This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774548.

EC Framework Programme for Research and Innovation

Horizon 2020
H2020-SFS-2017-2-RIA-774548-STOP:
Science & Technology in childhood Obesity Policy

Science and Technology in childhood Obesity Policy

Science & Technology in childhood Obesity Policy

Start date of project: 1st June 2018 Duration: 48 months

D4.3: Assessment of the potential impacts of new fiscal and regulatory policies on added sugar in Europe

Coordination: O. Allais (INRAE)
Authors: O. Allais, C. Bonnet, J Dulieu, P. Leveneur, G Narayanane, and M. Tranchard (INRAE)

Version: Final

Preparation date: 31/05/2022

Dissemination Level

PU	Public	☒
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Abbreviation	Definition
DID	Differences and differences
EC	European Commission
EU	European Union
FOPL	Front-of-Pack Label
OECD	Organisation for Economic Co-operation and Development
PHE	Public Health England
PPP	Public-Private Partnerships
SDIL	Soft Drink Industry Levy
STOP	Science & Technology in childhood Obesity Policy (H2020 project)
WHO	World Health Organisation
WP4	Work Package 4 of the STOP project

Science and Technology in childhood Obesity Policy

Table of Content

Science and Technology in childhood Obesity Policy

Part 1: Assessment of the potential impacts of new fiscal policies on added sugar in France, Spain and the United Kingdom

Allais, O.†, C. Bonnet, P[ç]. Leveneur†[ç], M. Tranchard†[ç]

October, 2021

† Université Paris-Saclay, INRAE, UR ALISS, 94205, Ivry-sur-Seine, France.
[ç] Toulouse School of Economics, INRAE, 31080, Toulouse, France

Science and Technology in childhood Obesity Policy

Contents

Science and Technology in childhood Obesity Policy

List of Figures

List of Tables

Abstract

Context: Children in the Western world are currently consuming more added sugar than the 10% of total daily energy intake recommended by the World Health Organisation. The excessive consumption of added sugars is associated with obesity and type 2 diabetes. To address these public health issues, public health authorities have implemented or envisage to tax food products that contribute the most to the sugar intake of children and adolescents. Existing taxes are generally limited to sugar-sweetened beverages. Very little is known about the potential effects of a similar tax for products other than for non-alcoholic beverages, and household characteristics, such as the presence of children and/or adolescents in the household, are rarely taken into account in the analysis.

Objective: The main objective of this study is to assess and compare the effects of several hypothetical tax designs on variations in purchases of non-alcoholic beverages and biscuits, and on individuals' sugar purchases from the consumption of these products, which are also major contributors to sugar intake in children and adolescents, using a wide range of indicators to characterize households. Household composition (households with versus without children and adolescents, the presence of overweight or obese adults in the household), and the household's socioeconomic position are used to characterize households.

Method: To achieve these objectives, we use household scanner data to propose ex-ante evaluations and comparisons of the effects of different tax designs, already existing or designed in the same spirit as existing ones, on the purchased quantity on the non-alcoholic beverages and biscuits markets made by households in the United Kingdom (UK), France and Spain. Estimates of demand curves are combined with a supply model of oligopolistic price competition to produce simulations of tax effects that integrate firms' price reactions to tax.

Results: Demand in the UK markets for non-alcoholic beverages and biscuits is more elastic than in the Spanish and French markets and across all household characteristics considered. Second, biscuits demand is less price elastic than the demand for non-alcoholic beverages whatever the household characteristics considered, except in the UK. We also find that all tax scenarios simulated reach their goal: To increase the purchase of the less sugar-sweetened biscuits or non-alcoholic beverages at the expense of the more sugar-sweetened ones. Among the four tax designs analysed, the UK tax design (i.e., a two-tiered excise tax based on the total sugar content of products with relatively high levels of tax rates) is the most effective in reducing sugar purchase from either non-alcoholic beverages and the biscuits markets in France, the UK and Spain. Second, implementing a tax in the non-alcoholic beverage market results in higher sugar purchase reductions than in the biscuits markets.

Policy Implications: Rising the tax rate levels increases reductions in sugar purchase. These reductions will be all the larger the more price-sensitive households are and the higher the proportion of purchases of products taxed at each threshold in relation to total purchases. These results highlight the importance of (i) choosing to tax 'unhealthy' food categories consumed in excess

where households are the most price sensitive, and (ii) appropriately choosing the levels of tax tiers based on the distribution of purchases of taxed products with respect to sugar content.

Science and Technology in childhood Obesity Policy

1 Introduction

Children in the Western world are currently consuming more added sugar than the 10% of total energy intake recommended by the Word Health Organisation (WHO, 2015). Added sugars contribute between 11% to 17% of the total energy intake of children living in Western Europe (Sluik et al., 2017). The excessive consumption of added sugars is associated with obesity and type 2 diabetes (Vartanian et al., 2007; Te Morenga et al., 2013; Wang et al., 2015).

To address these public health issues, alongside the global increases in childhood overweight and obesity rates (Abarca-Gómez et al., 2017) with their medium- (Small and Aplasca, 2016; Abbasi et al., 2017) and long-term health risks (World Health Organization, 2016; Guh et al., 2009), governments and public health agencies have been implementing policies to promote preventive behaviours, by means of information and education campaigns and improved food product labelling. A review of these policies show that they have had some positive impacts that, however, remain small, at least in the medium term (Brambila-Macias et al., 2011). Given their modest impacts, additional strategies to prevent the increase in overweight and obesity rates in childhood have been considered (World Health Organization, 2016). Food tax is one of them.

However, at present, implemented taxes are generally limited to sugar-sweetened beverages (SSB), as one of the products that contribute most to the high sugar intake of children and adolescents (Table 1). As of January 2020, more than 50 SSB taxes (including import duty) are in effect worldwide (Cawley et al., 2019b; World Cancer Research Fund International, 2019), accounting for 87% of the total number of global food taxes implemented (World Cancer Research Fund International, 2019).[1] In several countries, there is ambitious collective voluntary agreements between public authorities and manufacturers, involving the joint setting of reformulation objectives to improve the nutrient composition of the other products that contribute the most to sugar intakes in children and adolescents (in particular in England, see Public Health England (2017) and in the Netherlands, see Duch National Institute for Public Health and the Environment (2014)). Although these policies generally meet the key conditions of success identified in previous studies (i.e., strong government leadership and pressure; the involvement of a large number of manufacturers; the publication of guidelines or reduction targets; and an effective monitoring and evaluation, (see Gressier et al., 2020; Trieu et al., 2017; Wyness et al., 2012), the level of their impact on product nutrient composition has been deemed unsatisfactory by policy makers, and thus insufficient to substantially address these major public health challenges. For example, Public Health England has assessed that the sugar reformulation progamme, which is part of the childhood obesity plan, could only achieve

[1] The other products that are major contributors to sugar intake in children and adolescents are not covered by a tax at present, except in Hungary where sugared cocoa powder, sweets with and without cocoa, including ice-creams are taxed; Mexico (de los Estados Unidos Mexicanos, 2014) where sweets and chocolates, and cereal-based sweet foods, such as ready-to-eat cereals, industrialized cakes and biscuits in addition to SSBs, are taxed; and in the 110 Navajo Nation communities, USA (The Healthy Diné Nation Act Navajo Nation Council, 2014), where pre-packaged and non-prepackaged snacks that have been stripped of essential nutrients but are high in sugar, such as sweets, are taxed.

an overall sugar reduction of 3% between 2015 and 2019 where it was expected to be 20% (Public Health England, 2020). In contrast, SSB excise taxes on SSBs have been effective in reducing SSB purchases and sugar intake, as a consequence of the increase in the price of taxed beverages for the consumer (for a the systematic review, see Alvarado et al., 2019) and for more recent studies, see Roberto et al. (2019); Royo-Bordonada et al. (2019); Cawley et al. (2019a); Lee et al. (2019); Pell et al. (2020, 2021)). These results have prompted public health authorities to tax food products that contribute the most to the sugar intake of children and adolescents (Hepatology, 2020; National Food Strategy, 2021).

However, little is known about the potential effect of a similar tax for products other than non-alcoholic beverages, and household characteristics, such as the presence of children and/or adolescents in the household, are rarely taken into account in the analysis. (except for Cawley et al., 2019a). The main objective of this study is to assess and compare the effects of several existing and hypothetical tax scenarios on variations in purchases and sugar purchased for non-alcoholic beverages and biscuits, which are also major contributors to sugar intakes in children and adolescents (see Table 1), using a wide range of indicators characterising households. Household composition (households with versus without children and adolescents, the presence of overweight or obese adults in the household), and household socioeconomic position are used to characterize households.

To achieve this objective, we carry out ex-ante evaluations and comparisons of the effects of different tax designs (already existing or designed in the same spirit as existing ones) on the purchased volume and quantity of non-alcoholic beverages and biscuits by households in the UK, France, and Spain. Specifically, we apply a three-step structural econometric strategy that has been used by Bonnet and Réquillart (2013) to analyse soft-drink taxes. In a first step, we use scanner data from France, the UK and Spain, disaggregated at both the household and product levels, to estimate a discrete choice model of demand allowing for substitutions both between varieties of biscuits or non-alcoholic beverages and towards a no-purchase option of non-alcoholic beverages or biscuits (namely, an outside option). We represent consumer preferences using a Mixed Multinomial Logit model (McFadden and Train, 2000), controlling for the endogeneity of prices. This estimation approach identifies household-specific preference parameters and the demand curves for the varieties of biscuits or non-alcoholic beverages market. In a second step, we model the supply side as an oligopoly proposing differentiated products and competing *à la Nash* in a Bertrand game, in the spirit of Berry et al. (1995) and Nevo (2001). We use the estimated demand curves to identify the price-cost margins for each product and the unit costs of production for firms. Knowing all parameters of firm pricing strategies and consumer purchase behaviours, we are eventually able to produce simulations of tax effects that integrate firms' price reactions to tax.

We simulate the effect of several tax scenarios. For non-alcoholic beverages, we produce ex-ante evaluations of the potential effects of each tax design already implemented in France (which uses

a tax with a sliding scale design based on added-sugar content), the UK and Catalonia (Spain), (where a two tiered sugar-concentration-based tax design is used for the two countries but with different tax rate levels: see Table 16 for details on each tax). We also simulate the potential effects of implementing the three existing tax design in the other two studied countries (e.g., in France and Spain for the UK tax scenario) but tailored to the characteristics of the country's non-alcoholic beverages market. For the biscuits markets, we propose tax designs (i.e., levels and the number of tax thresholds, and the amounts of tax rate relative to sugar concentration for each tier), replicating the three tax designs implemented in the UK, France and Catalonia in the non-alcoholic beverages market, but tailored to the distribution of the sugar content and prices of biscuits observed in each of the three markets. One of the original features of this study is to compare these effects on household purchases from several countries using a similar type of purchase data (home-scan data from the World Panel data company) and an identical estimation method.

This report is organised as follows. The next section describes the data. Section 3 presents the empirical methods, demand parameter, and elasticities estimates. Section 4 presents tax scenarios, simulation method, and simulation results. The last section provides concluding comments, a summary of the main results and suggested implications for policy makers.

Table 1: The contribution of non-alcoholic beverages and biscuits to the added-sugar intakes of children and adolescents in France, the UK and Spain

	Non-alcoholic beverages	Biscuits
France- *Sugar* (2014-2015)[1]		
Children 1-10	14.5% (2nd)	17.8% (1st)
Adolescents 11-17	20.3% (1st)	16.3% (2nd)
UK- *Added sugar* (2014-2016)[2]		
Children 4-10	22.2% (2nd)	8.7% (4th)
Adolescents 11-18	33.7% (1st)	8.2% (3rd)
Spain- *Added sugar* (2013)[3]		
Children 9-12	18.0% (3rd)	22% (2nd)
Adolescents 13-17	15.2% (1st)	12.5% (3rd)

Notes: The number in parenthesis indicates the rank of the category in the contribution to added-sugar (sugar) intakes in children and adolescents in France, the UK and Spain.
Sources: [1] Dubuisson et al. (2019); [2] Public Health England (2018); [3] Ruiz and Varela-Moreiras (2017).

2 Data

We use 2017 data from Kantar Worldpanel in France, the UK and Spain on the non-alcoholic beverages and the biscuits markets. These representative consumer panels collect, on a weekly basis, home-scan information on purchases of food products. Information of the household characteristics and product characteristics are available, such as brand, size, quantity, price, sugar ,and fat content. The dataset is divided into four-week periods (13 periods).

2.1 Demographic characteristics

We analyze the purchases of three representative consumer panels collected by Kantar Worldpanel (19,679 households in France, 24,586 households in the UK and 7,887 households in Spain[2]). The same set of households is used in the analyses of the non-alcoholic beverages and biscuits markets. Households are differentiated according to three dimensions (Table 2):

- **household composition** (presence of children in the household and their age)
- **obesity status** (proportion of obese or overweight[3] adults in the household)
- and **socio-economic class**[4].

[2]We exclude the households living in Catalonia in order to get a homogeneous set of Spanish households in terms of soda tax exposure. A tax was implemented on soft drinks in the Catalonia region in May 2017 (the "catalonia tax").

[3]Adults with BMI, defined as weight (in kg) divided by the square of the height (in m), above 30 are considered as obese, and individuals with BMI ranging between 25 and 30 are considered as overweight. The final dataset contains only households with no missing value on adults' BMI in the analysis. We exclude 1,765 households (8%) in France, 6,353 households (21%) in the UK and 2,923 households (27%) in Spain.

[4]The definition of this variable was different in the three databases. It is based on the monthly income and the number of members in the household in France; on the socio-professional categories in the UK and on the equipment; and on the level of education and employment situation in Spain. However, we assume that the ranking between households within a country is the same for any socio-economic class criteria used.

Table 2: Household characteristics in Kantar panel

	France		UK		Spain	
	N	%	N	%	N	%
Household composition						
Without children	12,055	61	16,093	65	4,624	59
With children below 6 years old	1,881	10	2,960	12	1,092	14
With children 7-16 years old	3,838	19	3,668	15	1,586	20
With children both below 6 and 7-16 years old	1,905	10	1,865	8	585	7
Obesity status						
No overweight or obese adults	7,317	37	5,972	24	2,083	27
Some overweight or obese adults	6,674	34	8,184	33	3,423	43
All overweight or obese adults	5,688	29	10,430	43	2,381	30
Socio-economic class						
Rich	2,719	14	5,262	21	1,529	19
Average	14,136	72	13,912	57	4,772	61
Poor	2,824	14	5,412	22	1,586	20
All	**19,679**		**24,586**		**7,887**	

2.2 Market definition

Our study focuses on two markets specifically marketed to children/adolescent and so largely consumed by children: non-alcoholic beverages and biscuits. The market definition in the three countries is presented in Table 3.

Non-alcoholic beverages markets: For the three countries, we include sugar sweetened beverages (SSBs), fruit juice and flavoured water in our study. We additionally include milk-based drinks (e.g. flavoured milk) in the UK market because they are part of the diet of children. We exclude water and products that are not ready-to-drink (*e.g.* syrup, powdered drinks, cocktail mixers).

Biscuits markets: For the three countries, following the Kantar food classification, we exclude sweets, chocolate tablets and chocolate bars from our analysis. Indeed, they are not close substitutes of biscuits as is illustrated in the supermarket, where they are generally not located in the same aisle as biscuits. The only exception is the UK chocolate bar smaller than two fingers as they are targeted as biscuits in the UK childhood obesity plan (Public Health England, 2016).

Table 3: Summary of the market definition: non-alcoholic beverages and biscuits

Non-alcoholic beverages	**France**	**UK**	**Spain**
Sugar sweetened beverages (cola, iced tea, lemonade, fruit-flavoured drink, sport and energy drink, tonic, other)	yes	yes	yes
Fruit juice (pure fruit juice, nectar, smoothie, fruit juice with milk)	yes	yes	yes
Flavoured water	yes	yes	yes
Milk-based drinks	no	yes	no
Water	no	no	no
Syrup, powdered drink, cocktail mixer	no	no	no
Biscuits	**France**	**UK**	**Spain**
Biscuits	yes	yes	yes
Biscuits coated with chocolate	yes	yes	yes
Chocolate bar $<$ 2 fingers	no	yes	no
Chocolate bar $>$ 2 fingers	no	no	no
Chocolate tablet	no	no	no
Sweets	no	no	no

The preliminary data cleaning excludes the products that do not enter the market definition and products considered as price outliers[5]. Purchases from households with sample weight equal to 0 are also excluded.

2.3 Product attributes

We first study the products attributes in each market in order to understand what drives consumers' preferences. These attributes are used to describe the alternatives available on the markets in France, the UK and Spain.

Sub-categories

Non-alcoholic beverages market: The data contain information on beverage categories (e.g., sugar-sweetened beverages, fruit juice, milk-based drinks, ...), firm name (Coca-Cola, Pepsi, ...), whether it is a national or a private label brand, the flavour of fruit juice, the sugar content, and whether the soft drink is regular or diet.

We create 14 different sub-categories of non-alcoholic beverages, reported in Table 4. The sugar-sweetened beverage category is made up of colas, iced tea, fruit-flavoured drinks, flavoured water, tonic water, lemonade, energy drinks, and other SSBs. The fruit juice category includes nectar, fruit juice made from concentrate, pure fruit juices, fruit juice with milk, and smoothies. Milk-based drinks are made up of flavoured milk. The sub-categories may be different between countries because Kantar does not use the same drinks classification between countries (e.g. flavoured milk

[5]We also exclude products with price outliers because they might be errors or they are not a direct substitute for standard non-alcoholic beverages or biscuits. Products with a price higher than 10 euros per litre in the non-alcoholic beverages market and 50 euros per kg in the biscuits markets are considered as price outliers.

is considered as a SSBs by Kantar in the UK market) and because consumption levels are different and so grouped in the "Other SSBs", "pure fruit juice" or "nectar" sub-category to avoid having too much noise in the estimation process.

Table 4: Non-alcoholic beverages sub-categories

	France	**UK**	**Spain**
Sugar sweetened beverages (SSB)			
Colas	✓	✓	✓
Iced teas	✓	with Other SSBs	✓
Fruit-flavoured drinks	✓	✓	✓
Flavoured waters	✓	✓	with Other SSBs
Tonic waters	with Other SSBs	✓	with Other SSBs
Lemonades	with Other SSBs	✓	✓
Energy drinks	with Other SSBs	✓	✓
Other SSBs	✓	✓	✓
Fruit juice			
Nectars	✓	✓	✓
Fruit juice (from concentrate)	✓	with Pure fruit juice	with Pure fruit juice
Pure fruit juice	✓	✓	✓
Fruit juice with milk			✓
Smoothies	with Nectar	✓	
Milk-based drinks			
Flavoured milks		✓	

Notes: A sub-category specified as "with Other SSBs", "with Pure fruit juice" or "with Nectar" means that the purchases of this category are grouped with those of the Other SSBs, Pure juice or Nectar category, respectively.

Biscuits market: The data contain information on the type of biscuits (e.g., Jaffa Cakes, Mallows, Rich Tea, Shortbread, Wafer). In contrast to the non-alcoholic beverages market, the supply of biscuit is country specific. We cannot construct homogeneous sub-categories of biscuits. These sub-categories are presented in Table 5.

Table 5: Biscuit sub-categories

France	*Assortiment, Barquette, Barre Biscuite, Boudoir,Cookies, Croquant, Feuillete, Genoise, Petit Beurre, Sable, Speculos*
UK	*Assortment, Breakfast, Cereal Bars, Coated, Cookies, Digestives, Dips, Fig Rolls, Fingers, Fruit Bars, Half Iced, Jaffa Cakes, Jam, Mallows, Rich Tea, Shortbread, Wafer*
Spain	*Barquillo, Especialidades, Galleta Banada, Galleta Bizcocho, Galleta Mantequila, Galleta Maria, Galleta Relieve,Galeta Relena, Galleta tostada, Pasta de Te, Surtido Galleta*

Notes: A sub-category is created for each country, named "Biscuit", which represent an aggregate of products that did not enter the previous subcategory.

Sugar and added sugar content

The sugar content is provided by Kantar for the UK and Spanish markets. It was not available in the French dataset and was retrieved from the nutritional data of Oqali (2011) and from additional

researches to find the nutritional composition of the products using the brands' website and the Open Food Facts website (Open Food Facts, 2012). In the three countries, we identify the products containing added sugar.[6]

Definition of the differentiated products

Non-alcoholic beverages markets: The definition of the differentiated products is based on information on the firm name (e.g., Coca-Cola), the brand name[7] (e.g., Coca-Cola, Fanta, Sprite, ...), the drinks sub-category, and other product characteristics (diet or regular characteristic for SSBs, and the presence of added sugar and flavour for fruit juice).[8] Beverages of a given sub-category a with small purchase occurrence are aggregated either with similar products of the same firm or in a hypothetical product defined as other firm/other brand of the sub-category a. Following this product differentiation, we get a set of 319, 402, and 285 distinct varieties of beverages (hereafter, called alternatives) that we consider in our analysis in France, the UK and Spain, respectively. Table 6 presents a summary of the market structure with the definition of alternatives in the non-alcoholic beverages market. We also report the number of purchases and the average price per litre of non-alcoholic beverages and non-alcoholic beverage with added sugar in each market.

Biscuits market: We identify 57 firms competing in the French biscuits market, 70 in the UK and 71 in Spain: *Such as Mondelez, Nestle, ..., an aggregate of the small firms called "Others" and an aggregate of the private labels sold by retailer.* For these firms we identify 84 brands in France, 104 in the UK, and 87 in Spain. Following our process, we have the firms' aggregate for smalls brands and private labels. For example, to distinguish between *LU.Granola* and *LU.Prince*, which are both from the "LU" brand, we consider a subsidiary brand. Here "Granola" or "Prince". Then we use the country specific sub-categories of biscuits to define our alternatives. Finally, we use information on the flavour of the biscuits (e.g., chocolate, vanilla) to more precisely describe these products. Crossing these characteristics, we obtain 407 alternatives in France, 500 in the UK, and 309 in Spain, with at least 50 occurrences of purchase for each product.

Prices

The four-week period unit price of each alternative is calculated as the weighted ratio of total

[6]For the French market, we were able to get an approximation of the added sugar content with the help of a nutritionist. Natural sugar comes from fruits only. It results that pure fruits juices and fruit juices from concentrate do not contain added sugar content. We assumed that the added sugar content equals the sugar content for sugar-sweetened beverages (fruit content is negligible in the sugar-sweetened beverage category). For nectars and smoothies, we computed an approximation of the added sugar content based on the proportion of fruits in the list of ingredients (retrieved with additional researches). For the UK and Spanish market, we were only able to identify products containing added sugar (but not the exact content) based on additional researches on the list of ingredients.

[7]Private labels are aggregated in one firm and one brand.

[8]A Flavoured water is considered as diet if it contains 1 gram or less of sugar per 100 ml.

expenditure in euros[9] over the total quantities in litres or kilogram of all items belonging to the alternative in the corresponding four-week period. The weights used are Kantar period-specific household sample weights.[10] Mean prices in Table 6 are calculated in the same way, except that we use the ratio of total expenditure in euros over the total quantities in litres of all drinks or kilograms of all biscuits purchased in each market.

Table 6: Market structure

Non-alcoholic beverages	**France**	**UK**	**Spain**
Number of firms	60	78	50
Number of national brands	119	151	109
Number of sub-categories	8	11	10
Number of alternatives	319	402	285
Number of observations	666,482	1,319,069	270,211
Mean price (per litre)	1.18 €	0.78 €	0.84 €
Mean price of non-alcoholic beverages with added sugar (per litre)	1.02 €	0.67 €	0.82 €
Biscuits	**France**	**UK**	**Spain**
Number of firms	57	70	71
Number of national brands	84	104	87
Number of sub-categories	12	18	12
Number of alternatives	407	500	309
Number of observations	482,154	860,461	141,177
Mean price (per kg)	6.10 €	4.24 €	3.34 €

Note: The number of observations refers to the number of Kantar references purchased per household, date and store. If on a given date and in a given store, a household buys 3 bottles of 1L of Coke, this is an observation, but if a household buys 2 bottles of 1L of Coke and 1 bottle of 1.5L, this is 2 observations.

2.4 Descriptive statistics

2.4.1 Non-alcoholic beverages market

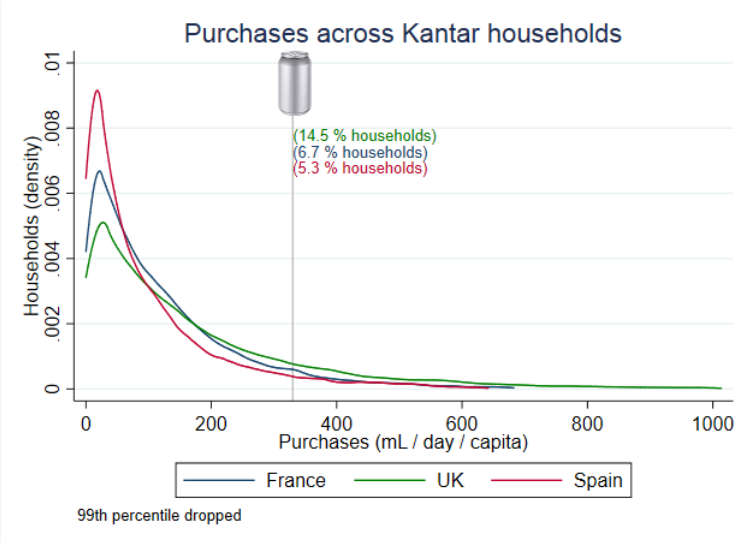
The level of purchase varies across countries (Table 7). Households in the UK panel are the highest consumers of non-alcoholic drinks: they purchased on average 65 litres per capita per year (among which 44 litres of beverages have added sugar). Households in the French panel purchased on average 47 litres per capita per year (among which 26 litres of beverages have added sugar). Households in the Spanish panel purchased on average 38 litres per capita per year (among which 30 litres of beverages have added sugar).

Figure 1 shows the individual distribution of the daily purchase of non-alcoholic beverages across the households in the Kantar panels. In the French panel, 6.7 % of Kantar households (14.4% in the UK panel and 5.3% the Spanish panel) purchase more than the equivalent of one can (330 mL) per day per capita. In Table A1, we also display households' purchases by sugar content level with respect to demographics.

[9]The following conversion rate is used: 1 pound = 1.15 euros

[10]These weights are calculated by Kantar. They ensure that the panel is representative and correct for reporting biases related to periods away from home (see subsection A.4.1 on weights in Appendix)).

Figure 1: Purchase of non-alcoholic beverages across Kantar households



Lecture note: 14.5 % of households consume more than 330 mL per day per capita in the UK panel

Table 7 provides a comparison of the purchase of non-alcoholic beverages per capita per year across households with respect to household composition, obesity status and socio-economic class. In the three countries, households with children between 7 and 16 years old are the highest consumers and households with children between 0 and 6 years old are the lowest consumers. In all three countries, mean purchase increases gradually with the proportion of adults who are overweight or obese within the household. Furthermore, poor households buy more than rich households in the three countries. However, differences in consumption levels between households of different socio-economic class in Spain are smaller.

Table 7: Households purchase - non-alcoholic beverages market

Mean quantity (l/capita/year) (standard deviation)	France All beverages	France Added sugar	UK All beverages	UK Added sugar	Spain All beverages	Spain Added sugar
Household composition						
No children	46 (56)	25 (44)	67 (85)	46 (68)	39 (51)	30 (44)
Children below 6	40 (41)	22 (31)	45 (54)	30 (44)	30 (39)	24 (33)
Children 7-16	53 (51)	30 (39)	76 (74)	53 (60)	40 (49)	32 (42)
Children both below 6 & 7-16	43 (43)	24 (32)	53 (57)	36 (46)	36 (41)	29 (37)
Obesity status						
None overweight or obese	42 (52)	26 (40)	53 (73)	37 (61)	29 (41)	22 (34)
Some overweight or obese	55 (52)	31 (42)	63 (71)	44 (58)	39 (50)	31 (44)
All overweight or obese	59 (65)	33 (51)	73 (87)	50 (68)	43 (52)	34 (45)
Socio-economic class						
Rich	42 (48)	19 (33)	59 (68)	38 (55)	36 (47)	28 (40)
Average	47 (53)	26 (40)	65 (79)	45 (62)	38 (48)	30 (42)
Poor	50 (58)	26 (41)	70 (88)	51 (73)	39 (51)	32 (42)
All	47 (53)	26 (41)	65 (79)	44 (64)	38 (49)	30 (42)

Table 8 presents the average market share, price and sugar content in g per 100 mL of the 14 sub-categories on the non-alcoholic beverages markets. The most expensive sub-categories are pure fruit juice and nectar in France, smoothies and energy drinks in the UK, and nectar, pure fruit juice, and energy drinks in Spain. In France and Spain, regular products are more frequently purchased than their diet alternatives (except for colas in Spain). In the UK, either regular or the diet sub-category is the most purchased. There is no unequivocal pattern between price and diet characteristic: depending on the sub-category, diet products can be more expensive or less expensive than regular products.

Science and Technology in childhood Obesity Policy

Table 8: Average market share, price and sugar content of each sub-category in the French, UK, and Spanish non-alcoholic beverages markets

	France			UK			Spain		
	Share %	**Price** €/l	**Sugar** g/100ml	**Share** %	**Price** €/l	**Sugar** g/100ml	**Share** %	**Price** €/l	**Sugar** g/100ml
Sugar sweetened beverages									
Colas	**28.5**	**1.0 (0.4)**	**6.5 (5.7)**	**26.8**	**0.8 (1.0)**	**3.1 (5.0)**	**30.7**	**0.8 (0.4)**	**4.9 (4.8)**
Regular	61.3	1.0 (0.5)	10.4 (1.7)	29.6	0.8 (1.3)	10.3 (1.5)	45.1	0.8 (0.3)	10.4 (2.3)
Diet	38.7	0.9 (0.3)	0.0 (0.0)	70.4	0.8 (0.4)	0.0 (0.0)	54.9	0.8 (0.5)	0.1 (0.1)
Iced teas	**5.5**	**1.0 (0.8)**	**5.2 (2.6)**				**2.5**	**0.7 (1.0)**	**3.4 (3.4)**
Regular	86.7	0.9 (0.9)	5.6 (1.7)				55.8	0.8 (1.2)	6.5 (2.4)
Diet	13.3	1.3 (0.7)	2.6 (2.2)				44.2	0.6 (0.3)	0.2 (0.3)
Fruit-flavoured drinks	**20.9**	**1.1 (0.9)**	**8.0 (3.6)**	**12.2**	**0.9 (0.8)**	**3.4 (3.8)**	**13.6**	**0.8 (0.6)**	**6.9 (4.1)**
Regular	93.1	1.1 (0.9)	8.8 (2.4)	73.2	1.2 (0.6)	6.1 (3.2)	75.3	0.8 (0.6)	6.9 (4.1)
Diet	6.9	1.0 (0.5)	0.7 (1.8)	26.8	0.5 (1.1)	0.4 (2.3)	24.7	0.8 (0.4)	3.3 (3.3)
Flavoured waters	**4.6**	**0.8 (1.6)**	**2.6 (3.4)**	**22.2**	**0.4 (0.7)**	**0.3 (1.3)**	**0.7**	**0.7 (0.8)**	**7.1 (3.1)**
Regular	55.9	0.9 (2.2)	4.2 (3.1)	1.4	0.8 (1.1)	4.7 (1.6)	96.6	0.7 (0.8)	7.3 (2.6)
Diet	44.1	0.8 (0.3)	0.2 (0.4)	98.6	0.4 (0.6)	0.2 (0.1)	3.4	0.6 (0.5)	0.0 (0.0)
Tonic waters				**3.1**	**0.9 (1.2)**	**1.8 (2.7)**			
Regular				45.8	1.2 (1.3)	4.3 (1.8)			
Diet				54.2	0.7 (1.3)	0.3 (1.4)			
Lemonades				**5.0**	**0.4 (1.1)**	**1.8 (4.2)**	**3.9**	**0.6 (0.3)**	**7.8 (4.7)**
Regular				40.0	0.5 (1.3)	4.9 (3.3)	80.0	0.6 (0.4)	9.6 (1.8)
Diet				60.0	0.3 (0.3)	0.1 (0.1)	20.0	0.6 (0.2)	0.5 (0.6)
Energy drinks				**5.8**	**1.4 (0.9)**	**5.4 (5.2)**	**5.7**	**1.1 (0.9)**	**5.9 (4.7)**
Regular				74.5	1.4 (0.9)	7.0 (3.1)	79.3	1.1 (0.8)	7.3 (2.5)
Diet				25.5	1.5 (1.0)	0.2 (0.2)	20.7	1.2 (1.2)	0.1 (0.1)
Other SSBs	**7.5**	**1.0 (1.1)**	**6.7 (4.5)**	**3.5**	**0.7 (1.1)**	**3.6 (4.4)**	**8.4**	**0.8 (2.2)**	**2.3 (4.3)**
Regular	87.3	1.1 (0.9)	8.1 (2.3)	46.7	1.0 (1.1)	9.4 (2.5)	56.7	1.9 (2.3)	8.3 (0.7)
Diet	12.7	0.9 (1.5)	0.0 (0.0)	53.3	0.6 (1.2)	0.1 (1.6)	43.3	0.3 (0.6)	0.0 (0.0)
Fruit juices									
Nectars	**4.9**	**1.5 (1.0)**	**10.0 (1.8)**	**5.6**	**1.1 (0.6)**	**7.2 (3.5)**	**3.5**	**1.1 (1.0)**	**8.6 (3.1)**
Regular	94.7	1.5 (1.0)	10.4 (1.8)	70.9	1.1 (0.6)	7.2 (3.5)	67.6	1.5 (1.1)	10.6 (1.6)
Diet (no added sugar)	5.3	1.0 (1.0)	5.8 (2.7)	29.1	0.9 (0.4)	2.5 (2.2)	32.4	0.7 (0.6)	6.4 (5.7)
Fruit juices (from concentrate)	**10.3**	**1.1 (0.7)**	**9.9 (2.3)**						
Pure fruit juice	**17.8**	**1.6 (1.3)**	**9.8 (2.7)**	**11.7**	**1.2 (0.9)**	**9.8 (2.7)**	**12.3**	**1.1 (1.1)**	**10.0 (2.5)**
Fruit juice with milk							**18.7**	**0.9 (0.3)**	**7.6 (2.4)**
Regular							78.4	0.9 (0.2)	8.5 (1.4)
Diet (no added sugar)							21.6	1.0 (0.4)	4.2 (1.7)
Smoothies				**1.5**	**2.9 (0.9)**	**10.7 (1.2)**			
Regular				72.7	2.7 (0.7)	10.5 (1.1)			
Diet (no added sugar)				27.3	3.6 (0.9)	11.2 (1.5)			
Milk-based drinks									
Flavoured milks				**2.6**	**1.7 (1.3)**	**9.2 (2.5)**			
Diet				92.9	1.7 (1.4)	9.4 (2.3)			
Regular				7.1	2.0 (1.1)	5.6 (2.5)			

Price and sugar columns: Mean (standard deviation)

2.4.2 Biscuits markets

The level of purchase varies across country (see last line in Table 9). Households in the UK panel consume on average 5.3 kg of biscuits per capita per year, while the French and Spanish panels respectively, consume 4.8 and 4.4 kg of biscuits per capita per year. Figure 2 shows the distribution of the consumption in the three countries. A significant percentage of the panel consume more than 40 g per day,[11] per capita: 5.67%, 4.2% and 3.3 % of the households of the UK, French, and Spanish panels, respectively. In Table A2, we also display household consumption by sugar content level with respect to demographics.

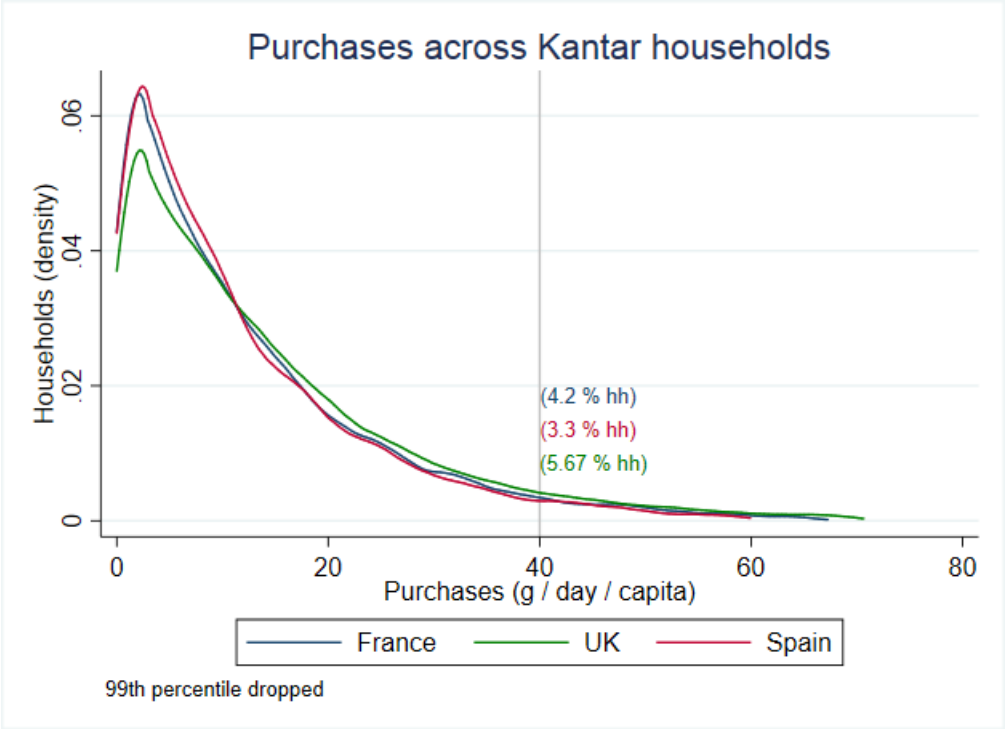


Figure 2: Consumption across Kantar households

Lecture note: 5.7% of households consume more than 40 g per day per capita of biscuit in the UK panel

Table 9 presents a comparison of the average consumption of biscuits per capita per year across households with respect to household composition, obesity status, and socio-economic class. It shows in the three countries that households with children aged between 7 and 17 consume more on average than the whole panel (as in the non-alcoholic beverages market). In the three countries, rich households and households with no overweight or obese consume adults less on average than the mean consumption of the panel. However, differences in consumption levels between households of

[11] Which represents 5 "Petit beurre lu"

different socio-economic class and obseity status in Spain are smaller than in France and the UK. As in the non-alcoholic beverages market, poor households and households where adults are all obese or overweight have the highest level of biscuits consumption.

Table 9: Household purchase - biscuits market

Mean quantity (kg/capita/year) (standard deviation)	**France**	**UK**	**Spain**
Household composition			
No children	4.5 (5.3)	5.7 (6.1)	4.3 (4.9)
Children below 6	4.2 (4.4)	3.4 (3.5)	3.6 (3.7)
Children 7-16	5.8 (5.2)	5.5 (5.0)	5.4 (4.9)
Children below 6 & 7-16	5.4 (5.0)	4.8 (4.3)	4.8 (4.5)
Obesity status			
None overweight or obese	4.7 (5.3)	4.8 (5.4)	4.2 (4.5)
Some overweight or obese	4.7 (4.9)	5.2 (5.1)	4.4 (4.7)
All overweight or obese	4.9 (5.5)	5.8 (6.1)	4.6 (5.0)
Socio-economic class			
Rich	4.0 (4.9)	4.6 (5.0)	4.3 (4.5)
Average	4.8 (5.3)	5.3 (5.6)	4.5 (4.7)
Poor	5.4 (5.2)	6.0 (6.3)	4.3 (5.0)
All	4.8 (5.2)	5.3 (5.6)	4.4 (4.8)

We report in Table 10 the average market shares and prices in the French, UK and Spanish biscuits market with respect to seven categories of sugar content.[12] The majority of biscuits have a sugar content between 20 and 37 g of sugar per 100 g of biscuits in the three countries. Biscuits belonging to these sugar content categories are also less expensive in France (7€/kg) and the UK (4€/kg). The less expensive biscuits have a sugar content between 20 and 26 g per 100 g of biscuit in Spain. Overall, we note that French biscuits are more expensive than the UK and Spanish biscuits for the seven sugar content categories (except for biscuits with a sugar content between 31 and 37 g of sugar per biscuit), on average. The most expensive biscuits are those with the lowest and the highest sugar content in France and the UK, but price dispersion in the former country is weaker.

[12]We choose not to display these statistics for each biscuits sub-category since most sub-categories are country specific (see Table 5).

Table 10: Average market shares and price in the French, UK, and Spanish biscuits markets

	France		UK		Spain	
	Share	**Price**	**Share**	**Price**	**Share**	**Price**
Sugar in 100g of biscuits	%	€/kg	%	€/kg	%	€/kg
[0;10[	0.4	17 (3.6)	.	.	8	6 (2.6)
[10;20[	1	9 (4.9)	10	6 (4.4)	22	4 (2.7)
[20;26[	12	7 (4.3)	19	4 (3.8)	44	3 (1.9)
[26;31[	21	7 (3.3)	36	4 (2.9)	13	4 (2.3)
[31;37[	45	6 (3.0)	21	6 (3.3)	10	7 (2.9)
[37;43[	11	8 (3.1)	8	6 (2.7)	20	6 (3.1)
>= 43	10	8 (3.6)	6	6 (4.2)	12	4 (2.0)

Price column: Mean (standard deviation)
Notes: We chose to present statistics with respect to seven sugar content categories to allow comparison between the three markets. Most biscuits sub-categories are country specific. The levels of sugar threshold are based on the distribution of biscuits sugar content. The 4 highest sugar content categories from 26 to 43 g per 100 g of biscuit, are based on the percentile of the distribution of biscuits in the french market. (closest integer) The other categories, from 10 and 20 g per 100 g of biscuit, account for the distribution biscuits sugar content in Spain and the UK.

3 Empirical modelling: demand and supply models

Following the empirical industrial organization literature, the market is modelled by combining a flexible discrete-choice model of demand for differentiated products with a linear-pricing model of supply. The estimation method is in two steps. First, we estimate a demand model in order to understand household preferences regarding non-alcoholic beverages and biscuit purchases. Second, we model the supply side *(i.e.,* the nature of the competition between firms) to study pricing strategy.

3.1 The demand model

We consider a flexible discrete-choice model to estimate the demand, obtain the price elasticities for every product and substitution patterns for consumers. We opt for this type of demand models because it is imperative to accurately evaluate policy impacts on specific markets. As food markets are highly segmented, a sugar tax is more likely to make consumers of a high sugar content variety exit the market first or switch to the nearest low sugar content counterparts in the same market segment, rather than substitute a product from another food category. Specifically, we use a random coefficients logit model (RCLM) (Berry et al., 1995; McFadden and Train, 2000). In this model, preferences over product characteristics are specified in a flexible manner, as it allows for both observed and unobserved heterogeneity in the intercept and slopes of the utility function. Household heterogeneity in the Willingness-To-Pay (WTP) for a given nutrient content is thus better accounted for in this model.

3.1.1 The random coefficient logit model

Following Revelt and Train (1998), let t denote the index of time ($t = 1, \ldots, T$), i the index of the household in the sample ($i = 1, \ldots, N$) and j the index of the product inside the choice set of differentiated products ($j = 1, \ldots, J_t$) at time t.

Utility

The indirect utility function V_{ijt} for household i buying product j in period t is given by

$$V_{ijt} = \alpha_i p_{jt} + X_{jt}\beta + \epsilon_{ijt} \tag{1}$$

where p_{jt} is the price of product j in period t, α_i is the marginal disutility of the price for household i, ϵ_{ijt} is an individual error term, X_{jt} is a vector of observed product characteristics and β is the vector of associated parameters that capture the taste for product characteristics.

We assume that parameter α_i varies across households. Indeed, households can have a different price disutility. It can be rewritten as

$$\alpha_i = \alpha + \pi DM_i + \sigma\nu_i \tag{2}$$

where α is the mean marginal disutility of the price for all households, DM_i is a vector of demographic characteristics and ν_i measures the unobserved heterogeneity of the households. We denote $P_\nu(.)$ the distribution of parameter ν.

We can divide the indirect utility between a mean utility $\delta_{jt} = \alpha p_{jt} + X_{jt}\beta + \xi_{jt}$ where ξ_{jt} captures all unobserved product characteristics and a deviation from this mean utility $\mu_{ijt} = (\sigma\nu_i + \pi DM_i)p_{jt}$. Hence the indirect utility is given by

$$V_{ijt} = \delta_{jt} + \mu_{ijt} + \epsilon_{ijt} \tag{3}$$

We also interact food product variables characterizing the nutritional composition of products with household characteristics (i.e. sugar content of SSBs, fruit juices, and biscuits, lipid content of biscuits, and whether the non-alcoholic beverage is diet). Table 11 summarizes the demand specification for each market.

Outside option

The household can decide not to buy one of the considered products. The utility of this option is normalised to zero. The indirect utility of choosing the outside option is written as $V_{i0t} = \epsilon_{i0t}$.

Market share

We assume that ϵ_{ijt} is independently and identically distributed as an extreme value type I distribution. The conditional probability that household i chooses product j in period t is:

$$s_{ijt}(\nu) = \frac{exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{k=1}^{J_t} exp(\delta_{kt} + \mu_{ikt})} \tag{4}$$

The market share of product j in period t is (Nevo, 2001):

$$s_{jt} = \int_{A_{jt}} \left(\frac{\exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{k=1}^{J_t} \exp(\delta_{kt} + \mu_{ikt})} \right) dP_\nu(\nu) \tag{5}$$

where A_{jt} is the set of consumers who have the highest utility for product j in period t, a consumer is defined by the vector $(\nu_i, \varepsilon_{i0t}, ..., \varepsilon_{iJt})$ and P_ν is the cumulative distribution function of ν which is typically assumed to be standard normal.

Elasticity

The random coefficients logit model generates a flexible pattern of substitutions between products. We can then write the own-price and cross-price elasticities of the market share s_{jt} as:

$$\theta_{jkt} = \frac{\partial s_{jt}}{\partial p_{kt}} \frac{p_{kt}}{s_{jt}} = \begin{cases} \frac{p_{jt}}{s_{jt}} \int \alpha_i s_{ijt}(1 - s_{ijt}) \phi(\nu_i) \mathrm{d}\nu_i & \text{if } j = k \\ -\frac{p_{kt}}{s_{jt}} \int \alpha_i s_{ijt} s_{ikt} \phi(\nu_i) \mathrm{d}\nu_i & \text{otherwise} \end{cases} \tag{6}$$

where $\phi()$ is the pdf of $P_\nu(.)$.

Table 11: Summary demand specification

Non-alcoholic beverages markets	
France	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \delta_{Diet(i)}\ \delta_{PureJuice}\ \rho_{SugarSD(i)}\ \rho_{SugarFruitJuice(i)})$
UK	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \beta_{category}\ \delta_{Diet(i)}\ \rho_{SugarSD(i)}\ \rho_{SugarFruitJuice(i)})$
Spain	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \delta_{Diet(i)}\ \delta_{PureJuice}\ \delta_{FruitDrink}\ \delta_{FJwithMilk}\ \rho_{SugarSD(i)}\ \rho_{SugarFruitJuice(i)})$
Biscuits markets	
France	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \rho_{Sugars(i)}\ \rho_{Lipids(i)}\ \rho_{SugarLipids(i)})$
UK	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \rho_{Sugars(i)}\ \rho_{Lipids(i)}\ \rho_{SugarLipids(i)})$
Spain	Price: $\alpha_i = \alpha + \alpha_{\text{child(i)}} + \alpha_{\text{obesity(i)}} + \alpha_{\text{class(i)}} + \sigma\nu_i$
	Preferences: $\beta = (\beta_{brand}\ \rho_{Sugars(i)}\ \rho_{Lipids(i)}\ \rho_{SugarLipids(i)})$

α is the mean marginal disutility of the price
α_{child}, α_{obesity} and α_{class} are associated with the household composition, obesity status and socioeconomic class
β_{brand} and $\beta_{category}$ are brand and category fixed effects
We include category fixed effects in the UK specification because several brands sell different categories of products
$\delta_{Diet(i)}$ is the coefficient associated with diet products
$\delta_{PureJuice}$ is the coefficient associated with pure fruit juices
$\delta_{FruitDrink}$ is the coefficient associated with fruit-flavoured still drinks
$\delta_{FJwithMilk}$ is the coefficient associated with fruit juices with milk
$\rho_{SugarSD(i)}$ and $\rho_{SugarFruitJuice(i)}$ are the coefficients associated with the sugar content for SSBs or fruit juices
$\rho_{SugarS(i)}$ is associated with the sugar content
$\rho_{Lipids(i)}$ is associated with the lipids content
$\rho_{SugarLipids(i)}$ is associated with the multiplication between the lipid and sugar content
Note: When the parameter $\delta_{Nutrient(i)}$ or $\rho_{Nutrient(i)}$ is indexed by household i it indicates that the variable associated to the parameter is interacted with household composition characteristics

3.1.2 Identification

This method relies on the assumption that all product characteristics X_{jt} are independent of the error term ϵ_{ijt} (which can be decomposed into a product-specific error term and an individual error term, $\epsilon_{ijt} = \xi_{jt} + e_{ijt}$). However, there is empirical evidence that unobserved factors included in ξ_{jt} can be correlated with observed characteristics X_{jt}, producing endogeneity problems (Berry, 1994). Such unobserved characteristics can be promotions or advertising, for example. For instance, promoted products are often moved to the front of the shelf, advertised, and sold at a lower price at the same time. Since we do not have any information on advertising expenditure spent by firms, the estimated impact of observed prices on demand will then capture both a true price effect and the effect of unobserved marketing efforts. Prices may also be endogenous if some unobserved characteristics are positively valued by consumers, who are thus ready to pay a premium for them. This may be taken into account by firms in setting their prices.

We use a control function approach as in Petrin and Train (2010) to account for price endogeneity,

using the set of instruments reported in Table 12. More details on the approach and results on the first stage are presented in Tables A4 and A5 in the Annex.

Table 12: Summary instrumental variables

Non-alcoholic beverages markets	
France	Number of competing products offered by other firms within the nutritional category
	Total sugar content of competing products offered by other firms within the nutritional category
	Glass input price
	Aluminium input price
UK	Number of competing products offered by other firms within the product category
	Total sugar content of competing products within the nutritional category
	Glass input price
Spain	Number of competing products offered by other firms within the product and nutritional category
	Total sugar content of competing products within the product and nutritional category
	Glass input price
	Aluminium input price
Biscuits market	
France	Number of competing products within the category of biscuits
	Chocolate input price
UK	Sum of sugar quantities of the other products of the firm in the category of biscuits
	Sum of lipid quantities of the other products of the firm with the same flavour
Spain	Sum of sugar quantities of the other products of the firm in the category of biscuits
	Sum of lipid quantities of the other products of the firm with the same flavour
	Number of competing products offered by other firms within the category and the flavour

Notes: The nutritional category refers to the regular or diet characteristic for SSBs, milk-based drinks and to the three levels of sugar content for fruit juices "Low sugar-sweet", "Sugar-sweet" and "High sugar-sweet" (these three sugar levels are based on the terciles of the sugar content distribution and are computed for each category separately).

3.2 The supply side

Firms are likely to adjust to exogenous shocks, and ignoring their strategic behaviour may lead to biased estimates of the effect of public policies (Griffith et al., 2010; Bonnet and Réquillart, 2013; Allais et al., 2015). The simulation of the effects of policy shocks on the market equilibrium therefore requires a structural model of the supply side. Below, we assume that only price strategies are implemented by firms in reaction to tax. Other strategic firms' reactions, such as modifying the set of products or products reformulation, are beyond the scope of our assessment.

We consider F firms that compete in prices on the non-alcoholic beverages market. We do not account for vertical relationships: we consider that firms sell products directly to consumers and set prices. At each period, the firm maximizes its profit, conditional on the demand parameters and other firms' prices, holding the menu of products on offer and every other observed and unobserved

characteristics constant:

$$\Pi_{ft} = \sum_{j \in G_{ft}} [M_t(p_{jt} - c_{jt}) s_{jt}(p)] \tag{7}$$

where G_{ft} is the set of products sold by firm f in period t, M_t is the size of the market in period t, p_{jt} is the price of product j in period t, c_{jt} is the constant marginal cost to produce and sell product j in period t, $s_{jt}(p)$ is the market share of product j in period t given the vector of product price p.

Prices of products j are determined with the first order conditions:

$$s_{jt}(p) + \sum_{k \in G_{ft}} [M_t(p_{kt} - c_{kt}) \frac{\partial s_{kt}}{\partial p_{jt}}] = 0 \ \forall j \in G_{ft} \tag{8}$$

We recover estimates of margins of firms $\gamma_{jt} = p_{jt} - c_{jt}$ for each product using the first order conditions and estimates of the demand model. Using equation (8), the vector of margins $\gamma_t = (p - c)_t$ can be written in matrix notation (see computation details in A.3).

$$\gamma_t = (p - c)_t = -\Big(\sum_{f=1}^{F} I_{ft} S_{pt} I_{ft} \Big)^{-1} \Big(\sum_{f=1}^{F} I_{ft} s_t(p) \Big) \tag{9}$$

where I_{ft} is the ownership matrix $(J_t \times J_t)$ of firm f in period t (I_{ft} is diagonal with elements $I_{ft}(j,j)$ equal to 1 if product j is produced by firm f in period t and zero otherwise), S_{pt} is the matrix $(J_t \times J_t)$ of the first derivatives of all market shares with respect to all prices in period t, $S_{pt} = (\frac{\partial s_{kt}}{\partial p_{jt}})_{(j=1,\ldots,J_t; k=1,\ldots,J_t)}$ and $s_t(p)$ is the vector of product market shares in period t. We then derive estimates of marginal costs, given observed prices.

3.3 Results

3.3.1 Demand estimates

The estimates from the random coefficient logit model on the non-alcoholic beverage markets are presented in Table 13. Price has a significant and negative impact on utility for all populations and for all countries. In France, households with children are less sensitive to price than households without children. In the UK and Spain, households with young children are less sensitive to price and households with children above 7 years of age are more sensitive to price than households without children. Households from the poor and average classes are more sensitive to price than rich households. Households with overweight or obese individuals are more sensitive to price than households with no overweight or obese individuals.

Results also suggest that households prefer regular products to diet products in France and Spain whereas it is the opposite in the UK. The preference for diet products is stronger for households with

children. For a given brand and a given regular or diet characteristic, households prefer products with less sugar in France and products with more sugar in the UK and Spain both for SSBs and fruit juices.[13] Households with children have a higher taste for sugar in the three countries. Brand fixed effect parameters estimates, not displayed in the Table, are large compared to the other preferences parameter estimates, indicating that households have high brand loyalty and the choice of the brand prevails over the taste for sugar both for SSBs and fruit juices. The error term is positive and significant. It measures the unobserved part explaining prices, hence a positive coefficient means that this unobserved part encourages the purchase of the alternative (i.e., promotion, beverage advertised).

Table 13: Estimates of the random coefficient logit model (non-alcoholic beverages market)

	France	**UK**	**Spain**
Price (p_{jt})			
Mean (α)	-2.65 (0.00)	-6.84 (0.00)	-5.35 (0.00)
× children below 6 years old	0.05 (0.00)	0.13 (0.00)	0.15 (0.00)
× children 7-16 years old	0.03 (0.00)	-0.03 (0.00)	-0.22 (0.00)
× average class	-0.36 (0.00)	-0.24 (0.00)	-0.13 (0.00)
× poor class	-0.70 (0.00)	-0.35 (0.00)	-0.36 (0.00)
× at least one obese	-0.06 (0.00)	-0.12 (0.00)	-0.08 (0.00)
× all obese	-0.24 (0.00)	-0.15 (0.00)	0.00 (0.00)
Standard deviation (σ)	0.91 (0.00)	1.64 (0.00)	0.61 (0.00)
Pure juice	0.66 (0.00)		3.35 (0.00)
Fruit drink			0.64 (0.00)
Fruit juice with milk			1.48 (0.00)
Diet	-1.59 (0.00)	1.02 (0.00)	-0.34 (0.00)
× children below 6 years old	0.09 (0.00)	0.13 (0.00)	0.30 (0.00)
× children 7-16 years old	0.06 (0.00)	0.07 (0.00)	0.21 (0.00)
Sugar (SSBs)	-0.05 (0.00)	0.16 (0.00)	0.11 (0.00)
× children below 6 years old	0.05 (0.00)	0.03 (0.00)	0.02 (0.00)
× children 7-16 years old	0.04 (0.00)	0.02 (0.00)	0.02 (0.00)
Sugar (fruit juices)	-0.06 (0.00)	0.03 (0.00)	0.14 (0.00)
× children below 6 years old	0.04 (0.00)	0.05 (0.00)	0.08 (0.00)
× children 7-16 years old	0.04 (0.00)	0.04 (0.00)	0.07 (0.00)
Fixed effects			
Sub-category	no	yes	no
Brand (NBs & PLs)	yes	yes	yes
Error ($\hat{\eta}_{jt}$)	0.51 (0.00)	4.09 (0.00)	4.49 (0.00)
Observations	708,940	1,364,000	270,000
Log-likelihood	-1.53588e+10	-2.32081e+10	-9.05930e+09

Note: standard errors of coefficient estimates are in parentheses.

[13]The sugar coefficient for SSBs should be interpreted with caution. There is variability in the sugar content only if a brand sells different categories of products, for example "fruit-flavoured drinks" and "other SSBs". We estimate the preference for sugar inside these brands. Hence the coefficient does not represent the absolute preference for sugar but rather preference between products for a given brand.

Science and Technology in childhood Obesity Policy

Table 14: Estimates of the random coefficient logit model - Biscuits market

	France	**UK**	**Spain**
Price (p_{jt})			
Mean (α)	-0.42 (0.00)	-1.33 (0.00)	-0.92 (0.00)
× children below 6 years old	-0.02 (0.00)	0.02 (0.00)	0.03 (0.00)
× children 7-16 years old	-0.01 (0.00)	0.04 (0.00)	0.06 (0.00)
× average class	-0.02 (0.00)	-0.01 (0.00)	-0.01 (0.00)
× poor class	-0.05 (0.00)	-0.05 (0.00)	-0.07 (0.00)
× at least one obese	0.03 (0.00)	0.12 (0.00)	0.05 (0.00)
× all obese	-0.01 (0.00)	-0.00 (0.00)	0.02 (0.00)
Standard deviation (σ)	0.17 (0.00)	0.21 (0.00)	0.20 (0.00)
Sugar	0.02 (0.00)	0.09 (0.00)	-0.02 (0.00)
× children below 6 years old	0.02 (0.00)	0.01 (0.00)	0.02 (0.00)
× children 7-16 years old	0.02 (0.00)	0.02 (0.00)	0.03 (0.00)
Lipid	0.06 (0.00)	0.22 (0.00)	0.09 (0.00)
SugarLipid	-14.97 (0.00)	-40.38 (0.00)	-10.51 (0.00)
× children below 6 years old	1.44 (0.00)	-4.55(0.00)	-5.46 (0.00)
× children 7-16 years old	5.47 (0.00)	-1.75 (0.00)	-0.02 (0.00)
Fixed effects			
Brand (NBs & PLs)	yes	yes	yes
Error ($\hat{\eta}_{jt}$)	0.14 (0.00)	1.00 (0.00)	0.56 (0.00)
Observations	544,980	928,920	170,080
Log-likelihood	-7.63538e+09	-7.10512e+09	-2.05663e+09

Note : Standard errors of coefficient estimates are in parentheses.

Table 14 presents the estimates from the random coefficient logit model on the biscuits markets. Results strengthen our findings in the non-alcoholic beverages markets. Households from the poor and average classes are more sensitive to price than rich households. Contrary to what we find in the soft drinks market, French households with children are more sensitive to price, while they are less sensitive in both the UK and Spain. Households with at least one obese individual tend to be less sensitive to price. The three panels show a strong preference for sugar and lipids, in particular, households in the UK. In contrast, the estimates of the interaction between sugar and lipids are negative: consumers dislike biscuits that are both sweet and fatty. Households without children in Spain show a weak dis-utility for sugar. This highlights a specificity of the Spanish biscuits market: biscuits tend to be less sweet than in the two other markets. Households have high brand loyalty (preferences for brands are very strong) and the choice of the brand prevails over the taste for sugar and lipids in the three countries. The error term is positive and significant. It measures the unobserved part explaining price, hence a positive coefficient means that this unobserved part encourages the purchase of the alternative (e.g., price discount, advertising).

3.3.2 Elasticities and demographic characteristics

Table 15 presents the own-price elasticities of non-alcoholic beverages and biscuits by household composition, obesity status and socio-economic class (details on how they are calculated are in Annex A.5.1) in France, the UK and Spain. First, the UK demand is more elastic than Spanish and French demand for both markets and across all household characteristics considered. Second, biscuits demand is less price elastic than that of non-alcoholic beverages, whatever the household characteristics considered, except in the UK. When comparing the elasticities by country and household characteristics, the non-alcoholic beverages demand is the most elastic for households with 7-16 years old children in the UK and Spain. French households without children are the most sensitive to price. In contrast, the biscuits demand of households without children is the most elastic in the UK and Spain. In France, the demand of households with 0-16 years old children is the most elastic. On the non-alcoholic beverages and biscuits markets, the demand of households with all adults overweight or obese is the most elastic in France and the UK. This also valid for the demand for biscuits in France and the UK. In Spain, the biscuits demand is the most elastic for households with no overweight or obese adults. For all countries and both markets, the demand of poor households is the most elastic.

Table 15: Own-price elasticities by markets, countries, and household characteristics

	Non-alcoholic beverages			**Biscuits**		
	France	**UK**	**Spain**	**France**	**UK**	**Spain**
Household composition						
Without children	-4.71	-8.93	-7.39	-3.26	-9.28	-5.35
With children below 6 years old	-4.64	-8.84	-7.21	-3.49	-9.19	-5.20
With children 7-16 years old	-4.67	-9.01	-7.69	-3.40	-9.12	-5.05
With children below 6 and 7-16 years old	-4.59	-8.92	-7.51	-3.64	-9.04	-4.91
Obesity status						
No overweight or obese	-4.48	-8.84	-7.42	-3.50	-9.18	-5.24
At least one overweight or obese	-4.58	-8.95	-7.52	-3.28	-9.11	-4.99
All overweight or obese	-4.89	-8.98	-7.42	-3.55	-9.19	-5.14
Socio-economic class						
Rich	-4.06	-8.73	-7.24	-3.24	-9.04	-4.97
Average	-4.66	-8.96	-7.40	-3.42	-9.12	-5.04
Poor	-5.24	-9.08	-7.71	-3.68	-9.31	-5.36

Notes: Own-price elasticities are calculated at the alternative level. For a given household characteristic, it is the mean elasticity computed across all the alternatives' own-price elasticities.

Tables A6 and A7 in Annex A.5.2 display own-price elasticities of non-alcoholic beverages and biscuits by sugar content and households characteristics in France, the UK and Spain, respectively. We find that the sweeter the non-alcoholic beverage, the more elastic the demand in France. This result is observed for all household characteristics considered. This result is also valid for the demand of non-alcoholic beverages with a sugar content above 0 and strictly below 10 g/100 mL in the UK

and Spain. It is also interesting to note that the elasticities of non-alcoholic beverages with a sugar content above 10 g per 100 mL remain almost constant in the UK. In the French biscuits market, we find that the demand is the most elastic for biscuits with a sugar content ranging from 0 to 10 g per 100 g of products. In contrast, in the UK it is the demand of biscuits with the highest level of sugar content (above 43 g/100g) that is the most elastic (10.92%). These two results are valid for all household characteristics considered. Furthermore, all previous results in Table 15 are still valid for all sugar content considered. We also provide aggregated elasticities, by sub-categories, own-price elasticities and margins by firms and by firms-sub-category (see the supplementary tables in the subsection A.5.2 in the Annex).

4 Counterfactual experiments

This section aims to determine the impact of existing and alternative forms of taxation both on the non-alcoholic beverage and the biscuits markets in France, the UK, and Spain. We study the effects of the taxes on the market (transmission of the tax, changes in price) and the consequences on diet (changes in purchase and sugar intake).

First, we design tax scenarios based on the policies implemented on the sugar-sweetened beverage market in France, the UK, and Catalonia. Then, using estimates of the demand model and the expression of the pricing equilibrium derived from the supply model, we simulate the tax policies and evaluate their effects, taking into account consumer substitution patterns and firms' reaction in price on several market outcomes.

4.1 Taxation scenarios

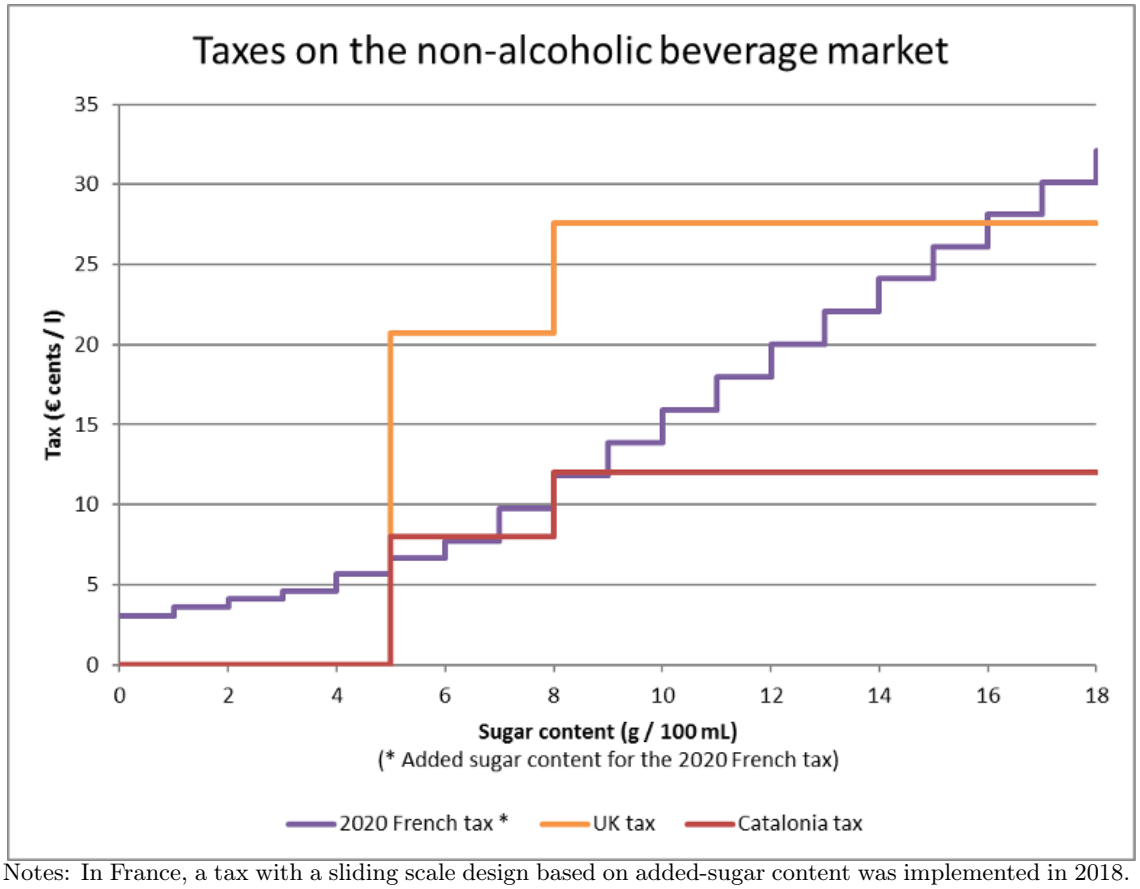
4.1.1 Presentation of the existing taxes on the non-alcoholic beverages markets

Table 16 summarises the different tax designs that were implemented in France, the UK and Catalonia. In France, a volume based tax was first established from 2012 to 2018, and then replaced by a tax with a sliding scale design based on added-sugar content. In 2020, the tax levels were updated (the sugar thresholds stayed the same). In contrast, a two tiered sugar-concentration-based tax design was implemented in the UK and Catalonia (both based on total sugar content of products and using same thresholds), however the levels of the tax rate of the UK tax are higher. Figure 3 plots the tax level according to the sugar content of the taxes.

Table 16: Taxes implemented in the non-alcoholic beverages markets in France, the UK, and Catalonia

	France		UK	Catalonia
Year	2012	2018	2018	2017
Targeted soft drinks	All with added sugar or artificial sweeteners	All with added sugar or artificial sweeteners	All with added sugar	with added sugar
	Exempt: milk-based drinks and drinks with more than 1.2% alcohol by volume			
Nutrient taxed		Added sugar	Sugar	Sugar
Design	Flat tax 0.753€/l	Progressive 15 thresholds (see Figure 3)	Two tiered tax 0-<5g/100mL sugar: no tax 5g-8g/100mL sugar : 0.207 €/l ≥ 8g/100mL sugar : 0.276 €/l	Two tiered tax 0-5g/100mL sugar: no tax 5g-8g/100mL sugar : 0.080 €/l ≥ 8g/100mL sugar : 0.120 €/l
Tax subject to VAT	yes (5.5%)	yes (5.5%)	no	yes (10%)

Figure 3: Comparison of taxes implemented in the non-alcoholic beverages markets in France, the UK, and Catalonia



Notes: In France, a tax with a sliding scale design based on added-sugar content was implemented in 2018. In 2020, the tax levels were updated (the sugar thresholds stayed the same).

4.1.2 Design of new tax scenarios

We design taxation scenarios based on the taxes for non-alcoholic beverages implemented in France,[14] the UK and Catalonia.

Adaptation from the soft drink taxes to the biscuits taxes

There is no existing tax for biscuits. In our analysis, the taxes on biscuits are designed in the same vein as the design of the SSBs tax but tailored to the distribution of biscuits' sugar content observed in the biscuits markets, and the average price difference between SSBs and biscuits observed in each country. First, we identify which percentile of the SSB sugar distribution each SSB tax tier corresponds to. These percentiles are then used to identify the corresponding sugar levels in the biscuits sugar content distribution. These sugar levels are then used to set the levels of the tax tiers

[14] In all evaluations of the French tax design conducted below, we use the tax rate levels in force in 2020.

for the biscuits. To determine the levels of tax rates on biscuits for each tier, we first calculate the average price difference between SSBs and biscuits in each country. Then we multiply this average price difference by the tax rate level on SSBs for each tier to determine the value of the tax rate (see example in Annex A.6).

Adaptation from one country to another

For a given scenario, we used the same number and levels of tiers as in the country where the tax is implemented. To determine the correct amount of tax at each threshold for each country, we first calculated the average price difference (either non-alcoholic beverages with added sugar or biscuits) between the two countries in each market. Then, we multiplied this average price difference by the implemented tax rate level for each tier (see example in Annex A.6).

Tables 17 and 18 describe the four tax scenarios on SSBs and the three tax scenarios on biscuits, respectively. We create an additional French tax with four thresholds for the non-alcoholic beverages markets to assess the impact of the number of thresholds on consumption. We also assess this design in the biscuits markets rather than tailoring the 2020 French soft-drink tax. As non-alcoholic beverages with added-sugar in the UK are less expensive on average than in Spain and France, the amounts of the tax in the two previous countries are higher for all scenarios. In contrast, biscuits in Spain are less expensive than in the UK and France, on average. The amounts of tax in Spain are the lowest for all scenarios. In both the biscuits and non-alcoholic beverage markets, the amounts of tax in France are the highest.

Science and Technology in childhood Obesity Policy

Table 17: Tax scenarios in the non-alcoholic beverages markets in France, the UK and Spain

	France	**UK**	**Spain**
Nutrient taxed (g / 100ml)	Added sugar	Sugar	Sugar
French tax			
< 1	0.03 €/l	0.02 €/l	0.02 €/l
[1 ; 2 [	0.04 €/l	0.02 €/l	0.03 €/l
[2 ; 3 [	0.04 €/l	0.03 €/l	0.03 €/l
[3 ; 4 [	0.05 €/l	0.03 €/l	0.04 €/l
[4 ; 5 [	0.06 €/l	0.04 €/l	0.05 €/l
[5 ; 6 [	0.07 €/l	0.04 €/l	0.05 €/l
[6 ; 7 [	0.08 €/l	0.05 €/l	0.06 €/l
[7 ; 8 [	0.10 €/l	0.06 €/l	0.08 €/l
[8 ; 9 [	0.12 €/l	0.08 €/l	0.09 €/l
[9 ; 10 [	0.14 €/l	0.09 €/l	0.11 €/l
[10 ; 11 [	0.16 €/l	0.10 €/l	0.13 €/l
[11 ; 12 [	0.18 €/l	0.12 €/l	0.14 €/l
[12 ; 13 [	0.20 €/l	0.13 €/l	0.16 €/l
[13 ; 14 [	0.22 €/l	0.14 €/l	0.18 €/l
[14 ; 15 [	0.24 €/l	0.16 €/l	0.19 €/l
≥ 15	+0.02 € / g of added sugar	+0.01 € / g of sugar	+0.02 € / g of sugar
French tax with 4 thresholds			
< 3	0.04 €/l	0.03 €/l	0.03 €/l
[3 ; 6 [	0.07 €/l	0.04 €/l	0.05 €/l
[6 ; 9 [	0.12 €/l	0.08 €/l	0.10 €/l
[9 ; 12 [	0.18 €/l	0.12 €/l	0.14 €/l
≥ 12	0.24 €/l	0.16 €/l	0.19 €/l
UK tax			
< 5	no tax	no tax	no tax
[5 ; 8 [	0.31 €/l	0.21 €/l	0.25 €/l
≥ 8	0.42 €/l	0.27 €/l	0.34 €/l
Catalonia tax			
< 5	no tax	no tax	no tax
[5 ; 8 [	0.10 €/l	0.07 €/l	0.08 €/l
≥ 8	0.15 €/l	0.10 €/l	0.12 €/l
Tax subject to VAT	yes (5.5%)	no	yes (10%)

Notes: In the UK market, flavoured milk was also taxed in the simulations.

Table 18: Tax scenarios in the biscuits markets in France, the UK and Spain

	France	**UK**	**Spain**
Nutrient taxed (g /100g)	Sugar		
French tax with 4 thresholds			
< 23	0.25 €/kg	0.17€/kg	0.13 €/kg
[23 ; 29 [	0.40 €/kg	0.28 €/kg	0.22 €/kg
[29 ; 36 [	0.70 €/kg	0.49 €/kg	0.39 €/kg
[36 ; 50 [	1.07 €/kg	0.74 €/kg	0.59 €/kg
≥ 50	1.44 €/kg	1.00 €/kg	0.79 €/kg
UK tax			
< 27	no tax	no tax	no tax
[27 ; 32 [	1.88 €/kg	1.31 €/kg	1.03 €/kg
≥ 32	2.51 €/kg	1.74 €/kg	1.37 €/kg
Catalonia tax			
< 17	no tax	no tax	no tax
[17 ; 27 [	0.60 €/kg	0.41 €/kg	0.33 €/kg
≥ 27	0.90 €/kg	0.62 €/kg	0.49€/kg
Tax subject to VAT	yes (5.5%)	no $\star$	yes (10%)
$\star$ (only coated ones at 20%)			

4.2 Simulation method

We simulate the impact on prices and consumption of a change in tax design. We denote $t^d = (t^d_1, \ldots, t^d_j, \ldots, t^d_{J_t})$ the vector of the amounts of the excise tax paid for each alternative j at period t in tax design d, and $\hat{c}_t = p_t - \gamma_t = (\hat{c}_{1t}, \ldots, \hat{c}_{j_t}, \ldots, \hat{c}_{J_t})$ estimated marginal costs vector, obtained from firms profit maximization conditional on demand parameters estimates (see Section 3.2). We find the new equilibrium prices vector in period t, denoted $p^\star_t = (p^\star_{1t}, \ldots, p^\star_{j_t})$, using the following optimizing programme:

$$\min_{\{p^\star_{jt}\}_{j=1,\ldots,J_t}} || \underbrace{p^\star_t - \gamma(p^\star_t)}_{\hat{c}_t(p^\star_t)} - \tilde{c}_t || \tag{10}$$

where $\tilde{c}_t = \hat{c}_t - t^0 \times (1 + VAT) + t^1 \times (1 + VAT)$ (if the tax is subject to VAT) stands for the new marginal costs vector when the tax amounts vector changes from t^0 to t^1, and the function $\gamma(p^\star_t)$ is defined in equation (9).

4.3 Results non-alcoholic beverages markets

4.3.1 Impact on market structure

Tables in the Annex A.7 report the impact of each tax scenario on prices, pass-through (i.e. the degree to which food firms may change prices in response to taxes) and variations in the market

shares for each non-alcoholic beverage subcategory and each firm in France, the UK and Spain. The UK tax scenario generates the highest variations in these indicators. All tax scenarios considered bring about an increase in the market share of pure fruit juice in France, the UK and Spain. These variations are the highest in Spain. The Spanish pure fruit juices market share would experience an increase of almost 30% in the Catalonia tax scenario, versus about 2% and 13% in France and the UK, respectively. The implementation of all tax scenarios also benefits diet (cola, fruit-flavoured drink, sport and energy drink, and flavoured water) and low added-sugar content (nectar) alternatives in the three markets. UK households also switch from regular to diet flavoured milk but only in the UK and Catalonia tax scenarios. In contrast, all smoothies, including those with a low level of sugar content, would experience a decrease in their market shares in the four tax scenarios. A specificity of the French market is the increase in the market shares of both regular and diet flavoured water and iced tea in the four tax scenarios, while only diet flavoured water and iced tea experience an increase of their market shares in Spain. In the UK, both regular and diet tonic water and lemonade market shares increase in the UK and Catalonia tax scenarios.

Table 19 displays to what extent tax affects the percentage of households that do not purchase one of the considered beverage (outside option), and a summary of several market structure indicators such as the pass-through, tax revenue, and the variations in firms' profit, consumer surplus, total welfare, and total welfare excluding tax revenue. All of theses indicators are calculated at the market level. We find similar pass-through values for the four tax scenarios in the three countries: on average 100% of the tax is passed-through onto SSBs consumer prices. In particular, we find in the UK that drinks with a sugar content between 5 and 8 g per 100 mL of beverage and those that contain more than 8 g per 100 mL of beverage passe on 4% of the UK levy on the prices of those two non-alcoholic beverage categories (see Table A21). In contrast, Scarborough et al. (2020) find in their evaluation of the SDIL on prices that the latter drinks pass on 31% of the levy, while the prices of former drink category reduce after the implementation of the SDIL (the pass-through equals -59%). The UK tax scenario generates the highest reduction in consumer surplus as it is characterized by the highest tax rate levels. We also find that the implementation of the four tax scenarios has almost no effect on firms' profit. Overall, the four tax scenarios yield total welfare losses except in Spain if French tax scenarios (the 2020 tax or the four threshold tax) are implemented: tax revenues offset losses in profit and consumer surplus.

Table 19: Summary of simulations - non-alcoholic beverages market

	French tax 4 thresholds	**French tax**	**UK tax**	**Catalonia tax**
		France		
Outside option (percentage point variation)	0.22	0.10	0.62	0.6
Pass-through (mean)	1.01	0.99	1.04	1.07
[Q5;Q95]	[0.81;1.51]	[0.55;1.34]	[1.01;1.22]	[1.01;1.38]
Tax revenue (€)	2.1E+08	1.9E+08	2.6E+08	1.8E+08
Variation in				
Profit	-0.2%	-0.2%	+0.7%	+0.2%
Consumer surplus	-2.8%	-2.0%	-5.7%	-1.9%
Total welfare	-1.2%	-1.1%	-2.1%	-1.1%
Total welfare (without tax revenue)	-2.1%	-1.5%	-4.0%	-1.3%
		UK		
Outside option (percentage point variation)	0.39	0.32	0.32	0.17
Pass-through (mean)	1.00	1.01	1.04	1.04
[Q5;Q95]	[0.99;1.06]	[0.99;1.06]	[1.02;1.05]	[1.01;1.06]
Tax revenue (€)	1.0E+08	8.5E+07	6.8E+07	5.4E+07
Variation in				
Profit	-0.3%	-0.2%	+0.8%	+0.4%
Consumer surplus	-4.2%	-3.7%	-6.5%	-3.0%
Total welfare	-0.3%	-0.3%	-2.8%	-0.6%
Total welfare (without tax revenue)	-3.4%	-2.9%	-4.8%	-2.3%
		Spain		
Outside option (percentage point variation)	1.22	1.03	2.20	0.90
Pass-through (mean)	0.99	0.99	1.01	1.01
[Q5;Q95]	[0.96;1.06]	[0.96;1.08]	[1.00;1.03]	[0.98;1.04]
Tax revenue (€)	7.2E+07	6.2E+07	6.9E+07	5.4E+07
Variation in				
Profit	-0.6%	-0.4%	-0.6%	-0.3%
Consumer surplus	-4.9%	-4.2%	-8.2%	-4.3%
Total welfare	+1.4%	+1.3%	-1.3%	-0.8%
Total welfare (without tax revenue)	-3.8%	-3.3%	-6.3%	-3.1%

4.3.2 Variations in purchase and sugar purchase

Variations in purchase

Table 20 reports the variations in purchase (in ml/week/household) associated with the four taxation designs in the three countries. Overall, the purchase of highly taxed beverages (with more than 5 grams of sugar per 100 mL) is decreasing for each scenario and each country. The purchase of low or no taxed beverages (less than 5 grams of sugar per 100 mL and pure fruit juice) is increasing for each scenario and each country. The UK tax generates the highest decrease in the purchase of taxed beverages. The French tax with four tiers generates a higher decrease in the purchase than the French tax with 15 tiers. Finally, purchase reductions in volume are higher in Spain and the UK than in France.

Table 20: Consumption variations resulting from four design taxes scenarios in the Kantar sample in France, the UK, and Spain (in mL/week/household) - non-alcoholic beverages market

	French tax with 4 thresholds	**French tax**	**UK tax**	**Catalonia tax**
		France		
Liable drinks (sugar/100 mL)				
High tier ≥ 8g	-52.21	-47.17	-99.67	-53.45
Low tier [5g ; 8g [	-0.29	3.43	-9.93	-0.23
] 0g ; 5g [	14.21	14.01	42.42	25.85
0g	28.50	24.65	42.17	23.87
Exempt drinks				
Pure fruit juices	7.85	4.12	20.08	3.24
		UK		
Liable drinks (sugar/100 mL)				
High tier ≥ 8g	-118.37	-110.89	-214.43	-111.71
Low tier [5g ; 8g [	-50.73	-38.91	-154.14	-61.44
] 0g ; 5g [	14.32	21.35	174.46	83.88
0g	97.56	81.60	125.96	58.47
Exempt drinks				
Pure fruit juices	49.91	40.93	62.20	27.74
		Spain		
Liable drinks (sugar/100 mL)				
High tier ≥ 8g	-168.66	-153.53	-359.34	-163.55
Low tier [5g ; 8g [	-36.24	-21.60	-139.87	-40.04
] 0g ; 5g [	84.24	75.52	278.13	113.43
0g	35.33	29.34	62.69	25.44
Exempt drinks				
Pure fruit juices	67.97	55.91	127.44	52.02

We compare our results with the ex-post evaluation of the UK Levy tax conducted in Pell et al. (2021). On the UK market, we find that the UK tax causes a decrease in 214.4 mL/day/household of beverages taxed in the high tier (respectively 155.0 in Pell et al. (2021), Table 2); a decrease in 154.1 mL/day/household of beverages taxed in the low tier (respectively 177.3); an increase of 174.4 mL/day/household of non-taxed beverages with sugar (respectively 217.4) and an increase of 125.96 ml/day/household of sugar-free beverages (respectively 197.0). Overall, we predict purchase changes similar to those of Pell et al. (2021), which confirms the consistency, relevancy and interest of our methodology.

Sugar purchase variations

The magnitude of the effects of tax on sugar purchase depends on several factors. It depends not only on the tax design (such as the levels and number of tax thresholds, and the amounts of tax rate relative to sugar concentration for each tier), but also on the demand characteristics (such as households' sensitivity to price and the distribution of product purchase with respect to sugar) and product supply characteristics (such as the distribution of product sugar content).

To disentangle the effects of the tax design from those linked to demand and product supply characteristics, we analyse the effects of the four tax scenarios in each country. Figures 4 to 6 show the variations in the daily per capita quantity of sugar purchased[15] for each tax scenario and each households panel. The trend in purchase reductions is similar to the trend in sugar purchase reductions. We find, first, that the UK tax design, characterized by the highest tax rate levels, is the most effective tax design in reducing sugar purchase in the three markets. Moreover, we find higher reductions in the UK tax design than in the Catalonia tax design, which has the same design as UK tax but with lower tax rate levels, in France, the UK and Spain. **Rising the tax rate levels increases the reductions in sugar purchase**. However, we cannot conclude whether this relationship is strictly increasing for all tax rate levels. Second, we find higher reductions if the French tax with four tiers scenario is implemented than if it is the French tax with more than 15 tiers scenarios, in the three countries. Moreover, the French tax with four tiers scenario yields lower reduction than the Catalonia tax scenario, characterized with 2 tiers and tax rate levels lower for beverages with a sugar content between 6 and 9 g and with a sugar content above 9 g per 100 mL of beverage, in the three countries. **The number of tax tiers affects the level of sugar purchase drops. At similar tax rate levels and for at least two tax tier levels, lowering the number of thresholds increases the reduction in sugar purchases**.

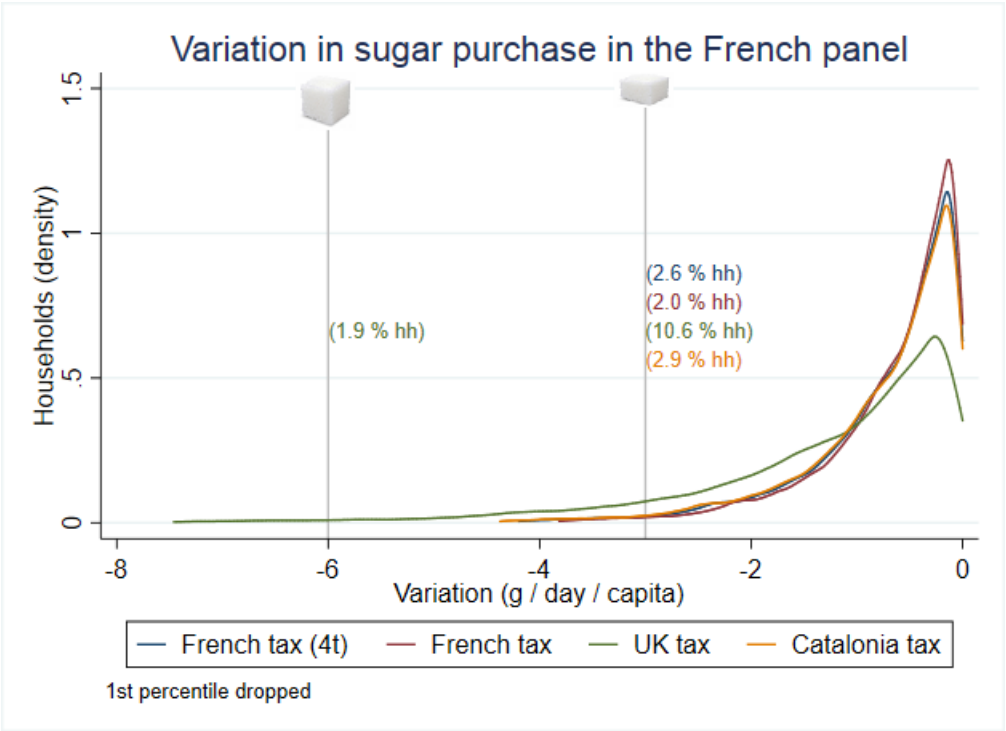
In the French panel (Figure 4), the UK tax would reduce sugar purchase by half a sugar cube for 10.6% of households and by one sugar cube for 1.9% of households. The French tax with four thresholds (respectively 15) would reduce the purchase of sugar by half a sugar cube for 2.6% (respectively 2.0%) of households. The Catalonia tax would reduce sugar purchase by half a sugar cube for 2.9% of households.

In the UK panel (Figure 5), the UK tax would reduce sugar purchase by half a sugar cube for 23.4% of households, by one sugar cube for 8.1% of households, by one and a half sugar cubes for 3.2% of households, and by two sugar cubes for 1.5% of households. The French tax with four thresholds (respectively 15) would reduce the purchase of sugar by half a sugar cube for 6.6% (respectively 5.6%) of households and by one sugar cube for 1.1% of households. The Catalonia tax would reduce sugar purchase by half a sugar cube for 7.9% of households and by one sugar cube for 1.5% of households.

In the Spanish panel (Figure 6), the UK tax would reduce sugar purchase by half a sugar cube for 19.7% of households, by one sugar cube for 7.4% of households, by one and a half sugar cubes for 3.3% of households, and by two sugar cubes for 1.6% of households. The French tax with four thresholds (respectively 15) would reduce the purchase of sugar by half a sugar cube for 4.8% (respectively 3.8%) of households and by one sugar cube for 0.9% (respectively 0.6%) of households. The Catalonia tax would reduce sugar purchase by half a sugar cube for 5.5% of households and by one sugar cube for 1.1% of households.

[15] One sugar cube is 6 grams

Figure 4: Variation in sugar purchase (French panel) - Non-alcoholic beverages market



Lecture note: The French tax with four thresholds would reduce sugar purchase by 3g for 2.6% of households in the French panel.

Figure 5: Variation in sugar purchase (UK panel) - Non-alcoholic beverages market

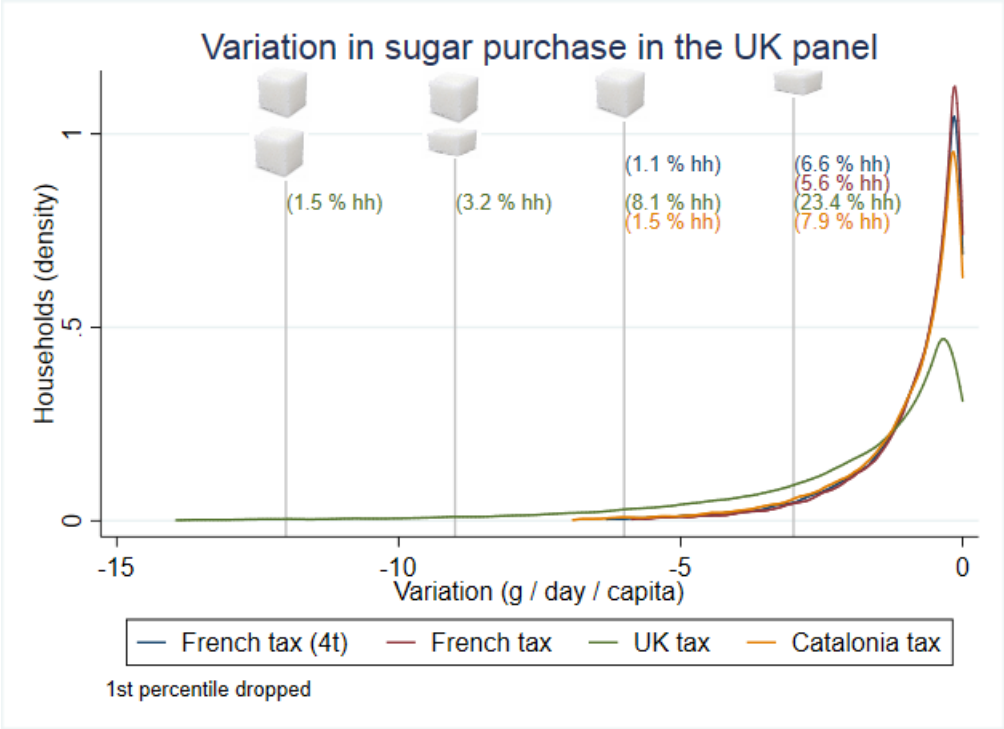
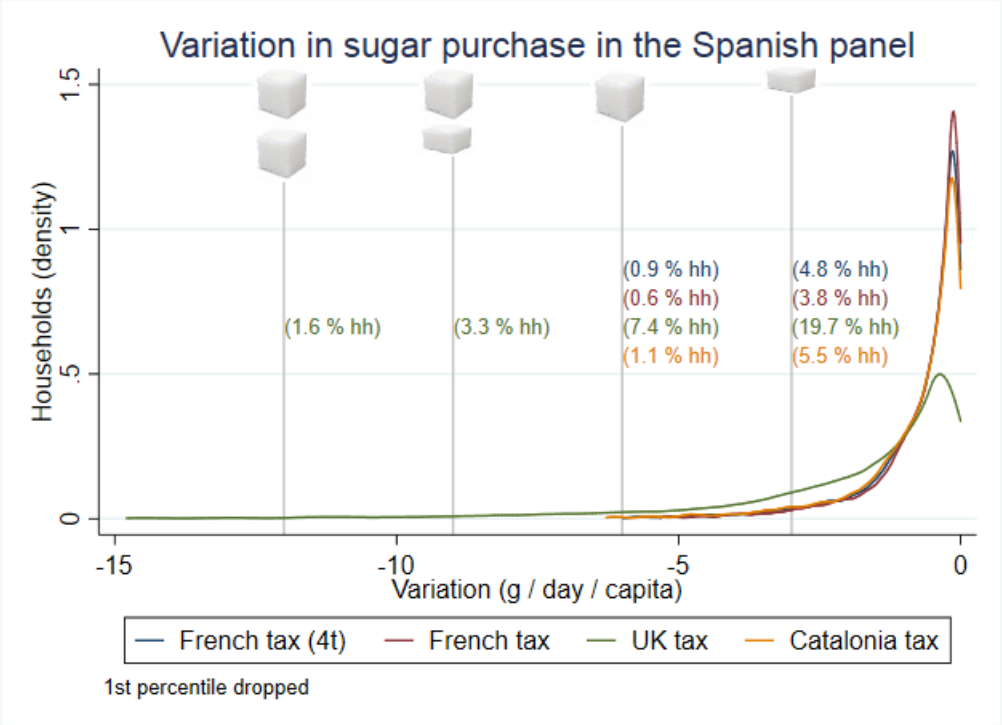


Figure 6: Variation in sugar purchase (Spanish panel) - Non-alcoholic beverages market



If the tax scenario is set, Table 21 allows us to analyse the effects of demand and product supply characteristics, excluding the effect of tax design. It reports the average variations in sugar purchase per gram/day/capita for each tax design scenario in the three countries. Thus, for a given tax scenario, we find that **the lower price sensitivity, the weaker the sugar purchase reduction**: although the tax amounts in France are the highest in all tax scenarios considered (see Table 17), reductions in sugar purchase in France are the lowest. This result is due to the fact that French households have the lowest price sensitivity for all non-alcoholic beverages whatever the sugar content level considered (see Table A6): although the average sugar content of non-alcoholic beverages in Spain is lower than in France and Spanish households purchase less non-alcoholic beverages (see Figure 1), the four tax scenarios bring about higher sugar consumption reductions in Spain than in France.

Table 21: Sugar consumption reductions resulting from the four design taxes scenarios in France, the UK and Spain (in gram/day/capita) - non-alcoholic beverages market

	France	UK	Spain
French tax with 4 thresholds	0.33	0.91	0.90
French tax	0.30	0.84	0.81
UK tax	0.59	2.00	2.26
Catalonia tax	0.35	0.99	0.96

Variation in sugar purchase by household characteristics

Figures 7 to 9 show the variations in sugar purchase according to demographic characteristics.[16] We find that the UK tax is the most effective in decreasing sugar purchase whatever the demographic characteristics considered. We find that the reduction in sugar purchase is the highest for households with 7-16 years old children in France and the UK for the four tax scenarios. The much larger average purchase of non-alcoholic beverages by households with 7-16 years old children compared to average households purchase (as documented in Table 7) explains this result.[17] However, households in France and the UK with 7-16 years old children still have on average the highest quantity of sugar purchase after the implementation of the four tax scenarios (see Table A43 that compares the effects of the four tax scenarios on the quantity of sugar purchase before and after the four tax scenarios implementation, by household characteristics). Spanish households with no children and with 7-16 year old children experience the highest reduction in sugar purchase for all tax scenarios.

As expected, the highest reductions are found for households where all adults are overweight or obese in the UK for the four tax scenarios: these households are the most price sensitive and have the strongest proportion of taxed non-alcoholic beverage purchase (see Table A1). These type of households in Spain also experience the highest reductions in sugar purchases. Although they are not the most price-sensitive, their larger average sugar purchase of non-alcoholic beverages with more than 5 g per 100 mL compared to average other households sugar purchase explains this result (as documented in Table A1). In France, households with at least one obese or overweight adult experienced the highest sugar purchase reduction whatever the tax scenario considered. Although they are not the most price-sensitive of French households, their proportion of purchases of taxed non-alcoholic beverages is the highest: the purchases of non-alcoholic beverage with a sugar content above 5 g per 100 mL for households with at least one obese or overweight adult account for 74% non alcoholic beverages purchases (excluding pure fruit juices) compared to 67% for households where all adults are overweight or obese (see Table A1). However households where all adults are overweight or obese in the UK and Spain and households with at least one obese or overweight adult still have

[16] Figures A3 to A5 in the Annex present variations in purchase.

[17] UK households with 7-16 years old children are also the highest price elastic households in the UK (see Table 15).

the highest sugar purchase after the four tax scenarios implemented (see Table A43). We also find that poor households in France, Spain and the UK, which are characterized by both the highest purchase of taxed non alcoholic beverages and the strongest sensitivity to price, experience the highest decreases in sugar purchase for the four tax scenarios. However, poor households in France and the UK still have on average the highest quantity of sugar purchase after the implementation of the four tax scenarios considered (see Table A43).

Figure 7: Impact on sugar purchase in France (non-alcoholic beverages market)

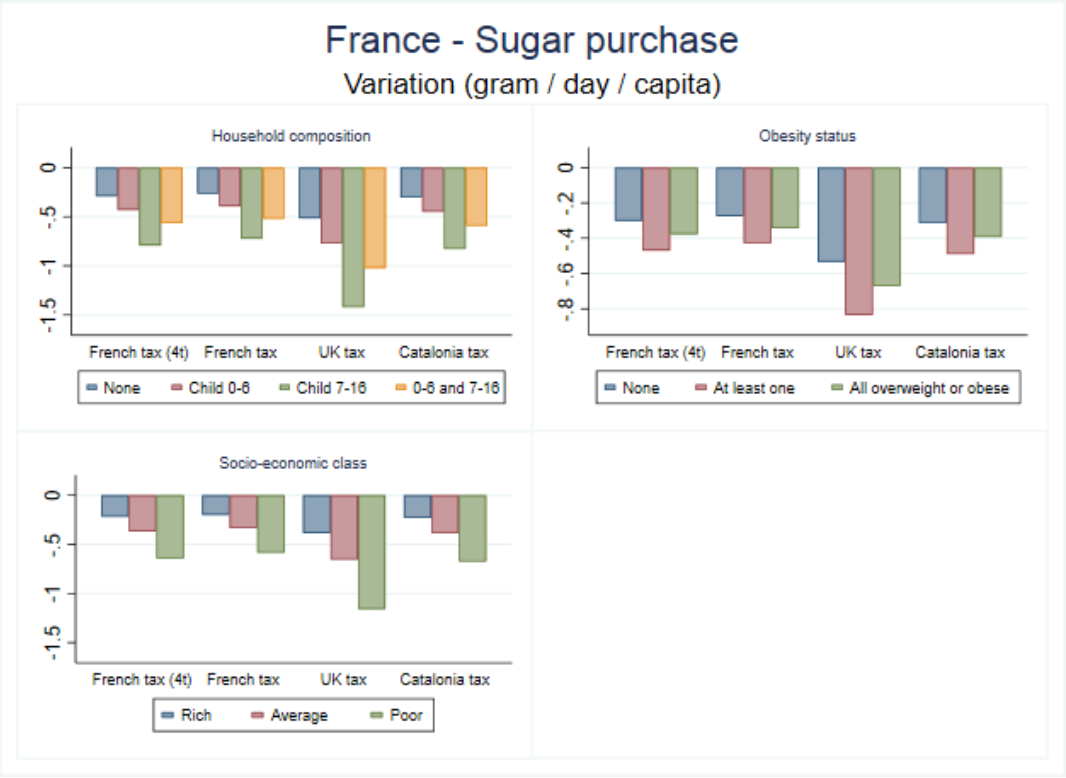


Figure 8: Impact on sugar purchase in the UK (non-alcoholic beverages market)

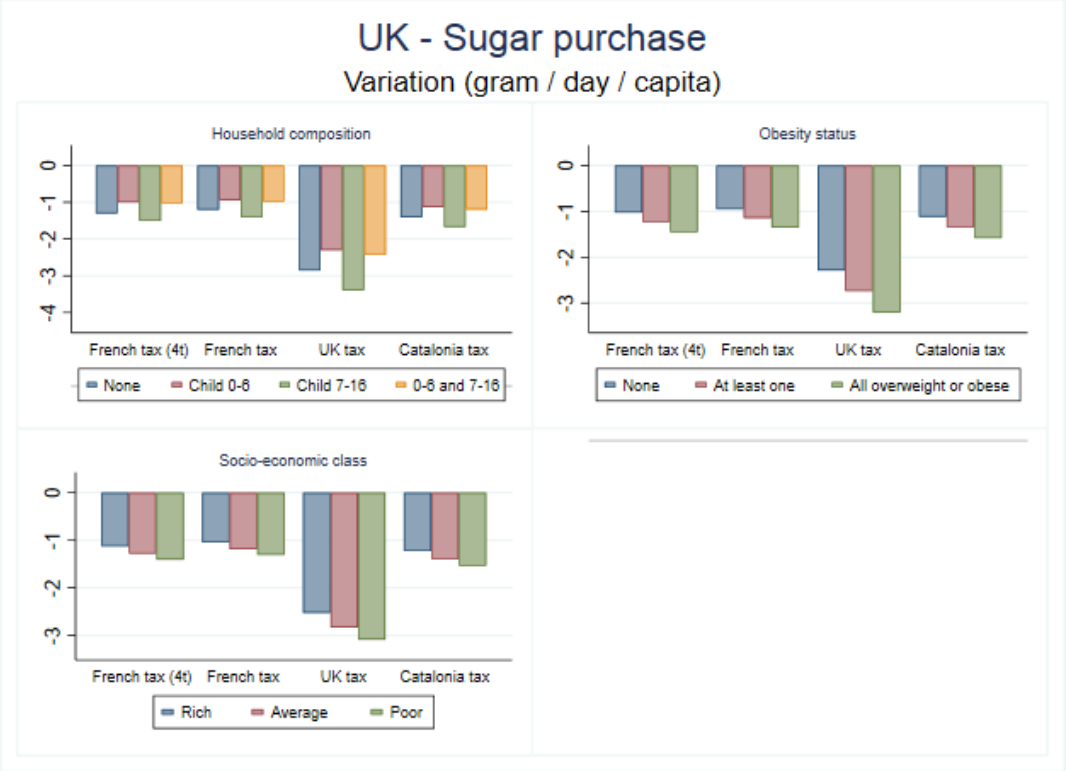
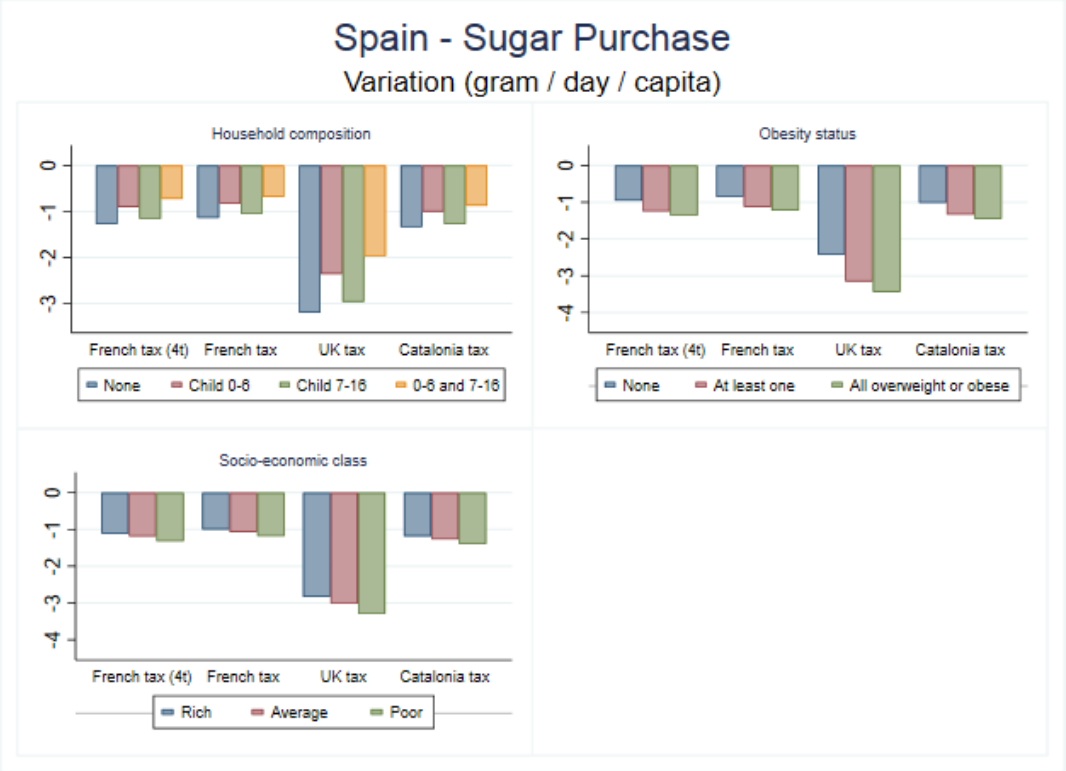


Figure 9: Impact on sugar purchase in Spain (non-alcoholic beverages market)



4.4 Results biscuits markets

4.4.1 Impact on market structure

Tables A34 to A42 in Annex A.7 report the impact of each tax scenario on prices, pass-through, and variations in the market shares for biscuits with respect to the seven sugar content categories considered in Table 10 and each firm in France, the UK, and Spain. As in the non-alcoholic beverages markets, simulations show a greater effect of the UK scenario on market shares. Each scenario in the three markets shows a significant increase of the market shares of biscuit with less than 26g of sugar per 100g of biscuits (except in Spain if the Catalonia tax plan is implemented), ranging from 4% in the Spanish market if the French tax scenario is implemented, to 135% in the UK market if the UK scenario is implemented. As it is targeted by tax, these increases are at the expense of the market shares of biscuits with a sugar content above 31 g per 100 g, which decreases in all scenarios and for the three markets. Market share decreases the range from more than 6% in France if the French tax with four thresholds is implemented to 79% with the implementation of the UK scenario in the UK. We also find heterogeneity in the extent to which firms change their prices in response to the tax. In particular, private label brands decrease their margins and tend not to pass the entire tax to the consumer leading to a smaller decrease of their market shares (except in the UK tax scenario). In contrast, national brand companies tend to pass-through 100% of the tax onto biscuits' consumer prices.

Table 22 presents to what extent tax affects the percentage of household that do not purchase biscuits and a summary of several market structure indicators such as the pass-through, tax revenue and the variations in firms' profit, consumer surplus, total welfare, and total welfare excluding tax revenue. We find that, on average, 100% of the tax is passed-through onto the biscuits consumer prices in the three markets in the UK tax scenario. In contrast, companies do not pass the entire tax onto consumer prices in France, the UK, and Spain in the two other tax scenarios. We also find that decreases in profit are much larger than those obtained if a tax in the non-alcoholic beverages markets is implemented: taxes implemented lead to larger market share variations in the biscuits markets than in the non-alcoholic beverages markets. Consumer surplus reductions are also stronger in the biscuits markets in France and the UK. However, they are lower in Spain (ranging from 2% to 3%), which results in welfare gains in the French and Catalonia tax scenarios. Spanish households are less affected by the three tax designs as biscuits with a sugar content below 23 g per 100 g of biscuit (i.e. below the first French and UK tax tier) accounts for 70% of total Spanish households biscuit purchase (see Table A2).

Table 22: Summary of simulations - Biscuits market

	French tax with 4 thresholds	UK tax	Catalonia tax
	France		
Outside option (percentage point variation)	3.33	9.67	3.87
Pass-through (mean)	0.95	1.04	0.97
[Q5;Q95]	[0.58;1.13]	[0.95;1.20]	[0.92;1.06]
Tax revenue	2.20E+08	4.03E+08	2.52E+08
Variation in			
Profit	-4.88%	-14.44%	-5.48%
Consumer surplus	-9.06%	-28.09%	-10.68%
Total welfare	-2.86%	-15.23%	-3.46%
Total welfare without tax Rev	-8.02%	-24.68%	-9.38%
	UK		
Outside option (percentage point variation)	4.45	8.93	5.80
Pass-through (mean)	0.98	1	0.96
[Q5;Q95]	[0.84;1.02]	[0.85;1.03]	[0.84;1.03]
Tax revenue	1.07E+08	6.69E+07	1.33E+08
Variation in			
Profit	-4.95%	-7.53%	-7.80%
Consumer surplus	-12.43%	-24.93%	-15.81%
Total welfare	-4.55%	-17.61%	-6.25%
Total welfare without tax Rev	-11.04%	-21.69%	-14.32%
	Spain		
Outside option (percentage point variation)	2.85	3.50	3.52
Pass-through (mean)	0.93	1.04	0.92
[Q5;Q95]	[0.82;1.05]	[1.02;1.07]	[0.82;1.06]
Tax revenue	3.11E+07	2.16E+07	3.76E+07
Variation in			
Profit	-4.83%	-6.38%	-7.07%
Consumer surplus	-2.17%	-3.34%	-2.50%
Total welfare	0.78%	-1.61%	0.71%
Total welfare without tax Rev	-2.89%	-4.16%	-3.73%

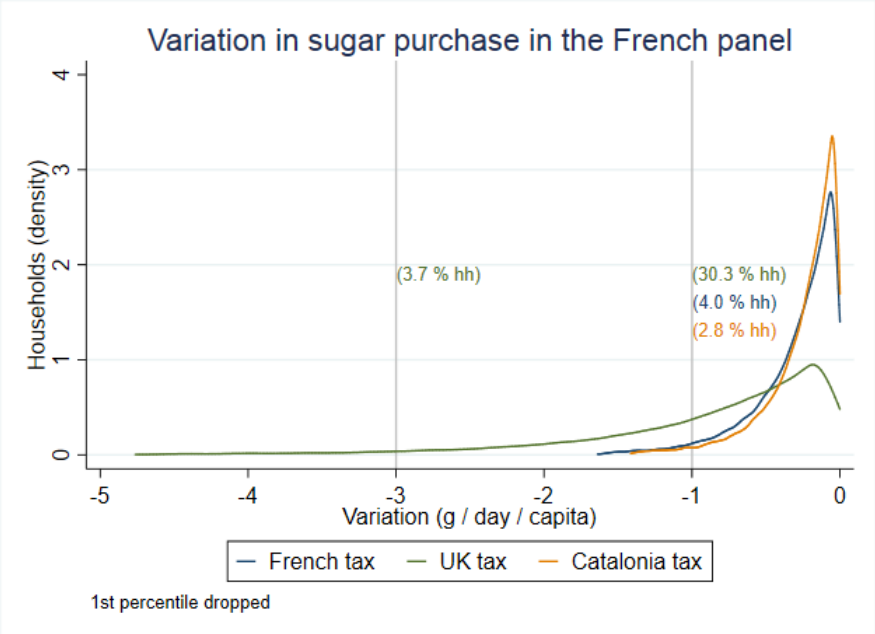
4.4.2 Variations in sugar purchase

As for the analysis of the effects of the four tax designs in the non-alcoholic beverages markets, we first disentangle the effects of the tax design from those linked to demand and product supply characteristics, by analysing the effects of four tax scenarios in each country. Thus, Figures 10 to 12 show the distribution of individual variation in the daily per capita sugar purchase[18] for each tax scenario in France, the UK, and Spain, respectively. The UK tax is the most effective tax in reducing sugar purchase in the three markets, and reductions are higher in the UK tax scenario than in the Catalonia tax scenario. So, as for the tax in the non-alcoholic beverages market, rising the tax rate levels increases the reductions in sugar purchase. However, we cannot conclude whether

[18] One sugar cube is 6 grams

this relationship is strictly increasing for all tax rate levels. In the French panel (Figure 10), the UK tax would reduce daily sugar purchase by half a sugar cube for 3.7% of households, and by 1 g for 30.3% of households. Otherwise, the French tax (respectively the Catalonia tax) would reduce the purchase of sugar by 1g per day per capita for 4.0% (2.8%) of households. In the UK panel (Figure 11), the UK tax would reduce daily sugar purchase by 2 g per day per capita[19] for 20.1% of households and by two-thirds of a sugar cube for 4.5% of households. Meanwhile, the French tax (respectively the Catalonia tax) would reduce the purchase of sugar by one-third of a sugar cube for 2.0% (2.1%) of households. In the Spanish panel (Figure 12), the UK tax would reduce daily sugar purchase by one-third of a sugar cube for 3.2% of households, and by 1 g for 16.6% of households. The French tax, however, (respectively the Catalonia tax) would reduce the purchase of sugar by 1g per day per capita for 1.9% (respectively 3.9%) of households and by one sugar cube for 0.9% (respectively 0.6%) of households.

Figure 10: Variation in sugar purchase (French panel) - Biscuits market



Lecture note: The French tax with four thresholds would reduce sugar purchase by 1g for 4% of households in the French panel.

[19] one-third of a sugar cube.

Figure 11: Variation in sugar purchase (UK panel) - Biscuits market

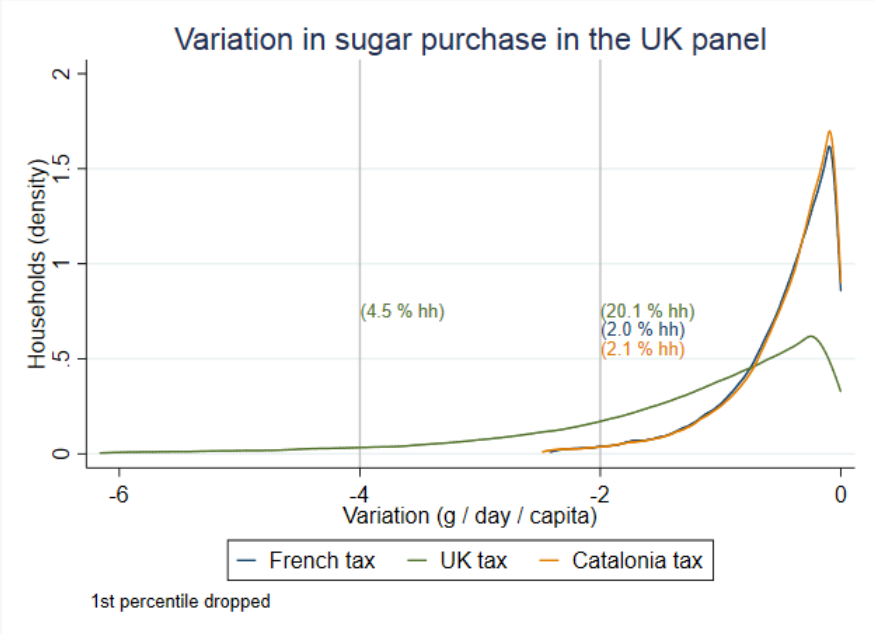


Figure 12: Variation in sugar purchase (Spanish panel)- Biscuits market

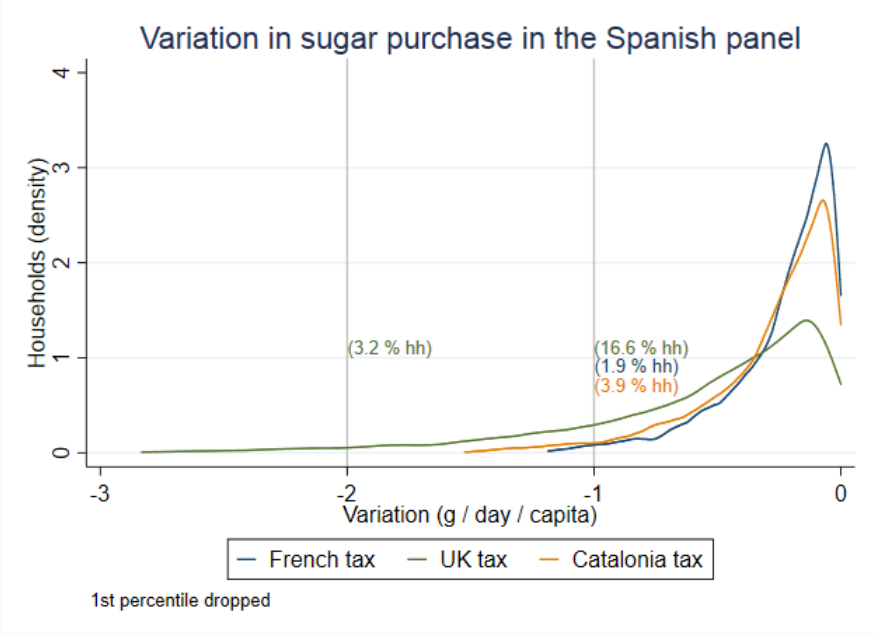


Table 23 reports the average variations in sugar purchase per gram/day/capita for each of the tax design scenarios. In the UK and Spain, we find lower sugar reductions than those obtained when a tax on the non-alcoholic beverages markets is implemented (see Table 21), whatever the tax scenario

considered. Although biscuits have on average a stronger sugar content than non-alcoholic beverages, Spanish and UK households purchase considerably less biscuits than non-alcoholic beverages (see Tables 7 and 9). In France, sugar reductions are almost similar whether a French tax with four thresholds or a Catalonia tax scenario is implemented in the biscuits or non-alcoholic beverages markets. However, the UK tax implemented in the French biscuits market would generate a higher sugar reduction than if it is implemented in the non-alcoholic beverage market (1.14 g per day and capita vs. 0.59 g per day and capita, respectively). Indeed, the purchase of biscuits with a sugar content above 32 g per 100 g (the level of the high tier in the UK tax scenarios) that are the most impacted by tax accounts for 56% of total French biscuits purchase (see Table A2).

Table 23: Sugar purchase reductions resulting from the four design taxes scenarios in France, the UK and Spain (in gram/ day/capita)

	France	**UK**	**Spain**
French tax with 4 thresholds	0.39	0.62	0.34
UK tax	1.14	1.59	0.77
Catalonia tax	0.34	0.62	0.42

Table 23 also allows us to analyse the effects of demand and product supply characteristics, excluding the effect of tax design. We find that for a given tax scenario, the strong relationship between the level of price elasticity and the level of the reduction in purchase in the case of the tax in the non-alcoholic beverages market is not so clear. The French panel has the lowest price sensitivity but is not always the panel with the lowest reduction in sugar purchase depending on the tax (see simulated variations in Spain and in France in the French and UK tax scenarios in Table 23). This no clear relationship is due to a very different distribution of biscuits purchase with respect to sugar content in France and Spain. In France, 81% of biscuits consumed have a sugar content of more than 27g per 100g of biscuits, whereas in Spain this proportion is only 26% (see Table A2). French households are so more impacted by tax than Spanish households. **The higher the proportion of purchase of taxed products, the larger the reduction in sugar purchase**. This result highlights the importance of appropriately choosing the levels of tax tiers based on the distribution of purchases of taxed products with respect to sugar content. The UK households experience the highest reductions in sugar purchase: They have not only the highest price sensitivity, but also those the highest level of biscuits purchase (see Figure 2).

Variation in sugar purchase by household characteristics

Figures 13 to 15 show the variations in sugar intake according to demographic characteristics. We find that the UK tax is the most effective in decreasing the purchase of biscuits and of sugar purchase whatever demographic characteristics considered, as in the non-alcoholic beverages market. Looking at the socio-economic classes' characteristics, we can see first that there is no sharp difference in

sugar purchase variation with respect to socio-economic class and obesity status in Spain. This is due to fairly similar levels of biscuit consumption within these two categories of households, as well as a low proportion of taxed cookies consumed (25% in the UK tax scenario), see Table A2). Poor households and households with all adults overweight or obese in France and the UK show the highest reductions in sugar purchase for all tax scenarios. As in the non-alcoholic beverages markets, they are characterised by the highest purchase of taxed biscuits and the strongest sensitivity to price (see Tables 9 and A17). However, these two household categories in the UK and poor households in France have still on average the highest levels of sugar purchase after the implementation of the four tax scenarios considered (see Table A44). Households with at least one adult overweight or obese in France remain the household type with the highest levels of sugar purchase.

In the UK, households with no children have the highest sugar purchase reductions. They are also the most price sensitive (see Table A17) and their purchase is also among the largest. Household with 7-16 year old children in the UK experience slightly lower reduction than households with no children, but they remain households with the highest sugar purchase from biscuits after tax implementation (see Table A44). In France and Spain, households with 7-16 years old children would also experience the highest reductions in the three tax scenarios. Although they are not the households that are the most sensitive to price, their average purchase of taxed biscuits is the highest (see Table A2). After tax implementation, those households in Spain remain the type of households with the highest sugar purchase from biscuits (see Table A44). In France, this is still households with children below 6 and 7-16 year old, although they experience almost similar reduction in sugar purchase as households with 7-16 years old children.

Figure 13: Impact on sugar purchase in France (biscuits market)

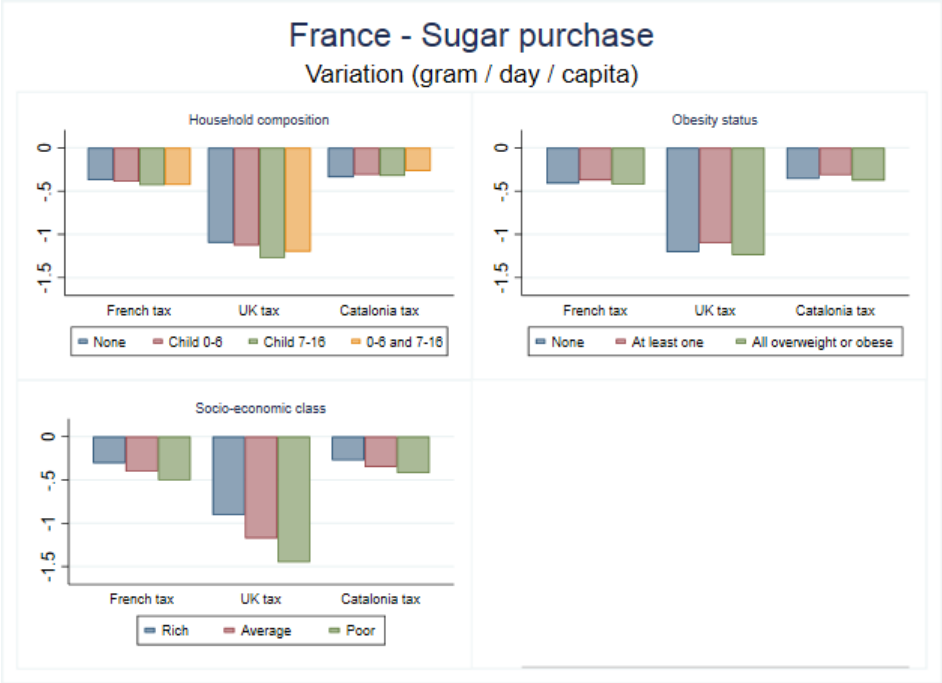


Figure 14: Impact on sugar purchase in the UK (biscuits market)

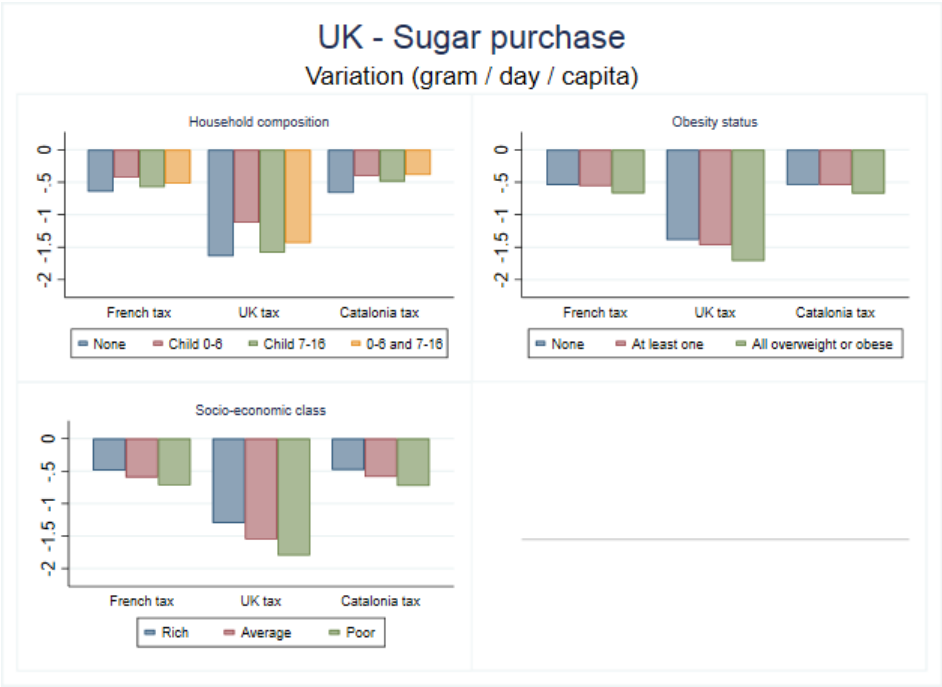


Figure 15: Impact on sugar purchase in Spain (biscuits market)

5 Conclusions

The main objective of this study is to assess and compare the effects of several existing and hypothetical tax scenarios on variations in purchases and sugar purchased for non-alcoholic beverages and biscuits, using a wide range of indicators characterising households. The comparison of the effects of each tax scenario offers guidance to policymakers on the most likely effective fiscal lever(s) to encourage households to substitute more sugar-sweetened products with less sugar-sweetened products in a given products category. To achieve our goal, we propose ex-ante evaluations using an empirical model that combines estimates of demand curves with a supply model of oligopolistic price competition to integrate firms' price reactions to tax in the evaluations. We have shown that our ex-ante analysis allows us to obtain consumption changes similar to those found in the most recent ex-post evaluation of the UK Levy tax on changes in non-alcoholic purchased by British households.

Our main results regarding **tax effects** are the following:

- The UK demand is more elastic than the Spanish and French demand for non-alcoholic beverages and biscuits, and across all household characteristics considered. Second, biscuits demand is less price elastic than the demand for non-alcoholic beverages whatever the household characteristics considered, except in the UK.
- For the four tax scenarios, we find that, on average 100% of the tax is passed-through onto

non-alcoholic beverage consumer prices in France, the UK, and Spain. We also find similar results if the UK tax design is implemented in the biscuits market. In contrast, in the French and Catalonia scenario, firms do not pass the entire tax onto biscuits consumer prices in the three markets.

- All tax scenarios simulated reach their goal; that is, they increase the purchase of the less sugar-sweetened biscuits or non-alcoholic beverages at the expense of the more sugar-sweetened ones. Among the four tax scenarios analysed, the UK tax scenario (i.e., a two-tiered excise tax based on the total sugar content of products with relatively high levels of tax rate) is the most effective in reducing sugar purchase from either the non-alcoholic beverages and biscuits markets in France, the UK and Spain. Second, implementing a tax in the non-alcoholic beverages market results in higher sugar purchase reductions than in the biscuits markets.

Our main results regarding **tax effects with respect to household characteristics** considered in the analysis are the following:

- *In the UK*, we find that the four tax scenarios implemented in the non-alcoholic beverages market produce the highest reductions in the sugar purchase of households with 7-16 years old children, while households with no children (and to a slightly lesser extent households with 7-16 years old children) have the highest reductions in the sugar purchase if implemented in the biscuits market. However after the implementation of the four taxes scenarios on the non-alcoholic beverages and biscuits markets, households with 7-16 years old children still have on average the highest daily quantity of sugar purchase per capita. Households with all adults overweight or obese experience the highest sugar purchase reduction in either non-alcoholic beverages or biscuits markets in the four tax scenarios simulated. However, those households have still on average the highest levels of sugar purchase from non-alcoholic beverages and biscuits purchases after the implementation of the four tax scenarios considered;
- *In France*, we find that the reduction in sugar purchase is the highest for households with 7-16 years old children in either non-alcoholic beverages or biscuits markets in the four tax scenarios simulated. However, after the implementation of four taxes scenarios considered, households with 7-16 years old children still have on average the highest daily quantity of sugar purchase per capita after tax on non-alcoholic beverages. Households with both children below 6 and with 7-16 years old children remain the household type with the highest sugar purchase from biscuits, although they experience almost similar reductions in sugar purchase as households with 7-16 years old children. Households with at least one overweight or obese adult experience the highest sugar purchase reductions in the non-alcoholic beverages markets, while those with all adults overweight or obese experience the highest sugar purchase reductions in the biscuits market, in the four tax scenarios simulated. However, households with at least one overweight or obese adult have still on average the highest levels of sugar purchase from non-alcoholic beverages and biscuits markets, after the implementation of the four tax scenarios considered;

- *In Spain*, we find in the four tax scenarios simulated that reductions in sugar intake are the highest for households with no children if a tax is implemented in the non-alcoholic beverages market, while it applies to those with 7-16 years old children in the biscuits markets. We also find that households with both children below 6 and 7-16 years old children (7-16 years old children) remain the type of households with the highest sugar purchase from non-alcoholic beverages (biscuits) after the implementation of the tax scenarios considered. Households with all adults overweight or obese experience the highest sugar purchase reductions in non-alcoholic beverages in the four tax scenarios simulated. However households with all adults overweight or obese remains households where the quantity of sugar purchased is the highest after the implementation of the tax scenarios considered. There is no sharp difference in sugar purchase variation with respect to socio-economic class and obesity status in Spanish biscuits markets;
- For the four tax scenarios, poor households in France and the UK experience the highest decreases in sugar purchase if they are implemented in either the non-alcoholic beverages or the biscuits markets. This result is only true for poor Spanish households in the non-alcoholic beverages market. However, poor households in France and the UK still have on average the highest daily quantity of sugar purchase per capita after the implementation of tax on non-alcoholic beverages and biscuits markets.

Implications for policy makers

The results of these analyses lead to the following implications for policy makers regarding the design of excise taxes based on sugar content:

- Rising the tax rate levels increases the reductions in sugar purchase. However, we cannot conclude whether this relationship is strictly increasing for all tax rate levels;
- The number of thresholds affects the levels of purchase variations. However the analyses in this report do not allow us to determine the number of thresholds that maximises the effects on purchase;
- The larger the price sensitivity of households, and the higher the proportion of purchase of taxed products at each threshold relative to total purchase, the greater these reductions will be. These results highlight the importance of (i) choosing to tax 'unhealthy' food categories consumed in excess where households are the most price sensitive, and (ii) appropriately choosing the levels of tax tiers based on the distribution of purchases of taxed products with respect to sugar content;
- To maximise the magnitude of the effects of the tax on sugar purchase, the threshold levels should be chosen according to the distribution of households' sugar purchase of the targeted products category.

Science and Technology in childhood Obesity Policy

References

Abarca-Gómez, L., Z. A. Abdeen, Z. A. Hamid, N. M. Abu-Rmeileh, B. Acosta-Cazares, C. Acuin, R. J. Adams, W. Aekplakorn, K. Afsana, C. A. Aguilar-Salinas, et al. (2017): "Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128· 9 million children, adolescents, and adults," *The lancet*, 390, 2627–2642.

Abbasi, A., D. Juszczyk, C. H. van Jaarsveld, and M. C. Gulliford (2017): "Body mass index and incident type 1 and type 2 diabetes in children and young adults: a retrospective cohort study," *Journal of the Endocrine Society*, 1, 524–537.

Allais, O., F. Etilé, and S. Lecocq (2015): "Mandatory labels, taxes and market forces: An empirical evaluation of fat policies," *Journal of Health Economics*, 43, 27–44.

Alvarado, M., N. Unwin, S. J. Sharp, I. Hambleton, M. M. Murphy, T. A. Samuels, M. Suhrcke, and J. Adams (2019): "Assessing the impact of the Barbados sugar-sweetened beverage tax on beverage sales: an observational study," *International Journal of Behavioral Nutrition and Physical Activity*, 16, 1–11.

Berry, S. (1994): "Estimating discrete-choice models of product differentiation," *RAND Journal of Economics*, 25, 242–262.

Berry, S., J. Levinsohn, and A. Pakes (1995): "Automobile Prices in Market Equilibrium," *Econometrica*, 63, 841–890.

Bonnet, C. and V. Réquillart (2013): "Tax incidence with strategic firms in the soft drink market," *Journal of Public Economics*, 77–88.

Brambila-Macias, J., B. Shankar, S. Capacci, M. Mazzocchi, F. J. Perez-Cueto, W. Verbeke, and W. B. Traill (2011): "Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising," *Food and nutrition bulletin*, 32, 365–375.

Cawley, J., D. Frisvold, A. Hill, and D. Jones (2019a): "The impact of the Philadelphia beverage tax on purchases and consumption by adults and children," *Journal of Health Economics*, 67, 102225.

Cawley, J., A. M. Thow, K. Wen, and D. Frisvold (2019b): "The economics of taxes on sugar-sweetened beverages: a review of the effects on prices, sales, cross-border shopping, and consumption," *Annual review of nutrition*, 39, 317–338.

de los Estados Unidos Mexicanos, C. (2014): "Ley de Impuesto Especial sobre Producción y Servicios," Tech. rep.

Dubuisson, C., A. Dufour, S. Carrillo, P. Drouillet-Pinard, S. Havard, and J.-L. Volatier (2019): "The Third French Individual and National Food Consumption (INCA3) Survey 2014–2015: method, design and participation rate in the framework of a European harmonization process," *Public health nutrition*, 22, 584–600.

Duch National Institute for Public Health and the Environment (2014): "Dutch Agreement to Improve Product Composition 2014-2020," Tech. rep., available online at `https://www.akkoordverbeteringproductsamenstelling.nl/en/media/1061`, accessed March, 2019.

Gressier, M., F. Sassi, and G. Frost (2020): "Healthy foods and healthy diets. how government policies can steer food reformulation," *Nutrients*, 12, 1992.

Griffith, R., M. O'Connell, and L. Nesheim (2010): "Sin taxes in differentiated product oligopoly: an application to the butter and margarine market," *CeMMAP working papers 37/10*.

Guh, D. P., W. Zhang, N. Bansback, Z. Amarsi, C. L. Birmingham, and A. H. Anis (2009): "The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis," *BMC public health*, 9, 1–20.

Heiss, F. and V. Winschel (2008): "Likelihood approximation by numerical integration on sparse grids," *Journal of Econometrics*, 144, 62–80.

Hepatology, T. L. G. (2020): "Voluntary agreements with industry: no sweet success," .

Lee, M. M., J. Falbe, D. Schillinger, S. Basu, C. E. McCulloch, and K. A. Madsen (2019): "Sugar-sweetened beverage consumption 3 years after the Berkeley, California, sugar-sweetened beverage tax," *American journal of public health*, 109, 637–639.

McFadden, D. and K. Train (2000): "Mixed MNL models for discrete response," *Journal of Applied Econometrics*, 15, 447–470.

Menard, C., C. Dumas, R. Goglia, M. Spiteri, N. Gillot, P. Combris, J. Ireland, L. Soler, and J. Volatier (2011): "OQALI: A French database on processed foods," *Journal of food composition and analysis*, 24, 744–749.

National Food Strategy (2021): "The plan," Tech. rep., available online at `https://www.nationalfoodstrategy.org/the-report/`, accessed July, 2021.

Navajo Nation Council (2014): "Resolution of the Navajo Nation Council. The Healthy Diné Nation Act (HDNA), CN54-14," Tech. rep., available online at `http://www.navajonationcouncil.org`, accessed September, 2021.

Nevo, A. (2001): "Measuring Market Power in the Read-To-Eat Cereal Industry," *Econometrica*, 69, 307–342.

Open Food Facts (2012): "Food products database," Tech. rep., available online at `https://fr-en.openfoodfacts.org/`, accessed July, 2020.

Pell, D., O. Mytton, T. L. Penney, A. Briggs, S. Cummins, C. Penn-Jones, M. Rayner, H. Rutter, P. Scarborough, S. J. Sharp, et al. (2021): "Changes in soft drinks purchased by British households associated with the UK soft drinks industry levy: controlled interrupted time series analysis," *bmj*, 372.

Pell, D., T. L. Penney, O. Mytton, A. Briggs, S. Cummins, M. Rayner, H. Rutter, P. Scarborough, S. J. Sharp, R. D. Smith, et al. (2020): "Anticipatory changes in British household purchases of soft drinks associated with the announcement of the Soft Drinks Industry Levy: A controlled interrupted time series analysis," *PLoS medicine*, 17, e1003269.

Petrin, A. and K. Train (2010): "A Control Function Approach to Endogeneity in Consumer Choice Models," *Journal of Marketing Research*, 47, 3–13.

Public Health England (2016): "The childhood obesity plan," Tech. rep., available online at `https://www.gov.uk/government/collections/sugar-reduction#childhood-obesity-plan`.

——— (2017): "Sugar reduction: Achieving the 20%: A technical report outlining progress to date, guidelines for industry, 2015 baseline levels in key foods and next steps," Tech. rep., available online at `https://www.gov.uk/government/publications/sugar-reduction-achieving-the-20`, accessed March, 2019.

——— (2018): "Results of the National Diet and Nutrition Survey (NDNS) rolling programme for 2014 to 2015 and 2015 to 2016," Tech. rep., available online at `https://https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/699241/NDNS_results_years_7_and_8.pdf`, accessed March, 2019.

——— (2020): "Sugar reduction: report on progress between 2015 and 2019," Tech. rep., available online at `https://www.gov.uk/government/publications/sugar-reduction-report-on-progress-between-2015-and-2019`, accessed March, 2021.

Revelt, D. and K. Train (1998): "Mixed Logit with Repeated Choices: Households' Choices of Appliance Efficiency Level," *Review of Economics and Statistics*, 80, 647–657.

Roberto, C. A., H. G. Lawman, M. T. LeVasseur, N. Mitra, A. Peterhans, B. Herring, and S. N. Bleich (2019): "Association of a beverage tax on sugar-sweetened and artificially sweetened beverages with changes in beverage prices and sales at chain retailers in a large urban setting," *Jama*, 321, 1799–1810.

Royo-Bordonada, M. Á., C. Fernández-Escobar, L. Simón, B. Sanz-Barbero, and J. Padilla (2019): "Impact of an excise tax on the consumption of sugar-sweetened beverages in young people living in poorer neighbourhoods of Catalonia, Spain: a difference in differences study," *BMC Public Health*, 19, 1–11.

Ruiz, E. and G. Varela-Moreiras (2017): "Adequacy of the dietary intake of total and added sugars in the Spanish diet to the recommendations: ANIBES study," *Nutricion hospitalaria*, 34, 45–52.

Scarborough, P., V. Adhikari, R. A. Harrington, A. Elhussein, A. Briggs, M. Rayner, J. Adams, S. Cummins, T. Penney, and M. White (2020): "Impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size and number of available soft drinks in the UK, 2015-19: A controlled interrupted time series analysis," *PLoS medicine*, 17, e1003025.

Sluik, D., M. Maillot, F. Kok, L. A. Moreno, et al. (2017): "Review of total & added sugar intakes and dietary sources in Europe," *Nutrition journal*.

Small, L. and A. Aplasca (2016): "Child obesity and mental health: a complex interaction," *Child and Adolescent Psychiatric Clinics*, 25, 269–282.

Te Morenga, L., S. Mallard, and J. Mann (2013): "Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies," *Bmj*, 346.

Trieu, K., E. McMahon, J. A. Santos, A. Bauman, K.-A. Jolly, B. Bolam, and J. Webster (2017): "Review of behaviour change interventions to reduce population salt intake," *International Journal of Behavioral Nutrition and Physical Activity*, 14, 1–15.

Vartanian, L. R., M. B. Schwartz, and K. D. Brownell (2007): "Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis," *American journal of public health*, 97, 667–675.

Wang, J., L. Shang, K. Light, J. O'Loughlin, G. Paradis, and K. Gray-Donald (2015): "Associations between added sugar (solid vs. liquid) intakes, diet quality, and adiposity indicators in Canadian children," *Applied Physiology, Nutrition, and Metabolism*, 40, 835–841.

WHO (2015): "Sugars intake for adults and children: Guideline," .

World Cancer Research Fund International (2019): "Nourishing database of implemented polices to promote healthy diets reduce obesity," Tech. rep., available online at `https://www.wcrf.org/int/policy/nourishing-database?country=Brunei#!`, accessed March, 2019,.

World Health Organization (2016): *Report of the commission on ending childhood obesity*, World Health Organization.

Wyness, L. A., J. L. Butriss, and S. A. Stanner (2012): "Reducing the population's sodium intake: the UK Food Standards Agency's salt reduction programme," *Public health nutrition*, 15, 254–261.

A Annex

A.1 Households purchase by sugar content level

Table A1: Households purchase by sugar level - non-alcoholic beverages market

Sugar content (g/100mL)	**Pure fruit juices**	**0**	**] 0 ; 5 [**	**[5 ; 8 [**	**>= 8**
Mean quantity (l/capita/year)					
			France		
Household composition					
No children	11.77	5.06	5.51	5.10	18.59
Children below 6	9.13	3.60	3.28	3.57	19.97
Children 7-16	11.98	4.92	5.35	5.78	25.17
Children below 6 & 7-16	9.67	3.91	3.46	3.69	22.13
Obesity status					
No overweight or obese	11.39	3.75	3.98	4.27	18.66
Some overweight or obese	11.25	4.44	4.95	5.14	21.34
All overweight or obese	11.44	6.50	6.60	5.61	21.37
Socio-economic clas					
Rich	14.24	5.94	4.33	4.21	13.79
Average	11.37	4.88	4.98	4.94	20.44
Poor	8.54	3.18	6.23	5.75	26.21
			UK		
Household composition					
No children	8.97	11.74	32.97	5.42	8.35
Children below 6	6.84	7.36	20.65	2.92	6.93
Children 7-16	10.92	11.42	35.14	7.34	11.46
Children below 6 and 7-16	8.91	7.62	23.94	4.55	8.36
Obesity status					
No overweight or obese	9.55	5.97	24.47	4.92	7.73
Some overweight or obese	9.10	9.95	30.06	5.23	8.94
All overweight or obese	8.62	14.36	35.78	5.66	8.92
Socio-economic clas					
Rich	10.49	9.88	27.26	4.28	6.75
Average	9.03	11.14	31.51	5.30	8.49
Poor	7.50	11.06	33.90	6.46	10.86
			Spain		
Household composition					
No children	3.61	3.08	11.91	8.10	12.12
Children below 6	3.52	1.54	9.31	5.96	9.96
Children 7-16	3.77	2.39	12.36	8.73	12.98
Children below 6 and 7-16	3.52	1.45	10.85	7.90	12.61
Obesity status					
No overweight or obese	3.66	1.87	8.45	5.92	9.37
Some overweight or obese	3.66	2.57	11.71	8.49	12.90
All overweight or obese	3.54	3.31	14.07	8.84	13.10
Socio-economic clas					
Rich	4.18	3.13	11.45	6.97	10.69
Average	3.49	2.54	11.87	7.79	11.91
Poor	3.46	2.30	10.73	9.18	13.66

Science and Technology in childhood Obesity Policy

Table A2: Households purchase by sugar level - Biscuits market

Sugar content	**[0 ; 27[**	**[27 ; 32[**	**>= 32**
Mean quantity (kg/capita/year)			
		France	
Household composition			
No children	0.91	1.09	2.46
Children below 6	0.69	1.09	2.41
Children 6-17	1.09	1.42	3.27
Children below 6 & 6-17	0.85	1.41	3.11
Obesity status			
No overweight or obese	0.92	1.20	2.59
Some overweight or obese	0.90	1.17	2.67
All overweight or obese	0.94	1.19	2.77
Socio-economic clas			
Rich	0.86	0.96	2.17
Average	0.92	1.18	2.70
Poor	0.96	1.41	3.02
		UK	
Household composition			
No children	2.01	2.18	1.51
Children below 6	0.94	1.45	0.97
Children 6-17	1.54	2.27	1.72
Children below 6 & 6-17	1.24	2.09	1.45
Obesity status			
No overweight or obese	1.57	1.87	1.35
Some overweight or obese	1.67	2.05	1.45
All overweight or obese	1.92	2.28	1.57
Socio-economic clas			
Rich	1.48	1.77	1.34
Average	1.76	2.11	1.47
Poor	2.01	2.40	1.62
		Spain	
Household composition			
No children	3.39	0.48	0.38
Children below 6	2.69	0.51	0.40
Children 6-17	3.67	0.97	0.79
Children below 6 & 6-17	3.27	0.88	0.62
Obesity status			
No overweight or obese	3.19	0.56	0.46
Some overweight or obese	3.27	0.66	0.51
All overweight or obese	3.57	0.59	0.46
Socio-economic clas			
Rich	3.23	0.59	0.52
Average	3.38	0.63	0.51
Poor	3.34	0.57	0.37

Notes: Sugar level are based on the UK and Spain scenario threshold

Science and Technology in childhood Obesity Policy

Table A3: Households purchase by sugar level - Biscuits market

Sugar content	**[0 ; 23[**	**[23 ; 29[**	**[29 ; 36[**	**[36 ; 50[**	**>= 50**
Mean quantity (kg/capita/year)					
			France		
Household composition					
No children	0.13	1.00	2.30	0.74	0.29
Children below 6	0.06	0.77	2.37	0.73	0.26
Children 6-17	0.10	1.19	3.22	0.97	0.30
Children below 6 & 6-17	0.08	0.94	3.20	0.91	0.24
Obesity status					
No overweight or obese	0.11	1.04	2.51	0.76	0.29
Some overweight or obese	0.11	0.99	2.57	0.81	0.27
All overweight or obese	0.13	1.01	2.64	0.84	0.28
Socio-economic clas					
Rich	0.13	0.98	1.89	0.69	0.29
Average	0.12	1.01	2.58	0.81	0.29
Poor	0.08	1.06	3.14	0.87	0.22
			UK		
Household composition					
No children	1.45	1.32	2.08	0.64	0.22
Children below 6	0.65	0.80	1.32	0.42	0.17
Children 6-17	1.07	1.27	2.13	0.77	0.30
Children below 6 & 6-17	0.83	1.14	1.90	0.65	0.25
Obesity status					
No overweight or obese	1.13	1.09	1.79	0.58	0.20
Some overweight or obese	1.20	1.19	1.94	0.62	0.22
All overweight or obese	1.37	1.35	2.13	0.67	0.25
Socio-economic clas					
Rich	1.08	1.00	1.74	0.58	0.19
Average	1.25	1.25	1.99	0.63	0.22
Poor	1.44	1.42	2.22	0.69	0.26
			Spain		
Household composition					
No children	3.10	0.36	0.64	0.14	0.01
Children below 6	2.47	0.26	0.74	0.12	0.01
Children 6-17	3.38	0.42	1.36	0.26	0.01
Children below 6 & 6-17	3.03	0.32	1.23	0.19	0.00
Obesity status					
No overweight or obese	2.91	0.35	0.78	0.15	0.01
Some overweight or obese	3.01	0.36	0.91	0.17	0.01
All overweight or obese	3.29	0.36	0.80	0.17	0.01
Socio-economic clas					
Rich	2.96	0.37	0.83	0.18	0.01
Average	3.09	0.37	0.89	0.17	0.01
Poor	3.11	0.31	0.71	0.14	0.01

Notes: Sugar level are based on the french scenario thresholds

A.2 Identification of demand estimates

A control function approach to endogeneity

This method relies on the assumption that all product characteristics are independent of the error term ϵ_{ijt}. However, assuming $\epsilon_{ijt} = \xi_{jt} + e_{ijt}$, where ξ_{jt} is a product-specific error term varying across periods and e_{ijt} is an individual-specific error term, the independance assumption cannot hold if unobserved factors included in ξ_{jt} (and hence in ϵ_{ijt}) such as promotions, displays, and advertising are correlated with observed characteritics X_{jt}. For instance, we do not know the amount of advertising expenditure that firms incur each month for their brand. This effect is thus included in the error term because advertising might play a role in the choice of products by households. As advertising is an appreciable share of production costs, it is obviously correlated with prices. To solve the problem that omitted product characteristics might be correlated with prices, we use a control function approach as in Petrin and Train (2010). We then regress prices on instrumental variables (W_{jt}) and observed characteristics X_j of the demand equation:

$$p_{jt} = W_{jt}\gamma + X_j\mu + \eta_{jt}$$

where η_{jt} is an error term that captures the remaining unobserved variations in prices. The estimated error term $\widehat{\eta}_{jt}$ of the price equation includes some omitted variables such as advertising variations and promotions that could explain price variations across products and time periods. Introducing this term in the mean utility of consumers δ_{jt} allows us to capture unobserved product characteristics varying across time. Prices are now uncorrelated with the new product-specific error term varying across periods ($\zeta_{jt} = \xi_{jt} - \lambda\widehat{\eta}_{jt}$). We then write

$$\delta_{jt} = \alpha p_{jt} + X_{jt}\beta + \lambda\hat{\eta}_{jt} + \zeta_{jt}$$

where λ is the estimated parameter associated with the estimated error term of the first stage. Estimations of the first stage are reported in Table A4 for each market.

Science and Technology in childhood Obesity Policy

Table A4: Results on price equation (Non-alcoholic beverages market)

	France Coefficient (se)	**UK** Coefficient (se)	**Spain** Coefficient (se)
Instrumental variables			
BLP instruments			
Number of competing products offered by other firms within			
- the nutritional category	-0.02*** (0.00)		
- the product category		-0.01*** (0.00)	
- the product and nutritional category			-0.02*** (0.01)
Total sugar content of competing products			
- products offered by other firms within the nutritional category	0.00*** (0.00)		
- within the nutritional category		-0.00*** (0.00)	
- within the product and nutritional category			0.00*** (0.00)
Cost shifter (input prices)			
Aluminium	-0.00*** (0.00)		-0.00*** (0.00)
Glass	0.00*** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Exogenous variables			
Pure fruit juice	-0.01 (0.04)		0.65*** (0.05)
Fruit-flavoured drink			-0.05 (0.06)
Fruit juice with milk			0.10 (0.07)
Diet	0.38*** (0.06)	0.11*** (0.04)	0.10* (0.06)
Sugar (Soft drinks)	0.05*** (0.01)	0.07*** (0.01)	0.02*** (0.01)
Sugar (Fruit juices)	0.03*** (0.01)	0.28*** (0.01)	0.01 (0.01)
Brand fixed effects	yes	yes	yes
Category fixed effects	no	yes	no
IV joint significance test	F(4,3950) = 21.41 Prob > F = 0.0000	F(3,5035) = 35.97 Prob > F = 0.0000	F(4,3438) = 19.11 Prob > F = 0.0000
Observations	4,077	5,182	3,539
R^2	0.950	0.944	0.875

Notes: Cost shifters are form France - INSEE price production indices for France (`https://www.insee.fr/fr/plan-du-site/famille-bdm/102776019`); ONS price production indices for the United Kingdom (`https://www.ons.gov.uk/economy/inflationandpriceindices`); and INE price production indices for Spain (`https://www.ine.es/jaxiT3/Tabla.htm?t=8381`). They are not likely to be correlated with unobserved determinants of demand for non-alcoholic beverages. The non-alcoholic beverages industry only represents a very small share of the demand for those inputs, which justifies the absence of correlation between input prices and unobserved determinants of the demand for non-alcoholic beverages. Estimators' standard errors (se) are in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Science and Technology in childhood Obesity Policy

Table A5: Results on price equation - Biscuits market

	France Coefficient (se)	**UK** Coefficient (se)	**Spain** Coefficient (se)
Instrumental variables			
BLP instruments			
Number of competing products offered by other firms			
- within the category	-0.00*** (0.00)		
- within the category and the flavor			-0.02*** (0.00)
Total sugar content of competing products			
offered by other firms within the category		-0.00*** (0.00)	-0.06*** (0.01)
Total lipid content of competing products			
offered by other firms within the flavor		-0.01*** (0.00)	0.00*** (0.00)
Cost shifter (input prices)			
Chocolat	0.00*** (0.00)		
Exogenous variables			
Lipid	0.17*** (0.0)	0.03 (0.01)	0.10* (0.06)
Sugar	0.09*** (0.02)	0.04*** (0.01)	0.02*** (0.01)
SugarLipid	-32.00*** (5.22)	0.07 (0.01)	0.02*** (0.01)
Brand fixed effects	yes	yes	yes
IV joint significance test	F(2,5018) = 15.84 Prob > F = 0.0000	F(2,5989) = 18.72 Prob > F = 0.0000	F(3,3743) = 59.90 Prob > F = 0.0000
Observations	5,107	6,097	3,869
R^2	0.909	0.921	0.898

Notes: Cost shifters are form France - INSEE price production indices for France (`https://www.insee.fr/fr/plan-du-site/famille-bdm/102776019`); They are not likely to be correlated with unobserved determinants of demand for biscuit. The biscuit industry only represents a very small share of the demand for those inputs, which justifies the absence of correlation between input prices and unobserved determinants of the demand in the biscuit market. Estimators' standard errors (se) are in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Estimation procedure

We estimated the demand model using individual data. We used the simulated maximum likelihood method as in Revelt and Train (1998). In our model, as purchases are independent considering household and period, the likelihood function for household i can be written as:

$$L_i = \int \prod_{t=1}^{T} \prod_{j=0}^{J_t} [\frac{exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{k=1}^{J_t} exp(\delta_{kt} + \mu_{ikt})}]^{Y_{ijt}} \mathrm{d}P_\nu(\nu) \tag{11}$$

where Y_{ijt} is a dummy variable equal to 1 if household i chooses product j in period t and 0 otherwise.

We estimate the vector of demand parameters by maximizing the simulated log-likelihood function given by:

$$SLL = \sum_{i=1}^{N} W_i \times ln[\hat{s}_{ijt}]$$

where N is the total number of purchases registered by Kantar for a given market, and $W_i = N_i \times W_i^{ht}$ is the weight associated to the purchase i. N_i is the number of units purchased at the ith purchase used to take into account multiple choices of the same type of product (*i.e.* buying three bottles of the same product at the same time). This is then multiply by Kantar period-specific household sample weights associated to the household h that made the ith purchase W_i^{ht}. $\hat{s}_{ijt}$ stands for the individual simulated market share of product j in market t:

$$\hat{s}_{ijt} = \frac{1}{R}\sum_{r=1}^{R} w_r \prod_{t=1}^{T}\prod_{j=0}^{J_t}[\frac{exp(\alpha_i^r p_{jt} + X_{jt}\beta + \lambda\hat{\eta}_{jt})}{\sum_{k=1}^{J_t} 1 + exp(\alpha_i^r p_{kt} + X_{kt}\beta + \lambda\hat{\eta}_{kt})}]^{Y_{ijt}}$$

where R is the number of draws[20], w_r is the r^{th} entry in the vector of weights and $\alpha_i^r = \alpha + \pi D M_i + \sigma\nu_i^r$ with $\nu^r \sim \mathcal{N}(0,1)$.

A.3 Computation details for the supply model

The FOC from the supply model are:

$$s_{jt}(p) + \sum_{k \in G_{ft}} [M\gamma_{kt}\frac{\partial s_{kt}}{\partial p_{jt}}] = 0 \tag{12}$$

$$\iff I_{ft}s_t(p) + (I_{ft}S_{pt}I_{ft})\gamma_t = 0 \ \forall f = 1, \ldots, F \tag{13}$$

$$\iff \sum_{f=1}^{F}(I_{ft}s_t(p) + (I_{ft}S_{pt}I_{ft})\gamma_t) = 0 \tag{14}$$

$$\iff \sum_{f=1}^{F} I_{ft}s_t(p) + \sum_{f=1}^{F}(I_{ft}S_{pt}I_{ft})\gamma_t = 0 \tag{15}$$

$$\iff \gamma_t = -\Big(\sum_{f=1}^{F} I_{ft}S_{pt}I_{ft}\Big)^{-1} \underbrace{\Big(\sum_{f=1}^{F} I_{ft}}_{\text{identity matrix}} \quad s_t(p)\Big) \tag{16}$$

$$\iff \gamma_t = -\Big(\sum_{f=1}^{F} I_{ft}S_{pt}I_{ft}\Big)^{-1} s_t(p) \tag{17}$$

[20] To address the curse of dimensionality, we use a sparse grid method as it is developed in Heiss and Winschel (2008). The choice for the number of simulations is explained on `http://www.sparse-grids.de/`. Integration on sparse grids has low computational costs compared to other methods. The number of draws is especially reduced because each draw is associated with a weight. Let R be the number of simulations which depends on the type of integration rule, the number of dimensions and the chosen accuracy. Let x_r and w_r be the r^{th} entries respectively in the vector of draws and the vector of weights. We want ν^r to follow a standard normal distribution so we apply a transformation (inverse of the standard normal cumulative distribution function) to x_r ($x_r \in [0,1] \ \forall r$) so that $\nu^r = \Phi^{-1}(x_r)$ and $\nu^r \sim \mathcal{N}(0,1)$.

A.4 Formulas

A.4.1 Sample weights

Kantar provides weights to ensure the representativeness of the sample.

- **Panel representativeness**: *Wachat* is a household-specific monthly weight.
- **France representativeness**: we use the weight *WFrance*, computed as follows

$$WFrance_{it} = \frac{Wachat_{it}}{\sum_h Wachat_{ht}} \times HF \tag{18}$$

where

- $WFrance_{it}$ is the weight of household i at period t, ie the number of French households represented by Kantar household i at period t
- $Wachat_{it}$ is the weight of household i at period t (obtained with Kantar variables *kgcper1* to *kgcper13*)
- HF is the number of households in France (29,012,000 in 2015[21]).

A.4.2 Household consumption

$$\text{Consumption L/per capita/year of household h } \bar{q}_h = \frac{\sum_{t \in T_h} q_{ht}}{uc_h} \tag{19}$$

$$\text{Mean consumption L/per capita/year } \bar{q} = \frac{1}{H} \sum_{h \in H} \bar{q}_h \text{ with } H \in \{HH_K, HH_{BK}\} \tag{20}$$

where

- T_h is total number of purchase occasions of household h
- q_{ht} is the beverage purchased quantity of household h at the occasion trip t
- uc_h is the number of consumption units of household h
- H corresponds either to the total number of households (HH_K) or to the number of households who purchased on the considered market (HH_{BK}).

[22]

[21] INSEE, *Tableaux de l'économie française*, available on `https://www.insee.fr/fr/statistiques/3676599?sommaire=3696937`

[22] The number of consumption units is computed as: uc = 0,3 per household + 0,7 per individual aged 15 or more + 0,5 per individual aged less than 15

A.4.3 Consumer surplus

Let CS_{dt} be the surplus of consumer from type d at market t.

$$CS_{dt} = \frac{1}{|\alpha_d|} \int \left(\log \sum_{j \in J_t} \delta_{jt} \right) \mathrm{d}P_\nu(\nu) \tag{21}$$

with $\delta_{jt} = \alpha p_{jt} + X_{jt}\beta$ the mean utility.

A.5 Computation details of elasticities and additional results

A.5.1 Computation details of elasticities and margins over different populations

A period t is defined by a 4-week portion of time. We define D populations (for example the 4 types of households based on their composition). We have J products in NC categories.

In the following formulas D could then represent several sets of population. When we are looking at the effect on the overall population, D is equal to the set of all populations analysed. But if D contains only populations with some shared characteristic (for example household without children), the formula is still consistent with a result on that population.

Own and cross elasticities

Let s_{jt} be the market share of product j in period t

$$s_{jt} = \sum_{d=1}^{D} W_d^t s_{jt}^d \tag{22}$$

where s_{jt}^d is the probability that households of group d buy product j in period t and W_d^t is the proportion of households in group d, ie

$$W_d^t = \frac{\sum_{h=1}^{H_d} WFrance_h^t}{\sum_{h=1}^{H} WFrance_h^t} \tag{23}$$

where h is an household, H_d is the number of households in population d, H is the total number of households in Kantar and $WFrance_h^t$ is the number of French households represented by household h in Kantar in period t.

Let η_{jk}^t be the elasticity of product j with respect to an increase of the price of product k in

period t (used in the supply and the simulations).

$$\eta_{jk}^{t} = \underbrace{\sum_{d} W_d^t \frac{\partial s_{kt}^d}{\partial p_{tj}}}_{\frac{\partial s_{kt}}{\partial p_{tj}}} \frac{p_{tj}}{s_{kt}} \tag{24}$$

Let η_{jk}^{td} be the elasticity of product j with respect to an increase of the price of product k in period t for the population d.

$$\eta_{jk}^{td} = \frac{\partial s_{kt}^d}{\partial p_{tj}} \frac{p_{tj}}{s_{kt}^d} \tag{25}$$

Aggregated elasticities

Let $\eta_{gg'}^{td}$ be the variation of the market share of the category g when the prices of all products belonging to category g' increase by 1% in period t for population d.

$$\eta_{gg'}^{td} = \sum_{j \in g'} \eta_{gj}^{td} = \sum_{j \in g'} \sum_{k \in g} \underbrace{\frac{\partial s_{kt}^d}{\partial p_{tj}} \frac{p_{tj}}{s_{kt}^d}}_{\eta_{jk}^{td}} \frac{s_{kt}^d}{s_{gt}^d} \tag{26}$$

where

$$s_{gt}^d = \sum_{k \in g} s_{kt}^d \tag{27}$$

Let $\eta_{gg'}^{d}$ be the variation of the market share of the category g when the prices of all products belonging to category g' increase by 1% for population d.

$$\eta_{gg'}^{d} = \sum_{t=1}^{T} P_t^d \eta_{gg'}^{td} \tag{28}$$

where P_t^d is the proportion of period t among all the periods for population d, ie

$$P_t^d = \frac{\sum_{i=1}^{N_d^t} W_i}{\sum_{i=1}^{N_d} W_i} \tag{29}$$

where i is a purchase, N_d^t is the number of purchases by population d in period t, N_d is the number of purchases by population d and W_i is the representative number of units.

Let $\eta_{gg'}^{t}$ be the variation of the market share of the category g when the prices of all products

belonging to category g' increase by 1% in period t for the whole population.

$$\eta^t_{gg'} = \sum_{j \in g'} \eta^t_{gj} = \sum_{j \in g'} \sum_{k \in g} \frac{\partial s_{kt}}{\partial p_{tj}} \frac{p_{tj}}{s_{kt}} \frac{s_{kt}}{s_{gt}} \tag{30}$$

$$= \sum_{j \in g'} \sum_{k \in g} (\sum_d W^t_d \frac{\partial s^d_{kt}}{\partial p_{tj}}) \frac{p_{tj}}{s_{kt}} \frac{s_{kt}}{s_{gt}} \tag{31}$$

Mean own elasticities by categories

Let $\bar{\eta}^d_{jj|g}$ be the mean own-price elasticity of product j belonging to category g for population d.

$$\bar{\eta}^d_{jj|g} = \sum_{t=1}^{T} P^d_t \sum_{j \in g} \underbrace{\eta^{td}_{jj} \frac{s^d_{jt}}{s^d_{gt}}}_{\bar{\eta}^{td}_{jj|g}} \tag{32}$$

Let $\bar{\eta}_{jj|g}$ be the mean own-price elasticity of product j belonging to category g.

$$\bar{\eta}_{jj|g} = \sum_{t=1}^{T} P_t \sum_{j \in g} \underbrace{\eta^t_{jj} \frac{s_{jt}}{s_{gt}}}_{\bar{\eta}^t_{jj|g}} \tag{33}$$

$$= \sum_{t=1}^{T} P_t \sum_{j \in g} (\sum_d W^t_d \frac{\partial s^d_{jt}}{\partial p_{tj}}) \frac{p_{tj}}{s_{jt}} \frac{s_{jt}}{s_{gt}} \tag{34}$$

Mean margins by categories

Let $\bar{\gamma}_g$ be the average margin for the category g

$$\bar{\gamma}_g = \sum_{t=1}^{T} P_t \underbrace{\sum_{j \in g} \gamma^t_j \frac{s_{jt}}{s_{gt}}}_{\bar{\gamma}^t_g} \tag{35}$$

where

$$s_{gt} = \sum_{j \in g} s_{jt} \tag{36}$$

$$P_t = \frac{\sum_{i=1}^{N_t} W_i}{\sum_{i=1}^{N} W_i} \tag{37}$$

where i is a purchase, N_t is the number of purchases in period t and N is the total number of purchases.

Mean margins by firms

Let $\bar{\gamma}_f$ be the average margin for the firm f

$$\bar{\gamma}_f = \sum_{t=1}^{T} P_t \underbrace{\sum_{j \in f} \gamma_j^t \frac{s_{jt}}{s_{ft}}}_{\bar{\gamma}_f^t} \tag{38}$$

where

$$s_{ft} = \sum_{j \in f} s_{jt} \tag{39}$$

A.5.2 Price elasticities: additional results

Tables A6 and A7 display own-price elasticities of non-alcoholic beverages and biscuits by sugar content and households characteristics in France, the United Kingdom and Spain, respectively.

Science and Technology in childhood Obesity Policy

Table A6: Own-price elasticities by sugar content and household characteristics - non-alcoholic beverages market

	Sugar content (g/100mL)					
	0	] 0 ; 5 [	[5 ; 8 [	[8 ; 10 [	[10 ; 12 [	>= 12
				France		
All households	**-3.30**	**-3.93**	**-4.41**	**-4.76**	**-4.87**	**-5.39**
Household composition						
Without children	-3.33	-3.97	-4.46	-4.82	-4.92	-5.48
With children below 6	-3.29	-3.92	-4.40	-4.75	-4.85	-5.38
With children 7-16	-3.31	-3.94	-4.42	-4.77	-4.88	-5.41
With children below 6 & 7-16	-3.27	-3.89	-4.36	-4.70	-4.81	-5.31
Obesity status						
No overweight or obese	-3.19	-3.79	-4.27	-4.59	-4.69	-5.17
At least one overweight or obese	-3.25	-3.87	-4.35	-4.68	-4.79	-5.29
All overweight or obese	-3.45	-4.13	-4.62	-5.01	-5.12	-5.72
Socio-economic class						
Rich	-2.92	-3.44	-3.90	-4.15	-4.25	-4.59
Average	-3.30	-3.94	-4.42	-4.76	-4.87	-5.40
Poor	-3.68	-4.42	-4.92	-5.37	-5.48	-6.19
Margins (% price)	38.87	56.60	40.42	43.73	38.10	34.04
				UK		
All households	**-7.17**	**-6.90**	**-9.53**	**-10.18**	**-10.13**	**-10.12**
Household composition						
Without children	-7.16	-6.89	-9.54	-10.19	-10.14	-10.13
With children below 6	-7.11	-6.84	-9.44	-10.08	-10.03	-10.03
With children 7-16	-7.23	-6.95	-9.62	-10.27	-10.22	-10.21
With children below 6 & 7-16	-7.18	-6.90	-9.52	-10.16	-10.11	-10.11
Obesity status						
No overweight or obese	-7.11	-6.84	-9.44	-10.07	-10.03	-10.03
At least one overweight or obese	-7.19	-6.91	-9.56	-10.21	-10.16	-10.15
All overweight or obese	-7.22	-6.94	-9.60	-10.24	-10.19	-10.19
Socio-economic class						
Rich	-7.03	-6.76	-9.32	-9.95	-9.90	-9.91
Average	-7.20	-6.92	-9.57	-10.22	-10.17	-10.16
Poor	-7.29	-7.01	-9.71	-10.36	-10.31	-10.30
Margins (% price)	19.23	49.86	20.09	17.65	22.50	19.11
				Spain		
All households	**-6.29**	**-5.34**	**-7.07**	**-8.76**	**-7.94**	**-8.39**
Household composition						
Without children	-6.24	-5.29	-7.01	-8.70	-7.88	-8.34
With children below 6	-6.09	-5.18	-6.84	-8.47	-7.69	-8.12
With children 7-16	-6.49	-5.50	-7.30	-9.06	-8.19	-8.66
With children below 6 & 7-16	-6.34	-5.38	-7.13	-8.83	-8.00	-8.43
Obesity status						
No overweight or obese	-6.26	-5.31	-7.04	-8.72	-7.90	-8.35
At least one overweight or obese	-6.35	-5.38	-7.13	-8.85	-8.01	-8.46
All overweight or obese	-6.26	-5.31	-7.04	-8.72	-7.90	-8.35
Socio-economic class						
Rich	-6.11	-5.19	-6.87	-8.51	-7.72	-8.14
Average	-6.25	-5.31	-7.03	-8.71	-7.89	-8.33
Poor	-6.50	-5.51	-7.32	-9.08	-8.21	-8.68
Margins (% price)	24.35	44.28	38.70	41.13	27.92	25.79

Table A7: Own-price elasticities by sugar content and household characteristics - Biscuits market

	Sugar content (g/100g)						
	[0 ; 10[	[10 ; 20[	[20 ; 26[	[26 ; 31[	[31 ; 37[	[37 ; 43[	>= 43
				France			
Household composition							
All households	**-4.26**	**-3.41**	**-3.51**	**-3.36**	**-3.28**	**-3.47**	**-3.62**
Without children	-3.98	-3.22	-3.32	-3.18	-3.11	-3.28	-3.42
With children below 6	-4.34	-3.45	-3.56	-3.40	-3.32	-3.51	-3.67
With children 7-16	-4.18	-3.36	-3.46	-3.31	-3.24	-3.42	-3.57
With children below 6 & 7-16	-4.55	-3.60	-3.72	-3.54	-3.45	-3.65	-3.83
Obesity status							
No overweight or obese	-4.36	-3.46	-3.58	-3.41	-3.33	-3.52	-3.69
At least one overweight or obese	-3.99	-3.25	-3.34	-3.21	-3.14	-3.31	-3.45
All overweight or obese	-4.44	-3.51	-3.63	-3.45	-3.38	-3.57	-3.74
Socio-economic class							
Rich	-3.91	-3.20	-3.29	-3.16	-3.10	-3.26	-3.40
Average	-4.22	-3.39	-3.49	-3.34	-3.26	-3.45	-3.60
Poor	-4.65	-3.63	-3.76	-3.57	-3.49	-3.69	-3.88
Margin (%)	26.87	63.94	53.60	56.55	60.11	56.78	43.75
				UK			
Household composition							
All households	.	**-10.43**	**-8.45**	**-7.67**	**-9.42**	**-10.48**	**-10.92**
Without children	.	-10.59	-8.56	-7.76	-9.55	-10.63	-11.10
With children below 6	.	-10.47	-8.48	-7.70	-9.46	-10.52	-10.98
With children 7-16	.	-10.38	-8.42	-7.65	-9.38	-10.43	-10.87
With children below 6 & 7-16	.	-10.27	-8.35	-7.58	-9.30	-10.34	-10.75
Obesity status							
No overweight or obese	.	-10.45	-8.47	-7.69	-9.44	-10.50	-10.95
At least one overweight or obese	.	-10.37	-8.41	-7.63	-9.37	-10.42	-10.86
All overweight or obese	.	-10.46	-8.48	-7.69	-9.45	-10.51	-10.96
Socio-economic class							
Rich	.	-10.28	-8.35	-7.58	-9.30	-10.34	-10.77
Average	.	-10.38	-8.42	-7.64	-9.39	-10.44	-10.88
Poor	.	-10.62	-8.59	-7.79	-9.58	-10.66	-11.12
Margin (%)	.	37.44	45.42	31.90	26.24	17.90	22.91
				Spain			
Household composition							
All households	**-5.33**	**-5.28**	**-4.19**	**-4.77**	**-6.03**	**-5.70**	**-4.38**
Without children	-5.55	-5.52	-4.35	-4.97	-6.32	-5.96	-4.56
With children below 6	-5.40	-5.36	-4.25	-4.84	-6.13	-5.79	-4.44
With children 7-16	-5.25	-5.19	-4.14	-4.70	-5.92	-5.61	-4.32
With children below 6 & 7-16	-5.11	-5.04	-4.03	-4.58	-5.74	-5.45	-4.20
Obesity status							
No overweight or obese	-5.44	-5.40	-4.28	-4.88	-6.17	-5.83	-4.47
At least one overweight or obese	-5.19	-5.13	-4.09	-4.65	-5.85	-5.55	-4.27
All overweight or obese	-5.34	-5.30	-4.21	-4.79	-6.05	-5.72	-4.39
Socio-economic class							
Rich	-5.16	-5.11	-4.07	-4.63	-5.82	-5.52	-4.25
Average	-5.24	-5.19	-4.13	-4.70	-5.92	-5.61	-4.31
Poor	-5.57	-5.54	-4.37	-4.99	-6.33	-5.98	-4.57
Margin (%)	26.52	52.26	63.92	46.41	26.92	35.65	45.05

Aggregated elasticities by categories

Tables A8, A9 and A10 present the matrix of aggregate elasticities for all non-alcoholic beverages sub-categories. The substitution patterns across categories are heterogeneous. Cross-price elasticities differ between the categories and are all positive.

Table A8: Aggregated elasticities (Non-alcoholic beverages, France)

	Colas	**Iced teas**	**Nectars**	**Fruit juices**	**Pure FJ**	**Fruit drinks**	**Other sodas**	**Flavoured water**
Colas	-2.26	0.90	0.85	0.87	0.76	0.89	0.89	0.95
Iced teas	0.20	-3.20	0.19	0.19	0.18	0.20	0.20	0.21
Nectars	0.16	0.16	-3.63	0.16	0.16	0.16	0.16	0.16
Fruit juices	0.44	0.43	0.42	-3.26	0.40	0.43	0.42	0.44
Pure fruit juices	0.77	0.78	0.80	0.79	-3.66	0.78	0.76	0.75
Fruit drinks	0.71	0.69	0.67	0.68	0.63	-2.77	0.69	0.72
Other sodas	0.20	0.21	0.21	0.20	0.21	0.20	-3.01	0.21
Flavoured water	0.13	0.12	0.12	0.12	0.10	0.12	0.12	-2.69

Lecture note: if the price of all colas increases by 10% then the demand for iced teas would increase by 9%.

Table A9: Aggregated elasticities (Non-alcoholic beverages, United Kigdom)

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
Colas (1)	-4.42	1.37	1.69	1.61	1.68	1.58	1.59	1.56	0.96	1.52	1.61
Flav. milks (2)	0.22	-9.40	0.16	0.25	0.18	0.28	0.26	0.31	0.67	0.34	0.23
Flav. waters (3)	0.81	0.55	-2.70	0.79	0.95	0.73	0.84	0.68	0.38	0.65	0.88
Fruit drinks (4)	0.78	0.87	0.71	-5.55	0.72	0.81	0.75	0.83	0.89	0.84	0.74
Lemonades (5)	0.20	0.17	0.23	0.20	-3.90	0.19	0.22	0.18	0.18	0.18	0.22
Nectars (6)	0.38	0.47	0.34	0.40	0.35	-6.67	0.38	0.43	0.54	0.44	0.37
Other sodas (7)	0.18	0.27	0.18	0.20	0.19	0.21	-5.48	0.21	0.45	0.23	0.22
Pure FJ (8)	0.86	1.10	0.73	0.89	0.75	0.94	0.84	-6.79	1.25	1.00	0.80
Smoothies (9)	0.12	0.43	0.07	0.18	0.09	0.22	0.21	0.24	-11.65	0.29	0.18
Energy drinks (10)	0.47	0.68	0.38	0.50	0.40	0.53	0.49	0.56	0.90	-7.78	0.46
Tonic waters (11)	0.14	0.21	0.15	0.16	0.16	0.16	0.18	0.16	0.35	0.17	-4.95

Table A10: Aggregated elasticities (Non-alcoholic beverages, Spain)

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Other (1)	-5.82	0.35	0.43	0.36	0.32	0.35	0.39	0.33	0.35	0.39
Fruit drinks (2)	0.59	-3.84	0.58	0.60	0.61	0.59	0.57	0.61	0.58	0.60
Energy drinks (3)	0.31	0.28	-6.79	0.28	0.27	0.28	0.29	0.27	0.27	0.29
Colas (4)	1.35	1.38	1.36	-3.75	1.39	1.35	1.33	1.39	1.34	1.38
Flavoured waters (5)	0.07	0.07	0.07	0.07	-2.85	0.07	0.07	0.07	0.07	0.07
Fruit juices with milk (6)	0.89	0.91	0.89	0.90	0.91	-4.10	0.93	0.91	0.94	0.90
Fruit juices (7)	0.77	0.72	0.77	0.73	0.70	0.77	-5.53	0.71	0.79	0.74
Lemonades (8)	0.20	0.20	0.19	0.20	0.21	0.20	0.19	-3.21	0.19	0.20
Nectars (9)	0.27	0.26	0.26	0.26	0.26	0.27	0.28	0.26	-4.66	0.26
Iced teas (10)	0.21	0.19	0.21	0.19	0.18	0.19	0.19	0.18	0.18	-4.72

We display in Tables A11, A12 and A13 aggregate elasticities by sugar content in the biscuit market.

Table A11: Aggregated elasticities (Biscuit, France)

Sugar content	**[0 ; 10[**	**[10 ; 20[**	**[20 ; 26[**	**[26 ; 31[**	**[31 ; 37[**	**[37 ; 43[**	**>= 43**
[0 ; 10[	-3.8	0.0	0.0	0.0	0.0	0.0	0.1
[10 ; 20[	0.0	-2.3	0.1	0.1	0.1	0.1	0.1
[20 ; 26[	0.2	0.3	-2.4	0.3	0.3	0.3	0.3
[26 ; 31[	0.4	0.6	0.6	-2.1	0.6	0.6	0.5
[31 ; 37[	0.6	0.9	0.9	0.9	-1.7	0.9	0.8
[37 ; 43[	0.3	0.3	0.3	0.4	0.4	-2.4	0.3
>= 43	0.2	0.2	0.2	0.2	0.2	0.2	-2.9

Table A12: Aggregated elasticities (Biscuit, UK)

Sugar content	**[10 ; 20[**	**[20 ; 26[**	**[26 ; 31[**	**[31 ; 37[**	**[37 ; 43[**	**>= 43**
[10 ; 20[	-4.4	0.5	0.5	0.5	0.5	0.5
[20 ; 26[	0.7	-4.6	0.7	0.7	0.7	0.7
[26 ; 31[	1.6	1.6	-4.2	1.7	1.7	1.7
[31 ; 37[	1.5	1.6	1.6	-5.4	1.7	1.7
[37 ; 43[	0.8	0.8	0.8	0.8	-6.9	0.9
>= 43	0.5	0.5	0.5	0.5	0.6	-7.1

Table A13: Aggregated elasticities (Biscuit, Spain)

Sugar content	**[0 ; 10[**	**[10 ; 20[**	**[20 ; 26[**	**[26 ; 31[**	**[31 ; 37[**	**[37 ; 43[**	**>= 43**
[0 ; 10[	-4.2	0.5	0.5	0.5	0.5	0.5	0.5
[10 ; 20[	0.6	-2.5	0.6	0.6	0.6	0.6	0.6
[20 ; 26[	0.6	0.7	-2.2	0.7	0.6	0.6	0.7
[26 ; 31[	0.4	0.4	0.4	-3.1	0.4	0.4	0.4
[31 ; 37[	0.6	0.5	0.5	0.6	-4.6	0.6	0.6
[37 ; 43[	0.2	0.1	0.1	0.2	0.2	-4.2	0.2
>= 43	0.1	0.1	0.1	0.1	0.1	0.1	-3.5

Own-price elasticities and margins by firms

Non-alcoholic beverages and biscuit own-price elasticities and margins of each firm are reported in Tables A14, A15, respectively.

Table A14: Elasticities and margins by firms (Non-alcoholic beverages market)

	France		UK		Spain	
Firms	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**
National brands						
Firm 1	-3.2	40.0	-6.5	19.2	-5.3	24.6
Firm 2	-3.7	29.6	-6.6	17.6	-4.9	23.1
Firm 3	-3.9	29.9	-8.2	12.6	-4.0	27.1
Firm 4	-4.6	22.9	-4.2	27.2	-6.4	20.8
Firm 5	-4.2	25.0	-5.6	19.5	-7.8	13.1
Firm 6	-2.9	36.0	-3.5	28.4	-5.4	20.1
Firm 7	-3.8	27.6	-4.8	21.4	-15.8	6.4
Firm 8	-6.2	16.3	-12.5	8.7	-9.8	10.3
Firm 9	-5.2	19.2	-10.8	9.8	-3.0	41.8
Firm 10	-4.7	21.6	-6.4	16.5	-11.3	8.9
Small firms	-4.0	27.7	-7.9	18.9	-10.5	16.4
Very small firms	-3.7	32.0	-7.5	15.3	-5.9	26.6
Private labels	-3.1	56.9	-4.4	52.3	-4.0	54.0

Firm 1 to Firm 10 are the ten firms with the highest market shares.
Thus Firm 1 in France is not necessarily the same than Firm 1 in Spain.

Table A15: Elasticities and margins by firms - Biscuits market

	France		UK		Spain	
Firms	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**
National brands						
Firm 1	-2.6	56.9	-5.4	25.0	-3.4	36.2
Firm 2	-3.2	33.3	-7.4	17.0	-3.9	33.1
Firm 3	-2.3	48.9	-6.0	19.8	-5.1	23.5
Firm 4	-3.2	33.8	-6.3	18.2	-3.9	28.4
Firm 5	-3.4	31.0	-11.2	9.6	-6.3	18.7
Firm 6	-3.5	29.3	-11.3	9.3	-3.8	26.8
Firm 7	-2.5	40.8	-10.7	10.2	-3.0	34.2
Firm 8	-3.5	29.5	-8.1	12.5	-3.3	33.3
Firm 9	-4.0	25.5	-9.9	11.0	-2.2	44.9
Firm 10	-2.0	55.4	-2.6	42.8	-4.0	21.7
Small firms	-3.3	34.5	-10.3	12.2	-5.5	21.2
Very small firms	-2.7	40.3	-5.7	23.2	-5.0	22.1
Private labels	-2.5	68.5	-4.9	46.2	-2.9	67.2

Firm 1 to Firm 10 are the ten firms with the highest market shares.
Thus Firm 1 in France is not necessarily the same than Firm 1 in Spain.

Own-price elasticities and margins by categories

Table A16 displays the average own-price elasticity and margin by non-alcoholic drinks sub-category.

Science and Technology in childhood Obesity Policy

Table A16: Elasticities and margins by categories - Non-alcoholic beverages market

	France		UK		Spain	
Firms	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**
Colas	**-2.8**	**48.0**	**-5.7**	**24.3**	**-4.7**	**30.6**
regular	-2.7	47.1	-5.9	25.0	-4.5	31.2
diet	-3.0	50.6	-5.6	24.0	-4.9	29.9
Iced tea	**-3.4**	**41.9**			**-4.9**	**45.3**
regular	-3.3	43.3			-5.4	41.6
diet	-3.6	36.8			-3.3	56.6
Fruit-flavoured drinks	**-3.4**	**40.3**	**-6.3**	**30.5**	**-4.4**	**35.6**
regular	-3.5	38.8	-7.5	17.1	-4.6	34.3
diet	-3.1	48.5	-4.4	49.8	-4.0	37.7
Flavoured waters	**-2.8**	**47.9**	**-3.4**	**50.8**	**-2.9**	**69.7**
regular	-2.9	46.6	-6.2	24.5	-2.9	70.0
diet	-2.7	49.1	-3.3	52.6	-3.0	24.8
Tonic waters	**-5.1**	**42.6**				
regular	-5.0	42.5				
diet	-5.1	42.7				
Lemonades			**-4.1**	**53.2**	**-3.4**	**54.7**
regular			-4.2	50.7	-3.4	54.8
diet			-4.0	56.6	-3.3	54.5
Energy drinks			**-8.3**	**15.9**	**-7.1**	**23.1**
regular			-7.9	17.0	-7.1	23.6
diet			-8.7	14.6	-7.0	22.8
Other SSBs	**-3.2**	**51.3**	**-5.7**	**37.6**	**-6.2**	**65.8**
regular	-3.3	48.6	-6.5	29.9	-9.8	22.5
diet	-2.9	58.2	-5.0	43.0	-3.3	100.8
Nectars	**-3.8**	**40.5**	**-7.1**	**23.3**	**-4.9**	**38.7**
little sugar-sweet	-3.4	49.7	-6.4	25.6	-3.8	49.0
sugar-sweet	-3.9	37.2	-7.6	22.0	-5.8	29.8
very sugar-sweet	-4.6	26.3	-7.0	21.8	-6.2	29.9
Fruit juices	**-3.7**	**42.0**				
little sugar-sweet	-3.6	43.0				
sugar-sweet	-4.1	31.7				
very sugar-sweet	-3.4	46.1				
Pure fruit juices	**-4.5**	**32.2**	**-7.8**	**20.8**	**-6.3**	**30.1**
little sugar-sweet	-4.7	28.9	-8.2	19.3	-6.2	28.2
sugar-sweet	-4.3	34.2	-8.5	17.1	-5.9	33.1
very sugar-sweet	-4.7	29.4	-7.3	22.8	-6.5	30.3
Smoothies	**-12.5**	**10.4**				
little sugar-sweet	-14.7	8.0				
sugar-sweet	-12.2	11.1				
very sugar-sweet	-12.5	9.9				
Fruit juices with milk					**-4.9**	**32.0**
little sugar-sweet					-5.6	25.8
sugar-sweet					-4.7	34.7
very sugar-sweet					-6.1	17.0
Flavoured milk			**-9.8**	**12.7**		
regular			-9.8	12.9		
diet			-9.7	10.6		

Table A17 displays the average own-price elasticity and margin by sugar levels in the biscuit market.

Table A17: Elasticities and margins by sugar content - Biscuits market

	France		UK		Spain	
Sugar content (g/100g)	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**	**Own-price elasticities**	**Margins (% price)**
[0 ; 10 [	-3.8	26.9	.	.	-4.7	26.5
[10 ; 20 [	-2.3	63.9	-4.8	37.4	-3.1	52.3
[20 ; 26 [	-2.6	53.6	-5.2	45.4	-2.8	63.9
[26 ; 31 [	-2.6	56.6	-5.8	31.9	-3.5	46.4
[31 ; 37 [	-2.6	60.1	-7.0	26.2	-5.2	26.9
[37 ; 43 [	-2.7	56.8	-7.7	17.9	-4.4	35.7
>= 43	-3.1	43.7	-7.7	22.9	-3.6	45.1

A.6 Design of new scenario: example with the French tax with four thresholds

A.6.1 Adaptation from the soft drink taxes to the biscuit taxes

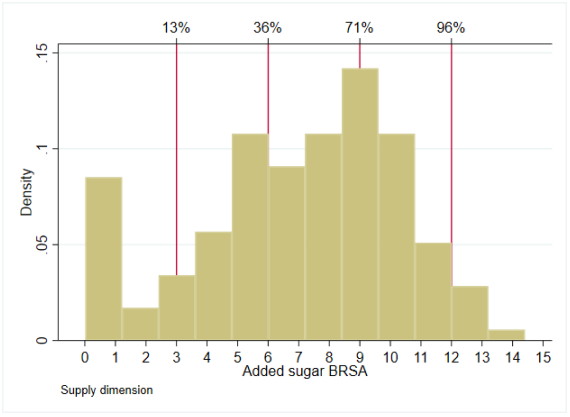
Step 1: Calibration in the non-alcoholic beverages market

Table A18: French tax with 4 thresholds

Sugar content (g/100mL)	**Tax amount** (€ per l)
0-3	0.04
3-6	0.07
6-9	0.12
9-12	0.18
12-	0.24

We associate the four taxation thresholds (3, 6, 9 and 12 grams of added sugar per 100 mL) with the added sugar distribution on the non-alcoholic beverage market over the 151 products with added sugar (13th, 36th, 71th and 95th percentiles).

Figure A1: Distribution of added sugar content with 4 thresholds (Soft drinks)



Step 2: Transfer to the biscuit market

In the sugar distribution on the biscuit market, these percentiles correspond to 23g, 29g, 36g and 50g of sugar per 100g. Using the average price difference between biscuit and soft drinks (5.96), we compute the equivalent tax amount in the biscuit market for each subgroups.

Figure A2: Distribution of sugar content with 4 thresholds (Biscuits)

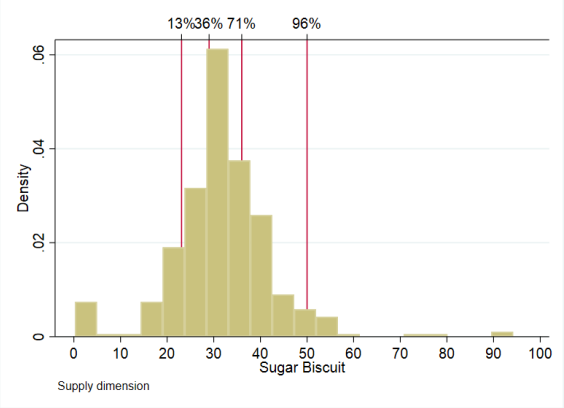


Table A19: Biscuit French tax with 4 thresholds

Sugar content (g/100g)	**Tax amount** (€ per kg)
0-23	0.25 ($\approx 0.04 \times 5.96$)
23-29	0.40 ($\approx 0.07 \times 5.96$)
29-36	0.70 ($\approx 0.12 \times 5.96$)
36-50	1.07 ($\approx 0.18 \times 5.96$)
50-	1.44 ($\approx 0.24 \times 5.96$)

A.6.2 Adaptation from one country to another country

On the soft drink market, the mean price of products with added sugar is 1.02 € in France and 0.67 € in the United Kingdom. Price in France are 0.66 times higher than in the United Kingdom.

Table A20: French tax with 4 thresholds - Country adaptation

Sugar content (g/100mL)	**Tax amount (France)** (€ per l)	**Tax amount (UK)** (€ per l)
0-3	0.04	0.03 ($\approx 0.04 \times 0.66$)
3-6	0.07	0.04 ($\approx 0.07 \times 0.66$)
6-9	0.12	0.08 ($\approx 0.12 \times 0.66$)
9-12	0.18	0.12 ($\approx 0.18 \times 0.66$)
12-	0.24	0.16 ($\approx 0.24 \times 0.66$)

A.7 Impact on market structure

Table A21 displays the pass-through of each tax scenarios on the non-alcoholic beverages market.

Table A21: Pass-through resulting from four design taxes scenarios in the Kantar sample in France, the UK, and Spain - non-alcoholic beverages market

	French tax with 4 thresholds	**French tax**	**UK tax**	**Catalonia tax**
		France		
Liable drinks (sugar/100 mL)				
High tier $\geq$ 8g	1.03	1.03	1.04	1.05
Low tier [5g ; 8g [	1.05	1.16	1.08	1.13
] 0g ; 5g [	0.96	0.98	.	.
		UK		
Liable drinks (sugar/100 mL)				
High tier $\geq$ 8g	1.03	1.03	1.04	1.04
Low tier [5g ; 8g [	1.03	1.03	1.04	1.04
] 0g ; 5g [	0.98	1.00	.	.
		Spain		
Liable drinks (sugar/100 mL)				
High tier $\geq$ 8g	1.00	1.00	1.01	1.01
Low tier [5g ; 8g [	1.03	1.04	1.02	1.02
] 0g ; 5g [	0.94	0.94	.	.

Tables A22 to A25 report the impact of each tax scenario on prices, pass-through and variation in market shares for each non-alcoholic subcategories and each firm in France.

Science and Technology in childhood Obesity Policy

Table A22: Simulation France (Non alcoholic beverages) - French tax 4 thresholds

	2012 French tax amount (€/ l)	Tax 4 thresholds amount (€/ l)	Price		Pass-through	Variation market share (%)
			Pre	Post		
Categories						
Sugar-Sweetened Beverages						
Colas	0.08	0.18	1.00	1.11	0.99	-23.82
Colas - diet	0.08	0.04	0.98	0.89	0.85	43.92
Iced teas	0.08	0.12	1.10	1.12	1.05	1.30
Iced teas - diet	0.08	0.04	1.22	1.19	1.03	17.86
Fruit-flavoured drinks	0.08	0.15	1.16	1.24	1.06	-14.08
Fruit-flavoured drinks - diet	0.08	0.04	0.98	0.95	1.05	21.57
Flavoured waters	0.08	0.09	0.93	0.94	0.94	7.76
Flavoured waters - diet	0.08	0.04	0.81	0.75	0.96	35.99
Other SSBs	0.08	0.13	1.28	1.35	1.10	-10.94
Other SSBs - diet	0.08	0.04	1.04	0.97	0.85	30.88
Fruit juices						
Nectars - little sweet	0.08	0.06	1.16	1.14	0.93	16.16
Nectars - sweet	0.08	0.13	1.38	1.39	1.17	2.23
Nectars - very sweet	0.08	0.15	1.73	1.81	1.11	-13.60
Fruit juices - little sweet	0.00	0.00	1.25	1.25		5.57
Fruit juices - sweet	0.00	0.00	1.44	1.45		6.24
Fruit juices - very sweet	0.00	0.00	1.14	1.14		5.53
Pure fruit juices	0.00	0.00	1.69	1.69		5.66
Firms						
Firm 1	0.07	0.18	1.16	1.22	0.97	-5.99
Firm 2	0.08	0.12	1.26	1.30	1.05	-3.81
Firm 3	0.05	0.14	1.38	1.42	1.06	-0.93
Firm 4	0.04	0.12	1.73	1.74	1.07	4.09
Firm 5	0.02	0.18	1.53	1.53	1.10	7.23
Firm 6	0.08	0.04	0.89	0.85	1.04	23.91
Firm 7	0.08	0.14	1.28	1.26	1.08	18.24
Firm 8	0.08	0.18	4.52	4.60	1.11	-7.59
Firm 9	0.02	0.15	2.19	2.20	1.08	2.36
Firm 10	0.08	0.14	1.76	1.83	1.06	-11.14
Small firms	0.06	0.15	1.57	1.61	1.06	-3.28
Very small firms	0.06	0.12	1.32	1.34	1.09	4.47
Private labels	0.03	0.10	1.04	1.05	1.07	2.81
Outside option						8.55

Notes: This table reports average tax amounts in each tax design, the average consumer prices observed in 2017 and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A23: Simulation France (Non alcoholic beverages) - 2020 French tax

	2012 French tax amount (€/ l)	2020 French tax amount (€/ l)	Price		Pass-through	Variation market share (%)
			Pre	Post		
Categories						
Sugar-Sweetened Beverages						
Colas	0.08	0.16	1.00	1.09	1.00	-20.68
Colas - diet	0.08	0.03	0.98	0.89	0.93	38.46
Iced teas	0.08	0.06	1.10	1.09	0.84	5.99
Iced teas - diet	0.08	0.04	1.22	1.18	1.08	17.89
Fruit-flavoured drinks	0.08	0.13	1.16	1.21	1.07	-11.14
Fruit-flavoured drinks - diet	0.08	0.03	0.98	0.94	1.05	20.98
Flavoured waters	0.08	0.06	0.93	0.92	0.98	8.56
Flavoured waters - diet	0.08	0.03	0.81	0.74	0.99	32.08
Other SSBs	0.08	0.12	1.28	1.33	1.20	-7.83
Other SSBs - diet	0.08	0.03	1.04	0.97	0.93	28.59
Fruit juices						
Nectars - little sweet	0.08	0.05	1.16	1.14	0.94	14.87
Nectars - sweet	0.08	0.10	1.38	1.38	1.12	3.24
Nectars - very sweet	0.08	0.13	1.73	1.79	1.11	-11.19
Fruit juices - little sweet	0.00	0.00	1.25	1.25		2.51
Fruit juices - sweet	0.00	0.00	1.44	1.45		3.08
Fruit juices - very sweet	0.00	0.00	1.14	1.14		2.45
Pure fruit juices	0.00	0.00	1.69	1.69		2.77
Firms						
Firm 1	0.07	0.15	1.16	1.20	0.98	-4.78
Firm 2	0.08	0.11	1.26	1.28	1.08	-1.12
Firm 3	0.05	0.13	1.38	1.40	1.08	0.43
Firm 4	0.04	0.11	1.73	1.74	1.10	1.14
Firm 5	0.02	0.08	1.53	1.53	1.08	4.68
Firm 6	0.08	0.04	0.89	0.85	1.04	19.75
Firm 7	0.08	0.12	1.28	1.25	1.09	16.33
Firm 8	0.08	0.18	4.52	4.60	1.13	-8.94
Firm 9	0.02	0.13	2.19	2.20	1.10	0.72
Firm 10	0.08	0.11	1.76	1.81	1.08	-7.70
Small firms	0.06	0.13	1.57	1.60	1.08	-3.71
Very small firms	0.06	0.10	1.32	1.33	1.08	4.13
Private labels	0.03	0.08	1.04	1.05	1.06	1.98
Outside option						3.99

Notes: This table reports average tax amounts in each tax design, the average consumer prices observed in 2017 and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A24: Simulation France (Non alcoholic beverages) - UK tax

	2012 French tax amount (€/ l)	**UK Tax amount** (€/ l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories						
Sugar-Sweetened Beverage						
Colas	0.08	0.28	1.00	1.22	1.00	-38.16
Colas - diet	0.08	0.00	0.98	0.88		68.04
Iced teas	0.08	0.21	1.10	1.16	1.07	7.55
Iced teas - diet	0.08	0.00	1.22	1.13		56.49
Fruit-flavoured drinks	0.08	0.27	1.16	1.37	1.06	-35.40
Fruit-flavoured drinks - diet	0.08	0.21	0.98	0.91	1.08	56.24
Flavoured waters	0.08	0.22	0.93	1.01	1.07	1.35
Flavoured waters - diet	0.08	0.00	0.81	0.73		60.48
Other SSBs	0.08	0.24	1.28	1.47	1.11	-29.48
Other SSBs - diet	0.08	0.00	1.04	0.96		55.72
Fruit juices						
Nectars - little sweet	0.08	0.22	1.16	1.15	1.15	33.31
Nectars - sweet	0.08	0.23	1.38	1.50	1.16	-10.86
Nectars - very sweet	0.08	0.26	1.73	1.94	1.12	-32.90
Fruit juices - little sweet	0.00	0.00	1.25	1.26		14.68
Fruit juices - sweet	0.00	0.00	1.44	1.45		16.65
Fruit juices - very sweet	0.00	0.00	1.14	1.16		14.36
Pure fruit juices	0.00	0.00	1.69	1.69		15.01
Firms						
Firm 1	0.07	0.27	1.16	1.29	0.98	-10.18
Firm 2	0.08	0.25	1.26	1.39	1.04	-12.67
Firm 3	0.05	0.24	1.38	1.46	1.07	-0.26
Firm 4	0.04	0.25	1.73	1.82	1.08	-1.18
Firm 5	0.02	0.24	1.53	1.53	1.09	22.87
Firm 6	0.08	0.21	0.89	0.91	1.07	21.10
Firm 7	0.08	0.28	1.28	1.32	1.08	21.78
Firm 8	0.08	0.28	4.52	4.69	1.10	-12.82
Firm 9	0.02	0.27	2.19	2.23	1.09	8.19
Firm 10	0.08	0.24	1.76	1.95	1.07	-27.71
Small firms	0.06	0.25	1.57	1.68	1.07	-9.60
Very small firms	0.06	0.26	1.32	1.36	1.08	16.46
Private labels	0.03	0.25	1.04	1.09	1.18	7.07
Outside option						22.60

Notes: This table reports average tax amounts in each tax design, the average consumer prices observed in 2017 and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Table A25: Simulation France (Non alcoholic beverages) - Catalonia tax

	2012 French tax amount (€/ l)	Catalonia Tax amount (€/ l)	Price Pre	Price Post	Pass-through	Variation market share (%)
Categories						
Sugar-Sweetened Beverages						
Colas	0.08	0.15	1.00	1.08	1.01	-19.28
Colas - diet	0.08	0.00	0.98	0.89		39.01
Iced teas	0.08	0.10	1.10	1.08	1.09	10.89
Iced teas - diet	0.08	0.00	1.22	1.13		34.26
Fruit-flavoured drinks	0.08	0.14	1.16	1.24	1.07	-16.97
Fruit-flavoured drinks - diet	0.08	0.10	0.98	0.90	1.09	34.60
Flavoured waters	0.08	0.11	0.93	0.93	1.11	6.95
Flavoured waters - diet	0.08	0.00	0.81	0.73		36.65
Other SSBs	0.08	0.12	1.28	1.34	1.19	-10.66
Other SSBs - diet	0.08	0.00	1.04	0.95		34.60
Fruit juices						
Nectars - little sweet	0.08	0.11	1.16	1.12	1.25	23.66
Nectars - sweet	0.08	0.11	1.38	1.39	1.28	-0.36
Nectars - very sweet	0.08	0.14	1.73	1.80	1.15	-14.69
Fruit juices - little sweet	0.00	0.00	1.25	1.25		1.44
Fruit juices - sweet	0.00	0.00	1.44	1.45		2.34
Fruit juices - very sweet	0.00	0.00	1.14	1.15		1.28
Pure fruit juices	0.00	0.00	1.69	1.69		2.07
Firms						
Firm 1	0.07	0.15	1.16	1.20	0.98	-4.17
Firm 2	0.08	0.13	1.26	1.29	1.06	-3.74
Firm 3	0.05	0.13	1.38	1.40	1.08	-0.14
Firm 4	0.04	0.13	1.73	1.76	1.09	-1.84
Firm 5	0.02	0.12	1.53	1.52	1.12	7.73
Firm 6	0.08	0.10	0.89	0.86	1.12	16.85
Firm 7	0.08	0.15	1.28	1.26	1.10	14.48
Firm 8	0.08	0.15	4.52	4.57	1.12	-5.12
Firm 9	0.02	0.14	2.19	2.20	1.11	-0.24
Firm 10	0.08	0.13	1.76	1.82	1.09	-10.65
Small firms	0.06	0.13	1.57	1.60	1.08	-3.96
Very small firms	0.06	0.13	1.32	1.31	1.10	9.35
Private labels	0.03	0.13	1.04	1.05	1.26	2.61
Outside option						2.82

Notes: This table reports average tax amounts in each tax design, the average consumer prices observed in 2017 and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Tables A26 to A29 report the impact of each tax scenario on prices, pass-through and variation in market shares for each non-alcoholic subcategories and each firm in the United-Kingdom.

Science and Technology in childhood Obesity Policy

Table A26: Simulation UK (Non alcoholic beverages) - French tax 4 thresholds

	Tax amount (euro / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.11	0.88	0.99	1.03	-45.25
Colas - diet	0.03	0.87	0.87	0.95	23.65
Fruit-flavoured drinks	0.07	1.20	1.27	1.03	-18.61
Fruit-flavoured drinks - diet	0.03	0.66	0.69	0.97	3.59
Flavoured waters	0.04	0.92	0.96	1.02	-9.05
Flavoured waters - diet	0.03	0.47	0.49	0.98	4.41
Tonic waters	0.05	0.82	0.87	1.00	-10.23
Tonic waters - diet	0.03	0.84	0.87	0.98	4.97
Lemonades	0.05	0.61	0.67	1.00	-13.95
Lemonades - diet	0.03	0.54	0.56	0.95	14.37
Energy drinks	0.08	1.30	1.39	1.03	-27.90
Energy drinks - diet	0.03	1.52	1.55	1.02	5.20
Other SSBs	0.09	1.14	1.23	1.02	-30.74
Other SSBs - diet	0.03	0.80	0.83	0.98	7.00
Fruit juices					
Nectars - little sweet	0.04	0.93	0.94	1.03	18.70
Nectars - sweet	0.07	1.29	1.36	1.03	-21.26
Nectars - very sweet	0.13	1.08	1.21	1.03	-47.33
Pure fruit juices	0.00	0.00	1.25	1.25	23.06
Smoothies - little sweet	0.11	3.54	3.65	1.02	-23.42
Smoothies - sweet	0.12	2.62	2.74	1.03	-32.33
Smoothies - very sweet	0.13	2.71	2.84	1.03	-34.63
Milk-based drinks					
Flavoured milk	0.11	1.81	1.92	1.03	-34.38
Flavoured milk - diet	0.05	1.73	1.78	1.03	-6.32
Firms					
Firm 1	0.09	1.03	1.07	1.02	-2.57
Firm 2	0.08	1.04	1.07	1.07	6.30
Firm 3	0.05	1.33	1.38	1.02	-11.17
Firm 4	0.03	0.59	0.62	1.02	1.33
Firm 5	0.07	0.79	0.85	1.02	-12.96
Firm 6	0.03	0.46	0.49	1.01	2.03
Firm 7	0.03	0.64	0.68	1.02	-1.26
Firm 8	0.12	2.70	2.76	1.02	-1.11
Firm 9	0.06	2.08	2.09	1.04	16.28
Firm 10	0.06	0.94	0.99	1.02	-8.42
Small firms	0.06	1.52	1.57	1.03	-6.44
Very small firms	0.05	1.24	1.27	1.03	4.39
Private labels	0.04	0.64	0.67	0.98	0.73
Outside option					28.05

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A27: Simulation UK (Non alcoholic beverages) - French tax

	Tax amount (euro / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.10	0.88	0.98	1.03	-42.91
Colas - diet	0.02	0.87	0.87	0.98	19.84
Fruit-flavoured drinks	0.05	1.20	1.26	1.03	-14.78
Fruit-flavoured drinks - diet	0.02	0.66	0.68	0.99	4.29
Flavoured waters	0.04	0.92	0.96	1.03	-11.20
Flavoured waters - diet	0.02	0.47	0.48	0.99	5.01
Tonic waters	0.03	0.82	0.85	1.01	-5.04
Tonic waters - diet	0.02	0.84	0.86	1.01	5.08
Lemonades	0.04	0.61	0.66	1.01	-12.42
Lemonades - diet	0.02	0.54	0.55	0.98	12.60
Energy drinks	0.06	1.30	1.36	1.03	-17.85
Energy drinks - diet	0.02	1.52	1.54	1.03	5.86
Other SSBs	0.08	1.14	1.22	1.02	-27.62
Other SSBs - diet	0.02	0.80	0.82	1.00	6.86
Fruit juices					
Nectars - little sweet	0.03	0.93	0.94	1.04	15.37
Nectars - sweet	0.06	1.29	1.35	1.04	-18.77
Nectars - very sweet	0.11	1.08	1.19	1.03	-44.60
Pure fruit juices	0.00	0.00	1.25	1.26	18.89
Smoothies - little sweet	0.09	3.54	3.63	1.02	-18.32
Smoothies - sweet	0.10	2.62	2.73	1.03	-29.39
Smoothies - very sweet	0.12	2.71	2.83	1.03	-34.43
Milk-based drinks					
Flavoured milk	0.09	1.81	1.90	1.04	-29.05
Flavoured milk - diet	0.04	1.73	1.77	1.03	-5.39
Firms					
Firm 1	0.08	1.03	1.07	1.02	-2.64
Firm 2	0.08	1.04	1.07	1.06	3.83
Firm 3	0.04	1.33	1.37	1.02	-5.58
Firm 4	0.02	0.59	0.61	1.02	2.75
Firm 5	0.06	0.79	0.85	1.02	-11.70
Firm 6	0.02	0.46	0.48	1.02	3.41
Firm 7	0.02	0.64	0.67	1.02	0.24
Firm 8	0.11	2.70	2.75	1.02	-1.66
Firm 9	0.05	2.08	2.09	1.05	13.78
Firm 10	0.05	0.94	0.99	1.02	-6.81
Small firms	0.05	1.52	1.56	1.03	-5.41
Very small firms	0.04	1.24	1.27	1.03	3.94
Private labels	0.03	0.64	0.66	1.00	0.91
Outside option					22.68

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A28: Simulation UK (Non alcoholic beverages) - UK tax

	Tax amount (euro / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.27	0.88	1.16	1.04	-80.18
Colas - diet	0.00	0.87	0.87		31.32
Fruit-flavoured drinks	0.22	1.20	1.37	1.04	-40.54
Fruit-flavoured drinks - diet	0.21	0.66	0.67	1.04	22.35
Flavoured waters	0.21	0.92	1.08	1.04	-44.21
Flavoured waters - diet	0.00	0.47	0.47		22.99
Tonic waters	0.21	0.82	0.85	1.04	13.22
Tonic waters - diet	0.00	0.84	0.85		24.96
Lemonades	0.24	0.61	0.67	1.04	2.87
Lemonades - diet	0.00	0.54	0.54		25.72
Energy drinks	0.22	1.30	1.53	1.05	-66.58
Energy drinks - diet	0.00	1.52	1.52		33.13
Other SSBs	0.23	1.14	1.38	1.04	-69.48
Other SSBs - diet	0.00	0.80	0.81		25.89
Fruit juices					
Nectars - little sweet	0.00	0.93	0.94		26.02
Nectars - sweet	0.24	1.29	1.52	1.04	-64.27
Nectars - very sweet	0.28	1.08	1.36	1.04	-78.90
Pure fruit juices	0.00	0.00	1.25	1.26	28.52
Smoothies - little sweet	0.27	3.54	3.82	1.03	-53.49
Smoothies - sweet	0.28	2.62	2.91	1.03	-62.66
Smoothies - very sweet	0.28	2.71	2.99	1.04	-61.31
Milk-based drinks					
Flavoured milk	0.27	1.81	2.08	1.04	-68.54
Flavoured milk - diet	0.28	1.73	1.75	1.04	29.58
Firms					
Firm 1	0.25	1.03	1.13	1.03	-10.71
Firm 2	0.25	1.04	1.11	1.06	2.24
Firm 3	0.22	1.33	1.45	1.05	-17.18
Firm 4	0.28	0.59	0.60	1.04	23.83
Firm 5	0.24	0.79	0.91	1.04	-18.55
Firm 6	0.00	0.46	0.46		24.86
Firm 7	0.21	0.64	0.65	1.05	24.02
Firm 8	0.28	2.70	2.83	1.02	-5.46
Firm 9	0.28	2.08	2.09	1.04	33.48
Firm 10	0.25	0.94	1.02	1.05	-1.23
Small firms	0.25	1.52	1.62	1.05	-7.77
Very small firms	0.22	1.24	1.31	1.05	4.88
Private labels	0.24	0.64	0.69	1.04	3.76
Outside option					22.64

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A29: Simulation UK (Non alcoholic beverages) - Catalonia tax

	Tax amount (euro / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.10	0.88	0.97	1.03	-42.35
Colas - diet	0.00	0.87	0.87		14.66
Fruit-flavoured drinks	0.07	1.20	1.26	1.03	-15.98
Fruit-flavoured drinks - diet	0.07	0.66	0.67	1.04	10.87
Flavoured waters	0.07	0.92	0.97	1.06	-18.06
Flavoured waters - diet	0.00	0.47	0.47		11.27
Tonic waters	0.07	0.82	0.83	1.04	7.38
Tonic waters - diet	0.00	0.84	0.84		11.52
Lemonades	0.08	0.61	0.63	1.04	1.78
Lemonades - diet	0.00	0.54	0.54		12.44
Energy drinks	0.07	1.30	1.37	1.05	-27.38
Energy drinks - diet	0.00	1.52	1.52		14.34
Other SSBs	0.08	1.14	1.22	1.05	-31.91
Other SSBs - diet	0.00	0.80	0.80		12.05
Fruit juices					
Nectars - little sweet	0.00	0.93	0.94		12.06
Nectars - sweet	0.08	1.29	1.37	1.05	-29.79
Nectars - very sweet	0.10	1.08	1.18	1.04	-41.88
Pure fruit juices	0.00	0.00	1.25	1.26	12.72
Smoothies - little sweet	0.10	3.54	3.64	1.03	-22.68
Smoothies - sweet	0.10	2.62	2.72	1.04	-28.98
Smoothies - very sweet	0.10	2.71	2.81	1.04	-27.78
Milk-based drinks					
Flavoured milk	0.09	1.81	1.90	1.05	-32.96
Flavoured milk - diet	0.10	1.73	1.74	1.04	12.67
Firms					
Firm 1	0.08	1.03	1.06	1.02	-5.35
Firm 2	0.09	1.04	1.07	1.05	0.52
Firm 3	0.07	1.33	1.37	1.05	-6.35
Firm 4	0.10	0.59	0.60	1.04	11.64
Firm 5	0.08	0.79	0.83	1.04	-8.65
Firm 6	0.00	0.46	0.46		12.24
Firm 7	0.07	0.64	0.65	1.05	11.74
Firm 8	0.10	2.70	2.75	1.02	-2.55
Firm 9	0.10	2.08	2.08	1.04	14.01
Firm 10	0.09	0.94	0.97	1.05	-0.84
Small firms	0.09	1.52	1.55	1.04	-3.17
Very small firms	0.07	1.24	1.26	1.05	2.97
Private labels	0.08	0.64	0.66	1.05	1.82
Outside option					11.60

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Tables A33 to A30 report the impact of each tax scenario on prices, pass-through and variation in market shares for each non-alcoholic subcategories and each firm in Spain.

Table A30: Simulation Spain (Non alcoholic beverages) - French tax 4 thresholds

	Tax amount (€ / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.14	0.91	1.05	0.97	-34.65
Colas - diet	0.03	0.95	0.97	0.81	25.95
Iced teas	0.09	1.02	1.11	1.01	-11.57
Iced teas - diet	0.03	0.60	0.62	1.14	22.57
Fruit-flavoured drinks	0.12	0.84	0.96	1.02	-23.65
Fruit-flavoured drinks - diet	0.04	0.72	0.76	1.02	16.09
Flavoured waters	0.13	0.52	0.65	1.03	-32.92
Flavoured waters - diet	0.03	0.68	0.70	0.99	35.08
Lemonades	0.13	0.62	0.75	1.02	-29.26
Lemonades - diet	0.03	0.58	0.60	1.11	25.67
Energy drinks	0.11	1.34	1.45	0.99	-20.13
Energy drinks - diet	0.03	1.32	1.33	1.17	39.60
Other SSBs	0.10	1.99	2.09	1.02	-19.58
Other SSBs - diet	0.03	0.62	0.64	1.13	27.09
Fruit juices					
Nectars - little sweet	0.00	0.67	0.68		39.15
Nectars - sweet	0.13	1.08	1.22	1.03	-34.06
Nectars - very sweet	0.16	1.14	1.25	1.03	-15.78
Pure fruit juices	0.00	0.00	1.18	1.18	38.2
Fruit juices with milk - little sweet	0.08	1.02	1.04	1.00	26.40
Fruit juices with milk - sweet	0.11	0.86	0.97	1.04	-24.59
Fruit juices with milk - very sweet	0.14	1.10	1.25	1.00	-36.66
Firms					
Firm 1	0.10	1.04	1.13	0.89	-7.92
Firm 2	0.09	0.89	0.95	1.01	2.87
Firm 3	0.12	0.72	0.81	1.00	-4.12
Firm 4	0.08	1.19	1.25	1.01	5.33
Firm 5	0.12	1.46	1.56	1.00	-8.94
Firm 6	0.09	0.97	1.03	1.01	6.29
Firm 7	0.09	3.29	3.39	1.00	-14.04
Firm 8	0.15	1.86	1.97	1.01	-12.86
Firm 9	0.10	0.53	0.62	1.00	-7.29
Firm 10	0.14	2.20	2.26	1.01	9.21
Small firms	0.11	2.17	2.25	1.00	-2.87
Very small firms	0.11	1.12	1.18	1.00	5.01
Private labels	0.09	0.74	0.80	1.08	2.44
Outside option					45.34

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A31: Simulation Spain (Non alcoholic beverages) - French tax

	Tax amount (\euro / l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.13	0.91	1.03	0.97	-31.65
Colas - diet	0.02	0.95	0.97	0.77	23.77
Iced teas	0.06	1.02	1.09	1.02	-4.95
Iced teas - diet	0.02	0.60	0.62	1.20	20.18
Fruit-flavoured drinks	0.09	0.84	0.93	1.03	-16.60
Fruit-flavoured drinks - diet	0.03	0.72	0.76	1.02	13.36
Flavoured waters	0.10	0.52	0.63	1.04	-25.90
Flavoured waters - diet	0.02	0.68	0.69	0.99	29.89
Lemonades	0.11	0.62	0.73	1.02	-25.08
Lemonades - diet	0.03	0.58	0.60	1.15	22.25
Energy drinks	0.08	1.34	1.43	0.98	-12.14
Energy drinks - diet	0.02	1.32	1.33	1.22	33.28
Other SSBs	0.09	1.99	2.08	1.03	-17.18
Other SSBs - diet	0.02	0.62	0.64	1.19	23.52
Fruit juices					
Nectars - little sweet	0.00	0.67	0.68		31.94
Nectars - sweet	0.12	1.08	1.20	1.03	-30.93
Nectars - very sweet	0.15	1.14	1.25	1.03	-18.34
Pure fruit juices	0.00	0.00	1.18	1.18	31.32
Fruit juices with milk - little sweet	0.06	1.02	1.04	1.00	22.43
Fruit juices with milk - sweet	0.09	0.86	0.96	1.04	-21.92
Fruit juices with milk - very sweet	0.11	1.10	1.22	1.00	-27.67
Firms					
Firm 1	0.09	1.04	1.12	0.87	-6.99
Firm 2	0.08	0.89	0.94	1.01	2.50
Firm 3	0.11	0.72	0.80	1.00	-5.23
Firm 4	0.06	1.19	1.24	1.01	5.73
Firm 5	0.09	1.46	1.54	1.00	-7.04
Firm 6	0.07	0.97	1.01	1.01	8.96
Firm 7	0.09	3.29	3.38	1.00	-13.89
Firm 8	0.14	1.86	1.96	1.01	-15.36
Firm 9	0.08	0.53	0.60	1.00	-4.48
Firm 10	0.13	2.20	2.25	1.01	6.26
Small firms	0.09	2.17	2.24	1.00	-3.53
Very small firms	0.09	1.12	1.17	1.00	4.68
Private labels	0.07	0.74	0.79	1.10	2.39
Outside option					37.45

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A32: Simulation Spain (Non alcoholic beverages) - UK tax

	Tax amount (€/ l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.34	0.91	1.24	1.00	-71.32
Colas - diet	0.00	0.95	0.95		82.22
Iced teas	0.25	1.02	1.25	1.01	-37.42
Iced teas - diet	0.00	0.60	0.60		76.27
Fruit-flavoured drinks	0.29	0.84	1.10	1.01	-49.10
Fruit-flavoured drinks - diet	0.26	0.72	0.76	1.00	59.94
Flavoured waters	0.33	0.52	0.85	1.02	-68.52
Flavoured waters - diet	0.00	0.68	0.68		79.25
Lemonades	0.29	0.62	0.92	1.01	-66.20
Lemonades - diet	0.00	0.58	0.58		77.79
Energy drinks	0.27	1.34	1.62	1.01	-59.63
Energy drinks - diet	0.00	1.32	1.32		79.75
Other SSBs	0.29	1.99	2.29	1.02	-62.80
Other SSBs - diet	0.00	0.62	0.62		76.50
Fruit juices					
Nectars - little sweet	0.00	0.67	0.68		72.76
Nectars - sweet	0.33	1.08	1.41	1.02	-71.34
Nectars - very sweet	0.34	1.14	1.38	1.02	-26.34
Pure fruit juices	0.00	0.00	1.18	1.18	71.68
Fruit juices with milk - little sweet	0.25	1.02	1.09	1.01	37.62
Fruit juices with milk - sweet	0.31	0.86	1.17	1.02	-67.61
Fruit juices with milk - very sweet	0.34	1.10	1.45	1.01	-72.82
Firms					
Firm 1	0.33	1.04	1.23	1.00	-5.34
Firm 2	0.27	0.89	1.06	1.00	-8.95
Firm 3	0.33	0.72	0.92	1.01	-10.49
Firm 4	0.29	1.19	1.31	1.02	20.65
Firm 5	0.31	1.46	1.71	1.00	-35.22
Firm 6	0.27	0.97	1.13	1.01	-1.22
Firm 7	0.29	3.29	3.58	1.00	-56.96
Firm 8	0.34	1.86	2.10	1.01	-23.73
Firm 9	0.32	0.53	0.70	1.01	2.87
Firm 10	0.34	2.20	2.34	1.01	15.78
Small firms	0.31	2.17	2.38	1.01	-17.63
Very small firms	0.33	1.12	1.28	1.01	5.64
Private labels	0.30	0.74	0.89	1.03	3.15
Outside option					81.05

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Science and Technology in childhood Obesity Policy

Table A33: Simulation Spain (Non alcoholic beverages) - Catalonia tax

	Tax amount (€/ l)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Categories					
Sugar-Sweetened Beverages					
Colas	0.12	0.91	1.02	0.99	-31.90
Colas - diet	0.00	0.95	0.95		33.36
Iced teas	0.08	1.02	1.09	1.01	-9.73
Iced teas - diet	0.00	0.60	0.60		31.03
Fruit-flavoured drinks	0.10	0.84	0.93	1.01	-17.85
Fruit-flavoured drinks - diet	0.08	0.72	0.73	1.00	25.06
Flavoured waters	0.12	0.52	0.63	1.02	-30.99
Flavoured waters - diet	0.00	0.68	0.68		32.10
Lemonades	0.10	0.62	0.72	1.01	-25.20
Lemonades - diet	0.00	0.58	0.58		31.63
Energy drinks	0.09	1.34	1.43	1.00	-19.32
Energy drinks - diet	0.00	1.32	1.32		32.09
Other SSBs	0.10	1.99	2.09	1.02	-23.40
Other SSBs - diet	0.00	0.62	0.62		31.05
Fruit juices					
Nectars - little sweet	0.00	0.67	0.67		29.71
Nectars - sweet	0.11	1.08	1.19	1.02	-31.36
Nectars - very sweet	0.12	1.14	1.22	1.03	-13.16
Pure fruit juices	0.00	0.00	1.18	1.18	29.06
Fruit juices with milk - little sweet	0.08	1.02	1.04	1.00	17.06
Fruit juices with milk - sweet	0.11	0.86	0.97	1.02	-28.03
Fruit juices with milk - very sweet	0.12	1.10	1.23	1.00	-32.84
Firms					
Firm 1	0.12	1.04	1.11	0.98	-3.19
Firm 2	0.09	0.89	0.95	1.00	-1.17
Firm 3	0.11	0.72	0.79	1.00	-5.58
Firm 4	0.10	1.19	1.23	1.02	9.22
Firm 5	0.11	1.46	1.55	1.00	-14.36
Firm 6	0.09	0.97	1.02	1.01	2.26
Firm 7	0.10	3.29	3.39	1.00	-19.99
Firm 8	0.12	1.86	1.95	1.01	-11.80
Firm 9	0.11	0.53	0.59	1.01	0.24
Firm 10	0.12	2.20	2.25	1.01	4.77
Small firms	0.11	2.17	2.24	1.01	-7.15
Very small firms	0.11	1.12	1.17	1.01	1.18
Private labels	0.10	0.74	0.79	1.03	1.49
Outside option					33.10

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of non-alcoholic beverages, and the average variations in market share for each sub-category of non-alcoholic beverages and firm.

Tables A34 to A36 report the impact of each tax scenario on prices, pass-through and variation in market shares for biscuits with respect to seven sugar content categories and each firm in France.

Table A34: Simulation France (Biscuits Market) - French tax 4 thresholds

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	0.24	15.17	15.28	0.61	16.76
[10 ; 20[	0.24	5.86	6.04	0.71	21.66
[20 ; 26[	0.38	6.58	6.92	0.84	13.36
[26 ; 31[	0.59	6.49	7.07	0.93	2.46
[31 ; 37[	0.78	6.13	6.93	0.97	-6.55
[37 ; 43[	1.07	6.63	7.79	1.02	-19.36
>= 43	1.28	8.43	9.88	1.07	-25.94
Firms					
Firm 1	0.77	6.26	7.06	0.95	-5.19
Firm 2	0.63	8.33	9.03	1.03	-0.44
Firm 3	0.68	5.30	6.06	1.04	-4.49
Firm 4	0.83	8.44	9.37	1.04	-8.53
Firm 5	0.45	11.66	12.09	0.88	7.32
Firm 6	0.76	9.61	10.47	1.00	-5.31
Firm 7	0.50	5.69	6.23	1.03	4.94
Firm 8	0.40	10.83	11.23	0.92	10.01
Firm 9	0.61	16.48	17.12	0.92	2.24
Firm 10	0.65	4.52	5.24	1.04	-3.43
Small firms	0.73	10.61	11.41	1.00	-3.82
Very small firms	0.67	7.07	7.82	1.02	-2.84
Private labels	0.78	5.65	6.42	0.92	-5.00
Outside Option					37.07

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Table A35: Simulation France (Biscuits Market) - UK tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	15.17	14.79	.	91.16
[10 ; 20[	.	5.86	5.70	.	118.94
[20 ; 26[	.	6.58	6.30	.	133.06
[26 ; 31[	4.39	6.49	10.78	1.09	-44.81
[31 ; 37[	2.75	6.13	9.12	1.02	-39.03
[37 ; 43[	2.51	6.63	9.30	1.01	-32.00
>= 43	2.51	8.43	11.25	1.07	-31.65
Firms					
Firm 1	3.00	6.26	8.92	1.09	-8.88
Firm 2	2.94	8.33	10.57	1.12	10.59
Firm 3	3.35	5.30	8.22	1.10	-12.95
Firm 4	3.16	8.44	11.88	1.11	-33.79
Firm 5	4.15	11.66	14.55	1.15	-5.13
Firm 6	2.51	9.61	11.63	1.11	8.42
Firm 7	4.39	5.69	7.34	1.13	54.47
Firm 8	3.84	10.83	12.32	1.16	51.00
Firm 9	3.50	16.48	19.52	1.16	-2.35
Firm 10	3.67	4.52	7.00	1.10	9.10
Small firms	3.12	10.61	13.10	1.11	0.12
Very small firms	3.00	7.07	9.51	1.11	1.29
Private labels	3.09	5.65	8.49	0.98	-22.19
Outside Option					106.66

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Table A36: Simulation France (Biscuits Market) - Catalonia tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	15.17	14.96	.	30.63
[10 ; 20[	0.60	5.86	6.26	0.93	13.98
[20 ; 26[	0.60	6.58	7.16	0.93	6.18
[26 ; 31[	0.85	6.49	7.37	0.98	-6.59
[31 ; 37[	0.89	6.13	7.05	0.98	-8.34
[37 ; 43[	0.89	6.63	7.55	0.98	-7.78
>= 43	0.89	8.43	9.38	1.01	-7.74
Firms					
Firm 1	0.83	6.26	7.12	0.98	-5.44
Firm 2	0.79	8.33	9.20	1.04	-4.57
Firm 3	0.83	5.30	6.17	1.05	-5.74
Firm 4	0.87	8.44	9.41	1.05	-8.18
Firm 5	0.84	11.66	12.31	1.05	1.56
Firm 6	0.89	9.61	10.29	1.06	4.71
Firm 7	0.69	5.69	6.45	1.04	-1.26
Firm 8	0.72	10.83	11.46	1.03	4.79
Firm 9	0.81	16.48	17.37	1.03	-2.54
Firm 10	0.77	4.52	5.37	1.05	-6.72
Small firms	0.82	10.61	11.45	1.04	-3.44
Very small firms	0.82	7.07	7.92	1.05	-3.97
Private labels	0.87	5.65	6.50	0.93	-5.58
Outside Option					43.82

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Tables A37 to A39 report the impact of each tax scenario on prices, pass-through and variation in market shares for biscuits with respect to seven sugar content categories and each firm in the UK.

Table A37: Simulation UK (Biscuits Market) - French tax 4 thresholds

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	.	.	.	.
[10 ; 20[	0.17	3.77	3.93	0.97	27.53
[20 ; 26[	0.22	4.10	4.32	0.95	20.20
[26 ; 31[	0.35	4.48	4.82	0.98	2.50
[31 ; 37[	0.52	5.58	6.10	0.99	-18.02
[37 ; 43[	0.74	6.18	6.93	0.95	-38.23
>= 43	0.86	6.38	7.24	0.99	-45.55
Firms					
Firm 1	0.37	4.07	4.45	1.02	0.33
Firm 2	0.51	5.88	6.39	0.94	-12.01
Firm 3	0.44	4.54	4.98	1.01	-9.46
Firm 4	0.62	4.85	5.48	1.00	-28.50
Firm 5	0.51	9.58	10.10	1.01	-10.70
Firm 6	0.50	9.64	10.15	1.02	-9.38
Firm 7	0.25	9.17	9.43	1.03	17.03
Firm 8	0.64	6.30	6.96	1.02	-28.78
Firm 9	0.58	8.21	8.80	0.89	-20.34
Firm 10	0.32	1.81	2.13	1.02	3.02
Small firms	0.50	9.02	9.54	1.01	-9.78
Very small firms	0.34	4.60	4.95	1.02	2.47
Private labels	0.40	3.76	4.15	0.95	-1.74
Outside Option					57.43

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Science and Technology in childhood Obesity Policy

Table A38: Simulation UK (Biscuit Market) - UK tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	.	.	.	.
[10 ; 20[	.	3.77	3.78	.	134.86
[20 ; 26[	.	4.10	4.11	.	139.08
[26 ; 31[	3.05	4.48	6.89	1.02	-42.69
[31 ; 37[	2.12	5.58	7.75	1.01	-78.80
[37 ; 43[	1.74	6.18	7.96	0.96	-71.62
>= 43	1.74	6.38	8.16	1.01	-71.19
Firms					
Firm 1	2.57	4.07	5.67	1.02	-1.08
Firm 2	2.26	5.88	7.61	0.95	-22.40
Firm 3	2.08	4.54	6.28	1.01	-42.10
Firm 4	2.12	4.85	7.00	1.00	-79.15
Firm 5	2.17	9.58	11.48	1.02	-39.16
Firm 6	2.07	9.64	11.25	1.03	-12.46
Firm 7	3.05	9.17	10.86	1.03	25.63
Firm 8	1.74	6.30	8.09	1.02	-71.53
Firm 9	2.22	8.21	10.30	0.88	-55.95
Firm 10	2.62	1.81	2.76	1.03	48.28
Small firms	2.06	9.02	10.54	1.01	-7.10
Very small firms	2.69	4.60	6.06	1.02	17.10
Private labels	2.44	3.76	5.27	1.01	0.43
Outside Option					114.06

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Table A39: Simulation UK (Biscuit Market) - Catalonia tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	.	.	.	.
[10 ; 20[	0.41	3.77	3.91	0.93	50.51
[20 ; 26[	0.41	4.10	4.49	0.94	4.48
[26 ; 31[	0.58	4.48	5.04	0.97	-15.43
[31 ; 37[	0.62	5.58	6.19	0.97	-20.02
[37 ; 43[	0.62	6.18	6.80	0.94	-19.71
>= 43	0.62	6.38	6.99	0.97	-18.84
Firms					
Firm 1	0.58	4.07	4.53	1.03	3.92
Firm 2	0.57	5.88	6.45	0.94	-14.30
Firm 3	0.59	4.54	5.13	1.00	-18.68
Firm 4	0.62	4.85	5.48	1.00	-22.31
Firm 5	0.59	9.58	10.18	1.01	-12.99
Firm 6	0.58	9.64	10.21	1.01	-8.33
Firm 7	0.53	9.17	9.68	1.02	-3.68
Firm 8	0.62	6.30	6.93	1.02	-20.50
Firm 9	0.61	8.21	8.82	0.89	-16.42
Firm 10	0.50	1.81	2.25	1.02	-1.28
Small firms	0.57	9.02	9.56	1.01	-6.31
Very small firms	0.52	4.60	5.13	1.01	-12.47
Private labels	0.55	3.76	4.24	0.91	-5.29
Outside Option					74.44

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Tables A40 to A42 report the impact of each tax scenario on prices, pass-through and variation in market shares for biscuits with respect to seven sugar content categories and each firm in Spain.

Table A40: Simulation Spain (Biscuits Market) - French tax 4 thresholds

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	0.13	5.80	5.90	0.98	8.49
[10 ; 20[	0.13	3.58	3.71	0.91	4.45
[20 ; 26[	0.16	3.17	3.33	0.87	2.67
[26 ; 31[	0.31	4.12	4.45	0.97	-11.96
[31 ; 37[	0.40	6.80	7.24	1.01	-16.99
[37 ; 43[	0.59	5.40	6.05	1.01	-31.13
>= 43	0.63	4.24	4.93	1.00	-34.45
Firms					
Firm 1	0.20	3.82	4.02	1.04	-0.95
Firm 2	0.19	4.63	4.83	1.05	-1.02
Firm 3	0.29	6.56	6.88	1.01	-7.76
Firm 4	0.19	4.48	4.70	1.04	-2.43
Firm 5	0.19	10.73	10.92	1.04	2.98
Firm 6	0.13	4.36	4.49	1.05	4.68
Firm 7	0.20	3.23	3.46	1.04	-3.89
Firm 8	0.20	3.72	3.95	1.04	-3.80
Firm 9	0.39	2.35	2.79	1.04	-21.97
Firm 10	0.39	5.00	5.44	1.04	-18.79
Small firms	0.30	7.34	7.66	1.04	-7.02
Very small firms	0.16	6.18	6.37	1.05	1.35
Private labels	0.26	3.31	3.56	0.82	-4.24
Outside Option					16.96

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Table A41: Simulation Spain (Biscuit Market) - UK tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	5.80	5.80	.	27.78
[10 ; 20[	.	3.58	3.56	.	28.16
[20 ; 26[	.	3.17	3.15	.	29.85
[26 ; 31[	2.40	4.12	6.35	1.04	-65.26
[31 ; 37[	1.60	6.80	8.64	1.04	-66.15
[37 ; 43[	1.37	5.40	6.96	1.03	-62.98
>= 43	1.37	4.24	5.79	1.03	-64.54
Firms					
Firm 1	1.67	3.82	4.19	1.07	6.34
Firm 2	2.05	4.63	5.26	1.06	-0.92
Firm 3	1.76	6.56	7.56	1.05	-18.06
Firm 4	1.37	4.48	4.65	1.06	17.52
Firm 5	1.37	10.73	11.06	1.02	14.58
Firm 6	0.00	4.36	4.37	.	25.38
Firm 7	2.40	3.23	4.75	1.05	-36.83
Firm 8	0.00	3.72	3.74	.	25.82
Firm 9	2.40	2.35	5.11	1.05	-89.32
Firm 10	2.40	5.00	7.78	1.05	-86.23
Small firms	1.69	7.34	8.18	1.06	-11.63
Very small firms	2.01	6.18	6.36	1.06	20.60
Private labels	1.81	3.31	4.00	1.02	-5.66
Outside Option					20.86

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

Science and Technology in childhood Obesity Policy

Table A42: Simulation Spain (Biscuit Market) - Catalonia tax

	Tax amount (€/ kg)	**Price** Pre	Post	**Pass-through**	**Variation market share (%)**
Sugar Content					
[0 ; 10[	.	5.80	5.78	.	22.49
[10 ; 20[	0.33	3.58	3.70	0.85	9.59
[20 ; 26[	0.33	3.17	3.49	0.89	-9.19
[26 ; 31[	0.46	4.12	4.59	0.94	-19.85
[31 ; 37[	0.49	6.80	7.33	0.99	-20.69
[37 ; 43[	0.49	5.40	5.91	0.96	-20.78
>= 43	0.49	4.24	4.75	0.94	-20.93
Firms					
Firm 1	0.40	3.82	4.01	1.06	3.99
Firm 2	0.40	4.63	4.88	1.05	-0.14
Firm 3	0.43	6.56	6.94	1.02	-9.59
Firm 4	0.35	4.48	4.83	1.04	-9.65
Firm 5	0.49	10.73	10.84	1.01	14.62
Firm 6	0.33	4.36	4.39	1.04	18.77
Firm 7	0.42	3.23	3.71	1.04	-20.64
Firm 8	0.33	3.72	4.10	1.04	-12.88
Firm 9	0.49	2.35	2.91	1.04	-27.76
Firm 10	0.49	5.00	5.56	1.04	-24.33
Small firms	0.43	7.34	7.67	1.04	-4.58
Very small firms	0.37	6.18	6.29	1.05	12.52
Private labels	0.39	3.31	3.63	0.83	-8.03
Outside Option					21.23

Notes: This table reports average tax amounts, the average consumer prices observed before tax and the average equilibrium consumer prices estimated after the implementation of the tax, how the tax is passed-through onto the consumer prices of biscuits, and the average variations in market share for each sub-category of biscuit and firm.

A.8 Impact on purchases

Figure A3: Impact on purchase on products with sugar in France (non-alcoholic beverage market)

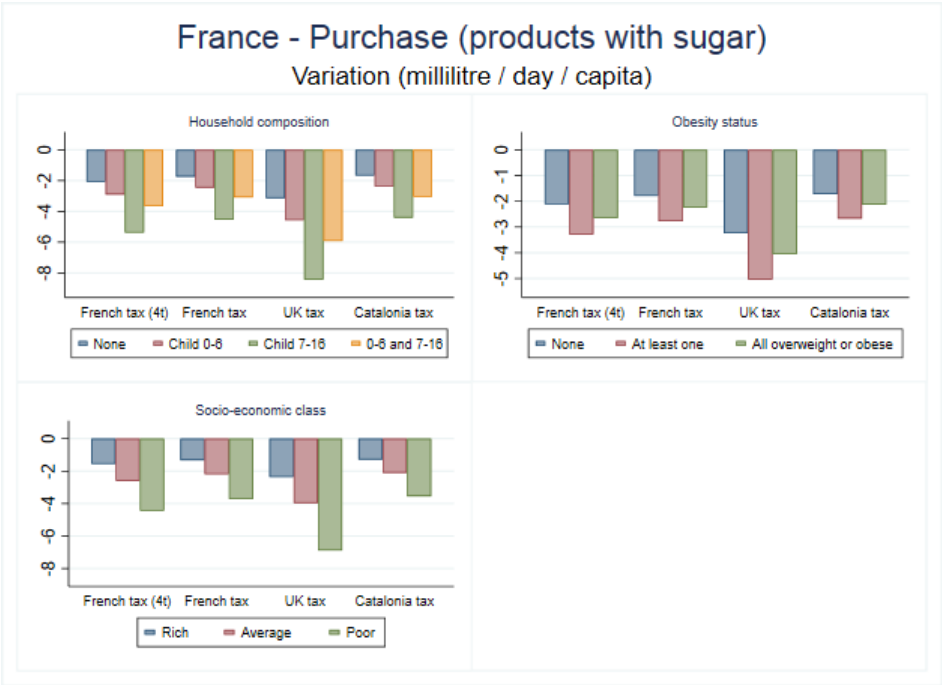


Figure A4: Impact on purchase on products with sugar in the UK (non-alcoholic beverage market)

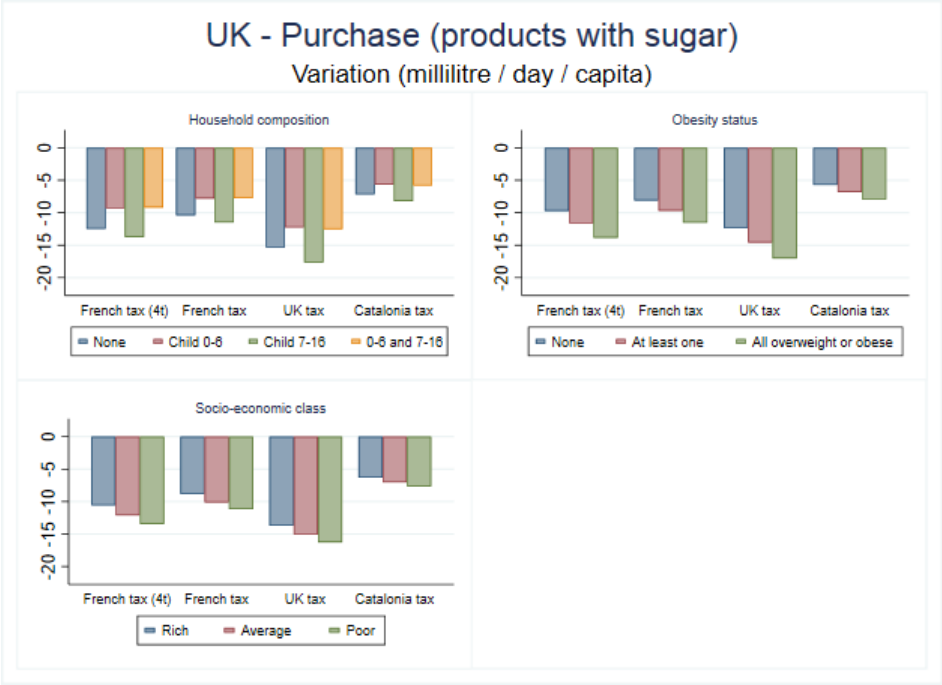


Figure A5: Impact on purchase on products with sugar in Spain (non-alcoholic beverage market)

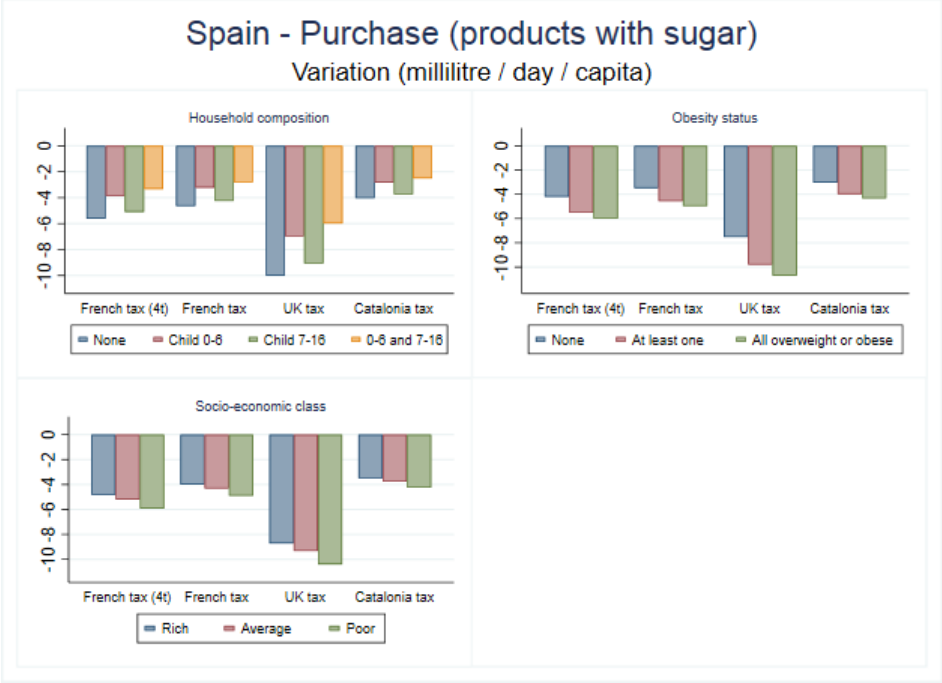


Figure A6: Impact on purchase in France (biscuit market)

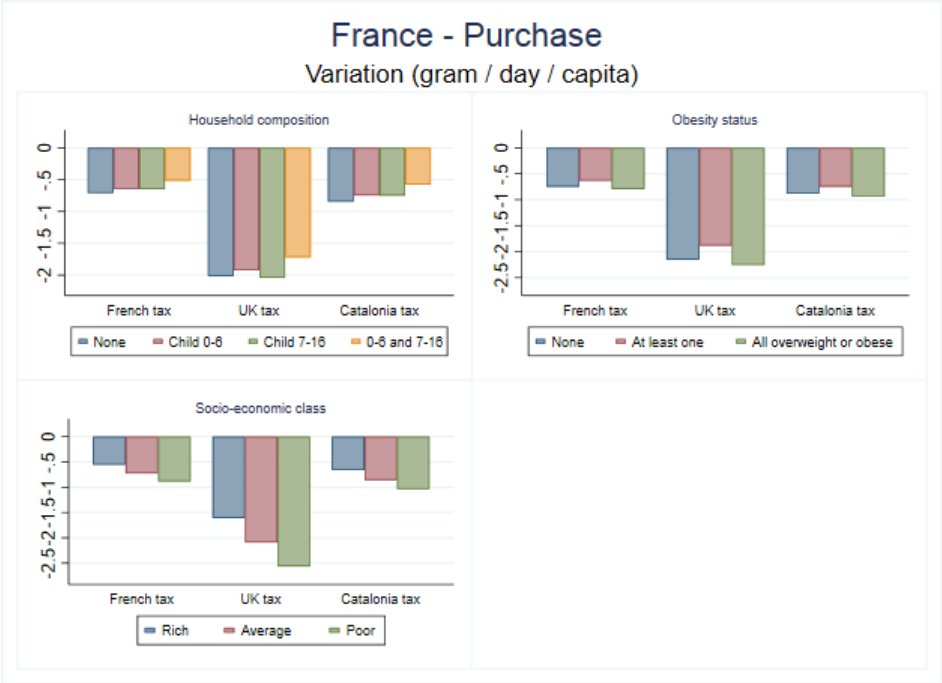


Figure A7: Impact on purchase in the UK (biscuit market)

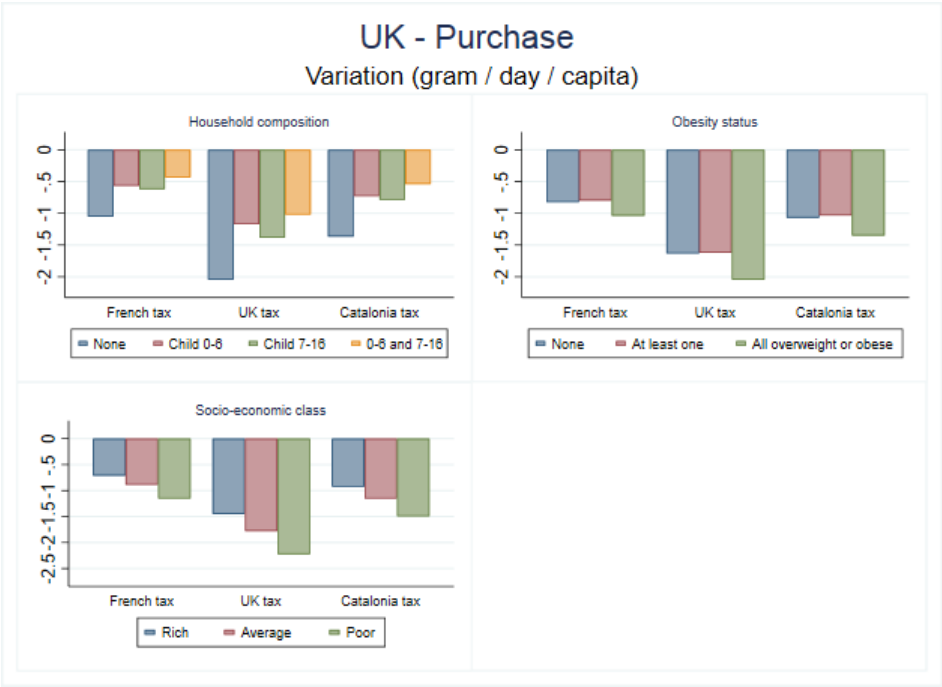


Figure A8: Impact on purchase in Spain (biscuit market)

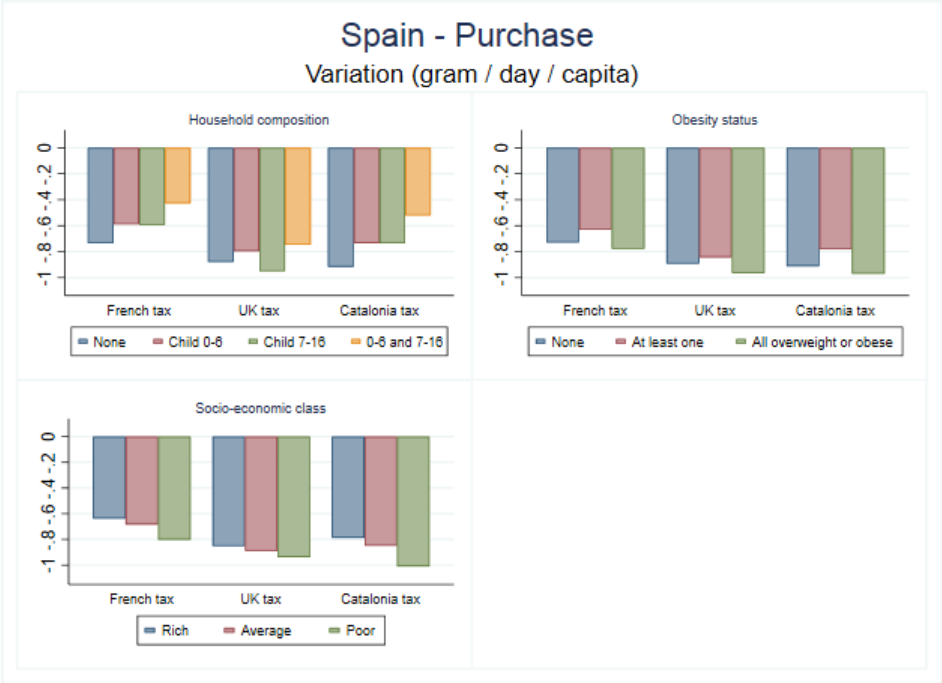


Figure A9: Variation in lipids purchase (French panel)

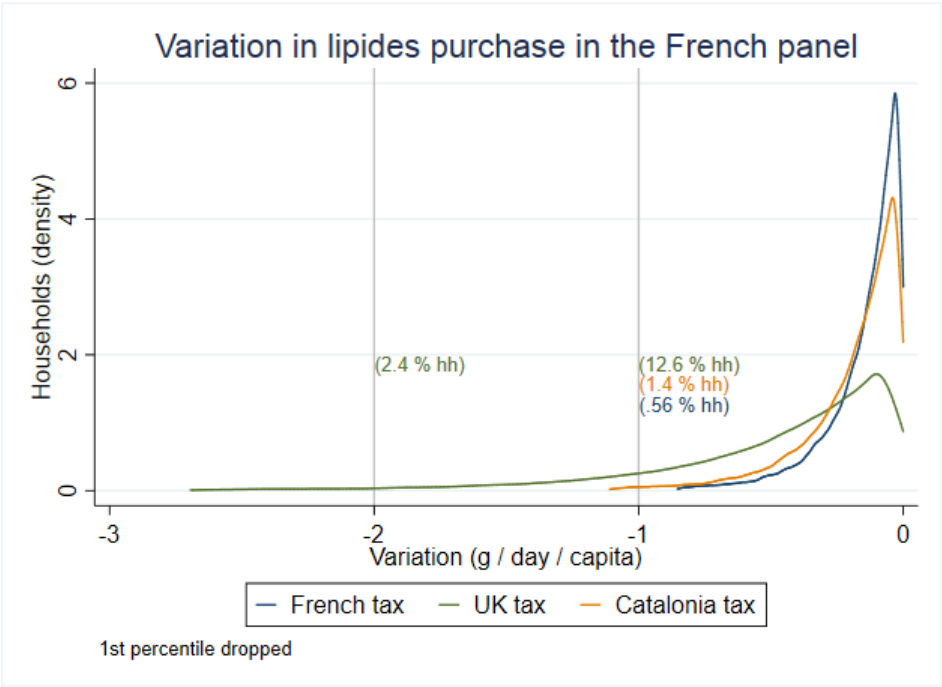


Figure A10: Variation in lipids purchase (UK panel)

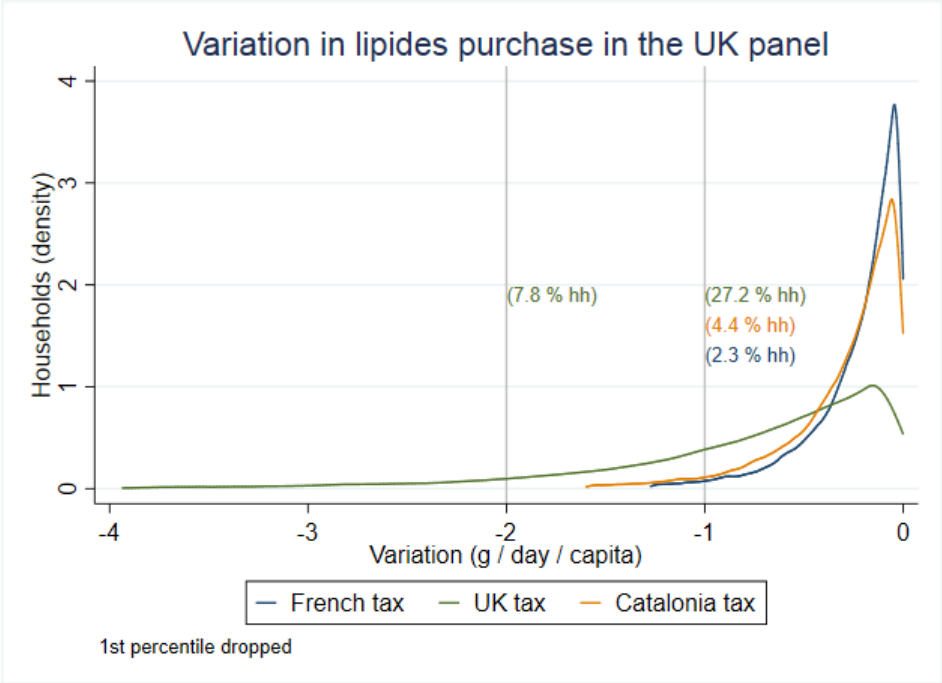
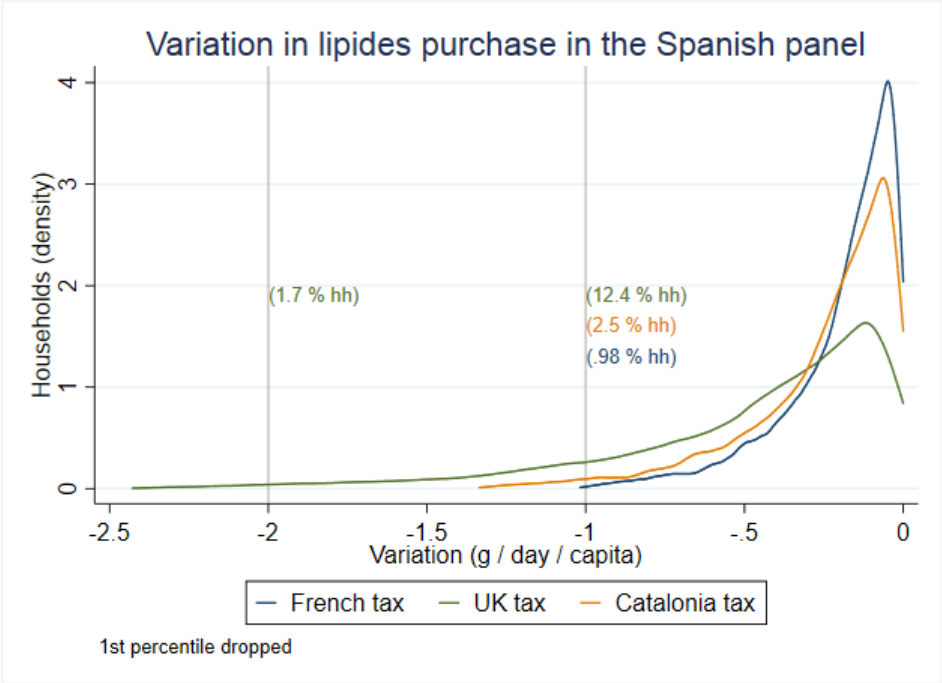


Figure A11: Variation in lipids purchase (Spanish panel)




stop
Science and Technology in
childhood Obesity Policy

A.9 Impact on sugar purchase

Table A43: Households sugar purchase before and after tax implementation - non-alcoholic beverages market

Sugar content (g/day/capita)	Sugar purchase				
	Before tax	After tax			
		French tax 4 thresholds	French tax	UK tax	Catalonia tax
		France			
Household composition					
No children	3.5	3.2	3.2	3.0	3.2
Children below 6	6.3	5.9	6.0	5.6	5.9
Children 7-16	11.1	10.3	10.4	9.7	10.3
Children below 6 & 7-16	10.2	9.6	9.7	9.2	9.6
Obesity status					
No overweight or obese	4.0	3.7	3.8	3.5	3.7
Some overweight or obese	6.2	5.7	5.7	5.3	5.7
All overweight or obese	4.4	4.0	4.0	3.7	4.0
Socio-economic class					
Rich	3.2	2.9	3.0	2.8	2.9
Average	4.6	4.3	9.1	4.0	4.3
Poor	7.6	6.9	7.0	6.4	6.9
		UK			
Household composition					
No children	7.9	6.6	6.7	5.1	6.5
Children below 6	7.5	6.5	6.5	5.2	6.3
Children 7-16	10.2	8.7	8.8	6.9	8.6
Children below 6 & 7-16	8.8	7.8	7.8	6.4	7.6
Obesity status					
No overweight or obese	6.7	5.7	5.7	4.4	5.6
Some overweight or obese	8.0	6.8	6.9	5.3	6.7
All overweight or obese	9.1	7.6	7.7	5.9	7.5
Socio-economic class					
Rich	7.6	6.4	6.5	5.0	6.3
Average	8.2	6.9	7.0	5.3	6.8
Poor	8.7	7.3	7.4	5.6	7.1
		Spain			
Household composition					
No children	8.6	7.4	7.5	5.5	7.3
Children below 6	8.9	8.0	8.1	6.5	7.9
Children 7-16	10.2	9.1	9.2	7.2	8.9
Children below 6 & 7-16	11.0	10.3	10.3	9.1	10.1
Obesity status					
No overweight or obese	7.1	6.2	6.3	4.7	6.1
Some overweight or obese	9.5	8.3	8.4	6.3	8.2
All overweight or obese	10.0	8.6	8.8	6.6	8.6
Socio-economic class					
Rich	8.8	7.7	7.8	5.9	7.6
Average	9.1	8.0	8.1	6.1	7.9
Poor	9.0	7.7	7.8	5.7	7.6

Table A44: Households sugar purchase before and after tax implementation - biscuits market

Sugar (g/day/capita)	Sugar purchase			
	Before tax	After tax		
		French tax	UK tax	Catalonia tax
	France			
Household composition				
No children	4.9	4.6	3.9	4.6
Children below 6	5.6	5.2	4.5	5.3
Children 7-16	7.2	6.8	5.9	6.9
Children below 6 & 7-16	7.7	7.3	6.5	7.4
Obesity status				
No overweight or obese	5.6	5.2	4.4	5.3
Some overweight or obese	5.7	5.4	4.6	5.4
All overweight or obese	5.6	5.2	4.4	5.2
Socio-economic class				
Rich	4.4	4.1	3.5	4.1
Average	5.6	5.2	4.4	5.3
Poor	6.9	6.4	5.4	6.4
Household composition	**UK**			
No children	5.4	4.8	3.8	4.7
Children below 6	3.8	3.5	2.8	3.5
Children 7-16	5.7	5.1	4.1	5.2
Children below 6 & 7-16	5.4	4.9	4.0	5.0
Obesity status				
No overweight or obese	4.7	4.1	3.3	4.1
Some overweight or obese	5.0	4.5	3.6	4.5
All overweight or obese	5.7	5.1	4.0	5.0
Socio-economic class				
Rich	4.5	4.0	3.2	4.0
Average	5.3	4.7	3.7	4.7
Poor	5.9	5.2	4.1	5.2
Household composition	**Spain**			
No children	3.2	2.8	2.5	2.8
Children below 6	3.4	3.1	2.7	3.0
Children 7-16	4.9	4.5	3.8	4.4
Children below 6 & 7-16	4.8	4.4	3.8	4.5
Obesity status				
No overweight or obese	3.4	3.1	2.7	3.0
Some overweight or obese	3.6	3.3	2.8	3.2
All overweight or obese	3.7	3.3	2.9	3.3
Socio-economic class				
Rich	3.6	3.3	2.8	3.2
Average	3.6	3.3	2.9	3.2
Poor	3.4	3.0	2.6	2.9

Science and Technology in childhood Obesity Policy

Part 2: The impact of committing to a voluntary front-of-pack nutrition Label on market shares: The Nutri-Score in France

Allais, O†, Dulieu, J†, Narayanane, G†

May, 2022

† Université Paris-Saclay, INRAE, UR ALISS, 94205, Ivry-sur-Seine, France.

Science and Technology in childhood Obesity Policy

Table of contents

Abstract

Context: Unhealthy eating is a key risk factor in chronic non-communicable diseases, which have sharply risen and account for 60% of deaths worldwide. One increasingly popular policy tool governments are using or considering to use to combat unhealthy eating is front-of-pack nutrition label, which clearly and prominently provides to consumers ready-to-use nutritional information or warnings on the front-of-pack of food products.

Objective: The objective of this report was to assess the impact of brands' commitment to a front-of-package nutrition label, namely the Nutri-Score, on the evolution of brands' market shares over time. The evaluation was conducted for all product categories together as well as by category.

Data: We used home-scan data on French household food and beverage purchases from Jan, 1, 2017 to Dec 31, 2019, matched to the list of all brands that have committed to the Nutri-Score as well as the date of their commitments.

Method: We used a differences-in-differences empirical strategy to estimate the cumulative effect of committing to the Nutri-Score over time on the evolution of brand market share. It compares the relative change in brand's market shares over time in the set of brands that have committed to the Nutri-Score and in the set of brands that have not, while controlling for price changes.

Results: We found that a brand's commitment to the Nutri-Score had on average a weak impact on its market share, even after two and half years after the commitment has taken place. The variations were overall not statistically significant, except for fresh dairy products and desserts (-0.13 percentage points, 95% CI -0.24 to -0.03 pp) and cakes and biscuits (-0.06 percentage points; 95% CI-0.05 to -0.00 pp) categories. We concluded that committing to the Nutri-Score has no or a very minor impact on manufacturers' revenue including in product categories characterized by a high prevalence of products with poor nutritional quality.

Limitations: The scope of the evaluation was limited by the data at our disposal. Neither information on whether the Nutri-Score label has actually been affixed on the products nor the Nutri-Score grade of each product was collected by our data provider. Thus, we could not assess whether, how and to what extent a Nutri-Score label, including the score, can lead consumers to change their product purchases.

Introduction

Unhealthy eating is a key risk factor in chronic non-communicable diseases such as cardiovascular disorders and diabetes, which have sharply risen and account for 60% of deaths worldwide each year.[1–4] In this context, public health authorities are eager to institute prevention programs promoting foods of better nutritional quality.[5] One such policy is the of front-of-pack nutrition label (FOPL).

FOPL is a visual label prominently placed on the front-of-pack of food products. It provides simplified and ready-to-use nutritional information or warning in addition to the nutritional declaration on food packages, to facilitate comparisons among products in the constrained environment of food purchases.[6,7] It has been identified to be of major interest by the WHO[8] and the OECD.[9] Recent systematic reviews[10,7,11,12] and more recent studies[13–16] provide evidence from experimental and real-life studies indicating that FOPLs encourage healthier food purchasing.

The European regulation No. 1169/2011[17] on the provision of nutrition information to consumers, introduced on December 16, 2016, stating that "the energy value and the amount of nutrients […] may be given by other forms of expression and/or presented using graphical forms or symbols in addition to words or numbers", provides the legal framework for the implementation of FOPLs policy in Europe. In particular, this information must be placed on the front-of-pack of the food product. Although the Commission is working on a proposal for a harmonised mandatory FOPL, FOPL is currently provided on a voluntary basis in EU countries. In the European region, seven countries (Belgium, France, Germany, Luxemburg, the Netherlands, Spain and Switzerland) have now adopted the Nutri-Score as the officially endorsed FOPL.[18] The Nutri-Score was first introduced in France in Oct 31, 2017.[19,20] It was registered as a brand owned by the French public national Health Promotion Agency to ensure that companies adopting it follow the same standards for its computation and format (size and place on pack).

The Nutri-Score labeling system provides an overall assessment of the nutritional quality of foods and beverages based on the amount of positive and negative nutrients. It is adapted from the British Food Standards Agency's nutrient profiling system. It grades products on a five-point scale, from A for healthier products, to E for less healthy products, and displays the assigned grade with a larger font on a sliding scale showing the five grades, colored from green to yellow to dark orange, identifying the relative nutritional quality on this scale. The Nutri-score has been demonstrated to encourage consumers towards healthier food purchases,[13,14,16,21] including in catering setting,[15] and finally to potentially reduce mortality from diet-related non-communicable diseases, according to a simulation study.[22] However, all these evaluations are ex-ante evaluations either experimental or real-life analysis. No ex-post evaluation of Nutri-Score effects on the evolution of brand market shares or quantity or product purchased has yet been carried out.

Conducting such an assessment requires not only detailed data on consumers' product purchases, but also extensive data on product characteristics, including the information on whether the Nutri-Score label is actually affixed on the front-of-pack of the product. Although we had at our disposal a large-scale and representative database on consumers' product purchases and product characteristics, neither the information on the presence/absence of the Nutri-Score label on the packaging, nor product nutritional information were collected. We overcame the lack of the information on the presence/absence of the Nutri-Score on the packaging by focusing our assessment on brand's

commitment to the Nutri-Score for which a database exists. It provides a list of brands that have committed to the Nutri-Score as well as the date of each commitment.

We hypothesized that the longer a brand has been committed to the Nutri-Score, the greater the likelihood that a Nutri-Score label is actually present on the front-of-pack of brand's products, and should be close to one after two years: The conditions of use of the Nutri-Score indicate in particular that the manufacturer should affix a Nutri-Score label in the front-of-pack of all products marketed under the brand, within a period of 24 to 36 months (depending on the number of references involved), from the date the brand owner has committed the brand to the Nutri-Score.

The main objective of this report was to assess the cumulative impacts over time of having committed to the Nutri-Score on the market shares of brands that have committed to the Nutri-Score, in the French market from 2017 to 2019. Our evaluations were done in comparison to the evolution of market shares of brands that have not committed to the Nutri-Score. The assessments were conducted for all product categories together and by product category (e.g. breakfast cereals, soft drinks, cakes and biscuits). The final goal was to assess whether and to what extent committing to the Nutri-Score can impact manufacturers' revenue. Quantifying this effect, especially for unhealthy product categories such as soft drinks, confectionery, chocolate or biscuits, is important from a public health perspective, as the Nutri-Score is currently provided on a voluntary basis by manufacturers: a non-negative impact could encourage more manufacturers to commit to the Nutri-Score.

Method

Data and sample

We used data on household food and beverage purchases from Jan, 1, 2017 to Dec 31, 2019 collected by Kantar WorldPanel France. It is a representative panel of French households that continually provide information about their purchases in a longitudinal study. Kantar consumer panellists use in-home scanners to record all of their purchases (from any outlet) intended for personal, in-home use. Purchases in restaurants, cafetarias and take-away are not registered. Consumers provide information about their households and what products they buy, as well as when and where they make purchases. In particular, the manufacturer's and brand's names, quantity purchased in kilos, and expenditure in euros for each product purchased are registered. So we can assign to each product purchase a manufacturer's name (e.g Netslé) and a brand's name (e.g Chocapic, Herta, Kit-Kat), and calculate for each brand the total quantity purchased in kilos, the total expenditure in euros and brand price, defined as the ratio of total expenditure to the total quantity purchased in the brand products. Dividing expenditure by quantity does not yield price but a unit value that encompass consumers' decisions about products prices and qualities, and so is a composite of price and quality.[23] Correcting it would have involved having households' characteristics.[24] To alleviate this problem, brand prices were calculated for each product category and a brand price index was proposed when the analyses were carried out for all categories together (see Annex 3). Before data manipulation, our original dataset contains information on over 19 million product purchases of more than 14 thousand different brands by over 23 thousand households each year.

Although the Nutri-Score is eligible to all food products for which a nutrient declaration has been made, we limited our analyses to products with packaging marketed in supermarkets and hypermarkets and specialised supermarkets (e.g hard discount and organic supermarkets,

supermarkets specialised in frozen food). The food categories considered are those of the French food observatory Oqali (e.g. chocolate products, Canned fruits, Margarines, Bread products, ready-to-eat meals, Fresh dairy products and desserts).[25] We used manufacturer's name, brand's name, Kantar's food category to categorize each product in Oqali 's food category classification. The Annex 1 in the supplemental materials provides additional details on the composition of the 29 food categories used.

We calculated the quarterly market share of each brand in 2017, 2018 and 2019 at two different levels: whole market or all product categories together and by food category. Throughout the study, brand market share is defined as the total quantity purchased of products of a brand in kilos out of the total quantity of products purchased in a quarter of a given year. Annex 2 in the supplemental materials presents how we have calculated them for all product categories together, as well as by food category. Only brands that were purchased in each quarter of our study period were used to calculate market shares and so kept in the analysis: the statistical method used to conduct the analysis (detailed below) requires that no period (year—quarter) is missing for each brand. A balance dataset was so considered. **The impact of the Nutri-Score on the market share of new brands and removed ones in the market is beyond the scope of this study**. Finally, our dataset contains information on price, total expenditure in euros, and quantity purchased in kilos for 5,254 different brands, accounting for 36% of total brands but 96% of total quantity purchased in kilos on average over the period.

Kantar documents a large variety of product characteristics, but the presence of the Nutri-Score label on the packaging is not registered by Kantar. We overcame this issue by mobilising a list of all brands that have received from the French public national Health Promotion Agency the right to use the Nutri-Score from 2017.[26] A manufacturer can obtain it by registering its own brand on the platform of public national Health Promotion Agency.[27] A brand that has followed this process is defined as a brand that has committed to the Nutri-Score. In particular, the list documents the date of each brand registration. Registration implies that the manufacturer commits to using the Nutri-Score for all the products manufactured and/or distributed under the brands registered, and to use the label in accordance with the conditions of use.[26] These conditions indicate in particular that the manufacturer should affix a Nutri-Score label in the front-of-pack of all products marketed under the brand, within a period of 24 to 36 months (depending on the number of references concerned), from the date it has registered the brand.

We then matched the brand list to the Kantar data using manufacturer and brand names to document whether the brand has committed to the Nutri-Score and in which year-quarter the commitment has taken place. The evaluation proposed is therefore based on the market shares of brands that have committed to the Nutri-Score and not on the market shares of brands whose products have actually a Nutri-Score label affixed on the packaging. We hypothesized that the longer a brand has been committed to the Nutri-Score, the greater the likelihood that a Nutri-Score label is actually present on the front-of-pack of brand's products, and should be close to one after two years.

Assumption: the longer a brand has been committed to the Nutri-Score, the greater the likelihood that a Nutri-Score label is actually present on the front-of-pack of brand's products.

The number of brands committed to the Nutri-Score accounted for 4% (226 brands), 11% (603 brands), and 19% (1002 brands) of total brands purchased the 12 quarters respectively in 2017, 2018, and 2019. Figure 1 reports the market share of these products over time. We observe that their market share has

kept increasing since 2017. Furthermore, although these brands only account for 19% of the total number of brands, their market share amounts to 47% in 2019.

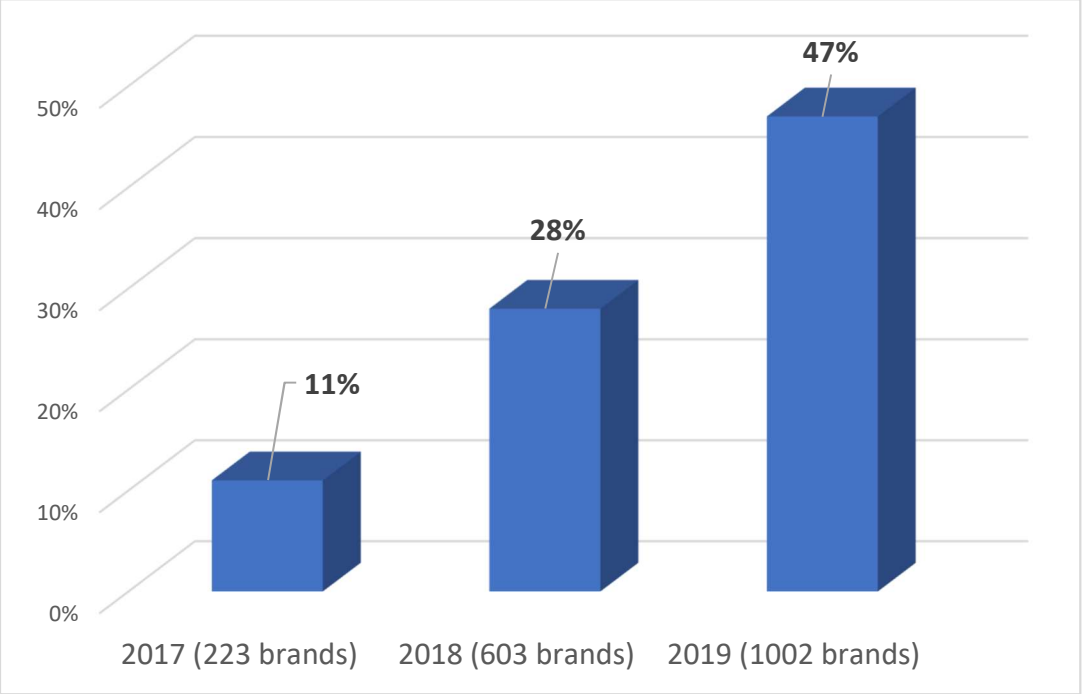


Fig 1. Evolution of the market share of brands that have committed to the Nutri-Score (only brands purchased the 12 quarters of the study period)

Table 1 reports the evolution of the number of brands, the proportion of brands that have committed to the Nutri-Score in comparison to the total number of brands marketed, and the market shares of the brands that committed to the Nutri-Score in 2017, 2018 or 2019. These three statistics have been rising steadily over the period. The proportion of brands that have committed to the Nutri-Score was above 50% in three food categories in 2019: canned fruits, margarines, and processed potato products categories. Furthermore, the market shares of the brands committed to the Nutri-Score were above 50% in eleven categories in 2019: chocolate products; canned fruits; margarines; bread products; all three ready-to-eat meals categories, fresh dairy products and desserts, processed potato products, hot sauces, fresh delicatessen products.

Table 1: Evolution of the number of brands, the proportion of brands and the market shares of brands committed to the Nutri-Score in 2017, 2018 and 2019 by product category

Product category	Number of brands			Proportion of brands			Market share		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
Crackers	19	43	81	5.67%	12.84%	24.18%	5.62%	19.75%	35.05%
Cereal bars	5	12	21	8.77%	21.05%	36.84%	3.40%	6.78%	22.77%
Cakes and biscuits	17	70	101	2.58%	10.64%	15.35%	4.01%	17.60%	26.08%
Soft drinks	10	32	45	4.57%	14.61%	20.55%	2.76%	11.00%	16.89%
Soups and broths	10	23	53	6.58%	15.13%	34.87%	2.99%	10.90%	33.20%
Breakfast cereals	11	30	59	8.40%	22.90%	45.04%	3.52%	8.65%	36.56%
Delicatessen meats and similar	41	73	101	7.32%	13.04%	18.04%	15.00%	36.47%	58.16%
Chocolate products	13	23	52	3.62%	6.41%	14.48%	2.93%	7.18%	22.13%
Fruit purees, compotes and desserts	15	23	46	15.00%	23.00%	46.00%	23.31%	39.51%	62.83%
Confectionery	5	14	25	1.75%	4.91%	8.77%	2.45%	6.27%	11.85%
Jams	9	16	26	8.41%	14.95%	24.30%	9.52%	20.07%	31.21%
Canned fruits	5	12	27	9.62%	23.08%	51.92%	6.31%	27.20%	76.39%
Cheeses	22	49	69	3.73%	8.31%	11.69%	7.32%	25.51%	40.92%
Ice creams and sorbets	5	20	35	3.65%	14.60%	25.55%	4.06%	15.92%	24.65%
Fruit juices and nectars	14	39	59	5.76%	16.05%	24.28%	7.02%	31.99%	46.32%
Margarines	7	14	28	12.96%	25.93%	51.85%	3.33%	11.42%	45.20%
Bread products	16	61	93	4.29%	16.35%	24.93%	8.75%	25.72%	57.85%
Ready-to-eat canned meals	24	54	94	6.90%	15.52%	27.01%	13.63%	42.12%	74.19%
Ready-to-eat fresh meals	40	84	144	8.97%	18.83%	32.29%	12.60%	28.24%	56.24%
Ready-to-eat frozen meals	23	70	113	7.54%	22.95%	37.05%	11.84%	34.29%	55.25%
Dessert mixes	3	5	10	7.32%	12.20%	24.39%	3.16%	6.88%	37.68%
Fresh dairy products and desserts	50	93	125	12.32%	22.91%	30.79%	28.72%	42.06%	58.68%
Fresh delicatessen products	40	115	188	6.81%	19.59%	32.03%	11.09%	40.53%	64.76%
Processed potato products	30	55	80	19.74%	36.18%	52.63%	25.24%	49.99%	74.83%
Sauces to warm	13	33	55	8.12%	20.62%	34.38%	6.07%	19.79%	62.72%
Cold sauces	13	30	50	8.28%	19.11%	31.85%	5.63%	18.54%	34.80%
Syrups	7	15	23	10.00%	21.43%	32.86%	7.58%	30.06%	45.71%
Frozen snacking products	9	15	28	11.39%	18.99%	35.44%	13.33%	18.00%	44.42%
Frozen pastries and desserts	5	13	19	9.43%	24.53%	35.85%	6.91%	15.14%	29.45%

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: The proportion of brands stands for the proportion of brands that have committed to the Nutri-Score. It is calculated in comparison to the total number of brands marketed each year. Market share is calculated as the total quantity purchased of products in food category *c* of the brands that have commited to the Nutri-Score in kilos out of the total quantity purchased of products in food category *c*, in year t=2017, 2018, 2019. Only brands that were purchased the 12 quarters of the period are used to calculate the three statisitcs. But, the total number of brands and the total quantity purchased of products in food category *c* are calculated for all brands including those not purchased in the 12 quarters of the period. Categories characterised by a proportion of brands or market share above 50% are highlighted in blue.

Table 2 displays the evolution of the number of brands, the proportion of brands of type b that have committed to the Nutri-Score in comparison to the total number of brands marketed by the brands of type b, and the market shares of the brands committed to the Nutri-Score by brand type in 2017, 2018 and 2019. Six different brand types were considered: national brand; private label or store brand; first price private label brand; hard-discount brand; brands specialized in frozen food and organic private label brands. These three statistics have been rising steadily over the period. Almost all purchases in private label brands and first price private label brands were made from brands that have committed to the Nutri-Score in 2019 (more than 91%). In addition, no retailer brand specializing in organic products has signed up to the Nutri-Score over the period.

Table 2: Evolution of the number of brands, the proportion of total brands purchased and market shares of the brands committed to the Nutri-Score by brand type

Brand type	Number of brands			Proportion of the total number of brands			Market share		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
National brand	113	242	480	2.59%	5.56%	11.02%	10.07%	13.98%	22.32%
Private label	110	355	475	19.10%	61.63%	82.47%	17.12%	60.01%	91.80%
First price Private label	3	6	11	18.75%	37.50%	68.75%	18.47%	73.81%	98.12%
Hard discount	0	0	35	0.00%	0.00%	12.68%	0.00%	0.00%	26.74%
Specialized retailer in frozen foods	0	0	1	0.00%	0.00%	3.85%	0.00%	0.00%	10.24%
Specialized retailer organic	0	0	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: The proportion of the brands stands for the proportion of the brands of type *b* that have committed to the Nutri-Score. It is calculated in comparison to the total number of brands marketed by the brands of type *b*. Market share is calculated as the total quantity purchased of products of the brands of type *b* that have commited to the Nutri-Score in kilos out of the total quantity purchased of product sold by the brands of type *b*, in year t=2017, 2018, 2019. Only brands that were purchased in the 12 quarters of the period are used to calculate the three statistics. But the total number of brands marketed by the brands of type b and the total quantity purchased of products sold by the brands of type *b* are calculated for all brands including those not purchased in the 12 quarters of the period. Brand type characterised by a proportion of brands or market share above 50% are highlighted in blue.

Empirical strategy

The statistical method

A differences-in-differences (DID) empirical strategy was used to quantify changes in the effect of committing to the Nutri-Score on brand market shares. In accordance with Assumption 1, the method used allowed to estimate the cumulative effects of having committed to the Nutri-Score over time. Specifically, the method estimated the cumulative effect of a Nutri-Score commitment for each of the quarters following the date a brand owner has committed the brand to the Nutri-Score on brand market share.

In our data, all brands have maintained their commitments to the Nutri-Score after they have announced it. However, their decisions to commit to the Nutri-Score have occurred in different periods. The estimator used in the analysis is valid in this particular context and even if there are heterogeneity in the effects across brands and time periods.[28] The effects were assessed for the whole market as well as for each food categories and type of brands levels.

Our parameter of interest in our study is the effect of having committed to the Nutri-Score for the first-time l quarters ago, δ_l . De chaisemartin and D'Hautefeuille (2021) show that δ_l is a weighted average of the DID estimators comparing the relative change in brand's market shares from $t-l-1$ to t in the set of brands that have committed to the Nutri-Score for the first-time *l* periods ago in period *t* and in the set of brands that have not from 2017Q1 to t, denoted $DID_{t,l}$.[28] For example, δ_9 is the weighetd average of DID estimators of brands that committed for the first-time 9 quarters ago in 2019 Q3 (so in 2017 Q2), denoted $DID_{t=2019Q3,l=9}$, and 2019 Q4 (so in 2017 Q3), denoted $DID_{t=2019Q4,l=9}$; and the estimator $DID_{t=2019Q3,l=9}$ compares the relative change in brand's market shares from 2017 Q1 to 2019 Q3 in the set of brands that have committed to the Nutri-Score for the first-time in 2017 Q2 (so nine quarters ago in *2019* Q3) and in those that have not from 2017 Q1 to 2019 Q3. The estimator δ_l is the weighted average of the cumulative effects of having committed to

the Nutri-Score for $l+1$ quarters, in the set of brands reaching $l+1$ quarters of treatment at period t. The estimator δ_0 stands for the instantaneous effect of committing.

We expected the estimator δ_l to become statistically significant as *l* increases, or in other words as the probability that the brand has actually affixed the Nutri-Score increases. Given our dataset, we were able to estimate the effect of committing to the Nutri-Score after a maximum of 10 quarters ($l = 10$) for brands that adopted the Nutri-Score for the first-time in 2017 Q2.

Covariates included in regressions

In all regressions, we used brand type fixed effects to allow for brand type specific linear trends. When the effects were assessed for the whole market, we also used Oqali food category dummy variables taking the value one for each food category in which the products of the brand were purchased. We also integrated a price variable in the regressions, as time- and brand-varying covariate, since it may affect the evolution of brand market share. Brand price would have been an ideal candidate variable. However, it may be endogenous as manufacturers can adjust prices in response to nutritional information.[29,30] We think that the decision to commit to the Nutri-Score can impact price through at least two channels. First, affixing a Nutri-Score on the front-of pack of a product signals to consumers its nutritional quality and can result in strategic pricing reactions by manufacturers. A signal of good quality may play as a quality premium that can encourage a manufacturer to increase product price. In contrast, a negative signal can induce a manufacturer to lower the product price to offset potential negative consumers' reactions to the disclosure of the negative information. Second, the decision to commit to the Nutri-Score may bring about food reformulation to improve product Nutri-Score grade. Products may become healthier but also more expensive due to higher production costs, as it was found in Chile for another FOPL system.[30]

Following Berry and Pakes,[31] we instrumented brand price *b* in food category *c* in period *t* by the average brand price of all brands (excluding brand b) purchased in the food category *c* in period *t.* The identifying assumption is that, controlling for the brand and the type of brand, consumers valuation of the product-specific unobserved characteristics, ε_{ibct}, of product *i* of brand *b* in food category *c* at time *t* is independent across the products of the other brands in *c*. Given this assumption, the valuation of a particular brand is independent of the average price of its rivals. At the same time, common market structures, and production and/or distribution costs imply that the price of a brand within a food category will be correlated with the average price of competitors, which can therefore be used as a valid instrumental variable. When the effects were assessed for all product categories together, we used a brand price index as brand price instrument equals to the weighted sum of price instruments of brand *b* in each food category in which the products of brand *b* were purchased. Annex 3 gives more details on the construction of all instruments.

Testing common trends assumption

The DID estimator is unbiased only if the common trends assumption holds, i.e. the assumption that the trends of the average market share would have been the same in brands that have not committed to the Nutri-Score and in brands that have committed to Nutri-Score in the absence of commitment to the Nutri-Score. Unfortunately, the assumption is not directly testable. To assess its plausibility, we assessed if the set of brands that committed to the Nutri-Score for the first-time l quarters ago and those that have not committed to the Nutri-Score are on parallel trends before the set of brands that

committed to the Nutri-Score for the first-time l quarters ago did so. De chaisemartin and D'Hautefeuille (2021) show that assumption can be tested by estimating the placebo estimator δ_l^{pl}.[28] It is a weighted average of the DID estimators comparing the relative change in brand's market shares among brands that have committed to the Nutri-Score for the first-time *l* periods ago in period *t* and those that have not from 2017 Q1 to t, like $DID_{t,l}$. But unlike $DID_{t,l}$, it compares the market share evolutions of those two sets of brands from period $t-2l-2$ to $t-l-1$. For example, to determine $\delta_{l=4}^{pl}$, we calculated the weighted average of DID estimators of brands that committed for the first-time in 2018 Q3 and 2018 Q4; the latter estimator compares the relative change in brand's market shares from 2017 Q2 to 2018 Q3 in the set of brands that have committed to the Nutri-Score for the first-time in 2018 Q4 (4 quarters ago in *2019* Q4) and in those that have not from 2017 Q1 to 2018 Q4. A significant difference from 0 implies that the common trends assumption does not hold for l +1 quarters. In our dataset, the placebo estimator could be calculated for $l \in \{0,1,\ldots,4\}$.

Annex 4 in the supplemental materials provides additional details on all estimators used. The Stata 15 module *DID_multiplegt* was used for all analyses.

Results

In this section, we present the effects of having committed to the Nutri-Score on the evolution of the market shares of brands that have committed to the Nutri-Score. We report the estimated effects for all product categories together as well as by product category. All results were compared to the average market share of brands that have not committed to the Nutri-Score. All estimated effects are in percentage points.

All product categories together

Table 3 reports the estimated effects δ_l of having committed to the Nutri-Score for the first-time $l = 0,1,2,\ldots.,10)$ quarters ago on the average market share. As it was explained above, it is an estimate of the cumulative effect of having committed to the Nutri-Score for $l+1$ quarters. The estimator δ_0 stands for the instantaneous effect of committing to the Nutri-Score. We were able to estimate the effect of committing to the Nutri-Score after a maximum of 10 quarters ($l = 10$): This estimator corresponds to the estimated effect on the market shares of brands that committed the Nutri-Score for the first-time in 2017 Q2. In other words, for these 31 brands, we could calculate the estimator δ_l for $l = 0,1,2,\ldots.,10$. There are also 72 brands for which we could only estimate δ_0 : the brands that committed to the Nutri-Score in 2019 Q3. We also reported the 95% confidence interval of each estimator; the total number of brands (#obs) and the number of brands that have committed to the Nutri-Score for the first-time l quarters ago (# switchers) used to find each estimator δ_l . The placebo estimator δ_l^{pl} are also displayed to check if the common trends assumption holds. If the stimator δ_l^{pl} is significantly different from 0, it implies that the common trends assumption does not hold for $l+1$ quarters. Given our dataset, the placebo estimator could be calculated for $l \in \{0,1,\ldots,4\}$, meaning that we could not check whether the common trends assumption held for estimators δ_l , $l > 4$.

We found almost null impacts of committing to the Nutri-Score for all l. The unique significant impact was obtained for the variation in the market shares of brands that have committed to Nutri-Score for the first-time 8 quarters ago (-0.007 percentage points). We also found that the common trends assumption underlying the estimators δ_2 and δ_3 is violated.

Table 3: Instantaneous and cumulative effects of committing to the Nutri-Score on market share of all brands, and assessments of the plausibility of the common trends assumption (in percentage point variation)

	Estimate	95% confidence interval		# obs	# switchers
		Lower bound	Upper bound		
δ_0	-0.001	-0.003	0.001	27845	731
δ_1	0.000	-0.002	0.001	24894	594
δ_2	-0.001	-0.004	0.001	22075	522
δ_3	-0.001	-0.003	0.001	19389	508
δ_4	-0.001	-0.004	0.001	16794	450
δ_5	-0.002	-0.004	0.001	14265	441
δ_6	-0.002	-0.006	0.002	11745	325
δ_7	-0.004	-0.007	0.000	9333	308
δ_8	**-0.008**	-0.014	-0.002	6861	173
δ_9	-0.002	-0.006	0.001	4463	98
δ_{10}	0.000	-0.002	0.003	2145	31
	Placebo tests				
δ_1^{pl}	0.000	-0.001	0.001	25000	700
δ_2^{pl}	**0.001**	0.000	0.003	19377	496
δ_3^{pl}	**0.002**	0.000	0.003	14173	349
δ_4^{pl}	0.000	-0.002	0.002	9225	200

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: δ_l stands for the estimated effect of having committed to the Nutri-Score for the first-time l quarters ago on the average brand market share. δ_l^{pl} stands for placebo estimator. It assesses if the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first-time l quarters ago and those that have not are on parallel trends for l+1 quarters if the commitment had not taken place. An estimor significantly different from 0 implies that the common trends assumption is violated. # obs is the number of observations and # switchers is the number of brands that have committed to the Nutri-Score for the first-time l quarters ago used to calculate δ_l and δ_l^{pl}. All estimations integrated price index intrument, food category fixed effects in which the products of brand b were purchased and type of brand fixed effects. All estimators' standard errors were computed using a block bootstrap at brand level (500 replications). Statitistically significant estimates at 5% level are in bold.

For each food category

We also estimated the effect of brand's commitment to the Nutri-Score for each product category. Only product category with statistically significant effects were reported in the main text. Furthermore, only estimators δ_l for which there are at least 30 brands that have committed to the Nutri-Score for the first-time l quarters ago were reported in tables: The estimator was deemed irrelevant below this number of switchers. The estimated effects for the other product categories were provided in Annex 5. All Tables below follow the same structure as Table 3.

We found significant and weak decreases in average brand market share for only the fresh dairy products and desserts, and cakes and biscuits categories.

We reported in Table 4 the estimated effects of committing to the Nutri-Score on the market shares of brands that marketed products in the former category. The estimator $\delta_{l=10}$ could not be calculated because there is no brand in that category that committed to the Nutri-Score in 2017 Q2. The estimator $\delta_{l=9}$ is not displayed as there are only 11 brands that have reached 9 quarters of commitment to the Nutri-Score. We found significant declines in the average market shares of brands that committed to the Nutri-Score as early as 2 quarters after commitment. The drop kept increasing from one year after the commitment, reaching -0.134 percentage points, or 0.25% decline of the average quantity purchased of fresh dairy products and desserts. We also found that the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first-time $l = 0, 1, 2, 3, 4$ quarters ago and those that had not are on parallel trends for $l + 1$ quarters if the commitment had not taken place.

Table 4: Instantaneous and cumulative effects of committing to the Nutri-Score on market share of all brands marketed in the fresh dairy products and desserts category, and assessments of the plausibility of the common trends assumption (in percentage point variation)

	Estimate	95% confidence interval		# obs	# switchers
		Lower bound	Upper bound		
δ_0	-0.031	-0.059	-0.003	2594	124
δ_1	-0.038	-0.080	0.003	2226	101
δ_2	**-0.063**	-0.107	-0.018	2153	101
δ_3	**-0.057**	-0.106	-0.008	1835	100
δ_4	**-0.062**	-0.111	-0.013	1535	93
δ_5	**-0.067**	-0.113	-0.020	1504	93
δ_6	**-0.094**	-0.159	-0.029	1188	70
δ_7	**-0.108**	-0.177	-0.038	901	69
δ_8	**-0.134**	-0.237	-0.032	597	50
	Placebo tests				
δ_1^{pl}	-0.007	-0.022	0.007	2594	124
δ_2^{pl}	0.020	-0.004	0.043	1879	90
δ_3^{pl}	0.010	-0.006	0.027	1470	51
δ_4^{pl}	-0.006	-0.034	0.022	864	31

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: δ_l stands for the estimated effect of having committed to the Nutri-Score for the first-time l quarters ago on the average brand market share. δ_l^{pl} stands for placebo estimator. It assesses if the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first-time l quarters ago and those that had not are on parallel trends for l+1 quarters if the commitment had not taken place. An estimor significantly different from 0 implies that the common trends assumption is violated. # obs is the number of observations and # switchers is the number of brands that have committed to the Nutri-Score for the first-time l quarters ago used to calculate δ_l and δ_l^{pl}. All estimations integrated price intrument and type of brand fixed effects. All estimators' standard errors were computed using a block bootstrap at brand level (500 replications). Statitistically significant estimates at 5% level are in bold.

Table 5 displays the estimated effects of committing to the Nutri-Score on the average market shares of brands that marketed products in the cakes and biscuits category. The estimator $\delta_{l=10}$ could not be calculated because there is no brand in that category that committed to the Nutri-Score in 2017 Q2. The estimators $\delta_{l=8,9}$ were not displayed as there are only 17 (7) brands that have reached 8 (9) quarters of treatment.

We found one significant drop in the average market shares of brands that committed to the Nutri-Score 7 quarters after commitment (-0.027 percentage points), or a decline of 0.06% of the average quantity purchased of cakes and biscuits.

Table 5: Instantaneous and cumulative effects of committing to the Nutri-Score on market share of all brands marketed in the cake and biscuits category, and assessments of the plausibility of the common trends assumption (in percentage point variation)

	Estimate	95% confidence interval		# obs	# switchers
		Lower bound	Upper bound		
δ_0	-0.002	-0.017	0.013	4855	101
δ_1	-0.012	-0.026	0.001	4209	76
δ_2	-0.008	-0.024	0.007	3573	73
δ_3	0.004	-0.009	0.018	2970	71
δ_4	-0.003	-0.024	0.018	2391	70
δ_5	0.002	-0.013	0.016	2363	70
δ_6	-0.011	-0.035	0.012	1783	47
δ_7	**-0.027**	-0.053	-0.000	1753	47
	Placebo tests				
δ_1^{pl}	-0.006	-0.021	0.010	4855	101
δ_2^{pl}	-0.013	-0.026	0.001	3567	69
δ_3^{pl}	-0.001	-0.027	0.026	2346	56
δ_4^{pl}	0.003	-0.019	0.025	1154	24

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: δ_l stands for the estimated effect of having committed to the Nutri-Score for the first-time l quarters ago on the average brand market share. δ_l^{pl} stands for placebo estimator. It assesses if the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first time l quarters ago and those that have not are on parallel trends for l+1 quarters if the commitment had not taken place. An estimor significantly different from 0 implies that the common trends assumption is violated. # obs is the number of observations and # switchers is the number of brands that have committed to the Nutri-Score for the first-time l quarters ago used to calculate δ_l and δ_l^{pl}. All estimations integrated price intrument and type of brand fixed effects. All estimators' standard errors were computed using a block bootstrap at brand level (500 replications). Statitistically significant estimates at 5% level are in bold.

A key feature of the two previous sectors is the high prevalence of products with a Nutri-Score grade of C, D and E. The French food observatory found that 52% and 95% of products in the fresh dairy products and desserts and cakes and biscuits categories, sold in supermarkets and specialized food retailers, had a grade of C, D or E in 2020.[32]

We also analysed whether we found significant variations in product categories in which there is more than 50% of products with a Nutri-Score A. The categories compotes, canned fruit and sauces to warm respond to this specificity.[32] Table 6 displays the estimated effects of committing to the Nutri-Score on the average market share of brands that marketed products in these three categories. In contrast to fresh dairy products and desserts, and cakes and biscuits categories, the market share of brands that committed to the Nutri-Score for the first-time l=2,3,4,5,6,7 quarters ago increased compared to the average market share of brands that have not committed to the Nutri-Score. However, the increases were statistically not significant.

Table 6: Instantaneous and cumulative effects of committing to the Nutri-Score on market share of all brands marketed in compotes, canned fruits and sauces to warm categories, and assessments of the plausibility of the common trends assumption (in percentage point variation)

	Estimate	95% confidence interval		# Obs	# Switchers
		Lower bound	Upper bound		
δ_0	-0,007	-0,091	0,078	2597	128
δ_1	-0,021	-0,124	0,083	2270	98
δ_2	0,003	-0,075	0,081	1968	75
δ_3	0,090	-0,009	0,189	1701	73
δ_4	0,016	-0,075	0,106	1432	68
δ_5	0,093	-0,026	0,213	1184	66
δ_6	0,137	-0,012	0,287	922	48
δ_7	0,108	-0,070	0,285	682	47
	Placebo tests				
δ_1^{pl}	-0,059	-0,128	0,010	2597	128
δ_2^{pl}	-0,045	-0,199	0,109	1976	83
δ_3^{pl}	-0,133	-0,410	0,143	1406	42

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: The categories compotes, canned fruits and sauces to warm are defined as healthy categories: more than 50% of total products whose brand have commited to the Nutri-Score have a Nutri-Score grade A in these three categories.[32] δ_l stands for the estimated average effect of having committed to the Nutri-Score for the first-time l quarters ago on brand market share. δ_l^{pl} stands for placebo estimator. It assesses if the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first-time l quarters ago and those that have not are on parallel trends for l+1 quarters if the commitment had not taken place. An estimor significantly different from 0 implies that the common trends assumption is violated. # obs is the number of observations and # switchers is the number of brands that have committed to the Nutri-Score for the first-time l quarters ago used to calculate δ_l and δ_l^{pl}. All estimations integrated price intrument and type of brand fixed effects. All estimators' standard errors were computed using a block bootstrap at brand level (500 replications).

Conclusion

We found that a brand's commitment to the Nutri-Score has on average a weak impact on its market share, even after two and half years after the commitment has taken place. The estimated variations were not statistically significant, except for fresh dairy products and desserts, and cakes and biscuits categories. In particular, the quantity purchased of fresh dairy products and desserts of brands that committed to the Nutri-Score for the first-time two years ago decreased by 0.25% on average (0.06% for cakes and biscuits category). These two product categories are characterized by a majority of Nutri-Score grade C, D or E. In contrast, we found an upward trend in the average market share of brands in product categories characterized by a majority of products with a Nutri-Score grade A (compotes, canned fruits and sauces to warm). However, the effect was statistically not significant. We concluded that **committing to the Nutri-Score has no or a very minor impact on manufacturers' revenue**, including in product categories characterized by a high prevalence of products with poor nutritional quality.

Although we did not directly assess the effect of the presence of a Nutri-Score label on the front-of-pack of product but brand's commitment to the Nutri-Score, we hypothesized that the longer a brand has been committed to the Nutri-Score, the greater the likelihood that a Nutri-Score label is actually present on the front-of-pack of brand's products, and should be close to one after two years. If our assumption holds in compliance with the condition of use of the Nutri-Score, this study suggested that the Nutri-Score has a on average a weak effect on consumers purchases. This result was also found in another study assessing in real-life grocery shopping settings the effects of the Nutri-Score on the nutritional quality of supermarket food purchases.[33] However, they found a significant positive impact on the nutritional quality of the shopping basket of labeled products purchased at 10% level, thanks to the positive impact of the Nutri-Score on the purchases of high-nutritional quality products (+14% compared to post period purchases). In our study, we were not able to carry out such analysis with respect to the nutritional quality of the products because we do not know the Nutri-Score grade of each product. They also found that the effect of the Nutri-Score was different in each four product categories studied (fresh prepared food; pastries, breads and canned prepared foods), as in our analysis.

The weak effect of the Nutri-Score on purchases is not specific to the Nutri-Score, but a common result to all FOPL systems. [7,34,35] However, higher effects were found for the mandatory FOP warning labels "high in sugar" and "high in calories" implemented in Chile in the breakfast cereal category.[30] The warning labels reduced the quantity of labeled products sold relative to unlabeled ones by an average of 26.4%. But no effect was found for other categories such as chocolates and cookies.[36] The authors argued that the effect was significant for products in the breakfast cereal category because consumers have mistaken prior beliefs about the healthiness of breakfast cereal products. One of their conclusions is that consumers would not change their behavior unless new information is displayed about product nutritional content.

Such positive prior beliefs about milk products' healthiness might explained the decline found in the market share of products of the brands that have committed to the Nutri-Score in the fresh dairy products and desserts category. In France, National Health Nutrition Program recommends the consumption of two dairy products per day. The dairy products recommended are milk; cheese; and yoghurts, fermented milks, and fromage blanc (a creamy, soft, fresh, white cheese made with whole, semi-skimmed or skimmed milk).[37,38] Although the type of dairy products and the recommended

number of time dairy products should be consumed per day have changed, the recommendation has been largely disseminated since 2006.[39] Consumers seeing that the dairy product that they intended to purchase had a Nutri-Score grade C, D, or E, although they have a positive prior belief on the health benefits of the product and without knowing that the recommendation only concerns the three previous categories of dairy products, might have switch their choices to dairy products without a Nutri-Score label. Although these products may be as poor in nutritional quality as products with a Nutri-Score label. This potential consumers' misperception of the nutritional quality of products without a Nutri-Score label may support the mandatory Nutri-Score labelling on products.

Limitations

The scope of the evaluation was limited by the data at our disposal. Extending the scope of the evaluation would require access to the information on whether the Nutri-Score label has actually been affixed on the products of the brands that have committed to the Nutri-Score. A second key limitation of our study is that we do not know the Nutri-Score grade of each product of the brands that have committed to the Nutri-Score. Thus, we could not assess whether, how and to what extent affixing a Nutri-Score label, including the Nutri-Score grade, on the front-of-pack of the product can lead consumers to change their products purchases. Yet, it was shown that the substitution of purchases towards products with a Nutri-Score A or B is the main channel through which the Nutri-Score improves the nutritional composition of foods purchased.[14] We leave these extensions to future research.

References

1. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet. 2012;380(9859):2224–60.

2. World Health Organization. Obesity: preventing and managing the global epidemic. 2000;

3. World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks. World Health Organization; 2009.

4. Alwan A. Global status report on noncommunicable diseases 2010. Global status report on noncommunicable diseases 2010. 2011;

5. World Cancer Research. NOURISHING and MOVING policy databases [Internet]. 2022. Available from: https://policydatabase.wcrf.org/level_one?page=nourishing-level-one

6. Kleef EV, Dagevos H. The growing role of front-of-pack nutrition profile labeling: a consumer perspective on key issues and controversies. Critical reviews in food science and nutrition. 2015;55(3):291–303.

7. Croker H, Packer J, Russell SJ, Stansfield C, Viner RM. Front of pack nutritional labelling schemes: a systematic review and meta-analysis of recent evidence relating to objectively measured consumption and purchasing. Journal of Human Nutrition and Dietetics. 2020;33(4):518–37.

8. World Health Organization. Global strategy on diet, physical activity and health. 2004;

9. OECD. Promoting sustainable consumption: good practices in OECD countries [Internet]. OECD; 2008. Available from: https://www.oecd.org/greengrowth/40317373.pdf

10. Cecchini M, Warin L. Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies. Obesity reviews. 2016;17(3):201–10.

11. Grummon AH, Hall MG. Sugary drink warnings: A meta-analysis of experimental studies. PLoS medicine. 2020;17(5):e1003120.

12. da Silva CP, Bento AC, Guaraldo E. The impact of front-of-the-packaging nutrition labelling warnings on consumer habits: a scoping review exploring the case of the Chilean Food Law. British Food Journal. 2022;

13. Finkelstein EA, Ang FJL, Doble B, Wong WHM, van Dam RM. A randomized controlled trial evaluating the relative effectiveness of the multiple traffic light and nutri-score front of package nutrition labels. Nutrients. 2019;11(9):2236.

14. Dubois P, Albuquerque P, Allais O, Bonnet C, Bertail P, Combris P, et al. Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. Journal of the Academy of Marketing Science. 2021;49(1):119–38.

15. Julia C, Arnault N, Agaësse C, Fialon M, Deschasaux-Tanguy M, Andreeva VA, et al. Impact of the Front-of-Pack Label Nutri-Score on the Nutritional Quality of Food Choices in a Quasi-Experimental Trial in Catering. Nutrients. 2021;13(12):4530.

16. van den Akker K, Bartelet D, Brouwer L, Luijpers S, Nap T, Havermans R. The impact of the nutri-score on food choice: A choice experiment in a Dutch supermarket. Appetite. 2022;168:105664.

17. EU, regulation 1169/2011. Regulation of the European Parliament and of the Council on the provision of food information to consumers. Official Journal of the European Union. 2011;304.

18. Kelly B, Jewell J. Front-of-pack nutrition labelling in the European region: identifying what works for governments and consumers. Public health nutrition. 2019;22(6):1125–8.

19. République française. Loi de modernisation de notre système de santé [Internet]. Loi N° 2016-41 2016. Available from: https://www.legifrance.gouv.fr/loda/id/JORFTEXT000031912641/

20. Chantal J, Hercberg S, Organization WH. Development of a new front-of-pack nutrition label in France: the five-colour Nutri-Score. Public health panorama. 2017;3(04):712–25.

21. Crosetto P, Lacroix A, Muller L, Ruffieux B. Nutritional and economic impact of five alternative front-of-pack nutritional labels: Experimental evidence. European Review of Agricultural Economics. 2020;47(2):785–818.

22. Egnell M, Crosetto P, D'almeida T, Kesse-Guyot E, Touvier M, Ruffieux B, et al. Modelling the impact of different front-of-package nutrition labels on mortality from non-communicable chronic disease. International Journal of Behavioral Nutrition and Physical Activity. 2019;16(1):1–11.

23. Deaton A. The analysis of household surveys (reissue edition with a new preface): A microeconometric approach to development policy. World Bank Publications; 2019.

24. Park JL, Capps Jr O. Demand for prepared meals by US households. American Journal of Agricultural Economics. 1997;79(3):814–24.

25. Menard C, Dumas C, Goglia R, Spiteri M, Gillot N, Combris P, et al. OQALI: A French database on processed foods. Journal of food composition and analysis. 2011;24(4–5):744–9.

26. Santé Publique France. Conditions of use of the Nutri-Score logo [Internet]. 2022. Available from: https://www.santepubliquefrance.fr/content/download/150258/file/20210908_RU_International_Users_regulation_ENG.pdf

27. Santé publique France. Registration procedure for the operator to obtain the right to use the registered collective trademark Nutri-Score [Internet]. 2017. Available from: https://www.demarches-simplifiees.fr/commencer/ns_international_registration_procedure

28. de Chaisemartin C, D'Haultfoeuille X. Difference-in-Differences Estimators of Intertemporal Treatment Effects. Available at SSRN 3731856. 2020;

29. Villas-Boas SB, Kiesel K, Berning JP, Chouinard HH, McCluskey JJ. Consumer and strategic firm response to nutrition shelf labels. American Journal of Agricultural Economics. 2020;102(2):458–79.

30. Barahona N, Otero C, Otero S, Kim J. Equilibrium effects of food labeling policies. Available at SSRN 3698473. 2020;

31. Berry S, Levinsohn J, Pakes A. Automobile prices in market equilibrium. Econometrica: Journal of the Econometric Society. 1995;841–90.

32. Oqali. Suivi du Nutri-Score par l'OQALI: bilan Annuel [Internet]. 2021. Available from: https://www.oqali.fr/media/2022/01/OQALI-2021_Suivi-du-Nutri-Score-1.pdf

33. Dubois P, Albuquerque P, Allais O, Bonnet C, Bertail P, Combris P, et al. Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. Journal of the Academy of Marketing Science. 2021;49(1):119–38.

34. Cecchini M, Warin L. Impact of food labelling systems on food choices and eating behaviours: a systematic review and meta-analysis of randomized studies. Obesity reviews. 2016;17(3):201–10.

35. Ikonen I, Sotgiu F, Aydinli A, Verlegh PW. Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. Journal of the Academy of Marketing Science. 2020;48(3):360–83.

36. Araya S, Elberg A, Noton C, Schwartz D. Identifying food labeling effects on consumer behavior. Available at SSRN 3195500. 2019;

37. French Ministery for Solidarity and Health. The French National Nutrition and Health Program [Internet]. 2011. Available from: https://solidarites-sante.gouv.fr/IMG/pdf/PNNS_UK_INDD_V2.pdf

38. French Ministry for Solidarity and Health. French National Nutrition and Health Program (2019-2023). 2019.

39. French Ministery for Solidarity and Health. The French National Nutrition and Health Program: Second Program [Internet]. 2006. Available from: https://solidarites-sante.gouv.fr/IMG/pdf/plan.pdf

Supplemental materials

Annex 1: Oqali food category classification

Oqali Sector	Categories definition
Crackers	Peanuts and seeds, coated or sweetened peanuts, dried fruit cocktails, fruit and seed mixtures, Asian mixtures, shrimp fritters, choux pastries, salted crackers, salted crepes dentelles, wafers, breadsticks, savoury mini cakes, sweet or salted popcorn, puffs, sticks and pretzels, tortillas, tuile biscuits
Cereal bars	Cereal bars and bites (cereal bars with fruits or nuts, with or without chocolate, with caramel, with pieces of biscuit, plain, etc.)
Cakes and biscuits	Chocolate or fruit biscuits, filled biscuits, shortbread, barquettes, sandwich biscuits, dry biscuits, etc., biscuit bars, breakfast biscuits, moist cakes, marble cakes, puff pastries, cakes with filling, genoise sponge, etc., macaroons, finger biscuits, crepes, gingerbread, madeleines, financiers, speculoos, coconut macaroons, cookies, rolled biscuits, waffles and wafers
Soft drinks	All beverages with tea, fruit beverages, energy drinks, colas, flavoured waters, lemonades, tonics and bitters, sports drinks, plant-based beverages, flavoured milk beverages (chocolate, vanilla, strawberry, etc.), alcohol-free beers, alcohol-free aperitif beverages, in liquid or powder/granule form to be reconstituted, as well as fruit and/or vegetable beverages that resemble juices or nectars but contain unauthorised ingredients for this type of product (e.g. fibre, colourings, etc., see la Directive 2012/12/EU), juices containing coconut milk (coconut milk is not a juice according to the Codex Alimentarius).
Soups and broths	Products to be stored at room temperature, chilled or frozen Broths mentioning consumption as soup on their packaging, vegetable soups, meat-based soups, ethnic soups, starchy soups, cold soups, soups with pasta, fish/shellfish/mollusc soups
Breakfast cereals	All types of breakfast cereals (plain, chocolate, caramel, filled, healthy, whole wheat, etc.), cereal cakes, cereals requiring preparation such as oatflakes, muesli, puffed rice
Delicatessen meats and similar	Delicatessen meats and alternative meat-free products (containing tofu, soy, etc.), found in the room-temperature, chilled and frozen, pre-packed sections (excluding foods cut to order) Cooked ham and shoulder, ham knuckle, roast poultry, ham, raw-cured ham, dry-cured ham, sausages, cooked sausages, duck mousse, country-style pâté, pâté, pork liver mousse or terrine, pâtés or terrines of game, pork, poultry or rabbit, preserved liver, rillettes, lardons, pork belly, dry sausages, sausage specialities, chorizo, pavé, rosette, salami, preparation of cooked ham and shoulder, preparation of poultry, preparation of raw- or dry-cured ham, boudin (white or blood sausage), uncooked andouille and andouillette (chitterling sausage), head cheese, brawn, ham in parsley aspic, roast pork, alternative meat-free products (containing tofu, soy, etc.), sausage specialities such as chipolatas, merguez or sausages with Provençal herbs, coarse minced sausages (Morteau, Montbéliard, Figatelli, etc.), dried, smoked or cured pork (bacon, coppa, Alsatian Kassler, Corsican Lonzu and other regional specialities of this type), dried, smoked or cured beef (Bündnerfleisch, bresaola), preserved uncooked meat (such as canned sausages), corned beef, corned lamb or other (canned or not)
Chocolate products	Chocolate assortments, chocolate bars, sweets, chocolate truffles or bites, chocolate tablets (diet/light, dark, milk, white, filled, with inclusions, etc.), spreads, chocolate powders (to mix with water or milk), capsules for making cocoa beverages, chocolate subsitute.
Fruit purees, compotes and desserts	All compotes, low-sugar (light) compotes, fruit desserts, fruit purées, fruit compotes with specific added ingredients, fruit compotes with specific added ingredients (without added sugar)
Confectionery	Boiled sweets, lollipops, gum/jelly sweets, liquid, powdered or gel confectionery, caramels, sugared almonds, candied fruit, fruit pastes, liquorice, calissons, nougats, lozenges, chewy sweets, chewing gum, sugar-free confectionery
Jams	All standard jams, jellies or marmalades (extra or not), low-sugar (light) jams, jellies or marmalades, fruit preparations, other jam-like products, sweetened chestnut or prune purées
Canned fruits	All fruits preserved in water, fruits in fruit juice, fruits in light syrup, fruits in syrup
Cheeses	All cheeses, including cheese bites such as Apérivrais and mixed snacks such as breadsticks/cheese, products as cottage cheese.
Ice creams and sorbets	All ices, ice creams and sorbets in the various existing formats (mini stick, stick, cone, tub and mini tub, bulk), but also ice-cream bars and mini bars, water or fruit ices, sundaes and frozen desserts (mini logs, vacherin, baked Alaska, Liègeois, etc.) and frozen desserts for sharing (including ice cream logs)
Fruit juices and nectars	All fruit juices, fruit juices made from concentrate, nectars, vegetable juices that comply with the national code of good practice, and smoothies that comply with Directive 2012/12/EU
Margarines	Margarines

Oqali Sector	Categories definition
Bread products	Rusks, brioches, crackers, croutons, unleavened bread, puffed cakes, savoury muffins, sandwich breads, toasted bread, hamburger buns, hot-dog buns, sandwich buns, pita bread, pre-baked bread, pre-packaged bread, tortilla wraps, cereal specialities (wheat crackers, etc.), filled cereal specialities (filled crackers, filled cereal sticks, etc.), fine bakery wares (croissants, chocolate croissants, apple turnovers, etc.), kouglof, brioche pretzel, fougasse, panettone, pancakes, crispbreads (sweet or savoury)
Ready-to-eat canned meals	Canned complete meals (such as cassoulet, blanquette, beef Bourguignon, chili con carne, sauerkraut, couscous, cottage or shepherd's pies, paella, meat with vegetables or starchy foods, fish with vegetables or starchy foods, gratins), cooked (microwavable or not) vegetable and/or starchy food dishes, quenelle dumplings, cooked meats without a side dish (duck confit, pork sauté, etc.), cooked pasta, tabbouleh, canned salads
Ready-to-eat fresh meals	Fresh complete meals (such as sauerkraut, paella, couscous, cottage or shepherd's pies, stuffed vegetables and rice, meat with vegetables or starchy foods, fish with vegetables or starchy foods, gratins, risottos), cooked vegetables or starchy foods, plain fresh pasta, cooked pasta (lasagne, stuffed fresh pasta, etc.), breaded meats, battered or breaded fish, quenelle dumplings, cooked meats, cooked fish, fish burgers, prepared shrimps, cooked scallops, tripe, cereal cakes/soy steaks, snails, exotic products (fajitas, enchiladas, pastillas, samosas, fried spring rolls, shrimp fritters, salt cod fritters, etc.)
Ready-to-eat frozen meals	Frozen complete meals (such as couscous, lasagne, moussaka, cottage or shepherd's pies, meat/fish + various side dishes), cooked meats or fish without a side dish (e.g. fish à la Bordelaise), cooked vegetables or starchy foods (side dishes "alone" such as Chinese fried rice, gnocchi, etc.), vegetable patties, gratins and flans, delicatessen seafood starters (fish baked in scallop shell, cassolette, etc.), breaded and/or fried products (battered or breaded fish, squid fritters, nuggets, cordon bleu, etc.), ethnic fried products (salt cod fritters, etc.), snails, savoury soufflés, as well as all the mini and cocktail versions of these dishes. Vegetable protein steaks (including unflavoured), steaks flavoured with tomato or onion, for example (including non-protein steaks). Minced meatballs. Breaded cheeses.
Dessert mixes	Powdered dessert preparations to which ingredients have to be added (mixes for clafoutis, custard tarts, cookies, custard sauces, pastry cream, crème brûlée, panna cotta, crepes, waffles, pancakes, rice desserts, dairy-based desserts, cakes, etc.), ready-to-cook doughs or batters (for cookies, crème brûlée, cakes)
Fresh dairy products and desserts	All yoghurts and fermented milks (sugar-sweetened, artificially-sweetened or unsweetened, classic or gourmet), fresh cheeses (sugar-sweetened, artificially-sweetened or unsweetened, classic or gourmet), skyr, fresh desserts (dessert creams, curdled milks, jellied milks, Liégeois desserts, fresh desserts with cereals such as rice pudding, fresh mousse desserts, fresh desserts with eggs such as crème caramel, crème brûlée, custards and flans, floating islands, panna cotta and other dairy-based desserts, desserts such as chocolate fondant, profiteroles, tiramisu, clafoutis, rum babas and cakes, whether sugar-sweetened, light or artificially-sweetened) and fresh plant-based desserts (soy desserts and other plant-based desserts)
Fresh delicatessen products	Products to be stored chilled Pizzas, ready-rolled pastry (brick, filo, shortcrust, flaky, rich shortcrust, pizza dough), smoked fish, starchy salads (pasta salads, potato salads, tabbouleh, etc.), raw vegetable salads (crudités), mixed salads, brawn or saveloy salads, sandwiches, burgers, toasted sandwiches and breaded escalopes, other snacks, surimi (crab sticks), savoury tarts, flammekueches, quiches Lorraines, spreads (seafood rillettes, taramasalata, seafood terrines, tzatziki, ktipiti, etc.), blinis, savoury filled crepes, fresh plain or sweetened crepes, shrimps, puff pastries or brioches, pâté in pastry, mussels, fish roe, sauces for pasta or fish, seafood tapas, set lunches such as mixed salad sold with a starter and/or dessert, other fresh delicatessen products such as savoury cakes, pizza kits, crustless tarts, etc.
Processed potato products	All crisps and similar products (old-fashioned, classic, wavy, low-fat, including oven-baked potato products), French fries (for microwave, deep-fryer or oven), other potato-based side dishes (dauphiné, croquettes, duchess and noisette potatoes, röstis – including onion röstis, potatoes sautéed in duck fat, potato wedges, sautéed or fried potatoes), steamed potatoes and mashed potatoes (ready-to-eat (stored at room temperature/chilled/frozen), in flakes, may contain mushrooms). Sweet potato fries.
Sauces to warm	Sauces for meat or fish (Armorican, Bearnaise, beurre blanc, Hollandaise, etc.), sauces for pasta (Bolognese, with cooked vegetables, pesto, etc.), sauces to accompany dishes (sweet and sour, Basque, curry, Mexican, etc.), tomato coulis, bechamel sauces
Cold sauces	Seasoning sauces (such as French dressing, vinaigrette, salad dressings, crudité sauces, Caesar sauce, etc.; low-fat/light or not), cold emulsified sauces (such as mayonnaise, aïoli, tartare, Béarnaise, pepper, Bourguignon, burger, American, rouille, curry, for chips, etc.; low-fat/light or not), cold non-emulsified sauces (such as ketchups, barbecue sauce, Mexican sauce, etc.; light or not)
Syrups	All syrups, concentrated beverages to dilute (squashes and cordials), concentrated beverages to dilute without added sugar
Frozen snacking products	Pizzas, quiches, tarts, pies, savoury cakes, crepes, pancakes, pastillas, puff pastries, pastry friands, buns, hamburgers, wraps, filled/topped baguettes, cocktail or aperitif products (aumonière bundles, puff pastries, choux pastries, gougères, party loaves, canapés, verrines), salads, tabbouleh, sandwiches, toasted sandwiches (croque monsieur), hot dogs, kebabs, meats in pastry (pâté, roast meat, ham)
Frozen pastries and desserts	All frozen fine bakery wares and cakes, as well as products found in the frozen dessert section, i.e. products such as: - croissants, chocolate croissants, raisin buns, brioches, milk breads, apple turnovers; - plain or flavoured brioche, with chocolate chips or candied fruit, Tropézienne, French-toast style brioche; - doughnuts, sweet fritters, churros, crepes, waffles, pancakes; - macaroons; - tarts, crumbles, gâteaux, cakes, genoises (sponges), financiers, madeleines; - choux pastries (éclairs, profiteroles, Paris-Brest, Saint-Honoré, etc.); - desserts such as bavarois, tiramisu, opéra, cheesecake, Black Forest gâteau, charlotte, dessert logs (the "Ice creams and sorbets" sector already includes ice-cream logs), etc.; - custard tarts, clafoutis, Breton far cake, Basque cake, kouign-amann, kings' cakes, mille-feuilles, cookies; - products such as panna cotta, crème brûlée and mousses found in the frozen dessert section.

Annex 2: Market shares calculation

The market share of a brand *b* in a given quarter *t* for the whole market is given by:

$$w_{bt}^{market} = \left(\frac{\sum_{j \in b} quantity_{jbt}}{\sum_{b} \sum_{j \in b} quantity_{jbt}} \right) \times 100$$

Where $quantity_{jbt}$ is the total quantity purchased in kilos of product j of brand b by all households in quarter t. The market shares were calculated in volume rather than in value since we suspected that the decision to commit to the Nutri-Score may influence brand prices.

The market share of a brand *b* in a given quarter *t* for the food category *C* is given by:

$$w_{bt}^{category} = \left(\frac{\sum_{j \in b, b \in C} quantity_{jbt}}{\sum_{b \in C} \sum_{j \in b} quantity_{jbt}} \right) \times 100$$

The market share of a brand *b* in a given quarter *t* for the brand type B is given by:

$$w_{bt}^{btype} = \left(\frac{\sum_{j \in b, b \in B} quantity_{jbt}}{\sum_{b \in B} \sum_{j \in b} quantity_{jbt}} \right) \times 100$$

Annex 3: Brand price index instrument construction

We used as brand price instrument for brand *b* that sell products in food category *c* the average brand prices of all brands (excluding brand b in food category *c*) purchased in food category *c* in period *t*:

$$Zprice_{bct} = \frac{\sum_{b \in c} price_{bct} - price_{bct}}{N_{ct} - 1}$$

where $price_{bct}$ is brand *b* price in kilos calculated as the ratio of total expenditure to the total quantity purchased of products of brand *b* marketed in food category *c* and period *t*, and N_{ct} is the total number of brands purchased in food category *c* at period *t.*

When the effects were assessed for the whole market, we used a brand price index instrument equals to the weighted sum of brand price instruments of each food category *c* in which the products of the brand *b* are purchased such that:

$$I\_Zprice_{bt} = \sum_{c_b} \omega_{bct} Zprice_{bct}$$

where c_b stands for the list of food categories in which the products of brand *b* are purchased and the weight ω_{bct} is calculated as:

$$\omega_{bct} = \left(\frac{\sum_{b \in c} expenditure_{bct} - expenditure_{bct}}{\sum_{c_b} \left[\sum_{b \in c} expenditure_{bct} - expenditure_{bct} \right]} \right)$$

where $expenditure_{bct}$ is the total expenditure in products of brand *b* in food category *c* and period *t*.

Annex 4: Statistical method

Estimation method

We will use differences-in-differences (DID) estimators of intertemporal treatment effects to assess the effet of committing to the Nutri-Score on brands' market shares from 2017 to 2019 (our outcome).[28] Specifically, these estimators compare brands' market shares evolution of brands that have committed to the Nutri-Score (the treated brands) to those of brands that have not (the brands control group), from the last quarter before the commitment has been announced to the *lth* quarter after that annoucement. Commitment's instantaneous effect is estimated for $l = 0$ and dynamic effects for $(l \geq 1)$.

We applied de chaisemartin and D'Hautefeuille (2021) to our staggerred treatment adoption design: in our data all brands have maintained their commitments to the Nutri-Score after they have announced it, but their decisions to commit to the Nutri-Score have occurred in different periods. They show that their estimator is valid in this particular context and even if there are heterogeneity in the effects across brands and time periods.[28]

We first set the following notations. For any $l \in \{0,1,\ldots,L_{max}\}$ and $t \in \{2017Q1 + l, 2017Q2,\ldots,2019Q4\}$, let $N_{t,l}^{1}$ stands for the number of treated brands for the first-time at period *t-l*. Let N_t^{nt} denotes the number of brands that have not committed to the Nutri-Score from 2017Q1 to *t*. In our data, N_t^{nt} is always strictly positive for all *t*: there are manufacturers that have not committed to the Nutri-Score in the studied period all over the period. In our dataset $L_{max} = 10$ since the first-time a brand committed to the Nutri-Score was 2017 Q2. Finally, $W_{b,t}$ is the observed market share of brand *b* at period *t*. We define:

$$DID_{t,l} = \begin{cases} \frac{1}{N_{t,l}^{1}} \sum_{b:F_{b,1}=t} \left(W_{b,t} - W_{b,t-l-1}\right) - \frac{1}{N_t^{nt}} \sum_{b:F_{b,1}>t} \left(W_{b,t} - W_{b,t-l-1}\right) if \ N_{t,l}^{1} > 0 \\ 0 \ otherwise \end{cases}$$

where $F_{b,1}$ denotes the first year at which brand *b* has announced to commit to the Nutri-Score. $DID_{t,l}$ is the DID estimator comparing the market shares evolution from period $t-l-1$ to t in the set of brands that have committed to the Nutri-Score for the first-time in $t-l$ and in the set of brands that have not committed from period 2017 Q1 to t. For example, $DID_{2019Q2,2}$ is the DID estimator comparing the market shares evolution from 2018 Q3 to 2019 Q2 in the set of brands that committed to the Nutri-Score in 2018Q4 for the first-time and brands that have not committed from 2017 Q1 to 2019 Q2. de chaisemartin and D'Hautefeuille (2021) demonstrated that $DID_{t,l}$ in our staggered design is an unbiased estimator of the cumulative effect of having been treated for l+1 quarters, in the set of brands reaching l+1 quarters of treatment at period *t*.

The effect of having switched from untreated to treated for the first-time l quarters ago, DID_l , our parameter of interest, is a weighted average of $DID_{t,l}$. It is defined as:

$$DID_l = \delta_l = \frac{\sum_{t=2017Q2}^{2019Q4} N_{t,l}^1 DID_{t,l}}{\sum_{t=2017Q2}^{2019Q} N_{t,l}^1}$$

For example $\delta_{10} = DID_{t,10}$and δ_9 is the weighetd sum of brands that committed for the first-time 9 quarters ago in 2019 Q3 (so in 2017 Q2) and 2019 Q4 (so in 2017 Q3), $\delta_9 = \frac{N_{2019Q3,9}^1 DID_{2019Q\ ,9} + N_{2019Q4,9}^1 DID_{2019Q\ ,9}}{N_{2019Q\ ,9}^1 + N_{2019Q4,9}^1}$.

De chaisemartin and D'Hautefeuille (2021) shows that δ_l is an unbiased estimator of the cumulative effect of having announced to commit to the Nutri-Score for *l+1* quarters if the common trends assumption holds, i.e. the trends of the mean market share would have been the same in both the treated and control brands in the absence of commitment to the Nutri-Score. In other words, any selection bias implied by using data from the control brands group to build the counterfactual and not captured by the fixed effects is either constant over time, or, if it does evolve over time, the evolution is linear.

Placebo estimators: Plausibility of common trends hypothesis

The common trends assumption is not directly testable, but to assess its plausibility "long-difference" placebo estimators computed using pre-policy observations will be used.[28] Contrary to standard tests used in event-study model, the test deployed in the analysis is robust even if the effects are heterogeneous over time.

Given the length of our dataset, we define for l ∈ $\{0,1,\dots,4\}$ and $t \in \{2017Q3, 2017Q4, .., 2019Q4\}$:

$$DID_{t,l}^{pl} = \begin{cases} \sum_{b:F_{b,1}=t} \frac{(W_{b,t-2l-2} - W_{b,t-l-1})}{N_{t,l}^1} - \sum_{b:F_{b,1}>t} \frac{(W_{b,t-2l-2} - W_{b,t-l-1})}{N_t^{nt}} \ if\ N_{t,l}^1 > 0 \\ 0\ otherwise \end{cases}$$

$DID_{t,l}^{pl}$, like $DID_{t,l}$, compares the market shares evolution in the set of brands treated for the first-time in period in $t-l$ and in the set of brands untreated from period 2017Q1 to *t.* But unlike $DID_{t,l}$, it compares the market share evolutions of those two sets of brands from period $t-2l-2$ to $t-l-1$. Thus, $DID_{t,l}^{pl}$ is a placebo estimator testing if the common trends assumption holds for $l+1$ quarters, for those set of brands reaching l+1 quarters of treatment at period t. Finally, de chaisemartin and D'Hautefeuille (2021) defined:

$$DID_l^{pl} = \delta_l^{pl} = \frac{\sum_{t=2017Q3}^{201} N_{t,l}^1 DID_{t,l}^{pl}}{\sum_{t=2017Q3}^{2019Q4} N_{t,l}^1}$$

for l ∈ $\{0,1,\dots,4\}$. If the common trend assumption holds for l quarters, then de chaisemartin and D'Hautefeuille (2021) show in an staggered design that $E[DID_l^{pl}] = 0$. So finding an estimation of DID_l^{pl} significantly different from 0 would imply that the common trends assumption is violated: treated brands that have commited to the Nutri-Score l+1 quarters ago experienced different trend

before the announcement of the commitment to Nutri-Score than brands belonging to the control group.

Annex 5: Estimated effects by product category

In this annex, we reported the effects of committing to the Nutri-Score on the market share of all brands marketed by product category. Only estimates for which we have at least 30 brands that have committed to the Nutri-Score are displayed. All Tables below follow the same structure as Table 3.

Science and Technology in childhood Obesity Policy

Table A1: Instantaneous and cumulative effects of committing to the Nutri-Score on market share of all brands marketed for each category, and assessments of the plausibility of the common trends assumption (in percentage point variation)

	Crackers							Cakes and biscuits							Soups and broths					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	0.007	0.016	-0.024	0.038	2149	81	δ_0	-0.002	0.008	-0.017	0.013	4855	101	δ_0	-0.466	0.366	-1.184	0.252	1209	53
δ_1	-0.009	0.011	-0.031	0.013	1807	48	δ_1	-0.012	0.007	-0.026	0.001	4209	76	δ_1	-0.098	0.070	-0.235	0.039	1047	35
δ_2	-0.009	0.017	-0.041	0.024	1494	46	δ_2	-0.008	0.008	-0.024	0.007	3573	73	δ_2	-0.078	0.089	-0.253	0.097	899	27
δ_3	-0.014	0.015	-0.044	0.016	1221	43	δ_3	0.004	0.007	-0.009	0.018	2970	71	δ_3	0.010	0.083	-0.152	0.173	769	25
δ_4	-0.015	0.016	-0.046	0.016	1206	43	δ_4	-0.003	0.011	-0.024	0.018	2391	70	δ_4	-0.018	0.086	-0.186	0.151	650	23
δ_5	-0.006	0.020	-0.045	0.034	1170	43	δ_5	0.002	0.008	-0.013	0.016	2363	70	δ_5	0.001	0.143	-0.279	0.282	620	23
δ_6	-0.022	0.024	-0.070	0.026	898	30	δ_6	-0.011	0.012	-0.035	0.012	1783	47	δ_6	-0.064	0.178	-0.414	0.285	485	17
δ_7	-0.040	0.022	-0.083	0.003	860	30	δ_7	-0.027	0.014	-0.053	0.000	1753	47	δ_7	-0.022	0.163	-0.342	0.298	357	16
δ_8	-0.042	0.035	-0.110	0.027	560	19	δ_8	-0.009	0.017	-0.042	0.024	1144	17	δ_8	-0.104	0.188	-0.471	0.264	226	10
δ_9	-0.071	0.060	-0.190	0.047	264	10	δ_9	-0.055	0.046	-0.146	0.035	558	7	δ_9	-0.057	0.229	-0.506	0.392	105	6
δ_1^{PL}	-0.006	0.010	-0.025	0.013	2149	81	δ_1^{PL}	-0.006	0.008	-0.021	0.010	4855	101	δ_1^{PL}	-0.343	0.260	-0.853	0.167	1209	53
δ_2^{PL}	0.008	0.019	-0.028	0.044	1481	38	δ_2^{PL}	-0.013	0.007	-0.026	0.001	3567	69	δ_2^{PL}	-0.180	0.079	-0.335	-0.025	899	29
δ_3^{PL}	0.034	0.036	-0.038	0.105	865	27	δ_3^{PL}	-0.001	0.013	-0.027	0.026	2346	56	δ_3^{PL}	-0.081	0.072	-0.221	0.059	618	17
δ_4^{PL}	0.023	0.021	-0.019	0.065	302	13	δ_4^{PL}	0.003	0.011	-0.019	0.025	1154	24	δ_4^{PL}	-0.044	0.064	-0.170	0.081	360	9
	Cereals bars							**Soft drinks**							**Breakfast cereals**					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	-0.096	0.104	-0.301	0.109	294	21	δ_0	-0.027	0.017	-0.061	0.007	1383	45	δ_0	-0.025	0.021	-0.066	0.016	894	59
δ_1	-0.081	0.136	-0.347	0.186	244	17	δ_1	0.017	0.015	-0.013	0.046	1182	34	δ_1	-0.031	0.030	-0.090	0.029	755	43
δ_2	-0.029	0.134	-0.291	0.233	196	12	δ_2	0.025	0.022	-0.017	0.067	1148	34	δ_2	-0.004	0.026	-0.054	0.046	636	31
δ_3	-0.030	0.121	-0.267	0.206	194	12	δ_3	0.018	0.019	-0.019	0.056	953	33	δ_3	0.000	0.032	-0.064	0.063	546	30
δ_4	-0.169	0.147	-0.458	0.119	187	12	δ_4	-0.010	0.023	-0.055	0.035	769	32	δ_4	-0.006	0.036	-0.075	0.064	521	30
δ_5	-0.087	0.164	-0.409	0.235	183	12	δ_5	-0.020	0.032	-0.082	0.042	756	32	δ_5	0.026	0.042	-0.056	0.108	492	30
δ_6	-0.058	0.167	-0.385	0.269	140	10	δ_6	-0.022	0.035	-0.090	0.047	572	22	δ_6	-0.026	0.055	-0.134	0.082	379	18
δ_7	-0.124	0.190	-0.496	0.247	131	10	δ_7	-0.031	0.045	-0.119	0.058	560	22	δ_7	-0.005	0.061	-0.124	0.115	274	14
δ_8	-0.229	0.247	-0.714	0.255	81	5	δ_8	-0.084	0.046	-0.174	0.006	365	10	δ_8	-0.024	0.070	-0.162	0.114	171	11
δ_9	-0.407	0.370	-1.133	0.319	40	4	δ_9	-0.079	0.059	-0.194	0.036	177	5	δ_9	-0.020	0.076	-0.170	0.129	79	7
δ_1^{PL}	0.229	0.109	0.015	0.443	294	21	δ_1^{PL}	-0.009	0.012	-0.032	0.015	1383	45	δ_1^{PL}	0.038	0.029	-0.019	0.095	894	59
δ_2^{PL}	0.001	0.121	-0.236	0.237	188	13	δ_2^{PL}	-0.005	0.021	-0.046	0.035	970	29	δ_2^{PL}	0.043	0.049	-0.053	0.138	628	36
δ_3^{PL}	-0.002	0.110	-0.218	0.213	97	7	δ_3^{PL}	0.002	0.021	-0.039	0.043	748	24	δ_3^{PL}	-0.038	0.028	-0.092	0.016	395	20
δ_4^{PL}	0.106	0.210	-0.306	0.518	47	2	δ_4^{PL}	0.017	0.045	-0.072	0.106	366	11	δ_4^{PL}	0.010	0.035	-0.059	0.080	217	16

Science and Technology in childhood Obesity Policy

Continued table A1

	Delicatessen meat and similar							Fruits purees, compotes							Jams					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	-0.006	0.009	-0.023	0.012	3959	100	δ_0	-0.055	0.054	-0.161	0.052	652	46	δ_0	-0.110	0.079	-0.265	0.045	582	26
δ_1	0.009	0.023	-0.035	0.053	3452	80	δ_1	-0.082	0.069	-0.217	0.053	551	32	δ_1	-0.113	0.069	-0.248	0.022	484	18
δ_2	-0.001	0.021	-0.042	0.041	2960	77	δ_2	-0.071	0.071	-0.210	0.067	462	27	δ_2	-0.195	0.080	-0.351	-0.039	469	18
δ_3	0.014	0.009	-0.004	0.032	2908	77	δ_3	0.087	0.104	-0.116	0.291	388	26	δ_3	-0.249	0.143	-0.530	0.031	381	16
δ_4	0.009	0.012	-0.016	0.033	2431	72	δ_4	-0.061	0.068	-0.195	0.072	319	23	δ_4	-0.316	0.164	-0.637	0.005	378	16
δ_5	0.011	0.022	-0.032	0.054	2384	72	δ_5	-0.067	0.068	-0.200	0.066	301	23	δ_5	-0.283	0.143	-0.563	-0.003	368	16
δ_6	-0.014	0.024	-0.061	0.032	1912	50	δ_6	0.063	0.093	-0.119	0.246	234	19	δ_6	-0.251	0.121	-0.488	-0.013	282	13
δ_7	0.018	0.015	-0.011	0.048	1884	50	δ_7	-0.011	0.118	-0.243	0.221	214	19	δ_7	-0.329	0.191	-0.704	0.046	272	13
δ_8	-0.002	0.019	-0.040	0.035	1409	40	δ_8	-0.252	0.210	-0.664	0.160	137	15	δ_8	-0.255	0.158	-0.563	0.054	179	9
δ_9	0.032	0.032	-0.030	0.094	937	33	δ_9	-0.023	0.170	-0.357	0.311	60	6	δ_9	-0.363	0.164	-0.683	-0.042	85	4
δ_{10}	-0.012	0.027	-0.065	0.041	467	25														
δ_1^{PL}	-0.006	0.019	-0.043	0.032	3417	75	δ_1^{PL}	-0.076	0.064	-0.202	0.050	652	46	δ_1^{PL}	-0.056	0.052	-0.158	0.045	582	26
δ_2^{PL}	0.002	0.034	-0.064	0.069	2408	47	δ_2^{PL}	-0.054	0.086	-0.222	0.114	460	26	δ_2^{PL}	-0.059	0.142	-0.338	0.219	382	14
δ_3^{PL}	-0.029	0.015	-0.060	0.001	1434	37	δ_3^{PL}	-0.115	0.106	-0.323	0.093	285	12	δ_3^{PL}	-0.223	0.145	-0.507	0.061	272	9
δ_4^{PL}	-0.033	0.023	-0.078	0.012	934	27	δ_4^{PL}	-0.190	0.105	-0.396	0.015	134	7	δ_4^{PL}	0.002	0.097	-0.188	0.191	92	3
	Chocolat products							**Confectionery**							**Canned fruits**					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	-0.031	0.024	-0.077	0.015	2353	52	δ_0	-0.010	0.031	-0.071	0.051	1389	25	δ_0	-0.033	0.164	-0.354	0.288	344	27
δ_1	-0.039	0.035	-0.107	0.028	1992	34	δ_1	-0.076	0.037	-0.150	-0.003	1111	14	δ_1	0.059	0.166	-0.266	0.385	303	23
δ_2	-0.016	0.025	-0.065	0.033	1654	26	δ_2	-0.052	0.044	-0.140	0.035	1102	14	δ_2	0.245	0.205	-0.157	0.647	252	13
δ_3	-0.026	0.020	-0.065	0.013	1345	23	δ_3	-0.036	0.045	-0.124	0.052	1098	14	δ_3	0.366	0.244	-0.112	0.843	233	13
δ_4	-0.014	0.034	-0.080	0.052	1336	23	δ_4	-0.113	0.056	-0.222	-0.004	1094	14	δ_4	0.120	0.288	-0.445	0.685	187	12
δ_5	-0.036	0.034	-0.103	0.032	1315	23	δ_5	-0.046	0.068	-0.179	0.086	1083	14	δ_5	0.447	0.375	-0.288	1.183	153	10
δ_6	0.024	0.047	-0.069	0.116	1001	22	δ_6	-0.086	0.083	-0.248	0.077	820	10	δ_6	0.403	0.479	-0.536	1.341	114	7
δ_7	-0.033	0.027	-0.087	0.020	972	22	δ_7	-0.104	0.081	-0.262	0.054	809	10	δ_7	0.252	0.553	-0.832	1.336	100	7
δ_8	-0.065	0.053	-0.169	0.040	635	13	δ_8	-0.204	0.151	-0.499	0.091	534	5	δ_8	-0.016	0.688	-1.364	1.332	59	5
δ_9	-0.090	0.052	-0.191	0.012	309	7	δ_9	-0.451	0.165	-0.774	-0.127	261	2	δ_9	-0.023	0.991	-1.965	1.919	27	2
δ_1^{PL}	0.039	0.030	-0.020	0.099	2353	52	δ_1^{PL}	-0.025	0.021	-0.068	0.017	1389	25	δ_1^{PL}	-0.188	0.101	-0.387	0.010	344	27
δ_2^{PL}	-0.017	0.032	-0.080	0.046	1644	27	δ_2^{PL}	0.038	0.043	-0.047	0.122	830	12	δ_2^{PL}	-0.102	0.286	-0.662	0.458	254	21
δ_3^{PL}	0.041	0.031	-0.021	0.103	977	13	δ_3^{PL}	0.018	0.048	-0.075	0.111	549	9	δ_3^{PL}	-0.652	0.637	-1.902	0.597	157	8
δ_4^{PL}	-0.064	0.030	-0.122	-0.006	329	1	δ_4^{PL}	-0.024	0.029	-0.080	0.033	274	4	δ_4^{PL}	-0.056	0.236	-0.519	0.407	99	6

Science and Technology in childhood Obesity Policy

Continued table A1

	Cheeses							Fruit juices and nectars							Bread products					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	-0.016	0.014	-0.044	0.012	3194	69	δ_0	0.005	0.017	-0.029	0.039	1715	59	δ_0	-0.007	0.017	-0.041	0.026	2806	88
δ_1	-0.013	0.014	-0.040	0.013	2661	50	δ_1	-0.018	0.016	-0.050	0.014	1480	44	δ_1	-0.016	0.014	-0.044	0.011	2459	69
δ_2	-0.018	0.016	-0.049	0.013	2633	50	δ_2	-0.028	0.018	-0.062	0.007	1255	43	δ_2	-0.005	0.018	-0.039	0.030	2121	68
δ_3	-0.007	0.011	-0.029	0.015	2599	50	δ_3	0.004	0.018	-0.032	0.039	1039	40	δ_3	-0.005	0.015	-0.034	0.024	1813	67
δ_4	-0.018	0.015	-0.049	0.012	2091	49	δ_4	0.006	0.024	-0.040	0.053	841	39	δ_4	-0.048	0.024	-0.094	-0.001	1489	58
δ_5	-0.035	0.016	-0.066	-0.004	2071	49	δ_5	0.006	0.024	-0.041	0.054	822	39	δ_5	-0.038	0.026	-0.088	0.013	1192	57
δ_6	-0.031	0.025	-0.081	0.018	1564	34	δ_6	0.025	0.026	-0.026	0.075	622	26	δ_6	-0.057	0.040	-0.134	0.021	896	38
δ_7	-0.018	0.025	-0.067	0.030	1545	34	δ_7	0.014	0.032	-0.048	0.076	603	26	δ_7	-0.039	0.023	-0.084	0.007	875	38
δ_8	-0.054	0.027	-0.106	-0.001	1023	22	δ_8	-0.017	0.035	-0.086	0.052	393	14	δ_8	-0.133	0.073	-0.277	0.011	567	16
δ_9	-0.079	0.037	-0.151	-0.006	502	11	δ_9	0.031	0.041	-0.050	0.112	189	7	δ_9	-0.078	0.034	-0.144	-0.011	273	7
δ_1^{PL}	-0.002	0.007	-0.016	0.012	3194	69	δ_1^{PL}	-0.004	0.011	-0.026	0.017	1715	59	δ_1^{PL}	0.000	0.013	-0.026	0.025	2806	88
δ_2^{PL}	0.015	0.013	-0.009	0.040	2112	39	δ_2^{PL}	0.006	0.017	-0.027	0.039	1246	37	δ_2^{PL}	-0.012	0.017	-0.045	0.020	2114	62
δ_3^{PL}	0.029	0.014	0.002	0.057	1559	28	δ_3^{PL}	0.003	0.026	-0.047	0.053	811	29	δ_3^{PL}	0.009	0.018	-0.027	0.045	1473	52
δ_4^{PL}	0.023	0.010	0.003	0.043	1017	16	δ_4^{PL}	-0.022	0.035	-0.091	0.046	394	14	δ_4^{PL}	0.021	0.022	-0.023	0.065	866	29
	Ice creams and sorbets							**Margarine**							**Ready-to-eat canned meals**					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	0.004	0.064	-0.120	0.129	643	35	δ_0	0.069	0.046	-0.021	0.158	263	28	δ_0	-0.007	0.016	-0.038	0.024	2736	94
δ_1	0.057	0.090	-0.119	0.232	515	20	δ_1	0.145	0.082	-0.017	0.306	227	24	δ_1	0.018	0.029	-0.039	0.074	2380	67
δ_2	0.054	0.091	-0.125	0.233	500	20	δ_2	0.141	0.089	-0.033	0.315	216	24	δ_2	0.038	0.051	-0.061	0.137	2055	62
δ_3	0.065	0.070	-0.073	0.203	494	20	δ_3	-0.022	0.102	-0.221	0.177	167	14	δ_3	0.020	0.027	-0.033	0.072	1754	58
δ_4	0.178	0.125	-0.066	0.423	488	20	δ_4	-0.019	0.117	-0.249	0.211	164	14	δ_4	0.010	0.025	-0.039	0.059	1453	54
δ_5	0.070	0.129	-0.183	0.323	473	20	δ_5	0.024	0.138	-0.247	0.296	150	14	δ_5	0.015	0.037	-0.058	0.089	1165	53
δ_6	0.145	0.172	-0.193	0.483	365	14	δ_6	-0.068	0.132	-0.326	0.190	111	11	δ_6	0.020	0.066	-0.109	0.150	892	44
δ_7	0.143	0.122	-0.096	0.383	350	14	δ_7	-0.028	0.168	-0.358	0.301	97	11	δ_7	-0.010	0.041	-0.091	0.070	856	44
δ_8	0.066	0.180	-0.286	0.418	224	5	δ_8	-0.044	0.185	-0.407	0.319	63	7	δ_8	-0.063	0.063	-0.187	0.061	553	24
δ_9	0.009	0.230	-0.441	0.459	105	3	δ_9	0.057	0.270	-0.471	0.586	31	5	δ_9	-0.035	0.082	-0.197	0.126	258	7
δ_1^{PL}	-0.082	0.046	-0.172	0.008	643	35	δ_1^{PL}	0.034	0.046	-0.057	0.125	263	28	δ_1^{PL}	0.023	0.032	-0.039	0.085	2736	94
δ_2^{PL}	-0.006	0.093	-0.189	0.177	380	17	δ_2^{PL}	0.156	0.143	-0.125	0.436	175	19	δ_2^{PL}	0.010	0.026	-0.042	0.061	2052	60
δ_3^{PL}	0.146	0.111	-0.073	0.364	249	15	δ_3^{PL}	0.218	0.143	-0.062	0.498	123	17	δ_3^{PL}	0.018	0.029	-0.038	0.074	1429	38
δ_4^{PL}	0.131	0.165	-0.192	0.453	123	6	δ_4^{PL}	-0.071	0.112	-0.290	0.147	33	3	δ_4^{PL}	0.039	0.026	-0.013	0.090	826	14

Science and Technology in childhood Obesity Policy

Continued table A1

	Ready-to-eat fresh meals							Dessert mixes							Fresh delicatessen products					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	0.003	0.010	-0.016	0.023	3433	144	δ_0	0.072	0.188	-0.298	0.441	226	10	δ_0	0.010	0.011	-0.012	0.032	5003	186
δ_1	0.014	0.012	-0.010	0.037	3017	118	δ_1	-0.129	0.380	-0.874	0.616	185	6	δ_1	0.016	0.017	-0.017	0.050	4439	148
δ_2	0.016	0.014	-0.012	0.044	2590	106	δ_2	-0.115	0.415	-0.928	0.698	151	5	δ_2	0.016	0.018	-0.020	0.052	3881	144
δ_3	0.002	0.012	-0.021	0.025	2219	105	δ_3	-0.462	0.473	-1.388	0.465	150	5	δ_3	-0.002	0.008	-0.017	0.013	3368	143
δ_4	0.002	0.018	-0.033	0.036	1845	84	δ_4	-0.364	0.601	-1.542	0.814	148	5	δ_4	0.014	0.017	-0.019	0.047	2825	113
δ_5	-0.010	0.018	-0.044	0.025	1776	84	δ_5	-0.304	0.624	-1.527	0.920	144	5	δ_5	0.006	0.024	-0.041	0.052	2314	112
δ_6	0.014	0.022	-0.028	0.056	1422	63	δ_6	-0.571	0.564	-1.677	0.534	111	4	δ_6	0.025	0.035	-0.044	0.094	1838	66
δ_7	-0.009	0.017	-0.042	0.024	1362	63	δ_7	-0.607	0.562	-1.708	0.495	106	4	δ_7	0.006	0.015	-0.023	0.036	1765	66
δ_8	-0.024	0.027	-0.076	0.029	1001	40	δ_8	0.212	0.694	-1.147	1.571	69	3	δ_8	0.007	0.020	-0.031	0.045	1300	38
δ_9	-0.051	0.037	-0.124	0.022	651	27	δ_9	-0.740	0.718	-2.148	0.668	33	2	δ_9	0.006	0.034	-0.061	0.073	851	25
δ_{10}	-0.049	0.026	-0.100	0.002	310	11									0.015	0.040	-0.062	0.093	402	8
δ_1^{PL}	0.018	0.013	-0.006	0.043	2990	133	δ_1^{PL}	0.167	0.182	-0.523	0.189	226	10	δ_1^{PL}	0.006	0.014	-0.022	0.034	4423	178
δ_2^{PL}	0.034	0.017	0.001	0.067	2171	91	δ_2^{PL}	0.836	0.535	-0.213	1.886	145	4	δ_2^{PL}	0.013	0.018	-0.021	0.048	3317	123
δ_3^{PL}	-0.001	0.012	-0.024	0.023	1387	66	δ_3^{PL}	0.298	0.491	-0.665	1.261	74	2	δ_3^{PL}	0.011	0.009	-0.007	0.029	2273	106
δ_4^{PL}	-0.021	0.015	-0.051	0.009	678	42	δ_4^{PL}	0.823	0.316	0.204	1.442	37	1	δ_4^{PL}	-0.004	0.008	-0.021	0.012	1339	77
	Ready-to-eat frozen meals							**Fresh dairy products and desserts**							**Processed patato products**					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	-0.022	0.013	-0.048	0.005	2291	113	δ_0	-0.031	0.014	-0.059	-0.003	2594	124	δ_0	0.014	0.030	-0.045	0.074	1010	80
δ_1	-0.008	0.015	-0.038	0.022	1985	92	δ_1	-0.038	0.021	-0.080	0.003	2226	101	δ_1	0.042	0.041	-0.037	0.122	868	62
δ_2	-0.020	0.019	-0.057	0.018	1692	80	δ_2	-0.063	0.023	-0.107	-0.018	2153	101	δ_2	0.084	0.040	0.005	0.164	760	58
δ_3	-0.005	0.016	-0.036	0.025	1443	79	δ_3	-0.057	0.025	-0.106	-0.008	1835	100	δ_3	0.045	0.031	-0.015	0.105	716	58
δ_4	-0.003	0.025	-0.053	0.046	1204	70	δ_4	-0.062	0.025	-0.111	-0.013	1535	93	δ_4	0.034	0.036	-0.036	0.104	604	55
δ_5	-0.024	0.023	-0.069	0.021	1161	70	δ_5	-0.067	0.024	-0.113	-0.020	1504	93	δ_5	0.049	0.061	-0.071	0.168	497	50
δ_6	-0.009	0.024	-0.055	0.038	910	54	δ_6	-0.094	0.033	-0.159	-0.029	1188	70	δ_6	0.084	0.068	-0.050	0.217	393	43
δ_7	-0.005	0.029	-0.061	0.052	675	45	δ_7	-0.108	0.035	-0.177	-0.038	901	69	δ_7	0.044	0.062	-0.078	0.166	292	36
δ_8	-0.059	0.037	-0.131	0.013	428	23	δ_8	-0.134	0.052	-0.237	-0.032	597	50	δ_8	0.027	0.059	-0.089	0.143	192	30
δ_9	-0.047	0.051	-0.148	0.054	203	11	δ_9	-0.036	0.023	-0.081	0.008	273	11	δ_9	0.039	0.080	-0.118	0.196	96	24
δ_1^{PL}	-0.026	0.013	-0.052	0.000	2291	113	δ_1^{PL}	-0.007	0.007	-0.022	0.007	2594	124	δ_1^{PL}	0.036	0.031	-0.024	0.096	1010	80
δ_2^{PL}	-0.011	0.017	-0.044	0.023	1692	81	δ_2^{PL}	0.020	0.012	-0.004	0.043	1879	90	δ_2^{PL}	-0.019	0.050	-0.116	0.078	722	38
δ_3^{PL}	0.027	0.017	-0.006	0.060	1158	57	δ_3^{PL}	0.010	0.008	-0.006	0.027	1470	51	δ_3^{PL}	-0.019	0.040	-0.097	0.058	505	28
δ_4^{PL}	-0.002	0.017	-0.035	0.031	677	34	δ_4^{PL}	-0.006	0.014	-0.034	0.022	864	31	δ_4^{PL}	0.006	0.050	-0.093	0.105	372	22

Science and Technology in childhood Obesity Policy

Continued table A1

	Sauces to warm							Syrups							Frozen pastries and desserts					
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers
δ_0	0.046	0.023	0.002	0.091	1232	55	δ_0	0.026	0.069	-0.109	0.160	312	23	δ_0	-0.331	0.209	-0.741	0.078	275	19
δ_1	0.007	0.045	-0.080	0.095	1068	43	δ_1	0.002	0.091	-0.177	0.181	249	15	δ_1	-0.330	0.250	-0.820	0.159	229	14
δ_2	-0.024	0.054	-0.130	0.081	914	35	δ_2	0.040	0.115	-0.186	0.266	241	15	δ_2	-0.097	0.240	-0.568	0.374	220	14
δ_3	-0.002	0.066	-0.130	0.127	782	34	δ_3	0.045	0.085	-0.123	0.212	238	15	δ_3	-0.116	0.204	-0.516	0.283	211	14
δ_4	0.054	0.043	-0.031	0.139	655	33	δ_4	0.038	0.100	-0.158	0.234	235	15	δ_4	-0.373	0.279	-0.919	0.173	171	13
δ_5	0.126	0.092	-0.054	0.306	633	33	δ_5	0.092	0.152	-0.206	0.390	227	15	δ_5	-0.542	0.392	-1.309	0.226	165	13
δ_6	0.150	0.120	-0.085	0.385	495	22	δ_6	0.036	0.146	-0.250	0.321	177	12	δ_6	-0.191	0.389	-0.954	0.573	126	9
δ_7	0.210	0.152	-0.087	0.507	368	21	δ_7	0.175	0.177	-0.173	0.523	169	12	δ_7	-0.692	0.421	-1.518	0.134	121	9
δ_8	0.188	0.177	-0.160	0.535	235	13	δ_8	-0.052	0.181	-0.407	0.303	109	7	δ_8	-0.711	0.460	-1.613	0.190	78	5
δ_9	0.097	0.123	-0.145	0.338	112	7	δ_9	0.179	0.183	-0.180	0.538	51	4	δ_9	-1.210	0.644	-2.471	0.052	36	2
δ_1^{PL}	0.014	0.041	-0.067	0.095	1232	55	δ_1^{PL}	0.019	0.097	-0.170	0.209	312	23	δ_1^{PL}	-0.326	0.169	-0.657	0.006	275	19
δ_2^{PL}	0.027	0.043	-0.058	0.111	914	36	δ_2^{PL}	0.055	0.258	-0.451	0.561	182	11	δ_2^{PL}	0.012	0.118	-0.220	0.243	179	12
δ_3^{PL}	0.053	0.025	0.004	0.102	624	22	δ_3^{PL}	-0.087	0.064	-0.213	0.039	118	8	δ_3^{PL}	-0.201	0.202	-0.597	0.196	127	9
δ_4^{PL}	-0.002	0.086	-0.170	0.167	369	13	δ_4^{PL}	0.136	0.235	-0.324	0.595	58	3	δ_4^{PL}	0.368	0.217	-0.057	0.793	78	5
	Cold sauces							**Frozen snacking products**												
	Estimate	SE	LB	UB	N	Switchers		Estimate	SE	LB	UB	N	Switchers							
δ_0	0.005	0.019	-0.031	0.042	1089	50	δ_0	0.203	0.125	-0.043	0.448	538	28							
δ_1	-0.014	0.029	-0.071	0.043	936	38	δ_1	-0.221	0.211	-0.634	0.192	465	21							
δ_2	0.017	0.024	-0.030	0.063	793	31	δ_2	0.022	0.196	-0.361	0.406	400	19							
δ_3	0.008	0.040	-0.069	0.086	667	30	δ_3	-0.075	0.093	-0.257	0.107	385	19							
δ_4	0.030	0.045	-0.058	0.118	638	30	δ_4	-0.182	0.175	-0.525	0.161	321	15							
δ_5	0.053	0.076	-0.097	0.202	516	29	δ_5	-0.302	0.219	-0.731	0.127	308	15							
δ_6	0.051	0.074	-0.094	0.196	392	20	δ_6	-0.310	0.247	-0.795	0.174	241	12							
δ_7	0.070	0.083	-0.092	0.233	372	20	δ_7	-0.141	0.162	-0.459	0.177	180	11							
δ_8	-0.045	0.063	-0.169	0.079	239	13	δ_8	0.153	0.217	-0.272	0.579	118	9							
δ_9	-0.037	0.083	-0.201	0.126	113	6	δ_9	-0.565	0.371	-1.291	0.162	58	7							
δ_1^{PL}	-0.033	0.016	-0.065	-0.001	1089	50	δ_1^{PL}	0.107	0.123	-0.135	0.349	538	28							
δ_2^{PL}	-0.024	0.034	-0.091	0.044	786	32	δ_2^{PL}	-0.045	0.229	-0.495	0.404	388	14							
δ_3^{PL}	0.024	0.020	-0.016	0.065	506	18	δ_3^{PL}	0.071	0.121	-0.167	0.309	256	10							
δ_4^{PL}	0.086	0.078	-0.066	0.239	255	10	δ_4^{PL}	-0.041	0.127	-0.290	0.208	179	8							

Source: Authors' own calculations based on data from Worldpanel Kantar data and French public national Health Promotion Agency, January 2017 to December 2019. **Notes**: δ_l stands for the estimated effect of having committed to the Nutri-Score for the first-time l quarters ago on the average brand market share. δ_l^{pl} stands for placebo estimator. It assesses if the evolution of the market shares of the set of brands that committed to the Nutri-Score for the first time l quarters ago and those that have not are on parallel trends for l+1 quarters if the commitment had not taken place. An estimor significantly different from 0 implies that the common trends assumption is violated. LB and UB stand for the lower bound and upper bound of the 95% confidence interval, respectively. N is the number of bservations and Switchers is the number of brands that have committed to the Nutri-Score for the first-time l quarters ago used to calculate δ_l and δ_l^{pl}. All estimations integrated price intrument and type of brand fixed effects. All estimators' standard errors were computed using a block bootstrap at brand level (500 replications).