Gluttony in England?
Long-term change in diet

Rachel Griffith
Rodrigo Lluberas
Melanie Lührmann

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Rachel Griffith

Institute for Fiscal Studies and University of Manchester

Rodrigo Lluberas

Institute for Fiscal Studies and Royal Holloway

Melanie Lührmann

Institute for Fiscal Studies and Royal Holloway

Executive summary

- There has been a substantial decline in the amount of calories that households purchase between 1980 and 2009. Depending on the household type, households in 2009 purchased between 15% and 30% fewer calories than in 1980.

- Calories purchased have declined at all parts of the distribution: both households that purchase the most calories and households that purchase relatively few calories have reduced the amount of calories they purchase.

- The largest reduction in calories – by 27% to 30% – is observed among couples with children and multi-adult households.

- Calories purchased for consumption outside the home, including takeaways, restaurant food, soft drinks, confectionery and snacks, have increased for all but young single households. The increase is as large as 70% for older single households, while it is smaller for couples with children (36%).

- However, calories purchased for consumption at home make up the bulk of food that households purchase, so the increase in calories purchased for consumption outside the home amounts to a much smaller number of calories than the reduction in calories purchased for consumption at home.

- Calories purchased as alcohol have declined for most household types; they account for only a small fraction of overall calories (around 3% on average).

- These figures raise a puzzle, as there have been substantial increases in body weight in the UK. The average weight of an adult male has increased by 8.6 kilograms and the weight of an adult female by 7.9 kilograms over the same period.

- The literature, mainly from the US, has focused on increased calorie consumption as the reason for increased body weight. In England, we see a substantial *decrease* in total calories purchased.

- In ongoing work, we are looking at contemporaneous trends in physical activity.

1. Introduction

There has been a marked increase in body weight across much of the developed world. In the UK, over 25% of adults are obese and 70% overweight.[2] Excess weight is a result of an imbalance between calories ingested and calories expended in physical exertion.

Research, largely based on US data, has emphasised the importance of increased calorie consumption in driving weight gain (Cutler, Glaeser and Shapiro, 2003; Swinburn, Sacks and Ravussin, 2009; Duffey and Popkin, 2011). In this briefing note, we document the fact that in England there has been a substantial *decrease* in total calories purchased. This is despite an increase in purchases of some high-calorie categories such as fast food, snacks and drinks.

Previous work using the National Food Survey over an earlier period has documented the decline in calories from food purchased for consumption at home (Prentice and Jebb, 1995). Food at home accounts for around two-thirds of food expenditure. We use imputation methods to obtain measures of calories purchased for consumption outside the home and alcoholic drinks. We show that there has been an increase in calories purchased for food out – including takeaways, restaurant meals, snacks and drinks – but it is more than offset by the decrease in calories purchased for food at home.

This leads to a puzzle. If calories are declining, why are people gaining weight? Changes in the nature of work and leisure, housework and other activities have led to substantial reductions in the strenuousness of daily life. In ongoing work, we are investigating how changes in purchased foods correspond to changes in time use and the strenuousness of activities. It appears that weight gain has resulted from a faster decrease in activity levels than in calories consumed, leading to an excess of calories.

Our aim is to help inform policy by increasing our understanding of the factors that have driven the rapid rise in obesity. Our results do not say that food is not a problem, but that we need to consider *both* – calories ingested and calories expended.

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[2] OECD Health Data 2011. Obesity is defined using the Body Mass Index (BMI). BMI is weight in kilograms squared divided by height in metres. A BMI over 25 is overweight and over 30 is obese.

2. The decline in total calories from food and drinks

Real expenditure on food has increased over the past three decades for most household types; however, calories purchased have declined. Table 1 shows the decline over time in the amount of calories purchased by household type. The figure reported is calories purchased per day. We use household-level purchase data from the Living Costs and Food Survey (LCF) and its predecessors. This is a representative sample of English households.

Table 1. Calories purchased, all food and drinks

	Single under 50	Single 50+	Lone parent	Couple	Family	Other
Calories purchased per household per day						
1980	3,076	3,174	7,152	6,354	10,383	11,906
1985	2,757	3,119	7,007	5,950	9,328	11,030
1990	2,752	2,953	5,840	5,714	8,941	10,028
1995	2,701	2,817	5,953	5,491	8,487	9,304
2000	2,891	2,920	6,173	5,430	8,418	9,237
2005	2,517	2,699	5,486	5,252	7,936	9,121
2009	2,457	2,709	5,436	5,084	7,580	8,335
Percentage change, 1980–2009						
	−20.1	−14.6	−24.0	−20.0	−27.0	−30.0

Note: Household types are: single under 50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

One of the problems that have confounded research in this area has been the lack of historical data on calories across all food groups. The LCF and its predecessors include information on expenditure for all food groups back to 1980. They also include quantities and nutrient conversion factors for many food groups: for food consumed at home, this information goes back to 1980; however, for foods eaten outside the home, the quantity and nutrient conversion factors are not available for earlier years. Specifically, we do not have complete information on the quantities of and calories in alcohol, soft drinks and confectionery at home before 1992 and on all foods eaten out (soft drinks, confectionery, snacks, takeaways, restaurant meals and alcohol) before 2001.

We use statistical imputation methods to recover estimates of calories using information on expenditures and demographic data for the missing years. We show that our main conclusions stand up to a wide range of robustness concerns that we might have about the statistical imputation methods.

We combine these data to impute real expenditure and calories per real pound spent. In the appendix and in Griffith, Lluberas and Lührmann (2013), we provide further details on the precise method. These methods give us reasonably precise estimates of real expenditure and calories for the missing categories; in Figures 4 and 7 later, we provide confidence bands on our estimates. In our initial description in this section, we combine the observed and imputed data to obtain a measure of total real expenditure and total calories.

Table 1 shows that mean calories purchased have declined for all household types. Averaging crudely across all households, calories purchased fell by 34.4%, from 8,187 per household per day in 1980 to 5,373 in 2009. However, this number is misleading as it ignores changes in household size and composition over time. Broken down by different types of households, we find large variation: the percentage decline in calories from all food and drinks ranged from 14.6% for older single households to 30% for multi-adult (other) households.

Comparing mean calories per household over time within these household types could still be misleading if average household size or composition has changed over time, because individuals of different ages and genders require different levels of calories. However, in the appendix, we show that most changes over time are in the proportions of households in these six groups, with relatively little change within the groups. Hence, the percentage changes within household type are not very affected by demographic changes. For simplicity, in this briefing note, we compare changes over time within these groups without adjusting for changes within household types.

We might be interested not only in the mean, but also in how calories vary at other points of the distribution. In particular, if our concern is about obesity and weight gain, we might be particularly interested in households that purchase a large amount of calories relative to other households of the same type. In Figure 1, we show the amount of calories purchased in 1980 and 2009 within each household type by decile. The deciles are defined based on total calories purchased in each year; so on the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories, and on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories. We see a decline in calories purchased at all parts of the distribution.

In the next section, we look at what is the source of this decline, and whether households eat proportionally less of all foods or whether the composition of foods purchased has changed.

Figure 1. Calories purchased by household type and calorie decile
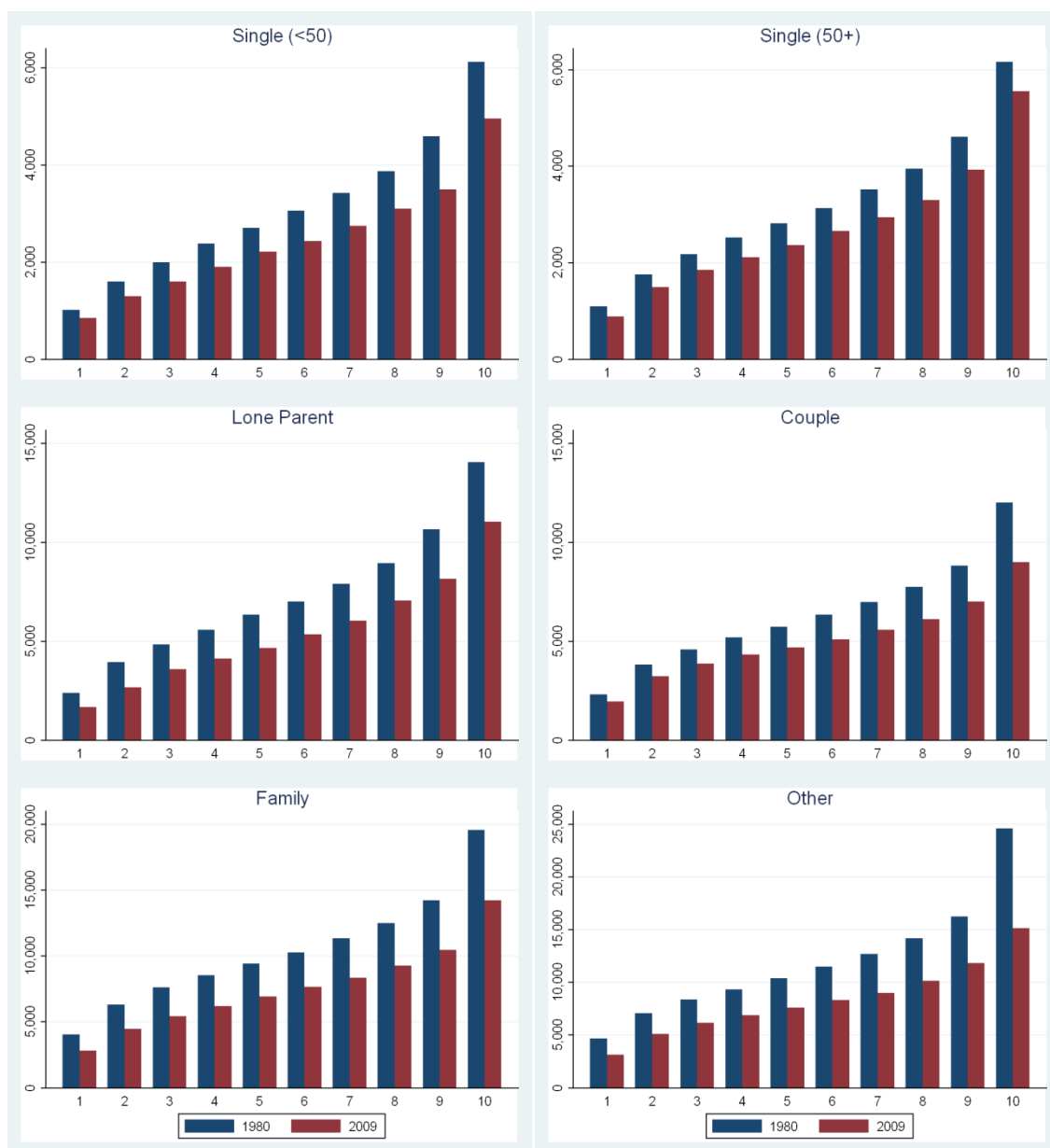
Note: The horizontal axis indicates the decile in terms of calories purchased. On the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories; on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

3. Types of food purchased: calories from food at home, eating out, snacks and soft drinks, and alcohol

We consider three groups of foods: (i) food purchased for consumption at home, (ii) eating out, snacks and soft drinks, which includes confectionery and snacks and food purchased for consumption out, including takeaways and restaurant meals, and (iii) alcohol for consumption at home and out. Information on expenditure on these categories is complete.

Table 2 shows real expenditure per day by household type and food group. Real expenditure is nominal expenditure divided by the relevant price index; we use the appropriate components of the retail price index (RPI) to deflate expenditure. Expenditure patterns vary, with most households reducing real expenditure on food at home, except for couples and older singles. All household types except younger single households have increased real expenditure on food out. For alcohol, the direction of change varies by household type.

Table 2. Real expenditure per day by household type

	Food at home			Eating out, snacks and soft drinks			Alcohol		
	1980	**2009**	**% change**	**1980**	**2009**	**% change**	**1980**	**2009**	**% change**
Single (<50)	2.61	2.58	−1.4	2.49	2.05	−17.7	3.21	1.46	−54.4
Single (50+)	2.84	3.25	14.1	0.82	1.42	73.5	0.62	0.85	36.5
Lone parent	5.61	4.76	−15.0	2.06	3.09	49.9	0.66	0.82	24.0
Couple	5.60	5.83	4.0	2.17	3.39	56.3	2.51	2.05	−18.3
Family	8.35	7.60	−8.9	3.92	5.14	31.0	2.87	1.77	−38.5
Other	9.48	8.12	−14.4	5.06	5.84	15.4	4.89	2.85	−41.7

Note: We deflate expenditure by the relevant components of the RPI. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

As mentioned above, while the information on expenditure is complete back to 1980, the information on calories is not, and we have used statistical imputation methods to recover estimates of calories for food eaten out and alcohol. In the appendix, we show that our main conclusions stand up to a wide range of robustness concerns that we might have about the statistical imputation methods.

In Table 3, we combine observed data on calories with data that we have imputed. The table shows how the composition of calories has shifted. The share of total calories purchased for food at home declined, by 6.5 percentage points on average, while the share of calories purchased for eating out increased, by 7.6 percentage points on average; alcohol declined, most notably for younger single households. The shift from food at home towards eating out is largest for households with children, and particularly strong among lone-parent households.

Table 3. Calorie shares by household type

	Food at home			Eating out, snacks and soft drinks			Alcohol		
	1980	2009	Percentage point change	1980	2009	Percentage point change	1980	2009	Percentage point change
Single (<50)	71.2	73.4	2.2	16.5	20.7	4.3	12.3	5.9	−6.4
Single (50+)	90.6	82.9	−7.7	6.4	13.2	6.8	3.0	3.9	0.9
Lone parent	86.1	73.6	−12.5	12.3	24.6	12.3	1.6	1.9	0.2
Couple	86.3	80.5	−5.8	8.0	15.1	7.1	5.6	4.4	−1.3
Family	84.6	76.5	−8.1	11.2	20.8	9.7	4.2	2.7	−1.5
Other	83.2	76.6	−6.7	11.3	19.8	8.5	5.4	3.6	−1.8

Note: Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

Food at home accounts for over 70% of total calories purchased for all household types. Food at home is also the category that drives most of the calorie decline between 1980 and 2009.

Food at home

Food at home accounts for the bulk of calories purchased. Table 4 shows the decline in calories purchased as food consumed at home across all household types between 1980 and 2009. Overall, the decline ranges from –18.8% in younger single households to –35.0% for other households. For all household types other than singles under 50, calories from food at home declined by more than overall calories.

Table 4. Calories purchased for consumption at home

	Single under 50	Single 50+	Lone parent	Couple	Family	Other
Calories purchased for consumption at home, per household per day						
1980	2,323	2,902	6,229	5,581	8,927	10,031
1985	2,077	2,803	5,909	5,130	7,752	8,985
1990	1,940	2,619	4,638	4,731	7,111	7,839
1995	1,936	2,460	4,785	4,506	6,732	7,287
2000	2,185	2,548	4,747	4,472	6,554	7,162
2005	1,857	2,305	4,066	4,280	6,136	6,998
2009	1,887	2,310	4,101	4,184	5,942	6,522
Percentage change, 1980–2009						
	−18.8	−20.4	−34.2	−25.0	−33.4	−35.0

Note: Household types are: single under 50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

As in Section 2, we might be interested not only in the mean, but also in how calories vary at other points of the distribution. In Figure 2, we show the amount of calories purchased for food at home in 1980 and 2009 within each household type by decile. The deciles are defined based on calories purchased for food at home in each year; so on the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories for food at home, and on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories for food at home.

We see a decline in calories purchased for food at home at all parts of the distribution, except for the lower declines for single households below the age of 50.

The amount of calories purchased has fallen faster than real expenditure (nominal expenditure divided by the price index for food at home), implying that the 'unit price' (the ratio of real expenditure to calories) for food at home has increased. Figure 3 shows the average unit price paid for 1,000 calories: it has increased by around 50% from about £1.00 in 1980 (in real 2005 pounds) to about £1.50 in 2007. Thus households have shifted towards more expensive calories. However, this trend has reversed, with the unit price of calories for food at home falling since 2007.

Figure 2. Calorie purchased for food at home, by household type and calorie decile
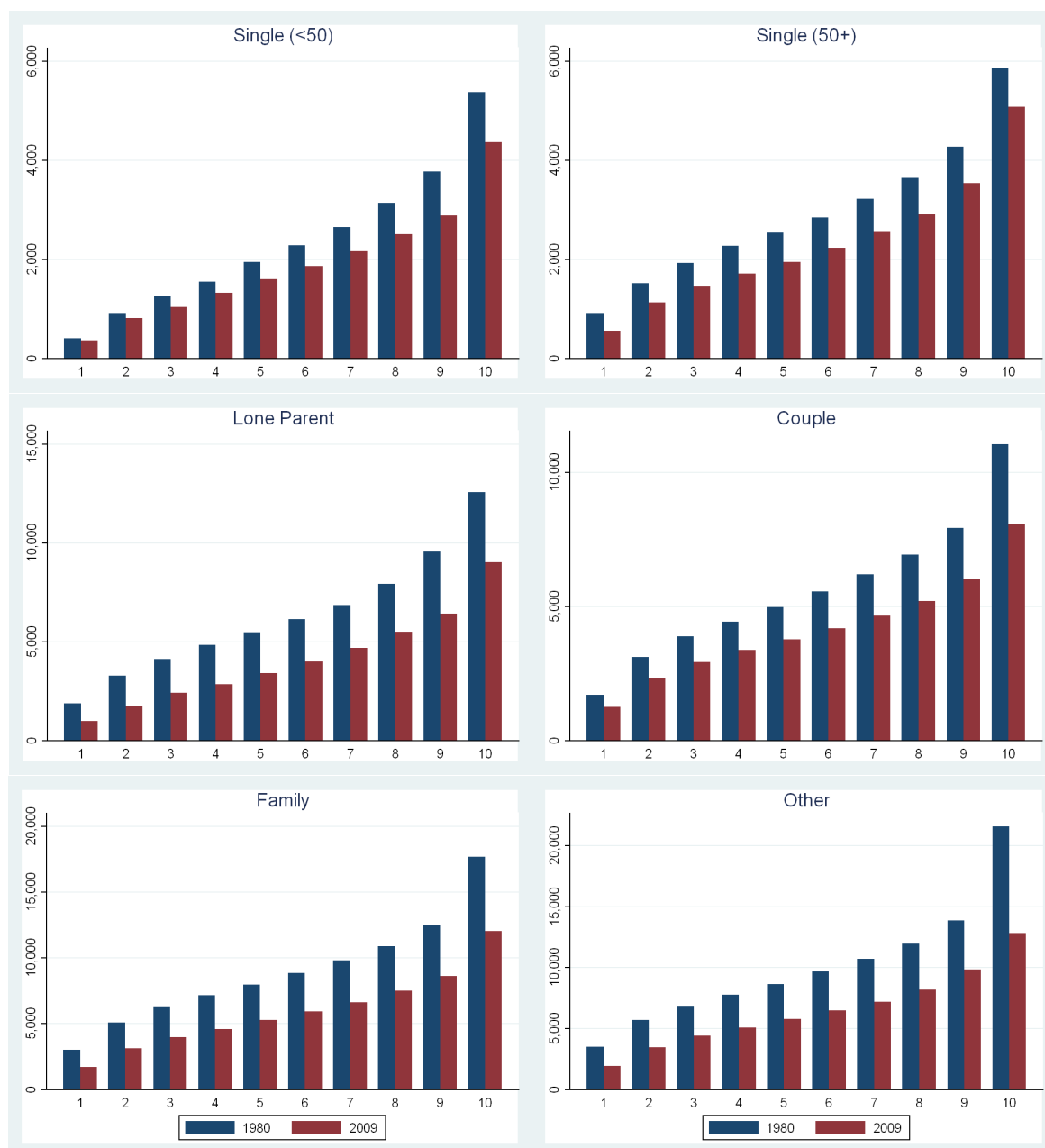
Note: The horizontal axis indicates the decile in terms of calories purchased for food at home. On the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories for food at home; on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories for food at home. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

**Figure 3. 'Unit price' of 1,000 calories for food at home (2005 £)**
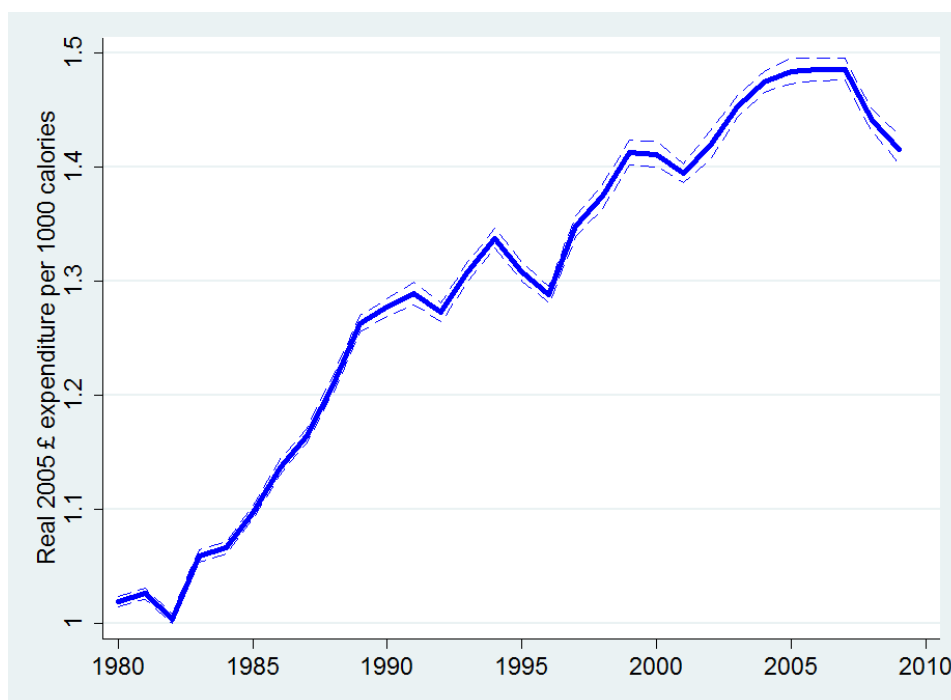
Note: The vertical axis is real expenditure on food at home divided by calories from food at home. The dashed lines indicate the 95% confidence intervals.

Food out: soft drinks, confectionery and snacks, takeaways and restaurant food

We have seen that households have substituted away from food at home towards eating out, snacks and soft drinks (Table 2 showed this for the share of real expenditure and Table 3 showed it for calorie shares). Recall that we observe expenditure for the entire period, but that calories for food out are only observed from 2001. In the appendix, we explain how we use statistical methods, combined with data on expenditure, demographics and prices, to impute calories back to 1980.

Our estimates suggest that calories purchased for eating outside the home and in soft drinks, confectionery and snacks have increased for all household types, except in the most recent years. Figure 4 shows the trends over time by household type, with the dotted lines showing the 95% confidence intervals around our estimates. The increase in food out was strongest up to the early 1990s. After that, the rate of increase slowed for all household types, and for some it reverses.

Figure 4. Calories from eating out, snacks and soft drinks, by household type
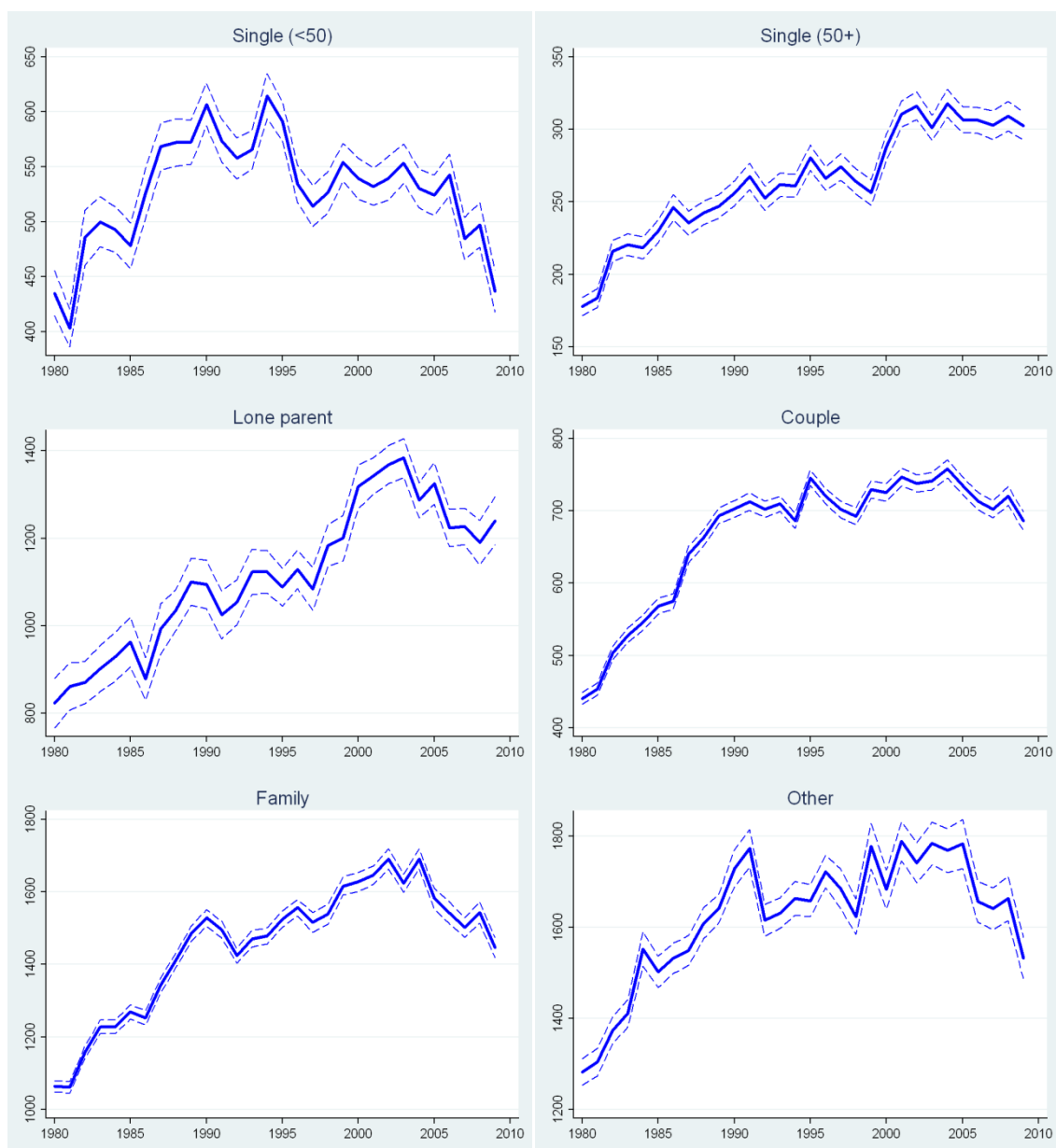
Note: The dashed lines indicate the 95% confidence intervals. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

Table 5 shows our estimates of calories purchased for eating out, snacks and soft drinks. Calories from this category account for at most a quarter of overall calories in each household type (see Table 3), so the increase that we estimate does not compensate for the decrease in calories purchased for food at home shown in Table 4.

Table 5. Calories purchased for eating out, snacks and soft drinks

|	Single under 50	Single 50+	Lone parent	Couple	Family	Other
Calories purchased for eating out, snacks and soft drinks, per household per day						
1980	435	178	823	441	1,064	1,283
1985	478	230	963	568	1,269	1,502
1990	607	256	1,094	703	1,529	1,729
1995	592	280	1,089	746	1,525	1,658
2000	539	288	1,318	725	1,628	1,683
2005	524	307	1,326	735	1,582	1,783
2009	437	302	1,240	686	1,447	1,533
Percentage change, 1980–2009						
	0.4	69.7	50.7	55.6	36.0	19.5

Note: Household types are: single under 50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

As before, we might be interested not only in the mean, but also in how calories vary at other points of the distribution. In Figure 5, we show the amount of calories purchased for eating out, snacks and soft drinks in 1980 and 2009 within each household type by decile. The deciles are defined based on calories purchased for eating out, snacks and soft drinks in each year; so on the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories for eating out, snacks and soft-drinks, and on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories for eating out, snacks and soft drinks.

We see an increase in calories purchased for eating out, snacks and soft drinks at all parts of the distribution for all household types, except for single households below the age of 50, for which it remains largely the same.

Figure 5. Calories purchased for eating out, snacks and soft drinks, by household type and calorie decile
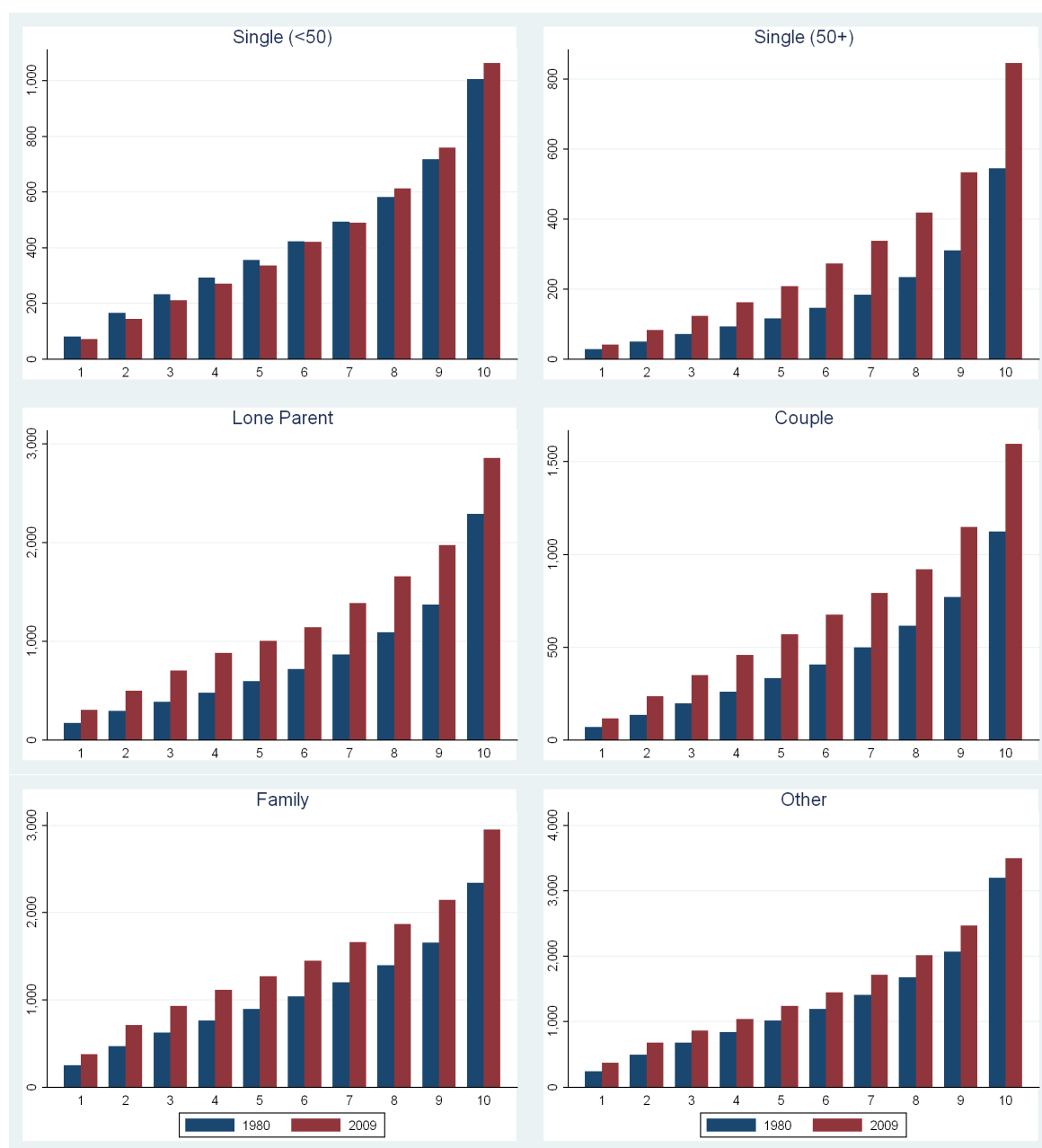

Note: The horizontal axis indicates the decile in terms of calories purchased for eating out, snacks and soft drinks. On the far left, the bar marked '1' is for the 10% of households that purchase the smallest amount of calories for eating out, snacks and soft drinks; on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories for eating out, snacks and soft drinks. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).

Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

14

The unit price of calories from eating out, snacks and soft drinks, shown in Figure 6, increases by around 20% over time, indicating that there is a shift towards more expensive calories.

Figure 6. 'Unit price' of 1,000 calories for eating out, snacks and soft drinks (2005 £)
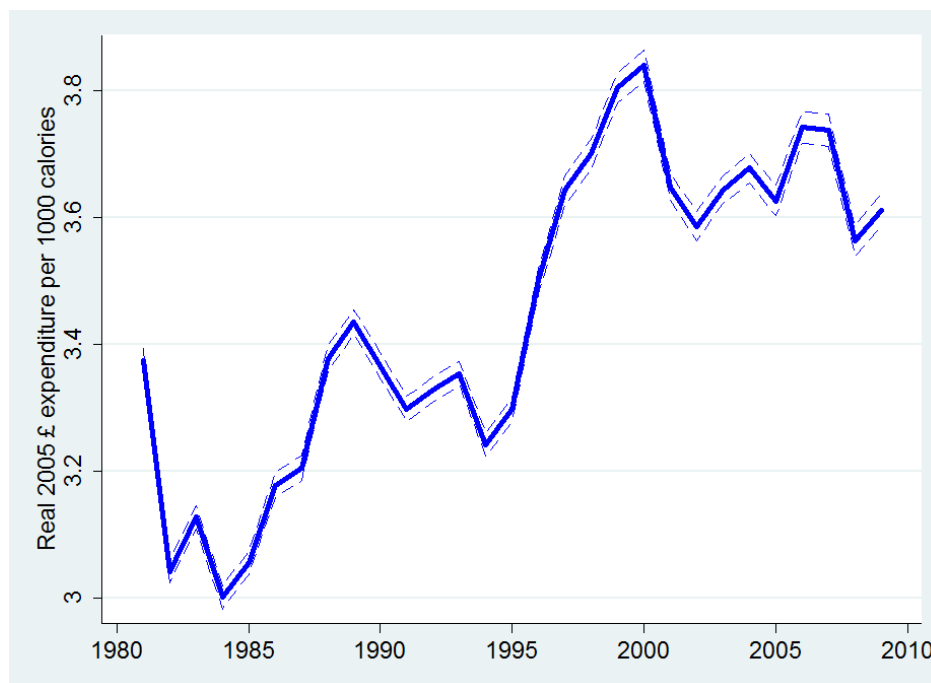
Note: The vertical axis is real expenditure on eating out, snacks and soft drinks divided by calories from eating out, snacks and soft drinks. The dashed lines indicate the 95% confidence intervals.

Alcohol

Table 3 showed that households have reduced, or only slightly increased, calories purchased as alcohol. Table 2 showed that several household types have reduced their real expenditure on alcohol. Recall that we observe expenditure for the entire period, but that calories from alcohol are only observed fully from 2001. In the appendix, we explain how we use statistical methods combined with data on expenditure, demographics and prices, to impute calories back to 1980.

Our estimates suggest that calories purchased in the form of alcoholic drinks decline for all households, except for singles aged 50 and over, for whom the amount remains fairly static. Figure 7 shows the trends over time by household type; the dashed lines show the 95% confidence intervals around our estimates.

Figure 8 shows that calories purchased in the form of alcohol declined at most parts of the distribution, except a few cases where they increase slightly. There are a number of households that do not purchase any alcoholic drinks.

15

Figure 7. Calories from alcohol, by household type
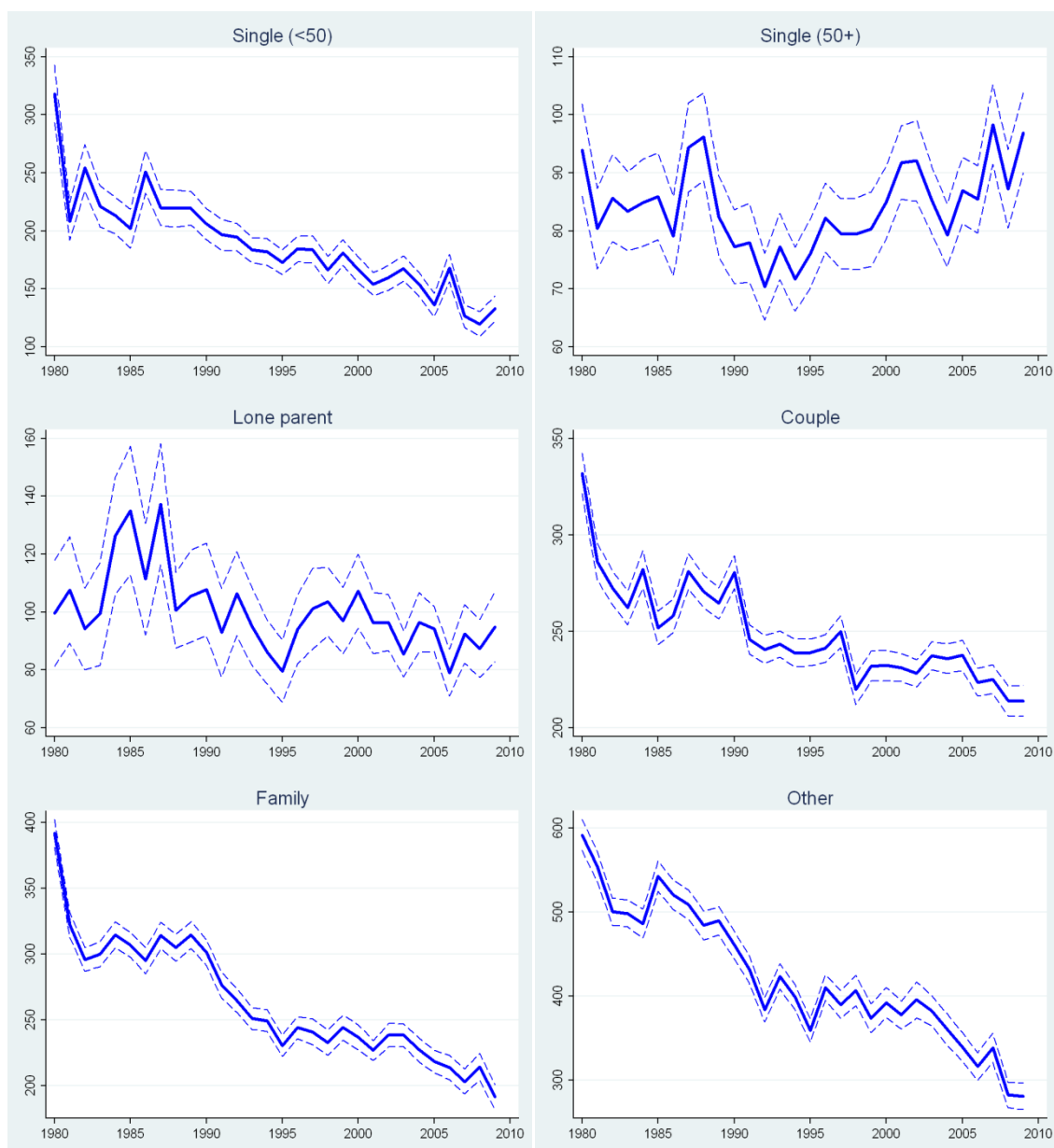
Note: The dashed lines indicate the 95% confidence intervals. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

Figure 8. Calories purchased from alcohol, by household type and calorie decile
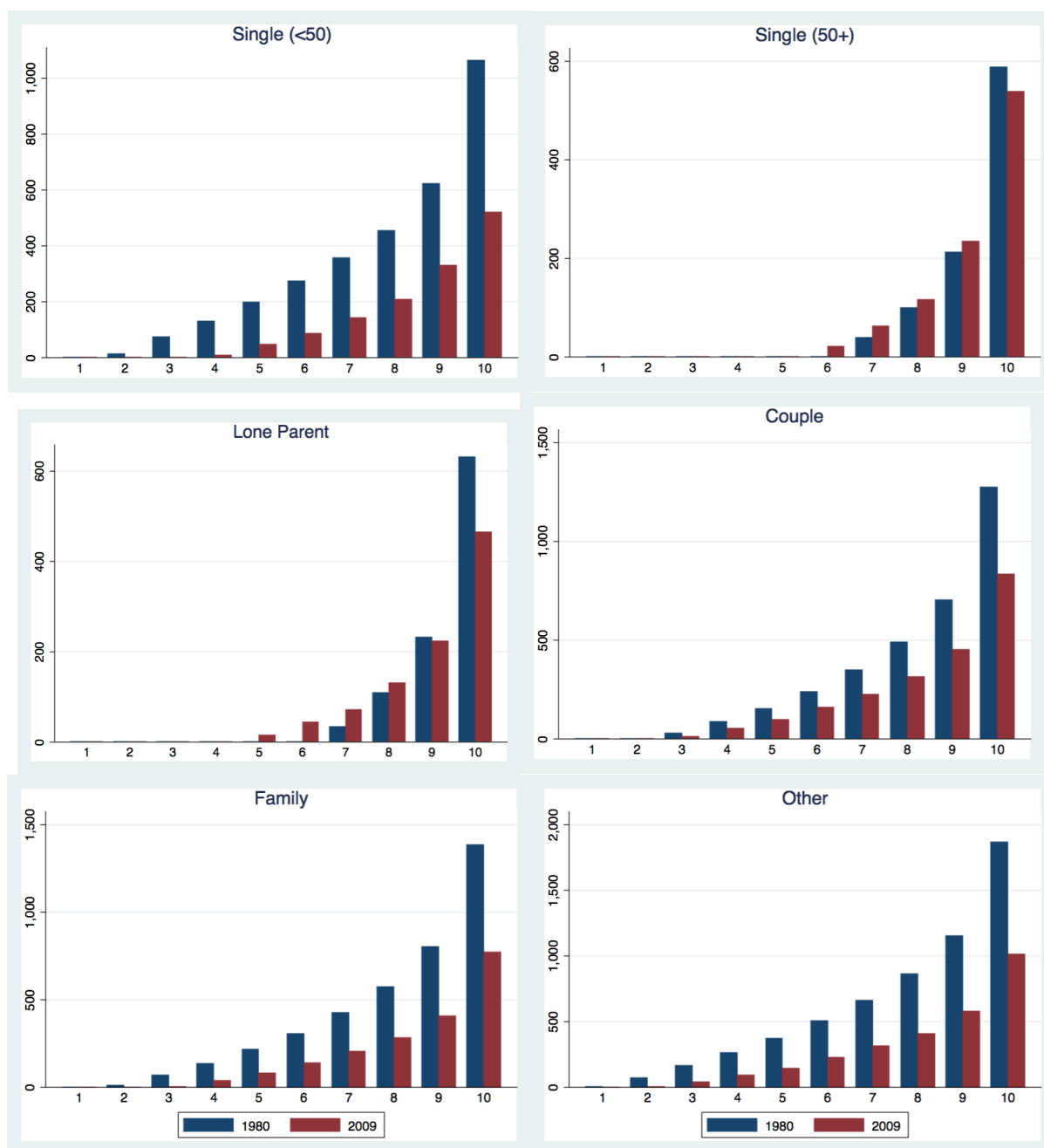
Note: The horizontal axis indicates the decile in terms of calories purchased in alcoholic drinks. On the far left, the bar marked '1' is the 10% of households that purchase the smallest amount of calories in alcoholic drinks; on the far right, the bar marked '10' is for the 10% of households that record purchasing the largest amount of calories in alcoholic drinks. Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

4. Summary

There has been an increase in the prevalence of obesity and overweight in the UK population, as in most industrial countries. Attention has focused on the role of overeating and increased calories through unhealthy diets.

Studies of nutrition have been hampered by a lack of data. We present new numbers based on the Living Costs and Food Survey and its predecessors, combined with statistical imputation methods.

We find, somewhat surprisingly, that there has been a fairly substantial decline in calories purchased. This is true for all household types and at all points of the distribution. Breaking the decline down by three broad categories – food for home consumption, eating out and snacks and soft drinks, and alcohol – we show that the decline is driven by a decline in calories purchased for food at home, which represents the largest part of households' food purchases. There is an increase in calories purchased for food out and snacks and soft drinks, but this is not sufficiently large to counteract the decline in calories purchased for consumption at home.

These numbers raise a puzzle: if calories are declining, why is weight increasing? In ongoing work, we are investigating the association between the changes in calories purchased and changes in physical activity. We hope to be able to quantify to what extent changes in time use and the strenuousness of activities have resulted in an even greater reduction in calories expended.

Appendix

Data

We use data from the Living Costs and Food Survey and its predecessors.

National Food Survey (NFS): The National Food Survey is a repeated cross-section that samples about 8,000 households per year. The information is collected continuously during the year. The person who does most of the food shopping is in charge of keeping records of all the food purchased and brought home during seven days. For each item, the diary keeper has to record in the diary: a short description, quantity purchased and the cost. Free food is recorded at the time of use. Depending on the year, there are between 180 and 240 food items. Together with food purchases, demographic characteristics of the household members are obtained through a face-to-face interview.

Expenditure and Food Survey (EFS) and Living Costs and Food Survey (LCF): From April 2001, the NFS was merged with the Family Expenditure

Survey to form the new Expenditure and Food Survey. In 2008, the EFS became the Living Costs and Food Survey (LCFS). The EFS/LCF collects household expenditure on food and beverages. All household members aged 16 or older keep a personal diary of daily expenditure for 14 days. Simplified diaries are kept by members of the household aged between 7 and 15. The EFS/LCF also collects information on food and drinks purchased outside of the house, such as restaurant meals and school meals. For household purchases, the quantities are collected in the diaries and also through receipts. This is not possible for eating out, takeaways and some instances of free food. For these items, the Department for Environment, Food and Rural Affairs (Defra) uses estimated portion sizes to calculate weight/volume and, in turn, nutrient intakes. Where possible, whole meals eaten out are split into food components. Demographic characteristics of household members are obtained through a face-to-face interview.

Adjustment factors: We follow the procedure recommended by Defra for adjusting quantities in the NFS to make them more comparable to the EFS. For some types of food, expenditure estimates from the NFS (1980–2000) are lower than those from the EFS (from 2001). Defra suggests applying an adjustment factor. A detailed explanation of the estimation of the NFS adjustment factors can be found in Department for Environment, Food and Rural Affairs (2011).

Purchase data have some advantages over other data that have been used to measure calories over a long time period. The advantage over intake data is that recording food purchases is less sensitive to under-reporting. The existence of such under-reporting in surveys of nutrient intakes is estimated to be around 15.7% for women and 9.5% for men relative to recommended intakes (Bingham et al., 1995; Briefel et al., 1997; Rennie, Coward and Jebb, 2007). On the other hand, purchase data have the disadvantage that they are not at the individual level.

Purchase data also have advantages over food availability data, which record food production and trade and compute food for human consumption as a residual (for example, Bleich et al. (2008)).

A number of studies have shown that food availability data overestimate the time-series trends in calorie consumption in many countries – for example, in India (Deaton and Dreze, 2010), Japan (Dowler and Seo, 1985) and the US (Crane, Lewis and Yetley, 1992).

Wastage: There is no systematic survey of the level of food waste until 2007. Department for Environment, Food and Rural Affairs (2007) suggests that calorie wastage makes up a low fraction of calories (around 11%). The fraction of

wasted food is higher than the fraction of wasted calories. Some part of waste – i.e. cooking waste and removal of inedible parts – is accounted for in the nutrient conversion factors provided by Defra.

Imputation of missing quantity and nutrition data

One of the problems that have confounded research in this area has been the lack of historical data on calories. The LCF and its predecessors include information on expenditure on a large number of food groups back to 1980. They include quantities and nutrient conversion factors for many food groups back to 1980. However, for a subset of foods, we do not have quantity and nutrient conversion factors before 2001. We impute calories using information on expenditures and demographic data for the missing years; details are provided below.

We do not have complete information on food purchased for consumption outside the home; this includes soft drinks, confectionery, snacks, food purchased in takeaways, restaurant meals and alcohol. However, we observe the evolution of expenditures and prices on all goods for the full period 1980–2009 in the LCF. Additionally, we observe quantities and nutrition conversion factors on alcohol, soft drinks and confectionery at home from 1992 and on food, alcohol, soft drinks and confectionery from 2001.

We use information on expenditure and demographics from the LCF and its predecessors and prices from the Office for National Statistics (ONS) to impute real expenditure and calories per real pound spent. In a first step, we use multiple imputation by chained equations (MICE) (Rubin, 1987 and 1996; Schafer, 1997 and 1999; Royston and White, 2011) to impute real expenditure on food out and alcohol in the NFS sample. In a second step, we estimate calories per real pound spent for each category using observed spending trends, prices and demographics. We apply a generalised linear model (GLM) estimator with a log-link function to incorporate abstinence or purchase infrequency. The product of the partially observed and partially imputed objects in the first and second steps – real expenditures and calories purchased per pound spent – is calorie purchases for the two missing categories.

Full details of the procedure and results can be found in Griffith, Lluberas and Lührmann (2013), along with a number of robustness checks. In that paper, we show that a conservative estimate – where we assume that calories per (real) pound spent on the categories eating out and alcohol differ across household types due to differences in diets, but are constant over time – gives similar results, and we show that our imputation method fits the data well.

Expenditure: household surveys versus National Accounts

There is a literature that raises concern about the fact that reporting in household budget surveys has declined, based on comparison of total expenditure in household surveys with total consumption in the National Accounts – for example, Deaton (2005) for the US. According to Attanasio, Battistin and Leicester (2006), the coverage problem is more important in the US than in the UK. The LCF in the UK has historically followed quite closely consumption in the National Accounts; however, there is some concern that recently the coverage has declined (Brewer and O'Dea, 2012).

In this briefing note, we use the data from the LCF and its predecessors as they have been reported. However, it is possible that the reduction in coverage has led to under-reporting of some goods more than others. We now consider how sensitive our results might be to this concern.

We use data from Brewer and O'Dea (2012) to assess the coverage of food expenditure in the LCF and its predecessors. Figure A1 shows the percentage of expenditure captured in the LCF relative to the National Accounts for the three expenditure categories – food at home, alcohol and food out (catering). Note that the National Accounts data may also have measurement errors, but are typically seen as a good benchmark to which to compare household-level data.

Figure A1. Expenditure LCF coverage compared with National Accounts (%)
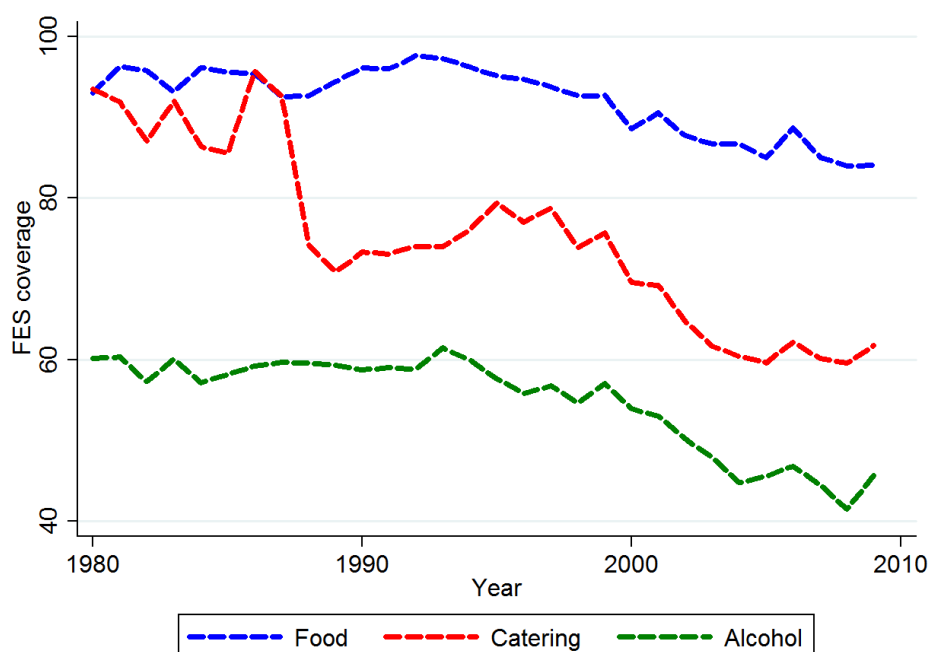
Source: Brewer and O'Dea, 2012.

The level of coverage of food expenditure is relatively high but has declined over time, particularly from the mid-1990s. While the LCF captured 93% of food expenditure in the National Accounts in 1980, coverage has declined to 84% in 2009. The cases of alcohol and food out are more worrisome. Alcohol coverage has declined from 60% in 1980 to 46% in 2009 and food out coverage has declined from 94% to 62% during that period.

We consider the extreme assumption that all of this decline in reporting was due to under-reporting of these goods by the extent of the proportions shown in Figure A1. We gross up the reported and imputed calories by these percentages. Table A1 reproduces the figures for total calories purchased, shown in Table 1, if we grossed up calories. We still find an overall reduction for all household types except for single aged 50 and over, although the declines are smaller. The main points in our analysis remain unchanged.

Table A1. Calories purchased, all food and drinks, using grossed-up calories

	Single under 50	Single 50+	Lone parent	Couple	Family	Other
Calories purchased per household per day						
1980	3,492	3,466	7,742	7,024	11,386	13,140
1985	3,079	3,348	7,537	6,462	10,118	12,086
1990	3,196	3,205	6,500	6,357	9,994	11,296
1995	3,081	3,071	6,540	6,090	9,397	10,371
2000	3,549	3,446	7,450	6,520	10,174	11,228
2005	3,362	3,417	7,214	6,788	10,350	11,968
2009	3,243	3,448	7,092	6,554	9,828	10,851
Percentage, change 1980–2009						
	−7.1	−0.5	−8.4	−6.7	−13.7	−17.4

Note: Household types are: single under 50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data (see text and appendix for details).

Changes in household composition over time

Our data are at the household level. When comparing total calories purchased over time, we need to consider whether household composition has changed. Males and females require different amounts of calories, as do people of different ages. Table A2 shows the official estimated average requirements (EARs) for energy published by the UK Department of Health.

Table A2. Estimated average requirements (EARs) for energy (calories)

Age	Female	Male
4–6	1,545	1,715
7–10	1,740	1,970
11–14	1,845	2,220
15–18	2,110	2,755
19–50	1,940	2,550
51–59	1,900	2,550
60–64	1,900	2,380
65–74	1,900	2,330
75+	1,810	2,100

Source: Department of Health, 1991.

Table A3. Household composition

	1980	1990	2000	2009	All
% of households of each type					
Single <50	3.5	6.5	8.2	7.4	6.4
Single 50+	12.7	13.4	16.6	19.2	14.9
Lone parent	2.7	3.7	6.0	5.6	4.7
Couple	30.2	33.3	32.6	34.9	32.9
Family	32.7	26.4	23.5	20.1	25.9
Other	18.2	16.6	13.0	12.8	15.1
Average household size					
Lone parent	2.8	2.7	2.8	2.8	2.8
Family	4.0	3.9	3.9	3.8	3.9
Other	4.1	3.9	3.8	3.8	3.9
% of household members that are female					
Single <50	45.7	40.3	42.3	44.4	42.8
Single 50+	75.3	70.8	66.0	62.0	68.6
Lone parent	64.6	68.4	66.4	64.8	66.1
Couple	51.4	50.7	50.5	50.5	50.8
Family	49.2	48.3	49.3	50.8	49.2
Other	48.6	48.6	49.6	49.2	48.9
Average age					
Single <50	31.5	31.9	34.4	37.4	33.9
Single 50+	69.7	69.9	69.5	67.7	69.2
Lone parent	36.6	32.5	35.5	36.4	35.2
Couple	54.9	53.4	55.7	57.7	55.2
Family	37.1	37.4	39.2	39.5	38.0
Other	51.8	50.7	52.4	52.0	51.6

Note: Household types are: single <50 (single household, less than 50 years old), single 50+ (single household, aged 65 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors.

In the main text of this briefing note, we report the level of calories by household type and explain that this is because demographic change is concentrated in changes *across* and not *within* household types. In Table A3, we confirm that the main changes in household size were due to the shift in shares *across* these household types. There is relatively little variation within household types, except for a reduction in the share of single 50+ households that are female and an increase in the average age of single households under 50.

In Table A4, we show that the figures in Table 1 are not that sensitive to changes in household composition within these household types. We express calories in per adult male equivalents by using the estimated average requirement levels of calories shown in Table A2. We sum the estimated average requirements of all household members and divide by 2,550 to obtain an estimate of the number of adult male equivalents in the household (if there were one adult male aged 19–50 in the household, this number would be 1). We then divide total calories by that number and show the percentage changes between 1980 and 2009.

Table A4. Changes in calories purchased, all food and drinks, 1980–2009

	Single under 50	Single 50+	Lone parent	Couple	Family	Other
Calories purchased per household per day (from Table 1)						
Percentage change, 1980–2009						
	−20.1	−14.6	−24.0	−20.0	−27.0	−30.0
Calories purchased per adult male equivalent						
Percentage change, 1980–2009						
	−19.6	−16.4	−22.1	−19.8	−23.3	−25.1

Note: Household types are: single under 50 (single household, less than 50 years old), single 50+ (single household, aged 50 or more), lone parent (one adult with children), couple (two adults without children), family (two adults with children) and other (multi-adult households such as couples with adult children or families with grandparents).
Source: Data are from the LCF and its predecessors and include both observed and imputed data.

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