

# The impact of a tax on added sugar in sugary snacks

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# 1 Introduction

In this note we demonstrate the range of impacts a tax on added sugar in sugary snacks could have on total purchases of added sugar at home and out of the home in the UK. The paper closely follows previous work in Griffith et al. (2021) which considered a tax on added sugar in all food products. Material that was published in that previous work is not duplicated here; the reader should read the two papers together.

Sugary snacks (confectionery, biscuits, cakes and desserts) account for around 14% of expenditure on food for home consumption, but account for around 60% of the added sugar in food purchased for home consumption. They account for around 7% of purchases of food for consumption out of the home, but around 50% of added sugar purchased in food for consumption out of the home.

The impact of a tax on added sugar will depend on how firms and consumers respond. There is considerable uncertainty about each of these. Therefore we take a robust approach and consider scenarios that cover the full range of realistic possible levels of response – from very responsive firms and consumers to non-responsive firms and consumers, and everything in between. On the one hand firms and consumers could not respond at all, and there could be no impact. On the other hand fully responsive firms would reformulate products to reduce added sugar (we assume the maximum reformulation would be to targets set by Public Health England, PHE), and fully responsive consumers would substitute away from products in proportion to the increase in price, and not increase purchases of added sugar in other products.

## 2 Data

We use the Kantar Fast Moving Consumer Goods (FMCG) Purchase Panel (Take Home) 2019 and Kantar Out of Home Purchase Panel 2016-2019. The Kantar purchase panel data covers food purchased and brought into the home and has demographic and purchase data for over 30,000 households in the UK and price and nutritional information for over 100,000 products. The Out of Home data has demographic and purchase information on over 10,000 individuals aged 13 and older from the Kantar Worldpanel households. The Out of Home data does not include nutritional information, we match this in at the category level.

We consider a tax of £3 per kilo on added sugar in sugary snacks, which we consider to include the categories:

- In home
  - biscuits
  - confectionery
  - desserts

- Out of home
  - sugar confectionery
  - chocolate confectionery
  - cakes and desserts

We do not include sugary drinks because they are already subject to the Soft Drinks Industry Levy.

In all data there are sometimes extreme observations. Here this could for example be a household that purchased an extraordinary amount of food that was not representative of their usual purchases. When looking at means these extreme observations can distort the numbers. Because of this we drop the largest 1% of purchases of added sugar.

## **Added sugar**

We consider a tax that is applied to added sugar in these sugary snacks products. The Kantar data records total sugar as reported on the back of package label. We use estimates of the % of sugars that are added sugar from the nutritional conversion factors provided by DEFRA; these are recorded at the level of around 500 food groups (maffcodes) and are used in combination with the Living Cost and Food Survey (previously Expenditure and Food Survey or National Food Survey).

For at home purchases we apply this % to the amount of total sugar recorded in the Kantar data to estimate the amount of added sugar, see description in Table 2.1. For the out of home data there are some products where we do not have quantities or nutrients (for example meals out). We impute the quantity of added sugar in each product using information from the Living Costs and Food Survey (LCFS), assuming that the relationship between expenditure in quantity is the same in the Kantar data and the LCFS when comparing similar food categories. The lower panel in Table 2.1 describes sugar and added sugar for the out of home data.

Table 2.1: *Sugar and added sugar by category*

Category	Mean sugar intensity g per 100g	% of sugar that is added sugar	% from this category			
			sugar	added sugar	calories	expenditure
<b>Food at home</b>						
Biscuits	27	85.0	8.3	14.7	6.9	3.6
Confectionery	54	96.1	12.1	22.8	4.8	4.5
Desserts	28	80.8	13.7	21.7	7.2	5.9
Total all snacks	36	87.3	34.1	59.2	18.9	14.0
Total all other	9	37.3	65.9	40.8	81.1	86.0
<b>Food out of home</b>						
Sugar confectionery	50	84.6	6.9	8.3	1.5	0.6
Chocolate confectionery	55	87.6	14.7	16.0	5.4	1.1
Cakes and desserts	21	69.6	23.7	24.9	15.0	5.0
Total all snacks	42	80.6	45.3	49.2	21.9	6.7
Total all other	5	19.7	54.7	50.8	78.1	93.3

*Notes: The first column shows the mean sugar intensity across products in that category. The second column show the mean percentage that is added sugar. The final four columns show the share of total sugar, added sugar, calories, and expenditure that are from each category.*

## Consumption versus purchases

We calculate the change in purchased amounts. To calculate health impacts we require consumed amounts. We assume that all food and drink that is purchased is consumed. Using data from 2008, DEFRA estimated that around 15% of food and drink that is purchased by UK households is not consumed (Defra, 2010. Household Food and Drink Waste linked to Food and Drink Purchases). This varied substantially by product category and by nutrient. Evidence shows that the share of food that is purchased that is consumed in the UK has been increasing over recent years (WRAP, 2020). In the absence of reliable and up-to-date estimates we do not make any adjustment for waste; we assume food waste to be zero.

### 3 Prices

Table 3.1 shows estimated price increases from the introduction of a tax on added sugar in sugary snacks. See Appendix C in Griffith et al. (2021) for details of how these are calculated.

If firms fully pass the tax on to prices and they do not reformulate, an added sugar tax of £3 per kilo would lead to price increases for foods purchased for consumption at home of around 2.5%, this could be reduced to around 2% if firms fully reformulated to PHE targets. The equivalent price rises for food purchased for consumption outside of the home are 0.5% and 0.4%.

Table 3.1: *% increase in prices, fixed basket price index*

Reformulation		
	Home	Out
none	2.47	0.54
	2.42	0.53
	2.37	0.51
	2.32	0.50
	2.27	0.49
	2.22	0.48
	2.18	0.46
	2.13	0.45
	2.08	0.44
	2.03	0.43
full	1.98	0.41

*Notes: The reported price change is the change in the cost of the observed pre-tax basket of products assuming that the increased cost of the tax is fully pass on to prices. As with other fixed basket (Laspeyres) price indices, such as the CPI, these overestimate the price change that people will experience because people will substitute to alternative, cheaper, products.*

Table 3.2 shows that these price increases would be higher for lower income households than for higher income households. This is because a larger share of their food basket is comprised of products that are affected more by the tax (have more added sugar and are lower price).

Table 3.2: *% increase in prices, fixed basket price index, by equivalised income quartiles, home only*

Reformulation	Equivalised household income quartile			
	1=lowest income	2	3	4=highest income
none	2.97	2.67	2.36	1.97
	2.91	2.62	2.31	1.93
	2.85	2.56	2.27	1.89
	2.80	2.51	2.22	1.85
	2.74	2.46	2.17	1.81
	2.68	2.40	2.13	1.78
	2.62	2.35	2.08	1.74
	2.56	2.30	2.03	1.70
	2.51	2.25	1.99	1.66
	2.45	2.19	1.94	1.62
full	2.39	2.14	1.89	1.58

*Notes: See notes to Table 3.1.*

Table 3.1 shows the overall price increases from the taxes for different levels of reformulation. Table 3.3 shows price changes by food category if there is no reformulation (top panel) and if there is full reformulation (bottom panel).

Table 3.3: *% increase in prices by category*

Category	Added sugar tax	Expenditure share
<b>No reformulation</b>		
<b>Food at home</b>		
Biscuits	17.20	3.6
Confectionery	21.24	4.5
Desserts	15.35	5.9
All other foods	0.00	86.0
Total	2.47	100.0
<b>Food out of home</b>		
Sugar confectionery	16.09	0.6
Chocolate confectionery	15.69	1.1
Cakes and desserts	5.55	5.0
All other foods	0.00	93.3
Total	0.54	100.0
<b>Full reformulation</b>		
<b>Food at home</b>		
Biscuits	14.78	3.6
Confectionery	16.67	4.5
Desserts	12.07	5.9
All other foods	0.00	86.0
Total	1.98	100.0
<b>Food out of home</b>		
Sugar confectionery	11.63	0.6
Chocolate confectionery	12.27	1.1
Cakes and desserts	4.33	5.0
All other foods	0.00	93.3
Total	0.41	100.0

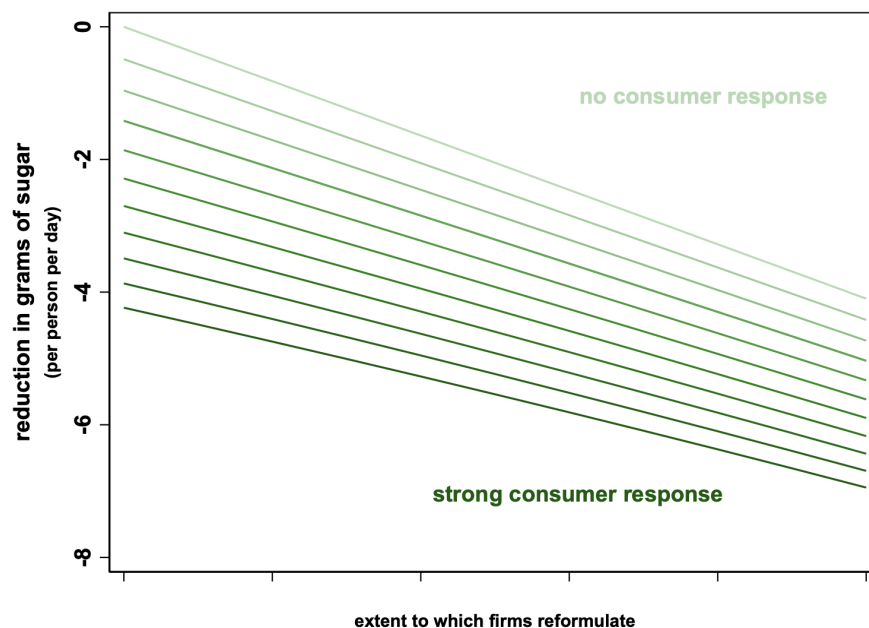
*Notes: The reported price change is the change in the cost of the observed pre-tax basket of prices assuming the increased cost of the tax is fully pass on to prices and (top panel) no reformulation (bottom panel) full reformulation to PHE targets.*

## 4 Impact on purchases of added sugar

Figure 4.1 shows the range of potential impacts of implementing a tax on added sugar in sugary snacks. The vertical axis shows the reduction in grams of added sugar; these are reported as the change, so lower numbers indicate larger reductions. The horizontal axis shows the extent of reformulation; points to the far left show the reduction if firms do no reformulation; points to the far right show the reduction if firms fully reformulate to PHE's reduction targets; points in between show situations between these two extremes. The different lines show the reduction for different levels of consumer responsiveness. Table 4.1 shows the same information.

If consumers are fully responsive, the impact of an added sugar tax would be to reduce added sugar from between 4.2 to 6.9 grams per person per day, whatever firms do. If firms fully reformulate then the impact will be to reduce sugar between 4.1 to 6.9, whatever consumers do. The reduction will be more than 2.0 gram of sugar per person per day as long consumers *and* firms are not *both* very unresponsive.

Figure 4.1: *Impact of a tax on added sugar in sugary snacks*



Notes: Mean reduction in grams of added sugar from an added sugar tax of £3 per kilo. Includes reduction from at home and out of home; mean over 9,000 individuals aged 13+ observed in both.



Table 4.1: *Impact of a tax on added sugar in sugary snacks*

reduction in added sugar (g per person per day)													
	Firm reformulation:												
	none			→			increasing to			→			full
Consumer													
response:													
none	-0.0	-0.4	-0.8	-1.2	-1.2	-1.6	-2.0	-2.5	-2.9	-3.3	-3.7	-4.1	
	-0.5	-0.9	-1.3	-1.7	-1.7	-2.1	-2.4	-2.8	-3.2	-3.6	-4.0	-4.4	
	-1.0	-1.3	-1.7	-2.1	-2.1	-2.5	-2.8	-3.2	-3.6	-4.0	-4.3	-4.7	
	-1.4	-1.8	-2.1	-2.5	-2.5	-2.8	-3.2	-3.6	-3.9	-4.3	-4.7	-5.0	
	-1.9	-2.2	-2.5	-2.9	-2.9	-3.2	-3.6	-3.9	-4.3	-4.6	-5.0	-5.3	
	-2.3	-2.6	-2.9	-3.3	-3.3	-3.6	-3.9	-4.3	-4.6	-4.9	-5.3	-5.6	
	-2.7	-3.0	-3.3	-3.6	-3.6	-3.9	-4.3	-4.6	-4.9	-5.2	-5.6	-5.9	
	-3.1	-3.4	-3.7	-4.0	-4.0	-4.3	-4.6	-4.9	-5.2	-5.5	-5.8	-6.2	
	-3.5	-3.8	-4.1	-4.3	-4.3	-4.6	-4.9	-5.2	-5.5	-5.8	-6.1	-6.4	
	-3.9	-4.1	-4.4	-4.7	-4.7	-5.0	-5.2	-5.5	-5.8	-6.1	-6.4	-6.7	
full	-4.2	-4.5	-4.7	-5.0	-5.0	-5.3	-5.5	-5.8	-6.1	-6.4	-6.7	-6.9	

*Notes: Mean reduction in grams of added sugar per person per day from an added sugar tax of £3 per kilo. Includes reduction from at home and out of home; mean over 9,000 individuals aged 13+ observed in both.*

## 5 Variation across age and gender

We demonstrate the impacts individuals considering four possible scenarios:

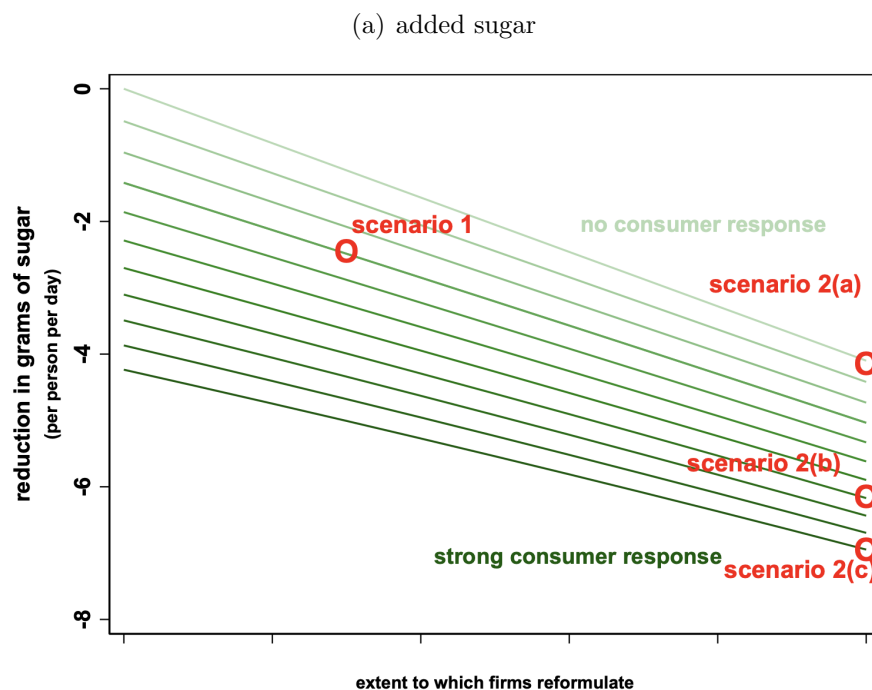
1. a modest response by industry (firms reformulate to 30% of PHE targets), and a modest response by consumers (they substitute away from products by one-third of the price increase)
2. firms fully reformulate to PHE targets, and consumers:
  - (a) do not respond to price increases at all,
  - (b) respond moderately (they substitute away from products by 70% of the price increase),
  - (c) they fully respond (they substitute away from products by the same amount as the price increase).

These are shown in Table 5.1 and Figure 5.1.

Table 5.1: *Reformulation and elasticities of different scenarios*

Scenario	Reformulation	Price responsiveness
1	30%	0.3
2(a)	100%	0
2(b)	100%	0.7
2(c)	100%	1

Figure 5.1: *Impact of a tax on added sugar in sugary snacks*



Notes: Mean reduction in grams of added sugar per person per day from an added sugar tax of £3 per kilo. Includes reduction from at home and out of home; mean over 9,000 individuals aged 13+ observed in both.

The degree of responsiveness of consumers can be interpreted as the own-price elasticity of demand for snacks with added sugar *net of the increase in added sugar from products that consumers substitute towards*. The own-price elasticity of demand expresses the percentage change in quantity that we would expect from a percentage change in the price of all products that contain added sugar (incorporating any patterns of substitution *within* this set of products). However, it does not account for added sugar that is in products outside the sugary snacks category that consumers substitute towards.

## 5.1 Estimating individual level from household level purchases

Purchases of food are made at a household level. The DHSC model is at the individual level. In Figure 4.1 and Table 4.1 we simply divide by the number of people in the household and show the impacts averaged over people of all ages. In this section we show the impacts by age. To convert these to the individual level we apportion the

food in the household to individuals in proportion to government recommended kcal levels,<sup>1</sup> shown in Table 5.2.<sup>2</sup>

There are several limitations to this approach. We know that young people eat more sugar than old people (see for example Griffith et al. (2020)). We also know that people’s responsiveness varies with age (see for example Dubois et al. (2020)). These will likely work in opposite directions in terms of the likely change in consumption in response to a tax; we would have to estimate a full demand model for all snacks in order to estimate the relative size of the two effects.

Table 5.2: *Recommended calories*

Age	Female	Male
0-1	698	745
1-3	1165	1230
4-6	1545	1715
7-10	1740	1970
11-14	1845	2220
15-18	2110	2755
19-50	1940	2550
51-59	1900	2550
60-64	1900	2380
65-74	1900	2330
75+	1810	2100

We convert the predicted added sugar reductions into calorie reductions, by multiplying the added sugar reduction in grams by 3.75 (the energy value ascribed to 1g of sugar; PHE (2021)); these are used as the input in the DHSC calorie model.

<sup>1</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/618167/government\\_dietary\\_recommendations.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/618167/government_dietary_recommendations.pdf)

<sup>2</sup>For example, if a household consisted of a 52 year-old women, a 52 year-old man and a 12 year-old girl then the shares would be 30% for the women =  $(1900/(1900+2550+1845))$ , 41% for the man =  $(2550/(1900+2550+1845))$  and 29% for the child =  $(1845/(1900+2550+1845))$ .

Table 5.3: *Scenario 1: reduction in added sugar and calories*

lshtmAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-17	-1.3	1.3	-5.1	4.8
Male 0-17	-1.5	1.4	-5.8	5.3
Female 18+	-2.4	2.2	-9.1	8.2
Male 18+	-2.9	2.6	-10.9	9.6

dhscAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-4	-0.9	0.8	-3.3	3.0
Male 0-4	-1.0	1.0	-3.7	3.8
Female 5-12	-1.5	1.4	-5.8	5.1
Male 5-12	-1.8	1.4	-6.6	5.4
Female 13-18	-2.3	1.7	-8.7	6.3
Male 13-18	-2.9	2.2	-10.8	8.2
Female 19-64	-2.3	2.0	-8.5	7.5
Male 19-64	-2.7	2.3	-10.2	8.7
Female 65+	-3.8	3.2	-14.4	11.9
Male 65+	-4.0	3.4	-15.2	12.8

*Notes: Reformulation of 30% of target, consumers respond by 30% of price increase. Mean reduction in grams of added sugar per person per day from a tax on added sugar in snacks of £3 per kilo. Calories are 3.75 times grams reduction in added sugar. For ages less than 13 at home food only.*

Table 5.4: *Scenario 2(a): reduction in added sugar and calories*

lshtmAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-17	-2.1	2.1	-7.9	7.7
Male 0-17	-2.4	2.2	-9.0	8.4
Female 18+	-4.0	3.7	-15.1	14.0
Male 18+	-4.8	4.3	-17.8	16.0

dhscAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-4	-1.4	1.3	-5.1	4.7
Male 0-4	-1.5	1.6	-5.7	6.0
Female 5-12	-2.4	2.2	-9.0	8.3
Male 5-12	-2.8	2.3	-10.3	8.7
Female 13-18	-3.8	2.9	-14.3	10.9
Male 13-18	-4.5	3.5	-17.0	13.2
Female 19-64	-3.8	3.4	-14.1	12.8
Male 19-64	-4.4	3.9	-16.6	14.4
Female 65+	-6.5	5.3	-24.2	19.8
Male 65+	-6.6	5.8	-24.9	21.7

*Notes: Reformulation of 100% target, no response by consumers. Mean reduction in grams of added sugar per person per day from a tax on added sugar in snacks of £3 per kilo. Calories are 3.75 times grams reduction in added sugar. For ages less than 13 at home food only.*

Table 5.5: *Scenario 2(b): reduction in added sugar and calories*

lshtmAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-17	-3.3	3.0	-12.3	11.3
Male 0-17	-3.7	3.4	-14.1	12.6
Female 18+	-6.0	5.3	-22.5	20.0
Male 18+	-7.2	6.2	-27.0	23.3

dhscAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-4	-2.1	1.9	-8.0	7.1
Male 0-4	-2.4	2.3	-8.9	8.7
Female 5-12	-3.8	3.2	-14.1	12.1
Male 5-12	-4.3	3.5	-16.2	13.0
Female 13-18	-5.8	4.2	-21.6	15.6
Male 13-18	-7.1	5.4	-26.6	20.2
Female 19-64	-5.6	4.9	-21.1	18.2
Male 19-64	-6.7	5.6	-25.2	21.0
Female 65+	-9.5	7.7	-35.8	28.8
Male 65+	-10.0	8.4	-37.5	31.5

*Notes: Reformulation of 100% target, consumers respond by 70% of price increase. Mean reduction in grams of added sugar per person per day from a tax on added sugar in snacks of £3 per kilo. Calories are 3.75 times grams reduction in added sugar. For ages less than 13 at home food only.*

Table 5.6: *Scenario 2(c): reduction in added sugar and calories*

lshtmAge	Added sugar		Calories	
	Mean	Sd	Mean	Sd
Female 0-17	-3.7	3.4	-14.0	12.7
Male 0-17	-4.3	3.8	-16.0	14.2
Female 18+	-6.7	6.0	-25.3	22.3
Male 18+	-8.1	7.0	-30.5	26.1

dhscAge	Mean	Sd	Mean	Sd
Female 0-4	-2.4	2.1	-9.1	7.9
Male 0-4	-2.7	2.6	-10.1	9.7
Female 5-12	-4.3	3.6	-15.9	13.5
Male 5-12	-4.9	3.9	-18.4	14.6
Female 13-18	-6.5	4.6	-24.4	17.4
Male 13-18	-8.1	6.1	-30.2	22.9
Female 19-64	-6.3	5.4	-23.7	20.3
Male 19-64	-7.6	6.3	-28.4	23.5
Female 65+	-10.7	8.6	-40.2	32.3
Male 65+	-11.3	9.4	-42.3	35.3

*Notes: Reformulation of 100% target, consumers respond by 100% of price increase. Mean reduction in grams of added sugar per person per day from a tax on added sugar in snacks of £3 per kilo. Calories are 3.75 times grams reduction in added sugar. For ages less than 13 at home food only.*



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