Does a Comprehensive Food Policy affect Household Demand Behavior

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Abstract

The objective of this study is to test whether a compressive law on food labeling and advertising influenced household purchasing behavior in Chile. The law imposed mandatory warning labels and marketing restrictions to unhealthy packaged foods (i.e., targeted foods with high amounts of calories, sugars, sodium, and saturated fats). Using cross-sectional data for the periods of 2011/12 and 2016/17 from the National Household Budget Survey, we estimate demand systems for each survey period and explore whether changes in price and expenditure demand elasticities for non-targeted foods (i.e., fruit, vegetables, sugar, sweeteners, and bottled water) occur. We found some evidence that own-price and expenditure elasticities of demand for non-targeted foods changed after the policy implementation.

Keywords: Warning labels; demand elasticities; demand system

JEL Classifications: I18; D12

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Introduction

Obesity and overweight are on the rise throughout Latin America and the Caribbean, and are particularly prevalent among women and children (Food and Agricultural Organization 2017). The increasing obesity rate among children has placed Chile as the top country of childhood obesity in Latin America with over half of 6-year-old children overweight or obese (Jacobs 2018). Further, overweight is among the highest in Latin America and Caribe, reaching 63% among adults (Food and Agricultural Organization 2017). This is probably a consequence of an important change in the Chilean diet over the past two decades, mainly with a decrease in the consumption of whole grains, legumes, vegetables and fruit and an increase in the consumption of energy-dense foods (Uauy, Albala and Kain 2001). In 2017, only 15% of the population consumed at least five portions of fruit and vegetables every day (Ministerio de Salud 2018). The development of initiatives that combat obesity has become a national priority. In 2016, the implementation of the Law of Food Labeling and Advertising took place in Chile. The law imposed mandatory warning labels and marketing restrictions to targeted packaged foods (i.e., foods with high levels of sugar, sodium, calories, and fat). A three-stage implementation of the regulation was planned, with nutrient limits becoming increasingly stricter over a three-year period. Leiva (2018) indicated that about 60% of the foods had warning labels in 2018. Figure 1 shows the warning labels in Chile.

Three primary short-run policy outcomes have been identified: (1) Consumers switched to foods without labels, within a category, for some food categories according to an unpublished preliminary work (Araya et al., 2018), (2) the number of warning labels on the front package affects product sales in a non-linear manner (Sánchez and Silva 2018), and (3) food industry has reformulated their products to avoid the labels by replacing sugar for non-sugar sweeteners (see

Appendix for a summary). Warning labels do not seem to cause radical changes in consumer´s food choices beyond encouraging more healthful choices within a product category (Tórtora, Machín and Ares 2019). In fact, the within-category effects are the most pronounced effect of the labels, especially when there are substitutes available (e.g., products without warning labels) (Ares et al. 2018). One central question has remained unanswered: whether households, induced by the reform, have changed their sensitivity to price and total income changes when purchasing healthy foods or non-targeted foods.

In this study, we further contribute to understanding the impact of the comprehensive food policy reform in Chile. Using cross-sectional data from the National Household Budget Survey (EPF, acronym in Spanish) for the periods of 2011/12 (VII EPF) and 2016/17 (VIII EPF), we estimate households' demand elasticities of non-targeted foods (i.e., fruits, vegetables, non-sugar sweeteners, sugar, and bottled water). We explore whether changes in own-price and expenditure elasticities for non-targeted foods occur after the implementation of the policy. To our best knowledge, no other study has evaluated the impact of the Chilean reform on household behavior to price and total income changes after the reform implementation by using an extensive demand system with 14 food at home (FAH) categories and a *numéraire* good in Chile.

Although previous work has estimated a demand system in Chile, this appears to be the first time that a large demand system is estimated including foods with increasing demand and interest to health policymakers such as sweeteners. Caro et al. (2017) using data from the 2011/12 EPF survey estimated price elasticities of nine food categories and reported that the demand for salty snacks and chips; sugar-sweetened beverages; and water, coffee, and tea were elastic. Their model does not account for quality effects as they employed unit values as prices, and it is conditional on food expenditures. Failure to account for quality will generate bias price estimates (Cox and Wohlgenant 1986). Moreover, the estimation of conditional food demand by assuming group expenditure being exogenous may violate theoretical demand restrictions (Thompson 2004).

The Chilean reform has the potential to influence households' choice and behavior by changing demand parameters (i.e., elasticities). Testing whether demand elasticity estimates changed after the policy implementation would allow us to better understand patterns of household purchasing behavior over time in Chile.

We estimate a large demand system consisting of 14 food groups and a *numéraire* good using a cross-sectional national survey data of Chilean households. Although other studies have estimated a large demand system in the past (See Zhen et al. (2014)), this appears to be the first time that sweeteners elasticities are estimated in an incomplete demand framework. Their consumption has become more widespread around the world, especially in Chile, where the food industry has replaced sugar for sweeteners to avoid the warning labels on food packages. To our knowledge, this is the most extensive food demand system ever estimated for Chile that addressed price endogeneity due to product quality. Because elasticities post-reform implementation are likely to be different from pre-policy estimates, the resulting elasticities can be used by policymakers to simulate post-reform effects of price and income enhancement policy proposals on the consumption of foods including sweeteners.

Demand Model

We estimate the demand before and after the policy implementation. A flexible demand system such as the two-way linear approximate Exact Affine Stone Index (EASI) demand system can be specified as follows:

$$w_{hit}^{*} = \sum_{j=1}^{J} a_{ij} lnp_{hjt} + \sum_{j=1}^{J} a_{ijy} y_h lnp_{hjt} + \sum_{r=1}^{L} b_{ir} lny_{ht}^{r} + \sum_{k=1}^{K} g_{ik} z_{hkt} + u_{hit}, \text{h} = 1, \ldots, H;\ i = 1, \ldots, J-1;\ t = 1, \ldots, T$$

where w_{hit}^{*} is the latent budget share of category *i* in period *t* for households *h. J i*s the number of categories (*J* food categories and a *numéraire*); p_{hjt} is the price index for household *h* and category *j; L* is the highest order polynomial in y_{ht}; *H* is the number of households; y_{ht}^{r} is real total household expenditure; z_{hkt} is the k^{th} demand shifter; and u_{hit} is the residual. The corresponding model parameters are a_{ij}, a_{ijt}, b_{ir}, and g_{ik}. The latent budget share is related to the observed budget share as follows $w_{hit} \equiv \max(0, w_{hit}^{*})$, where w_{hit} is calculated as is calculated as the category-level expenditure divided by weekly total expenditures. The real household expenditures y_{ht}^{r} is calculated as the Stone price-deflated real expenditures: $lnx_{ht} - \sum_{j=1}^{J} w_{hjt}\, lnp_{hj}$, where x_{ht} is nominal total household expenditures on food and other goods and services. We specified demand shifters z_{hkt} to include household characteristics (Appendix). For comparison purposes with a previous study, in this study, we restrict $L = 2$ and $a_{ijt} = 0$ and estimate a Quadratic Almost Ideal Demand System (QUAIDS).

An earlier demand study in Chile employed QUAIDS with nine food categories (Caro et al. 2017). In this study, non-food items are excluded from the system and therefore imposing the assumption that expenditures on these items are held fixed. This assumption is unlikely to hold and can generate biased welfare effects (Zhen et al., 2013a). We included a *numéraire* good in our demand system to relax this assumption.

There are three potential sources of endogeneity in equation (3). First, total real income Y_{ht} is endogenous because budget shares are used in its construction via the Stone price index. This form of endogeneity has been found to have a minor impact (Lewbel and Pendakur 2009; Zhen et al. 2014). Second, total household expenditure is most likely to be endogenous with category demand. We employ instrumental variables to address this source of endogeneity. Third, category-level price indexes are endogenous because unit values are used in their calculation. Omitted variable bias is analogous to the bias from using unit values because they contain information on market prices and quality. We explain how we intended to address price endogeneity in the next section.

Data and Variables Construction

Data

We use data from Household Budget Survey (EPF, acronym in Spanish) collected by the Chilean National Institute of Statistics (INE is the Spanish acronym) over the period 2011-2012 (VII EPF) and 2016-2017 (VIII EPF) (Instituto Nacional de Estadística de Chile, 2013). Figure 2 shows the dates the survey data was collected and the policy rollout period.

EPF data are collected from a sample of households in Chile using self-reported diaries of all purchases, including food, over two weeks (Instituto Nacional de Estadística de Chile 2013). Data include monthly income and expenditure values, which are recorded where possible, and otherwise estimated. Quantities of the food items and month in which a household participated in the survey, withheld from the public-use version of the EPF data, were provided for this research by INE.

Compared with EPF data, household scanner data is not suited for this research purposes. First, scanner data from retailer research marketing companies collect either only consumer packaged goods expenditures (e.g., Kantar) or random weight foods, whose expenditures might be more vulnerable to underreporting than packaged foods (Zhen et al. 2009). Second, households' scanner data fail in providing representative inferences from purchases. Panelists households are not representative of retailer shoppers (Gupta et al. 1996).

We found two main differences in terms of expenditure information between VII and VIII EPF. First, while quantities of foods and beverages are reported in kilograms in the VII EPF, quantities are reported in four different units of measurement (kg, litter, unit, and compra) in the VIII EPF. We intended to standardize quantities of the VIII EPF following the guidelines provided by INE for the VII EPF; however, the information provided by INE is not enough to standardize quantities. Therefore, we excluded all products whose quantities were not reported in kg or litters in both surveys. These products represent roughly 17% of total expenditures. The total number of foods at CCIF level that was considered in the demand system is 161 after excluding those with no records of volume in kg.

Second, there are 251 FAH products in VIII EPF while there are 188 FAH products in the VIII. There are five levels of aggregation in EPF. The lowest is product, followed by sub-class, class, group, and division. Although INE definition of sub-classes is the same in the two surveys, VIII EPF data contains information of goods at a more disaggregated level compared with the VII EPF data. To maintain the same number of products in each category, we assign every CCIF code-level FAH product in the VIII EPF to a product category in the VII EPF. We aggregate expenditures and quantities of the VIII EPF into 161 products.

We defined 14 categories of foods and beverages based on the main food categories defined in EPF and categories of interest in this study (non-targeted foods). The non-targeted food aggregates considered are fruit, vegetables, sugar, sweeteners, and bottled water. We analyze fruit and vegetables because of the growing interest by policymakers to promote their consumption as an additional effort to improve the dietary quality of Chilean households and combat the high obesity rates in the nation[3]. The choice of sweeteners is due to different reasons. First, sweeteners have gained popularity among consumers and the food industry, especially following the Chilean law of food labeling and advertising (IANSA 2017). Second, there is a debate about the potential effects on health and taste preferences (Serra-Majem et al. 2018). Finally, we include sugar to capture any substitution with sugar substitutes, hereinafter referred to as sweeteners.

The excluded at-home foods include packaged ingredients (e.g., oil, baking mixes, and flour) that require nontrivial preparation and foods that are present in only one survey. The full EPF panel contains 10,501 households (VII survey) and 15,210 (VIII survey). More than 90% of households reported monthly category-level unit values (i.e., expenditure divided by quantity) that lie outside five standard deviations from the category-level means (extreme unit values) for at least one category. Sweeteners; fish; and coffee, tea, and cacao are the FAH categories with a high incidence of price outliers (more than 75% in the VIII EPF). To reduce the incidence of price outliers, we dropped households with more than three food categories with extreme unit values[4]. In contrast, Caro et al. (2017) replaced extreme unit values with category means ± 2.5 standard deviations based on households zone and income level.

With this approach, households that participated in the VII EPF during October 2014 were excluded from the analysis. This is not surprising given that a soda tax was implemented on October 1, 2014.

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[3] https://www.cooperativa.cl/noticias/pais/salud/alimentos/chile-enfrenta-la-obesidad-fomentando-el-consumo-de-frutas-y-verduras/2018-10-02/124834.html

[4] Dropping households with more than three categories with extreme unit values resulted in upward sloping demand for seafood and coffee, tea, and cacao.

Average sample characteristics for each survey period are provided in the Appendix. Table 1 presents per capita purchase quantities, expenditures, and unit values. Among the 14 foods and beverages, the category of bread and cereals is the top source of food at home.

Comparing unit vales (adjusted to 2016 Chilean Pesos) between the two periods, the data indicates that households paid about 41% more for sweetened beverages in 2016/17 than what households in 2011/12 did. Part of this increase may be associated with a tax rate increase from 13% to 18% on industrialized beverages with high levels of sugar in October 2014 (Caro et al. 2018).

Food away from home account for about 3% and 5% total expenditure share in 2011/12 and 2016/17, respectively. About 25% and 39% of at-home food expenditure would come from store-purchased foods not individually modeled in our demand system using VII and VIII EPF, respectively. Therefore, the composite *numéraire* good in the demand systems contains all foods away from home, at least 25% of at-home foods, as well as all other goods and services.

Price Index

We address the unit value bias and potential biases from consumer cost minimization behavior in two ways. First, we construct household Fisher Ideal price indexes at the food category level using CCIF-level unit values as elements. Specifically, the Fisher Ideal price index for household h, FAH category j is calculated as

$$p_{hj} = \sqrt{\frac{\sum p_{kht}q_{ko} \sum p_{kht}q_{kht}}{\sum p_{ko}q_{ko} \sum p_{kht}q_{kht}}}, \mathrm{k} = 1, \dots, \mathrm{K}$$

where p_{kht} and q_{kht} are the unit value and quantity (in kilograms or liters) of kth CCIF code in category j in month t. We set the base at the sample mean. The base is the first month of a reported unit value. The CCIF-level unit values are missing if the household did not purchase the product. We imputed the missing unit values using predicted unit values produced from a regression of reported unit values on CCIF, month, and regional indicators; the interactions between regional and month indicators, CCIF and regional indicators, CCIF and month indicators; and household demographics, including presence of children; at least one main shopper with a college degree; adult equivalents; and income quintile indicators.

The price index for each category j was calculated using CCIF code-level unit values of *K* product items as elements, except for the three categories: sweeteners, sugar, and water. Because these categories are the last disaggregation level, there was only one element in their calculation of price index. The Fisher Ideal price index reduces the part of unit value bias due to within-category substitutions, except for sweeteners, sugar, and water. However, to the extend that the Fisher Ideal price index uses CCIF code-level unit values as its elements, it is still subject to the unit value bias due to simultaneity where households who engage in price search will pay lower prices for foods purchased.

The INE reports monthly consumer price index (CPI) at the national level. The CPI is normalized to 100 at the base month (first month of the survey). Each household was matched to a CPI based on the month the household participated in the survey. The *numéraire* price index was calculated by solving $\ln CPI_{ht} = \sum_{j=1}^{J} w_{hjt} \ln p_{hjt}$ for p_{hJt}, where p_{hjt} and w_{hjt} are the price index and budget shares, respectively, of category j for household h and month t.

Instruments

We create instruments for each of the Fisher Ideal price index by calculating 1) the cluster-level mean price index and 2) weighted mean price index using data from households in the same region (donors) excluding the household being instrumented (target). The weight is the number of months that overlapped between donors and target households. We regress p_{hj} on the cluster mean and weighted regional mean price indexes. The predicted price from this regression is used as the instrument for p_{hj}. Unfortunately, we only have cluster-level information for households in the VII EPF, therefore we are currently unable to instrument for prices using both survey data[5]. For comparison purposes, we only report estimation without instrumental variables.

For total household expenditure, we create the instrument by regressing total expenditure on total household income (that excludes rent imputation), quadratic and cubic terms of total income, household size, and an indicator variable for the metropolitan region. This regression yields an adjusted R^2 of 0.76 and 0.78 for VII EPF and VIII EPF estimations, respectively.

Results

Predicted Budget Shares

Our elasticity and budget share estimates from a demand system of 14 FAH categories and a composite *numéraire* good assuming price exogeneity are reported in table 2. A comparison of the predicted budget shares of foods between the two survey periods indicates that the budget share of bottled water has slightly increased. The budget share for sugar has slightly decreased, and for water and sweeteners have remained unchanged. Interestingly, the budget share for sweet foods (sweets) has remained unchanged. While this seems contrary to expectations, it is possible that households have switched from unhealthy foods to reformulated foods within each category and that the increase in the demand for reformulated sweet foods that do not carry the warning labels offsets the decrease in the demand of sweet foods with the labels. Considering that 20% of the food products were reformulated in the first year of policy implementation by replacing half

[5] Cluster variable information for VII EPF data were requested to INE at the end of May.

the sugar with artificial sweeteners to avoid the labels on their packages (Jacobs 2018; Ministerio de Salud 2016), this is a plausible explanation.

While this comparison of budget shares over time is informative, it does not take into account that households are not the same in each survey period and that the market conditions that affected the demand during the two periods are substantially different mainly due to the tax on sweetened beverages and the food policy reform.

Elasticities

Table 2 also reports own-price Marshallian price and expenditure elasticities. All own-price elasticities are statistically significant and negative at the mean, except for one own-price elasticity, i.e., sweeteners in 2011/12. Overall, average elasticities are similar to those reported in previous studies. Our results indicate that demand for bottled water is price elastic in both periods. The demands for fruit and vegetables remained price inelastic over time. The results showing the inelastic and elastic price elasticities of demand for these foods are consistent with previous estimates (Andreyeva, Long and Brownell 2010; Zhen et al. 2014).

There is limited evidence of demand elasticity estimates for sugar. In our study, the price elasticity of demand for sugar is inelastic in both periods. This is consistent with a previous study that reported an inelastic price elasticity of demand for sugar (-0.2) in Iran (Soleimany and Babakhani 2012). In contrast, in a US study, an elastic price elasticity of demand for sugar was reported (-1.32) (Lakkakula, Schmitz and Ripplinger 2016).

In our study, the demand for sweeteners is elastic in the 2016/17 period. For this period, the demand for sugar is less price elastic compared to that for sweeteners. According to Lakkakula, Schmitz and Ripplinger (2016), sugar has a more inelastic demand compared with two non-sugar sweeteners, High Fructose Corn Syrup (HFCS) and glucose in the US. They also reported positive expenditure elasticities for HFCS (1.19) and sugar (1.69) but a negative expenditure elasticity for glucose (-3.85). In contrast, our expenditure elasticities indicate that sugar is a necessity with an estimate of less than 0.5. To our knowledge, no previous study has estimated the demand elasticities for sweeteners in a developing country.

Because the main goal of this study is to identify whether households have changed their sensitivity to price and income changes after the policy, we evaluate whether there are differences in the elasticities between the two periods for non-targeted foods. Capacci and Mazzocchi (2011) argue that a national campaign that encourages fruit and vegetables (FV) consumption will make households less responsive to changes in prices of FV. In principle, the policy that aims to discourage the consumption of unhealthy products could have induced consumers to be more sensitive to changes in prices of foods that carry the warning labels (targeted foods). Because we do not have data of foods at barcode-level, we cannot test this hypothesis. Instead, we evaluate changes in demand elasticities of targeted and non-targeted food categories.

Considering that following the policy, the majority of targeted foods (i.e., all processed and packaged foods except for some foods such as) carry the labels (Leiva 2018), we can expect that the policy could have induced households to be less responsive to price changes of healthy non-targeted foods (e.g., fruit and vegetables). Contrary to this expectation, price elasticity of demand for fruits and vegetables became slightly more price elastic.

The other two food categories of interest are sugar and sweeteners. These processed foods are categories of increasing interest for policymakers and health researchers. Recently, the increase of information in the media about potential adverse effects of sweeteners consumption could have induced some consumers to perceive sugar to be healthier than sweeteners. This could partially explain the smaller price elasticity for sugar after the policy.

Because about 20% of products were reformulated to avoid the labels on their front package, and at least 60% of all packaged foods carried the warning signs during the first stage of implementation (Leiva 2018; Ministerio de Salud 2016), we can predict that the remaining 20% of total processed foods have initially their nutrient levels below the critical levels (they were healthful choices before the reform). This points out the poor nutritional quality of the majority of processed and packaged foods sold in Chile. Considering that approximately 40% of consumer-packaged foods did not carry the labels (including 20% of reformulated products), whether own-price elasticities of demand for the targeted categories in our study should increase or decrease after the policy implementation is not intuitive.

Conclusion

We estimated the demand for food at home (FAH) before and after the implementation of a comprehensive food policy reform in Chile. The policy imposes mandatory labeling and marketing restrictions on unhealthy processed foods (targeted foods with high levels of sugar, sodium, saturated fat, and calories). Using cross-sectional data of household food expenditure from the EPF 2011/12 and 2016/17 survey periods, we estimated Quadratic Almost Ideal demand systems with 14 FAH groups including five non-targeted foods (fruit, vegetables, sugar, water, and sweeteners) and a *numéraire* good for all other consumption goods and services. To our knowledge, this is so far the largest food demand system ever estimated for Chile. Another study contribution is that no other study has estimated the elasticities for sweeteners in the developing country context, a category that has generated outgoing debate related to its potential negative effect on health.

The results indicate evidence of changes in own-price elasticities of the demand for three non-targeted foods that can convey health associations. The own price elasticity of bottled water slightly decreased while the own-price elasticities of fruit and vegetables marginally increased. We also found that expenditure elasticity for fruits slightly increased. These results point out that households in Chile became more responsive to price changes of fruit and vegetables. However, if a policy aims to increase households income, households would spend more on fruits after the reform implementation, than they would have spent pre-reform.

We employed the QUAIDS in this study, which has been widely used in the demand literature and can provide initial evidence of elasticities of categories that have not been widely assessed (e.g., sweeteners). Because total income can affect demand in a nonlinear manner beyond a quadratic form, in future work, a more flexible demand system should be modeled. Currently, our estimation does not address price endogeneity because of data limitation.

Tables and Figures

Figure 1. Warning Labels in Chile

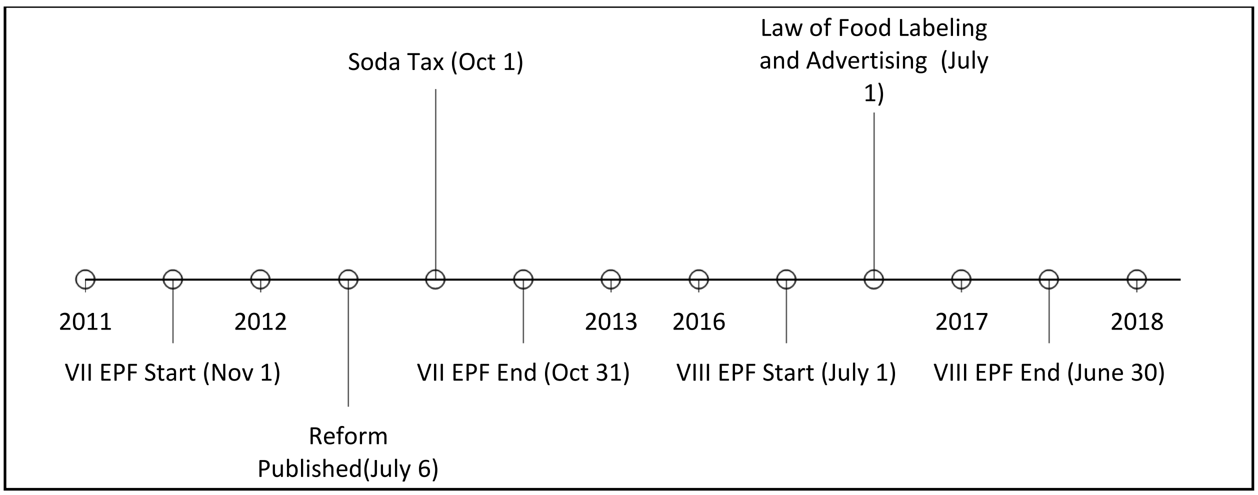

Figure 2. Timeline for the first stage of the comprehensive food policy reform in Chile[6].

[6] The Chilean Senate approved the Law of Food Labeling and Advertising in July 2012.

Table 1. Average Per Capita Expenditures, Purchase Quantities, Unit Values by Food Category

	VII EPF (2011/12)				VIII EPF (2016/17)			
Category	Expenditure ($/day)	Volume (g/day)	Unit Value ($/100 g)	% Censoring	Expenditure ($/day)	Volume (g/day)	Unit Value ($/100 g)	% Censoring
Bread and cereals	337,5	299,617	120,834	0	390,183	302,966	140,922	0
Meat	272,3	73,899	371,313	2,394	200,695	61,627	372,974	3,313
Sea food	108,964	43,172	347,124	17,892	92,915	19,125	597,909	31,627
Dairy products and eggs	215,301	155,684	179,256	0,564	231,336	149,567	187,862	1,429
Oils and fats	90,093	51,44	206,592	4,049	104,13	50,654	262,347	5,2
Fruit	111,765	147,663	94,462	4,479	150,68	148,387	131,765	3,226
Vegetables	229,647	291,489	98,907	0,139	325,386	298,301	139,903	0,206
Sweets	104,787	32,011	437,553	5,464	130,843	34,577	511,927	6,198
Spices	84,12	42,276	266,278	2,749	123,346	51,589	294,601	2,893
Coffee, Tea, and Chocolate	67,217	7,841	1261,722	32,089	82,152	8,475	1359,922	31,558
Sweetened Drinks, Ready to Drink	169,934	271,539	68,261	2,661	211,815	265,165	86,141	1,027
Sugar	42,552	68,442	64,715	24,73	42,138	57,75	80,758	27,509
Sweeteners	52,481	4,612	1142,83	80,89	74,927	7,905	1064,161	80,105
Water	43,454	120,175	64,088	56,996	66,126	143,245	71,353	38,541
All other food and services	11817,336				16040,789			
Households	2476				1604			

Note: Average expenditures and unit values of VII EPF are expressed in 2016 Chilean Pesos

Table 2. Average Budget Share and Elasticity Estimates QUAIDS, Total Expenditure Endogeneity

	VII EPF (2011/12)			VIII EPF (2016/17)		
Category	Share	Expenditure	Own-Price	Share	Expenditure	Own-Price
Bread and cereals	0.038***	0.653***	-0.882***	0.030***	0.737***	-0.808***
Meat	0.028***	1.204***	-0.721***	0.015***	1.048***	-0.743***
Sea food	0.008***	1.024***	-1.013***	0.004***	0.813***	-0.409*
Dairy products and eggs	0.021***	1.058***	-0.943***	0.016***	0.890***	-0.839***
Oils and fats	0.009***	0.704***	-0.687***	0.008***	0.900***	-0.487***
Fruit	0.010***	0.810***	-0.775***	0.010***	1.106***	-0.799***
Vegetables	0.024***	0.985***	-0.728***	0.022***	0.910***	-0.897***
Sweets	0.008***	0.927***	-1.049***	0.008***	1.249***	-0.705***
Spices	0.009***	0.850***	-0.575***	0.008***	0.856***	-0.576***
Coffee, Tea, and Chocolate	0.004***	0.588***	-1.029***	0.004***	0.434*	-0.732***
Sweetened Drinks, Ready to Drink	0.017***	0.967***	-0.917***	0.017***	1.256***	-1.080***
Sugar	0.003***	0.482***	-0.754***	0.002***	0.409*	-0.663***
Sweeteners	0.001***	0.574*	0.462	0.001***	1.419***	-1.061***
Water	0.002***	0.876***	-1.482***	0.003***	1.135***	-1.205***
All other food and services	0.820***	1.021***	-1.144***	0.852***	1.011***	-1.159***

Note: *** $p < .01$, ** $p < .05$, * $p < .10$.

Appendix A

Table A1. Characteristics Socio-demographics of Households

Variables	VII EPF	VIII EPF
Exogenous Demand Shifters		
Household has at least one child	0.620	0.556
Household has at least one main shopper who is female and married	0.620	0.573
Household has at least one main shopper who has a college degree	0.037	0.366
Household has at least one main shopper who is female under 35	0.044	0.080
Adult Equivalents	3.946	3.840
Other Variables		
Household lives in Metropolitan Region		
Household is in the first (bottom) income quintile	0.044	0.051
Household is in the second income quintile	0.095	0.141
Household is in the third income quintile	0.169	0.172
Household is in the fourth income quintile	0.258	0.231
Household is in the fifth (top) income quintile	0.434	0.405

Table A2. Average Budget Shares and Elasticity Estimates QUAIDS, Total Expenditures Exogeneity

	VII			VIII		
Category	Share	Expenditure	Own-Price	Share	Expenditure	Own-Price
Bread and cereals	0.034***	0.650***	-0.881***	0.028***	0.761***	-0.818***
Meat	0.023***	1.233***	-0.729***	0.014	1.114***	-0.769***
Sea food	0.008***	0.942***	-1.002***	0.005***	0.838***	-0.413*
Dairy products and eggs	0.021***	1.039***	-0.940***	0.017***	0.976***	-0.855***
Oils and fats	0.009***	0.752***	-0.700***	0.008***	0.889***	-0.486***
Fruits	0.009***	0.945***	-0.817***	0.010***	0.979***	-0.777***
Vegetables	0.020***	0.990***	-0.730***	0.021***	1.041***	-0.965***
Sweets	0.008***	1.008***	-1.053***	0.009***	1.161***	-0.689***
Spices	0.008***	0.901***	-0.589***	0.008***	1.025***	-0.590***
Coffee, Tea, and Chocolate	0.005***	0.702***	-1.044***	0.005***	0.715***	-0.734***
Sweetened Drinks, Ready to Drink	0.016***	1.026***	-0.931***	0.015***	1.088***	-1.068***
Sugar	0.003***	0.552***	-0.759***	0.002***	0.418***	-0.664***
Sweeteners	0.002***	0.826***	0.466	0.002***	0.939***	-0.969**
Water	0.003***	0.963***	-1.477***	0.003***	0.868***	-1.210***
All other food and services	0.830***	1.015***	-1.147***	0.854***	1.008***	-1.161***

Note: *** $p < .01$, ** $p < .05$, * $p < .10$.

Table A3. Demand Elasticities

Categories	Own-Price Elasticity	Source
Bottled Water	-1.7	Zhen et al. (2014)
Sugar	-0.2 -1.32	Soleimany and Babakhani (2012) Lakkakula, Schmitz and Ripplinger (2016).
HFCS Glucose	-2.95 -4.44	Lakkakula, Schmitz and Ripplinger (2016).
Fruit	-0.70	Andreyeva, Long and Brownell (2010)
Vegetables	-0.58	Andreyeva, Long and Brownell (2010)

Table A4. Reformulation and Products with Warning Labels

Dates	Description	% Reformulated Products	% Products with Warning Labels
June 2015[1]	Ministry of Health published the new regulation standards for nutritional labeling of food	19% of all 8 000 products of AB Group companies (i.e., Coca Cola, Nestle, Carozzi, Agrosuper, Evercrisp, and Ideal) were reformulated (Jan 2015-March 2016). Less than 2% would have avoided at least one warning label with reformulation (February 2015-February 2016) (Kanter et al. 2019)	90% of all chocolates and cookie products 40-50% of all 8 thousands products produced by AB Group companies (Aguirre 2016)
First Stage June 2016	Maximum Limit allowed without a label for each 100 g of food: Calories 350 kcal, Sodium 800 mg, Saturated Fat 6 g, Sugar 22.5 g	Reformulation of critical nutrients in almost 20% of the products (MINSAL, 2016)	60% of all packaged goods (Leiva 2018) After the first month of implementation, At least 70% of processed foods (Herrera 2016)
Second Stage June 2018	Maximum Limit allowed without a label for each 100 g of food: Calories 300 Kcal, Sodium 500 mg, Saturated Fat 5 g, Sugar 15 g	The industry says: It is not possible to continue reformulating. (Bio Bio, 2018)	80% of products are predicted to display the labels in 2018 during the second stage (Leiva 2018) At least 10% of all food products that did not have warning labels in the First Stage are predicted to display the labels (24Horas 2018).
Third Stage June 2019	Maximum Limit allowed without a label for each 100 g of food: Calories 275 Kcal, Sodium 400 mg, Saturated Fat 4 g, Sugar 10 g	-	It is predicted that 90% of all food products of some food companies (Vega 2018)

Note: The Chilean Law on Food Labeling and Advertising was known since 2012.

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