

The potential impacts of banning television advertising of HFSS food and drink before the watershed

Report produced for the Obesity Policy Research Unit

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Executive Summary

- The purchase decisions of the main shopper in a household are an important determinant of what children consume: over 70% of calories eaten by children are consumed in the home.
- We look at the impact of a ban on advertising foods high in fat, salt and sugar (HFSS) on television before the 9pm watershed, using data on the adverts shown in 2015. Under the assumption that firms would not have responded and all banned advertising instead had ‘disappeared’, the exposure of main shoppers in households with children to HFSS adverts would have fallen from an average of 10.5 to 3.8 minutes a day. The share of main shoppers exposed to at least 10 minutes a day would have fallen from 50% to 2.5%.
- There is considerable variation in this decline across households. Main shoppers in low income households and households with an unskilled head of the household would have had larger reductions in their exposure to HFSS adverts.
- However, firms are likely to respond to advertising restrictions by changing their advertising strategies, prices, or product nutrient compositions. The extent to which these responses will impact HFSS purchases following the introduction of a ban is uncertain.
- Purchases are a pre-requisite for consumption. The effect of a ban on reducing HFSS consumption will depend, in part, on whether advertising leads people to switch between similar products (*rivalrous effect*), or expands the size of HFSS markets (*expansionary effect*).

1 Introduction

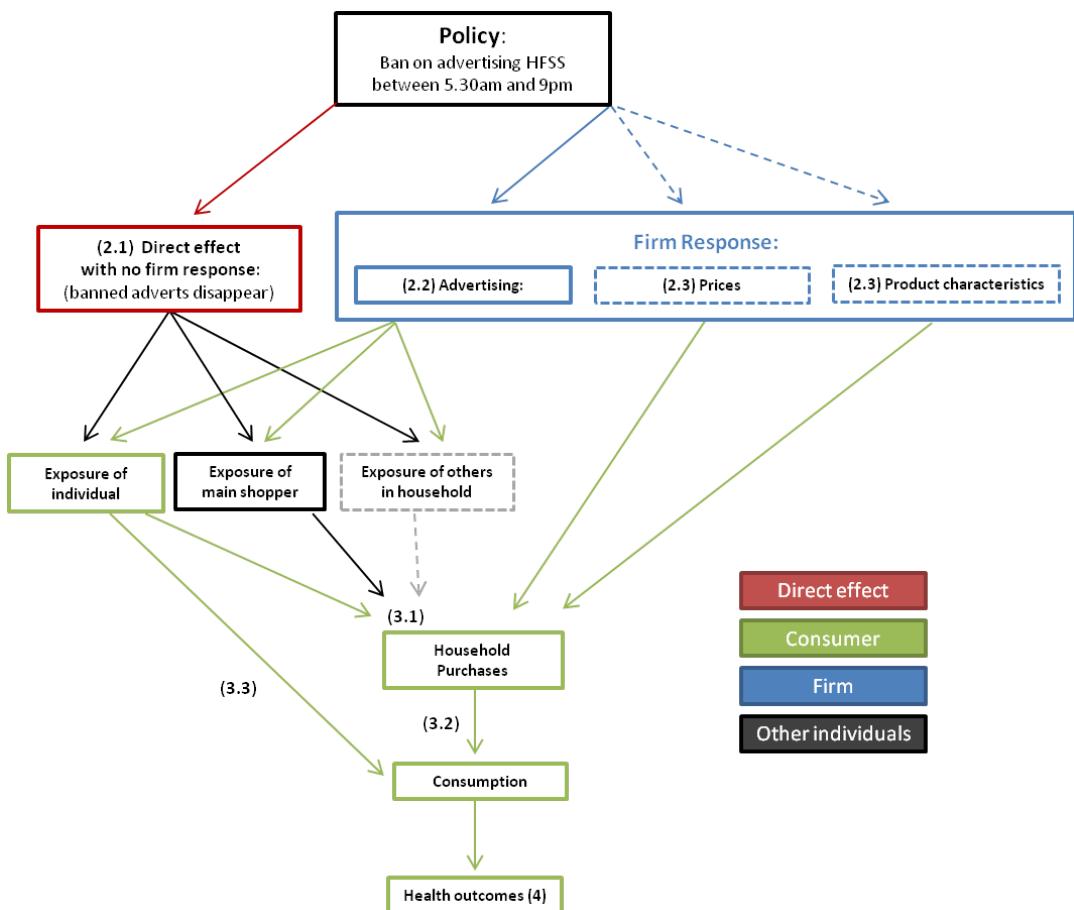
Advertising of high fat, salt or sugar (HFSS) food and drink during children's television programmes has been banned in the UK since 2007. The Government will consult on further advertising restrictions for products high in fat, salt and sugar on TV.

The effects of this reform on health outcomes will depend on a number of factors: how exposure to advertising is affected, how firms respond in terms of prices, reformulation and other behaviours, how these changes affect the purchase and consumption decisions that households and individuals make, how all of this varies across individuals and how reductions in consumption affects health outcomes. Figure 1.1 depicts these channels.

In this report we discuss each channel, and highlight where there is uncertainty about the magnitude of the effects. The numbers in parentheses in Figure 1.1 refer to the section number in this report (for example, we discuss the direct effect of policy on advertising exposure assuming no firm response in Section 2.1). In Section 2.1 we describe how advertising exposure would have differed in 2015, had the ban been in place and firms had not responded. In Sections 2.2 and 2.3 we discuss how firms might respond to such a ban, for example, by changing their advertising strategies, adjusting prices or reformulating products. In Section 3 we discuss how changes in the exposure of different individuals to adverts for HFSS may feed through to choices over purchases and consumption of HFSS. In a final section we discuss (very briefly) how consumption will feed through into health outcomes; this is an area that we leave mainly for future work.

In Section 2.1 we focus primarily on the effect of a ban on the exposure of the main shopper in households with children to television adverts for HFSS food and drink. This is because over 70% of calories consumed by children are consumed in the home, and are typically purchased by the main shopper – see Section 3.1. It is therefore important to understand how the advertising exposure of the main shopper may change under a ban. We estimate exposure of main shoppers in households with children to HFSS advertising using 2015 data from AC Nielsen on the timing of adverts and from the Kantar Worldpanel on television viewing habits of main shoppers. This differs from the impacts measure that we have used in previous reports, which measures the number of pairs of eyes that see individual adverts. In some parts of the report we provide supplementary statistics using the impacts data.

Figure 1.1: Effects of advertising restrictions



Notes: Numbers in parentheses refer to the section in the document in which the pathway or effect is discussed.

2 Impact on advertising exposure and the market environment

In this section we discuss the potential impact of extending the ban on advertising exposure and the market environment (prices, product characteristics).

2.1 Advertising exposure of main shoppers in households with children to television adverts if there is no response by firms

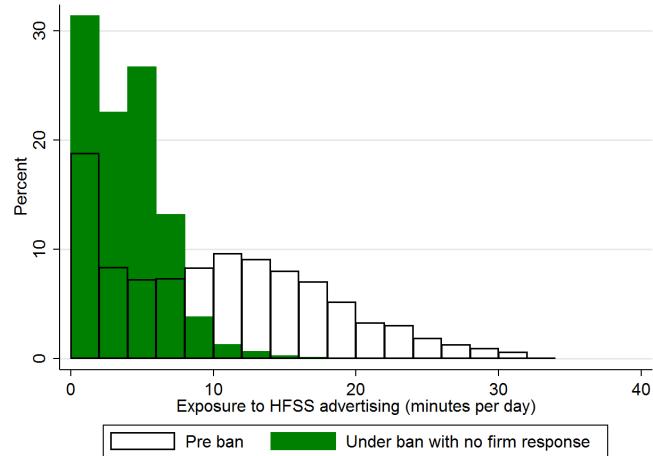
We estimate the exposure of main shoppers in households with children (“main shoppers”) to television adverts of HFSS food and drink during the calendar year 2015 using data from: (i) Kantar Worldpanel on the self-reported viewing habits of the main shopper in 6,668 households with children, and (ii) AC Nielsen data on the product, timing and channel of all food and drink adverts on television. We use product level nutrient information from the Kantar Worldpanel to classify products as HFFS.¹

We describe how exposure would have changed if the pre-watershed restrictions had been in place in 2015 and there was *no response by firms*. This assumes that all advertising of HFSS food and drink before the watershed would have ‘disappeared’ following the introduction of the ban i.e. it would not have moved to a different time, channel or media type. This is clearly a restrictive and unrealistic assumption, nonetheless it provides a useful benchmark. We discuss the potential ways firms might adjust advertising in response to extended restrictions in Section 2.2.

Figure 2.1 shows the distribution of estimated exposure to HFSS advertising (minutes per day) based in 2015 (labelled “Pre ban”) and the distribution of estimated exposure to HFSS advertising had the ban been in place in 2015 and firms had not responded in any way (labelled “Under ban with no firm response”). Each bar shows the percentage of main shoppers (in households with children) with the exposure level indicated on the horizontal axis. The impact of the ban would have been to substantially reduce the exposure of main shoppers to HFSS. In the absence of the ban, 50% of main shoppers would have been exposed to at least 10 minutes per day of HFSS advertising, while in the presence of the ban only 2.5% would have been.

¹In Appendix A we detail how we estimate advertising exposure of the main shopper; this is the same as in the previous report “Exposure of main shoppers in household with children to advertising of food and drink high in fat, sugar and salt”, 26 September 2018. In Appendix B we detail how we classify products by HFSS; this is the same as in ‘TV advertising of food and drink, by Nutrient Profile Model score’, May 2018.

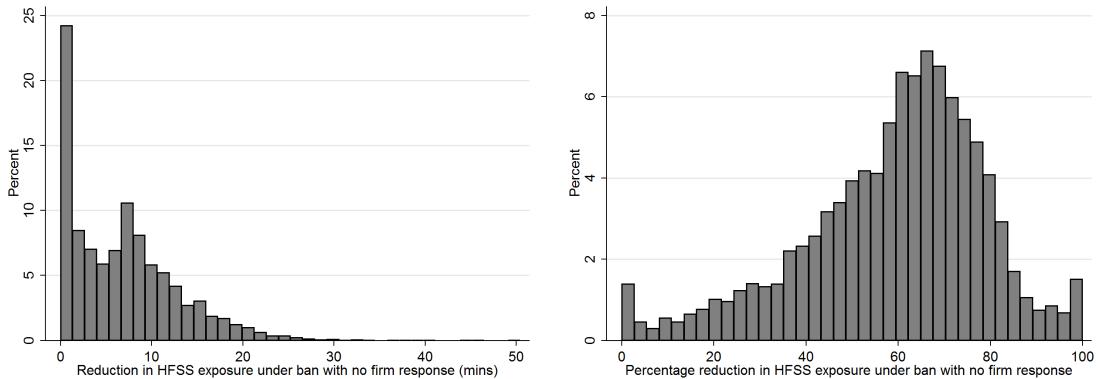
Figure 2.1: Main shoppers' daily exposure to HFSS advertising



Notes: Exposure measure is constructed as described in A and HFSS is defined in Appendix B. Histograms drawn over 6668 main shoppers, with a bin width of 2 minutes.

There is substantial variation across main shoppers in terms of how large this reduction would have been; the magnitude of the reduction depends on how much television they watched, when they watched it, and on what channel. Figure 2.2 shows the distribution of the size of the reduction in HFSS exposure that main shoppers would have experienced in minutes (left hand panel) and in percentage terms (right hand panel). Over 50% of individuals would have experienced at least a 6 minute reduction in their HFSS exposure and over two thirds of individuals would have experienced at least a 50% reduction in their HFSS exposure.

Figure 2.2: Reduction in main shoppers' daily exposure to HFSS advertising under a pre watershed ban, assuming no firm response



Notes: Exposure measure is constructed as described in Appendix A and HFSS is defined in Appendix B. Histograms drawn over 6668 main shoppers, with a bin width of 2 minutes (left hand panel) and 2 percentage points (right hand panel).

Variation by household demographics

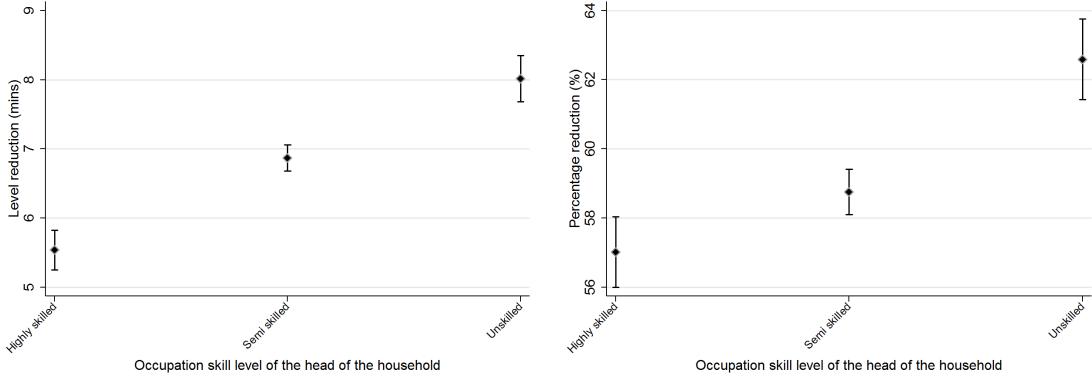
Table 2.1 shows how the reduction in exposure of the main shopper would have varied across different types of household (household types are defined in Appendix C). The reductions in exposure would have been larger for main shoppers in households with an unskilled head of the household: these main shoppers would have seen a fall of 8 minutes per day, compared with less than 6 minutes for main shoppers in households with a highly skilled head, see Figure 2.3. There are similar patterns with income: the reduction in exposure for main shoppers in the bottom income quartile would have been almost 7.5 minutes, compared with 6 minutes for main shoppers in the top income quartile, see Figure 2.4. The figures for all the remaining household type classifications are contained in Appendix C.

Table 2.1: *Reduction in main shopper's exposure to HFSS advertising under ban where there is no firm response by household type*

Household type	(1)	(2)	(3)	(4)	(5)
	Pre ban	no firm response	Under ban Mean main shopper exposure to HFSS advertising	Level reduction under ban	% reduction under ban
All households	10.52		3.77	6.75	59.04
Young kids	9.83		3.45	6.38	59.90
School kids	10.71		3.88	6.83	58.41
Older kids	12.34		4.41	7.92	59.38
Not working	11.26		3.81	7.45	61.52
Part time	10.81		3.81	7.00	59.11
Full time	9.98		3.72	6.26	57.89
Highly skilled	8.80		3.26	5.54	57.02
Semi skilled	10.76		3.89	6.87	58.76
Unskilled	12.07		4.05	8.02	62.59
Income quartile 1	11.31		3.90	7.40	61.14
Income quartile 2	10.92		3.90	7.02	59.75
Income quartile 3	10.46		3.85	6.61	58.11
Income quartile 4	9.57		3.53	6.04	57.12
IMD quartile 1	10.18		3.73	6.45	58.07
IMD quartile 2	10.38		3.79	6.58	57.97
IMD quartile 3	10.16		3.63	6.53	58.83
IMD quartile 4	10.95		3.84	7.12	60.61
Not obese	10.25		3.70	6.54	58.52
Obese	11.59		4.13	7.45	59.70

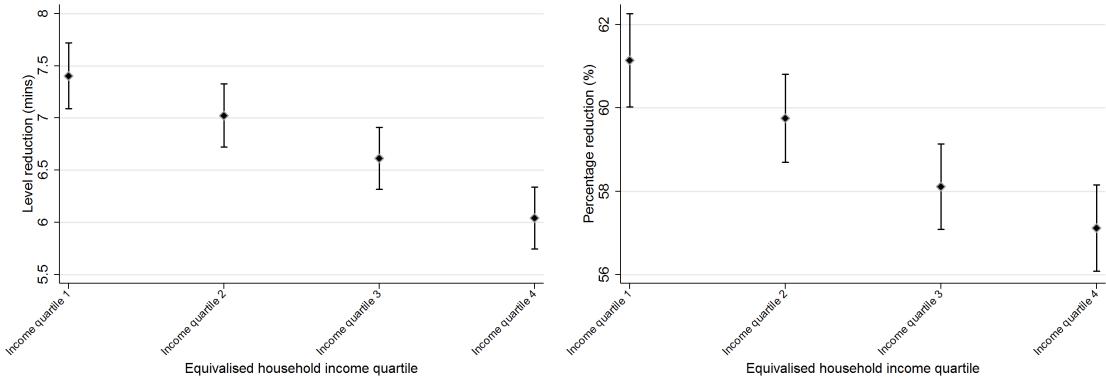
Notes: We estimate the exposure of main shoppers to HFSS foods pre ban and under the ban assuming no firm response as described in Appendix A. Columns (2) and (3) shows the mean of these exposure measures across main shoppers in each household type. We construct the reduction and percentage reduction between exposure pre-ban and under the ban assuming no firm response for each main shopper; columns (4) and (5) show the mean across main shoppers of these variables in each household type. Household type definitions are provided in Appendix C.

Figure 2.3: Reduction in main shopper's HFSS exposure by head of household skill level



Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by the occupation skill of the head of the household. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.

Figure 2.4: Reduction in main shopper's HFSS exposure by equivalised household income quartile



Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by the income quartile of the household. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.

Variation across food groups

Table 2.2 shows how the reduction in exposure would have been distributed across HFSS food groups. Columns (2) and (5) describe the mean exposure of main shoppers to HFSS adverts within each food group prior to the ban. Columns (3) and (6) show what the mean exposure to HFSS adverts within each food group would have been under the ban had firms had not responded in any way. The reductions would have been larger (in level terms) among product categories that constituted a larger share of exposure pre ban, but the declines across foods groups would have been approximately proportional. This indicates that the ban, assuming no firm response, would not have had a big impact on the composition of HFSS advertising exposure across food groups.

Table 2.2: Reduction in main shoppers' exposure to advertising of HFSS different food groups, assuming no firm response

(1)	Mean main shopper exposure to HFSS (mins per day)			(5)	Mean main shopper exposure to HFSS (mins per day)					
	Under ban (no firm response)				Under ban (no firm response)					
Food group	Pre ban	Change	% change		Pre ban	Change	% change			
Confectionery & Snacks	3.29	2.16	60.0	Chocolate	1.90	1.22	59.7			
				Crisps	0.65	0.43	58.6			
				Sweets	0.45	0.31	62.2			
				Other Confectionery & Snacks	0.29	0.20	61.3			
Restaurants & Bars	1.64	1.09	61.2	Fast Food Restaurants	1.51	1.00	61.0			
				Independent Restaurant	0.13	0.09	61.1			
				Chain Restaurants	0.00	0.00	69.2			
				Pubs & Bars	0.00	0.00	54.3			
Drinks	0.57	0.36	59.3	Soft Drinks	0.15	0.08	54.2			
				Hot Beverages	0.12	0.08	63.3			
				Squash	0.09	0.06	61.6			
				Sports & Energy & Health Drinks	0.08	0.05	55.0			
				Fruit Juice & Smoothies	0.05	0.03	64.9			
				Drink - Multi Product	0.03	0.02	54.8			
				Water	0.03	0.02	59.5			
				Childrens Drinks	0.02	0.01	53.1			
				Iced Tea & Iced Coffee	0.00	0.00	-			
Food Apps	0.00	0.00	-	Milk Drinks	0.00	0.00	-			
				Just Eat	0.00	0.00	-			
Other	5.00	3.14	57.5	Hungry House	0.00	0.00	-			
				Dairy	1.34	0.87	58.4			
				Alcohol	1.11	0.55	45.7			
				Other Food Cupboard	0.60	0.41	61.6			
				Cereal	0.55	0.38	61.4			
				Cooking Sauces	0.47	0.31	59.3			
				Frozen Food	0.45	0.29	60.0			
				Bakery	0.20	0.14	60.4			
				Meat & Poultry	0.18	0.13	62.2			
				Delicatessen & Chilled Food	0.06	0.04	61.2			
				Ready & Prepared Meals	0.04	0.02	58.4			
				Fish	0.01	0.01	64.4			
				Baby & Toddler Food	0.00	0.00	98.7			
				Fruit	0.00	0.00	-			
				Sponsorship	0.00	0.00	-			
				Salad & Vegetables	0.00	0.00	-			
				Free From	0.00	0.00	-			
Total	10.52	6.75			10.52	6.75				

Notes: Brands are categorised into food groups (column (1)) and sub food groups (column (5)) where these categorisations are as described in 'TV advertising of food and drink' report, May 2018. Columns (2) and (6) show the mean daily HFSS exposure in minutes to food and drink adverts by food group and sub food group respectively prior to the ban. Columns (3), (4), (7) and (8) show the mean change and percentage change in daily HFSS exposure (minutes) to food and drink adverts by food group and sub food group respectively, under the ban on HFSS advertising pre-watershed and assuming no firm response.

2.2 Advertising response

Section 2.1 describes how the exposure of main shoppers in households with children to television advertising of HFSS foods would have been affected by a ban on advertising HFSS before the 9pm watershed *if firms had not responded at all to the ban*. In practice, it is likely that firms would respond to such a ban in a number of ways. They might shift HFSS adverts to unrestricted post watershed slots, shift HFSS advertising to other advertising mediums such as the internet, and also change what products they advertise. In this section we discuss these different margins, and what we know about their relative magnitude.

2.2.1 Advertising of HFSS may shift to post watershed slots

One way that firms may respond to a ban on advertising HFSS products before the 9pm watershed is by moving adverts to post watershed slots. In 2015, 95% of all HFSS food and drinks brands that were ever advertised were advertised during slots both before and after the watershed. This suggests that a majority of firms were willing to advertise both pre and post watershed, even without being subject to timing restrictions, which may make them more likely to adjust the timing of their adverts (compared with firms that advertise exclusively pre-watershed).

There is evidence that this happened following the introduction of the 2007 ban on advertising HFSS products during children's television. Ofcom found that between 2005 and 2009 the total number of HFSS spots on non-children's television rose by 124% (from 1.4 million to 3.2 million). Much of this would have been driven by a large increase in non-public service broadcast (PSB) channels during this time. However, it is also likely that it reflects, at least in part, a response to restrictions on advertising during children's television. A smaller increase in HFSS spots during non-children's programming was also seen on PSB channels (4% increase).

Adams et al. (2012) study how advertising exposure was affected by the introduction of the 2007 ban. They compare advertising in a week six months prior to the introduction of restrictions to a week six months after restrictions were introduced. They find almost universal adherence to the restrictions but that exposure of children to HFSS food advertising did not change between these weeks. This suggests that HFSS adverts were shifted to unrestricted slots.

The magnitude of this response is uncertain and will depend on the extent to which firms respond along other margins. We use data from AC Nielsen on the number of child and adult impacts during adverts shown in 2015 to get an idea of the potential size of this form of firm response. We do the following thought experiment: what would have happened to child and adult impacts (in 2015) if HFSS adverts aired 5–9pm had moved to

9–11pm (on the same channel) and those aired 5.30am–5pm had moved to 11pm–5.30am (on the same channel)?² Some HFSS adverts, especially those for dairy, desserts and meat products, that were (hypothetically) shifted to the post watershed period would have seen an increase in their impacts. If all banned adverts had been shifted to post watershed slots in the way described, then 70% of the reduction in child impacts would have been offset due to children seeing more advertising after the watershed. We also find that this would have led to a 5% increase in the number of adult impacts for the shifted HFSS adverts.

2.2.2 Advertising may shift to other mediums

Another potential unintended consequence of the restrictions on television advertising is to encourage firms to move the advertising online (faster than they would otherwise have done so), potentially leading to higher exposure among some groups. The amount of time individuals are spending online is increasing; according to Ofcom’s 2018 “Media Use and Attitudes” report, the average internet user now spends 24 hours a week (the equivalent of a whole day) online. The extent to which firms may move advertising to other mediums is highly uncertain. We lack data on the online advertising of firms, and the exposure of children and adults to these adverts.

2.2.3 Advertising may shift to product ranges or related non-HFSS products

Many firms advertise and sell both HFSS and non-HFSS products (e.g. Coca Cola offer both Diet Coke and Original Coke). Firms that currently advertise a product that is HFSS but also sell non-HFSS products within the same market may respond to extended restrictions by advertising their non-HFSS products in place of their HFSS products; for example, Coca Cola could replace all of their Original Coke adverts before the 9pm watershed with adverts for Diet Coke.

One way to gauge the potential size of this response is to look at the number of firms that sell both HFSS and non-HFSS products. For example, Cadbury’s 2015 product offering consisted only of chocolate products, all of which are HFSS, which means that they could not have replaced adverts for HFSS products with adverts for non-HFSS products that they also sold. Table 2.3 shows the percentage of HFSS products advertised by firms in 2015 that also advertises non-HFSS products in different food groups.

²Specifically, we assume that an advert shown 5–9pm would have received the same number of impacts as the average advert shown 9–11pm (on the same channel), and an advert shown 5.30am–5pm would have received the same number of impacts as the average advert shown 11pm–5.30am (on the same channel). The average number of child impacts that an advert got in 2015 during the period 5.30am–5pm is 1,400, 5–9pm is 3,060, 9–11pm is 2,070 and 11pm–5.30am is 335. The average number of adult impacts that an advert got in 2015 during the period 5.30am–5pm is 14,400, 5–9pm is 37,200, 9–11pm is 38,500 and 11pm–5.30am is 10,300.

The markets in which firms would have been unable to respond along this margin are chocolate, sweets, other confectionery & snacks, and alcohol. The restaurant market is a market in which all firms would have been able to do so, given that they offer such a large variety of products. In 2015, McDonald's took this approach with its strategy, airing adverts that featured carrots rather than any of their HFSS products. The markets for cereal, dairy and soft drinks are markets in which many of the products that were advertised are HFSS but most firms also offered non-HFSS products that they could have advertised in their place. Most firms that advertised HFSS crisps also offered at least one non-HFSS equivalents; these were typically a low salt equivalent and make up a relatively small market share.

The extent to which a switch from advertising HFSS products to a non-HFSS product would reduce purchases of HFSS foods depends on how advertising affects purchasing. We discuss this further in Section 3.1.

Table 2.3: Markets in which firms offer both HFSS and non-HFSS products

(1)	(2)	(3) % of HFSS products advertised by firms that also advertise non-HFSS products
Food group	Sub food group	
Confectionery & Snacks	Chocolate	0
	Crisps	85.9
	Sweets	0.0
	Other Confectionery & Snacks	0.0
Restaurants & Bars	Fast Food Restaurants	100.0
	Independent Restaurant	100.0
	Chain Restaurants	100.0
	Pubs & Bars	100.0
Drinks	Soft Drinks	83.6
	Hot Beverages	100.0
	Squash	88.4
	Sports & Energy & Health Drinks	97.6
	Fruit Juice & Smoothies	66.7
	Alcoholic Drinks	0.0
	Water	100.0
	Children's Drinks	100.0
	Milk Drinks	-
	Iced Tea & Iced Coffee	-
Food Apps	Just Eat	-
	Hungry House	-
Other	Dairy	88.7
	Alcohol	0.0
	Other Food Cupboard	79.2
	Cereal	99.9
	Cooking Sauces	96.4
	Frozen Food	68.7
	Bakery	94.4
	Meat & Poultry	97.7
	Delicatessen & Chilled Food	62.5
	Ready & Prepared Meals	96.1
	Fish	97.7
	Baby & Toddler Food	0.0
	Salad & Vegetables	-
	Fruit	-
	Free From	0.0

Notes: Brands are categorised into food groups (column (1)) and sub food groups (column (2)) where these categorisations are as described in 'TV advertising of food and drink' report. Column (3) describes the percentage of HFSS products advertised within a market where the firm also advertised non-HFSS products within the same market, calculated using 2015 data. Food groups in which column (3) contains “-” do not contain HFSS products.

2.3 Other margins of response

Firms may also respond to advertising restrictions by adjusting other choices that they make, including over prices and the nutrient composition of their products.

2.3.1 Prices

There is evidence that restrictions on advertising influence what prices firms set. If restricting advertising of HFSS foods leads firms to raise the prices of HFSS products, then this may act to reinforce the impact of the policy (as people may both be exposed

to less advertising and face higher prices). On the other hand, it is possible that firms might respond to the restrictions by lowering prices, which will act to offset the impact of the policy on purchases. Whether advertising restrictions will lead to price reductions or price rises depends in part on the nature of advertising. If advertising plays the role of informing consumers about prices, then restricted advertising can lead to a lessening of competition in the market, and higher prices. However, if advertising acts to persuade people to purchase a product (without necessarily providing them with information about the product's price or quality), then restricting advertising may lead consumers to be less willing to pay for the products, giving firms an incentive to lower their prices.

Two examples of studies that provide evidence on the effects that restrictions (or their removal) on advertising have on price are: (i) Glazer (1981) compares supermarket food prices in Queens, New York and Long Island, over a two-month period in 1978 when a newspaper strike limited the price information that could be communicated through advertising in Queens. He finds relative prices rose in Queens during the strike, before returning to normal levels. (ii) Milyo and Waldfogel (1999) study the 1996 US Supreme Court ruling that overturned Rhode Island's ban on advertising the prices of alcoholic beverages and find it led to substantial reductions in price.

Dubois et al. (2018) study the effects of television advertising in the UK market for crisps. In this market advertising primarily consists of celebrity endorsements, and does not convey direct information about product prices. They find that one role of advertising in this market is to lead consumers to be less responsive to changes in the price of products, which has the effect of leading crisp firms to charge higher prices than if they were unable to advertise. This suggests that a ban on television advertising of crisps would lead to the firms intensifying their price competition and lowering their prices.

2.3.2 Product characteristics

Firms may also respond to advertising restrictions by altering product characteristics to enable them to continue to advertise their products (i.e. reformulate their product to create a non-HFSS product). The incentive for firms to reformulate their products depends on how easy it is to alter their product without noticeably changing the characteristics which lead consumers to purchase it.

There are some markets in which reformulation would be very difficult. For example, in the confectionery market, products typically have a nutrient profile score far above the threshold and we do not observe many non-HFSS confectionery products on offer. In other markets, such as the markets for cereal or yogurt, both HFSS and non-HFSS products are offered and advertised. This suggests that it would be technologically feasible for firms within these markets to either reformulate their products or to introduce new products that would be non-HFSS. Table 2.4 shows the percentage of products that are HFSS and

were advertised in 2015, in each food group. This gives an indication of the scope within each market to reformulate products to make them non-HFSS.

It is uncertain whether this would lead the advertising restrictions to be more or less effective than in the absence of this response. On the one hand, if firms change the nutrient composition of their products and consumers switch to (or carry on) buying these non-HFSS alternatives, this could act to reduce purchases of non-HFSS foods. On the other hand, if firms create or reformulate products in order to continue to advertise their brand, and advertising of the brand stimulates demand for both HFSS and non-HFSS products, then the reduction in HFSS purchases could be less than anticipated. We discuss these effects further in Section 3.1.

Table 2.4: *Percentage of products advertised that are HFSS*

(1)	(2)	(3)
Food group	Sub food group	% of product advertised that are HFSS
Confectionery & Snacks	Chocolate	100.0
	Crisps	94.4
	Sweets	97.5
	Other Confectionery & Snacks	98.3
Restaurants & Bars	Fast Food Restaurants	100.0
	Independent Restaurant	100.0
	Chain Restaurants	100.0
	Pubs & Bars	100.0
Drinks	Soft Drinks	40.5
	Hot Beverages	18.4
	Squash	53.5
	Sports & Energy & Health Drinks	60.3
	Fruit Juice & Smoothies	41.3
	Drink - Multi Product	100.0
	Water	22.1
	Childrens Drinks	84.8
	Milk Drinks	0.0
	Iced Tea & Iced Coffee	0.0
Food Apps	Just Eat	-
	Hungry House	-
Other	Dairy	66.8
	Alcohol	100.0
	Other Food Cupboard	66.8
	Cereal	68.0
	Cooking Sauces	56.7
	Frozen Food	30.9
	Bakery	50.1
	Meat & Poultry	49.8
	Delicatessen & Chilled Food	82.8
	Ready & Prepared Meals	70.4
	Fish	16.3
	Baby & Toddler Food	12.5
	Salad & Vegetables	0.0
	Fruit	0.0
	Free From	100.0

Notes: Brands are categorised into food groups (column (1)) and sub food groups (column (2)) where these categorisations are as described in ‘TV advertising of food and drink’ report. Each brand observed in the advertising data is matched to all relevant products in the Kantar data, as described in Appendix B. Column 3 describes the percentage of products advertised in 2015 within that sub food group that are HFSS.

3 Consumption response

3.1 Exposure → purchases

Purchases are a necessary prerequisite to consumption, which in turn affects health outcomes. It is therefore important to understand how exposure to advertising affects food and drink purchases. Most of the food that children eat has been purchased by their parents. Table 3.1 shows that the share of calories and added sugar that each age group consumes inside the home is high, especially for the youngest children.

Table 3.1: *Share of sugar and calories eaten in the home by age*

(1) Age	(2) Share of added sugar eaten in the home	(3) Share of calories eaten in the home
1-5	76.49	79.44
5-10	66.40	70.84
10-15	65.42	71.00
15-20	67.50	73.43

Notes: Column (2) and (3) describe the mean share of added sugar and calories that are eaten inside the home by individuals between 2008 and 2014, as recorded in the National Diet and Nutrition Survey.

This means that the purchase decisions of the main shopper in the household are an important determinant of the food and drinks available for children to consume. Advertising exposure of all household members is likely to influence the purchase decisions made by the main shopper. There is considerable uncertainty over the extent to which the advertising exposure of children affects the purchases made by the parent.

There is an extensive marketing and economics literature that studies how advertising affects purchasing decisions (Bagwell (2007)). The effects of advertising on the purchase decision are potentially complex, and challenging to estimate. It is important to distinguish between the *rivalrous* and *expansionary* effects of advertising. Rivalrous advertising leads consumers to switch between rival brands (i.e. increased purchases of one product come at the expense of another product in the same market), whereas expansionary advertising leads to an increase in purchases in the market as a whole. For example, an advert for Coca Cola may lead a consumer to buy Coke instead Pepsi (rivalrous effect) or to buy Coke instead of drinking tap water (expansionary effect). Gasmi et al. (1992) find that advertising of Coca Cola has strong and significant adverse effects on the demand for Pepsico products, whereas the advertising of Pepsico products has a weak stimulating effect on demand for Coca Cola products. The rivalrous and expansionary effects have different implications for the aggregate consumption of HFSS food and drink: switching from Pepsi to Coke leads to no change in sugar purchased, whereas switching from water to Coke leads to a large increase. In their study of the effects of television advertising in the crisps markets, Dubois et al. (2018) find evidence that brand level advertising tends

to lead some consumers to switch to the advertised brands from rival brands, but it also leads to an overall expansion in demand for crisps.

An additional consideration is that the effect of advertising on purchasing is unlikely to be the same for all consumers. If people who buy a lot of HFSS food have low advertising exposure, or are not particularly responsive to advertising, then restricting advertising is unlikely to have a large effect on their purchases. This means that the policy will be less effective at targeting those most at risk from negative health outcomes. It is therefore important to model how different people's purchases respond to advertising, and not to just assume a common aggregate effect.

3.2 Purchases → consumption

The main shopper buys food and drink that is consumed by all household members; as Table 3.1 shows, the bulk of calories are consumed at home. The path from purchases to consumption depends on the intra-household allocation of food and drink between members e.g. is it the case that the children consume all the biscuits and the adults consume all the salad? This will impact the extent to which a reduction in purchases induced by advertising restrictions leads to consumption falls for different household members. There is a large literature that studies how resources are allocated within households; one particularly relevant study is Chesher (1998) who uses data from the UK National Food Survey on household food acquisitions to estimate individual consumption from household data. In future work we will study further the relevance of this literature for understanding the potential impacts of advertising restrictions.

3.3 Exposure → consumption

Exposure to an advert could act to both increase the probability that you buy a product, but also increase the probability that you consume a product, conditional on already having purchased it. For example, if you have already bought Skittles and have them in your home, an advert for Skittles may make you more likely to consume those skittles.

Russell et al. (2018) perform a meta-analysis on the effects of exposure to television advertising on immediate consumption of food in experimental settings. They find that children (2-14 year olds) exposed to food advertising on television consume, on average, 60 kcal more than children exposed to nonfood advertising. The average length of exposure to television advertising was 4.4 minutes (with exposure ranging from 45 seconds to 8 minutes), but they find no association between the length of advert exposure and the size of the effect.

Advertising may shift who consumes food within a household, or the times at which things are consumed. An increase in consumption may in turn make consumers more likely to make additional purchases e.g. if, after I see an advert for skittles advert, I eat skittles that I had been planning to eat on Saturday, I may well buy another pack of skittles for Saturday. Therefore, we also need to understand the extent to which consumption decisions feed back into purchase decisions.

4 Consumption → health outcomes

There is a large literature in epidemiology that looks at how consumption affects health outcomes and related savings to the government. In recent work, Briggs et al. (2017) have modelled the impact of food choices onto health outcomes using a comparative risk assessment model and Public Health England and the Department of Health have developed a weight management economic assessment tool. These models estimate the impact of the change in diet on risk factors for a range of diseases, and then use epidemiological models to link the risk factor to the prevalence of the disease. These approaches could be used to estimate the effect of reduced consumption induced by advertising restrictions on health outcomes.

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APPENDIX

The potential impacts of banning television advertising of HFSS
food and drink before the watershed
Report produced for the Obesity Policy Research Unit

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February 8 2019

A Exposure Measure

This appendix is replicated from the previous report “Exposure of main shoppers in household with children to advertising of food and drink high in fat, sugar and salt”, 26 September 2018.

In order to construct the exposure measure we use both the Kantar media data and the Nielsen advertising data. The media data tells us which television shows, channels and slots the main shopper in each household regularly watches, as well as the region in which they live (and therefore watch television). Combining this with the advertising data (which tells us what brands were advertised on each show, channel (where channel is defined at the regional level) or slot) we are able to create a measure of how likely the main shopper in each household was to have seen each advert. This measure depends on:

1. Whether or not the advert was shown during television that the main shopper says they watch regularly; and
2. How many other television ‘items’ the main shopper watches regularly during the same half hour period.

If the advert is prior to or following a show asked about in the media data we do this as follows:

- Create an indicator for each advert to indicate if it is prior to or following a show that the main shopper watches regularly (which was shown in the region where they live)
- For each half hour period throughout 2015 we calculate how many shows shown during that half hour period the main shopper says it watches regularly.
 - If there is only one show that the main shopper watches regularly during the half hour period we say the main shopper saw it with probability 1.
 - If there are n shows that the main shopper watch regularly during that timeslot we say the main shopper saw it with probability 1/n

If the advert is not prior to or following a show asked about in the media data we do this as follows:

- Create an indicator for each advert to indicate if it is on a channel that the main shopper watches regularly (and which is shown in the region where they live) AND during a slot that the main shopper watches regularly.
- For each half hour period throughout 2015 we check to see if any there are any shows that the main shopper watches regularly during that period.

- If there are shows that they watch regularly during a given half hour period, we assume they are watching one of the shows they have said they watch regularly. This means we assume that they are not watching any of the other channel during that timeslot say they watch regularly (unless this coincides with a show they watch regularly).
- If there are no shows that the main shopper watches regularly during that half hour period we calculate how many different channels they have said they watch regularly during that half hour period.
 - If there is only one channel that the main shopper watches regularly during the half hour period we say the main shopper saw it with probability 1.
 - If there are n channels that the main shopper watches regularly during the half hour period we say the main shopper saw it with probability $1/n$.

In order to get a measure of the exposure of the main shopper to advertising for each brand we then multiply this measure of how likely the main shopper was to have seen the advert by the length of the advert.

Adjustment: When a main shopper says they watch a show, channel or timeslot regularly, they are in practice unlikely to have watched the entirety of that show, channel or timeslot every time. In this case the exposure measure computed as described above will overestimate the exposure of main shoppers to HFSS advertising.

To account for this we adjust our exposure measure by comparing the implied total daily television viewing time if we assume individuals watch the whole of each slot they say they watch regularly, with the official reported measures of total daily television consumption by Ofcom.

If we assume that the main shoppers in our data watched every minute of every slot they say they watch regularly, this would imply they watch on average 291 minutes of television a day (e.g. If they say they watch television regularly on weekdays between midday and 2pm this would implies they watched $(5*120)/7 = 85$ minutes a day). Ofcom estimates (based on official BARB figures) that the average individual in 2015 watched 216 minutes of television a day. We therefore adjust our results by multiplying our exposure measure by 0.74 ($=216/291$). This can be interpreted as assigning a probability of $0.74/n$ to a main shopper watching a given item that they watch regularly rather than a probability of $1/n$.

Note that this changes only the reported magnitudes of minutes of exposure seen by main shoppers, and not the comparisons across households (because we adjust the exposure measure by the same fixed factor for all households).

Limitations:

- As noted above, there is a portion of exposure that we will not capture as only the most popular shows and channels are asked about in the media data.
- The exposure measure as described counts main shoppers as likely to have seen a given advert if it is during television they watch regularly, but not television that they watch sometimes or hardly ever. In Appendix ?? we describe an alternative exposure measure that also takes account of television that main shoppers watch sometimes.
- In calculating how many television ‘items’ the main shoppers watches regularly during a given half hour period we do this differently for shows and channels:
 - As most channels are 24 hours, during any timeslot that the main shopper says they watch regularly, the likelihood that the main shopper was watching each channel it says it watches regularly is $1/n$ where n is the number of channel that they watch regularly. This may overestimate exposure as a small subset of stations are not shown 24 hours a day.
 - When a main shopper says that they watch a given show regularly, whether or not this coincides with another show that they watch regularly depends on the television schedule.
 - The information recorded in the advertising data provides a partial insight into the television schedule (it tells us the shows that are before and after each advert and the timing of the advert). However, in so far as a show is shown without any food or drink adverts during it we will not have a record of it.
 - This means that we are likely to overestimate the likelihood of individuals being exposed to adverts during shows that they watch regularly.
 - Consider the following example: A main shopper says they watch both Emmerdale and The Big Bang Theory regularly, both of which are shown at the same time. A food advert is shown during Emmerdale but all adverts shown during The Big Bang Theory are for non food and drink products and therefore we do not observe them in our data. As all adverts during Emmerdale are during television that the main shopper says they watch regularly we would say they were likely to have seen them. However we would assign probability 1 to this event rather than probability $1/2$ as we would not observe the adverts during The Big Bang Theory.

B Definition of HFSS

This appendix is replicated from the previous report ‘TV advertising of food and drink, by Nutrient Profile Model score’, May 2018.

In order to distinguish between advertising that is HFSS and non-HFSS we construct a nutrient profile score for each brand in the Nielsen data. We do this by matching the brand recorded in the Nielsen data to products indicated in the Kantar Worldpanel for 2015. Note that it is often the case that a brand in the Nielsen data encompasses many brands or products in the Kantar data; we describe below how we treat these brands.

The Kantar Worldpanel includes information on the nutritional composition of food and drink products purchased by the households in the sample. The Kantar Worldpanel data contain information on the energy (kj), sugar, saturated fat, salt, protein and fibre content at the individual product (barcode) level. Where necessary we supplement this information with information on nutritional content of products from other sources, as detailed in the appendix to Report ‘TV advertising of food and drink, by Nutritional Profiling Model score’. We apply the Nutritional Profiling Model (NPM) to these data to calculate an NPM score for each brand advertised.

A product is defined as HFSS if it has an NPM score above or equal to 4 for foods and 1 for drinks. In order to describe which adverts are for brands that are above or below this threshold we define three sets of adverts:

1. adverts for brands that contain products all of which have an NPM score below the threshold.
2. adverts for brands that contain products all of which have an NPM score equal to or above the threshold. Note that we treat all alcohol as having a NPM score above the threshold.
3. adverts for brands (or ranges) that contain some products with an NPM score that is below, and some product with an NPM score that is above or equal to the threshold, This includes three different types of adverts:
 - (a) adverts for supermarket ranges e.g. ‘Tesco - Food & Drink’
 - (b) adverts for restaurants & bars e.g. ‘McDonalds - Restaurant’
 - (c) adverts for product ranges e.g. ‘Coca Cola Range’ where Diet Coke is below the NPM threshold and Original Coke is above the NPM threshold.

In this report we treat the following as HFSS advertising:

- all advertising for brands that contain products all of which are above the threshold as HFSS advertising

- all advertising for restaurants and bars
- a portion of advertising for product ranges that contain products above and below the NPM threshold (we apportion product range advertising as HFSS or non-HFSS in proportion to the transaction share (calculated using the 2015 Kantar purchase data) of products within each brand that are HFSS and non-HFSS).

Adverts for brands that contain products all of which have an NPM score below the threshold are treated as non-HFSS adverts. In this report we also treat advertising for supermarket ranges as non-HFSS advertising.

C Household type

In total there are 20,874 households in the 2015 Kantar media data. In this report we focus on main shoppers from households with children and also do not consider main shopper who are retired or in full education or main shoppers that we observe making purchases in less than 10 weeks across the year. This leaves us with 6,668 households, with a variety of household characteristics. Table C.1 shows the number of main shoppers we observe from each type of household and below we define each household type.

Table C.1: *Summary of household types*

Household type		Number of households
All	All households with children	6,668
Unskilled	Unskilled occupation of main shopper (NRS social grade D or E)	1,223
Semi skilled	Semi-skilled occupation of main shopper (NRS social grade C1 or C2)	3,812
Highly skilled	Highly skilled occupation of main shopper (NRS social grade A or B)	1,633
Young kids	Youngest child is under 5 years old	2,491
School kids	Youngest child is aged 5-15 years old	3,615
Older kids	Youngest child is aged 16-18 years old	562
Income quartile 1	Equivalised household income (OECD modified scale) quartile 1	1,349
Income quartile 2	Equivalised household income (OECD modified scale) quartile 2	1,464
Income quartile 3	Equivalised household income (OECD modified scale) quartile 3	1,529
Income quartile 4	Equivalised household income (OECD modified scale) quartile 4	1,553
Unknown	Income information not asked about	773
Deprivation quartile 1	Mean index of multiple deprivation score quartile 1 (low deprivation)	1,524
Deprivation quartile 2	Mean index of multiple deprivation score quartile 2	1,558
Deprivation quartile 3	Mean index of multiple deprivation score quartile 3	1,471
Deprivation quartile 4	Mean index of multiple deprivation score quartile 4 (high deprivation)	1,388
Unknown	IMD score not known (IMD scores only calculated for in England)	727
Obese	Main shopper's BMI is 30 or above	1,184
Not obese	Main shopper's BMI is less than 30	4,187
Unknown	Main shopper's BMI not asked about	1,297

- *Skill level of the head of the household:* Based on the NRS social grades, skill level indicates the occupations of the head of the household:

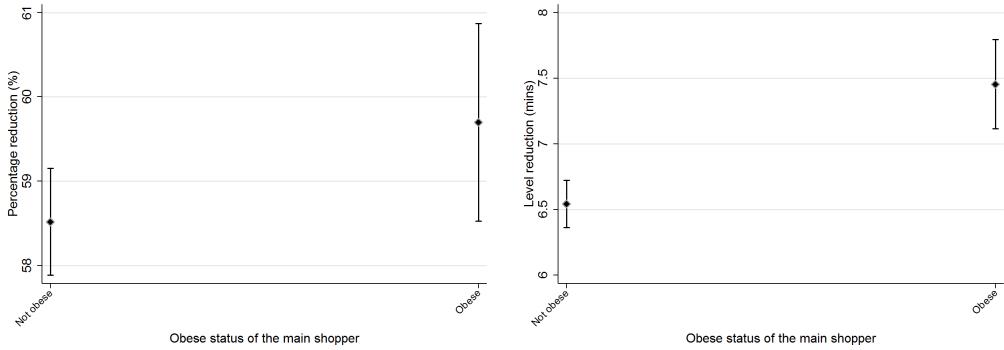
- Highly skilled workers are A or B grade (Grade A refers to higher managerial, administrative and professional occupations, grade B refers to intermediate managerial, administrative or professional occupations).
 - Semi skilled workers are C1 or C2 grade (Grade C1 refers to supervisory, clerical and junior managerial, administrative or professional occupations. Grade C2 refers to skilled manual workers).
 - Unskilled workers are D or E grade (Grade D refers to semi-skilled and unskilled manual workers. Grade E refers to state pensioners, casual and lowest grade workers, unemployed with state benefits only).
- *Employment status of main shopper:* employment status of the main shopper is provided in the kantar data, we aggregate this as follows:
 - If the main shopper is recorded as being unemployed or not working they are classified as not working
 - If they are working over 30 hours they are classified as full time
 - If they are working less than 30 hours they are classified as part time
 - We do not include main shoppers who are retired or in full time education
- *Obesity status of main shopper:* BMI score of the main shopper is recorded in the kantar world panel data. If the score is equal to or exceeds 30 the main shopper is classified as obese.
- *Age of children in the household:* The age and number of children in each household is recorded in the kantar data:
 - Households with young children have at least one child under the age of 5
 - Households with school children have no children under 5 and at least one child aged between 5 and 15
 - Households with older children have no children aged 15 or under but at least one child aged between 16 and 18
- *Equivalised household income:* Household income is recorded in the Kantar data as a banded measure (e.g 10,000 - 20,000). We take the midpoint of each band and, using the OECD modified scale, equivalise it (where first adult in each household is given a weight of 1, each additional adult is given a weight of 0.5 and each child is given a weight of 0.3). We then reband household income into quartiles.
- *The index of multiple deprivation:* Postcode district (i.e. SW6 level of a postcode) that each household live in is recorded in the kantar data. We calculate the mean index of multiple deprivation score within each postcode district (mean across LSOAs

within postcode district) and then place postcode districts into quartiles on the basis of their mean score.

- IMD scores are calculated for small areas called lower-layer super output areas, of which there are 32,844 in England. The IMD is the weighted sum of 7 other indexes: Income Deprivation Domain (given a weight of 22.5), Employment Deprivation Domain (22.5), Health Deprivation and Disability Domain (13.5), Education, Skills and Training Deprivation Domain (13.5), Barriers to Housing and Services Domain (9.3), Crime Domain (9.3), Living Environment Deprivation Domain (9.3).

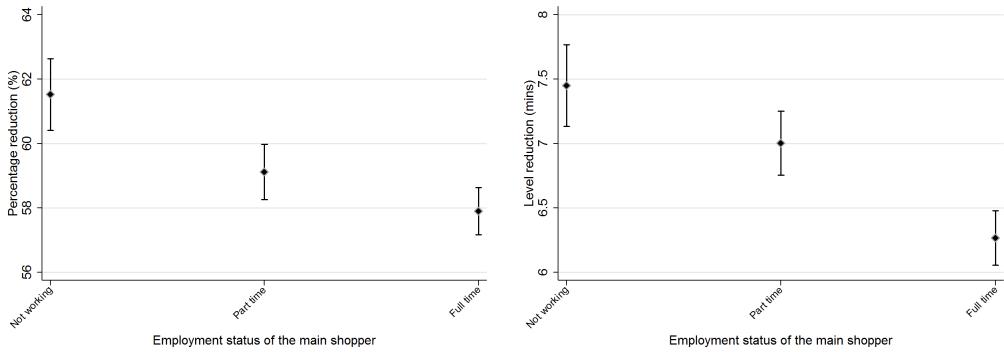
Figures C.1 – C.4 represent graphically the numbers in Table 2.1.

Figure C.1: *Reduction in main shopper's HFSS exposure by obesity status*



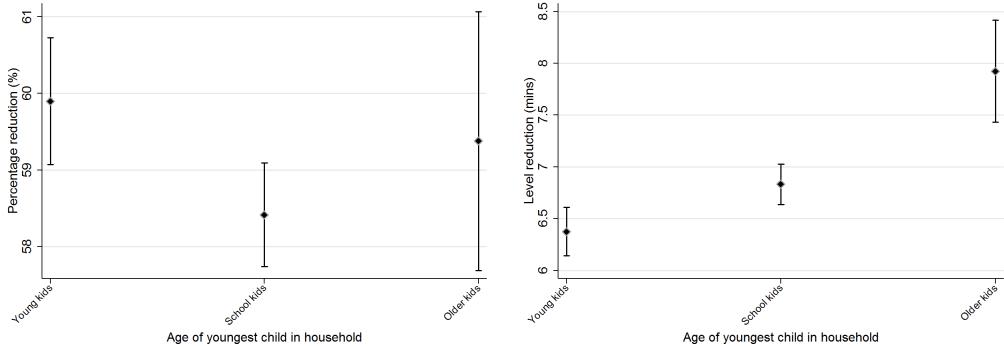
Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by the obesity status of the main shopper. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.

Figure C.2: *Reduction in main shopper's HFSS exposure by employment status*



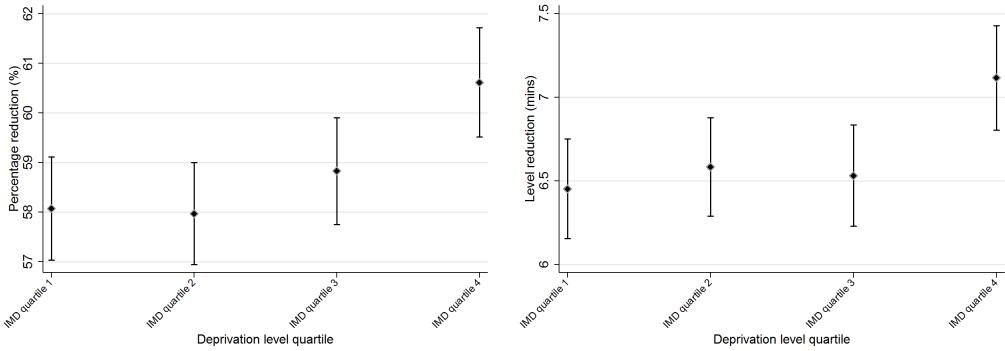
Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by employment status of the head of the household. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.

Figure C.3: Reduction in main shopper's HFSS exposure by age of children



Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by age of the children in the household. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.

Figure C.4: Reduction in main shopper's HFSS exposure by deprivation level



Notes: The markers show the mean (across households) reduction (left hand panel) and percentage reduction (right hand panel) in the exposure to HFSS advertising among main shoppers in households with children, by deprivation level of the household's locality. These numbers are shown in Table 2.1. The grey lines show 95% confidence intervals for the means. Household type definitions are provided in Appendix C.