had a positive and relatively important contribution in the period 1979-1992 but this was very small in the period 1992-1997; again increasing in the last period 1997-2008. The average positive contribution of ExNEF was less important during 1979 to 1992; however this considerably increased during 1992 to 1997, being a dominant contributing factor to expenditure changes. Although, the ExNEF contribution fell in the most recent period, it still dominated the economic factors. Government plans (e.g. subsidies for replacement of old cars by new ones), infrastructure and improvement in public transport service are some of the factors reflected in ExNEF which might affect expenditure. Obviously in this case, income and ExNEF were important at all times. Given that price also had an important effect in recent years on changes in expenditure, changes in both economic and non-economic factors including lifestyle and 'behaviours' might be considered by policy makers as means to control consumer expenditure in this category.

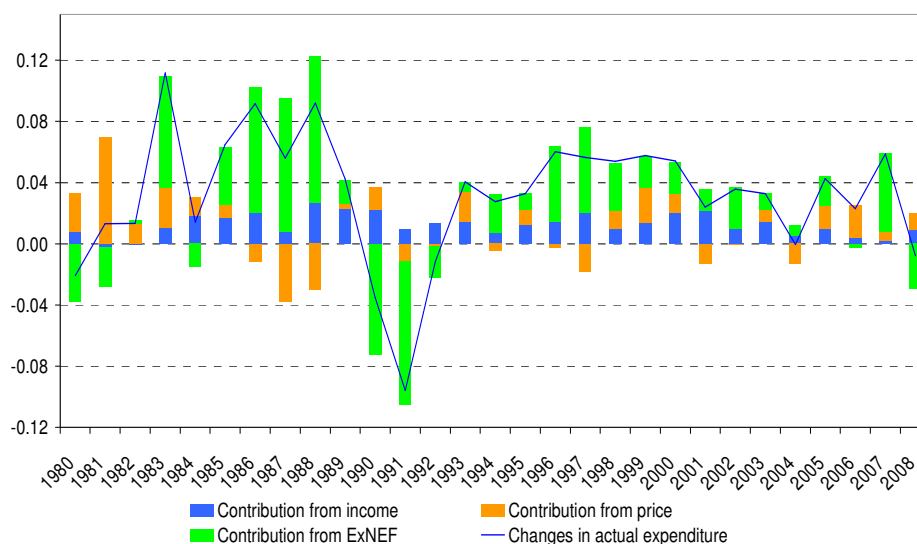


Figure 11: Contribution of income, price and ExNEF to changes in 'other transport' expenditure

Table 11: Summary of the contribution to the average percentage per annum change in 'other transport' expenditure (in logs)

Period	Contribution from:(%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	1.35	0.62	0.98	2.58
1992-1997	1.39	0.08	2.93	4.35
1997-2008	1.10	0.74	1.54	3.41
1979-2008	1.26	0.57	1.53	3.20

2.12. Communication

It is clear from Figure 12 that ExNEF had a very high positive contribution to changes in 'communication' expenditure since 1980. In the 1990s the ExNEF contribution even doubled - being the main reason for the strong growth during this period (with a smaller contribution from price). Interestingly, the strong positive contribution of ExNEF continued in the most recent period. Although, it might be expected that the increasing use of the internet would have reduced the 'communication' expenditure it seems this was not the case. The contribution of income to changes in expenditure which was higher than the price impact during the period 1979-1992, became less important over subsequent periods as shown in Table 12. Whereas for price, which had a negligible contribution in 1980s, the impact got rather more important in the 1990s and afterwards, compared to income. Clearly, there was a marked change in lifestyle and other non-economic factors affecting 'communication' expenditure and ExNEF is the main factor by which consumer expenditure might be influenced by policy makers in this sector. However, income, and specially price remain important elements if any change in expenditure is going to be obtained.

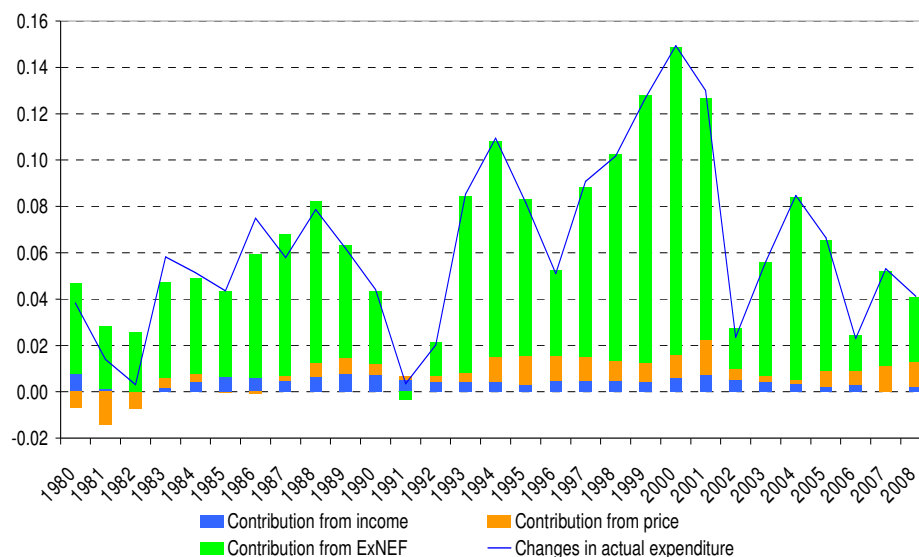


Figure 12: Contribution of income, price and ExNEF to changes in 'communication' expenditure

Table 12: Summary of the contribution to the average percentage per annum change in 'communication' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	0.48	0.02	3.74	4.23
1992-1997	0.43	0.96	6.94	8.36
1997-2008	0.39	0.77	6.61	7.79
1979-2008	0.44	0.47	5.38	6.29

2.13. Recreation and culture

As shown clearly in Figure 13, ExNEF had a very high positive contribution to changes in 'recreation and culture' expenditure at all times except the years of high prices and recession; i.e. the early 1980s and early 1990s. This is confirmed by Table 13 which shows that the ExNEF contribution nearly doubled in the period 1992-1997 compared to the period 1979-1992 - being the main reason for the strong expenditure growth during this period and remained stable thereafter. The contribution of income to changes in expenditure which was stable and considerably higher than the price impact during the period 1979-1997, became less important than the price contribution in the final period, 1997-2008 as shown in Table 13. In contrast, the contribution of price which was relatively small in the past two periods i.e. 1979-1997 becoming more important in the most recent period compared to income. Obviously, there was an important change in lifestyle and other non-economic factors influencing change in 'communication' expenditure; hence the main pathway to control expenditure in this sector. However income was non-trivial during all periods, along with price, especially in recent years – hence still leaving economic factors as an effective means of intervention for consideration by policy makers.

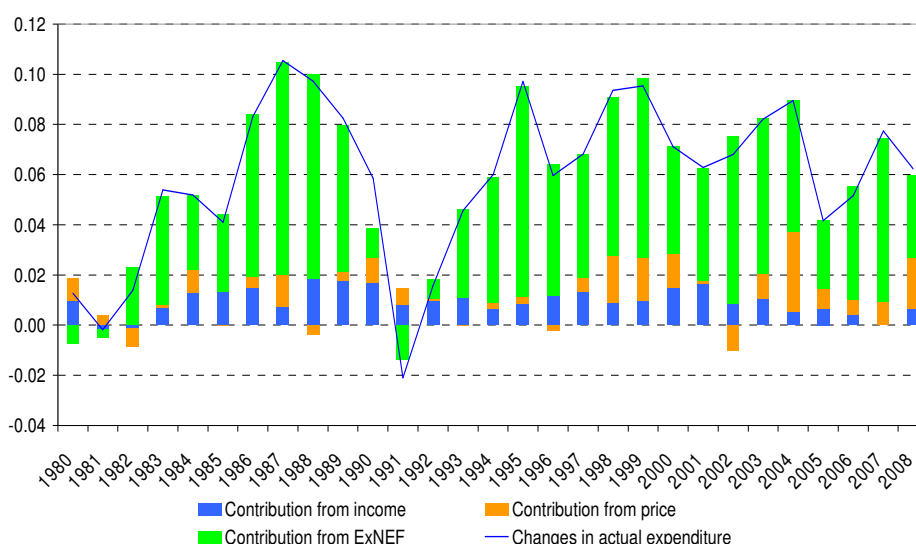


Figure 13: Contribution of income, price and ExNEF to changes in 'recreation and culture' expenditure

Table 13: Summary of the contribution to the average percentage per annum change in 'recreation and culture' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	1.03	0.39	3.17	4.56
1992-1997	1.01	0.16	5.43	6.62
1997-2008	0.84	1.14	5.22	7.23
1979-2008	0.95	0.63	4.34	5.93

2.14. Education

As shown in Figure 14 and Table 14 the contribution of income, price, and ExNEF to changes in 'education' expenditure were relatively stable, but dominated by the very high positive contribution from ExNEF over the period 1979 to 1997. Among the components that might be reflected in ExNEF are the incentives and the opportunity cost of studying versus working. Also, the number of women working affects the need for children to be at nursery. During the period 1979 to 1997, price and income had a similar impact on changes in expenditure but with opposite signs. Although the negative income contribution might be regarded as being counter intuitive. During 1997-2008, the income contribution was almost the same as before; however the price impact increased by about three times - having the largest contribution to changes in education expenditure. Surprisingly, the contribution from ExNEF fell sharply in the most recent period. Therefore, despite the increase in the price contribution, the growth in expenditure slowed down considerably during the period 1997-2008 – becoming negative. Given the contribution pattern it would appear that both economic and non-economic factors are important drivers of consumer expenditure and should be considered by policy makers if the wish to try and influence future education expenditure.

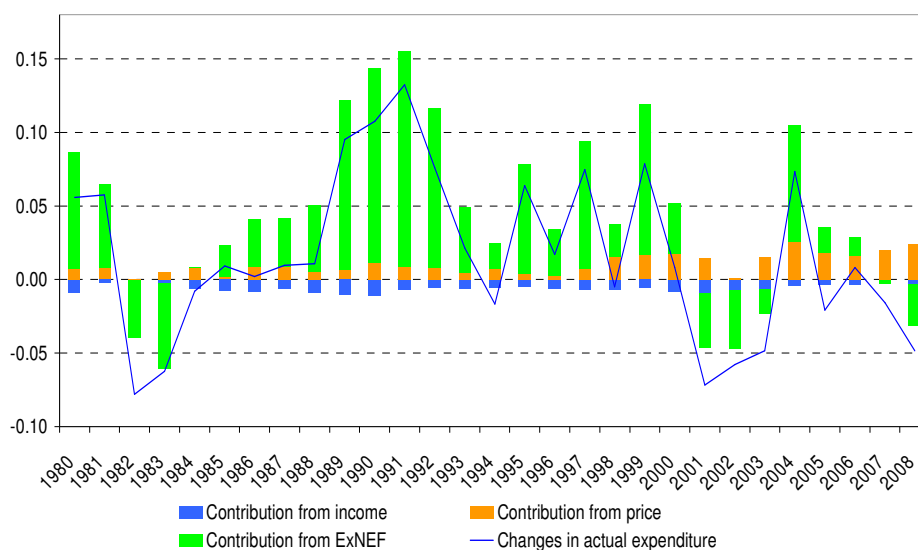


Figure 14: Contribution of income, price and ExNEF to changes in 'education' expenditure

Table 14: Summary of the contribution to the average percentage per annum change in 'education' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	-0.66	0.67	5.18	3.13
1992-1997	-0.60	0.52	5.08	3.20
1997-2008	-0.54	1.69	1.31	-0.90
1979-2008	-0.61	1.03	3.70	1.61

2.15. Restaurants and hotels

The positive contribution of income to changes in 'restaurants and hotels' expenditure was relatively high, stable and important during all sub-periods as shown in Table 15, being the dominant factor contributing to expenditure changes. The contribution from price was also noteworthy but this fell in the 1990s, again having a relatively high impact in recent years. The ExNEF contribution gradually decreased over the different periods but it was still relatively important. People drink and eat away from home when they socialise; also, lack of time, working women and even simply the ease of take away meals are some of the factors reflected within ExNEF which could affect the expenditure. Overall, the economic factors of income and price, specifically income, had higher contributions to changes in consumer expenditure. However, the effect of non-economic elements such as lifestyle and 'behaviours' should not be ignored by policy makers as a possible way of controlling expenditure in this category.

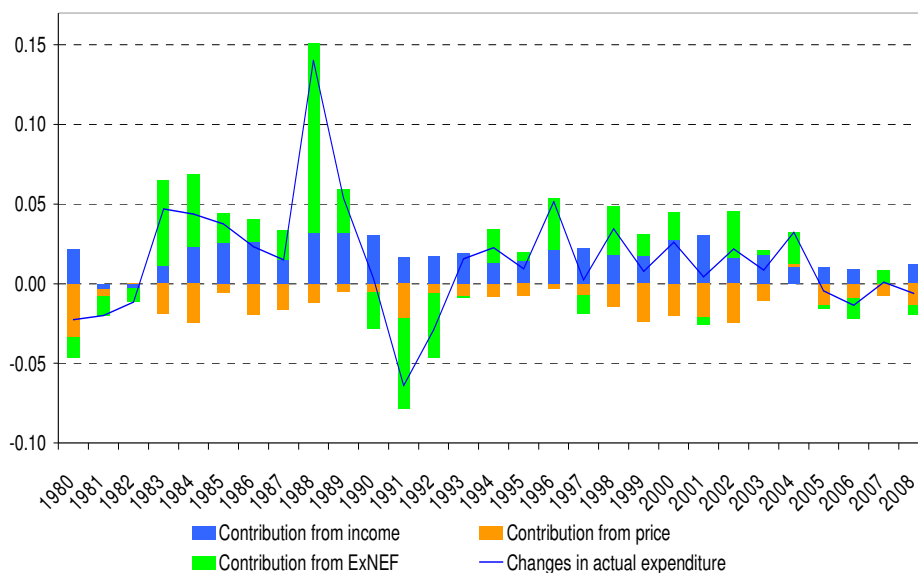


Figure 15: Contribution of income, price and ExNEF to changes in 'restaurants and hotels' expenditure

Table 15: Summary of the contribution to the average percentage per annum change in 'restaurants and hotels' expenditure (in logs)

Period	Contribution from: (%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	1.88	-1.33	1.10	1.66
1992-1997	1.81	-0.68	0.91	2.03
1997-2008	1.54	-1.42	0.88	1.03
1979-2008	1.74	-1.25	0.98	1.48

2.16. Miscellaneous goods and services

It is clear from Figure 16 that the contribution of income in driving the change in 'miscellaneous goods and services' expenditure was relatively important and was almost stable over the period 1979-1997 following a rather small fall during the period 1997-2008, as shown in Table 16. In contrast, the contribution of price was relatively small and falling over the different periods; being negative during the period 1979-1997 and positive during the period 1997-2008. ExNEF had a relatively high positive impact until 1992; although still important but fell sharply during the period 1992-1997; hence the main reason for the sudden fall in expenditure in this period. However, the ExNEF contribution increased again during the period 1997-2008 as did expenditure in 'miscellaneous goods and services'. All in all, ExNEF appears to be a dominant factor in contributing to the change in expenditure in this category. Thus in order to control consumer expenditure toward a more sustainable consumption, changes in lifestyle and 'behaviours' might be considered by policy makers in addition to economic incentives.

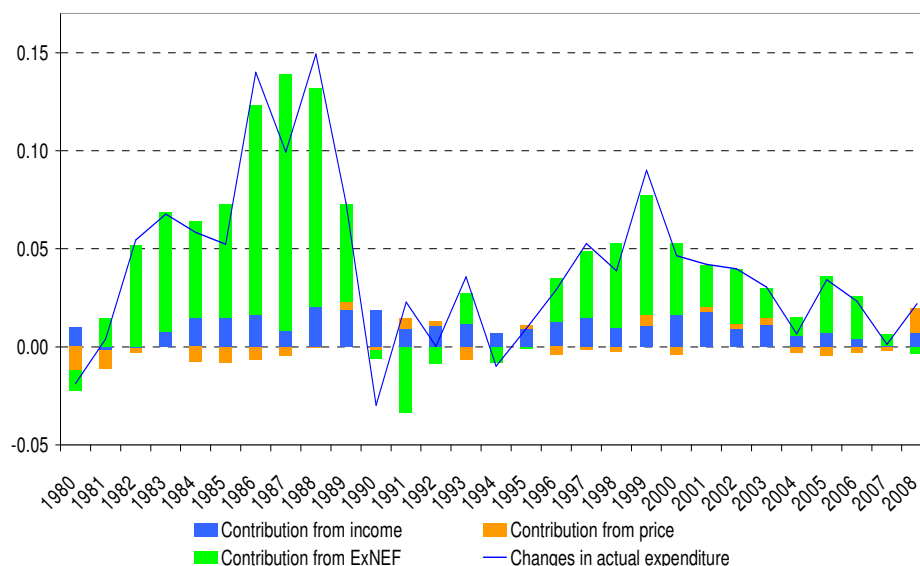


Figure 16: Contribution of income, price and ExNEF to changes in 'miscellaneous goods and services' expenditure

Table 16: Summary of the contribution to the average percentage per annum change in 'miscellaneous goods and services' expenditure (in logs)

Period	Contribution from:(%)			Change in expenditure
	Income	Price	ExNEF	
1979-1992	1.12	-0.31	4.44	5.18
1992-1997	1.11	-0.21	1.27	2.34
1997-2008	0.91	0.07	2.42	3.41
1979-2008	1.04	-0.15	3.13	4.02

3. Summary and conclusion

For a sustainable consumption perspective it is arguably vital to understand and clarify the contribution from the economic and non-economic factors to changes in household expenditure. If policy makers and planners wish to control and move consumer consumption towards a more sustainable future then this information should aid decision making and help achieve the associated goals. This study, following previous RESOLVE research therefore attempts to quantify for 16 UK COICOP categories of goods and services the relative contribution of economic and non-economic factors and present the annual contributions of price, income and ExNEF since 1980.

The overall results show that the contribution from the exogenous non-economic factors (ExNEF) to annual changes in expenditure was important and for a number of categories very high in all periods since 1980 relative to the contribution from the economic drivers of price and income; for example 'gas', 'other housing', 'health', 'vehicle fuels and lubricants', 'communication', 'recreation and culture' and 'miscellaneous goods and services'. The Income contribution to changes in household expenditure was also relatively important for all periods since 1980; in particular the 'restaurants and hotels' and 'furnishings' categories. For other categories a mixture of contributions from the different factors were important in driving expenditure changes. Interestingly, there was no category where ExNEF had no contribution in driving changes in expenditure; hence this should arguably not be ignored by policy makers when considering policies to reduce expenditure and consumption.

Thus policy makers could consider using economic instruments if they wish to attempt to curtail future expenditure (at least in some categories). However, it is unlikely that policy makers will wish to reduce the rate of economic growth; therefore, the only economic option left is to increase the price via taxes (although it has been shown this has limited impact in some categories). Nonetheless, this has to be considered carefully since it may cause other negative side effects resulting in a reduction in consumer welfare and poverty. Therefore, the important message for policy makers and planners is that in addition to these economic incentives other policies that attempt to influence non-economic factors such as lifestyles and 'behaviours' might well need to be used and hence considered if they wish to restrain future expenditure in order to achieve sustainable consumption.

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Appendix:

Table 1a: Estimated STSM expenditure functions for the UK 1964q1-2007q1

<i>Dependent variable: expenditure (in logs) - exp</i>				
Category Independent Variables	'food and non-alcoholic beverages'	'alcoholic beverages, tobacco and narcotics'	'clothing and footwear'	'electricity'
<i>y</i>	0.16 (2.38)	0.28 (3.50)	0.31 (3.72)	0.13 (1.18)
<i>y</i> (-1)	-	-	-	-
<i>y</i> (-4)	-	-	-	-
<i>p</i>	-0.39 (-3.74)	-0.49 (-6.03)	-	-0.08 (-2.36)
<i>p</i> (-1)	-	-	-	-
<i>p</i> (-3)	-	-	-	-
<i>p</i> (-6)	-	-	-0.63 (-4.33)	-
<i>exp</i> (-1)	-	-	-	-
<i>exp</i> (-4)	-	-	0.21 (3.29)	0.63 (13.78)
<i>exp</i> (-5)	-	-	-	-
<i>exp</i> (-6)	-	-	-	-
<i>exp</i> (-8)	-	-	-	-
<i>temp</i>	-	-	-	-0.03 (-7.18)
Long run Elasticities				
Price	-0.39	-0.49	-0.80	-0.22
Income	0.16	0.28	0.39	0.35
Estimated Variance of Hyperparameters				
Irr (10 ⁻⁵)	13.28	0.00	3.98	126.33
Lvl(10 ⁻⁵)	4.9	12.18	19.45	3.80
Slp(10 ⁻⁵)	-	-	-	-
Sea(10 ⁻⁵)	1.28	5.44	1.79	-
Trend				
Nature of Trend	Local level with drift	Local level with drift (Irr for 1976.1, 1994.4 included)	Local level with drift (Irr for 1973.1, 1979.2 included)	Local level with drift
Growth rate at end of period (% p.a.)	0.35	-0.40	0.56	0.13
DIAGNOSTICS				
Equation Residuals				
Std. Error	0.02	0.02	0.02	0.04
Normality	0.33	1.58	3.86	5.33
H(n)	H(56)=1.87	H(56)=0.64	H(54)=0.63	H(55)=0.62
<i>r</i> (1)	0.03	0.07	0.01	0.07
<i>r</i> (4)	0.03	0.08	0.03	0.02
<i>r</i> (8)	-0.06	-0.08	-0.01	0.004
D.W.	1.89	1.83	1.94	1.79
Q _(8,n)	Q _(8,5) =3.33	Q _(8,5) =10.79	Q _(8,5) =7.85	Q _(8,6) =7.26
RS ²	0.50	0.71	0.56	0.76

Table 1a: continued.

Category	'food and non-alcoholic beverages'	'alcoholic beverages, tobacco and narcotics'	'clothing and footwear'	'electricity'
Auxiliary Residuals				
Irregular Normality	0.25	4.69	1.38	6.32
Level Normality	0.80	1.15	1.45	4.68
Slope Normality	-	-	-	-
Predictive Failure Tests (2004q2-2006q1)				
$\chi^2_{(s)}$	12.01	5.22	7.72	17.39
Cusum $t_{(s)}$	-1.04	-1.43	1.04	-0.31
Likelihood Ratio Tests				
Test (a)	187	276.77	115.28	7.04
Test (b)	-	-	-	-
Test (c)	47.16	145.03	23.52	-

Notes for Table 2a:

exp, y and p represent expenditure, income and the real price of each category (all in logs). temp stands for weather temperature in Degrees Celsius. Irr represent intervention dummies.

t-statistics are given in parenthesis.

The restrictions imposed for the LR test are: a) fixed level, b) fixed slope, c) fixed seasonal.

Normality is the Doornik-Hansen statistic approximately distributed as $X^2_{(2)}$.

H(n) is the test for heteroscedasticity, approximately distributed as $F_{(n,n)}$.

$r_{(1)}$, $r_{(4)}$ and $r_{(8)}$ are the serial correlation coefficients at the 1st, 4th and 8th lags respectively, approximately distributed at $N(0,1/T)$.

DW is the Durbin Watson statistic.

$Q_{(8,n)}$ is the Box-Ljung Q-statistic based on the first n residuals autocorrelation; distributed as $X^2_{(n)}$.

R^2 is the coefficient of determination.

$X^2_{(8)}$ is the post-sample predictive failure test. The Cusum t is the test of parameter consistency, approximately distributed as the t-distribution.

5% probability level is considered for significance.

Following Harvey and Koopman (1992), where necessary, appropriate dummies are included in the models for outliers and structural breaks.

Table 1b: Estimated STSM expenditure functions for the UK 1964q1-2007q1

<i>Dependent variable: expenditure (in logs) - exp</i>				
Category Independent Variables	'gas'	'other fuels'	'other housing'	'furnishings, household equipment and routine maintenance of the house'
<i>y</i>	-	-	0.12 (2.73)	0.63 (6.07)
<i>y</i> (-1)	-	-	-	-
<i>y</i> (-4)	-	0.36 (1.39)	-	-
<i>p</i>	-0.08 (-1.96)	-0.33 (-3.61)	-0.32 (-6.64)	-0.70 (-3.30)
<i>p</i> (-1)	-	-	-	-
<i>p</i> (-3)	-	0.29 (3.22)	-	-
<i>p</i> (-6)	-	-	-	-
<i>exp</i> (-1)	-	0.21 (3.41)	-	0.18 (3.13)
<i>exp</i> (-4)	0.58 (9.38)	-	0.22 (4.39)	-
<i>exp</i> (-5)	-	-	-	-
<i>exp</i> (-6)	-	-	-	-
<i>exp</i> (-8)	0.22 (3.91)	-	-	-
<i>temp</i>	-0.05 (-7.74)	-0.05 (-7.78)	-	-
Long run Elasticities				
Price	-0.40	-0.05	-0.39	-0.85
Income	-	0.46	0.15	0.77
Estimated Variance of Hyperparameters				
Irr (10 ⁻⁵)	394.81	290.02	5.25*10 ⁻¹	3.28
Lvl(10 ⁻⁵)	-	40.20	3.36	20.64
Slp(10 ⁻⁵)	-	-	-	-
Sea(10 ⁻⁵)	-	11.76	1.40	9.29
Trend				
Nature of Trend	Conventional model (Irr 1969.2, 1969.4, 1994.3, 1999.3, 2004.4, 2005.2, 2005.4, 2007.3)	Local level with drift (Irr 1984.2, 2005.4 and Lvl 2005. 1)	Local level with drift (Lvl 1968.3 and Irr 1987.1, 1987.4, 1990.1, 1990.2 included)	Local level with drift (Irr 1968.1, 1973.1, 1973.2, 1979.2 included)
Growth rate at end of period (% p.a.)	0.47	-4.06	1.72	-0.02
DIAGNOSTICS				
Equation Residuals				
Std. Error	0.06	0.07	0.01	0.02
Normality	3.32	3.35	0.57	2.30
H(n)	H(54)=2.06	H(54)=1.98	H(54)=0.43	H(55)=0.64
r(1)	0.16	-0.08	0.06	0.04
r(4)	0.13	0.02	0.01	0.08
r(8)	0.01	0.02	0.03	-0.03
D.W.	1.67	2.13	1.86	1.92
Q _(8,n)	Q _(8,7) =17.95	Q _(8,5) =2.15	Q _(8,5) =8.02	Q _(8,5) =7.40
Rs ²	0.87	0.56	0.87	0.64

Table 2a: continued.

Category	'gas'	'other fuels'	'other housing'	'furnishings, household equipment and routine maintenance of the house'
Auxiliary Residuals				
Irregular Normality	1.21	1.31	1.14	1.43
Level Normality	-	3.75	0.73	3.26
Slope Normality	-	-	-	-
Predictive Failure Tests (2004q2-2006q1)				
$\chi^2_{(s)}$	26.33	15.90	7.50	9.67
Cusum $t_{(s)}$	-1.42	0.39	-1.37	-1.90
Likelihood Ratio Tests				
Test (a)	-	57.36	32.83	87.70
Test (b)	-	-	-	-
Test (c)	-	23.02	15.80	131.51

Notes for Table 1b: see notes to Table 1a.

Table 1c: Estimated STSM expenditure functions for the UK 1964q1-2007q1

<i>Dependent variable: expenditure (in logs) – exp</i>				
Category Independent Variables	'health'	'vehicle fuels and lubricants'	'other transport'	'communication'
<i>y</i>	0.08 (0.71)	-	0.54 (3.24)	-
<i>y</i> (-1)	-	0.09 (0.71)	-	0.14 (2.59))
<i>y</i> (-4)	-	-	-	-
<i>p</i>	-0.22 (-1.50)	-0.24 (-4.47)	-1.29 (-4.95)	-0.14 (-3.66)
<i>p</i> (-1)	-	-	-	-
<i>p</i> (-3)	-	-	-	-
<i>p</i> (-6)	-	-	-	-
<i>exp</i> (-1)	-	-	-	-
<i>exp</i> (-4)	-	-	-	0.30 (5.74)
<i>exp</i> (-5)	-	0.16 (2.22)	-	-
<i>exp</i> (-6)	0.18 (2.46)	-	-	-
<i>exp</i> (-8)	-	-	-	-
<i>temp</i>	-	-	-	-
Long run Elasticities				
Price	-0.27	-0.29	-1.29	-0.20
Income	0.10	0.11	0.54	0.20
Estimated Variance of Hyperparameters				
Irr (10 ⁻⁵)	16.67	30.75	0.00	5.90
Lvl(10 ⁻⁵)	28.57	29.28	82.72	27.81
Slp(10 ⁻⁵)	-	-	-	-
Sea(10 ⁻⁵)	4.29	4.51		-
Trend				
Nature of Trend	Local level with drift	Local level with drift	Local level with drift (Irr 1966.2, 1969.1, 1973.1, 1978.1, 1979.2, 1980.1 and Lvl 1968.2 included)	Local level with drift (Irr 1971.1, 1982.4, 1986.2 included)
Growth rate at end of period (% p.a.)	2.10	2.24	2.44	3.77
DIAGNOSTICS				
Equation Residuals				
Std. Error	0.03	0.03	0.04	0.02
Normality	4.01	2.91	2.40	3.56
H(n)	H(54)=0.51	H(54)=1.24	H(56)=0.36	H(55)=0.99
r(1)	0.02	0.001	0.07	0.02
r(4)	0.05	-0.08	0.11	0.06
r(8)	-0.002	-0.04	-0.004	-0.07
D.W.	1.96	1.89	1.84	1.95
Q _(8,n)	Q _(8,5) =2.98	Q _(8,5) =8.93	Q _(8,5) =12.87	Q _(8,6) = 2.63
Rs ²	0.59	0.67	0.80	0.59

Table 1c: continued.

Category	'health'	'vehicle fuels and lubricants'	'other transport'	'communication'
Auxiliary Residuals				
Irregular Normality	0.06	3.67	0.42	0.30
Level Normality	1.27	3.69	1.33	2.11
Slope Normality	-	-	-	-
Predictive Failure Tests (2004q2-2006q1)				
$\chi^2_{(s)}$	10.02	16.33	9.60	4.95
Cusum $t_{(s)}$	-1.48	-1.23	-1.60	-1.33
Likelihood Ratio Tests				
Test (a)	166.82	88.87	207	196.84
Test (b)	-	-	-	-
Test (c)	64.89	132.90	139.32	-

Notes for Table 1c: see notes to Table 1a.

Table 1d: Estimated STSM expenditure functions for the UK 1964q1-2007q1

<i>Dependent variable: expenditure (in logs) - exp</i>				
Category Independent Variables	'recreation and culture'	'education'	'restaurants and hotels'	'miscellaneous goods and services'
y	0.27 (3.32)	-0.06 (-1.34)	0.32 (3.40)	0.30 (3.97)
$y(-1)$	-	-	0.21 (2.22)	-
$y(-4)$	-	-	-	-
p	-0.55 (-3.35)	-0.50 (-9.03)	-0.68 (-4.00)	-0.24 (-2.01)
$p(-1)$	-	0.37 (6.02)	-	-
$p(-3)$	-	-	-	-
$p(-6)$	0.30 (1.92)	-	-	-
$exp(-1)$	0.34 (4.95)	0.69 (12.24)	0.23 (3.32)	0.28 (4.80)
$exp(-4)$	-	-	-	-
$exp(-5)$	-	-	-	-
$exp(-6)$	-	-	-	-
$exp(-8)$	-	-	-	-
$temp$	-	-	-	-
Long run Elasticities				
Price	-0.37	-0.42	-0.88	-0.23
Income	0.41	-0.19	0.69	0.33
Estimated Variance of Hyperparameters				
Irr (10^{-5})	4.23	4.67	4.55	11.63
Lvl(10^{-5})	11.28	16.03	18.24	-
Slp(10^{-5})	-	-	-	1.18
Sea(10^{-5})	3.98	-	5.46	1.95
Trend				
Nature of Trend	Local level with drift (Irr 1990.1 included)	Local level with drift (Irr 1965.3, 1970.4, 1971.2, 1972.1, 2005.1 included)	Local level with drift (Irr 1993.1 included)	Smooth trend (Irr 1986.1, 1987.4, 1990.1 included)
Growth rate at end of period (% p.a.)	2.54	1.16	0.73	0.87
DIAGNOSTICS				
Equation Residuals				
Std. Error	0.02	0.02	0.02	0.02
Normality	4.79	5.12	3.21	7.09
H(n)	H(54)=0.93	H(56)=1.16	H(55)=0.71	H(55)=1.44
$r(1)$	0.02	0.02	0.006	0.02
$r(4)$	0.08	-0.01	0.03	0.02
$r(8)$	-0.06	-0.001	-0.07	-0.07
D.W.	1.94	1.95	1.97	1.97
$Q_{(8,n)}$	$Q_{(8,5)}=10.26$	$Q_{(8,6)}=2.27$	$Q_{(8,5)}=6.55$	$Q_{(8,5)}=3.30$
Rs^2	0.54	0.60	0.61	0.59

Table 1d: continued.

Category	'recreation and culture'	'education'	'restaurants and hotels'	'miscellaneous goods and services'
Auxiliary Residuals				
Irregular Normality	4.68	2.41	4.95	4.12
Level Normality	2.37	2.99	3.67	-
Slope Normality	-	-	-	2.89
Predictive Failure Tests (2004q2-2006q1)				
$\chi^2_{(s)}$	8.29	7.51	3.41	3.30
Cusum $t_{(s)}$	-1.25	-1.12	-0.91	-0.74
Likelihood Ratio Tests				
Test (a)	41.20	71.49	38.30	-
Test (b)	-	-	-	52.72
Test (c)	101.86	-	119.34	52.66

Notes for Table 1d: see notes to Table 1a.