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**Article:**

Gell, L. and Meier, P. (2012) The nature and strength of the relationship between expenditure on alcohol and food: an analysis of adult-only households in the UK. *Drug and Alcohol Review*, 31 (4). 422 - 430. ISSN 0959-5236

<https://doi.org/10.1111/j.1465-3362.2011.00330.x>

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## **The nature and strength of the relationship between expenditure on alcohol and food**

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Keywords: alcohol drinking; diet; income

Short title: Alcohol and diet

### **Acknowledgements**

We would like to thank Robin Purshouse for the assistance he provided in accessing the dataset, Stephen Walters for his advice on statistics, and DEFRA for permitting use of the data. We would also like to thank Sabrina Schulte for useful comments on an early version of this paper. This research forms part of a dissertation submitted by the first author for the degree of Master of Public Health at the University of Sheffield. It is based on the Expenditure and Food Survey, 2005-2006, produced and sponsored by the Office for National Statistics and the Department for Environment, Food and Rural Affairs, and supplied by the UK Data Archive. The data are Crown copyright.

The authors report no conflict of interest.

## **Abstract**

**Context and Aims:** Unhealthy lifestyle behaviours can cluster to produce more detrimental overall health consequences than expected with a simple additive effect. This study aims to expand current knowledge of the nature and strength of the relationship between two such health behaviours, alcohol and diet, through analysis of household expenditure on food and drink from a nationally representative UK sample.

**Method:** Data from the Expenditure and Food Survey for 2005-2006 was used to analyse the expenditure on alcohol and diet for 3,146 UK households. The classification of a food as healthy or unhealthy was determined using dietary advice provided by the Food Standards Agency. Alcohol expenditure was disaggregated into spending in pubs, bars, clubs and restaurants (on-trade expenditure) and spending in off-licenses and supermarkets (off-trade expenditure). Analyses were stratified according to household disposable income quintile and household beverage preference.

**Results:** As household expenditure on alcohol increases, spending on both healthy and unhealthy food decreases. Households with a higher income spend proportionately more on on-trade alcohol and healthy food than lower income households, and spend less on unhealthy food. Off-trade alcohol expenditure does not differ significantly according to household income. Households that prefer to purchase wine have healthier expenditure patterns than those that prefer to buy beer or spirits, even after controlling for income.

**Conclusion:** Low-income households and those that purchase more beer or spirits than wine could be targeted for health promotion interventions to reduce their risk of negative health outcomes from the clustering of alcohol consumption and unhealthy diet.

## **Introduction**

Negative lifestyle behaviours (such as smoking and heavy alcohol consumption) tend to cluster; with many studies (1-3), although not all (4), suggesting a cumulative impact greater than the additive effect of the individual behavioural components. Heavier alcohol consumption has been associated with a less healthy diet (5), and has been linked to a lower intake of fruit (3;6;7) and higher consumption of processed meats and vegetable oils (3). Previous work has also investigated the relationship between diet and particular types of alcoholic beverage. One study investigating expenditure in Danish supermarkets found wine buyers purchased more fruit and vegetables than beer buyers, as well as more low fat dairy produce (8). Even after controlling for education and/or income, a US study found that drinkers with a preference for wine had healthier diets than those who preferred beer, spirits, or did not drink (9); and in Denmark, those who drank more wine (compared to beer or spirits) consumed more fruit, cooked vegetables and salad (10).

A multitude of health problems have been attributed to heavy alcohol consumption (11;12). Morbidity and mortality resulting from alcohol consumption disproportionately affects people of a lower socio-economic status (13), even when controlling for level of alcohol consumption (14;15). Higher quality diets, with their associated health benefits, have also been associated with income (16;17); for example, households with a higher income consume more fruit and vegetables. Given this evidence, there is the potential for unhealthy diet and harmful drinking to cluster in households of lower socio-economic status.

Previous studies investigating the relationship between alcohol and diet have been characterised by low response rates of around 40% (4;10), reliance on food intake recorded during a single day as a representation of diet (5), or a narrow sample population; for example highly educated populations (3;9) and single sex studies (3;7).

The current study uses a nationally representative UK general household survey, the Expenditure and Food Survey (EFS), to investigate the relationship between expenditure on alcohol and food, and whether this varies by income (as an indicator of socio-economic status). Additionally, households were categorised according to beverage preference to investigate the relationship between beverage preference and food expenditure.

## **Methods**

The EFS is an annual general household survey conducted in the UK. This study used the 2005-2006 dataset to analyse household expenditure on alcohol and healthy and unhealthy foods for 3,146 adult-only households. Data on a variety of consumables, including the data on food and drink utilised in this research, is collected at the level of the household using a questionnaire and a two-week individual-level diary recording all purchases. The household questionnaire also collates data on various demographic and socio-economic characteristics of the household and its constituent members, including a detailed analysis of household income. The purchasing diary must be completed by at least the main shopper for a household to be eligible to participate, but all individuals aged seven and over are asked to complete one. Additionally, information on income must be provided by all adults in the household for it to be included.

The 2005-2006 survey households were chosen using a multi-stage stratified random sample with clustering, drawn from the Postcode Address File for the UK and Valuation and Lands Agency list in

Northern Ireland (18). Six hundred and seventy two postal sectors were randomly selected for sampling following stratification by Government Office Region (to ensure geographical spread), as well as socioeconomic group and car ownership (19). The response rate for the 2005-2006 survey was 56.8% (n=6,285). The response rate was maximised through repeated calls at various times of day to households selected for participation; however it remained quite low because some of the households sampled were not contactable, and in others not all the adults were willing to complete the income section of the survey, invalidating the response of the whole household. Rigorous data quality checking procedures were followed by the data depositors (19). Weights provided by the data depositors were applied in this study to correct for sampling bias.

The EFS datasets use the United Nations Statistics Division Classification of Individual Consumption by Purpose (COICOP). The COICOP is used to group items of food expenditure together (such as pork chops and roast pork collectively as pork) to calculate a total expenditure on each type of food. Using the COICOP classifications administered by the ONS and DEFRA, the authors then categorised each type of food according to advice from the UK Food Standards Agency (20;21) and all expenditure was aggregated into one of five groups:

1. Healthy food (fruit and vegetables)
2. Unhealthy food (for example sweets and chocolate, cooking fats and takeaway food)
3. Off-trade alcohol (purchases for home consumption)
4. On-trade alcohol (purchases for consumption in pubs, bars, clubs, hotels and restaurants)
5. "Neutral" (including all foods not falling into categories 1 or 2, such as rice and dairy)

Only expenditure on food purchased for home consumption (such as supermarket shopping and takeaway food) was analysed because of the lack of detail on expenditure on healthy or unhealthy components of meals eaten outside the home. Households that did not purchase any alcohol were excluded, as we could not infer that they are abstainers; they may just not have purchased alcohol during the diary period. Twenty-eight households were excluded because they spent more money on food and drink expenditure than their total income, thus budget shares could not be calculated. Finally, households with children were excluded from the analysis because such households would likely have spent more on food because of their children, but would not have had greater alcohol expenditure. This would have distorted the relationship between drinking and dietary behaviour. The effect of removing households with children from the dataset was to reduce the number of households from 4,684 to 3,146; 61.3% of the households removed were headed by an individual aged 30 but <45 years.

The five categories of expenditure add up to total household food and drink expenditure. To determine whether spending on healthy and unhealthy food was associated with alcohol expenditure, the share of the budget accounted for by each category was calculated. Using budget shares instead of raw expenditure allowed the comparison of households of different numbers of adults, as well as comparison of changes in expenditure on food groups across households with different total food and drink expenditures. Off-trade and on-trade alcohol budget shares were divided into quintiles to allow comparison of expenditure on each budget category according to level of off-trade and on-trade alcohol expenditure.

Variations in the mean budget share of each expenditure category were examined across disposable income quintiles, where disposable income is gross weekly cash income minus statutory deductions, income tax and national insurance contributions. Disposable income quintiles were calculated to divide the dataset into five approximately equal categories: for example the top quintile included 629 households with a weekly disposable income greater than £754.39, whilst the 4<sup>th</sup> quintile included 631 households with a disposable income ranging from £224.16 to £350.00.

Households were also classified according to beverage preference, where a preference for beer, wine or spirits indicates the type of alcohol on which the household had the greatest combined off- and on-trade expenditure. No household in the sample spent an equal amount on two alcohol categories where it was the beverage of preference. Thirty-five households were excluded from this part of the analysis because their only alcohol expenditure was on a 'round of drinks' (see Table 1).

The data was analysed using SPSS version 16. Descriptive analysis was used to explore the distribution of the five categories of expenditure within the food and drink budget. The Independent Samples t-test was used to test for significant differences between the mean budget shares spent on the various food and drink categories between households with differing disposable incomes and beverage preferences.

## **Results**

### **Participants**

Of the 3,146 households included in the analysis, 40.8% were headed by an individual aged 60 years or older and only 10.1% were 'young' households (<30 years) (see Table 1). One third of households were headed by a woman and two thirds by a man. Continuous/full time education to 16 years was completed by 58.9%, with 22.7% educated beyond age 19, which usually indicates tertiary

education. The lower managerial and professional class made up 19.8% population, whilst 37.5% sample had either no socioeconomic status classified or stated. Household composition ranged from one man (15.8%) or one woman (15.9%) to three or more adults (15.4%); 49% were households of one man and one woman. Weekly disposable income ranged from £37 to £5447, with a median income of £429. Disaggregated by beverage preference, 1,439 households preferred to purchase beer (45.7%), 1,204 wine (38.3%) and 470 spirits (14.9%).

- INSERT TABLE 1 ABOUT HERE -

### **Household alcohol expenditure and diet**

Food and drink expenditure for the two week diary period ranged from £1.25 to £364.34, with a mean household expenditure of £63.75 and standard deviation of £39.53. The distribution of food and drink expenditure is normal. The average household spent 30.5% of the total food and drink budget on alcohol (see Table 1), with 12.6% spent on purchases for home consumption and 17.9% spent on alcohol in bars, pubs, clubs, hotels and restaurants. Households spent 14.6% and 14.2% of the budget on healthy and unhealthy food respectively.

- INSERT TABLE 2 ABOUT HERE -

Households spending a greater share of the budget on alcohol (both off-trade and on-trade) spent less of the budget on all other categories of expenditure, rather than replacing expenditure in just one category (such as healthy food) with their alcohol expenditure (see Table 2). For example, households with a 'high' off-trade budget share ( $\geq 16.7\%$  &  $< 26.4\%$ ) spent comparatively less on all other categories than households with an 'average' off-trade budget share ( $\geq 10.7\%$  &  $< 16.7\%$ ).

- INSERT TABLE 3 ABOUT HERE -

To determine whether budget share spent on the five food and alcohol categories varied by income, households were split into disposable income quintiles (see Table 3). Households with different levels of income did not significantly differ in terms of the proportion of their overall budget that was accounted for by off-trade alcohol ( $p=0.091$ ). In contrast, the on-trade alcohol budget share decreased from 21.8% in the top to 13.8% in the bottom income quintile (difference=8.0%, 95% CI 5.8-10.3;  $t=6.974$ ,  $p<0.001$ ) and healthy food budget share decreased from 16.3% to 13.8% (difference=2.5%, 95% CI 1.4-3.6;  $t=4.543$ ,  $p<0.001$ ). As income decreased, the budget share of

unhealthy food increased from 12.8% to 15.0% (difference=2.2, 95% CI 1.3-3.2;  $t=-4.660$ ,  $p<0.001$ ); and that of neutral food rose from 37.8% to 44.3% (difference=7.0, 95% CI 5.4-8.6;  $t=-8.437$ ,  $p<0.001$ ). Thus, more affluent households spent comparatively more of their budget on healthy food and on-trade alcohol, while lower income households spent more on unhealthy food and neutral food items.

### **Household beverage preference and diet**

Variations in healthy and unhealthy budget share also emerged when households were disaggregated by beverage preference (see Figure 1). Households with a preference for wine spent 17.9% of the budget on healthy food compared to households preferring beer or spirits which spent 12.3% (difference=5.6, 95% CI 4.9-6.3;  $t=15.663$ ,  $p<0.001$ ) and 13.4% (difference=4.5, 95% CI 3.5-5.4;  $t=9.339$ ,  $p<0.001$ ) respectively on healthy food. Households preferring spirits purchased the greatest share of unhealthy food at 15.4%, 1.9% (95% CI 1.0-2.7;  $t=4.290$ ,  $p<0.001$ ) more than beer and 0.9% (95% CI 0.05-1.8;  $t=2.066$ ,  $p<0.05$ ) more than wine preferring households.

Previous research found wine drinkers generally to be of higher socio-economic status than beer drinkers, therefore the variation in diet quality could be associated with socio-economic status rather than beverage preference. To test this, the analysis was re-run stratified by income (see Figure 1).

- INSERT FIGURE 1 ABOUT HERE -

Across all income groups, households that preferred wine consistently purchased more healthy food than beer or spirit households. For example, households in the bottom income quintile that preferred wine purchased 7.0% (95% CI 5.3-8.7;  $t=8.073$ ,  $p<0.001$ ) more healthy food than households that preferred beer and 5.5% more healthy food than households that preferred spirits (95% CI 1.9-6.0;  $t=5.362$ ,  $p<0.001$ ). There was no difference in expenditure on unhealthy food between income groups in the three beverage expenditure categories, except in the bottom income quintile where households preferring wine spent more on unhealthy food than those who preferred beer (difference=2.7%, 95% CI 1.0-4.5;  $t=3.099$ ,  $p<0.01$ ). So, low-income households that preferred wine purchased comparatively more healthy food than households that preferred beer or spirits, but also spent more on unhealthy food than beer preferring households.

## **Discussion**

### **Key Findings**

These analyses aimed to examine the relationship between expenditure on alcohol and food in a nationally representative sample of 3,146 households. Spending on both healthy and unhealthy food as a proportion of the food and drink budget decreased with increasing alcohol expenditure.

Data disaggregation by disposable income and beverage preference revealed variations in patterns of expenditure between population subgroups. Taking low-income as an indicator of socio-economic status, this sub-population experiences greater health inequality across a range of health outcomes, including alcohol-related health (14;15;27). If low-income households experience greater clustering of unhealthy food and alcohol purchasing, this might have implications for health inequalities.

Low-income households spent a lesser share of the food and drink budget on on-trade alcohol than high-income households; however, over one quarter of the budget was spent on alcohol suggesting it is a central component of the weekly diet. Diet in low-income households comprised comparatively greater expenditure on unhealthy food than in higher income households, and lower spending on healthy food. This suggests a potential clustering of unhealthy lifestyle behaviours in low-income households.

Household beverage preference also influenced food purchasing. Households categorised as wine purchasers bought more healthy food than beer or spirit purchasers, even when stratified by income. Therefore, a low-income, beer preferring household purchased more unhealthy food than a low-income wine preferring household, with high-income wine preferring households having the healthiest expenditure pattern. This finding is supported by previous research that found an individuals' preference for wine to be associated with a healthier diet, even when controlling for income or education (9;10).

The finding that low-income households spent over a quarter of their budget on alcohol suggests that diet quality may be sacrificed in order to be able to purchase alcohol. Households spent less on healthy food and may have opted for lower cost sources of dietary energy such as refined sugars and added fats that are cheaper and taste good (22). Additionally, households with a preference for spirits or beer may have purchased less healthy food because on average they spent 5% and 7% more of their total budget respectively on alcohol than wine households.

The observed clustering of alcohol and dietary behaviours can affect health in many ways; for example, both have the potential to significantly impact on various types of cancer (23;24). Often however, alcohol and diet are seen as independent problems and strategies in place to address one or the other issue rarely work complementarily, resulting in mixed messages for consumers (25). Interventions to tackle these two health behaviours simultaneously could include labelling alcohol as we label food to increase awareness of the nutritional content, health education campaigns to increase awareness of the relationship between alcohol and diet, or introducing lifestyle improvement or consumption moderation programmes that address multiple health behaviours together (25).

Successful health promotion involves implementing a variety of interventions for carefully targeted populations (26). This research has found that targeting interventions at low-income groups, and in particular households identified as preferentially purchasing beer or spirits, might prove fruitful. Unless we take steps to reduce the clustering of risky health behaviours in these populations, they may experience further health decline, and at a greater rate than their wine drinking or high-income counterparts, exacerbating health inequalities.

### **Strengths and Limitations**

The EFS is a large and nationally representative dataset, with data collected throughout the year to account for seasonal variations in expenditure; therefore, the results should reflect population expenditure accurately. The availability of both detailed food and drink expenditure data and household demographic and socio-economic characteristics permitted subgroup analysis. However, as households with children had to be excluded from the analysis, these findings are only applicable to adult only households. Additionally, it should be acknowledged that the exclusion of food eaten outside the home might have distorted the relationship between alcohol and diet. Households consistently spent proportionately more on food eaten outside the home with increasing income, with households in the top income quintile spending on average 18% more on such food than households in the bottom quintile (95% CI 16.0-20.3;  $t=16.711$ ,  $p<0.001$ ).

Data was collated at the household level with the analysis conducted assuming food purchased is split equally between household members, potentially masking true individual expenditure patterns. For example, in a two person household one individual might drink heavily and the other not at all, but the overall result would be a household with a moderate alcohol expenditure. At the same time, analysis of expenditure data at the level of the household (rather than the individual) may also result

in a clearer picture of consumption if one person is responsible for the majority of the food shopping within a household (28).

The results could be distorted if households differentially stocked up on longer-life food during the two-week period, which raises the concern of whether the two-week diary period is long enough to fully capture dietary behaviours. A longer diary period might also more adequately capture household alcohol expenditure, for example those households that buy alcohol in bulk infrequently.

### **Further Research**

An explanation for the differential dietary expenditure patterns according to household beverage preference is not evident. The differences exist across the income gradient, suggesting they cannot be explained by socio-economic variations in dietary behaviour. Further, possibly qualitative, research could explore this association to identify the reasons why beer and spirit preferring households seem to have less healthy expenditure patterns.

### **Conclusion**

A recent report published in the UK highlighted the need for improved recognition and understanding of the relationship between alcohol and diet (25). This research has attempted to explore this relationship and to identify population subgroups at risk. Investigating such clustering is important, as addressing multiple health behaviours in integrated public health programmes and policies could have the potential to generate greater health improvements than just focusing on individual health behaviours. Low-income households with a preference for beer or spirits were found to have the least healthy diets combined with allocating a larger share of the budget to alcohol, and therefore could be targeted for interventions (such as consumption moderation programmes) to reduce the risk of negative health outcomes associated with alcohol and dietary behaviour.

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Table 1: Demographic characteristics of the sample population

	N <sup>a</sup>	%
<b>Total Number of Households</b>	3146	
<b>Gender of HRP<sup>b</sup></b>		
Male	2084	66.3
Female	1062	33.7
<b>Age of HRP</b>		
< 30 years	317	10.1
30 but < 45 years	567	18.0
45 but < 60 years	978	31.1
≥ 60 years	1283	40.8
<b>Age at which HRP completed continuous/full time education</b>		
≤ 16 years	1854	58.9
17 or 18 years	544	17.3
≥ 19 years	714	22.7
Information not provided	34	1.1
<b>Socio-Economic Class<sup>c</sup></b>		
1 - Large Employers & Higher Managerial	123	3.9
2 - Higher Professionals	214	6.8
3 - Lower Managerial & Professionals	621	19.8
4 - Intermediate	182	5.8
5 - Small Employers & Own Account Workers	188	6.0
6 - Lower Supervisory & Technical	183	5.8
7 - Semi-Routine	188	6.0
8 - Routine	193	6.1
9 - Never Worker & Long-Term Unemployed	19	0.6
10 - Students	54	1.7
11 - Occupation Not Stated	20	0.6
12 - Occupation Not Classified	1161	36.9
<b>Household Composition</b>		
1 Man	498	15.8
1 Woman	499	15.9
1 Man and 1 Woman	1541	49.0
2 Men or 2 Women	123	3.9
3+ Adults	485	15.4
<b>Household Beverage Preference</b>		
Beer	1439	45.7
Wine	1204	38.3
Spirits	470	14.9
Excluded	35	1.0
<b>Household Expenditure</b>	<b>Mean (Budget Share)</b>	<b>SD</b>
Off-trade Alcohol	£8.49 (12.6%)	£13.18
On-trade Alcohol	£12.77 (17.9%)	£20.13
Healthy Food	£9.16 (14.6%)	£7.88
Unhealthy Food	£8.57 (14.2%)	£6.70
Neutral Food	£24.76 (40.7%)	£16.06
<b>Weekly Disposable Income Quintile<sup>d</sup></b>	<b>Median (Range)</b>	<b>SD</b>
Top	£1002.28 (754.39-5447.77)	478.73
2 <sup>nd</sup>	£615.80 (514.89-753.80)	66.62
3 <sup>rd</sup>	£429.38 (350.00-514.48)	48.20
4 <sup>th</sup>	£283.41 (224.16-350.00)	35.69
Bottom	£160.43 (36.60-224.13)	48.36

<sup>a</sup> Figures shown are based on weighted data (adjusted for non-response and matched to population totals).

<sup>b</sup> The HRP is the household reference person - the head of the household (house owner, responsible for rent, or has the house as an emolument. If there are joint householders, the individual with the higher income is the HRP, and if income is the same it is the older individual).

<sup>c</sup> Socioeconomic class is classified according to the National Statistics Socio-economic classification (NS- SEC) – an occupational based classification system with procedures for classifying those not in work.

<sup>d</sup> Gross weekly cash income minus statutory deductions, income tax and national insurance contributions.

Table 2: Differences in expenditure on budget share categories by off-trade and on-trade budget group

Off-Trade Budget Share (%)	N	On-Trade Alcohol		Healthy Food		Unhealthy Food		Neutral Food	
		Mean Expenditure (SD)	Budget Share (%)						
Very Low (>0 & <6.0)	463	£17.47 (28.91)	18.1	£11.65 (8.46)	17.0	£11.01 (7.07)	16.3	£31.15 (17.30)	45.2
Low (≥6.0 & <10.7)	464	£13.01 (20.00)	15.6	£10.45 (7.77)	16.3	£9.80 (7.14)	15.5	£27.88 (15.45)	44.4
Average (≥10.7 & <16.7)	463	£12.54 (20.97)	14.9	£10.14 (8.47)	15.5	£9.81 (7.75)	15.1	£26.26 (16.72)	40.9
High (≥16.7 & <26.4)	465	£9.64 (14.96)	12.5	£9.96 (8.46)	14.5	£8.81 (6.24)	13.6	£25.19 (15.45)	38.3
Very High (≥26.4)	463	£5.89 (11.52)	7.7	£7.38 (6.85)	10.8	£6.62 (5.74)	10.5	£20.22 (14.53)	31.5

  

On-Trade Budget Share (%)	N	On-Trade Alcohol		Healthy Food		Unhealthy Food		Neutral Food	
		Mean Expenditure (SD)	Budget Share (%)						
Very Low (>0 & <6.7)	452	£11.67 (22.00)	13.2	£12.18 (9.42)	17.9	£10.86 (7.07)	17.3	£30.81 (17.85)	47.7
Low (≥6.7 & <14.4)	442	£9.59 (14.60)	12.9	£10.36 (8.01)	16.8	£9.18 (6.54)	15.4	£26.67 (15.00)	44.7
Average (≥14.4 & <25.6)	443	£7.68 (10.88)	10.5	£10.15 (8.06)	15.2	£8.91 (6.91)	13.5	£26.62 (16.15)	41.4
High (≥25.6 & <42.4)	444	£7.46 (10.18)	9.1	£7.99 (6.76)	11.1	£8.27 (7.17)	11.9	£23.63 (14.73)	34.1
Very High (≥42.4)	445	£4.36 (7.69)	5.1	£5.17 (4.83)	6.9	£5.49 (4.82)	7.4	£16.05 (12.40)	21.1

Off-trade n=2,318 and On-trade n=2,226 (respectively, 828 did not purchase off-trade alcohol and 920 did not purchase on-trade alcohol from the original 3,146 households).

Table 3: Mean expenditure and budget shares by weekly disposable income quintile

Income Quintile	Off-Trade Alcohol		On-Trade Alcohol		Healthy Food		Unhealthy Food		Neutral Food	
	Mean Expenditure (SD)	Budget Share (%)								
<b>Top</b>	£11.63 (18.87)	11.5	£21.74 (26.80)	21.8	£14.34 (9.96)	16.3	£11.54 (8.06)	12.8	£33.69 (19.63)	37.5
<b>2nd</b>	£10.38 (13.59)	12.8	£16.13 (23.45)	19.6	£10.53 (7.10)	14.8	£10.01 (7.08)	13.9	£27.95 (14.59)	38.9
<b>3rd</b>	£8.22 (12.42)	12.4	£10.79 (15.80)	17.3	£8.87 (7.14)	14.6	£8.50 (5.96)	14.5	£24.94 (15.27)	41.3
<b>4th</b>	£7.18 (9.63)	13.5	£9.48 (15.18)	17.3	£6.80 (5.59)	13.5	£7.31 (5.60)	14.5	£21.04 (13.34)	41.2
<b>Bottom</b>	£5.04 (7.37)	12.9	£5.72 (11.12)	13.8	£5.23 (5.41)	13.8	£5.48 (4.58)	15.0	£16.19 (10.24)	44.5
	Mean Difference (95% CI)	t-statistic								
<b>Budget Share Difference<sup>a</sup></b>	-1.3% (-2.8-0.2)	-1.694	8.0% (5.8-10.3)	6.974***	2.5% (1.4-3.6)	4.543***	-2.2% (-3.2--1.3)	-4.660***	-7.0% (-8.6--5.4)	-8.437***

<sup>a</sup> Difference between the top and the bottom income quintiles.

\*\*\* significant at the p<0.001 level

Figure 1: Variations in budget share by household beverage preference and income quintile

