The Economic and Social Review, Vol. 43, No. 1, Spring, 2012, pp. 31–66

The Welfare Impact of Price Changes on Household Welfare and Inequality 1999-2011

JASON LOUGHREY
Teagasc/National University of Ireland Galway

CATHAL O'DONOGHUE
Teagasc

Abstract: This paper attempts to use applied micro-economic research to understand the impact of price changes over the period 1999-2011 in Ireland. This measure combines an efficiency component using a Linear Expenditure System (LES) and an equity component using the Atkinson Index of Inequality. The efficiency component includes the behavioural response to price changes for non-subsistence expenditures thereby producing a Cost of Living Index. The Atkinson Index of Inequality produces an inequality measure and this is combined with the Cost of Living Index to produce an overall welfare measure. This extends upon the existing Irish literature on this issue by accounting for this broader set of components. The results show that changes in the cost of living have differed substantially between households both in terms of demographics and the position of the household in the income distribution and that behavioural response can potentially improve the welfare position of households in response to price changes in most years.

I INTRODUCTION

After a decade of relatively low positive price changes, the welfare impact of inflation moved off the policy and research agenda. The recent period of price volatility amongst necessities such as food, fuel and housing costs as well as a recent period of deflation has resulted in increased discussion as to the differential impact of price changes on different socio-economic groups. The crisis of stagnant economic growth and high debt in many developed countries

Corresponding author: jason.loughrey@teagasc.ie

has combined with uncertainty about monetary regimes and, therefore, increased uncertainty about the future direction of the overall price level. This paper attempts to use applied micro-economic research to understand the impact of price changes over the period 1999-2011 in Ireland. However, the results produce many insights that can improve knowledge and understanding about the cost of living issue into the future.

The ongoing but intermittent movement in consumer prices combined with the heterogeneous consumption baskets of different households means that the welfare impact attributable to price changes can differ greatly between households over time. The rationale for this paper is to explore the degree to which price changes impacted differently upon the economic welfare of Irish households between 1999 and 2011. Numerous studies in other countries have found substantial differences in changes to the cost of living for different households. These include Hobijn and Lagakos (2005) which found that household-specific inflation rates in the USA between 1987 and 2001 varied substantially around the mean inflation rate. Crawford and Smith (2002) found that from 1976 to 2000, only about one-third of households in the United Kingdom faced inflation rates within one percentage point of the average rate in each year.

In Ireland, a recent study by Murphy and Garvey (2004) found that inflation for the urban poor exceeded the state average by a total of almost 4 per cent for the period between October 1996 and November 2001. Much of the difference is attributed to the increase in rent and accommodation charges and the sharp fall in mortgage interest rates. This widening in the cost of living gap between the urban poor and the state average occurred despite the high inflation for many commodities that form a lower share for the urban poor than the state average. These included entertainment, medical costs, vehicle insurance and motor tax. Food expenditures were among the expenditures for which prices rose the most including tea, fresh fruit and vegetables. Food expenditures are among the most essential expenditures and large price increases for these expenditures is likely to have increased inequality.

Murphy and Garvey (2004) focused purely on the direct welfare impact due to changing prices alone. However, the ability of consumers to alter their consumption basket in response to price changes means that the welfare loss or gain from changing prices can be improved for the consumer. The behavioural response to a price change is less in the case of goods and services with an inelastic demand such as food than for goods with an elastic demand that can be considered luxuries. Therefore, a change in the price of the most essential goods has a lower distortionary impact on the composition of the consumption basket.

This paper departs from the work of Murphy and Garvey (2004) by measuring the welfare change due to price changes both from the direct impact but also from the indirect impact due to substitution behaviour. Murphy and Garvey (2008) did account for behavioural response by producing Superlative Cost of Living Indices (Fisher and Tornqvist) and found the counterintuitive result that the behavioural response of consumers to price increases led to even greater welfare losses than those calculated using the Consumer Price Index (CPI). The calculation of Superlative Cost of Living Indices is beyond the scope of this paper as we use a demand system instead. Sommerville (2004) found a low substitution bias in the CPI of about 0.02 per annum using the Almost Ideal Demand System model and found that the growth of the superlative indices actually exceeded the CPI for approximately half of the period between 1988 and 2001. Sommerville found that the size of the substitution bias for the AIDS model corresponds closely to that of Irvine and McCarthy (1978).

A welfare measure must be employed in order to calculate the degree of substitution behaviour and therefore substitution bias in the Index. Uncompensated welfare measures such as consumer surplus are usually considered an insufficient basis for welfare measurement. The main alternatives available are the Hicksian compensated welfare measures of equivalent variation and compensating variation. In this case, the compensating variation is chosen as the welfare measure because it is with reference to restoring original utility. Hicksian compensated welfare measures should only be used from an ethical point of view if there is a realistic opportunity for the consumer to be compensated in income for the price increase. It is otherwise unethical to proceed with such a measure. The likelihood of compensation is increasingly unlikely for many households in Ireland given the scale of unemployment and indebtedness. A fall in real wages via higher prices could *ceteris paribus*, be viewed by policymakers as a path towards reducing unemployment.[1] Substitution behaviour will continue to take place but the prospects of income compensation for price changes is most likely in decline. Therefore, uncompensated measures of utility may be more appropriate in the near future. The calculation of price indices for different household groups and income deciles can potentially inform policymakers to a greater extent about cost of living changes for specific household types and, therefore, improve the likelihood of compensation taking place.

[1] While acknowledging the potential for this view taking hold among policymakers, it is important to consider that there are perhaps more important dynamics at play. The potential for expansionary monetary policy to provide for positive co-movement in nominal spending, inflation and real output means that we should not place too much weight on the real wage-unemployment trade-off.

In order to calculate compensating variation, we utilise data from the Household Budget Survey, together with a demand system containing elasticities of the response of households to price and income changes to produce behaviour adjusted welfare measures of price changes in Ireland. The transition from private household welfare change to societal welfare change is made using a social welfare function which accounts for inequality aversion.

The paper has the following outline. Section II describes the methodology used in the study. Section III outlines the price data and budget survey data used in the study. Section IV follows providing the Distributional Characteristic for different commodities. Section V provides the Compensating Variation for different demographic groups and consumption deciles in all years from 1999 to 2011 and the overall welfare effect in each year. This is followed by the conclusions.

The results for each household group are the welfare impact of consumer price changes. It is important to consider that welfare changes not attributable to price changes can clearly influence welfare to a much greater extent than welfare changes attributable to price changes. We should, therefore, keep in mind the broader set of welfare changes that have taken place for households in Ireland since 1999 including nominal household incomes and other non-monetary welfare changes. The findings in this paper can be complemented by a reading of Whelan and Maître (2010) which clearly shows that many of 'the economically vulnerable' earn incomes above the 60 per cent relative poverty line. This should be taken into account as targeted policy efforts to compensate for increases in the cost of living should not be based solely on the position of the household in the income distribution or their demographic composition but also on levels of deprivation and vulnerability as shown by Whelan and Maître.

II METHODOLOGY

The tendency of consumers to substitute between goods in response to price changes has implications for the measurement of the welfare result. A welfare measure that does not account for this substitution behaviour will overestimate the welfare loss from a price increase and underestimate the welfare gain from a price decrease in a given commodity. A measurement of welfare change must therefore account for this substitution behaviour. Measuring the impact of substitution behaviour upon consumer welfare can be done using a demand system, which reports own and cross price elasticities as well as income elasticities for each commodity group. There are a number of alternative demand systems that can be used to calculate price elasticities of demand and, therefore, the overall welfare change due to price changes. These

include the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980), the Rotterdam (ROTT) system of Theil (1976) and the LES of Stone (1954). The AIDS and ROTT models are broadly similar (Barnett and Seck, 2008). Both models require a supply of price and expenditure data from distinct time periods or geographical areas.

The suitability of the AIDS and ROTT demand systems for this form of price analysis is dependent on the extent of price variation during the time period of the study. We have potentially 10 quarters of price data that are suitable for this analysis, i.e. five quarters each from the 1999/2000 and 2004/2005 Household Budget Surveys. Bargain *et al.* (2010) explain that little price variation is found in the 2004/2005 price data. This reduces the potential performance of the AIDS model for the calculation of elasticities. When there is limited price and expenditure data, the LES method, although relatively crude, can be used to derive estimates of the elasticities required for the analysis. The LES methodology is based on the explicit use of direct utility functions and is therefore parametric. This study tries to overcome problems relating to population heterogeneity by using different household groups with separate parameters calculated for each group thereby producing twelve representative households.

Deaton (1974) critiques the assumption of additivity which is present in the LES. Creedy (1998) explains that the high degree of structure imposed by additive utility functions does not allow for complementary goods and requires approximate proportionality between income and price elasticities but regards these as the costs of overcoming data limitations. Creedy and Van de Ven (1996) advise that potential problems are much less severe when broad commodity groups are used. Other studies to have used the LES include Madden (1995), Powell (1974) and Lluch, Powell and Williams (1977).

2.1 *Utility Function*

In order to calculate welfare (utility) at the household level (pre- and post-price change), we require a utility function. As in the case of Creedy (2001), we utilise a Stone-Geary LES direct utility function for a:

$$U = \prod_i [x_i - \gamma_i]^{\phi_i} \tag{1}$$

where x_i is consumption for each good i and γ_i are LES parameters known as committed or subsistence consumption for each good i and the marginal budget shares[2] are $0 \leqslant \phi_i \leqslant 1$, $\Sigma_i \phi_i = 1$. The calculation of subsistence con-

[2] The marginal budget shares ϕ_i are the shares of non-subsistence consumption for each commodity group. The marginal budget share for necessities usually falls below the average budget share for those most necessary commodities.

sumption is a key motivation for the use of the Stone Geary function. The Engel curves are linear but do not travel through the origin. The substitution behaviour is assumed to only take place for those expenditures which lie above the level of subsistence consumption. The higher the level of subsistence income relative to total expenditure, the lower the scope exists to gain from substitution behaviour in response to price changes. An important assumption within the LES is that marginal budget shares remain the same at the new (post-price change) total expenditure level as under the original total expenditure level.

2.2 *Equivalent Income*

In this work, the Hicksian demand assumption is made that the household is compensated in money for price increases and penalised in money for price decreases to the extent that the original level of utility is restored. The amount of money required to provide the same utility level post-price change as the utility level under the original prices is the Equivalent income ($y_e{}^h$), a concept due to King (1983). In this work, equivalent income amounts to the total expenditure that at some set of new prices p_r and given characteristics gives the same utility as that derived from the original total expenditure and prices p. Hence the indirect utility function with the new prices [$V(p_r, y_e, z)$] is equal to the indirect utility with the original prices and income [V(p, y, z)] for a household with income y and demographic characteristics z. The reference demographic group is a single adult living alone with no children and lower secondary education.

Equivalent income is therefore:

$$y_e{}^h = E(p_r, V(p, y, z), z) \tag{2}$$

where E( ) is an expenditure function (i.e. the expenditure necessary with prices p_r to have utility V( ) with demographic characteristics z).

For convenience we ignore the subscripts, z indicating that different parameters are estimated for different demographic groups. Maximising utility subject to the budget constraint $C = \sum_i p_i x_i$, the linear expenditure function for good i is:

$$p_i x_i = p_i \gamma_i + \phi_i \left(C - \sum_j p_j \gamma_j \right) \tag{3}$$

Differentiating w.r.t. p_i and multiplying by $\frac{p_i}{p_i x_i}$, we produce the own price elasticity from which the γ_i parameters (subsistence expenditures) can be derived:

$$\eta_{ii} = \frac{p_i \gamma_i}{p_i x_i} - \frac{p_i \phi_i}{p_i x_i}(\gamma_i) = \frac{\gamma_i(1 - \phi_i)}{x_i} - 1 \Rightarrow \gamma_i = \frac{(\eta_{ii} + 1)x_i}{(1 - \phi_i)} \tag{4}$$

Differentiating (4) w.r.t. C and multiplying by $\frac{C}{p_i x_i}$, we produce the budget elasticity, from which we can derive the ϕ_i parameters:

$$\eta_i = \frac{\phi_i C}{p_i x_i} \tag{5}$$

Implies that the marginal budget shares are

$$\phi_i = \frac{\eta_i c_i}{C} = \eta_i w_i \tag{6}$$

We can produce the indirect utility function of the LES by substituting into the direct utility function (3), the Marshallian demand function:

$$\begin{aligned} V(p, y) &= \prod_i \left[\gamma_i + \frac{\phi_i}{p_i}\left(C - \sum_j p_j \gamma_j\right) - \gamma_i\right]^{\phi_i} \\ &= \prod_i \left[\frac{\phi_i}{p_i}\left(C - \sum_j p_j \gamma_j\right)\right]^{\phi_i} = \frac{\prod_i [C - \Sigma_j p_j \gamma_j]^{\phi_i}}{\prod_i [p_i/\phi_i]^{\phi_i}} \\ &= \frac{C - \Sigma_j p_j \gamma_j}{\prod_i [p_i/\phi_i]^{\phi_i}} \end{aligned} \tag{7}$$

Cross-multiplying, the LES expenditure function for price p_i is:

$$E(p, U, z) = C = \sum_i p_j \gamma_j + \prod_i (p_i/\phi_i)^{\phi_i} V(p, y) \tag{8}$$

While the expenditure function for price $p_{r,i}$ is:

$$E(p_r, U, z) = \sum_i p_{r,i} \gamma_i + \prod_i (p_{r,i}/\phi_i)^{\phi_i} U \tag{9}$$

Where $U = V(p, y)$

Hence from (7) and (9) we can produce the equivalent income necessary to produce utility U (based upon consumption C and price p_i), when prices are $p_{r,i}$.

$$\begin{aligned} y_e &= \sum_i p_{r,i} \gamma_i + \prod_i (p_{r,i}/\phi_i)^{\phi_i} \frac{C - \sum_i p_i \gamma_i}{\Pi_i (p_i/\phi_i)^{\phi_i}} \\ &= \sum_i p_{r,i} \gamma_i + \left[\prod_i (p_{r,i}/p_i)^{\phi_i}\right]\left[C - \sum_i p_i \gamma_i\right] \end{aligned} \tag{10}$$

2.3 *Compensating Variation*

The change in household welfare due to price changes is the Compensating Variation, i.e. the change in equivalent income due to price changes. Using the new prices as the reference prices p_r in Equation (10), the Compensating

Variation is the post-price change equivalent income minus the original income before the price change.

$$CV = Ye - Y \tag{11}$$

The Compensating Variation can be defined as the minimum amount of money required to compensate the household for the price change so that the utility level at the new prices equals the utility level under the original prices. Hence:

$$CV = E(p_r, V(p, y, z), z) - E(p, V(p, y, z), z) \tag{12}$$

2.4 *Social Welfare Calculation*

In order to scale up the individual impacts on welfare of a price change, we utilise a social welfare function. If citizens are indifferent to the differential inequality impact of price changes, then the sum of private household welfare gains or losses will equal the total change to societal welfare. In the presence of societal inequality aversion, citizens are concerned about the inequality impact of price changes outside of their own private welfare, which can be captured by a social welfare function. As in the case of Madden (1995), we utilise a variant of the Atkinson (1970) social welfare function:

$$W = \frac{1}{H} \sum_h \frac{(v^h)^{1-e}}{1-e} \tag{13}$$

Where H is the number of households and e is the inequality aversion parameter that relates to how much a transfer from rich to poor will improve social welfare; the higher the value of e the more a transfer will improve welfare.[3] This formula implies that additional consumption provides greater additional utility for low income than high income households. This means that the same price increase has a more adverse welfare impact upon low income than high income households. The degree to which inflation and thereby welfare affects low income households depends in part upon the degree of inequality aversion that exists in society and the relative composition of consumption baskets for low income households.

[3] In the case of there being a two person society with one individual having twice the income of another, an inequality aversion parameter of 0.3 indicates that total welfare is improved by a one euro transfer from rich to poor so long as the amount lost in the transaction is less than 19 cent. For an inequality aversion parameter of 0.8, the transfer improves total societal welfare so long as the amount lost in the transaction is less than 42.5 cent. Amiel *et al.* (1999) find that measures of inequality aversion can be obtained with some precision and calculate a value of 0.3 for students in Australia and Israel. Blinder (1978) found that inequality aversion for US citizens is in the range of 0.1 to 0.2.

Excluding the inequality aversion parameter, we assume that utility for each household equals consumption, $v^c = c^h$. Including the inequality aversion parameter means that a change in v^h or c^h results in the following:

$$\theta^h = \frac{\partial W}{\partial c^h} = \frac{1}{H}(c^h)^{-e}$$

Atkinson's measure of inequality is

$$A(e) = 1 - \left[\frac{\left[\left(\frac{1}{H}\right)\sum_h (y_e{}^h)^{(1-e)}\right]^{1/(1-e)}}{\bar{y}_e}\right] = 1 - \left[\frac{y_{ede}}{\bar{y}_e}\right] \tag{14}$$

For our purposes, we assume that $y^h = c^h = v^h$ i.e. that total household income equals total expenditure. This restriction means that savings are ignored. Combining this with our Social Welfare Function W, we produce a Social Welfare Function based upon equivalent income:

$$W = \frac{1}{H}\sum_h \frac{(y_e{}^h)^{1-e}}{1-e} = \frac{(y_{ede})^{1-e}}{1-e} \tag{15}$$

where $y_{ede} = \bar{y}_e(1 - A)(e))$ and $\bar{y}_e$ is the mean equivalent income and $A(e)$ is Atkinson's inequality of equivalent income. y_{ede} the equally distributed equivalent value can be interpreted as the equivalent income that if distributed equally across the population produces the same value of social welfare as the existing distribution of income. It captures the trade-off between equity and efficiency. The higher y_{ede} the higher the product of mean equivalent income (efficiency) and equality, hence an increase in equality or efficiency can increase y_{ede}.

III DATA

3.1 *Expenditure Data*

In order to produce our welfare estimates and derive our demand system, we require micro data that contains expenditure at the household level. We use the Irish Household Budget Survey (HBS) data of 1999/2000 and 2004/2005 for this study. There are 7,644 households and 525 expenditure items (expenditure greater than zero) in the 1999/2000 HBS. There are 6,884 households and 805 expenditure items (expenditure greater than zero) in the 2004/2005 HBS. These expenditure items are divided into twenty-one commodity groups.

The choice of grouped budget shares has the following advantages:

- It reduces the impact of the zero expenditures problem, which could substantially undermine the results of OLS regressions.[4]
- Estimates for smaller groups of goods could be unstable.
- In any case, twenty-one categories are a number sufficient to allow for a substantial degree of heterogeneity in inflation and consumption behaviour.
- Total Consumption for this study is defined as the monetary value of non-durable and durable goods and services purchased during the period of the survey.[5]

3.2 *Price Data*

The increases in the overall CPI from 1999-2011 (Table A3) are considered low by most economists and are much lower than those experienced during the 1970s and early 1980s. However, considerable divergence between commodity group inflation rates exists so that the welfare impact of changing prices may differ greatly between different households and income levels over time.

The price data is taken from the CSO. This data provides the annual price level for twenty-one commodity groups from 1998 to 2011. The price inflation for each commodity is calculated with the same method as the overall Consumer Price Index, a Laspeyres Price Index. In addition, we calculate the Cost of Living Index using the Linear Expenditure System (LES). We use the price level for 1998 to calculate the increase in the cost of living for 1999. The use of only twenty-one commodity groups does not pose major problems because the LES is best using a small number of commodity groups. However, an important assumption is that there is no price variation within commodity groups and the substitution effect within commodity groups is not calculated because of the limitations posed by the LES method. The calculation of the commodity group inflation rates is done by subtracting the current year's price

[4] A zero expenditure, can be due not only to infrequent purchases, but also to abstention from consumption: this is a problem relevant only for a few goods of our list (alcohol and tobacco); we deal with this problem for tobacco by including a smoker variable in the demographic characteristics. We find that the exclusion of the zero expenditures has minimal impact on the size of the behavioural response component in the model so that it is not a major issue. The inclusion of independent variables such as smoker, car owner and mortgage holder help overcome the limitations posed by zero expenditures. We make no adjustment for alcohol. These are listed in Table A1.

[5] This definition does *not* include: the imputed rents for home owners and the value of houses eventually purchased, the amounts paid for direct taxes or social security contributions, the value of home production, the value of debt repayment (interest repayments are included), the value of gifts received (but includes contribution to churches or associations, etc.).

level p1 from the previous year p0 and dividing this by the price level of the previous year p0.

$$((p1 - p0)/(p0) \tag{16}$$

3.3 *Estimating Budget and Price Elasticities*

The price elasticities of demand are used to impute the levels of subsistence expenditure for each good as shown by Equation (4). These are only imputations and cannot be taken as precise estimates of subsistence expenditures. The price elasticities of demand are calculated using the OLS regression method in Equation (17). The method assumes that a commodity with a low price elasticity of demand of approximately –0.2 leads to the imputation of a high level of subsistence expenditure for that commodity. In contrast, high price elasticities of demand lead to the imputation of low levels of subsistence expenditure and in many cases zero where the price elasticity of demand is less than –1, i.e. elastic.

The price elasticity of demand,

$$\eta_{k,i}^{h} = \frac{\delta x_k{}^h}{\delta p_i} \frac{p_i}{x_i{}^h}, \tag{17}$$

Creedy (2001) describes an approximate method for producing price elasticities. Rather than estimating a system of demand equations, it relies on a method due to Frisch (1959) that describes own and cross-price elasticities in terms of total expenditure (budget) elasticities (η_i), budget shares (w_i) and the "Frisch" marginal utility of income parameter (ξ) for directly additive utility functions.[6] Lluch, Powell and Williams (1977) found results conforming with that of Frisch that the expenditure elasticity of the marginal utility of income is negative and declines in value with GNP per capita. They empirically showed based upon a log linear regression analysis that the Frisch parameter declines by approximately 0.36 per cent for every one per cent increase in GNP per capita or that $-\xi = 0.36$ (real GNP per head in 1970 US dollars). Rather than assuming a constant elasticity relationship between ξ and total expenditure, we follow a method due to Creedy and Dixon (1998) which elaborated on the Lluch, Powell and Williams model as follows:

$$\ln(-\xi) = \phi - \alpha \ln(C/ER + \vartheta) \tag{18}$$

[6] Note an additive utility function is utilised which does not allow for complements and so one must exert a degree of caution over the results.

where the parameters ϕ, α and ϑ are ad hoc parameters (here respectively 7.1, 1.05, 177) derived by trial and error. The C parameter represents mean total expenditure per head and ER represents the exchange rate parameter. Frisch showed that the elasticities can be written as follows:

$$\eta_{ij} = -\eta_i w_j \left(1 + \frac{\eta_j}{\xi}\right) + \frac{\eta_i \delta_{ij}}{\xi}, \tag{19}$$

where $\xi_{ij} = 1$ if i = j, 0 otherwise and $w_j = \frac{p_j c_j}{C}$ is the budget share for good j (See Creedy, 2001 for more details).

In order to calculate the budget elasticities, consumption on particular goods is estimated as budget shares of total consumption, utilising Engel functions.

$$w_i = \alpha + \beta_1 \ln C_{HBS} + \delta X_{HBS} \tag{20}$$

where w_i = ith budget share, C is total non-durable consumption and X is the same set of demographic characteristics used above.

The coefficients produced by Equation (20) are included in Table A4a and Table A4b. These coefficients are taken from the 2004/2005 Household Budget Survey data and using the OLS regression method with correction for heteroskedasticity.[7] These coefficients are used to calculate the welfare measure from 1999 onwards as provided in Table 7. This means that the coefficients from the 1999/2000 Household Budget Survey are not used to calculate the overall welfare measure in Table 7. Employing coefficients from both surveys would clutter the presentation of results and the overall change in the cost of living differs little according to the choice of budget survey as Table 5 shows. The coefficients from the 1999/2000 Household Budget Survey data are used in Tables 4 and 5 to show the percentage change in the cost of living. The estimates are at the household level as budget shares for each individual are not available in the Household Budget Survey.

One can see from Table A4a the negative sign for the log of consumption (lcgrp1-lcgrp12).[8] This shows that additional units of log consumption significantly reduce the proportion of expenditure devoted to food. This is not

[7] The dependent variable is bounded at zero and one and the OLS method can therefore potentially bias the estimates. The fractional logit method was tested as an alternative estimator and the results showed little change in the value of the estimates. The survey weighting factors are not used in the regressions.

[8] The log of consumption for each household group (lcgrp) is calculated and the attached number corresponds to the number of the household group.

surprising given that food is a necessity and the food share should decline as total expenditure rises. The other highly inelastic goods include communications, local authority rents, refuse collection, electricity, natural gas, liquid fuels and solid fuels. All of these commodity groups are negatively related to the log of consumption in the budget share regressions (Tables A4a and A4b). Therefore, an increase in total expenditure leads to a decline in the budget share for each of these commodity groups. The log of consumption is positively and significantly related to a number of commodity groups including clothing, furniture, health, transport, education and restaurants. A unit increase in total expenditure will lead to an increase in the proportion of expenditure devoted to these expenditures. These commodities are shown to be among the most elastic commodity groups (Table 1).

The independent variables in the budget share regression manage to capture some of the variation in budget share that is not due simply to changes in total expenditure. Tables A4a and A4b show that being a smoker is associated with a number of expenditures including a reduction in the proportion of expenditure spent on food, clothing, health, furniture and household maintenance and an increase in the proportion spent on local authority rents. Car ownership is positively associated with health and mortgage interest shares and negatively associated with the share for food, alcohol and tobacco, clothing, furniture and household maintenance and communications.

Being an employee is negatively associated with the share for rents, alcohol and tobacco and positively associated with mortgage interest repayments. Being self-employed is positively associated with the food share, mortgage interest and negatively associated with rents. Employment is therefore a clear contributory factor in the size of the mortgage interest repayment. The employment variables could potentially pick up some of the variation in the savings rate between households given that total income is not among the independent variables. The education of the household head is negatively related to the food and transport shares for both university and upper secondary. Household heads with lower education are the base category. Health, communications and private rents are all positively associated with the household head having upper secondary or university level education. The number of children in the household is positively associated with the share for food and electricity and negatively associated with the share for restaurants with some variation in the significance in the case of restaurants according to the age bracket of the children. This suggests that households with children substitute away from restaurant expenditure towards home cooking. The number of adults over 64 years old is positively related at the one per cent level to the food share and negatively to rents and electricity. The number of

earners is negatively related to the food and education shares and positively to restaurants.

Table 1: *Budget Share Elasticity and Price Elasticity of Demand for Twenty-One Commodity Groups: 1999 and 2004 Budget Surveys*

	Budget Year	*1999*		*2004*	
		Budget Elasticity	*Price Elasticity*	*Budget Elasticity*	*Price Elasticity*
1	Food	0.21	–0.17	0.25	–0.20
2	Alcohol and Tobacco	1.07	–0.74	1.02	–0.75
3	Clothing	1.59	–1.08	1.41	–1.01
4	Furniture and Household Maintenance	1.29	–0.89	1.34	–0.96
5	Health	1.69	–1.15	1.50	–1.06
6	Transport	1.27	–0.89	1.26	–0.92
7	Communications	0.43	–0.30	0.57	–0.42
8	Leisure	1.04	–0.73	1.14	–0.83
9	Education	1.45	–0.98	1.40	–0.99
10	Restaurant	1.40	–0.96	1.28	–0.92
11	Other	1.22	–0.84	1.16	–0.84
12	Local Authority Rents	–0.31	0.23	–0.08	0.07
13	Private Rents	0.65	–0.46	0.74	–0.54
14	Mortgage Interest	0.81	–0.58	0.82	–0.60
15	Materials for Maintenance and Repair of Dwelling	1.67	–1.14	1.63	–1.15
16	Services for Maintenance and Repair of Dwelling	0.83	–0.57	1.20	–0.86
17	Refuse Collection	1.43	–0.96	0.25	–0.18
18	Electricity	0.08	–0.05	0.06	–0.04
19	Natural Gas	0.90	–0.61	0.83	–0.59
20	Liquid Fuels	0.05	–0.03	–0.08	0.07
21	Solid Fuels	–0.87	0.62	–0.46	0.35

IV RESULTS I: DISTRIBUTIONAL CHARACTERISTICS

Before undertaking our behavioural analysis, we firstly undertake a descriptive analysis of the distributional characteristics of the expenditure groups we are analysing in this study. To do this we utilise a measure known as the distributional characteristic used in Newbery (1995), Liberati (2001) and Madden (2009). The distributional characteristic is based upon a static analysis of the distribution of expenditure over the population and the welfare weights placed upon different groups. It is based on a Social Welfare Function

(SWF) $W = (v^1,\ldots,v^H)$, where $v^h = v^h(c^h, p)$ is the indirect utility function of household h for expenditure c and prices p.[9]

We define the impact of change in price as follows:

$$\frac{\partial W}{\partial p_i} = \sum_h \frac{\partial W}{v^h} \cdot \frac{\partial v^h}{\partial p_i} = \sum_h \frac{\partial W}{v^h} \cdot \frac{\partial v^h}{\partial c_i^h} \cdot \frac{\partial c_i^h}{\partial p_i} = -\sum_h \theta^h x_i^h, \tag{21}$$

where $\theta^h = \frac{\delta W}{\delta v^h} \cdot \frac{\delta v^h}{\delta c_i^h}$ and $c_i^h = p_i x_i^h$, θ^h, is the social marginal utility of total expenditures for household h and x_i^h is the consumption of good i by household h.

$$d_i = \frac{\Sigma_h \theta^h c_i^h}{\bar{\theta} \Sigma_h c_i^h}, \tag{22}$$

where $\bar{\theta}$ is the average social welfare weight. The more a good is consumed by households with higher social marginal utilities (social weight), the higher is d_i. If however we apply constant social welfare weights (i.e. we are indifferent between households of different income), then $d_i = 1, \forall i$.

We report the Distributional Characteristics of each commodity to provide some context as to the potential impact of price changes in different commodity groups from a purely distributional perspective. The E value represents the degree of inequality aversion and results are presented for two levels of inequality aversion. The following results indicate the relative desirability of price increases in twenty-one commodity groups from a purely distributional perspective. The DC results are presented below for the 1999 and 2004 Household Budget Surveys using two levels of inequality aversion. This information helps one to recognise the differential impact of price changes upon welfare for households at different points in the income distribution.

The higher distributional statistics (lower ranked) imply that these goods are purchased more intensively by low income households. There are few changes in the rankings in response to different levels of inequality aversion in both years. The results for 1999 and 2004 show that local authority rents is the commodity consumed most intensively by low income households relative to high income households. Food, solid and liquid fuels are among the other commodities consumed most intensively by low income households. Education,

[9] For a more detailed description of this method, see Liberati (2001).

mortgage interest and transport are the commodities consumed most intensively by high income households.

The big changes between 1999 and 2004 are that expenditures on furniture and household maintenance, communications, alcohol, tobacco and mortgage interest spending became more concentrated among high income households i.e. spending on these commodities came more from high income households. Restaurant, refuse collection, clothing and transport expenditures became more concentrated among low income households. The results suggest that price increases for local authority rents, food, electricity, solid and liquid fuels impact greater upon the welfare of low income households than for high income households. The results also suggest that price increases for education, mortgage interest, furniture and household maintenance impact greater upon the welfare of high income households than for low income households.

Table 2: *Distributional Characteristics 1999 and 2004*

	1999 (E=0.3)	*Rank*	*1999 (E=0.8)*	*Rank*	*2004 (E=0.3)*	*Rank*	*2004 (E=0.8)*	*Rank*
Local Authority Rents	1.07	1	1.20	1	1.09	1	1.26	1
Solid Fuels	1.04	2	1.09	2	1.03	2	1.06	2
Electricity	0.97	4	0.93	4	0.98	3	0.94	3
Food	0.98	3	0.94	3	0.98	4	0.94	4
Liquid Fuels	0.97	5	0.91	5	0.98	5	0.93	5
Refuse Collection	0.92	10	0.80	10	0.97	6	0.91	6
Private Rents	0.93	9	0.81	9	0.96	7	0.89	7
Natural Gas	0.93	8	0.83	8	0.95	8	0.87	8
Communications	0.95	6	0.86	6	0.95	9	0.86	9
Alcohol and Tobacco	0.94	7	0.84	7	0.94	10	0.84	10
Restaurant	0.90	13	0.75	14	0.91	11	0.77	12
Leisure	0.92	11	0.79	11	0.91	12	0.78	11
Other	0.90	15	0.74	15	0.90	13	0.76	13
Clothing	0.89	17	0.72	16	0.90	14	0.76	14
Services for Maintenance and Repair of Dwelling	0.91	12	0.78	12	0.89	15	0.75	15
Furniture and Household Maintenance	0.90	14	0.76	13	0.89	16	0.74	16
Transport	0.88	20	0.72	20	0.89	17	0.73	17
Education	0.89	16	0.72	17	0.89	18	0.72	18
Health	0.88	21	0.71	21	0.88	19	0.72	19
Materials for Maintenance and Repair of Dwelling	0.89	19	0.72	18	0.86	20	0.68	20
Mortgage Interest	0.89	18	0.72	19	0.86	21	0.67	21

V RESULTS II: COMPENSATING VARIATION AND TOTAL WELFARE EFFECT

The results in this section reveal the extent to which changes in the cost of living have differed between households over time and the contribution of price changes towards overall societal welfare. The Compensating Variation results show the change in the cost of living for different household groups for each year between 1999 and 2011. The total welfare effect is the effect of cost of living changes upon total societal welfare accounting for both private household welfare change and inequality aversion. The results produced using the chosen social welfare function show that private welfare changes the inequality effect in all years. This means that the sum of private household welfare changes does not depart far from the overall societal welfare change given the choice of social welfare function. Large differences between household groups are observed in some years thereby indicating that the Consumer Price Index is not always an accurate measure of the cost of living for different demographic groups and lends support to the case for a more disaggregated approach towards the reporting of price indices.

5.1 *Changes in Compensating Variation by Household Group*

The compensating variation measures the welfare change attributable to cost of living changes for each household and is calculated using Equation (11). Expressing the compensating variation as a percentage of total expenditure approximates the percentage change in the cost of living. The bottom row of Table 3 and Table 4 give the rate of change in the cost of living from 1999 to 2011 for the entire population. The Table 3 results are with reference to the 1999/2000 Household Budget Survey and Table 4 is with reference to the 2004/2005 Household Budget Survey. These results differ from the Consumer Price Index reported by the CSO, because of some aggregation issues,[10] the adjustment for substitution bias and the holding of the budget survey constant.

The results show that there are considerable differences between household groups in terms of the welfare impact of price changes in 1999, 2006, 2007 and 2009 but less in other years. Beginning with 2009, the first

[10] The use of twenty-one aggregates means that large within-group price differentials are overlooked and not accounted for. The restaurant and hotel category does not include expenditures by tourists and is therefore lower than the share reported by the CSO for the CPI weights. We adjust the mortgage interest, alcohol and tobacco shares to be consistent with the CPI weights for the 2004/2005 Household Budget Survey but the same rescaling value is applied across the population and this may differ from the CSO method. We do the same for the alcohol and tobacco component in the restaurant and hotel expenditure category.

Table 3: *Welfare Change from Consumer Price Changes 1999-2011*[11] *by Household Group Using the 2004/2005 Household Budget Survey*

	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
1	–0.5	5.9	5.2	3.4	2.5	2.2	2.7	4.5	5.4	3.5	–5.7	–1.1	2.5
2	2.7	5.7	3.9	4.4	3.5	1.9	2.0	2.3	2.4	3.4	–1.8	–1.7	1.3
3	0.7	6.0	5.5	3.6	2.2	1.4	2.3	4.0	5.3	3.5	–5.9	–2.0	2.0
4	1.7	5.5	4.7	4.1	2.9	1.4	1.7	2.9	3.9	3.3	–3.4	–2.4	1.4
5	–0.2	6.0	4.8	3.5	2.6	2.2	2.6	4.3	4.9	3.6	–5.2	–0.8	2.6
6	2.8	5.6	3.7	4.7	3.7	2.0	2.0	2.2	2.2	3.3	–1.3	–1.4	1.5
7	–0.7	5.9	5.0	3.3	2.4	2.2	2.7	4.5	5.2	3.7	–5.7	–0.8	2.8
8	–0.6	5.7	5.0	3.3	2.3	2.1	2.5	4.4	5.1	3.7	–5.6	–0.9	2.8
9	0.1	5.6	4.7	3.6	2.6	2.1	2.3	3.9	4.5	3.6	–4.6	–0.9	2.5
10	2.8	4.9	4.4	4.0	3.2	1.4	1.2	2.1	3.0	4.3	–0.9	–3.0	0.6
11	1.0	5.1	3.9	4.0	3.0	1.8	1.8	2.9	3.4	3.1	–3.1	–1.4	1.8
12	1.9	5.4	3.7	4.4	3.4	2.0	2.0	2.7	3.0	2.9	–2.4	–1.4	1.4
Total	0.7	5.6	4.4	3.9	2.9	2.1	2.3	3.5	4.1	3.3	–4.0	–1.2	2.1

1=single person, no children, under 65 2=one old person without children, 3=single person with 1 child, 4=single parent with more than 2 children, 5=young couple without children, 6=couple without children and with at least one spouse more than 65, 7=couple with one child, 8=couple with 2 children, 9=couple with 3 or more children, 10=family without children including person over 64, 11=family where more children than 1 and number of adults more than 3, 12=other
Note: Price Changes include Mortgage interest changes

year of deflation, the results show that households with a maximum of one child (groups 1, 3, 5, 7 and 8) benefitted from a fall of at least 5 per cent in the price level and thereby surpassing the average decline in the cost of living by at least 1.5 per cent. Single adults with one child (group 3) benefitted from a 5.9 per cent decline in the cost of living in 2009. The price index for both mortgage interest and rents fell dramatically in 2009 (Table A3). Those household groups with low budget shares for mortgage interest and rents benefitted from a much lower rate of deflation. Households including people over the age of 64 (groups 2, 6 and 10) benefitted from deflation by less than 2 per cent.

The results for 2010 shows that price changes reduced the cost of living on average at a lower rate than in 2009. However, some households departed from the average trend. Households including old people and more than one person (groups 6 and 10) experienced a larger drop in the cost of living in 2010 than in the case of 2009. This is partly due to higher than average budget shares for food and most home heating expenditures which declined in price in 2010. Single adults with children experienced the highest deflation of all

[11] CSO 2004/2005 Household Budget Survey anonymised microdata files.

household groups in 2010 (groups 3 and 4). These households have high budget shares for rents and the price index for rents declined by 6 per cent in 2010. In addition, these households have above average shares for most home heating expenditures and food so that price declines for these most necessary expenditures favoured these households to a greater extent than other households. The 2011 results show that households including people over the age of 64 (groups 2, 6 and 10) experienced lower than average increases in the cost of living. This is largely due to the 20.4 per cent increase in mortgage interest costs. It should be noted that there remains the possibility that households including people over the age of 64 are supporting their offspring in meeting mortgage debt repayments and these transfers are not accounted for in the analysis.

In the first year of the budget survey itself (2004), the index for private rents declined by 4.2 per cent (Table A3). Single people with children (groups 3 and 4) benefitted from lower than average increase in the cost of living as a result. The mortgage interest index increased by 12.3 per cent in 2005 (Table A3). Household groups 1, 5 and 7 had a bigger increase in the cost of living than the average household largely due to this increase. There appears to have been large variation between household groups in 2006. Mortgage interest rose by 31.5 per cent and the same household groups as in 2009 lost welfare attributable to much higher increases in the cost of living. This trend continued for 2007 as mortgage interest increased by 40.3 per cent. The large increase in food prices, local authority rents and mortgage interest in 2008 were not sufficient to produce large differentials in the cost of living between household groups.

It is best to analyse the trend for 1999 to 2003 using the 1999/2000 Household Budget Survey. A brief comparison of Table 3 and Table 4 will show that the average change in the cost of living does not differ much whether one uses the 1999/2000 Household Budget Survey or the 2004/2005 survey. There are however some differences within household groups. In the first year under study (1999), the large decline in the mortgage interest price index benefitted many households with young adults (groups 1, 7 and 8) because of high budget shares in mortgage interest. Single adults with one child (group 3) experienced the greatest deflation of 0.8 per cent as the low budget share for healthcare expenditures meant that such households did not lose as much from the healthcare price increase.

The rise in the cost of living peaked at 5.5 per cent in the following year but there appears to have been little difference between household groups. The large increase in food prices of 6.5 per cent in 2001 (Table A3) was overshadowed by the even larger increase in the index for mortgage interest (24.8), local authority rents (13.7), private rents (14.6) and refuse collection

Table 4: *Welfare Change from Consumer Price Changes 1999-2011*[12] *by Household Group Using the 1999/2000 Household Budget Survey*

Year	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
1	0.2	5.7	4.8	3.7	2.6	1.9	2.3	3.9	4.6	3.3	–4.8	–1.4	2.2
2	2.7	5.4	4.0	4.5	3.5	1.8	1.9	2.4	2.5	3.7	–1.5	–1.9	1.4
3	–0.8	6.0	5.7	3.0	1.9	1.6	2.4	4.7	6.0	3.8	–6.7	–1.5	2.8
4	1.1	5.3	5.0	3.9	2.9	1.5	1.7	3.1	4.3	3.8	–3.6	–2.5	1.5
5	0.4	5.9	4.6	3.6	2.7	2.0	2.3	3.8	4.4	3.4	–4.6	–1.1	2.3
6	2.6	5.4	3.5	4.4	3.4	1.9	1.8	2.2	2.2	3.4	–1.8	–1.6	1.4
7	–0.6	5.9	5.2	3.2	2.2	2.0	2.5	4.4	5.2	3.7	–5.8	–1.0	2.8
8	–0.7	5.7	5.2	3.2	2.2	2.0	2.4	4.4	5.1	3.8	–5.8	–1.0	2.9
9	0.0	5.5	4.9	3.4	2.3	1.8	2.1	3.9	4.6	3.7	–4.9	–1.3	2.5
10	1.9	4.8	3.4	3.0	2.1	1.0	1.5	1.8	1.8	3.5	–3.5	–2.1	1.5
11	1.4	5.2	4.0	3.9	3.1	1.8	1.6	2.7	3.3	3.2	–2.9	–1.8	1.5
12	2.0	5.3	3.8	4.3	3.4	1.9	1.8	2.6	2.9	2.9	–2.3	–1.7	1.3
Total	0.9	5.5	4.4	3.8	2.9	1.9	2.0	3.3	3.8	3.3	–3.8	–1.4	2.0

1=single person, no children, under 65, 2=one old person without children, 3=single person with 1 child, 4=single parent with more than 2 children, 5=young couple without children, 6=couple without children and with at least one spouse more than 65, 7=couple with one child, 8=couple with 2 children, 9=couple with 3 or more children, 10=family without children including person over 64, 11=family where more children than 1 and number of adults more than 3, 12=other

(26.8). This meant that household groups with the highest food shares did not have the biggest increases in the cost of living. In this year, the greatest increase in the cost of living was experienced by single adults with children (group 3) and therefore reversing the trend of the previous year. Households including old people only experienced the highest increase in the cost of living in 2002 compared to other household groups. This was due to the large increase in healthcare costs of 10 per cent. The same adverse trend for older people continued in 2003 as such households continued to lose from high healthcare spending while not benefitting directly from cost reductions in clothing, rents and mortgage interest to the same extent as other household groups.

The differential change in the cost of living between households appears just as strong in the case of households at different points of the income distribution as between households with different demographic characteristics.

Taking the 2004/2005 Household Budget Survey as a base, one can see that from 2006 to 2011, the gap in the cost of living change in each year was 0.9 per cent or greater between the top and bottom decile. This difference is

[12] CSO 1999/2000 Household Budget Survey anonymised microdata files.

Table 5: *Welfare Loss of Consumer Price Changes Including Mortgage Interest Repayments 1999-2011 by Decile of Equivalised Total Expenditure*

	1999/2000 Household Budget Survey												
	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Poorest	2.1	4.9	4.6	4.0	3.0	1.5	1.7	2.5	3.4	4.9	–2.4	–2.2	1.7
2	2.0	5.1	4.4	4.0	3.0	1.6	1.7	2.6	3.4	4.4	–2.6	–2.0	1.7
3	1.6	5.3	4.4	3.9	2.9	1.7	1.8	2.8	3.6	4.1	–3.0	–1.8	1.8
4	1.4	5.5	4.4	3.9	2.9	1.8	1.9	3.1	3.8	4.0	–3.3	–1.6	1.9
5	1.4	5.5	4.3	3.9	3.0	1.8	2.0	3.1	3.7	3.8	–3.3	–1.5	1.9
6	1.2	5.7	4.4	3.9	3.0	1.9	2.1	3.3	3.9	3.6	–3.6	–1.4	2.0
7	0.9	5.8	4.5	3.9	2.9	2.0	2.2	3.5	4.0	3.6	–3.8	–1.3	2.1
8	0.6	5.9	4.6	3.8	2.8	2.1	2.3	3.8	4.3	3.5	–4.4	–1.1	2.3
9	0.6	6.0	4.6	3.8	2.9	2.2	2.4	3.9	4.3	3.4	–4.4	–1.1	2.3
Richest	0.5	6.2	4.7	3.8	2.8	2.1	2.4	4.0	4.4	3.3	–4.8	–1.1	2.3
Total	0.9	5.8	4.5	3.9	2.9	2.0	2.2	3.5	4.1	3.6	–4.0	–1.3	2.1
	2004/2005 Household Budget Survey												
	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Poorest	2.3	5.4	4.2	4.2	3.4	1.9	2.3	2.6	3.3	4.6	–2.4	–1.7	1.8
2	2.0	5.4	4.1	4.2	3.3	1.9	2.2	2.6	3.3	4.1	–2.6	–1.6	1.8
3	1.7	5.6	4.2	4.1	3.2	1.9	2.2	2.9	3.6	3.9	–3.0	–1.5	1.9
4	1.4	5.6	4.3	4.0	3.1	2.0	2.2	3.1	3.7	3.7	–3.3	–1.4	2.0
5	1.3	5.7	4.3	4.0	3.1	2.1	2.3	3.2	3.8	3.6	–3.4	–1.3	2.0
6	0.8	5.8	4.4	3.9	3.0	2.1	2.4	3.6	4.1	3.6	–3.9	–1.1	2.3
7	0.7	5.8	4.5	3.9	2.9	2.1	2.4	3.7	4.2	3.5	–4.1	–1.1	2.3
8	0.5	6.0	4.5	3.8	2.9	2.2	2.5	3.8	4.4	3.5	–4.4	–1.0	2.3
9	0.6	6.2	4.6	3.9	3.0	2.3	2.6	4.0	4.5	3.5	–4.5	–0.9	2.4
Richest	–0.3	6.3	5.0	3.7	2.6	2.4	2.7	4.6	5.1	3.5	–5.6	–0.7	2.7
Total	0.7	5.9	4.5	3.9	2.9	2.2	2.5	3.7	4.3	3.6	–4.2	–1.1	2.3

over 1.5 per cent in 2006, 2007 and 2009. In 2006, there was a 2 per cent gap between the top and bottom decile largely driven by mortgage interest repayments. A similar trend occurred in 2007. The large increase in food prices in 2008 manifested itself in higher increases for those in the bottom two deciles. In 2009, the gap between those at the bottom and the top was 3.2 per cent using the 2004/2005 Household Budget Survey as a base. The cost of living for households at the bottom of the distribution declined by around 2.5 per cent and by above 4.5 per cent at the top of the distribution. The 2010 results show that households in the bottom of the distribution experienced declines in the cost of living to a greater extent than households at the top of the distribution. This is driven by declining food prices and home heating costs.

The 2011 results show that households in the bottom of the distribution experienced lower increases in the cost of living relative to households at the

top of the distribution. This is largely due to the 20.4 per cent increase in mortgage interest costs during the year and despite the 6.6 per cent increase in electricity and natural gas prices and the 24.2 per cent increase in the price of liquid fuels. Table 2 shows that expenditures for these three items are concentrated more among lower income households relative to other expenditures.

Taking the 1999/2000 Household Budget Survey data as a base, one can see that price changes in 1999 caused a 0.5 per cent increase in the cost of living while the bottom decile experienced an increase of 2.1 per cent in the cost of living. This was partially reversed the following year as households higher in the distribution experienced higher increases. Murphy and Garvey (2004) identified larger cost of living changes for poor urban households between 1996 and 2001. There is some overlap with that study. We find that price changes increased inequality in 1999 but not 2000 and 2001 and that the 1999 inequality increase could dominate the inequality reducing effect in 2000 and 2001.

5.2 *Decomposing Welfare Changes*

The results from Table 6 show that the percentage change in the equally distributed level of equivalent income (y_{ede}) is similar to the percentage change in the cost of living for each year shown in Table 5. This suggests that the changes in the Atkinson Index of Inequality, attributable to price changes, do not have a large effect on the size of the overall welfare measure. The results are sensitive in some cases, however, to the size of the inequality aversion parameter. For instance, the decline in y_{ede} is 0.3 per cent greater in 1999 using the inequality aversion parameter of 0.8 than in the case of the parameter value of 0.3. The increase in y_{ede} is 0.3 per cent greater in 2009 using the higher inequality aversion parameter of 0.8 than in the case of the parameter value of 0.3. Table 5 shows that changes in the cost of living were particularly different between income deciles in those two years relative to the percentage change for the average household.

The original y_{ede} under the parameter value of 0.3 is €706.67. This means that the average total household expenditure accounting for inequality aversion (E=0.3) is €706.67. The absence of inequality aversion and price changes would mean that y_{ede} simply equates to the average total household expenditure of €792. The original y_{ede} under the parameter value of 0.8 is €614.67. The lower in that case is due to the higher value of the Atkinson Index of Inequality under the higher inequality aversion parameter value.

The results from Table 7 show that the private welfare changes attributable to consumer prices far outweigh the inequality component in terms of their impact upon overall welfare. The extent of this result depends

Table 6: *Change in The Level of Equally Distributed Equivalent Income (Y_{ede}) using Alternative Values of Inequality Aversion (E)*

	Inequality Aversion Parameter Value E=0.3			*Inequality Aversion Parameter Value E=0.8*		
	Original Y_{ede}	*Y_{ede} Post Price Changes*	*Percentage Change in Y_{ede}*	*Original Y_{ede}*	*Y_{ede} Post Price Changes*	*Percentage Change in Y_{ede}*
1999	706.67	700.23	–0.9	614.67	607.52	–1.2
2000	706.67	664.78	–5.9	614.67	578.43	–5.9
2001	706.67	674.42	–4.6	614.67	586.72	–4.5
2002	706.67	678.71	–4.0	614.67	590.03	–4.0
2003	706.67	685.31	–3.0	614.67	595.65	–3.1
2004	706.67	691.43	–2.2	614.67	601.63	–2.1
2005	706.67	689.20	–2.5	614.67	599.54	–2.5
2006	706.67	680.79	–3.7	614.67	593.04	–3.5
2007	706.67	676.73	–4.2	614.67	589.33	–4.1
2008	706.67	680.85	–3.7	614.67	591.44	–3.8
2009	706.67	734.97	4.0	614.67	637.51	3.7
2010	706.67	714.63	1.1	614.67	622.13	1.2
2011	706.67	690.92	–2.2	614.67	601.35	–2.2

Table 7: *Contribution of Private Welfare Change and Inequality Change to Overall Welfare (W) using Alternative Values of Inequality Aversion (E)*

	Inequality Aversion Parameter Value E=0.3			*Inequality Aversion Parameter Value E=0.8*		
	Percentage Change in Welfare	*Percentage Due to Private Welfare Change*	*Percentage Due to Inequality*	*Percentage Change in Welfare*	*Percentage Due to Private Welfare Change*	*Percentage Due to Inequality*
1999	–0.6	87.7	12.3	–0.2	68.6	31.4
2000	–4.2	100.3	–0.3	–1.2	100.8	–0.8
2001	–3.2	100.1	–0.1	–0.9	100.5	–0.5
2002	–2.8	99.6	0.4	–0.8	98.2	1.8
2003	–2.1	99.0	1.0	–0.6	96.7	3.3
2004	–1.5	100.9	–0.9	–0.4	102.6	–2.6
2005	–1.7	100.2	–0.2	–0.5	100.6	–0.6
2006	–2.6	101.7	–1.7	–0.7	105.9	–5.9
2007	–3.0	100.9	–0.9	–0.8	103.8	–3.8
2008	–2.6	98.3	1.7	–0.8	95.0	5.0
2009	2.8	103.3	–3.3	0.7	111.2	–11.2
2010	0.8	96.7	3.3	0.2	89.7	10.3
2011	–1.6	100.8	–0.8	–0.4	103.7	–3.7

to some extent on the value of the inequality aversion parameter and heavily upon the choice of social welfare function. The absolute values of the welfare measure (pre and post price change) are provided in Loughrey and O'Donoghue (2011). In this particular social welfare function, an inequality aversion parameter of 0.3 gives greater weight to the private household changes than to the inequality component in each year. The value of 0.3 is close to that found by Amiel *et al.* (1999) which used various forms of the leaky bucket experiment. Madden (1995) found an estimated value of 0.36 for Ireland based upon the indirect tax system of 1980. The use of the higher inequality aversion parameter of 0.8 gives greater weight to the private household changes than to the inequality component but to a lesser extent.

The added value of the welfare measure over y_{ede} is that the welfare measure calculates utility using the social welfare function rather than simple money amounts. The welfare measure accelerates in response to the rate of change in the cost of living. As the rate of change in the cost of living increases, it has an accelerating affect on the welfare measure. This makes theoretical sense. As the increase in the cost of living becomes greater, the value that is placed upon each additional unit of lost consumption increases. That is because the last unit of consumption lost will tend to have a greater value than the first unit lost i.e., diminishing marginal utility and the ranking of goods. This means that the percentage changes in overall welfare are always lower than the percentage changes in the cost of living index shown in Tables 3, 4 and 5.

The higher the value of the inequality aversion parameter, the lower the percentage changes in welfare attributable to price changes. This is due to the faster rate of diminishing marginal utility that is implied by the higher inequality aversion parameter. The results in Table 7 show that the welfare changes are much lower under the inequality aversion parameter value of 0.8 than with a parameter value of 0.3. In some cases the private household welfare change and the inequality change work in opposite directions. The private welfare change component can therefore exceed 100 per cent.

VI CONCLUSION

This paper examines the welfare effects attributable to price changes for different household types and income levels in Ireland from 1999 to 2011. The role of behavioural response to price changes is included in the estimation of the welfare effects. The results show large differences in the welfare effects according to household type and income level. There does not appear to be a systematic relationship over time in terms of the relationship between the

position of the household in the income distribution and the cost of living change. An overall welfare measure including both efficiency and equity components is calculated and the decomposition results show that the efficiency component dominates the inequality component in all years. This result is heavily dependent upon the choice of social welfare function.

The behavioural response effect forms part of the efficiency component. Table A2 shows that the average substitution bias is 0.33 using the LES demand system and 0.12 using the LES demand system with an objective measure of subsistence. This means that the behavioural response component has been roughly between 2 and 11 per cent of the private household welfare change attributable to price changes given that the cost of living changed by about 3 per cent per annum. The size of the behavioural response component appears to rival the size of the inequality component and the level of inequality aversion in society could have a role in determining which component is greater in a particular time period. Again this result is heavily dependent upon the choice of social welfare function.

The large variation in cost of living changes between household types and income levels could be better reflected in the reporting of price indices by the CSO. The mortgage interest repayment item needs to be disaggregated between fixed, standard variable and tracker mortgages so that the welfare effects of variability in mortgage interest rates can be better captured. In addition, the availability of more frequently updated anonymised HBS data could improve the accuracy of the budget share calculations. The 2011 CPI is calculated based on December 2006 budget share weights and household consumption patterns are likely to have shifted in the interim. The results show that behavioural response to price changes has the capacity to reduce the welfare costs of increases in the overall price level and conversely increase the benefits of declines in the overall price level. We find that the size of the behavioural response component is greater than the findings of Sommerville (2004) albeit using a different demand system and time period.

This paper provides a partial equilibrium analysis as opposed to a macro-wide general equilibrium analysis. The specific contributions of monetary policy, fiscal policy and productivity towards the overall price level are therefore excluded. An important cautionary note therefore is that all declines in the overall price level should not be interpreted as a healthy sign for the macro-economy. The co-existence of contractionary monetary and fiscal policies in a deep recession tends to reduce both the price level and real output as price rigidities and debt deflation begin to emerge. However, Ireland has the third highest cost of living in the Euro Area (Eurostat, 2011). Reducing the cost of living to the Euro Area average will require that increases in the overall price level fall below the Euro Area average for the next five to ten years. The

distributional effect of reaching the Euro Area average cannot be calculated ex-post given that unforeseeable events and general equilibrium dynamics must be considered.

The prioritisation of the price level issue in the near future is subject to the monetary costs or benefits that can accrue to households as well as private firms and investors. This paper goes some way towards improving the understanding of the cost of living issue so that households can assess more closely the importance of consumer prices and mortgage interest costs to their own welfare.

BIBLIOGRAPHY

AMIEL, Y., J. CREEDY and S. HURN, 1999. "Measuring Attitudes Towards Inequality", *Scandinavian Journal of Economics*, Vol. 101, No. 1, pp. 83-96, Blackwell Publishing,

ATKINSON A. B., 1970. "On the Measurement of Inequality", *Journal of Economic Theory*, Vol. 2, pp. 244-263.

BARGAIN O., O. DONNI and M. GBAKOU, 2010. "The Measurement of Child Costs: Evidence from Ireland", *The Economic and Social Review*, Vol. 41, No. 1, pp. 1-20.

BARNETT, W. A. and O. SECK, 2008. "Rotterdam Model Versus Almost Ideal Demand System: Will the Best Specification Please Stand Up?" *Journal of Applied Econometrics*, Vol. 23, No. 6, pp. 795-824, John Wiley and Sons, Ltd.

BLINDER, A., 1978. "On Making the Tradeoff between Equality and Efficiency Operational", Paper presented at the Meetings of the Allied Social Science Associations, Chicago, IL.

CRAWFORD, I. and Z. SMITH, 2002. "Distributional Aspects of Inflation", The Institute for Fiscal Studies.

CREEDY, J. 1998. "The Welfare Effect on Different Income Groups of Indirect Tax Changes and Inflation in New Zealand", University of Melbourne, *The Economic Record*, Vol. 74, No. 227, pp. 373-383.

CREEDY, J., 2001. "Indirect Tax Reform and the Role of Exemptions", *Fiscal Studies*, Vol. 22, No. 4, pp. 457-486.

CREEDY, J, and R. DIXON, 1998. "The Relative Burden of Monopoly on Households with Different Incomes", *Economica*, Vol. 65, No. 258, pp. 285-293.

CREEDY, J. and J. VAN DE VEN, 1996. "The Distributional Effects of Inflation in Australia", Research Paper 537, The University of Melbourne.

DEATON, A., 1974. "A Reconstruction of the Empirical Implications of Additive Preferences", *Economic Journal*, Vol. 84, pp. 338-348.

DEATON, A. S. and J. MUELLBAUER, 1980. "An Almost Ideal Demand System", *American Economic Review*, Vol. 70, pp. 312-326.

EUROSTAT, 2011. "Comparative Price Levels of Final Consumption by Private Households Including Indirect Taxes", Eurostat Available from http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tsier010 [Accessed 7 September 2011]

FRISCH, R., 1959. "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors", *Econometrica*, Vol. 27, No. 2., pp. 177-196.

HOBIJN, B. and D. LAGAKOS, 2005. "Inflation Inequality in the United States", *Review of Income and Wealth*.

IRVINE, I. and C. McCARTHY, 1978. "Expenditure Patterns and the Welfare Effects of Inflation: Estimates of a 'True' Cost-of-Living Index", *The Economic and Social Review*, Vol. 9, No. 2, January, pp. 157-165.

KING, M., 1983. "Welfare Analysis of Tax Reforms Using Household Data", *Journal of Public Economics*, Vol. 21., pp. 183-214.

LAHIRI, S., M. BABIKER and R. S. ECKAUS, 2000. *The Effects of Changing Consumption Patterns on the Costs of Emission Restrictions.* MIT Joint Program on the Science and Policy of Global Change, Report 64, Cambridge, Massachusetts.

LIBERATI, P., 2001. "The Distributional Effect of Indirect Tax Changes in Italy", *International Tax and Public Finance*, Vol. 8, pp. 27-51.

LOUGHREY, J. and C. O'DONOGHUE, 2011. "The Welfare Impact of Price Changes on Household Welfare and Inequality 1999-2010", IZA Discussion Papers 5717, Institute for the Study of Labor (IZA).

LLUCH, C., A. POWELL and R. WILLIAMS, 1977. *Patterns in Household Demand and Saving*, Oxford: Oxford University Press for the World Bank.

MADDEN, D., 1995. "An Analysis of Indirect Tax Reform in Ireland in the 1980s", *Fiscal Studies*, Vol. 16, No. 1, pp. 18-37.

MADDEN, D., 2009. "Distributional Characteristics for Ireland: A Note", UCD Working Paper Series, WP09/10.

MURPHY E. and E. GARVEY, 2004. "A Consumer Price Index for Low-income Kouseholds in Ireland (1989-2001)", Combat Poverty Agency, Working Paper 04/03.

MURPHY, E. and E. GARVEY, 2008. "The Inadequacy of Cost of Living Indices Based on Subjective Preferences: An Ethical and Methodological Critique", *International Review of Applied Economics*, Vol. 22, No. 6, pp. 745-754.

NEWBERY, D., 1995. "The Distributional Impact of Price Changes in Hungary and the United Kingdom", *The Economic Journal*, Vol. 105, No. 431, pp. 847-863.

POWELL, A., 1974. "Empirical Analysis of Demand Systems", Lexington: Lexington Books.

ROBERTS, K., 1980. "Price-Independent Welfare Prescriptions", *Journal of Public Economics*, Vol. 13, pp. 277-297.

SOMERVILLE, R. A., 2004. "Changes in Relative Consumer Welfare and the Substitution Bias of the Laspeyres Price Index: Ireland, 1985-2001", *The Economic and Social Review,* Vol. 35, No. 1, pp. 55-82.

STONE, J. R. N., 1954. "Linear Expenditure System and Demand Analysis, An Application to Pattern of British Demand", *Econometrica*, Vol. 64, pp. 511-527.

THEIL, H., 1976. *Theory and Measurement of Consumer Demand,* Vol. 2, North Holland.

WHELAN, C. T. and B. MAITRE, 2010. "Protecting the Vulnerable: Poverty and Social Exclusion in Ireland as the Economic Crisis Emerged", *The Economic and Social Review*, Vol 41, No 4, pp. 501-525.

APPENDIX I
CRITERIA FOR TWELVE DEMOGRAPHIC GROUPS

Group 1 – There is only one person in the household and none of the individuals are aged 65 or over. The vast majority (approx. 85 per cent) of these individuals are never-married, widowed or divorced. There are some cases of individuals that are married but not residing with their spouse on a permanent basis (approx. 15 per cent).

Group 2 – There is only one person in the household and none of these individuals are 65 or over. The majority of people in this group are widows or widowers (approx. 65 per cent). The remainder include single people that have never married (approx. 30 per cent) and a small minority that are divorced or married but not residing with their spouse on a permanent basis.

Group 3 – There is only one adult and one child in the household. The vast majority of the adults in this household have never married (approx. 90 per cent). A small minority of the adults are divorce, widowed or married but not residing with their spouse on a permanent basis.

Group 4 – There is only one adult and there are at least two children in the household. Approximately half of these households are headed by adults that have never married and approximately 40 per cent are headed by married people living not residing with their spouse on a permanent basis. About one in ten are headed somebody that is divorced or widowed.

Group 5 – These households include married couples living together on a permanent basis with no children in the household. Therefore all of these households have two adults residing in them.

Group 6 – These households include couples living together on a permanent basis with no children in the household. At least one of the adults is aged 65 or over. All of these households have two adults residing in them.

Group 7 – These households include couples living together on a permanent basis with one child in the household.

Group 8 – These households include couples living together on a permanent basis with two children in the household.

Group 9 – These households include couples living together on a permanent basis with three children or more in the household.

Group 10 – All individuals in these households are aged 65 or older. There are more than two people living in these households. The vast majority are headed by people in a married relationship aged 65 and over (approx. 80 per cent) and the remainder are mainly either widowed or never married.

Group 11 – These are households with more than three people and at least one of the household members is a child. The vast majority are headed by people in a married relationship living together on a permanent basis (approx. 90 per cent) and the remainder are single, widowed, divorced or never married.

Group 12 – Any household that does not qualify under the criteria for the first eleven household groups enters this category. About 22 per cent of all households in the survey fall into this category. This large percentage is due to a number of factors. Approximately half of these households are headed by unmarried adults living together but not considered to be spouses to one another. Approximately half of the households in this category are headed by people in married relationships living together on a permanent basis. All of these households have a minimum of three adults in the household and none of these households includes more than one child.

APPENDIX II
DATA

Table A1: *Independent Variables for Budget Share Regressions*

Consumption and Employment Variables	*Age and Education Variables*	*Household Size Variables*	*Household Tenure Variables*
Log of Total Consumption	Co_age1 (Age-40)/10	Number of children aged 0-5 years old	Mortgage Holder
Log of Total Consumption Squared	Co_age2 (Co_age1 Squared)	Number of children aged 5-13 years old	Outright Owner
Smoker	Co_age3 (Co_age2 Squared)	Number of children aged 14-20 years old	Tenant Purchaser
Car owner	Upper Secondary Education	Number of people over 65 years old	Local Authority Tennant
Employee	University Education	Number of Adults aged 21 and over	Private Tenant
Self-Employed	Married	Number of Bedrooms	Rent Free
Other Employment	Gender of Household Head		New Resident – Less than ten years resident in the household (0,1)
Number of Earners	Pension		

APPENDIX III
SUBSTITUTION BIAS IN THE LASPEYRES PRICE INDEX

Table A2: *The Measured Substitution Bias in the Consumer Price Index, 1999-2011*

Year	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
Cumulative Bias 1998 Price Index Base using LES Demand System	0.12	0.21	0.38	0.59	0.94	1.14	1.47	1.75	2.45	3.18	3.10	3.57	3.97
Cumulative Bias 1998 Price Index Base using LES Demand System but under Objective Subsistence Measure	0.05	0.05	0.18	0.31	0.48	0.52	0.56	0.61	0.74	0.89	1.33	1.41	1.53
Average Bias 1998 Price Index Base using LES Demand System	0.12	0.11	0.13	0.15	0.19	0.19	0.21	0.22	0.27	0.32	0.28	0.30	0.33
Average Bias 1998 Price Index Base using LES Demand System but under Objective Subsistence Measure	0.05	0.03	0.06	0.08	0.10	0.09	0.08	0.08	0.08	0.09	0.12	0.12	0.12
Average Bias 2006 Price Index Base using LES Demand System	–	–	–	–	–	–	–	–	0.42	0.39	0.13	0.14	0.17
Average Bias 2006 Price Index Base using LES Demand System but under Objective Subsistence Measure	–	–	–	–	–	–	–	–	0.07	0.06	0.11	0.09	0.09

Table A3: *Percentage Change in the Price of Twenty-one Commodity Groups 1999-2011*

Commodity Group	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*Total*
Food and Non-Alcoholic Beverages	3.1	3.1	6.5	3.5	1.4	–0.3	–0.7	1.4	2.9	6.5	–3.4	–4.5	1.1	21.6
Alcoholic Beverages, Tobacco	4.0	11.5	2.5	5.6	9.8	3.5	0.6	1.1	5.4	4.7	6.3	–2.6	–0.1	65.8
Clothing and Footwear	–6.3	–4.9	–2.8	–4.3	–4.0	–3.5	–2.8	–2.0	–3.2	–4.9	–11.8	–9.4	–1.8	–47.1
Furnishings, Household Equipment and Routine Maintenance of the House	2.4	4.5	3.5	1.7	–0.7	–1.8	–1.4	–1.3	–1.8	–1.5	–3.2	–4.1	–2.3	–6.1
Health	5.7	7.1	7.5	10.0	7.7	6.0	6.2	4.4	3.0	5.9	3.6	0.6	3.4	99.0
Transport	2.3	8.0	–1.6	3.0	3.3	4.1	3.5	3.4	2.1	3.4	–3.9	3.1	3.4	39.3
Communication	–7.4	–3.0	–8.3	2.1	1.5	2.7	–0.2	–0.5	0.5	1.0	0.5	1.4	2.3	–7.8
Recreation and Culture	2.9	3.7	4.9	6.3	4.1	1.2	0.0	1.3	1.5	1.3	–0.4	–1.8	–0.8	26.9
Education	10.3	10.6	7.2	10.3	9.1	5.8	6.0	4.9	5.1	6.1	6.4	6.4	0.7	134.9
Restaurants and Hotels	4.1	5.5	6.0	7.4	6.3	4.0	3.3	3.9	4.2	3.1	0.0	–2.6	–0.7	54.0
Miscellaneous Goods and Services	5.6	7.6	9.3	9.7	4.7	–0.6	–0.1	1.6	1.0	2.3	7.6	1.1	6.5	72.5
Local Authority Rents	7.4	12.2	13.7	19.2	15.1	7.9	7.7	8.0	9.0	19.6	5.4	–2.1	–2.9	208.4
Private Rents	5.9	10.4	14.6	2.8	–3.4	–4.2	0.7	5.3	11.0	2.7	–17.4	–6.0	0.7	20.5
Mortgage Interest	–27.6	12.3	24.8	–7.7	–8.1	5.4	12.3	31.5	40.3	15.0	–40	6.4	20.4	65.9
Materials for Maintenance and repair of dwelling	2.8	3.7	4.0	2.3	1.5	0.8	3.1	3.0	3.4	1.2	–1.2	–2.1	0.6	27.3
Service for Maintenance and repair of dwelling	2.8	3.7	4.0	6.9	6.7	5.1	2.8	4.3	5.1	3.6	–1.6	–4.5	–6.5	36.4
Refuse Collection	30.8	25.5	26.8	19.2	22.4	19.6	30.2	6.8	4.5	0.6	0.0	–2.8	–4.4	393.4
Electricity	0.0	0.0	0.3	8.8	10.8	7.1	13.2	4.2	11.6	2.4	1.3	–3.5	6.6	81.8
Natural Gas	0.0	0.0	0.0	0.0	5.7	5.0	16.8	27.9	9.6	–1.0	1.8	–13.5	6.6	68.9
Liquid fuels	6.5	48.8	–1.5	–8.4	3.5	11.9	27.7	10.4	–1.4	27.2	–32.4	31.5	24.2	223.3
Solid fuels	2.7	5.4	8.1	4.1	2.9	3.6	7.6	7.6	8.7	9.2	7.6	–2.5	0.6	88.2
CPI	*1.60*	*5.60*	*4.90*	*4.60*	*3.50*	*2.20*	*2.50*	*4.00*	*4.90*	*4.10*	*–4.5*	*–1.0*	*2.5*	*40.5*

Table A4a: *OLS Regression Outputs from 2004 Household Budget Survey Data*[13]

	Food	*Alcohol and Tobacco*	*Clothing*	*Furniture and Household Maintenance*	*Health*	*Transport*	*Communica-tions*	*Leisure*	*Education*	*Restaurant*	*Other*
lc_grp1	–0.106***	0.00322	0.0230***	0.0239***	0.0162***	0.0394***	–0.0169***	0.00885***	0.00439***	0.0355***	0.0109***
lc_grp2	–0.105***	0.000890	0.0246***	0.0241***	0.0165***	0.0412***	–0.0175***	0.00930***	0.00439***	0.0348***	0.0126***
lc_grp3	–0.101***	0.000726	0.0237***	0.0237***	0.0157***	0.0389***	–0.0170***	0.0103***	0.00610***	0.0270***	0.0103***
lc_grp4	–0.0982***	0.00105	0.0238***	0.0231***	0.0163***	0.0375***	–0.0162***	0.0116***	0.00574***	0.0278***	0.0134***
lc_grp5	–0.0975***	0.00249	0.0224***	0.0242***	0.0164***	0.0388***	–0.0171***	0.00988***	0.00405***	0.0302***	0.0122***
lc_grp6	–0.0992***	0.000756	0.0229***	0.0239***	0.0170***	0.0383***	–0.0156***	0.0113***	0.00478***	0.0303***	0.0119***
lc_grp7	–0.0969***	0.00128	0.0232***	0.0245***	0.0164***	0.0391***	–0.0165***	0.0101***	0.00515***	0.0278***	0.0120***
lc_grp8	–0.0965***	0.00158	0.0233***	0.0231***	0.0163***	0.0372***	–0.0166***	0.0126***	0.00536***	0.0284***	0.0125***
lc_grp9	–0.0976***	0.00132	0.0227***	0.0219***	0.0164***	0.0375***	–0.0162***	0.0131***	0.00613***	0.0295***	0.0130***
lc_grp10	–0.0906***	0.00873	0.0225***	0.0224***	0.0108***	0.0376***	–0.0169***	0.0112**	0.00683***	0.0279***	0.00545*
lc_grp11	–0.100***	0.000781	0.0229***	0.0232***	0.0156***	0.0384***	–0.0154***	0.0112***	0.00638***	0.0324***	0.0119***
lc_grp12	–0.0990***	0.000632	0.0230***	0.0228***	0.0156***	0.0399***	–0.0160***	0.0103***	0.00553***	0.0339***	0.0109***
co_smoker	–0.0117***	0.107***	–0.0111***	–0.0107***	–0.00724***	–0.0157***	–0.00207**	–0.0133***	–0.00503***	0.00297	–0.0156***
co_car	–0.0195***	–0.0233***	–0.0117***	–0.0121***	0.00369	0.121***	0.00230	–0.0115***	–0.00245*	–0.0162***	0.000921
co_marr	–0.00141	0.00507	0.00156	–0.00158	–0.000400	–0.00459	0.00352*	–0.00331	0.00111	–0.00337	0.00227
Sexhoh	0.00499**	–0.00873***	0.0119***	0.00444**	0.00137	–0.00518	0.00434***	0.00389*	–0.000478	–0.0243***	0.0104***
Employee	0.00589	–0.0127*	0.00803**	–0.00485	–0.00143	–0.00426	0.00232	0.00142	0.00287	0.000352	0.00855**
Selfempl	0.0148***	–0.0181**	0.00536	–0.00839	–0.00479	0.00229	0.00653**	0.00241	0.00221	–0.00597	0.0110***
Pension	–0.00887	–0.00866	–0.00466	–0.00832	0.00106	0.00275	0.00593**	0.0125**	–0.00432	0.0228**	0.00759
oth_emp	0.00774	–0.00615	0.00368	–0.00519	–0.00261	–0.00372	0.00411	–0.00118	–0.0000849	0.00604	–0.00261
co_age1	6.382	–4.469	–10.74	9.278	–15.01**	10.04	–0.610	–15.12**	–15.55***	6.337	–2.206
co_age2	1.882	–1.246	–3.061	2.703	–4.268**	2.899	–0.0660	–4.257**	–4.531***	1.579	–0.535
co_age3	0.186	–0.115	–0.291	0.263	–0.403**	0.278	0.00331	–0.399**	–0.439***	0.125	–0.0401
Coupsec	–0.0111***	–0.00175	–0.000363	–0.000575	0.00711***	–0.0113***	0.000973	0.00595***	–0.000348	–0.00385	0.0139***
Couniv	–0.0122***	–0.00325	–0.00438**	0.00103	0.00629***	–0.0182***	–0.000645	0.00579***	0.00721***	–0.0133***	0.0212***

[13] Table A1 provides the list of explanatory variables –* p<0.10, ** p<0.05, *** p<0.01.

Table A4a: *OLS Regression Outputs from 2004 Household Budget Survey Data*[13] *(contd.)*

	Food	*Alcohol and Tobacco*	*Clothing*	*Furniture and Household Maintenance*	*Health*	*Transport*	*Communica-tions*	*Leisure*	*Education*	*Restaurant*	*Other*
nch05	0.0164***	0.00113	0.00809***	0.00119	0.00402***	–0.0000658	–0.00528***	–0.00892***	–0.00929***	–0.0118***	0.00105
nch513	0.0196***	0.000703	0.00224	–0.00180	–0.00344***	–0.000179	–0.00183**	0.00176	–0.00260**	–0.00776***	–0.000812
nch1420	0.0236***	–0.00437***	0.00440***	–0.00687***	–0.00244**	–0.0126***	0.00644***	0.0000787	0.00859***	–0.00420*	–0.00319**
co_npers65	0.0329***	0.000738	0.00523*	–0.00236	0.00252	–0.00566	–0.00358*	–0.00767**	–0.00614***	–0.00744	–0.00619**
co_nadult	0.0269***	–0.00517**	0.000859	–0.00937***	–0.00190	–0.00638*	0.00431***	–0.00332*	0.00538***	–0.00419	–0.00540***
co_nearn	–0.00803***	0.000590	–0.00303**	–0.00245*	–0.00118	0.00427	0.00205*	0.000546	–0.00780***	0.0178***	0.00249*
No bedrooms	0.000986	–0.00403***	–0.00177**	0.00214*	0.000114	–0.000687	0.000391	–0.00263***	0.00165***	–0.00532***	0.00280***
New Resident	–0.00521**	–0.00410*	–0.00538***	0.0000468	–0.00371**	–0.00185	0.000373	0.000341	–0.000835	–0.0133***	–0.0101***
Outright Owner	0.0262**	–0.0124	–0.00471	0.00667	0.00758*	–0.0429**	–0.00865	–0.0140	–0.00611	–0.0264*	–0.0165
Mortgage Holder	0.0158	–0.0145	–0.0122	0.000645	0.00327	–0.0758***	–0.0101	–0.0229**	–0.00611	–0.0391**	–0.0229*
Tenant Purchase	0.0280	–0.0136	0.0175	0.00279	0.0105	–0.0567**	–0.00656	–0.0356***	–0.00979	–0.0243	–0.0293*
Local Authority Rent	0.0116	0.0167	–0.00466	0.00201	–0.000376	–0.0536***	–0.00941	–0.0162	–0.0105*	–0.0367**	–0.0307**
Private –0.00524 Tenant		–0.00998	–0.0150	–0.0313***	0.00387	–0.0562***	–0.00555	–0.0289***	–0.00421	–0.0514***	–0.0321**
_cons	8.018	–5.207	–12.63	10.56	–17.59**	11.43	–1.045	–17.82**	–17.77***	8.170	–2.877
R-sq	0.525	0.368	0.067	0.063	0.060	0.211	0.095	0.044	0.123	0.141	0.137
adj. R-sq	0.522	0.364	0.061	0.058	0.054	0.207	0.090	0.039	0.118	0.136	0.132

[13] Table A1 provides the list of explanatory variables –* p<0.10, ** p<0.05, *** p<0.01

Table A4b: *OLS Regression Outputs from 2004 Household Budget Survey Data*

	Local Authority Rents	*Private Rents*	*Mortgage Interest*	*Materials for Maintenance and Repair of Dwelling*	*Service for Maintenance and Repair of Dwelling*	*Refuse Collection*	*Electricity*	*Natural Gas*	*Liquid Fuels*	*Solid Fuels*
lc_grp1	–0.00427***	–0.00304***	0.000712	0.00619***	0.00385*	–0.00375***	–0.0177***	–0.000914*	–0.0129***	–0.0113***
lc_grp2	–0.00406***	–0.00453***	–0.00261	0.00596***	0.00522**	–0.00392***	–0.0185***	–0.000769	–0.0119***	–0.0109***
lc_grp3	–0.00367***	0.00447**	–0.00312	0.00555***	0.00334	–0.00369***	–0.0166***	–0.000635	–0.0130***	–0.0112***
lc_grp4	–0.00492***	–0.000769	–0.00544***	0.00562***	0.00355	–0.00359***	–0.0173***	–0.000285	–0.0131***	–0.00997***
lc_grp5	–0.00424***	–0.00432***	–0.00224	0.00555***	0.00346	–0.00379***	–0.0174***	–0.000887*	–0.0122***	–0.0104***
lc_grp6	–0.00388***	–0.00477***	–0.00350**	0.00569***	0.00361*	–0.00370***	–0.0171***	–0.000653	–0.0120***	–0.0103***
lc_grp7	–0.00390***	–0.00413***	–0.00361**	0.00566***	0.00383*	–0.00374***	–0.0173***	–0.000877*	–0.0122***	–0.0104***
lc_grp8	–0.00368***	–0.00372***	–0.00484***	0.00544***	0.00396*	–0.00373***	–0.0175***	–0.000983**	–0.0123***	–0.0104***
lc_grp9	–0.00359***	–0.00398***	–0.00630***	0.00541***	0.00498**	–0.00372***	–0.0176***	–0.00113**	–0.0122***	–0.0102***
lc_grp10	–0.00419***	–0.00417**	–0.00377**	0.00433***	0.00220	–0.00333**	–0.0199***	–0.000111	–0.0166***	–0.000638
lc_grp11	–0.00340***	–0.00380***	–0.00500***	0.00613***	0.00426**	–0.00366***	–0.0177***	–0.000982**	–0.0126***	–0.0105***
lc_grp12	–0.00391***	–0.00348***	–0.00408***	0.00553***	0.00332	–0.00375***	–0.0174***	–0.000816*	–0.0125***	–0.0109***
co_smoker	–0.000930*	–0.00428***	–0.00342**	–0.00269***	–0.00530***	0.0000505	–0.00130***	–0.00143***	0.000177	0.00189**
co_car	–0.00251***	–0.0125***	–0.000661	–0.00300**	–0.00520**	–0.000369	–0.000206	–0.00571***	0.00477***	–0.00533***
co_marr	0.000693	0.00915***	0.000735	–0.000225	–0.00267	0.000478	0.0000371	–0.000385	–0.00255**	–0.00382**
Sexhoh	–0.0000547	–0.00331**	–0.00178	–0.00107	0.00142	0.000190	0.000950*	0.00155***	0.000426	–0.00125
Employee	–0.00365	–0.0116**	0.00799**	–0.00294	0.00150	0.000564	–0.00149	0.000731	0.000722	0.00198
Selfempl	–0.00360	–0.00931*	0.00646*	–0.00283	–0.00359	–0.000988	–0.0000662	–0.00101	0.00297*	0.00459**
Pension	–0.00401	–0.00757	0.00348	–0.00155	–0.00863**	0.00153*	–0.00141	0.00420**	–0.00215	–0.00196
oth_emp	–0.00662*	–0.00579	0.00866**	–0.00212	–0.00111	0.000212	–0.000925	0.000140	0.00251	0.00516**
co_age1	–6.624***	–5.879	26.33***	–0.514	4.881	–1.642	0.130	0.164	9.719***	5.432
co_age2	–1.909***	–1.629	7.358***	–0.133	1.387	–0.476	0.0559	0.0647	2.734***	1.539
co_age3	–0.183***	–0.150	0.682***	–0.0113	0.132	–0.0458	0.00707	0.00782	0.256***	0.145
Coupsec	0.000635	0.00305**	0.00177	0.000222	–0.000552	0.00103***	0.000857	0.000465	–0.00170**	–0.00465***
Couniv	0.000988	0.00172	0.0118***	–0.00147	–0.00182	0.000888***	0.00171***	0.000872*	–0.000992	–0.00341***

Table A4b: *OLS Regression Outputs from 2004 Household Budget Survey Data (contd.)*

	Local Authority Rents	*Private Rents*	*Mortgage Interest*	*Materials for Maintenance and Repair of Dwelling*	*Service for Maintenance and Repair of Dwelling*	*Refuse Collection*	*Electricity*	*Natural Gas*	*Liquid Fuels*	*Solid Fuels*
nch05	–0.00168**	0.00218	0.00152	–0.000395	–0.00194	0.0000436	0.00226***	0.000933**	0.000687	–0.0000548
nch513	–0.00116**	–0.00141	–0.00375**	0.000170	–0.00220*	0.0000850	0.00193***	0.000215	–0.000104	0.000330
nch1420	–0.00136***	0.00100	–0.00557***	–0.00205***	–0.00330***	–0.0000130	0.00163***	–0.000487*	0.000424	0.000417
co_npers65	–0.000627	–0.000873	0.00482**	0.0000574	–0.00210	–0.00123***	–0.00220**	–0.000165	0.0000282	–0.000402
co_nadult	0.00130*	–0.00260	0.00149	–0.00101	–0.00433***	–0.000210	0.00252***	–0.000328	0.000316	0.00119*
co_nearn	–0.00122***	–0.000608	–0.000132	0.000164	–0.00234**	0.0000288	–0.000626*	0.000161	0.0000325	–0.000761
Nobdrooms	0.000114	–0.000869	0.000856	0.000267	0.00277***	0.000231*	0.00104***	–0.00104***	0.00285***	0.000173
Newresident	0.000840	0.00239**	0.0450***	0.00208*	–0.00287*	0.0000639	–0.00138**	–0.00135***	0.00179**	–0.00259***
Outrightown	0.00158**	0.00673***	0.0435***	0.000963	0.0195***	0.00153	0.00200	–0.00102	0.00830**	0.00825
Mortgagehold	0.00389***	0.00696***	0.142***	–0.00247	0.0163***	0.00204	0.00161	0.00122	0.00570	0.00662
Tenantpur	0.00212**	0.00247	0.100***	–0.00434	0.00664	–0.000866	0.00158	0.00667	–0.00480	0.00781
Local Authority Rent	0.104***	–0.00335	0.0208***	–0.00397	–0.000417	0.00209	0.00203	0.00492**	–0.00651*	0.0124**
Private Tenant	0.00140*	0.259***	–0.0172***	–0.00875*	0.000152	–0.000470	0.00137	–0.000762	–0.000593	0.00216
_cons	–7.623***	–7.023	31.22***	–0.678	5.732	–1.856	0.202	0.137	11.58***	6.473
R-sq	0.691	0.776	0.590	0.018	0.073	0.092	0.211	0.071	0.163	0.131
adj. R-sq	0.689	0.775	0.587	0.012	0.068	0.087	0.207	0.066	0.158	0.126