Food and Agriculture Organization of the United Nations

UNIVERSIDAD DE CHILE
Instituto de Nutrición y Tecnología de los Alimentos
Doctor Fernando Monckeberg Barros

THE IMPACT OF THE CHILEAN LAW ON FOOD LABELLING ON THE FOOD PRODUCTION SECTOR

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Dr. Camila Corvalán, INTA, Universidad de Chile

Prof. Teresa Correa, School of Communications, Universidad Diego Portales

Dr. Marcela Reyes, INTA, Universidad de Chile

Prof. Guillermo Paraje, Business School, Universidad Adolfo Ibáñez

Food and Agriculture Organization of the United Nations (FAO)
and Institute of Nutrition and Food Technology of the Universidad de Chile (INTA)
Santiago, 2021

Required citation:

Corvalán, C., Correa, T., Reyes, M. and Paraje, G. 2021 *The impact of the Chilean law on food labelling on the food production sector*. Santiago, FAO and INTA. https://doi.org/10.4060/cb3298en]

ISBN 978-92-5-134389-0 [FAO]

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EXECUTIVE SUMMARY

"Healthy eating has few benefits from the business or productive perspective. That is why this aspect must definitely come from the administration's conviction. Because if tomorrow they tell us that we have to stop using sugar or salt, fat or whatever, it really forces a company to make transformation decisions; and since there is a lack of knowledge, you have to implement new things, buy new technologies mean a whole reinvestment process without the certainty that the final product will be appreciated. So, it's a step ahead of pure conviction, but one that we, the leading food companies, have to take. Beyond the laws, this is a value issue, not a legal one, because the health of our families is at stake".

Manager, Multinational, Food Sector

Chile is one of the countries with the highest levels of overweight in the world, both in the adult population (74.2 percent in 2016) and in children (50.2 percent at school entrance – 6-7 years – in 2019). These figures are the result of a series of changes in recent decades in the diet and physical activity patterns of Chileans that have led to the fact that, for example, today almost a third of the energy consumed by Chileans comes from highly processed foods – the so-called ultra-processed foods. Given the evidence that shows that interventions focused on people's environments – that is, food environments – are more likely to improve the diet of the population than interventions focused only on the behaviour of individuals, Chile implemented in June 2016 the Law No. 20.606 on Nutritional Composition of Food and its advertising (hereinafter "Law on Food Labelling") (Hawkes *et al*., 2015; Roberto *et al*., 2015; Swinburn *et al*., 2011). This law requires the use of "ALTO EN" ("high in") warning labels (similar to a stop disc) on foods that are high in sugar, sodium, saturated fat or energy, which makes it easier to identify these products. Besides, products with these labels cannot be sold in schools, cannot be advertised in mass media at peak times for children, cannot contain toys or figures that attract minors, and a number of other restrictions to prohibit their promotion to children under 14 (Corvalán, Reyes, Garmendia *et al*., 2019).

The desired outcome of such a policy is to transform food environments to make them healthier, and to influence people's behaviour by discouraging the purchase and consumption of unhealthy food. However, it is understood that these changes in people's behaviour can also affect the food production sector (World Cancer Research Fund International, 2019). The food industry in Chile played a very active role during the period of discussion and implementation of the law, generally being against the measure. However, at the time of its implementation, the industry complied properly with the regulation regarding the use of labels (Ministry of Health of Chile, 2017b). Information on the initial stage also shows that the food industry responded by reformulating some food products and innovating in the generation of new products (Reyes, Smith Taillie, Popkin *et al*., 2020). Additionally, we know that a sector of the food industry made adjustments to its marketing strategies following the start of the use of warning labels (Correa, *et al*., 2020; Mediano Stoltze *et al*., 2019). Finally, an area of concern for different actors has been to understand how these possible changes could affect the resources and production factors destined to the production process of these foods, becoming unemployed or underutilised (Paraje, Colchero, and Popkin, 2021).

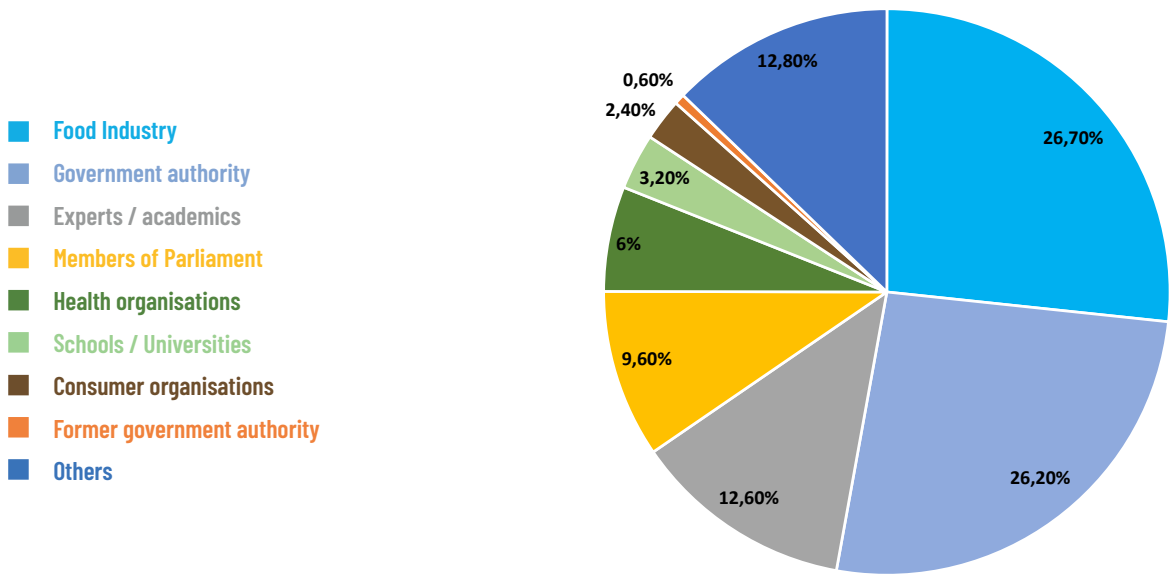
Given the relevance of these aspects to fully understand the scope of this public policy, ***this report evaluates four aspects of the response of the food production sector in Chile in relation to the implementation of the first phase of the Law on Food Labelling: attitudes of main actors in the food sector (through analysis of speeches and semi-structured interviews with key actors), food reformulation, use of labels as a marketing strategy, and impact on real variables of the manufacturing and commercial sector.*** This information is an additional input to the discussion of the impact of the Law on Food Labelling, which has eminently a health objective based on the growing figures of obesity and diet-related diseases observed in the Chilean population.

Main speeches associated with the implementation of the Law on Food Labelling

A qualitative and quantitative content analysis of the national media in Chile was conducted, including television, radio, newspapers, magazines and online media. For the selection of the news sample, the NexNews press clipping service was used; this service has a news search engine from 2007 to date in the main media of the country. Five key periods of six months each were identified since the beginning of the discussion of the Law on Food Labelling: (1) initial period of discussion of the regulation in Congress: March-August 2007; (2) approval and promulgation of the regulation: April-September 2012; (3) pre-implementation of the first phase of the regulation: January-June 2016; (4) post-implementation of the first phase of the regulation: July-December 2016; (5) implementation of the second phase of the law: April-September 2018. All press releases were analysed by five coders with experience in content analysis. The five main sources or spokespersons and their positions were identified along with their main frameworks or speeches. For each release, identification variables were analysed, such as date, medium, type of release (interview, documentary, editorial, column, letter), length (number of paragraphs for written releases and number of seconds for audiovisual).

The Law on Food Labelling was mainly covered by newspapers (51.7 percent) and secondly by television (18.1 percent) and online portals (17.8 percent). Three quarters of the coverage (75.9 percent) was through newspaper articles, and interviews were much less frequent (10.9 percent), as well as columns or letters to the editor (8.0 percent). Half of PR communications in the media were led by the food industry (26.7 percent) and government authorities (26.2 percent); less important were experts/academics (12.6 percent), parliamentarians (9.6 percent) and health organisations (6.0 percent).

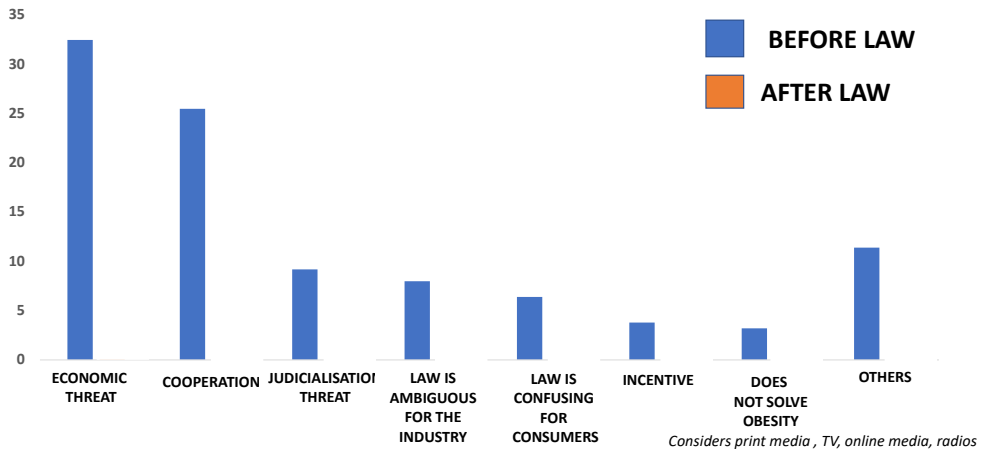
Figure 1. Origin of communications appearing in the media (print media, television, online, radio) talking about the Chilean Law on Food Labelling in the five study periods, according to communication source (Total spokespersons (N = 2 964))



Source: Elaborated by the authors.

Analysis of the food industry discourse before and after the Law on Food Labelling came into force shows that negative discourse decreased – for instance, that the law was an economic threat (from 32.5 percent to 9.7 percent), or that it was ambiguous for the industry (from 8.0 percent to 1.7 percent); so did the cases that were prosecuted or under threat of lawsuit (from 9.2 percent to 3.3 percent). In contrast, most positive speeches increased, for example about the industry's effort to cooperate with the law and new standards (from 25.5 percent to 29.6 percent), or highlighting that it was an incentive for innovation (from 3.8 percent to 11.8 percent). An exception to this pattern was an increase in the discourse that the law was confusing for consumers (from 6.4 percent to 16.4 percent).

Figure 2. Pre- and post-implementation discourses of the food industry on the Chilean Law on Food Labelling



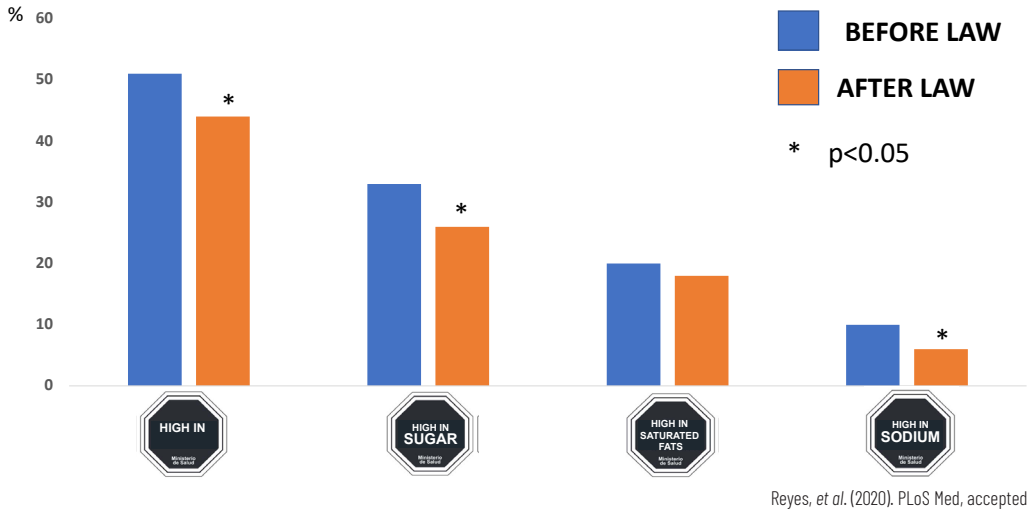
Source: Elaborated by the authors.

Reformulation of packaged food

To analyse food reformulation, a sample of 1915 foods was used for which information on nutritional content was available before the implementation of the law (years 2015 and 2016) and after the implementation of the first phase of the law (2017). Foods and beverages were assigned to each of the 16 categories that were mutually exclusive: beverages, milk and dairy beverages, yogurts, breakfast cereals, sweet baked goods, desserts and ice cream, sweets, sweet spreads, salted baked products, salted snacks, salted spreads, cheeses, ready-to-eat dishes, cold meat, processed meat other than cold meat, and soups. Foods and beverages were classified as high in calories, sodium, total sugar or saturated fats, according to the guidelines established in the first phase of the law. For the total sample and each of the 16 food categories, the proportion of "high in" energy and each of the critical nutrients, as well as the proportion of products with at least one "high in" were estimated and compared between the pre- and post-implementation periods (McNemar test). The proportion of reformulated products was estimated considering as a denominator those "high in" in the pre-implementation period.

This study identified 276 products (15 percent of the total sample) which were reformulated (namely, they were classified as "high in" in the pre-implementation period, but changed that condition in the post-implementation period), showing statistically significant changes. The 7 percent proportion of products that should have been labelled "high in sugar" according to their nutrient declaration in the pre-implementation period were reformulated, as were the 5 percent of foods that would be classified as "high in sodium" (both statistically significant). On the other hand, the 3 percent proportion of foods and beverages that would be classified as "high in saturated fats" and the 2 percent of those that would be classified as "high in energy" were reformulated, without reaching statistical significance.

Figure 3. Food reformulation, according to type of warning label



Source: Elaborated by the authors.

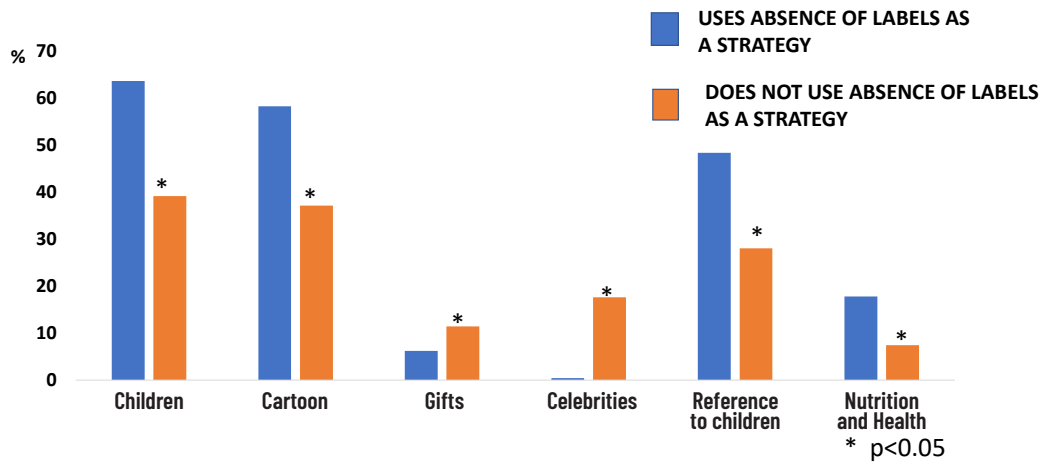
The proportion of 'high in sugar' products decreased significantly in beverages, milk and dairy beverages, breakfast cereals, desserts and ice cream, and sweet spreads. The proportion of "high in sodium" foods also fell significantly among salty spreads, cheese and cold meat categories. In the case of saturated fats, the proportion of "high in" decreased significantly between sweets and candies, and salted spreads, reaching the limit of significance for salty baked products. The proportion of "high in calories" decreased significantly only in breakfast cereals and salted spreads. Except for the categories of sweets and candies, sweet spreads and salty baked products, in the 13 other categories reformulated foods accounted for more than 33 percent of sales in their category.

Marketing analysis

This study uses information from a content analysis of television advertising (eight broadcast and cable channels over two months). During the year following the implementation of the law (April-May 2017), eight specially trained coders analysed 5 609 food and beverage advertisements, and coded according to a code book. Foods using marketing strategies associated with the absence of a label (by product and company) were identified, and the type of strategies used was compared according to the use of labels. All analyses were performed with Stata 15.0, considering a significant value of $p<0.05$.

From this analysis, it can be seen that 18.8 percent (n=1 056) of the total food and beverage advertisements used marketing strategies associated with the absence of labels to advertise that their products did not have labels or had fewer labels than those of the competition, or mentioned that they did not include any of the critical ingredients regulated by the law. Advertisements using the absence of a label as a marketing strategy highlighted nutrition/health and weight management ideas significantly more (17.8 percent vs 7.4 percent, $p < .001$) than those not using the new law as a strategy. Likewise, those using the law as advertising also had a higher proportion of strategies dedicated to children. For example, they included more children (63.6 percent vs 39.1 percent, $p < .001$), animated characters (58.2 percent vs 37.1 percent, $p < .001$) and references to children (48.3 percent vs 28.0 percent, $p < .001$).

Figure 4. Food and beverage marketing strategies, according to the absence of label as promotional strategy



Source: Elaborated by the authors with advertising data from eight open and cable television channels between April and May 2017.

Analysis of real food market variables

This section analyses data from three database sources using the Comparative Interrupted Time Series technique (CITS). The first source of data is the new National Employment Survey (NENE, by its acronym in Spanish – formerly ENE) which is representative of households residing in private homes in urban and rural areas throughout the country. The total sample is distributed over a quarterly period, divided into three sub-samples of roughly similar size, each systematically allocated to one of the three months of the quarter analysed. Economic activities are grouped according to the International Standard Industrial Classification of all economic activities ISIC Revision 4 (UN, 2009). Section C for manufacturing and section G for wholesale and retail trade were used for this analysis. The variable "employed" is studied, defined as all persons of working age who, during the reference week, worked at least one hour, receiving payment in cash or in kind, or an employee/employer or self-employed benefit.

In the CTSI regression, the logarithm of employment is used as a dependent variable; manufacturing industry as control variable; real estate and professional, scientific and technical activities are considered as treatment variable. The independent variables are the logarithm of the quarterly moving average (same months as for the dependent variable) of the non-mining Monthly Index of Economic Activity (IMACEC, by its acronym in Spanish). This variable aims to capture general trends in the non-mining economy. Besides, monthly dichotomous variables are used for seasonal adjustment, as well as a dichotomous variable that is equal to one from October 2014, when the tax on soft drinks was (moderately) increased.

The analyses show that the different phases of labelling had no effect on the evolution of employment (level and trend) in the manufacturing industry when compared to a group not subject to front-of-package food labelling: both groups behaved in the same way (non-significant slopes of treatment and control group, between adjacent periods). Given the quasi-experimental nature of the CITS method, it is possible to say that front-of-package food labelling did not cause changes in manufacturing sector´s employment, given the behaviour it had in other sectors of the economy. Given the lack of data disaggregation, we cannot state that front-of-package food labelling did not generate job losses in specific manufacturing sectors. But, if those changes existed, they were compensated by other sectors of the manufacturing sector, so that the aggregate analysis showed no significant variations.

The second source of data is the Index of Manufacturing Production (IPMan) which aims to estimate the monthly evolution of the production volume of the industrial manufacturing activity (companies and/or manufacturing establishments with ten workers or more, located in the national territory). This analysis uses the physical quantity produced of food and beverages.

The CITS regression uses as a dependent variable the logarithm of the IPMan for food and beverages, in the case of the treatment group; and the natural IPMan logarithm for the rest of the manufacturing sectors, in the case of the control group. The logarithm of the non-mining monthly IMACEC is used as independent variable. This variable aims to capture general trends in the non-mining economy that could affect the entire manufacturing sector. Additionally, monthly dichotomous variables are used for seasonal adjustment, as well as a dichotomous variable that is equal to one from October 2014, when the tax on non-alcoholic beverages was (moderately) increased.

The analyses show that there is no change in trends in the treatment and control group between adjacent periods. However, it is observed that physical production would have grown less in the food industry than in the rest of the industry after the second and third phases of the law. This would suggest that the implementation of the more advanced stages of the Law on Food Labelling would have generated a decrease in the purchase of certain foods and beverages (presumably the labelled ones, although this index does not allow to establish it) that was not compensated by the rest of the sector (presumably, non-labelled foods and beverages). However, it is also possible to argue that the adjustment in physical production, after a change in regulation such as the one discussed here, is not immediate (some inventories may build up as a result of uncertainty about how the regulation will affect demand). When we assume a scenario in which companies began to feel the effects of the law two or three months after its implementation, we observe that the differences in growth between the food and beverage sector and the control group disappear.

The third database we use in the analyses is called employee-employer of the Chilean tax service (SII, by its acronym in Spanish) and has been constructed from monthly tax records of the SII from 2013 to 2017, connecting companies to the formal salaried workers they hire, in terms of number, net salary and data from the Chilean civil registration department that provide date of birth and age of the workers reported. Interrupted time series analyses are carried out. The treatment or treated group refers to industries or industrial sectors that the front-of-package food labelling or treatment could have directly affected; the control group refers to industries or industrial sectors that the treatment would not have directly affected.

The first analysis is done with investment expenditure (capital goods) using as interest groups the food and beverage industries subjects to regulation, and as a control group the food and beverage industries probably not subject to regulation. Thus, in all cases, the dependent variable will be the logarithm of actual monthly investment expenditure, in billions of Chilean pesos as of December 2013 (deflated with the National Statistics Institute's consumer price index). The independent variables will be, in all cases: the monthly non-mining IMACEC logarithm; the monthly dichotomous variables for seasonal adjustment; a dichotomous variable that is equal to one as of October 2014, when the tax on soft drinks was (moderately) increased; and a dichotomous variable that is equal to one in July 2015 (due to unusually low values in the variables of interest).

The CITS results show that actual monthly expenditures have a similar behaviour (in terms of level and trend) between the treatment group and the control group (food and beverages probably not affected by treatment), suggesting that the implementation of the Law on Food Labelling had no influence on investment spending in sectors with companies potentially affected by treatment.

To verify the above result, the food and beverage industry is taken as the treatment group (regardless of whether or not its actors were affected by the front-of-package food labelling) and the rest of the non-metallic industry as the control group, with similar results to those already described.

Finally, the analyses are repeated considering as a treatment group the entire non-metallic manufacturing industry and as a control group, the metallic manufacturing industry. This analysis seeks to isolate any effects that might have affected the non-metallic industry as a whole, given the importance of the food and beverage industry within the non-metallic industry. Again, the results show that there are no significant differences, in level and trend, between the treated and control groups. This reinforces the idea that there was no decrease in real investment expenditure in the food and beverage industry after the implementation of the Law on Food Labelling or, in the most negative scenario, if there was a decrease, this was compensated by the increase in investment expenditure in other sectors of the non-metallic industry.

This study led us to conclude that after the implementation of the Chilean Law on Food Labelling, the food industry positively changed its discourse regarding regulation, improved the quality of the food supply, mainly by decreasing the sugar and sodium content, and used the presence of a healthier product portfolio as a strategy to promote its products. Besides, we observed that in aggregate terms, there was no impact on jobs, wages and physical production in the food production sector. Finally, we think it is relevant to clarify that health promotion policies have health objectives and therefore, the collection of information regarding the response of the food industry should be considered an additional, but secondary, argument in the enactment of these policies. Robust evidence demonstrates the cost-effectiveness of implementing actions at the level of food environments in the prevention of obesity and its associated diseases, in countries with a variety of political and economic contexts.

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1 INTRODUCTION

Excess weight (overweight and obesity) is the main cause of death, illness and disability in Chile. According to the National Health Survey held in 2016-2017, the total country prevalence of malnutrition due to excess (population >15 years) is 74.2 percent (39.8 percent overweight and 34.4 percent obese), with higher prevalence in women (74.8 percent vs 73.6 percent in men) and people with lower educational levels (80.4 percent in people with < 8 years of education vs 71 percent in people with 12 or more years of education) (Chilean Ministry of Health, 2017a). In the case of children, we observe that when entering school (primary education year 1-2) overweight affects 50.9 percent of children in public schools (26.1 percent overweight and 24.8 percent obese), with rural communes (56.0 percent - vs 52 percent in urban communes) and those of lower socioeconomic level being the most affected – for example, in 2019, children from the first quintile are 38.0 percent more likely to be obese than those from the fifth quintile (Junta Nacional de Auxilio Escolar y Becas, 2019). This places Chile as the country with the highest prevalence of adult obesity in the OECD, and with a rate of overweight and obesity in children that is considerably higher than the OECD average (25 percent) (Chilean Ministry of Health, 2019a).

This nutritional situation is the result of a series of changes in diet and physical activity that the Chilean population has experienced in recent decades. Analyses based on the National Food Consumption Survey (ENCA, by its acronym in Spanish) 2010-2011, show that almost 30 percent of energy consumed by Chileans comes from highly processed foods, the so-called ultra-processed foods (Ministry of Health of Chile, 2011). The excess consumption of these foods in Chile is associated with a lower-quality diet, increasing the probability of exceeding the recommendations for intake of sugar, saturated fats and energy (Cediel *et al.* , 2017). In Chile, these ultra-processed foods with higher contents of sugar, fats and

sodium are heavily promoted on TV, and especially targeted at children (Correa, Reyes, Smith Taillie *et al.*, 2019). As a result, many of these foods are consumed by children in the form of snacks (Jensen, Corvalán, Reyes *et al.*, 2019), with foods consumed outside the home being higher in energy and sugar (Rebolledo, Reyes, Corvalán *et al.*, 2019) than foods consumed inside the home.

For several decades now, Chile has implemented a series of measures to try to tackle this epidemic; however, these actions have had limited impact, and the figures of obesity progressively increased. One of the explanations for the lack of effectiveness of the implemented actions is that these were mainly based on behaviour change at the individual level, which today we know has little impact if it is not accompanied by measures aimed at modifying the environment in which people make food decisions (Corvalán, Reyes, Garmendia *et al.*, 2013). As a way to move forward with these types of measures that promote healthier food environments, in June 2016, Chile implemented a package of prevention actions grouped under the Law on Food Labelling. The most visible action in this package of actions is the incorporation of the use of "ALTO EN" ("high in") warning labels (similar to a stop disc), which allow to quickly distinguish based on simple and visible information the less healthy foods. The presence of one or more warning labels on a product indicates that it has levels above the limits set by the Ministry of Health for sodium, sugar, saturated fats or calories. Besides, the presence of these stamps entails a number of restrictions on the advertising and marketing of these foods. For example, they cannot be sold in schools, they cannot be advertised in the mass media during the hours of highest child presence, they cannot contain toys or figures that attract minors, etc. The law was implemented in phases, culminating in its full implementation in June 2019 (for details of dates and deadlines for each phase, see Annex 1) (Corvalán, Reyes, Garmendia *et al.*, 2019).

The desired outcome of such a policy is to transform food environments to make them healthier and to influence people's behaviour by discouraging the purchase and consumption of unhealthy food. In turn, it is understood that these changes in people's behaviour can also affect the food production sector (World Cancer Research Fund International, 2019).

In this sense, preliminary information has indicated that the food industry correctly implemented the warning labels and additionally, reformulated a series of foods, observing significant decreases in the average sugar content in best-selling beverages, dairy and breakfast cereals (between 20 percent and 35 percent of the initial content) along with reductions in the sodium content of best-selling dressings, cheeses and cold meats (between 5 and 15 percent of the initial content) (Reyes, Smith Taillie, Popkin *et al.*, 2020). Additionally, it has been suggested that the industry has increased the supply of non-regulated products (innovation). Initial reports have also indicated a decrease in the promotion of labelled foods to children both on television and on packaging. However, it is also observed that around 30 percent of food companies that promote products on open and closed television use the presence/absence of a warning label as a promotional strategy. A more detailed analysis of these changes is relevant in order to better understand the industry's response to the implementation of the Law on Food Labelling. Finally, it could happen that, to the extent that people change their eating habits, the resources and factors of production destined to the production process of these foods become unemployed or underutilised.

This report aims to evaluate four aspects of the response of the food production sector in Chile in relation to the implementation of the Law on Food Labelling: attitudes of main actors in the food sector (through analysis of speeches and semi-structured interviews with key actors), food reformulation, use of labels as a marketing strategy, and impact on real variables of the manufacturing and commercial sector. This information is an additional input to the discussion of the impact of the Law on Food Labelling, which has eminently a health objective that is supported by the growing figures of obesity and diet-related diseases observed in the Chilean population.

2 OBJECTIVES

After the implementation of the first phase (June 2016) of the Chilean Law on Food Labelling, the objectives are the following:

1) Characterise the food industry in Chile.
2) Study the main PR communications, frames and speeches promoted by actors related to the food industry, in relation to the implementation of the Law on Food Labelling.
3) Evaluate the reformulation of packaged food products, in terms of energy and critical nutrients (sugar, saturated fats and sodium), according to food category.
4) Evaluate the use of warning labels as a food and beverage marketing strategy, considering advertising strategies used and impact on reformulation.
5) Quantify the impact of the implementation of the first phase of the Law on Food Labelling, on real variables of the manufacturing and commercial sector (wholesale and retail) such as employment, usual hours worked, real wages, physical production, gross value of production, inputs and raw materials, average company size, investment, etc.
6) Explore attitudes and perceptions of the impact of the Law on the food production sector in Chile through semi-directed interviews with key actors in the sector

3 METHODOLOGY

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Objective 1:
Characterisation of the food industry in the Chilean market

The local information was obtained by considering the companies that represent more than 1 percent of the sales of their respective food group (national sales reported by Euromonitor International, from 2015 to 2017) according to the Euromonitor database. The food groups used for the market relevance analysis correspond to those used in the reformulation analysis (Annex 2). The links between brands and companies were obtained from (i) Euromonitor database, (ii) local websites of each company/brand with domain in Chile (.cl); (iii) websites of the main supermarkets in the country (Jumbo and Líder); (iv) websites of candy and chocolate shops (for example, thecandyland.cl); and (v) websites of food distributors. The companies that were relevant in the local market were categorised into one of the following groups: the ten largest food companies (OXFAM, 2013), international companies, or national companies (even if they had an international presence).

Objective 2:
Study of frameworks and discourses of the food industry in relation to the implementation of the first phase of the law on food labelling

Design: We conducted a qualitative and quantitative content analysis of the national media in Chile, which includes television, radio, newspapers, magazines and online media (see Annex 2 for a list of media).

Sample: for the selection of the news sample, we used the news clipping service NexNews, which has a news search engine from 2007 to date in the main national media. Five key periods of six months each were identified since the beginning of the discussion of the Law on Food Labelling:
(1) initial period of the regulation discussion in the Congress: March-August 2007;
(2) approval and promulgation of the regulation: April-September 2012;
(3) pre-implementation of the first phase of the regulation: January-June 2016;
(4) post-implementation of the first phase of the regulation: July-December 2016;
(5) implementation of the second phase of the Law: April-September 2018.

During the mentioned periods, the following search terms were used to identify news related to the Law on Food Labelling. These search terms include the various way the press has referred to the law since its inception: "*Ley Superocho*" (Superocho Law), "*Ley Super ocho*" (Super ocho Law), "*Ley Super 8*" (Super 8 Law), "*Ley semáforo*" (Stop-light Law), "*Rotulación alimentos*" (Food labelling), "*rotulación alimentaria*" (food labelling), "*rotulado alimentos*" (food labels), "*rotulado alimento*" (food label), "*ley de alimento*" (law on food), "*ley de alimentos*" (law on foods), "*ley de etiquetado*" (law on labelling), "*sello + alimento*" (label + food). After cleaning up the base and excluding releases that were not related to the law, a total of 1 295 news items were obtained, which were distributed as follows:

- 2007: 16 (1,2 percent)
- 2012: 126 (9,7 percent)
- 2016 pre-regulation: 351 (27.1 percent)
- 2016 post-regulation:560 (43.2 percent)
- 2018: 242 (18,7 percent)

Information Analysis: the total number of releases was analysed by five coders (graduate journalists with experience in content analysis) who received three training sessions. After a qualitative analysis conducted to identify the main sources (or spokespersons) during the discussion and implementation of the law, a code book was created. The unit of analysis was the news. For each release, identification variables were analysed, such as date, medium (see list in Annex 2), type of release (interview, documentary, editorial, column, letter), length (number of paragraphs for written releases and number of seconds for audiovisual). Besides, the five main sources or spokespersons and their positions were identified. For each source, the main frameworks or speeches were codified (for example, "law does not help to combat obesity and change habits", "nanny state"[1], "attacks the freedom of the consumer", "lacks evidence of effectiveness", "is an economic threat to the industry", "is ambiguous", "the accent should be on education and not on prohibition", "attacks on intellectual property", "the industry cooperates", "evidence proves the effectiveness of the law", "the industry as a lobbyist", "Chile positions itself internationally", "the industry does not look after the health of children"). After the pilot and modification to the code book, adequate levels of inter-coder reliability were achieved.

[1] The concept of the "nanny state" is often used in a pejorative way, referring to actions that governments take to influence and monitor the choices of their citizens, such as regulations or legislation, since they could limit the freedom of action of both individuals and industries. According to some interpretations, such measures transform the state into an overprotective nanny that treats citizens as if they were children in a nursery. This term is often used in policy discussions related to tobacco, alcohol and food consumption, where the interests of governments to protect the welfare of the population, and the interests of corporations to sell their products, get tense (Moens and Sharma, 2015; Moore, Yeatman, and Davey, 2015).

Objective 3:
Analysis of food reformulation in relation to the implementation of the first phase of the law on food labelling

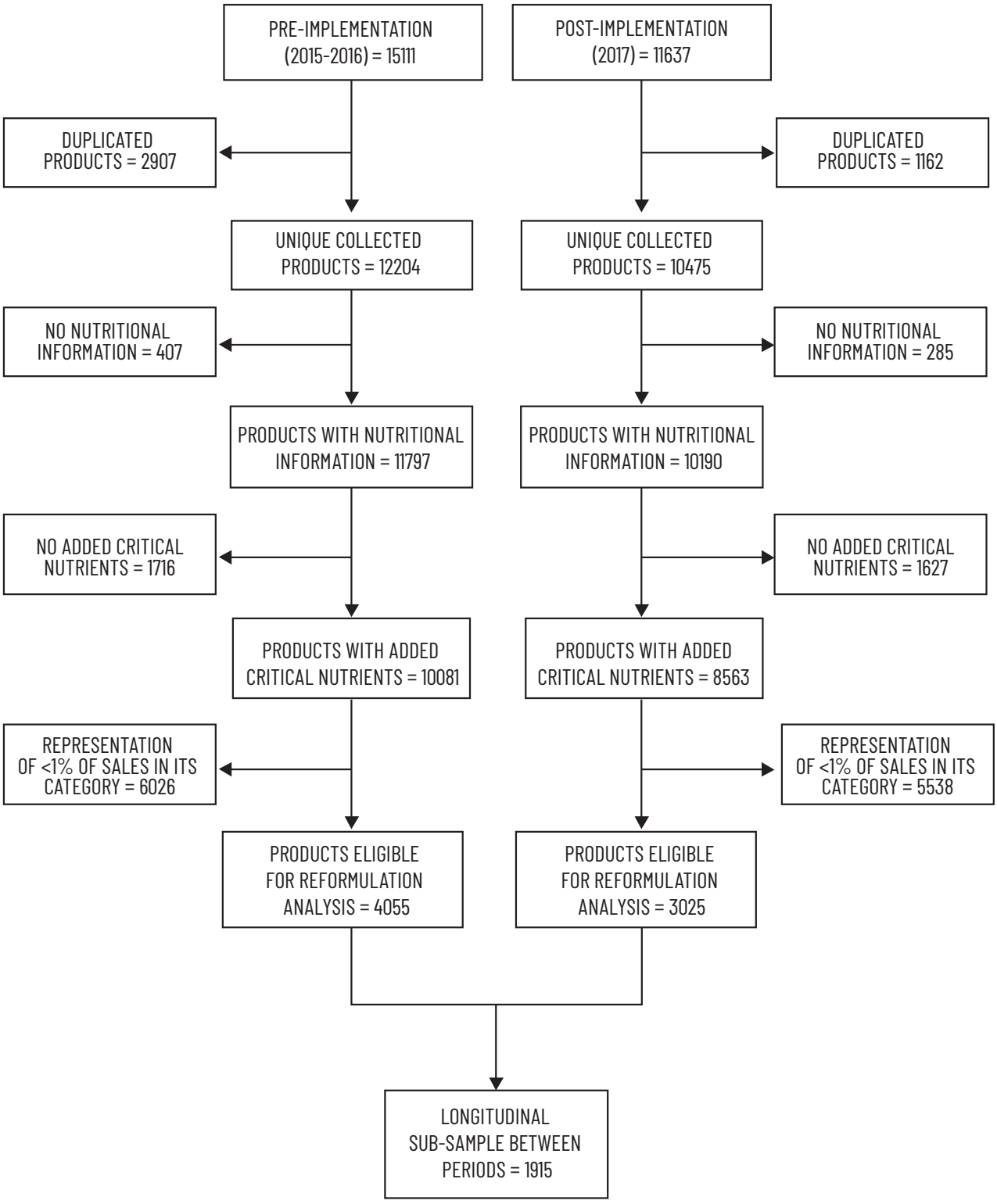
Design: longitudinal observational study, namely monitoring products from the period prior to the implementation of Law 20.606 to the period after the implementation of the first phase.

Sample: packaged food available in January-February 2015, 2016 and 2017 in six stores of the main supermarket chains and three candy distributors, located in the high-income neighbourhoods of Santiago, Chile. Where the same product had different pack sizes available, only the largest pack size was photographed. Photographs were taken of all sides of the packaging. The photographs were collected as part of an agreement with the Chilean National Association of Supermarkets (ASACH, by its acronym in Spanish). The methodological details of the photo collection have been published previously (Kanter, Reyes, and Corvalán, 2017).

Collection of nutritional information from foods: trained nutritionists reviewed photographs and scanned general information to identify the product (bar code, brand, taste, manufacturer, among others), list of ingredients, nutritional information (energy, protein, carbohydrate, total sugar, total fat, fat subtypes when declared, and sodium content) per 100g or 100ml, and instructions to reconstitute the product when necessary (for example, for milk powder). Non-quantitative ingredient declaration is mandatory in Chile, as well as the declaration of energy, macronutrient (including total sugar and fat subtypes when the total fat content is higher than 3g/portion) and sodium content, both per portion and per 100g or 100ml (Ministry of Health, Chile, 2019b). In total, 26 748 products were photographed during the three years of data collection; these products account for 95 percent of the food purchased by urban households nationally (Reyes, Smith Taillie, Popkin *et al*., 2020).

Data processing for the analysis: data collected in 2015 and 2016 (N=15 111) were compiled to conform the pre-implementation sample; both years are taken into account jointly since the comparison of the nutritional information collected in 2015 and 2016 does not show relevant differences to propose an important proactive reformulation (Kanter, Reyes, Vandevijvere *et al*., 2019). The products that were in more than one occasion in the sample of the pre-implementation period (N=2 907) were identified programmatically (by bar code or fantasy name), leaving aside the most recently collected (year 2016). In the post-implementation sample (N=11 637) collected in 2017, duplicate products were also identified and eliminated (N=1 162). Then, the following products were excluded: products that did not have ingredient or nutrient declaration information (N=407 in the pre-implementation period, N=285 in the post-implementation period), those that were not within the scope of the law (for instance, had no added ingredients that increased the levels of sodium, sugar or saturated or other fats as defined in the Food Health Regulation (RSA, by its acronym in Spanish) (N=1 716 in the pre-implementation period, N=1 627 in the post-implementation period) or representing less than 1 percent of sales of their respective food category (see below) (N=6 026 in the pre-implementation period, N=5 538 in the post-implementation period). The final sample consisted of 1 915 products present in the pre- and post-implementation sample of the first phase of the Law. This sample flow is shown in Figure 5 below:

Figure 5. Sample flow for food reformulation analysis in relation to the implementation of the first phase of the Law on Food Labelling



Source: Elaborated by the authors.

Based on the declaration of ingredients, the declared content of energy and critical nutrients as well as the limits defined in the first phase of implementation of Law 20.606, foods and beverages were classified as high in calories, sodium, total sugar or saturated fats as appropriate. In line with the RSA (Ministry of Health, 2019b), limits for solids were applied to foods labelled in grammes, and limits for liquids to foods and beverages labelled in millilitres. For foods and beverages sold in concentrate or powder form, the energy and critical nutrient content was calculated after following the reconstitution instructions described on the package. Thus, foods and beverages were classified as "high in energy", "high in saturated fat", "high in sugar", "high in sodium" and "at least one high in", according to the new regulation. Subsequently, reformulated products defined as those classified as "high in" in the pre-implementation period, but which lost this condition in the post-implementation period, were identified. This was also done for the condition of "at least one high in".

Food category: foods and beverages were assigned to each of 16 categories that were mutually exclusive: drinkables, milk and dairy beverages, yoghurts, breakfast cereals, sweet baked goods, desserts and ice cream, sweets, sweet spreads, salty baked goods, salty snacks, salty spreads, cheeses, ready-to-eat dishes, cold meats, processed meat other than cold meat, and soups. Details of the products included in each of these categories are presented in Annex 3.

Relevant market information: based on the sales information reported by Euromonitor, the proportion of sales by food/drink category (considering cold meat and meat products together) was calculated. The analytical sample included only products that represented at least 1 percent of their respective category. The Euromonitor groups are not the same as those used in this report, so the foods were reclassified for this analysis.

Statistical analysis: all analyses were carried out for the total sample and each of the 16 food categories. The proportion of "high in" energy and each of the critical nutrients, as well as the proportion of products with at least one "high in" were estimated and compared between the pre- and post-implementation periods using the McNemar test. The proportion of reformulated products was estimated considering as a denominator the "high in" products in the pre-implementation period. The energy and critical nutrient contents were compared between the pre- and post-implementation periods through multilevel quantum regression models, in which the quartiles of energy and nutrients are considered the dependent variables and the evaluation period (pre-post) is considered the independent variable. In this analysis, food categories are assumed to be fixed effects. The medians and confidence intervals (95 percent) derived from the respective models are presented. The analyses were performed with Stata 15.0 and the statistical program R, considering a value of $p<0.05$ as significant.

Confidentiality of data: by virtue of the agreements signed with ASACH, we cannot reveal names of products or manufacturing companies. So, the data will be presented anonymously, only incorporating general information that allows for their appropriate interpretation.

Objective 4: Food marketing analysis in relation to the implementation of the first phase of the law on food labelling

Design: This study uses information from a content analysis of television advertising before the implementation of the law (April-May 2016) and the year after the implementation of the law (April-May 2017). Details of this content analysis have been published previously (Reyes *et al.*, 2020; Mediano Stolze *et al.*, 2019). Advertisements related to the food industry that appear for 18 hours a day (from 6:00 to 24:00) on eight television channels during two months are coded. Based on audience data from Kantar Ibope Media, the four main open and national television channels are selected (Canal 13, TVN, Mega, and Chilevisión) and four cable channels with the highest child (4-12 years) and adolescent (13-17 years) audience (Disney, Cartoon Network, Discovery Kids and Fox). The National Television Council (CNTV, by its acronym in Spanish) made the recordings and gave them to the group of researchers in the framework of a collaboration agreement.

Sampling: Following the sampling standards of media content analyses (Riffe, Aust, and Lacy, 1993), this study used a stratified two-week random sample constructed over each two-month period (April-May, 2016 and April-May, 2017). Thus, the period includes two Mondays, two Tuesdays, two Wednesdays, two Thursdays, two Fridays, two Saturdays and two Sundays. As the media content changes throughout the week, the aim of this method is to represent this diversity. A team of eight coders in 2016 and seven coders in 2017 (six of the seven also coded in 2016) analysed the food advertisements, and the measurement instrument – code book –achieved adequate levels of intercoder reliability (Dillman Carpentier, Correa, Reyes, *et al.*, 2020).

Since the use of labels or the decrease in the use of labels as a marketing strategy began to appear on television in response to the implementation of the law, the analyses will focus on the advertisements that were codified in April-May 2017 (post-implementation). The food advertising database that was analysed has a sample of 5 609 advertisements in 2017. These include advertisements which feature food and/or drink. Advertisements for alcohol, infant formula and food supplements were excluded. The coded information includes: day and programme during which the spot was released, marketing strategies and specific product and/or brand advertised. Marketing strategies coded in a dichotomous way (1 = yes; 0 = no) include strategies targeting children: "inclusion of children" (presence of children, children voice or singing), "animated characters" (cartoon or animated character, licensing character, animated animal), gifts/incentives (gifts, competitions, interactive games), celebrities (celebrities or sportsmen), references to children (presence of toys, children's games, schools, playgrounds). A strategy calling for "nutrition, health or weight management" was codified as well. The code book also codified the use of labels as a marketing strategy. Five dichotomous variables were coded (1 = yes; 0 = no): "absence or decrease of labels for a specific product," "absence or decrease of labels for a product line of that brand," "absence or decrease of the entire brand," "absence or decrease compared to the competition," and "mention of attributes referring to law regulation and labels without being explicit" (for example, no added sugar). These five variables were combined into one: "use of labels". The product name and brand were an open question and up to four products were described in each advertisement. These were then classified.

Data processing (Identification of products that used promotional strategies associated with the label): Given that many companies in the food industry reacted to the law by incorporating elements of regulation into their marketing strategies – such as the absence of labels or regulated ingredients, the objective is to analyse which companies reacted to the law by incorporating this type of marketing strategy and which did not. To do this, the question "specific product or brand" was processed and tabulated, the frequencies of the four products that were coded in each commercial were added up, and a total proportion of each brand that used the label strategy was calculated.

Statistical analysis: Descriptive analyses (by product and by company) and bivariate analyses (chi-square and Mc Nemar test) are presented, to compare marketing strategies aimed at children that are used in advertising according to the use of labels. All analyses were performed with Stata 15.0, considering a significant value of $p<0.05$.

Objective 5: Impact analysis of the application of the Law on Food Labelling on real variables in the manufacturing sector

I. Available data:

1. National Employment Survey (ENE) or New National Employment Survey (NENE)

The National Employment Survey characterises and quantifies the population aged 15 and over concerning their situation in the labour market[2]. This instrument provides information on the employment situation of people living in Chile. The target population is the entire population of the country living in private housing. It considers the use of two sample frameworks according to geographical area – Urban, RAU16 and Rural[3] .

Sample distribution: Considering the purpose of the survey and in accordance with the levels for which representative and reliable estimates of the variable of interest have to be obtained, the sample size was determined from the average unemployment rate. This rate was calculated on the basis of the average estimates of the rates of five mobile quarters from a pilot study carried out in 2008, and from obtaining sampling errors similar to those reported by the old employment survey at the same levels of estimation.

The total sample is distributed over a quarterly period, divided into three sub-samples of roughly similar size, each systematically allocated to one of the three months of the moving quarter. This generates three sub-samples, one for each month, in which each one, independently, is not sufficiently accurate for all levels of estimation.

With this distribution, each household surveyed in month "t" is surveyed again in month "t+3". In turn, each household in the sample is surveyed once per quarter. Thus, estimates for a quarter "t" are calculated with the information corresponding to months "t-1", "t" and "t+1".

Working age population classification criterion: The measurement considers only people over 15 years of age, corresponding to the "Working Age Population" (PET, by its acronym in Spanish). The classification of this group according to their economic activity or labour force status is summarised in a variable called the "Summary Employment Code" (CSE, by its acronym in Spanish) which is based on a set of priority rules for classification according to international standards[4].

Industrial classification of economic activities: NENE uses the International Standard Industrial Classification of all Economic Activities (ISIC) Revision 4. It should be mentioned that although the survey records ISIC up to four digits, these data are not published (they are only available for internal use). Therefore, the most we can disaggregate the data is by section (letter). In this case, our interest is in section C corresponding to Manufacturing Industry, and section G corresponding to Wholesale and Retail Trade.

Variables of interest measured by NENE: The set of variables in this survey is varied, it includes the Working Age Population (PET, by its acronym in Spanish), the Economically Active Population (PEA, by its acronym in Spanish) or labour force, employed people (traditional, non-traditional and absent employees), unemployed people (unemployed and those looking for a job for the first time), available starters, the non-economically active population (together with the respective reasons for inactivity). Other ratio indicators include unemployment rate, standardised unemployment rate, participation rate, employment rate, etc. The following indicators are also available: percentage of involuntary employed part-time workers,

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[2] The NENE replaces the former ENE, which has been in force since 1966, as of April 2010. This change leads to the incorporation of new international measurement standards. The conceptual and methodological design of the New National Employment Survey includes, among other aspects, updating the concepts of employed population, unemployed population (incorporating the criteria of having sought employment in the last four weeks and being available to work in at least the following two weeks), the distinction of employed persons between "traditional" and "non-traditional" employed persons, and the classification of persons outside the labour force according to reasons of inactivity and possible potential to participate in the market.

[3] For the urban area of the country, the block sample framework (*Marco Muestral de Manzanas*) is used, while in the RAU and Rural areas, the sample framework used is the one traditionally used by the old National Employment Survey – a section sample framework (*Marco Muestral de Secciones*) built from CENSUS 2002.

[4] These priority rules are translated into a series of questions and sequences that make up the survey questionnaire. The CSE conceptual foundations are based on the updating of the classification criteria, which derive from the resolutions of the ILO's International Conferences of Labour Statisticians (ICLS).

percentage of voluntary employed part-time workers, percentage of employed persons working more than 45 hours per week, percentage of employed persons with a written contract, percentage of employed persons with a defined contract, percentage of employed persons with a high degree of protection, percentage of employed persons with a low degree of protection, normal hours, effective hours, involuntary part-time working.

Within the variables, the evolution of "Employed persons" is particularly interesting. This category comprises all persons of working age who, during the reference week, worked at least one hour, receiving payment in money or in kind, or an employee/employer or self-employed benefit.

2. IPMAN (Index of Manufacturing Production)

The aim of the IPMan (Manufacturing Production Index) is to estimate the monthly evolution of the production volume of industrial manufacturing activity. For this purpose, it uses four follow-up variables depending on the characteristics of the activities to be measured: physical quantity produced; sales deflated and adjusted by the variation of inventories[5] ; deflated cost of progress; and person-hours[6]. In the case of variables related to food and beverage production, the physical quantity produced is used. In general, the types of economic activity captured with this variable measure the most relevant productions for the establishments that generate the added value[7] of the respective activity and represent 80.03 percent of the index weighting. Broadly speaking, the preparation of the IPMan begins with basic indices, which depend on how the activity is measured (deflated sales corrected for the variation in inventory or production), and then goes on to the class, group, division and, finally, section openings. The data that create the index come from monthly surveys, and consider companies and/or manufacturing establishments with ten workers or more, located in the national territory[8].

Industrial classification of economic activities: The index is constructed according to division or group of activity (namely, at two or three digits). Since 2014, work has been carried out on Section C according to the International Standard Industrial Classification of All Economic Activities (ISIC) 4.CL 2012[9].

3. Employer-employee panel of the Chilean Tax Service (SII, by its acronym in Spanish)

A monthly database is built from the records of the Chilean Tax Service (SII), connecting companies with the formal salaried workers they hire, based on the information of the Annual Income Tax Statement N°1887 (DJ 1887) between 2013 and 2017. In this sworn statement, all companies that pay taxes in Chile must report annually to the SII information about the sum of net salaries paid to each employee formally hired during the year. This administrative database contains fictitious identifiers of formal salaried individuals and the companies that hire them, allowing individuals and companies to be tracked over time. Although the declaration is annual, each company must report the specific months in which each worker received a payment, so for each month it is possible to identify whether a worker was employed and evaluate his or her average monthly salary for the year. The structure of the information makes it possible to follow the worker's path from one job to another, building up his or her work and salary history. This database was combined with data from the Civil Registration Department to obtain the date of birth and age of the workers reported.

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[5] The classes measured with this variable represent 19.05 percent of the weighting. The decision was taken to change the measurement variable for these classes due to problems in monitoring with physical quantity, since these classes do not have a standard product and may present quality changes over time. It is worth mentioning that the classes measured by deflated VBP are not disaggregated at the product level, since the high heterogeneity of the products does not allow to set up products that are representative of the class. Likewise, it is operationally complex to capture sales by establishment and by product.

[6] These variables are used to measure the activity that corresponds only to class 3011 "Construction of ships and floating structures", which represents 0.92 percent of the weighting (used for cases where there is a long duration of the productive process of the activity).

[7] Added value: refers to the additional value that goods and services acquire when they are transformed during the production process. It is also defined as the gross value of production minus the value of intermediate consumption. It is a measure of the contribution to GDP made by a production unit, industry or sector.

[8] The selection of companies that must respond to the survey was obtained from the Annual National Industrial Survey 2013 (ENIA 2013, by its acronym in Spanish), which was also complemented with establishments from the Annual National Mining Survey 2013 (ENAM 2013, by its acronym in Spanish).

[9] For the years after 2014, section D was used in accordance with the International Standard Industrial Classification of all economic activities (ISIC) Revision 3.

Five minimum filtering processes were carried out to ensure the consistency of the base. First, potential mergers, acquisitions or spin-offs were corrected. Thus, whenever at least 20 percent of the workers in a closing company move together to another company within a year, this company is not considered closed, but experiencing a change in its ownership structure. Second, companies that do not declare workers and sales in a year are eliminated, as it is very likely that they are fictitious. Fourthly, for workers with gaps (unobserved consecutive periods between two periods actually observed) equal to or less than 12 months, these are not considered as an employment termination, as it may very well correspond to medical leaves. Finally, companies that hire more than 50 percent of their workers for only one month are eliminated.

Economic activity classification standardisation: Since the industrial classification used by the SII changed at the beginning of 2008, the decision was made to use data from January 2013 onwards. In November 2018, the SII made a further change in classification, to ISIC4 2012 International. Therefore, and because companies have the possibility to amend their F29 submissions[10] retrospectively, it is noted that even before November 2018, both classifications are used by different companies. It was decided to maintain the classification used between 2013 and the end of 2018. Therefore, the companies that declare under the new classification are subject to the homologation recommended by the SII, in order to recover the previous classification.

Identification of the company's most frequent economic activity: Given that there are companies that declare different economic activities over time, it was decided to define a single activity for each company, for the entire period under review. This is done by first filling in the gaps (namely, months in which companies do not specify any particular economic activity) with the activity declared as "nearest". In other words, for the months in which the companies do not declare economic activity, they are attributed the closest activity immediately preceding or following it. Then, for each company, the most frequent observation of the company's historical monthly declarations is taken.

Adjustment for inflation: The values stated in both DJ1887[11] and F29 are nominal at current prices. The sales, investment, exports, imports and materials variables (F29) are deflated so that they are expressed in December 2013 prices, and therefore remain nominal variables, but now in constant prices. This is done using a composite series of the CPI series published by INE.

Sectoral data: Finally, the collapse of the variables in question is carried out at the industry-month level. The final variables are:

- Total sales (according to companies' monthly declaration on form F29). The sales of all companies in the corresponding sector are added up for each month. Sales are in billions of Chilean pesos as of December 2013.
- Number of companies (by month and sector) reporting positive sales on form F29. Includes all companies, from those with only one employee to those with more than 50 000.
- Exports, imports (only available for 2016 onwards), investment expenditure, expenditure on materials (inputs, not wages or capital) (as per monthly declaration of companies on form F29). Exports/imports/investment/materials of all companies in the relevant sector are added up for each month. The variables are in billions of Chilean pesos as of December 2013.

10 Monthly tax return in Chile.

11 Annual declaration of income in Chile.

II. Analysis methodology:

Table 1 shows the data used to carry out the analyses.

Table 1. Overview of databases

Name data	Periodicity	t	t+n	No.	no. of obs first intervention (*)	no. of obs second intervention (**)	no. of obs third intervention (***)
ENE	Mobile Quarter	Jan/Mar-13	Oct/Dec 19	82	42	66	78
IPMAN	Monthly	Jan-14	Jan-20	73	30	54	66
Investment expenditure	Monthly	Jan-13	Dec-17	60	42	-	-

* First intervention in June 2016

** Second intervention in June 2018

*** Third intervention in June 2019

Source: Elaborated by the authors.

The Interrupted Time Series Analysis (ITS) method is presented as a flexible design to evaluate the effectiveness in the population of different types of interventions that have been implemented at a specific moment. In particular, it is a viable option when research does not involve the traditional randomised controlled trial (RCT) that results in a treatment group and a control group. ITS are often described as a quasi-experimental design, where a variable of interest is observed over a certain period of time equally spaced, before and after an intervention. In the time series, an underlying trend is established and is "interrupted" by an intervention at a known and exogenous time. The hypothetical scenario in which the intervention did not take place and the trend continues unchanged (namely, the "expected" trend, in the absence of the intervention, given the pre-existing trend) is known as the "counterfactual". This hypothetical scenario provides a comparison for the evaluation of the intervention's impact by examining any changes that occur in the period following the intervention. The advantage of this is that factors that are invariant over time are controlled by design. However, control of time-varying confounding factors can often escape, especially if the design is based on a set of strict assumptions that must be taken into account in the assessment of causal scenarios.

In general, this method estimates the effect of a certain intervention on a variable of interest when you have only one treatment group (without controls), or when you can compare it with one or more control groups. That said, having control groups gives the advantage of improving internal validity, since we can potentially control for omitted variables (Linden, 2015).

In order use this design, a clear differentiation between the pre-intervention and post-intervention period is required. At this point, it is important that sequential outcome measures are available both before and after the intervention. However, there are no fixed limits on the number of data, as power depends on several other factors, including the distribution of data points before and after the intervention, variability within the data, the strength of the effect, and the presence of confounding effects, such as seasonality. While power increases when the number of points is higher, it is not always preferable to have more data points where historical trends have changed substantially, as this would not provide an accurate description of current underlying trends. Therefore, a prior inspection of the data is always recommended (Bernal, Cummins, and Gasparrini, 2017).

Once it has been decided to work with an ITS design, it is appropriate to hypothesise what the impact of the intervention on the variable of interest would be if it were effective. Primarily, what matters is to understand whether this would be a gradual change in the trend gradient, a change in level, or both. Besides, it is important to analyse whether the change will follow immediately the intervention or whether there will be a period of delay before the effect is appreciated. Other methodological issues need to be addressed; these are mainly timing issues that need to be explored to improve the robustness of the analysis, such as confounding variables that vary over time, and autocorrelation, among others (Kutner, Nachtsheim, Neter, *et al*., 2005).

III. Use of controls in ITS

Because the evaluation is based on observation of a single population over time, ITS design does not present problems of differences between groups, such as selection bias or unmeasured confounding factors. Besides, by modelling the underlying trend, ITS also control for characteristics within the group that tend to change slowly over time. However, ITS studies cannot exclude confounding factors that vary over time and are not part of the underlying trend, for example, other interventions or events that occur around the time of the intervention and may also affect the outcome.

To limit the threat of these other confounding events, a control series can be included, which is a design known as controlled (or comparative) interrupted time series analysis (CITS). Lack of effect in a well-chosen control may provide stronger evidence to support a causal relationship between the intervention and the outcome. Conversely, the presence of an effect on the control series indicates that the change may be attributable to other factors.

CITS involves adding a series of non-intervention controls to the basic ITS design. This results in the definition of a more complex counterfactual based on a before and after comparison and an intervention control comparison. The main benefit of this approach is that it can help to control for historical bias due to confounding factors that vary over time, particularly co-interventions and other events concurrent with the intervention. In a CITS, if an effect is detected in the intervention group, but not in a well-chosen control, this suggests that the effect is more likely to be due to the intervention; and conversely, if an effect is detected in both the intervention and the control series, this suggests that it is due to some confounding event.

Broadly speaking, with studies that rely on control as the only means of approximating the counterfactual, the central requirement when selecting a control is that it should be as similar as possible to the intervention group. Ideally, these variables should not have been exposed to the intervention.

The key attribute of a control series for a CITS study should be its ability to control for known co-interventions or external events that may affect the outcome. Therefore, the control series should be exposed to such co-interventions or events that may also affect the intervention series. However, it should not be exposed to other interventions or events that may affect only the control series (and not the intervention series). The latter could lead to the detection of artifact effects in the CITS, which are actually due to independent changes in the control serie. Several different types of control series have been used for CITS analyses. Table 2 shows below some of the most commonly used controls classified as follows: location-based control groups, characteristics-based control groups, behaviour-based control groups, historical cohort controls, control results, and control time periods (Bernal, Cummins, and Gasparrini, 2017):

Table 2. Most used controls in ITS and their classification

Types of controls	Description	Example	Limitations
Based on location	The control corresponds to a selected series from a location similar to the study location but which did not receive the intervention	Countries, regions, provinces	It does not exclude events that are specific to the location where the intervention occurs
Based on characteristics	In line with interventions that are directed according to certain characteristics. Consequently, controls are chosen from groups that were not intervened	According to sex, a certain age group, specific ethnicity or patients with a certain diagnosis.	Interventions may have been targeted at the intervention group due to a detected deviation in trend. As a result, trends could differ substantially from the control group.
Behaviour-based	Sometimes, the intervention does not affect all members of the targeted population. This can occur when the intervention targets a behaviour that not all individuals engaged in (at or after the beginning of the intervention). Therefore, these can be used as a viable control.	Age group	Difficult to identify.
Historical cohort	Cohorts affected at different times. This is possible when a cohort periodically progresses to another level and is replaced by another cohort. These can be comparable.	School generations,	It may not be controlled by events that are specific to the year in which the intervention was implemented.
Based on results	Another unaffected result.	Accidental injury control in a study on the impact of the financial crisis on suicides in Spain.	It is only possible to control the factors that would affect both the primary outcome and the control outcome.
Period of time	Not affected period. It is possible to use as a control the periods of time where the intervention is inactive.	Certain times of day (day vs night) or days of the week.	It can only be used for short-term results with quick start. Difficult to identify.

Fuente: Elaboración propia.

When we have one or more control groups available for comparison and numerous interventions (three), the CITS presented model takes the following form (A. Linden, 2017)[12]:

$$Y_t=\beta_0 + \beta_1 T_{0t} + \beta_2 X_{1t} + \beta_3 X_{1t}T_{1t} + \beta_4 Z + \beta_5 ZT_{1t} + \beta_6 ZX_{1t} + \beta_7 ZX_{1t}T_{1t} + \beta_8 X_{2t} + \beta_9 X_{2t}T_{2t} + \beta_{10} ZX_{2t} + \beta_{11} ZX_{2t}T_{2t} + \beta_{12} X_{3t} + \beta_{13} X_{3t}T_{3t} + \beta_{14} ZX_{3t} + \beta_{15} ZX_{3t}T_{3t} + \epsilon_t$$

Y_t corresponds to the aggregate interest variable over time t. T_{it} represents the time elapsed since the beginning of the study and each intervention at the time of time t at a constant frequency (monthly or quarterly); i can be 0, 1, 2 or 3, corresponding to the pre-intervention periods, and each intervention respectively (T_{it} takes values equal to or greater than zero). X_{it} is a dichotomous variable representing the intervention in period i (the pre-intervention period takes the value 0, while the post-intervention period takes the value 1) and X_{it} T_{it} is a term of interaction. Additionally, Z is a dichotomous variable denoting cohort allocation (treatment is equal to 1, while control is zero) and ZT_t , ZX_t y ZX_t T_t are all the corresponding interactions described above.

The coefficients β_0-β_3 represent the control group in the pre-intervention period. The coefficient β_0 is the starting level of the variable of interest; β_1 is the slope or path of the variable of interest until the introduction of the first intervention; β_2 represents the change in level of the variable of interest that occurs in the period immediately following the introduction of the first intervention; β_3 represents the difference between the slopes before and after the first intervention of the variable of interest. Additionally, β_4 is the difference in level (intercept) of the variable of interest between the treatment group and the control group prior to the first intervention; β_5 is the difference in slopes (trends) of the variable of interest between the treatment group and the control group prior to the first intervention; β_6 is the difference in the level of the variable of interest between the treatment and control groups immediately after the first intervention β_7 represents the difference in the slope of the variable of interest between the period before and after the first intervention and between the treatment and control groups.

The coefficients β_8 - β_{11} measure the effect it has on the variable of interest under the second intervention. Thus, the coefficient β_8 shows the change in the level of the variable of interest in the control group with the second intervention; β_9 is the change in trend in the control group between the first and second intervention; β_{10} measures the difference in the level of the variable of interest between treatment and control groups immediately after the second intervention; β_{11} is the difference in slope differences (trends) between the treatment and control groups between the first and second intervention (Linden, 2017).

Finally, the coefficients β_{12} - β_{15} measure the effect it has on the variable of interest under the third intervention. The coefficient β_{12} shows the change in the level of the variable of interest in the control group with the third intervention; β_{13} is the change in trend in the control group between the second and third intervention; β_{14} measures the difference in the level of the variable of interest between treatment and control groups immediately after the third intervention; β_{15} is the difference in slope differences (trends) between the treatment and control groups between the second and third interventions.

[12] The three interventions correspond to the three phases of implementation of front-of-package labelling: June 2016, June 2018 and June 2019.

In addition to the coefficients derived from the regression, some other parameters can provide useful information:

The sum $\beta_1+\beta_3$ measures the trend of the control group after the first intervention.

The sum $\beta_1+\beta_3+\beta_5+\beta_7$ measures the trend of the treatment group after the first intervention.

The sum $\beta_5+\beta_7$ measures the change in trends of treatment and control groups after the first intervention.

The sum $\beta_3+\beta_7$ measures the change in trends in the treatment group between the pre-intervention and post-first intervention period.

The sum $\beta_1+\beta_3+\beta_9$ measures the trend of the control group after the second intervention.

The sum $\beta_1+\beta_3+\beta_5+\beta_7+\beta_9+\beta_{11}$ measures the trend of the treatment group after the second intervention.

The sum $\beta+\beta_7+\beta_{11}$ measures the difference in trends in the treatment and control group after the second intervention.

The sum $\beta_9+\beta_{11}$ measures the difference in trends in the treatment group between the first and second intervention.

The sum $\beta_3+\beta_7+\beta_9+\beta_{11}$ measures the difference in trends in the treatment group between the pre-intervention and the second intervention.

The sum $\beta_7+\beta_{11}$ measures the difference between treatment and control groups when comparing differences in trends between the pre-intervention and second intervention.

The sum $\beta_1+\beta_3+\beta_9+\beta_{13}$ measures the trend of the control group after the third intervention.

The sum $\beta_1+\beta_3+\beta_5+\beta_7+\beta_9+\beta_{11}+\beta_{13}+\beta_{15}$ measures the trend of the treatment group after the third intervention.

The sum $\beta_5+\beta_7+\beta_{11}+\beta_{15}$ measures the difference in trends between treatment and control groups after the third intervention.

The sum $\beta_{13}+\beta_{15}$ measures the difference in trend of the treatment group between the second and third intervention.

The sum $\beta_3+\beta_7+\beta_9+\beta_{11}+\beta_{13}+\beta_{15}$ measures the difference in trend of the treatment group between the pre-intervention and the third intervention.

The sum $\beta_7+\beta_{11}+\beta_{15}$ measures the difference between treatment and control groups when comparing differences in trends between the pre-intervention and third intervention.

Objective 6: interviews with key informants from the private sector regarding the implementation of the Chilean Law on Food Labelling

Design: To complement the secondary sources analysis contemplated by the project, semi-structured interviews will be conducted with key informants from the private sector to capture their views on the effects of Law 20.606 on the private sector.

Sample: For each of the areas of this study (private sector discourses, food reformulation, use of labels as a marketing strategy, impact on real variables in the productive sector) a key actor will be interviewed; the actors will be selected for convenience by the research group so as to represent diverse views of the impact of the law on the productive sector.

Methodology: The interview will be conducted through a 60-90-minute video call where the thematic areas of the company's experience in implementing Law 20.606 will be addressed (decision-making to face change, adaptation to regulation, factors to be considered in its response), the challenges of this process (communication and business strategies, advantages and disadvantages of decision-making, monitoring of implemented changes) and recommendations for the implementation of the law (evaluation of the process and the role of the food industry in this kind of changes).

Information analysis: Qualitative content analysis will be conducted based on the transcription of the audio of the interview, which will be recorded and then transcribed in strict confidentiality by a third party. The interviewee will have the opportunity to review the transcript and modify any accidental errors. Based on the information obtained from the participants and the main dimensions arising from each thematic axis of the interview, a critical view at the practices of the food industry will be provided considering the implementation of the law – which can be used for future similar public policy actions.

Ethical issues: All interviewees will sign an ethical consent form in advance, authorising the recording of the interview and the use of the information in this study. Textual quotations will be anonymous; only the functions or type of company that the interviewee represents can be mentioned (for example, CEO cereal company, CEO healthy venture, etc.)

4 RESULTS AND DISCUSSION BY TOPIC

5.1 Characterisation of the food industry in the Chilean market.

The different brands present in the Chilean market are grouped into only ten major manufacturing companies (OXFAM, 2013). Although some brands belong to smaller manufacturing companies are not represented in the figure, these large companies distribute the majority of the market (see Table 3) segmented by each of the 16 food and beverage categories.

Table 3. Distribution of the food and processed beverage market in Chile according to food categories, years 2015, 2016, 2017 (Euromonitor)

FOOD CATEGORY	BRAND/ COMPANY	LEGAL NAME COMPANY	MARKET DISTRIBUTION [1]
Beverages [based on litres] [2]	COCA COLA	THE COCA COLA COMPANY	60%
	CCU	CÍA CERVECERÍAS UNIDAS SA	12%
	UNIDENTIFIED	NA	8%
	DANONE/WATTS	DANONE GROUP	7%
	PEPSICO	PEPSICO INC	4%
	CRUSH	DR PEPPER SNAPPLE GROUP INC	2%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	1%
	TRESMONTES LUCCHETTI	GRUPO NUTRESA SA	1%

Milk and dairy beverages [based on Chilean pesos]	NESTLÉ	NESTLÉ SA	28%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	22%
	COLUN	COOPERATIVA AGRÍCOLA Y LECHERA DE LA UNION LTDA	16%
	DANONE/WATTS	DANONE GROUP	15%
	UNIDENTIFIED	NA	7%
	SURLAT	EMMI GROUP	4%
Yogurt [based on Chilean pesos]	UNIDENTIFIED	NA	56%
	DANONE/WATTS	DANONE GROUP	19%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	10%
	COLUN	COOPERATIVA AGRÍCOLA Y LECHERA DE LA UNION LTDA	6%
	PARMALAT	LACTALIS GROUP	4%
	SURLAT	EMMI GROUP	2%
	SODIAAL SA/QUILLAYES	SODIAAL SA (SOCIÉTÉ DE DIFFUSION INTERNATIONALE AGRO-ALIMENTAIRE)	2%
Breakfast cereals [based on Chilean pesos]	NESTLÉ	NESTLÉ SA	29%
	CAROZZI	CAROZZI CORP	26%
	UNIDENTIFIED	NA	24%
	PEPSICO (QUAKER)	PEPSICO INC	10%
	KELLOGG	KELLOGG CO (MARKETED BY ICB SA IN CHILE)	5%
	NUTRIMARKET SA	NUTRIMARKET SA	2%
	GENERAL MILLS (NATURAL VALLEY)	GENERAL MILLS INC	1%
Sweet baked goods [based on Chilean pesos]	UNIDENTIFIED	NA	49%
	CAROZZI	CAROZZI CORP	21%
	NESTLÉ	NESTLÉ SA	13%
	IDEAL	GRUPO BIMBO SAB DE CV	3%
	CCU	CÍA CERVECERÍAS UNIDAS SA	3%
	NUTRABIEN	CÍA CERVECERÍAS UNIDAS SA	3%
	FRUNA	ALIMENTOS FRUNA LTDA	3%
	PEPSICO	PEPSICO INC	2%
	MONDELEZ / KRAFT HEINZ	MONDELEZ INTERNATIONAL INC	1%
	ARCOR	ARCOR SAIC	1%
	UNIDENTIFIED	NA	37%
	NESTLÉ	NESTLÉ SA	22%
	TRENDY	INDUSTRIA DE ALIMENTOS TRENDY LTDA	14%

Desserts and ice cream [based on Chilean pesos]	UNILEVER	UNILEVER GROUP	13%
	FRUNA	ALIMENTOS FRUNA LTDA	4%
	LECHERÍAS SAN FRANCISCO DE LONCOMILLA	LECHERIAS LONCOMILLA LTDA	4%
	DANONE/WATTS	DANONE GROUP	2%
	DOS CABALLOS	CONSERVERA PENTZKE SA	2%
Sweets and candies [based on Chilean pesos]	CAROZZI	EMPRESAS CAROZZI SA	25%
	NESTLÉ	NESTLÉ SA	22%
	ARCOR	ARCOR SAIC	22%
	UNIDENTIFIED	NA	13%
	MONDELEZ / KRAFT HEINZ	MONDELEZ INTERNATIONAL INC	6%
	PEPSICO	PEPSICO INC	3%
	MARS	MARS INC	2%
	ICB CHILE	ICB SA	2%
	SABÚ	VELARDE HNOS	1%
Sweet spreads [based on Chilean pesos]	NESTLÉ	NESTLÉ SA	36%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	16%
	DANONE/WATTS	DANONE GROUP	14%
	COLUN	COOPERATIVA AGRÍCOLA Y LECHERA DE LA UNION LTDA	13%
	UNIDENTIFIED	NA	13%
	UNILEVER	UNILEVER GROUP	2%
	PARMALAT	LACTALIS, GROUPE	1%
	ICB CHILE (FERRERO)	FERRERO GROUP	1%
	SURLAT	EMMI GROUP	1%
Salted baked products [based on Chilean pesos]	UNIDENTIFIED	ND	89%
	IDEAL	GRUPO BIMBO SAB DE CV	4%
	NESTLÉ	NESTLÉ SA	2%
	ARCOR	ARCOR SAIC	1%
	BREDENMASTER / KARDAMILI / MESTRE	TEAM FOODS	1%
	CAROZZI	EMPRESAS CAROZZI SA	1%
Salted snacks [based on Chilean pesos]	PEPSICO (RAMITAS EVERCRISP)	PEPSICO INC	62%
	TRESMONTES LUCCHETTI	GRUPO NUTRESA SA	13%
	ICB CHILE	ICB S.A.	6%
	TRENDY	INDUSTRIA DE ALIMENTOS TRENDY LTDA	5%

	UNIDENTIFIED	ND	4%
	TIKA	ZE FARMS SA	3%
	KELLOGG	KELLOGG CO (MARKETED BY ICB SA IN CHILE)	2%
Salted spreads [based on Chilean pesos]	UNIDENTIFIED	NA	32%
	UNILEVER	UNILEVER GROUP	15%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	11%
	DANONE/WATTS	DANONE GROUP	9%
	COLUN	COOPERATIVA AGRÍCOLA Y LECHERA DE LA UNION LTDA	8%
	CAROZZI	EMPRESAS CAROZZI SA	5%
	NESTLÉ	NESTLÉ SA	4%
	SURLAT	EMMI GROUP	3%
	ICB CHILE	ICB SA	2%
	MONDELEZ / KRAFT HEINZ	MONDELEZ INTERNATIONAL INC	2%
	TRESMONTES LUCCHETTI	GRUPO NUTRESA SA	2%
	GOURMET	GOOD FOOD SA	2%
	TRAVERSO	TRAVERSO SA	1%
Cheese [based on Chilean pesos]	UNIDENTIFIED	NA	41%
	COLUN	COOPERATIVA AGRÍCOLA Y LECHERA DE LA UNION LTDA	23%
	SOPROLE	FONTERRA CO-OPERATIVE GROUP LTD	18%
	DANONE/WATTS	DANONE GROUP	14%
	QUILLAYES	SODIAAL SA (SOCIÉTÉ DE DIFFUSION INTERNATIONALE AGRO-ALIMENTAIRE)	3%
	MONDELEZ / KRAFT HEINZ	MONDELEZ INTERNATIONAL INC	1%
Ready-to-eat food/preparations [based on Chilean pesos]	ALIFRUT (MINUTO VERDE)	ALIMENTOS Y FRUTOS SA	35%
	DANONE/WATTS (FRUTOS DEL MAIPO)	DANONE GROUP	30%
	SADIA	SADIA BRF BRASIL FOODS SA	8%
	BONDUELLE	BONDUELLE GROUPE SA	6%
	PF	PRODUCTOS FERNANDEZ SA	4%
	AGROSUPER	AGROSUPER SA	3%
	CAROZZI	CAROZZI CORP.	2%
	TUCAPEL	ALIMENTOS CAMIL SA	25
	DEYCO	EMPRESAS DEMARIA SA	1%
Meat products (cold meat, and other than cold meat) [based on Chilean pesos]	CIAL ALIMENTOS / LA PREFERIDA	CIAL ALIMENTOS SA	26%
	PF	PRODUCTOS FERNANDEZ SA	16%

	UNIDENTIFIED	NA	17%
	AGROSUPER	AGROSUPER SA	12%
	SAN JOSÉ	PESQUERA IQUIQUE SA	8%
	CECINAS LLANQUIHUE	MODINGUER HERMANOS SA	4%
	AUSTEVOLL SEAFOOD ASA	AUSTEVOLL SEAFOOD SA	4%
	ROBINSON CRUSOE	ROBINSON CRUSOE Y CÍA LTDA	3%
	ARIZTIA	ARIZTIA COMERCIAL LTDA	2%
	SADIA	BRF BRASIL FOODS SA	2%
	TRUJILLO	SALAMANCA FOODS SA	1%
Soups [based on Chilean pesos]	NESTLÉ	NESTLÉ SA	70%
	TRESMONTES LUCCHETTI	GRUPO NUTRESA SA	17%
	GOURMET	GOOD FOOD SA	7%
	UNIDENTIFIED	NA	5%

Legend: 1. Percentage of sales by food category from the Euromonitor 2015-2017 database; 2. "Unidentified" considers categories marked in EUROMONITOR as "private brands", "handmade" and "others"; NA: Not available

Source: Elaborated by the authors

5.2 Analysis of communications and speeches during the discussion and implementation of the Law on Food Labelling

The Law on Food Labelling was mainly covered by the newspapers. As table 4 shows, most releases (51.7 percent) appeared in newspapers. El Mercurio (26.6 percent), La Tercera (17.3 percent) and Diario Financiero (17.0 percent) led the coverage in this category. Television and online portals were also important in coverage with 18.1 percent and 17.8 percent, respectively. Within television, cable news channels – CNN Chile (37.0 percent) and 24 Horas (24.7 percent) – led the way in coverage. Radio online portals– Cooperativa.cl (26.1 percent) and Radio Biobío.cl (19.1 percent) – were also relevant. Three quarters of the coverage (75.9 percent) was done through newspaper articles. Much less frequent were interviews (10.9 percent) and columns or letters to the editor (8.0 percent) (See Table 5).

Table 4. Media covering the Law on Food Labelling 2007-2018

Media		N (1295)	Percentage (%)
Total newspapers	670	51.7	51.7
	El Mercurio	178	26.6
	La Tercera	116	17.3
	Diario Financiero	114	17.0
	Pulso	75	11.2
	La Cuarta	40	6.0
	La Segunda	38	5.7
	Publimetro	34	5.1
	Las Últimas Noticias	33	4.9

	La Hora	23	3.4
	HoyXHoy	19	2.8
Total TV	Total TV	18.1	18.1
	CNN	87	37.0
	24 Horas	58	24.7
	Chilevisión	26	11.1
	Mega	24	10.2
	TVN	22	9.4
	Canal 13	18	7.7
Online portals	Online portals	17.8	17.8
	Cooperativa.cl	60	26.1
	Radio Biobío.cl	44	19.1
	Emol	39	17.0
	La Tercera Online	29	12.6
	El Mostrador	26	11.3
	Agricultura Online	16	7.0
	El Dínamo	10	4.3
	The Clinic Online	6	2.6
Total radio	Total radio	12.3	12.3
	Radio BioBío	45	28.3
	Radio Cooperativa	36	22.6
	ADN Radio	36	22.6
	Radio Agricultura	23	14.5
	Tele13 Radio	19	11.9
Magazine	1	0.1	0.1

Source: Elaborated by the authors.

Table 5. Types of release covering the Law on Food Labelling

	N = 1295	%
Journalistic note	983	75.9
Interview	141	10.9
Column/Letter to the Editor	103	8.0
Editorial	16	1.2
Documentary/feature article	16	1.2
Other	36	2.8

Source: Elaborated by the authors.

a) Communications

Half of the PR communications in the media were almost equally led by the food industry (26.7 percent) and government authorities (26.2 percent). Less important were experts/academics (12.6 percent), members of Parliament (9.6 percent) and health organisations (6.0 percent) (See Table 6). As shown in Table 7, within the industry, most messages are delivered by the industry's companies (55.1 percent) and, to a lesser extent, by the trade associations that represent the industry (42.0 percent). The companies that appear most in the media are Carozzi (11.9 percent), McDonalds (10.8 percent), Ferrero (8.7 percent), Nestlé (8.0 percent), Coca Cola (7.3 percent), CCU (3.7 percent) and Soprole (3.0 percent) (See Table 8). Within the industry's trade associations, more than two thirds of coverage are led by the food and beverage association AB Chile, created in 2014 and which includes 20 companies – among them Carozzi, Nestlé, CCU, Coca Cola, Embonor, and Andina (See Table 9).

Table 6. Types of spokesperson appearing in the media on the Law on Food Labelling

	Total speeches (N = 2964)	%
Food industry	790	26.7
Government authority	777	26.2
Experts/ academics	374	12.6
Members of Parliament	283	9.6
Health organisations	179	6.0
Schools/Universities	94	3.2
Consumer organisations	72	2.4
Former government authority	17	0.6
Others	378	12.8

Source: Elaborated by the authors.

Table 7. Food industry spokespersons covering the Law on Food Labelling

	Total speeches (786)	%
Companies of the industry	433	55.1
Food trade associations (for example, AB Chile)	330	42.0
Associations related to freedom of speech (for example, ANDA)	23	2.9

Source: Elaborated by the authors.

Table 8. Detail of the industry companies that appear in the media talking about the Law on Food Labelling

	N (427)	%
Carozzi	51	11.9
McDonalds	46	10.8
Ferrero	37	8.7
Nestlé	34	8.0
Coca Cola	31	7.3
CCU	16	3.7
Soprole	13	3.0
Fruna	9	2.1
Unilever	8	1.9
Iansa	7	1.6
Unimarc	7	1.6
Pepsico	5	1.2
Walmart	4	0.9
Evercrisp	3	0.6
Jumbo	3	0.6
Lider	3	0.6
Tottus	3	0.3
Colun	1	0.2
Others	146	34.2

Source: Elaborated by the authors.

Table 9. Details of the industry trade associations that appear in the media talking about the Law on Food Labelling

	N (331)	%
Food and beverage trade association (AB Chile)	217	65.6
Supermarket Association	32	9.7
Chilean Suppliers' Trade Association (AGIP)	27	8.2
Santiago Chamber of Commerce	17	5.1
Chilealimentos	10	3.0
Sofofa	9	2.7
Conapyme	1	0.3
Other	18	5.4

Source: Elaborated by the authors.

b) Speeches and topics

Topics and speeches on the Law on Food Labelling are presented in Table 10. In general, the most relevant speeches during the period of discussion and implementation of the law were about inspection (17.1 percent), namely, about complaints regarding non-compliance or non-respect of the new regulation's standards. On the other hand, the industry's cooperation with the law was also relevant (14.2 percent). In this category of speech, some releases were about product reformulation or companies and supermarkets that moved forward in the incorporation of labels before the law comes into force; or vendors who adapted and went on to sell fruit instead of alfajores (Chilean typical sweets). Some headlines illustrate this idea, for example: "Supermarkets seek to bring forward new food labelling by up to three months", or "Changes to be implemented in schools to encourage healthy snacks". The third most relevant speech is the economic threat to the industry (8.5 percent). However, the concrete impact on the industry is rarely specified. A headline that exemplifies this speech: "Rodrigo Álvarez, 'In this sector the economic impact will be very strong'. In a similar tone, Carozzi's president, Gonzalo Bofill, stated: "The future is uncertain due to the implementation of improvised reforms"; and Watts "warns of cost effects due to the anticipation of new labelling". The only more concrete note about the possible costs for the industry was given by Rodrigo Alvarez: "President of AB Chile: 'There are about USD 50 million in stock of products that will not be able to be sold (...) The problem is quite substantial: we have quantified about USD 50 million in stock that will have problems with commercialisation since 26 June'". Other speeches in the press stated that the labels were a source of information (8.3 percent); that the law sought to combat obesity (6.8 percent); and the industry's efforts to reformulate ingredients and/or adapt to new standards (6.6 percent).

As indicated in Table 11, a more detailed analysis of the speeches and topics proposed by the food industry reveals that the most relevant speeches were about the effort to cooperate with the law (27.8 percent). This discourse on cooperation was followed by the idea that the new law represented an economic threat to the industry (19.5 percent). Besides, the industry promoted the idea that the law was confusing for consumers (12.1 percent) and that it would mean an incentive or pressure to adapt (8.4 percent). The industry also spoke about the court cases that emerged from the discussion and implementation of the law. For example, the following release was entitled: "Law on Food Labelling: Justice rejects Pepsico giant's lawsuit against the tax authorities". The industry also encouraged the following speeches: The law was not going to end obesity (4.9 percent), it was insufficient (4.6 percent) and ambiguous (4.3 percent).

An analysis of how these discourses changed before and after the law came into force shows that the most relevant discourse of the industry before regulation was the law as an economic threat. One third (32.5 percent) of the industry's communications warned about the negative economic effect. But this discourse diminished strongly after regulation (9.7 percent). Although much less relevant in discourses, the cases that were taken to court or threatened to be taken to court also decreased their importance after the law came into force were (from 9.2 percent to 3.3 percent). The argument that the law is ambiguous for the industry decreased as well (from 8.0 percent to 1.7 percent). The discourse that remained, and even increased slightly after regulation, was the industry's effort to cooperate with the law and the new standards (from 25.5 percent to 29.6 percent). The industry also reinforced the following ideas after regulation: that it was confusing for consumers (from 6.4 percent to 16.4 percent), and it was an incentive or pressure to adapt to the new standards (from 3.8 percent to 11.8 percent) (see Table 12).

An analysis of speeches by company revealed that McDonalds, Coca Cola and Soprole promoted the discourse of cooperation with the law in most of their PR communications (75.0 percent, 70.0 percent, 57.6 percent, respectively). Nestlé also emphasised this discourse in a large percentage of its PR communications (42.1 percent) while promoting at the same time the idea that the law had an expropriatory nature in 15.8 percent of its messages, that is, that it infringed against intellectual property by changing the conditions of packaging (for example, packages that can no longer carry cartoons). The company also stated that the accent should be on education and not on prohibition (13.2 percent).

Carozzi, Ferrero and CCU had a different strategy than the other companies. A third of Carozzi's PR communications (34.0 percent) promoted the idea that the law was an economic threat to the industry. Other interventions emphasised that the law was confusing for consumers (21.3 percent) and insufficient (12.8 percent). Although appearing less than Carozzi, CCU followed the same strategy: in 60 percent of its PR communications, the company said that the law was a threat to the industry, and also that it was confusing (30 percent) and insufficient (10 percent). Ferrero's media appearances were related to the lawsuits and court cases against the state in 80 percent of releases, and to the argument that the law was an economic threat to the industry in the rest of his interventions (see Table 13).

Table 10. Speeches and topics related to the Law on Food Labelling

	N (2389)	%
Inspection	415	17.4
Cooperation with the law	343	14.4
Economic Threat	282	11.8
Labels as a source of information	201	8.4
Law as a solution to fight obesity	164	6.9
Incentive/pressure for adaptation	160	6.7
Law creates confusion	178	7.5
The law is insufficient	288	12.1
International positioning	108	4.5
Industry does not care about children's health	70	2.9
Protection of consumers and children	68	2.8
Law as a progress in public health policy	67	2.8
Nanny state	27	1.1
Private sector lobbying	18	0.8

Source: Elaborated by the authors.

Table 11. Speeches and topics proposed by the industry concerning the Law on Food Labelling

	N (737)	%
Cooperation with the law	205	27.8
Economic Threat	187	25.4
Law creates confusion	121	16.4
Incentive/pressure for adaptation	62	8.4
The law is insufficient	89	12.1
Inspection	25	3.4
Expropriation	24	3.3
Labels as a source of information	11	1.5
Law as a solution to fight obesity	4	0.5
Industry does not care about children's health	3	0.4
Nanny state	2	0.3
Law as a progress in public health policy	2	0.3
Private sector lobbying	1	0.1
International positioning	1	0.1
Protection of consumers and children	0	0.0

Source: Elaborated by the authors.

Table 12. Pre- and post-regulation food industry discourses and topics

	Pre-regulation		Post-regulation	
	N	%	N	%
Speech/topic	(314)		(422)	
Economic threat	131	41.7	55	13.0
Cooperation with the law	80	25.5	125	29.6
Law creates confusion	45	14.3	76	18.0
Incentive/pressure for adaptation	12	3.8	50	11.8
The law is insufficient	26	8.3	63	14.9
Inspection	10	3.2	15	3.6
Labels as a source of information	4	1.3	7	1.7
Nanny state	2	0.6	0	0.0
Expropriation	1	0.3	23	5.5
Law as a solution to fight obesity	1	0.3	3	0.7
Private sector lobbying	1	0.3	0	0.0
Law as a progress in public health policy	1	0.3	1	0.2
Industry does not care about children's health	0	0.0	3	0.7
International positioning	0	0.0	1	0.2
Protection of consumers and children	0	0.0	0	0.0

Source: Elaborated by the authors.

Table 13. Detail of speeches and topics of the food companies that appeared most in the media

	Carozzi (N = 47)	Ferrero (N = 26)	Soprole (N = 10)	McDonalds (N = 44)	Nestlé (N = 38)	Coca-Cola (N = 33)	CCU (N = 10)
The law will not end with obesity	2.1	0.0	0.0	0.0	0.0	0.0	0.0
The law is insufficient	12.8	0.0	0.0	0.0	2.6	0.0	10.0
Nanny state	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Ambiguous for the industry	0.0	0.0	0.0	0.0	0.0	3.0	0.0
Confusing for consumers	21.3	0.0	0.0	0.0	5.3	0.0	30.0
Accent should be on education	2.1	0.0	0.0	0.0	13.2	0.0	0.0
Cooperation with the law	6.4	0.0	70.0	75.0	42.1	57.6	0.0
Expropriation	6.4	0.0	0.0	0.0	15.8	0.0	0.0
Economic threat to industry	34.0	19.2	0.0	0.0	5.3	6.1	60.0
Judicialisation of the case	6.4	80.8	0.0	2.3	0.0	0.0	0.0
Inspection	2.1	0.0	0.0	18.2	5.3	0.0	0.0
Private sector lobbying	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industry does not care about children's health	0.0	0.0	0.0	0.0	2.6	0.0	0.0
Law as a solution to fight obesity	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Labels as a source of information	0.0	0.0	0.0	0.0	2.6	3.0	0.0
Law as a progress in public health policy	0.0	0.0	0.0	0.0	0.0	0.0	0.0
International positioning	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protection of consumers and children	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incentive/pressure for adaptation	2.1	0.0	30.0	4.5	5.3	30.3	0.0

Source: Elaborated by the authors.

5.3 Food reformulation analysis

The study identified 276 products which were reformulated; that is, they were classified as "high in" in the pre-implementation period, but that condition changed in the post-implementation period. Both the decreases in the total proportion of any "high in", as well as in the proportion of "high in sugar" and "high in sodium" between the pre- and post-implementation periods were statistically significant. The proportion of 7 percent of products that were required to be labelled "high in sugar" according to their pre-implementation nutrient declaration were reformulated. This was also the case for 5 percent of foods that would be classified as "high in sodium", 3 percent that would be classified as "high in saturated fats" and 2% that would be classified as "high in energy". Table 14 shows these results, plus the changes in frequency of "high in" and the proportion of foods reformulated for each food or drink category.

The proportion of "high in sugar" products decreased significantly in beverages, milk and dairy beverages, breakfast cereals, desserts and ice cream, and sweet spreads; the decrease in this proportion among sweet baked goods did not reach statistical significance. The proportion of high-sodium foods also fell significantly among salty spreads, cheese and cold meat categories. In the case of saturated fats, the proportion of "high in" decreased significantly in sweets and candies, and salty spreads, reaching the limit of significance for salty baked goods. The proportion of "high in calories" decreased significantly only in breakfast cereals and salted spreads.

Analysis of the least relevant products in the market (namely, <1 percent of sales in their category, n=333) showed similar results, with a significant fall in products with some "high in" (52 percent to 45 percent, p-value < 0.01); the "high in sugar" proportion specifically fell (from 34 percent to 30 percent, p-value < 0.01), as well as the "high in sodium" proportion (from 8 percent to 4 percent, p-value < 0.01). No analysis by food category is carried out.

Table 14. Changes in the proportion of "high in" products and each of the critical nutrients, and quantification of "reformulated" products, by food/drink category

	Pre-implementation N (%)	Post-implementation N (%)	p-value	Reformulated products* N (%)
Total sample	Total (N=1.915)			
Some "high in"	**996 (52)**	**804 (42)**	**<0.01**	276 (15%)
High in energy	479 (25)	460 (24)	0.48	41 (2%)
High in sugar	**536 (28)**	**421 (22)**	**<0.01**	122 (7%)
High in saturated fats	440 (23)	402 (21)	0.13	62 (3%)
High in sodium	**211 (11)**	**134 (7)**	**<0.01**	90 (5%)
Beverages	N=326			
Some "high in"	**65 (20)**	**29 (9)**	**<0.01**	39 (12%)
High in energy	0 (0)	0 (0)	-	-
High in sugar	**65 (20)**	**29 (9)**	**<0.01**	39 (12%)
High in saturated fats	0 (0)	0 (0)	-	-
High in sodium	0 (0)	0 (0)	-	-
Milk and dairy beverages	N=76			
Some "high in"	**23 (30)**	**0 (0)**	**<0.01**	24 (30%)
High in energy	1 (1)	0 (0)	-	1 (1%)

High in sugar	**21 (28)**	**0 (0)**	**<0.01**	22 (28%)
High in saturated fats	0 (0)	0 (0)	-	-
High in sodium	1 (1)	0 (0)	0.32	1 (1%)
Yogurts	N=184			
Some "high in"	0 (0)	0 (0)	-	-
High in energy	0 (0)	0 (0)	-	-
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	0 (0)	0 (0)	-	-
High in sodium	0 (0)	0 (0)	-	-
Breakfast cereals	N=67			
Some "high in"	**52 (78)**	**37 (55)**	**<0.01**	26 (39%)
High in energy	**51 (76)**	**36 (54)**	**<0.01**	16 (24%)
High in sugar	**28 (42)**	**13 (20)**	**<0.01**	14 (22%)
High in saturated fats	5 (8)	4 (6)	0.56	2 (3%)
High in sodium	0 (0)	0 (0)	-	
Sweet baked goods	N=118			
Some "high in"	118 (100)	117 (99)	0,32	14 (13%)
High in energy	113 (96)	114 (97)	0,32	1 (0.9%)
High in sugar	111 (94)	105 (89)	0,06	6 (5%)
High in saturated fats	92 (78)	86 (73)	0,08	9 (8%)
High in sodium	0 (0)	0 (0)	-	-
Desserts and ice cream	N=230			
Some "high in"	**104 (45)**	**87 (38)**	**<0.01**	31 (14%)
High in energy	5 (2)	7 (3)	0.32	3 (1%)
High in sugar	**85 (37)**	**69 (30)**	**<0.01**	26 (12%)
High in saturated fats	62 (27)	58 (25)	0.11	10 (5%)
High in sodium	0 (0)	0 (0)	-	
Sweets and candies	N=216			
Some "high in"	190 (88)	190 (88)	0.56	10 (5%)
High in energy	162 (75)	162 (75)	1.00	1 (0.5%)
High in sugar	177 (82)	177 (8)	0.32	1 (0,5%)
High in saturated fats	**117 (54)**	**108 (50)**	**<0.01**	8 (4%)
High in sodium	0 (0)	0 (0)	-	
Sweet spreads	N=73			
Some "high in"	58 (79)	52 (71)	0.06	8 (11%)
High in energy	2 (3)	3 (4)	0.32	-
High in sugar	**41 (56)**	**33 (45)**	**<0.01**	8 (11%)
High in saturated fats	20 (27)	22 (30)	0.32	-
High in sodium	0 (0)	0 (0)	-	-

Salted baked products	N=61			
Some "high in"	38 (62)	38 (62)	-	5 (8%)
High in energy	38 (62)	38 (62)	-	-
High in sugar	2 (3)	1 (2)	0.32	1 (2%)
High in saturated fats	**7 (11)**	**3 (5)**	**0.05**	4 (7%)
High in sodium	3 (5)	2 (3)	0.32	1 (2%)
Salted snacks	N=29			
Some "high in"	26 (90)	29 (100)	0.08	3 (11%)
High in energy	26 (90)	28 (97)	0.16	0
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	4 (14)	3 (10)	0.56	2 (7%)
High in sodium	2 (7)	1 (3)	0.32	1 (3%)
Salted spreads	N=112			
Some "high in"	**81 (72)**	**62 (55)**	**<0.01**	27 (25%)
High in energy	**47 (42)**	**38 (34)**	**<0.01**	11 (9%)
High in sugar	**4 (4)**	**0 (0)**	**0.03**	5 (4%)
High in saturated fats	**52 (46)**	**40 (36)**	**0.01**	13 (12%)
High in sodium	**32 (29)**	**19 (17)**	**<0.01**	14 (13%)
Cheese	N=60			
Some "high in"	49 (82)	49 (82)	-	10 (17%)
High in energy	13 (22)	12 (20)	0.71	4 (7%)
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	48 (80)	48 (80)	-	-
High in sodium	**19 (32)**	**11 (18)**	**<0.01**	8 (13%)
Ready-to-eat food/preparations	N=109			
Some "high in"	17 (16)	15 (14)	0.57	7 (6%)
High in energy	7 (6)	8 (7)	0.66	2 (2%)
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	7 (6)	3 (3)	0.18	4 (4%)
High in sodium	9 (8)	9 (8)	1.00	3 (3%)
Cold meat	N=120			
Some "high in"	**97 (81)**	**37 (31)**	**<0.01**	63 (54%)
High in energy	11 (9)	10 (8)	0.56	2 (2%)
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	12 (10)	14 (12)	0.48	3 (3%)
High in sodium	**88 (73)**	**32 (27)**	**<0.01**	60 (50%)
Meat products (other than cold meat)	N=77			
Some "high in"	24 (31)	21 (27)	0.37	9 (12%)
High in energy	0 (0)	2 (3)	0.16	0

High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	22 (28)	17 (22)	0.21	7 (9%)
High in sodium	4 (5)	2 (3)	0.16	2 (3%)
Soups	N=57			
Some "high in"	55 (96)	54 (95)	0.65	0
High in energy	0 (0)	0 (0)	-	-
High in sugar	0 (0)	0 (0)	-	-
High in saturated fats	0 (0)	0 (0)	-	-
High in sodium	57 (100)	57 (100)	-	0

**% of the total pre-implementation products*

Pre-implementation period (January and February 2015 + January and February 2016); post-implementation period (January and February 2017)

The values in column 2 and 3 represent the frequency (N and proportion of the total for each category) of "high in" products. The values in the last column represent the N of reformulated products and their percentage in relation to the total of "high in" products in the pre-implementation period.

Reformulated products: those classified as "high in" according to their nutritional composition in the pre-implementation period, which are not classified as "high in" in the post-implementation period (based on the new nutritional information declared in the pre-implementation period); the number of reformulated products is not necessarily equal to the difference in the number of "high in" products in each period, as in some cases, products that were not "high in" in the pre-implementation period were "high in" the post-implementation period (which could be due to errors in the pre-implementation period declaration corrected in the post-implementation period or other reasons).

Comparison between pre- and post-implementation periods: McNemar's test

Modified table, based on Reyes, 2020.

Source: Elaborated by the authors.

Table 14 shows the median changes for calories and different nutrients between the pre- and post-implementation periods of the law, separately for the 276 products that were reformulated and those that were not, both for the total sample and the different categories. As expected, in virtually all categories the reformulated products significantly decreased at least one of the critical nutrients (with exceptions in some very small sample size groups).

Table 15. Table 15. Changes in median calories and different nutrients between pre- and post-Law on Food Labelling implementation periods

	Reformulated Products			Non-Reformulated Products		
	pre-implementation	post-implementation	p-value	pre-implementation	post-implementation	p-value
	p50 (95% CI)	p50 (95% CI)		p50 (95% CI)	p50 (95% CI)	
Total Sample	N=26			N=40		
Energy (kcal/100 ml)	390 (370 – 408)	349 (348 – 384)	<0.001	373 (353 – 410)	390 (370 – 408)	349 (348 – 384)
Sugar (g/100 ml)	23.3 (16.6 – 30.5)	17.9 (15.0 – 21.1)	0.105	18.0 (3.7 – 26.6)	23.3 (16.6 – 30.5)	17.9 (15.0 – 21.1)
Saturated fats (g/100 ml)	2.0 (1.5 – 6.0)	1.8 (1.4 – 4.9)	0.94	1.8 (0.6 – 3.9)	2.0 (1.5 – 6.0)	1.8 (1.4 – 4.9)
Sodium (mg/100 ml)	186 (100 – 324)	142 (95 – 395)	0.531	183 (43 – 302)	186 (100 – 324)	142 (95 – 395)
Beverages						
Energy (kcal/100 ml)	N=14	24 (21 – 26)	N=98	10 (1 – 24)	N=14	1
Sugar (g/100 ml)	468 (428 – 478)	462 (416 – 481)	0.772	488 (453 – 504)	468 (428 – 478)	462 (416 – 481)
Saturated fats (g/100 ml)	25.0 (23.5 – 27.4)	24.5 (21.4 – 26.0)	0.463	33.0 (29.0 – 39.8)	25.0 (23.5 – 27.4)	24.5 (21.4 – 26.0)
Sodium (mg/100 ml)	7.9 (4.3 – 9.6)	5.7 (3.5 – 5.7)	0.199	11.0 (8.2 – 14.0)	7.9 (4.3 – 9.6)	5.7 (3.5 – 5.7)
Milk and dairy beverages	324 (280 – 397)		311 (254 – 357)	0.84		240 (177 – 298)
Energy (kcal/100 ml)	N=31		N=185		N=31	
Sugar (g/100 ml)	226 (173 – 284)	158 (131 – 239)	0.019	127 (75 – 211)	226 (173 – 284)	158 (131 – 239)
Saturated fats (g/100 ml)	25.3 (23.6 – 28.9)	20.0 (17.7 – 22.0)	<0.001	20.0 (13.7 – 23.6)	25.3 (23.6 – 28.9)	20.0 (17.7 – 22.0)
Sodium (mg/100 ml)	5.3 (2.2 – 9.3)	3.8 (2.0 – 5.9)	0.304	1.6 (0 – 5.6)	5.3 (2.2 – 9.3)	3.8 (2.0 – 5.9)
Yogurts	71 (49 – 110)		63 (36 – 107)	0.645		48.8 (15.8 – 80.0)
Energy (kcal/100 ml)	N=10		N=204		N=10	
Sugar (g/100 ml)	541 (467 – 589)	519 (439 – 605)	0.703	474 (346 – 541)	541 (467 – 589)	519 (439 – 605)
Saturated fats (g/100 ml)	29.4 (5.6 – 56.0)	5.6 (5.6 – 33.0)	0.181	56 (45 – 65)	29.4 (5.6 – 56.0)	5.6 (5.6 – 33.0)
Sodium (mg/100 ml)	9.2 (6.5 – 10.0)	5.5 (4.7 – 5.9)	0.025	8.3 (0 – 17)	9.2 (6.5 – 10.0)	5.5 (4.7 – 5.9)

	Reformulated Products			Non-Reformulated Products		
	pre-implementation	post-implementation	p-value	pre-implementation	post-implementation	p-value
	p50 (95% CI)	p50 (95% CI)		p50 (95% CI)	p50 (95% CI)	
Breakfast cereals						
Energy (kcal/100 ml)	N=8	349 (348 – 384)	N=62	373 (353 – 410)	N=8	0,753
Sugar (g/100 ml)	112 (109 – 118)	71 (60 – 87)	0.264	238 (163 – 313)	112 (109 – 118)	71 (60 – 87)
Saturated fats (g/100 ml)	27.1 (24.7 – 27.8)	8.9 (5.8 – 15.5)	0.011	33.1 (3.9 – 49.6)	27.1 (24.7 – 27.8)	8.9 (5.8 – 15.5)
Sodium (mg/100 ml)	0 (0 – 0)	0 (0 – 0)	-	0 (0 – 14)	0 (0 – 0)	0 (0 – 0)
Sweet baked products	16.0 (14.5 – 18.4)		15.0 (12.0 – 17.0)	0.609		25.5 (13.0 – 55.1)
Energy (kcal/100 ml)	N=5	462 (416 – 481)	N=55	488 (453 – 504)	N=5	0,519
Sugar (g/100 ml)	454 (443 – 454)	440 (426 – 453)	0.38	398 (288 – 418)	454 (443 – 454)	440 (426 – 453)
Saturated fats (g/100 ml)	21.7 (5.5 – 22.5)	20.7 (5.9 – 21.3)	0.901	3.1 (1.9 – 4.9)	21.7 (5.5 – 22.5)	20.7 (5.9 – 21.3)
Sodium (mg/100 ml)	8.0 (6.8 – 8.5)	5.6 (5.4 – 5.7)	0.163	2.0 (0.8 – 3.9)	8.0 (6.8 – 8.5)	5.6 (5.4 – 5.7)
Desserts and ice cream	271 (228 – 274)		267 (259 – 269)	0.985		464 (360 – 595)
Energy (kcal/100 ml)	N=3		N=25		N=3	
Sugar (g/100 ml)	504 (376 – 542)	503 (446 – 519)	-	504 (479 – 543)	504 (376 – 542)	503 (446 – 519)
Saturated fats (g/100 ml)	3.8 (0 – 4.0)	3.2 (0.7 – 6.4)	-	1.3 (0.2 – 4.4)	3.8 (0 – 4.0)	3.2 (0.7 – 6.4)
Sodium (mg/100 ml)	12.0 (4.2 – 13.0)	3.1 (2.8 – 5.5)	-	3.7 (2.8 – 4.0)	12.0 (4.2 – 13.0)	3.1 (2.8 – 5.5)
Sweets and candies	851 (392 – 936)		436 (344 – 883)	-		538 (485 – 624)
Energy (kcal/100 ml)						
Sugar (g/100 ml)	N=27	5,6 (5,6 – 33,0)	N=82	56 (45 – 65)	N=27	0,597
Saturated fats (g/100 ml)	362 (224 – 516)	182 (173 – 231)	<0.001	241 (53 – 544)	362 (224 – 516)	182 (173 – 231)
Sodium (mg/100 ml)	1 (0.3 – 4.9)	0.3 (0 – 4.9)	0.582	2.0 (0.4 – 5.5)	1 (0.3 – 4.9)	0.3 (0 – 4.9)

	Reformulated Products			Non-Reformulated Products		
	pre-implementation	post-implementation	p-value	pre-implementation	post-implementation	p-value
	p50 (95% CI)	p50 (95% CI)		p50 (95% CI)	p50 (95% CI)	
Sweet spreads	N=10		321 (317 – 336)	N=48		284 (163 – 343)
	327 (262 – 387)			0.338		
Energy (kcal/100 ml)	0.05 (0 – 0.2)	0.15 (0 – 1.7)	0.815	0.75 (0 – 2.65)	0.05 (0 – 0.2)	0.15 (0 – 1.7)
Sugar (g/100 ml)	15.3 (14.0 – 18.4)	14.8 (14.5 – 15.4)	0.893	13.8 (5.7 – 17.9)	15.3 (14.0 – 18.4)	14.8 (14.5 – 15.4)
Saturated fats (g/100 ml)	847 (842 – 1190)	689 (540 – 718)	0.053	493 (346 – 673)	847 (842 – 1190)	689 (540 – 718)
Sodium (mg/100 ml)						
Salted baked products	N=7		151 (107 – 287)	N=101		336 (93 - 341)
	321 (267 – 369)			0.084		
Energy (kcal/100 ml)	2.1 (0.9 – 2.4)	1.6 (0.3 – 2.1)	0.585	1.2 (0.1 – 3.0)	2.1 (0.9 – 2.4)	1.6 (0.3 – 2.1)
Sugar (g/100 ml)	6.2 (0.3 – 8.6)	1.0 (0.1 – 5.6)	0.08	0.5 (0 – 0.7)	6.2 (0.3 – 8.6)	1.0 (0.1 – 5.6)
Saturated fats (g/100 ml)	770 (463 – 900)	497 (303 – 726)	0.442	235 (10 – 452)	770 (463 – 900)	497 (303 – 726)
Sodium (mg/100 ml)	N=63		N=54		N=63	
Salted snacks	211 (103 – 277)		207 (103 – 281)	0.898		270 (168 – 313)
Energy (kcal/100 ml)	0.9 (0.2 – 1.5)	0.5 (0.5 – 1.1)	0.008	0.5 (0.1 – 1.5)	0.9 (0.2 – 1.5)	0.5 (0.5 – 1.1)
Sugar (g/100 ml)	5.1 (0 – 9.2)	5.2 (0.6 – 8.8)	0.948	7.8 (2.2 – 10.5)	5.1 (0 – 9.2)	5.2 (0.6 – 8.8)
Saturated fats (g/100 ml)	960 (850 – 1024)	760 (710 – 791)	<0.001	800 (706 – 1070)	960 (850 – 1024)	760 (710 – 791)
Sodium (mg/100 ml)						
Salted spreads	N=9		179 (168 – 191)	N=64		194 (138 – 251)
	206 (191 – 209)			0.206		
Energy (kcal/100 ml)	0 (0 – 0.1)	0 (0 – 1)	1	0.2 (0 – 1.2)	0 (0 – 0.1)	0 (0 – 1)
Sugar (g/100 ml)	8.4 (7.8 – 9.0)	5.9 (5.9 – 5.9)	0.005	2.6 (1.4 – 5.8)	8.4 (7.8 – 9.0)	5.9 (5.9 – 5.9)
Saturated fats (g/100 ml)	440 (403 – 607)	489 (480 – 516)	0.627	441 (375 – 602)	440 (403 – 607)	489 (480 – 516)
Sodium (mg/100 ml)	N=10		N=48		N=10	

	Reformulated Products			Non-Reformulated Products		
	pre-implementation	post-implementation	p-value	pre-implementation	post-implementation	p-value
	p50 (95% CI)	p50 (95% CI)		p50 (95% CI)	p50 (95% CI)	
Cheese	N=10			N=48		
Energy (kcal/100 ml)	327 (262 – 387)	321 (317 – 336)	0.338	284 (163 – 343)	327 (262 – 387)	321 (317 – 336)
Sugar (g/100 ml)	0.05 (0 – 0.2)	0.15 (0 – 1.7)	0.815	0.75 (0 – 2.65)	0.05 (0 – 0.2)	0.15 (0 – 1.7)
Saturated fats (g/100 ml)	15.3 (14.0 – 18.4)	14.8 (14.5 – 15.4)	0.893	13.8 (5.7 – 17.9)	15.3 (14.0 – 18.4)	14.8 (14.5 – 15.4)
Sodium (mg/100 ml)	847 (842 – 1190)	689 (540 – 718)	0.053	493 (346 – 673)	847 (842 – 1190)	689 (540 – 718)
Ready-to-eat food/preparations	N=7			N=101		
Energy (kcal/100 ml)	321 (267 – 369)	151 (107 – 287)	0.084	336 (93 -341)	321 (267 – 369)	151 (107 – 287)
Sugar (g/100 ml)	2.1 (0.9 – 2.4)	1.6 (0.3 – 2.1)	0.585	1.2 (0.1 – 3.0)	2.1 (0.9 – 2.4)	1.6 (0.3 – 2.1)
Saturated fats (g/100 ml)	6.2 (0.3 – 8.6)	1.0 (0.1 – 5.6)	0.08	0.5 (0 – 0.7)	6.2 (0.3 – 8.6)	1.0 (0.1 – 5.6)
Sodium (mg/100 ml)	770 (463 – 900)	497 (303 – 726)	0.442	235 (10 – 452)	770 (463 – 900)	497 (303 – 726)
Cold meat	N=63			N=54		
Energy (kcal/100 ml)	211 (103 – 277)	207 (103 – 281)	0.898	270 (168 – 313)	211 (103 – 277)	207 (103 – 281)
Sugar (g/100 ml)	0.9 (0.2 – 1.5)	0.5 (0.5 – 1.1)	0.008	0.5 (0.1 – 1.5)	0.9 (0.2 – 1.5)	0.5 (0.5 – 1.1)
Saturated fats (g/100 ml)	5.1 (0 – 9.2)	5.2 (0.6 – 8.8)	0.948	7.8 (2.2 – 10.5)	5.1 (0 – 9.2)	5.2 (0.6 – 8.8)
Sodium (mg/100 ml)	960 (850 – 1024)	760 (710 – 791)	<0.001	800 (706 – 1070)	960 (850 – 1024)	760 (710 – 791)
Meat products (other than cold meat)	N=9			N=64		
Energy (kcal/100 ml)	206 (191 – 209)	179 (168 – 191)	0.206	194 (138 – 251)	206 (191 – 209)	179 (168 – 191)
Sugar (g/100 ml)	0 (0 – 0.1)	0 (0 – 1)	1	0.2 (0 – 1.2)	0 (0 – 0.1)	0 (0 – 1)
Saturated fats (g/100 ml)	8.4 (7.8 – 9.0)	5.9 (5.9 – 5.9)	0.005	2.6 (1.4 – 5.8)	8.4 (7.8 – 9.0)	5.9 (5.9 – 5.9)
Sodium (mg/100 ml)	440 (403 – 607)	489 (480 – 516)	0.627	441 (375 – 602)	440 (403 – 607)	489 (480 – 516)

	Reformulated Products			Non-Reformulated Products		
	pre-implementation	post-implementation	p-value	pre-implementation	post-implementation	p-value
	p50 (95% CI)	p50 (95% CI)		p50 (95% CI)	p50 (95% CI)	
Soups	NA			N=55		
Energy (kcal/100 ml)	NA	NA	-	26 (22 – 34)	NA	0.645
Sugar (g/100 ml)	NA	NA	-	0.50 (0.20 – 1.38)	NA	0.756
Saturated fats (g/100 ml)	NA	NA	-	0 (0 – 0.08)	NA	1
Sodium (mg/100 ml)	NA	NA	-	361 (308 – 395)	NA	0.848

Source: Elaborated by the authors.

Pre-implementation period (January and February 2015, January and February 2016); post-implementation period (January and February 2017)

The values in columns 2, 3, 5 and 6 represent the median (and interquartile interval).

Reformulated products: classified as "high in" products according to their nutritional composition in the pre-implementation period, but which are not "high in" in the post-implementation period (based on the new nutritional information declared in the pre-implementation period).

Non-reformulated products: sum of products classified as "high in" in pre- and post-implementation periods, products not classified as "high in" in pre- and post-implementation periods, and products classified as "high in" only in post-implementation.

Comparisons between pre- and post-implementation periods: Wilcoxon Signed Rank test

NA: not available

In most cases, reformulated foods came from the most important companies in the market. Table 16 summarises this information.

Table 16. Percentage of the market for a given category, of reformulated brands, by food group

	Companies* to which the products belong [N]	Relevance of companies [% of sales in the specific category]
Beverages (reformulated N=39)	6	69
Dairy and dairy beverages (Reformulated N =24)	5	85
Breakfast cereals (Reformulated N = 26)	4	66
Sweet baked products (reformulated N =14)	2	34
Desserts and ice cream (N reformulated =31)	5	57
Sweets and candies (N reformulated =10)	0	0
Sweet spreads (reformulated N =8)	3	15
Salted baked products (reformulated N =5)	2	1,8
Salted snacks (reformulated N =3)	1	62
Salted spreads (reformulated N =27)	5	35
Cheese (N reformulated =10)	3	44
Ready-to-eat foods/preparations (reformulated N =7)	5	37
Cold meat and meat products other than cold meat (reformulated N = 9)	5	49

*Of the companies available in Table 3

Source: Elaborated by the authors

5.4 Food marketing analysis

In 2016, advertisements were not using labels as an advertising strategy. In 2017, of the 5 609 advertisements that included food and/or drinks, 18.8 percent (N = 1 056) used labels as a strategy. They advertised products that did not have labels, had less than the competition or did not include any of the critical ingredients regulated by law. According to Table 17, the advertisements that did use the new law as a strategy had significantly more strategies highlighting nutrition/health and weight management ideas (17.8 percent vs 7.4 percent, $p < .001$) than those not using the new law as a strategy. Likewise, those using the law as advertising also had a higher proportion of strategies dedicated to children. For example, they included more children (63.6 percent vs 39.1 percent, $p < .001$), animated characters (58.2 percent vs 37.1 percent, $p < .001$) and references to children (48.3 percent vs 28.0 percent, $p < .001$). Although less important overall, awards/gifts and the presence of celebrities were more prevalent among advertisements that did not use the law as a strategy.

Table 17. Comparison of marketing techniques between advertising that uses or does not use labels

Marketing strategies	Advertising that does NOT use labels as a strategy (N = 4 553)		Advertising that DOES use labels as a strategy (N = 1 056)		p-value
	N	%	N	%	
Inclusion of children	1780	39.1%	672	63.6%	p<0.01
Animated characters	1689	37.1%	615	58.2%	p<0.01
Prizes/Gifts	518	11.4%	66	6.2%	p<0.01
Celebrities	803	17.6%	4	0.4%	p<0.01
References to children	1277	28.0%	510	48.3%	p<0.01
Nutrition/Health	338	7.4%	188	17.8%	p<0.01

Source: Elaborated by the authors.

Table 18 shows the brands and companies that used the labels and the law as an advertising strategy. The brands of the four most important products that appeared in the advertisements were added. A total of 2 248 products appeared in advertisements that used the law as a strategy. Of this total, 60.9 percent were marketed by the Soprole brand. In second order of importance were CCU products (22.06 percent), particularly Cachantún (N = 144), Watts (N = 90), Loncoleche (N = 85), Calán (N = 68), Yogu Yogu (N = 47) and Danone (N = 47). Coca Cola also used this strategy (7.2 percent). So did other brands like Ideal (Bimbo Group) with 3.5 percent, Cola Cao (Idilia Foods) with 2.9 percent and Colun (1.6 percent).

Table 18. Frequency of brands that used the law's labels as a strategy

Company	Brand	N	%
Soprole	Soprole	1362	60.9%
	Griego	7	
	TOTAL	1369	
CCU	Cachantun	144	22.1%
	Watts	90	
	Loncoleche	85	
	Calan	68	
	Danone	47	
	Yogu Yogu	47	
	Calo	9	
	Gatorade	3	
	Vivo	2	
	Belmont	1	
	TOTAL	496	
Coca Cola	Coca Cola	135	7.2%
	Benedictino	25	
	Fanta	1	
	TOTAL	161	
Unilever	Lipton	7	0.5%
	Malloa	4	
	TOTAL	11	
Grupo Bimbo	Ideal	78	3.5%
Idilia Foods	Cola Cao	66	2.9%
Colun	Colun	36	1.6%
Iansa	Iansa	12	0.5%
Nestle	Nestle	8	0.4%
Grupo Abbott	Similac	8	0.4%
Cencosud	Jumbo	2	0.1%
Agrosuper	Super Pollo	1	0.04%
	TOTAL	2248	100%

Source: Elaborated by the authors.

5.5 Impact analysis of the implementation of the first phase of the Law on Food Labelling on real variables in the manufacturing sector

In this section, the "treatment" is the front-of-package food labelling in its various stages. "Interventions" refer to the different stages or phases of front-of-package food labelling Thus, the first intervention occurs in June 2016, the second intervention occurs in June 2018 and the third intervention occurs in June 2019.

The treatment – or treated – group refers to industries or industrial sectors that the front-of-package food labelling or treatment could have directly affected. In contrast, the control – or controlled – group refers to industries or industrial sectors where the treatment would not have had a direct effect.

The following results show the effect of front-of-package food labelling at the manufacturing industry level, using employment data from the National Employment Survey (ENE); and within the manufacturing industry, using physical production data from the Manufacturing Production Index (IPMan) and actual investment expenditure data (SII base).

National Employment Survey (ENE)

As mentioned above, the ENE contains data by mobile quarter. For the purpose of identifying the time of the interventions (June 2016, June 2018 and June 2019), the first quarter of intervention is considered to be the quarter where each month includes interventions. Thus, the monthly data from which the intervention period is considered to begin is June, July and August for the years 2016, 2018 and 2019.

The treatment group is the entire manufacturing industry, because there is no information for subdivisions of the industry that is specific enough to adequately separate the manufacturing sectors affected by the treatment from those that were not. However, considering manufacturing in an aggregate way is by no means a limitation of the analysis. On the contrary, it allows to analyse whether the treatment had an effect on an important sector of the economy (in terms of employment, the manufacturing sector employed between 9.5 percent and 11.5 percent in the period under review), where adjustments may occur. For example, if front-of-package food labelling had had a negative employment effect in specific manufacturing sectors but with compensation for this effect in other sectors that created jobs from the treatment, the employment effect on total manufacturing would have been zero. This could show, for example, that front-of-package food labelling could, hypothetically, destroy jobs in some sectors, but could also create jobs in sectors producing substitutes for labelled products. However, looking at manufacturing in aggregate, it is not possible to identify which parts of the sector might have destroyed jobs from treatment and which parts might have created new jobs.

One might even think that what matters is not what happens to manufacturing employment but what happens at the aggregate level of the entire economy. If net employment generation at the economy level is positive (or negative or zero) after treatment (or after each stage of treatment) it could mean that treatment was the cause of this behaviour. However, in the absence of a control group to contrast this development, it is impossible to say that this is the case.

In the analysis of ENE data, the sum of employment in "Real estate activities" and "Professional, scientific and technical activities" is used as a control group. Both activities are completely unrelated to treatment (meaning, they are not affected by the front-of-package food labelling) and, from that point of view, are an adequate control.

The CITS regression presented in Table 19 uses as a dependent variable the logarithm of employment in manufacturing industry for the treatment group, and the sum of employment in the real estate and professional, scientific and technical activities sectors for the control group. The independent variables are the logarithm of the quarterly moving average (same months as for the dependent variable) of the non-mining Monthly Economic Activity Index (IMACEC). This variable attempts to capture general trends in the non-mining economy. Besides, monthly dichotomous variables are used for seasonal adjustment, as well as a dichotomous variable that is equal to one from October 2014, when the tax on soft drinks was (moderately) increased. Apart from this tax on sweetened beverages, there were no other measures affecting the control and/or treatment groups during this period.

Table 19. CITS results of employment in manufacturing industry (ENE)

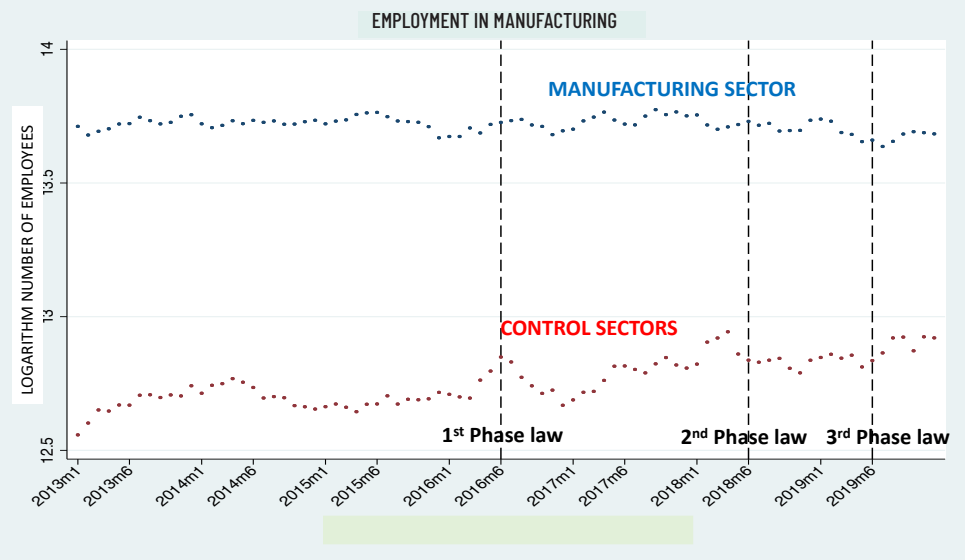
Variables	Model 1
Trend of the variable of interest before the intervention (β_1)	0.00294** (0.00125)
Change in the level of the variable of interest after the intervention (β_2)	-0.0128 (0.0416)
Change in trend of the variable of interest after the intervention (β_3)	0.00422 (0.00328)
Difference in level of the variable of interest between the treatment and control groups before the intervention (β_4)	1.056*** (0.0228)
Difference in the slope of the variable of interest between the treatment and control groups before the intervention (β_5)	-0.00135 (0.000956)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_6)	-0.000910 (0.0452)
Difference between the slopes of the variable of interest between the pre- and post-intervention period and between the treatment and control groups (β_7)	-0.00457 (0.00328)
Change in the level of the variable of interest in the control group with the second intervention (β_8)	-0.0656** (0.0301)
Change in trend in the control group between the first and second intervention (β_9)	-0.00458 (0.00333)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_{10})	0.0408 (0.0366)
Difference in slope differences between treatment and control groups between first and second intervention (β_{11})	0.00142 (0.00438)
Change in the level of the variable of interest with the third intervention (β_{12})	-0.00672 (0.0214)
Change in trend in the control group between the second and third interventions (β_{13})	0.0134** (0.00585)
Difference in level of the variable of interest between treatment and control groups after the third intervention (β_{14})	-0.0552* (0.0308)
Difference in slope differences between treatment and control groups between second and third intervention (β_{15})	0.000291 (0.00522)
IMACEC's natural non-mining logarithm	-0.0724 (0.504)
Alcoholic Beverage Tax October 2014	-0.0441* (0.0259)
Constant (β_0)	12.98*** (2.324)
Number of observations	168

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Source: Elaborated by the authors.

Firstly, the table shows that the control group has the same trend as the group treated before the first intervention (June/August 2016), since the coefficient β_5 is statistically not significant. Immediately after the interventions, there is no statistically significant difference (at 5 percent) in the change in employment level between control and treatment groups for any of the three interventions (parameters β_6, β_{10} and β_{14}). More importantly, there is no significant difference (even at 10 percent) in the slopes of the treatment and control groups, between adjacent periods, for any of the three interventions (parameters β_7, β_{11} and β_{15}, comparable to parameters of a difference-in-differences). In other words, the different phases of food labelling had no effect on employment trends in manufacturing when compared with the control group: both groups behaved in the same way. Figure 6 presents the evolution of the dependent variable for the treatment and control groups before and after each intervention.

Figure 6. Evolution of the dependent variable for the treatment and control groups before and after each intervention (employment)



Source: Elaborated by the authors.

Besides, this regression shows that after the first intervention (June 2016) there was no significant change in the trend of the treated group (sum β_3 + β_7 , coefficient equal to -0.013, p=0.48). There is, however, a significant difference (at 5 percent) in the slopes of the treated and control groups (sum β_5 +β_7, coefficient equal to -0.006, p=0.049). This difference in the slopes of the groups disappears for the second and third intervention (sum β_5 + β_7 + β_{11}, coefficient equal to -0.045; p=0.156; sum β_5 + β_7 + β_{11} + β_{15}, coefficient equal to -0.042, p=0.256; respectively).

Finally, there are no significant differences between the differences between slopes of the treatment and control groups after the second and third interventions, when compared to the difference in the pre-treatment period (sum β_7 + β_{11}, coefficient equal to 0.04, p=0.578; sumβ_7 + β_{11}+ β_{15}, coefficient equal to -0.015, p=0.848; respectively).

In summary, the CITS analysis of employment developments in the manufacturing sector shows that there was no change in either the level or trend of employment in any period following the interventions, when compared to a group that was not subject to front-of-package food labelling. Given the quasi-experimental nature of the CITS method, it is possible to say that front-of-package food labelling did not cause changes in manufacturing employment, given the behaviour it had in other sectors of the economy. This does not mean that front-of-package food labelling did not generate job losses in specific manufacturing sectors (there is no element to affirm or deny this, given the level of disaggregation of the data). What it means is that if these changes existed, they were compensated (in one way or another) by other sectors of the manufacturing sector, so that the aggregate did not suffer significant variations.

The Manufacturing Production Index (IPMan)

In the case of the analysis carried out with the Manufacturing Production Index (IPMan), information from this index – which measures physical production in companies and/or manufacturing establishments with ten workers or more – is available at three digits, which allows the food and beverage industry to be separated from the rest of the manufacturing sectors. To carry out this analysis, the sectoral weights for each branch of the food and beverage sector are considered, as well as the weights for the branches of industry other than food and beverage. The sectoral index for food and beverages would then be equal to:

$$IPMan_t^{AB} = \sum_{i=1}^{j} w_i \times IPMan_{it}$$

where IPMantAB is the index of manufacturing production in the food and beverage sector; wit is the weight of sub-sector i in the total IPMan (the weights have remained constant over the period analysed), and PManit is the index of sub-sector i at time t. The same can be done for the IPMan of the rest of the manufacturing sector.

In the CITS regression presented in Table 20, the IPMan logarithm for food and beverages is used as the dependent variable for the treatment group; and the IPMan natural logarithm for the rest of the manufacturing sectors is used for the control group. The logarithm of the monthly non-mining IMACEC is used as independent variables. This variable attempts to capture general trends in the non-mining economy that could affect the entire manufacturing sector. Additionally, monthly dichotomous variables are used for seasonal adjustment, as well as a dichotomous variable that is equal to one from October 2014, when the tax on non-alcoholic beverages was (moderately) increased.

Table 20. CITS results for physical production in the food industry (IPMan)

Variables	Model 1
Trend of the variable of interest before the intervention (β_1)	-0.00281* (0.00158)
Change in the level of the variable of interest after the intervention (β_2)	0.0187 (0.0231)
Change in trend of the variable of interest after the intervention (β_3)	-0.00176 (0.00180)
Difference in level of the variable of interest between the treatment and control groups before the intervention (β_4)	-0.340*** (0.0225)
Difference in the slope of the variable of interest between the treatment control groups before the intervention (β_5)	-0.000395 (0.00140)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_6)	-0.0307 (0.0310)
Difference between the slopes of the variable of interest between the pre- and post-intervention period and between the treatment and control groups (β_7)	0.00543*** (0.00487)
Change in the level of the variable of interest in the control group with the second intervention (β_8)	0.0533** (0.0256)

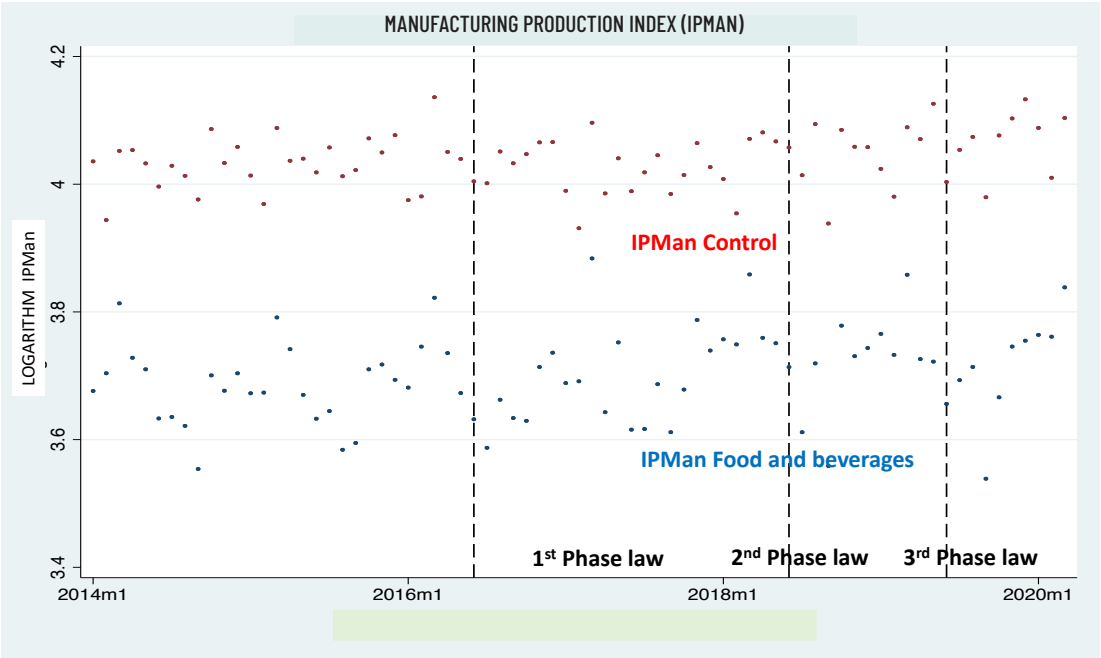
Change in trend in the control group between the first and second intervention (β_9)	-0.00208 (0.00361)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_{10})	-0.0994*** (0.0311)
Difference in slope differences between treatment and control groups between first and second intervention (β_{11})	0.000862 (0.00487)
Change in the level of the variable of interest with the third intervention (β_{12})	0.0494 (0.0432)
Change in trend in the control group between the second and third interventions (β_{13})	0.00854* (0.00484)
Difference in level of the variable of interest between treatment and control group after the third intervention (β_{14})	-0,113** (0.0568)
Difference in slope differences between treatment and control groups between second and third intervention (β_{15})	0.00588 (0.00578)
IMACEC's natural non-mining logarithm	1.481*** (0.341)
Alcoholic Beverage Tax October 2014	0.00737 (0.0213)
Constant (β_0)	-2.895* (1.597)
Number of observations	150

*Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1*

Source: Elaborated by the authors.

First, the table shows that the control group has the same trend as the group treated before the first intervention in June 2016, since the coefficient β_5 is statistically not significant. Immediately after the interventions, there is no statistically significant difference (at 5 percent) in the change in the level of physical production between control and treatment groups in the case of the first intervention (parameter β_6), although there is an immediate decrease in the level of physical production in the treatment group, compared to the control group, in the case of interventions 2 and 3 (parameters β_{10} and β_{14}, respectively). Figure 7 presents the evolution of the dependent variable for the treatment and control groups before and after each intervention.

Figure 7. Evolution of the dependent variable for the treatment and control groups before and after each intervention (IPMan)



Source: Elaborated by the authors.

What happens with the relative changes in the slopes of the treatment and control group, between adjacent periods (parametersβ_7, β_{11} and β_{15}) is even more relevant. In the case of the first intervention (parameter β_7), the table shows that after the intervention the slope of the treatment group increased compared to that of the control group and to the period before the implementation of front-of package food labelling. In other words, although the level of physical production (compared to the control group) fell after the first intervention, physical production grew faster in the treatment group than in the control group, compared to the previous period. For the second and third interventions (parameters β_{11} and β_{15}), there are no statistically significant differences, which implies that the physical production trends of treatment and control groups behaved in the same way after these interventions (compared to the immediate previous period).

Besides, the results show that after the first intervention (June 2016) there was no significant change in the trend of the treated group (sum β_3 + β_7, coefficient equal to -0.012, p=0.62) compared to the pre-treatment period. There is, however, a significant difference in the slope differences of the treated and control groups (sum β_5 +β_7, coefficient equal to 0.005, p<0.01). This difference in the slopes of the groups is maintained for the third intervention (sum β_5 + β_7 + β_{11} + β_{15}, coefficient equal to 0.012, p=0.02) but it is not verified for the second intervention (sum β_5 + β_7+β_{11}, coefficient equal to 0.006, p=0.21).

Finally, the differences in slope of the treatment and control groups after the second and third interventions, when compared to the difference in the pre-treatment period, are statistically significant (sum β_7 + β_{11}, coefficient equal to -0.13, p<0.01; sum 7+$\beta_{11}\beta$ + 15, β coefficient equal to -0.24, p<0.01; respectively).

This would imply that, while there would be no difference in physical production trends between treatment and control groups between consecutive periods, there would be changes in that difference after the second intervention (June 2018) and the third one (June 2019). In other words, physical production would have grown less in the food industry than in the rest of the industry after those interventions.

This may be due to at least two factors. The first is that the lower growth in physical production in the food and beverage sector was due to the fact that font-of-package food labelling implied a decrease in the purchase of certain foods and beverages (presumably the labelled ones, although it cannot be known with this index) that was not compensated by the rest of the sector (presumably, unlabelled foods and beverages). This possibility cannot be ruled out, but if it had occurred, it would not have affected employment in the entire sector as found in the previous subsection. The second factor could be purely statistical and given by the month in which the interventions begin (June). If the start of the interventions is artificially "delayed" by two or three months (it is assumed that, although they came into effect in June, the effect on companies began to be felt in the following August or September), this lower growth in food and beverages relative to the control group disappears. In other words, this result (not the previous ones) is not robust to change at the time of the interventions.

It remains to be seen whether the two- or three-month change scenario in which the interventions actually materialise is realistic and therefore the lack of robustness of the previous result is important. There is no evidence either for or against this assumption. However, it is reasonable to assume that the adjustment in physical production following a change in regulation such as that discussed here is not immediate (there are inventories that can build up as a result of uncertainty about how regulation will affect demand). If such an adjustment takes two months or more to materialise, it is reasonable to conclude that the lower growth observed in the food and beverage sector relative to the control group is a purely statistical effect that has to do with the choice of the moment when such regulation is supposed to materialise in the companies' production decisions.

SII Business panel

The information contained in this panel is more disaggregated than the previous information, since companies themselves report this data. For reasons of confidentiality, however, the information has been received at the six-digit level of a national version of the Chilean classifier of economic activities (National Institute of Statistics, 2014). Given the level of disaggregation, the information can be aggregated at the industry level, where the manufacturing industry is divided into two categories: metal manufacturing industry and non-metal manufacturing industry. Then, the idea is to start with the food and beverage industry – possibly affected or not by font-of-package food labelling – and add sectors to achieve robust indicators of change in the chosen variables.

The following analyses are carried out with investment expenditure (capital goods). In all cases, then, the dependent variable will be the logarithm of actual monthly investment expenditure, in billions of Chilean pesos as of December 2013 (deflated with the National Statistics Institute's consumer price index). In all cases, the independent variables will be the monthly IMACEC non-mining logarithm; monthly dichotomous variables for seasonal adjustment; a dichotomous variable that is equal to one as of October 2014, when the tax on soft drinks was (moderately) increased; and a dichotomous variable that is equal to one as of July 2015 (due to unusually low values in the variables of interest).

The food and beverage industry

Given the disaggregation of the data, it is possible to construct two groups of industries within the food and beverage industry. The first group – treatment group – includes industrial branches whose products are likely to have been affected by front-of-package food labelling. The second group – control group – includes industries whose products are unlikely to have been affected by the treatment. Table 21 shows the industries included in both groups.

Table 21. List of industry sectors, probably affected and probably not affected by front-of-package food labelling

Group	Chilean classification of economic activities
Sectors likely to be affected by front-of-package food labelling	151410 Manufacture of vegetable oils and fats 151420 Manufacture of oils and fats of animal origin, except butter 152010 Manufacture of milk, butter, dairy products and derivatives except cheese 152020 Cheese production 152030 Manufacture of ice cream, sorbets and other similar milk-based desserts 153190 Manufacture of other milling products and cereal-based foods 153210 Manufacture of starches and starch products 154110 Manufacture of bakery and pastry goods 154120 Biscuit manufacture 154310 Production of cocoa and chocolate 154320 Candy manufacture 154930 Manufacture of vinegar, mustard, mayonnaise and condiments in general 154990 Manufacture of other foodstuffs not elsewhere classified 155410 Production of non-alcoholic beverages
Sectors likely to be unaffected by front-of-package food labelling	151300 Processing and preserving of fruit and vegetables 153110 Wheat flour manufacture 153120 Rice milling 154910 Manufacture of tea, coffee and infusions 154920 Manufacture of natural or artificial yeasts 154400 Manufacture of macaroni, noodles, couscous and similar products 155110 Pisco production (pisco industry) 155120 Distillation, rectification and mixing of alcoholic beverages; production of ethyl alcohol from fermented materials and the like, except pisco. 155200 Wine production 155420 Production of prepared natural mineral, spring and drinking water 155430 Manufacture of ice 155300 Production of malt beverages (beers) and malts

This exercise of attributing industries to one group or another, is relatively arbitrary because there are companies whose product portfolio includes products affected and not affected by front-of-package food labelling. In this database it is impossible to separate within each company both types of products. Even if it was possible, it would be an arbitrary exercise as it is difficult to separate, for example, how much investment is made in each type of product the company has. There are investments that clearly affect multiple product lines and even some that affect all of them (for example, the construction of a new production plant or a new warehouse). For this reason, the results of this exercise must be analysed with caution.

Table 22 shows the CITS results for actual monthly investment expenditure. The table shows that the control group (food and beverages probably not affected by the treatment) has a similar behaviour (in trend) to the treated group (the coefficient β_5 is statistically not significant). The table also shows that after the first intervention (June 2016) the difference between the trends of the control and treatment groups was not significant (coefficient β_7). This implies that the intervention would not have had any influence on investment spending in sectors with companies potentially affected by treatment.

Table 22. Actual investment expenditure in the food and beverage industry

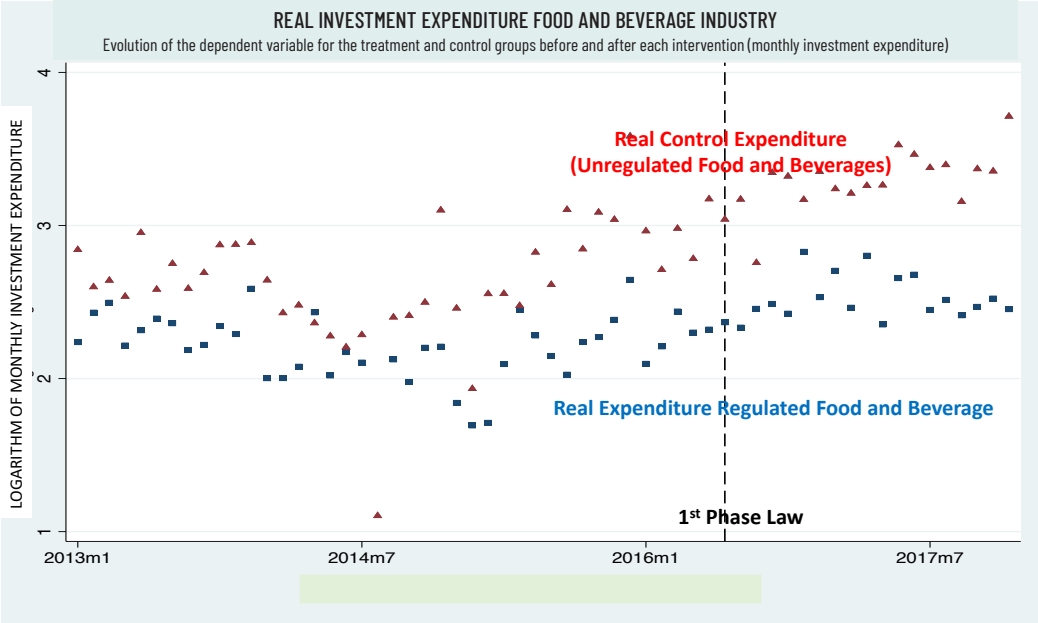
Variables	Modelo 1
Trend of the variable of interest before the intervention (β_1)	-0.0352* (0.0187)
Change in the level of the variable of interest after the intervention (β_2)	0.610*** (0.216)
Change in trend of the variable of interest after the intervention (β_3)	0.0125 (0.0162)
Difference in level of the variable of interest between the treatment and control groups before the intervention (β_4)	0.329** (0.155)
Difference in the slope of the variable of interest between the treatment and control group before the intervention (β_5)	0.00970 (0.00618)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_6)	-0.145 (0.219)
Difference between the slopes of the variable of interest between the pre- and post-intervention period and between the treatment and control groups (β_7)	0.0109 (0.0154)
IMACEC's natural non-mining logarithm	12.04** (5.913)
Alcoholic Beverage Tax October 2014	0.289 (0.278)
Dichotomous variable July 2015	-0.137 (0.124)
Constant (β_0)	-53.71* (27.63)
Number of observations	120

*Errores estándar en paréntesis *** p<0.01, ** p<0.05, * p<0.1*

Fuente: Elaboración propia.

Finally, the study shows that there was no significant change in the differences in slopes of the treated and control groups throughout the period (sum β_5 + β_7, coefficient equal to 0.021, p=0.154). On the other hand, there was a significant change in slope for 5 percent of the treated group with respect to the pre-treatment period (sum β_3 +β_7 equals 0.466, p=0.012). This difference, shows that the investment growth rate could have increased after the front-of-package food labelling. Figure 8 shows the evolution of the dependent variable for the treatment and control groups before and after the intervention.

Figure 8. Evolution of the dependent variable for the treatment and control groups before and after each intervention (monthly investment expenditure)



Source: Elaborated by the authors.

The non-metal manufacturing industry

The above results show clearly that, within the food and beverage industry, the introduction of front-of-package food labelling (in its first phase) had no impact on the trajectory of real monthly investment spending. However, it could be argued that this exercise is invalidated by the attribution of food and beverage producing manufacturing sectors to the treatment or control group. As mentioned above, in practice it is complex to make such an attribution, and the level of disaggregation available does not allow for this attribution to be taxable.

To remedy this and obtain robust results to the ambiguous attribution of groups, the analyses are carried out at the next level of aggregation. This means that instead of carrying out the CITS in the food and beverage industry, it is carried out in the non-metal industry, which includes the food and beverage industry. In terms of employment, the food and beverage industry employed half of the total labour force used in this period by the manufacturing industry.

Then, the food and beverage industry is taken as the treatment group (regardless of whether or not it was affected by front-of-package food labelling) and the rest of the non-metal industry is taken as the control group. Table 23 shows the result of this exercise for actual monthly investment expenditure.

Table 23. Actual investment expenditure in non-metal industry

Variables	Modelo 2
Trend of the variable of interest before the intervention (β_1)	-0.0303** (0.0149)
Change in the level of the variable of interest after the intervention (β_2)	0.527*** (0.173)
Change in trend of the variable of interest after the intervention (β_3)	0.00969 (0.0131)
Difference in level of the variable of interest between the treatment and control groups before the intervention (β_4)	-0.302** (0.118)
Difference in the slope of the variable of interest between the treatment and control group before the intervention (β_5)	0.00333 (0.00481)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_6)	-0.0433 (0.176)
Difference between the slopes of the variable of interest between the pre- and post-intervention period and between the treatment and control groups (β_7)	0.00994 (0.0130)
IMACEC's natural non-mining logarithm	11.35** (4.568)
Alcoholic Beverage Tax October 2014	0.269 (0.209)
Dichotomous variable July 2015	-0.190** (0.0830)
Constant (β_0)	-49.31** (21.32)
Number of observations	120

*Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1*

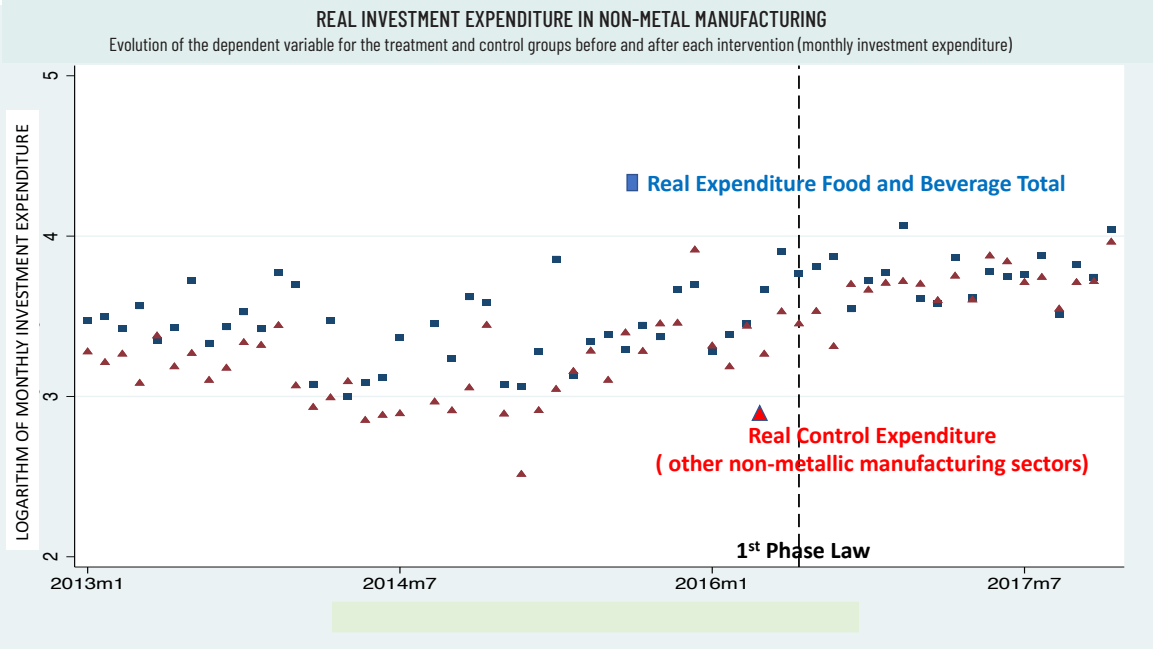
Source: Elaborated by the authors.

Firstly, this analysis shows that the control group behaves similarly (in trend) to the treated group (the coefficient β_5 is statistically not significant at any relevant level). Besides, the table shows that after the first intervention (June 2016) the difference between the trends of the control and treatment groups was not significant (coefficient β_7), which would indicate that the start of front-of-package food labelling would not have influenced the real investment expenditure in the food and beverage industry, when compared to the rest of the non-metal industries.

Additionally, no significant change is found in the differences in slopes of the treated and control groups throughout the period (sum of β_5 + β_7, coefficient equal to 0.013, p=0.275). On the other hand, there was a significant change in the trend of 1 percent of the treated group with respect to

the pre-treatment period (sum of β_3 +β_7 equals 0.484, p=0.001). This would indicate that the growth rate of investment in the food and beverage industries could have increased after the implementation of the first phase of the front-of-package food labelling. Figure 9 presents the evolution of the dependent variable for the treatment and control groups before and after the intervention.

Figure 9. Evolution of the dependent variable for the treatment and control groups before and after each intervention (monthly investment expenditure)



Source: Elaborated by the authors.

The manufacturing industry

A final aggregation is considered to give robustness to the above results. Instead of using the food and beverage industry as the treatment group, the non-metal manufacturing industry is used as the treatment group, and the control group becomes the metal manufacturing industry. This analysis seeks to isolate any effects that might have affected the non-metal industry as a whole given the importance of the food and beverage industry within the non-metal industry. If the results showed that for the whole manufacturing industry there was no appreciable effect of the entry into force of front-of-package food labelling, it would conclusively demonstrate that such an effect did not exist.

Table 24 shows the CITS results. The control group behaves similarly (in trend) to the treated group (the coefficient β_5 is statistically not significant at any relevant level). Additionally, the results show that after the first intervention the difference between the trends of the control and treatment groups was positive and significant at 1 percent (coefficient β_7). This would indicate that real monthly investment expenditures in the non-metal industry grew at a higher rate than those in the metal industry, after the implementation of labels. This is not to say that front-of-package food labelling boosted investment in the non-metal industry, but it does show that, in aggregate terms, it did not slow its growth. If the implementation of labels had decreased the growth of real investment expenditure in the food and beverage industry, this was compensated by the increase in investment expenditure in other sectors of the non-metal industry.

Table 24. Actual investment expenditure in manufacturing

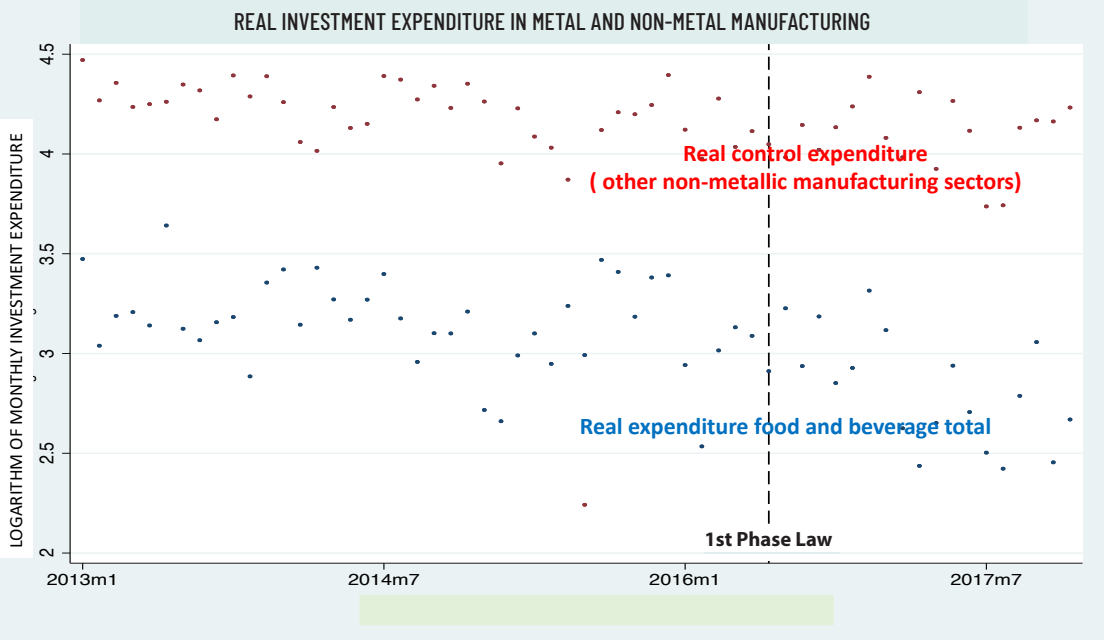
Variables	Model 3
Trend of the variable of interest before the intervention (β_1)	-2.51e-06 (0.00458)
Change in the level of the variable of interest after the intervention (β_2)	-0.0399 (0.118)
Change in trend of the variable of interest after the intervention (β_3)	-0.0315*** (0.00855)
Difference in level of the variable of interest between the treatment and control groups before the intervention (β_4)	1.087*** (0.0763)
Difference in the slope of the variable of interest between the treatment and control groups before the intervention (β_5)	-0.00358 (0.00442)
Difference in the level of the variable of interest between the treatment and control groups after the intervention (β_6)	0.0851 (0.154)
Difference between the slopes of the variable of interest between the pre- and post-intervention period and between the treatment and control groups (β_7)	0.0305*** (0.00999)
IMACEC's natural non-mining logarithm	0.242 (2.249)
Alcoholic Beverage Tax October 2014	-0.116 (0.0918)
Dichotomous variable July 2015	-0.972 (0.0920)
Constant (β_0)	2.313 (10.53)
Number of observations	120

*Errores estándar en paréntesis *** p<0.01, ** p<0.05, * p<0.1*

Fuente: Elaboración propia.

Additionally, there is a positive and significant difference (at 1 percent) in the differences in slopes of the treated and control groups throughout the period (sum β_5 + β_7, coefficient equal to 0.027, p=0.003). Figure 10 presents the evolution of the dependent variable for the treatment and control groups before and after the intervention

Figure 10. Evolution of the dependent variable for the treatment and control groups before and after each intervention (monthly investment expenditure)



Source: Elaborated by the authors.

5 GENERAL DISCUSSION

"There is one factor that is super important and that has to do with the fact that, given all these conditions [demanding nutrient profile but that allows for reformulation, phased implementation, technical capacity of the company], co-working with the industry and the authority also helped. We are very grateful for this because obviously there will always be companies that agree, others that don't, we are human beings, and within our field, not everyone thinks the same as we do, we are different; but also when you are a leader in a category, you also have the opportunity and responsibility to show leadership in that aspect too [...]. We were able to demonstrate that there can be innovations in the portfolio and that it is possible to continue to make profit, to have customers prefer your products, obviously it requires investment, talent and innovation work".

Management, Multinational, Beverage sector

This study sought to characterise the response of the Chilean food production sector to the implementation of the Law on Food Labelling in June 2016 in terms of: attitudes towards the law, product reformulation, use of the absence of labels as a marketing strategy, and impact on real variables of the sector. What we observed in our analysis is that although in a first stage the main actors in the food industry were in disagreement with the regulation, once it was implemented, the speeches focused more on highlighting the possibility of collaboration and the opportunities for reformulation and innovation that were generated for the industry. In line with these discourses, we observed that about 10 percent of the products that were originally supposed to carry a warning label were reformulated so that by the time the law was implemented they no longer exceeded the limits of the regulation; this was most notable in the case of sodium and sugar and in some food categories, such as sweetened drinks, pastries, cold meat, and cheese. Moreover, the companies that reformulated foods and avoided the application of labels, used these changes as a marketing strategy for their products, planting it as a comparative advantage over their competitors. Finally, in the analysis of real variables of the productive sector, we observe that in an aggregated way there is no effect in terms of jobs, wages and physical production of beverages and food after the Law on Food Labelling.

"[The private sector has] a role and we have had it from 2000 onwards, since Minister Bachelet created the first powerful initiative in the area of obesity and overweight prevention, but I believe that it has not been possible to implement policies that are sufficiently comprehensive and have an impact, that are evaluated, that are corrected, that add up, and that address all sides of this multifactoriality. So, how do I see the private sector? I see it having to continue to contribute to this work more than ever [...] and we are going to continue to raise our voices for obese children whose opportunities are being denied, adding to their vicious circle of poverty one more factor which is obesity and overweight. We are going to continue to do this and we are totally determined to do it along these lines [...]. We are working [with all the actors] without any complex, without this issue of conflicts of interest which the industry wants to take advantage of, without lobbying... No, let's get rid of these paradigms, and without these paradigms, I really believe that we can work absolutely efficiently, to the extent that the efforts and the work that the industry does, that the private sector does, are also taken into account".

Management, Food trade association

"We share the objectives pursued by the authority in terms of helping to solve this problem of obesity that the country faces, and this situation exists in Chile and worldwide. We understand that and we understand that we all have to be part of the solution. Our main technical discrepancies, that we made public at the time, both through the regular channels as well as through some interviews that we were given in the press, was that we had disparities regarding the technical solution that was given. Thinking that this could only be solved with labelling is an understatement, because we always deplored that any labelling system had to be strongly accompanied by education of the population. [...]. We have to start from a new relationship [with the authorities] and the way in which we can contribute, carry out studies, provide scientific information, technical studies and technical information, and that means going back to the technical conversation, in which we can disagree, but in the end, when there are technical concepts and scientific evidence, I believe that all these things that are of context, are going to be left out. So, this historical relationship of technical-scientific contribution from the industry as a contribution to the authorities, of being able to provide a source of data, I believe that we have to make every effort to be available and help, collaborate, etc. And we will continue to be available at all times".

Management, Food and beverage trade association

Vocerías y discursos de la industria

During regulatory processes or public policy discussions, the media become a powerful institution where discussions and disputes among stakeholders occur (Lance Bennett, 2016). Moreover, when there is a conflict between elites or different powerful actors, the media cover the conflict, use official sources and reproduce their views, arguments, discourses and ways of framing the problem (Entman, 2004; Manning, 2001). The sources or spokespersons that appear in the media seek to influence public discussion by framing the problem – in this case, regulation – from their point of view or framework. The influence of media coverage, both on policy discussion and public opinion, has been widely demonstrated in a wide range of public policies (Soroka, 2002), including health policies – from seat belt use to discussion of tobacco and alcohol policies (Siegel and Lotenberg, 2007).

Therefore, the analysis of the sources or spokespersons that appeared in the media and the speeches they promoted during the discussion and implementation of the Law on Food Labelling is the best way to understand which actors had more power during the discussion of the law, what their approaches or arguments were, and how they changed before and after the law was approved.

In line with the idea that the media become an important arena where the discussion and negotiation of regulations that bring out divergence between different stakeholders takes place, we found that half of all PR messages in the media were distributed between the food industry (26.7 percent) and government authorities (26.2 percent). The remaining discourses were distributed among academia, parliamentarians and health organisations. This suggests a need for greater involvement of other actors, especially experts and academia. Within the industry, most of the PR communications come from companies (55.1 percent) such as Carozzi, McDonalds, Nestlé, Ferrero, Coca, Cola, CCU, and Soprole. These companies exercised influence directly, but also indirectly through the trade associations that represent the industry, which account for the rest of the PR messages (42.0 percent). The most relevant trade association was AB Chile food and beverage association, formed especially for the discussion of the law in 2014. This association is made up of 20 companies, including Carozzi, Nestlé, CCU, Coca Cola, Embonor, and Andina.

The analyses also revealed that the industry's discourse changed after the law came into force. Before the regulation, the most relevant discourse was the threat of the negative economic effect that the law would cause on the sector. However, this decreased sharply after the regulation, putting more emphasis on the industry's effort to cooperate with the law and the new standards. An analysis of the companies that appeared most in the press showed that these discourses differed from company to company. While Carozzi, CCU promoted the idea of the economic threat to the industry, McDonalds, Coca Cola and Soprole promoted the discourse of cooperation with the law in most of their communications.

An analysis of the messages or sources that appeared in the media talking about the law and their respective speeches or frames is a better representation of the industry's arguments than other types of observations such as interviews or surveys based on self-reporting, especially if they are conducted after the implementation of the law. An example of this is that many of the industry's discourses changed after the implementation of the law. This change could not have been observed with self-reporting observations after the law. The strength of this study is also to develop a census of all media on different platforms (print, television, radio, magazines and online media) during the key periods of the law. This extensive analysis of the media coverage allows to compare the relevance of the food industry with other relevant actors during the discussion and implementation of the law such as government authorities, congressmen, academia and health organisations. Future research could complement press releases with companies and trade unions' presence on social media – such as Twitter, Facebook and Instagram. It can also be complemented by interviews or surveys of the industry, but it is important that these are done during the different stages of the discussion and implementation process of the law because this study showed that discourses and arguments change after the law comes into force.

"There was a concern in this process [of implementation], but there was something quite virtuous about our company in this respect, [because] we came with a strategy of reducing critical nutrients, with specific targets for 2020 [...]. Therefore, these reformulation processes were already being implemented in different countries of the world, in line with reducing sugar and our portfolio, and being able to have more options, as we do have today, options with sugar and options reduced or without sugar. So, I would tell you that, in a way, that was in our favour, [...] because even though it implied technological investment, investment in human resources, talent and testing, because obviously any reformulation process has risks and we are a company that has the purpose of selling beverages, therefore we have to make products that the consumer appreciates [...]. Therefore, with all the challenge that this implies – and continues to imply – we were able to somehow start this transformation process in a very agile and very fast way. [Our company], in 18 months since the law was implemented, we reduced and withdrew from the market 38 000 tons of sugar, [which] implies innovation, effort and, beyond that, it shows you a tremendous responsibility because we understand that sugar by itself is not harmful, but if consumed excessively it could produce some adverse effect. So, we take the responsibility to have a [broad] portfolio, with education, with transparency in our ingredients, so that the consumer can actually read our label and actually understand what ingredients it has, what ingredients it doesn't have, and make responsible decisions based on the information".

Management, Multinational, Beverage sector

"Once the law came out, retail realised that they didn't really have food without a label, especially in this category, and they all happily opened the doors to us; as a company, this changed our whole life, and the change in monthly billing was crazy. [...]. When the Law on Food Labelling came out, retail in a way wanted to show that they too were in favour of this, that they could also have healthy products on their shelves, and that they were in line with the Law on Food Labelling. So, we became one of the few partners who didn't have a label and they were really looking for us, most of the retailers. Truth be told, it was great for us".

Management, SME, Food sector

The reformulation results indicate that 15 percent of the products studied were reformulated, that is, once the regulation was implemented, they lost the "high in" condition in energy or some of the critical nutrients they had in the pre-implementation period (according to the label information collected in 2015-2016). This happened mainly for "high in sugar" and "high in sodium" products. As a result of these reformulations, the proportion of foods with labels fell by ten percentage points, from 52 percent to 42 percent of foods with some "high in". The reformulation occurred mainly in the categories of cold meat (54 percent reformulated), breakfast cereals (39 percent reformulated) and milk and dairy products (30 percent reformulated). The categories of salty spreads, cheese and drinks also had relevant reformulations, above the average of the sample (reformulation of 25 percent, 17 percent and 15 percent of the products, respectively). In some cases, the critical nutrient content of the reformulated products decreased significantly, as is the case of the 48 percent drop in the median sugar for reformulated drinks, or the 36 percent drop in the median sugar for milk and dairy beverages. It would be interesting to assess whether the use of non-caloric sweeteners also increased in these categories as a strategy to comply with the law. Moreover, it should be noted that in some categories the changes observed impact only the extremes of distribution with no significant differences in the averages (Reyes, Smith Taillie, Popkin *et al.*, 2020).

Reformulation can be defined in different ways, either as any decrease in the content of a specific nutrient, or as a decrease of a given magnitude in the amount of nutrients (for example, greater than 20 percent of the initial content). For the purposes of this report, reformulation was defined as a decrease in the content of a specific nutrient that would allow for the loss of at least some "high in" status. The proportion of reformulated products was calculated based on the total number of products available in that category, without considering differences in the presentation of the same product (namely, a specific beverage was considered as a single product, even if it had different presentation formats, such as can, single bottle and family bottle). The differences in these criteria, as well as the categories included in the analysis, could explain the discrepancies between the results of this report and those delivered by the food industry (Ministry of Health of Chile, 2017b), which indicate that 20 percent of the products were reformulated. The design of the study (comparison of pre- and post-implementation periods) does not allow to assume that the changes in energy and nutrient content are due to regulation, since they could be the result of other processes, for example a previous trend of improvement in the food formula as a result of changes in demand. However, several elements derived from the food and beverage industry's discourse on this issue, in addition to the marketing strategies used by some companies – added to the fact that they did not find relevant changes in the energy and critical nutrient content in the period prior to the implementation of the law (Kanter, Reyes, Vandevijvere *et al*., 2019), strongly suggest that these improvements are secondary to the regulation implemented.

The nutritional quality of food is one of the components of food environments. These environments can be defined as the physical, economic and socio-cultural characteristics that shape the diets and nutrition of populations beyond the characteristics and preferences of individuals (Swinburn, Sacks, Vandevijvere *et al*., 2013). Thus, the critical nutrient content of commercially available foods would influence the consumption of these nutrients by the population. In that sense, a comparative study between different countries in relation to the nutritional quality of foods available in supermarkets (based on the star system used in Australia and New Zealand) showed Chile as one of the countries with lower food nutritional quality (Dunford, Ni Mhurchu, Huang *et al*., 2019). Thus, an improvement in the energy content and different critical nutrients of packaged products available in the market after the implementation of the regulation is good news, especially in the light of recent reports that indicate reformulation as one of the most cost-effective measures to improve the diet and overall health of populations (World Cancer Research Fund International, 2018; OECD, 2019). Further studies could determine whether these changes in the composition of food and beverages will effectively reflect in an improvement in the consumption of these critical nutrients in the population residing in Chile, with special focus on children. Also, medium- and long-term monitoring will have to study the impact of these changes in different health parameters of the population. The results of this report show that in most categories (drinks, milk and dairy beverages; breakfast cereals; desserts and ice cream; salted snacks; cheese; cold meat and meat products other than cold meat), the reformulated products belong to companies that dominate the respective markets (covering over 40 percent of the sales of the respective category). This could be explained – at least in part – by the technological challenges of reformulation. The presence of critical nutrients in processed foods contributes to sensory characteristics and technological functions, so their reduction or elimination from processed food formulations can affect the quality and safety of the food.

The main characteristic attributed to **sodium** is that it confers a salty taste, which is often used as an enhancer of certain flavours (for example, sweet) or a cover-up for other flavours (for example, acid). In addition to conferring the salty taste (estimated at 70-85 percent for Na^+ and 15-30 percent for Cl^-) (Corvalán, Reyes, Garmendia *et al*., 2019), sodium has an important antimicrobial action depending on the concentration used, increasing the shelf life of products. Besides, it participates in technological events of some food matrices: it regulates the fermentation speed and strengthens gluten, increasing the extensibility and elasticity of doughs; it increases the ionic strength and solubilises the proteins, preventing the exudation of fat and water from sausages and giving them their typical texture; it softens the cheese curd and therefore moulds its texture; it interacts with starch, giving it a mechanical resistance that limits the expansion obtained by extrusion in snacks. Salt/sodium replacement alternatives include potassium chloride, glutamic acid, hydrolysed vegetable protein, yeast extracts, and herbs and spices.

Like sodium, **sugar** has several functions, along with giving food and drink a sweet taste. Sugar has an important antimicrobial role due to the decrease in water activity of the products. Additionally, by reacting with proteins in the food matrix, it participates in the Maillard reaction, causing the characteristic colour of baked goods. On the other hand, it also participates in the caramelisation reaction, which gives flavour and aroma, as well as colour and texture. It has some particular technological functions in some food matrices: by emulsifying with lipids, it improves air capture during the mixing process, achieving greater volume and porosity in the doughs. It also increases the temperature of starch gelatinisation and protein denaturation, resulting in a more viscous and resistant dough; it increases the solubility of some volatile compounds in fruit juices, contributing to the development of characteristic aromas; it lowers the freezing point and is a filling factor (body), both of which are very relevant in the manufacture of ice cream; in jams, sugar forms gels with the pectins (intrinsic or added) giving them a characteristic texture. Among the replacement options are non-caloric sweeteners, which, although they provide a sweet taste, have important sensory differences with sugar, besides not presenting any of the technological properties described. Polyols are also a replacement alternative; besides the sweet taste, they are stable at high temperatures and serve as emulsifiers, stabilizers, wetting agents, anticaking agents, filling agents, and cryoprotectors.

Saturated fats are used in processed foods mainly because of their technological characteristics, even though they contribute to the palatability of the food, improving its taste (sometimes acting as vehicles for fat-soluble elements that confer flavour to the food). Their technological properties are especially useful in doughs, in which their incorporation favours aeration and confers granularity, influencing texture and helping to shape the final product, which influences its appearance. Fat also gives softness in doughs, and delays hardening. The advantage of using saturated fats, over other types of fats, is that they remain solid at room temperature, softening at high temperatures giving the food characteristic plasticity. Among the substitution alternatives, different emulsifiers or surface agents can be found, derived from starch, maltodextrins, hemicelluloses, β-glucans, as well as some protein derivatives, which present different difficulties depending on the food matrix used.

In general, to successfully deplete or replace any of the critical nutrients, multiple tests are required before successful formulations are achieved, which – along with the generally higher cost of alternative ingredients – makes production more expensive.

It is relevant to monitor how consumers respond to changes in organoleptic properties produced by the decrease or replacement of critical nutrients, and how this response conditions new adaptations by the productive sector. The response of consumers to some modifications in product formulas has probably been closely monitored by the same production companies, which would explain the reappearance of "original versions" of some products. Systematising these experiences throughout the implementation of the different stages of regulation will help to better understand this phenomenon, and to explore more innovative reformulation options, incorporating, for example, modifications in food odour and texture characteristics as part of the modifications that increase product acceptability. In fact, such initiatives are positioned as an alternative to simply replacing sugar with non-caloric sweeteners, an aspect that is already being monitored, in order to quantify the increased presence of these additives in foods, with the consequent increase in their consumption by the population. This may be an issue of concern, as a result of the recent – and still controversial – findings regarding the association of the consumption of these additives and a poor regulation of the subsequent intake, showing modification of future food preferences in the case of children, insulin resistance, among others.

Use of labels as a marketing strategy

> "We don't use labels as a marketing strategy". Long before the implementation of the law, we had started to reduce the levels of fats, sugar and saturated fats. Although we advertised, this was the end result of a process we had started years earlier to reduce the levels of these ingredients. In our case, we arrived at "a conviction" that even led us to reformulate our recipes to make the promise of healthy and rich products real, we managed to balance a product that, while complying with the standards, had a very good taste. This is how we arrived in 2016, with a large part of our portfolio complying with the regulations. Probably other market players had other focuses, they worked on other issues. For us, the main thing was and is to keep our promise, which allowed a large part of our portfolio to communicate, advertise and continue to be offered in schools... The slogan at that time was "let's take advantage of this great effort", let's say clearly that our products "do not have labels". And that's what we did: in 2016, we came out with products and with campaigns to the public, indicating that this product was free of slabels".
>
> *Management, Multinational, Food Sector*

There is ample and strong evidence that food-related marketing has effects on people's knowledge, preferences and purchasing and eating behaviours, especially among children (Cairns, *et al.*, 2013; Smith, *et al.*, 2019). This evidence is even more significant with packaged and TV marketing (Smith, Kelly, Yeatman *et al*, 2019). Given this evidence, labels have been created to inform people which foods have high levels of critical nutrients (calories, sugar, saturated fats, and sodium), and regulations or standards have been implemented to restrict the advertising of these unhealthy foods (Reyes, Garmendia, Olivares *et al.*, 2019).

Along with changes to the formulation of the ingredients of several products (Reyes, Smith Taillie, Popkin *et al.*, 2020) and the elimination of strategies that appeal to children in products high in critical nutrients (Correa, Reyes, Smith Taillie *et al.*, 2020), some companies in the food industry also used the reduction or elimination of labels as a marketing tactic in their favour. After the implementation of the law, some brands' television advertising explicitly stated that they had no labels, had decreased their labels, or had fewer labels than the competition as a way of advertising themselves as being healthier.

The results showed that after the implementation of the law, 25 brands used this strategy. However, 17 of the 25 brands belonged to only four companies: Soprole, CCU, Coca Cola and Unilever. In the same vein, 90 percent of the advertisements using the label strategy belonged to those same four companies. As demonstrated by the results of industry PR messages and speeches that appeared in the media, these companies were among the most active during the discussion and implementation of the law, directly or through the AB Chile trade association. This strategy of using labels in television advertising after the implementation of the law coincides with the fact that the most prevalent discourse in the industry after the regulation came into force was that of cooperation with the new standards.

Although the industry seeks to show how its products are healthier, the effects of this type of strategy are not yet known. For example, qualitative research showed that they sometimes generated scepticism among mothers of children and adolescents. They did not believe that some products that were seen as unhealthy (for example, a fudge and chocolate flan) did not have any label (Correa, Fierro, Reyes *et al.*, 2019). In this sense, a halo effect can occur in two directions: consumers can extrapolate scepticism towards a product to the whole brand. But it can also happen that when using labels as a marketing strategy, consumers extrapolate a positive perception from a product to the whole brand or company, regardless of whether that brand or company has unhealthy products in its portfolio. Therefore, it is very important to study on a pilot basis the effects of this type of strategy on people's perceptions and behaviour.

"The economic cost of reformulation was very important", given that, for example, replacing sugar, means increases in the costs of the new raw material you use to replace it and because of changes in production processes, such as replacing sugar with stevia, for example, using a new recipe that aimed to offer equally rich and much healthier products. So, we faced structural changes in cost, not only of raw materials, but also changes in process, because obviously, in the example of sugar, the new sweetener works under certain conditions, at certain temperatures, depending on the recipe. All this forces you to do a lot of tests, to understand how it works, to adjust your production process, and obviously this impacts the whole production chain".

Management, Multinational, Food Sector

"Big companies are more concerned with making their lines productive than developing super functional or super healthy foods. Therefore, I believe that the SMEs play a very important role in this area, because we can go elsewhere, looking for well-being or an added value from something else, rather than just having my production line full in order to lower costs, as the large companies do. [...]. The implementation of the law brought us economic benefits, we began to sell much more, we began to produce much more. And that's when the problems begin for any company, when it starts to increase its sales, which can cause cash flow problems because you need more working capital turning over. We had to go out and look for investors, raise capital, we had two rounds of capital raising that were quite successful [...]. As a SME, one affects very little (sic), we can worry a lot about everything we are doing as an industry, but as long as the big industry does not do the same, we do not achieve transformation, we can help a little to generate trends and to change people's consumption a little; this is also our mission as SMEs: to generate that awareness, so that a consumer can push the big industry to have better ethical regulations in the background".

Management, SMEs, Food sector

The results show that the way industries subject to some new regulation warn about employment is unjustified in this case too. The analysis of employment variables, physical production and real investment expenditure does not show significant changes, with the entry into force of the different stages of the Law on Food Labelling. These results are robust to the use of different manufacturing industry aggregations from the potentially affected or not affected food and beverage sectors, to the entire manufacturing industry. These results show that, compared with appropriate control groups, the different stages of labelling did not alter the evolution of the variables analysed.

These results should not be surprising for at least four reasons. The first, in basic economics, refers to the fact that these regulations should be analysed from a general equilibrium approach. According to this, it would be possible for a regulation such as front-of-package food labelling to affect real variables of the industries involved, but this does not imply that it affects the aggregate evolution of these variables. In other words, it might be possible that a fall in demand for labelled food has a real effect, but this effect would be outweighed by an increase in demand for unlabelled food or other products. A person who decides not to purchase a labelled foodstuff or drink (because of such labelling) will use that money to buy other products or services. What matters, then, is the actual net effect of such a policy.

The second reason has to do with the market structure where regulation is applied. As mentioned in the paper, food and beverage markets are oligopolistic markets, where the companies involved have a large portfolio of products. These portfolios include products that are subject to labelling and others that are not. Thus, a potential fall in demand for product labelling may lead to an increase in demand for unlabelled substitutes. In this case, there is no reason to think that employment should even fall within these companies (in fact, it could even increase). The paradigmatic example of this is the industry of sweetened beverages, dominated by multinational companies producing labelled products and their unlabelled substitutes (water, sweetened beverages, etc.).

The third reason why the results found should not be surprising is that companies with labelled products can reformulate them to avoid such regulation. In fact, this reformulation has been discussed in this paper, and in some sectors, it has been very important. In companies/sectors that reformulate, there is no reason for the demand for these products to fall.

Finally, the fourth reason is purely empirical: studies have demonstrated in other countries and with other regulations that one or all of the above three reasons are usually verified. Studies in Mexico, for example, on the effect on employment of the tax on sugar-sweetened beverages and certain foods show that this measure did not change the trends already shown by industries before the intervention (Guerrero-López, Molina and Colchero, 2017). The same was found for similar taxes in US cities (Powell, Wada, Persky *et al.*, 2014), or taxes on other types of products, such as tobacco (U.S. National Cancer Institute and WHO, 2016). In all cases, there is no effect on employment.

The results shown and the reasons described above indicate that the alarmist discourses on falls in employment resulting from regulations have neither a theoretical nor an empirical basis and are often the result of tactics used to delay or prevent the adoption of these measures.

Although the methodology used to analyse the data is a standard one, it should be noted that, like all methodologies, it has limitations. When control groups are used, as in this paper, it is assumed that the control group, in addition to "behaving" like the pre-intervention treatment group, should not be affected by the intervention. This assumption is considered to be fulfilled by the chosen control groups, and to ensure that this is the case, where possible, different industry sector aggregations have been used. There is confidence, as far as possible, that the fundamental assumptions of the chosen method are fulfilled.

6 CONCLUSIONS

In this study, we found that after the implementation of the Law on Food Labelling in Chile, the food industry positively changed its discourse on regulation, improved the quality of the food supply, mainly by decreasing the sugar and sodium content, and used the presence of a healthier product portfolio as a strategy to promote its products. In addition, we observe that in aggregate terms there was no impact on jobs, wages and physical production in the food production sector. Finally, we think it is relevant to clarify that health promotion policies have health objectives and therefore, the collection of information regarding the response of the food industry should be considered an additional, but secondary, argument in the enactment of these policies. There is robust evidence to demonstrate the cost-effectiveness of implementing actions at the level of food environments in the prevention of obesity and its associated diseases, in countries with a variety of political and economic contexts.

"Healthy eating has few benefits from the business or productive perspective. That is why this aspect must definitely come from the administration's conviction. Because if tomorrow they tell us that we have to stop using sugar or salt, fat or whatever, it really forces a company to make transformation decisions; and since there is a lack of knowledge, you have to implement new things, buy new technologies mean a whole reinvestment process without the certainty that the final product will be appreciated. So, it's a step ahead of pure conviction, but one that we, the leading food companies, have to take. Beyond the laws, this is a value issue, not a legal one, because the health of our families is at stake".

Management, Multinational, Food Sector

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8 ANNEXES

Annex 1. Cut-off points to define food and beverages regulated by the Law on Food Labelling and advertising (Law 20.606)

	2016	2018	2019
Per 100 g of solids			
Energy [Kcal]	350	300	275
Sodium [mg]	800	500	400
Total sugar [g]	22.5	15	10
Saturated fats [g]	6	5	4
Per 100 mL of liquids			
Energy [Kcal]	100	80	70
Sodium [mg]	100	100	100
Total sugar [g]	6	5	5
Saturated fats [g]	3	3	3

Source: Law 20.606 (Ministry of Health of Chile, and Undersecretariat of Public Health, 2012) and Decreto 13/15 (Ministry of Health of Chile, 2015).

Annex 2. List of media included in content analysis

Newspapers: El Mercurio
- La Tercera
- La Segunda
- La Cuarta
- El Diario Financiero
- Publimetro
- HoyxHoy
- La Hora
- Las Últimas Noticias

Television: Televisión Nacional
- Canal 13
- Chilevisión
- Mega
- CNN Chile
- 24 Horas

Radios: Radio Bio Bio
- ADN
- Agricultura
- Cooperativa
- Radio Pudahuel
- Radio Corazón
- T13 Radio

Magazines: Capital
- Caras
- Cosas
- Vanidades
- Buena Salud
- Casas
- Cosmopolitan
- Qué pasa

Online portals: El Mostrador
- Emol
- Radio Cooperativa Online
- Radio Bio Bio Online
- El Dínamo

Annex 3. List of foods included in each category of reformulation study analysis

Food categories	Food and beverages included
Beverages	100% fruit juices; almond milk with or without sugar; flavoured or aromatic waters with or without sugar; carbonated water with or without sugar; carbonated drinks with or without sugar; frozen or non-frozen fruit pulp, with or without sugar; fruit-based juices (nectars or similar) with or without sugar, ready-to-drink tea, herbal or coffee-based beverages with or without sugar; isotonic beverages with or without sugar; non-carbonated waters; powdered or concentrated fancy drinks; soya milk with or without sugar; other beverages.
Milk and dairy beverages	Flavoured skim milk with or without sugar; flavoured low-fat milk with or without sugar; flavoured milk with or without sugar; unflavoured milk, whether skim, low-fat or whole; dairy beverages (those with at least 30 percent milk); dry milk for pre-school children 1-5 years); other types of milk. In all cases, powdered or liquid alternatives are considered.
Yogurt	Flavoured yoghurt; yoghurt with fruit; yoghurt with nuts; yoghurt with cereals; yoghurt with sauces or jams; natural yoghurt; other types of yoghurt. In all cases, with or without sugar, skimmed, whole or half-fat alternatives are considered.
Breakfast cereals	Baked cereals; chocolate cereals; fibre-enriched cereals; cereal flakes; granola; muesli; oats; other cereals; cereal bars of all kinds. In all cases, sweetened or unsweetened alternatives are considered.
Sweet baked products	*Alfajores* (typical Chilean sweet); biscuits with or without filling; biscuits; brownies; cakes; Chilean sweets; Easter bread; *cuchuflies* (typical Chilean sweet); biscuits; muffins; other sweet pastries or baked goods.
Desserts and ice cream	Canned fruits; ice cream desserts; popsicle or boxed water ice cream; popsicle or boxed milk ice cream; custard; fruit compote; roast milk; rice pudding; other desserts or ice cream. In all cases, with or without sugar alternatives are considered.
Sweets and candies	Candies; chewing gum; confections; chocolates; nuts with caramel; gummies; jellies; delicatessen bars; marshmallows; sweet goats; gummies; toffies; other sweets and candies. In all cases, with or without sugar alternatives are considered.
Sweet spreads	Caramel; Chantilly cream; filling creams for pastry; chocolate chips; *chuchoca*; condensed milk; evaporated milk; flavoured essences for pastry; powdered milk flavours; flavoured syrups; icing; honey; jam; *manjar* (Chilean fudge cream); sweet sauces; other sweet spreads or products for pastry.
Salted baked products	Dough for *sopaipillas*; bread dough; packaged breads of all types (wholemeal dough, refined flour, with or without seeds); crackers; *sopaipillas*; *tortillas*; other salted baked goods
Salted snacks	Crisps; twigs; salted soufflé products; other salted snacks.
Salted spreads	Butter; margarine; salad dressing; broths or seasonings; chilli paste or similar; mayonnaise; mustard; ketchup; peanut butter; tomato sauce; other salty spreads.
Cheese	Hard and soft cheeses, fermented and unfermented; spreadable cheeses; fresh cheeses; other types of cheese.
Ready-to-eat food/preparations	Canned vegetables; canned pulses; *empanadas*; frozen foods; *humitas*; instant mash; meat substitutes; ready-to-serve vegetables or pulses; ready-to-serve rice; pizza; gnocchi.
Cold meat	*Chorizo*; *choricillo*; ham; sausage; salami; bacon; other cured meats and sausages.
Meat products other than cold meat	Fresh, frozen or marinated chicken, pork, beef or turkey meat; fresh, frozen, marinated or canned fish meat; fresh, frozen or canned seafood or similar; hamburgers of all types of meat; nuggets of all types of meat; other processed meats.
Soups	Instant soups, vegetable/legume soups or creams for preparation.

Source: Elaborated by the authors.

ISBN 978-92-5-134389-0

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CB3298EN/1/06.21