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Not So Sweet: The Impact of the Portuguese Soda Tax on Producers

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Judite Gonçalves, Roxanne Merenda, and João Pereira dos Santos[1]

Not So Sweet: The Impact of the Portuguese Soda Tax on Producers

Abstract

In February 2017, Portugal implemented a tax on sugar-sweetened beverages (SSBs), under which producers were to be taxed according to the amount of sugar contained in the drinks they manufactured. We exploit administrative accounting data covering the universe of Portuguese firms between 2012 and 2019 to assess the causal impact of this tax on the behavior and performance of producers of SSBs. Our identification strategy relies on event study specifications, using producers of bottled water as counterfactual. Our findings indicate that SSBs producers became significantly less profitable in the post-tax period, vis-à-vis water bottlers, which was driven by a significant decrease in domestic sales. The soda tax hindered firms' capacity to convert receivables into cash and financial health deteriorated as liabilities grew. SSBs producers did not respond to this negative shock by cutting jobs or modifying their labor force towards relatively more skilled labor or higher R&D capacity.

JEL-Codes: D22, H25, I18, L66

Keywords: Firm-level impacts; policy evaluation; Portugal; public health; sugar-sweetened beverages tax

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1 Judite Gonçalves, Nova School of Business and Economics; Roxanne Merenda, Nova School of Business and Economics; João Pereira dos Santos, RWI and Nova School of Business and Economics. *- The authors thank Banco de Portugal for access to the data and for technical support. We are also indebted to comments and suggestions by Pedro Bação, Ronald Bachmann, Marc F. Bellemare, Pedro Freitas, Pedro Martins, Luís Catela Nunes, Susana Peralta, and Miguel Portela. This work was funded by Fundação para a Ciência e Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, LISBOA-01-0145-FEDER-022209), POR Lisboa (LISBOA-01-0145-FEDER-007722, LISBOA-01-0145-FEDER-022209) and PORNorte (LISBOA-01-0145-FEDER-022209) and the research project PTDC/EGE-ECO/31213/2017. All errors are our own.* *– All correspondence to: João Pereira dos Santo, Nova School of Business and Economics, Universidade Nova de Lisboa, Campus de Carcavelos, Rua da Holanda 1, 2775-405 Carcavelos, Portugal, e-mail: joao.santos@novasbe.pt*

In 2016, the World Health Organization urged policy makers to tax sugar-sweetened beverages (SSBs, or soda, for short), motivated by the evident link between soda consumption and major diseases such as obesity and type 2 diabetes, and by growing evidence on the effectiveness of soda taxes for curbing sugar intake from soda (WHO, 2016). As of December 2021, more than 50 countries around the world have implemented or are seriously discussing the implementation of soda taxes.

The impacts of soda taxes on prices and consumption are relatively well understood, as the body of literature on this topic has been expanding quickly (e.g., Allcott et al., 2019a; Cawley et al., 2019). Yet, and as soda taxes become increasingly popular around the globe, it is key to understand also their economic effects, namely their impacts on firms.

This study is the first to document the impacts of a soda tax on producers. We rely on a very rich administrative dataset that contains yearly accounting information from the profit and loss (P&L) statement and the balance sheet, as well as workforce-related information, for the universe of SSBs producers in Portugal from 2012 to 2019. This data allows for an in-depth analysis of the impacts of the tax on firms' economic and financial outcomes, including some of the mechanisms at play (e.g., domestic sales).

Beyond the richness of our data, the Portuguese soda tax is the ideal case study because of its design and because several years have passed since its implementation in 2017. The tax is levied on producers and is structured in several brackets, based on drinks' sugar content. This design appears to have incentivized firms to reformulate recipes towards lower sugar content (see the next section), something we also indirectly explore here by looking at changes in the firms' workforce, such as the number of employees working in research and development (R&D). Recipe reformulation is —besides decreasing soda consumption— another mechanism of multi-rate soda taxes to achieve public health gains. Recent studies show the superiority of multi-rate soda taxes in terms of welfare (O'Connell & Smith, 2021), as well as in terms of

economic and public health gains (Grummon et al., 2019). The good performance of the Portuguese soda tax —one of the first multi-rate soda taxes in the world— has been widely acknowledged and more countries have or are drawing on it to design their own soda taxes, e.g., the UK, Ireland, Estonia (Rapoula, 2021; WHO, 2020).

Our findings, based on event study specifications that compare SSBs producers with bottled water producers, suggest that SSBs producers' net income was significantly negatively impacted by the tax. There are no effects on expenses, but we find that domestic sales decreased. Further, we find evidence that the soda tax hindered firms' capacity to convert receivables into cash. Soda producers did not respond to the tax by cutting jobs or modifying their labor structure towards relatively more skilled labor or higher R&D capacity. Lastly, forgone corporate income tax was outshined by the direct revenue from the soda tax.

The main focus of previous studies on the impacts of soda taxes has been twofold. First, they analyze tax incidence and variations in SSBs prices. The existence and magnitude of a change in price depends on the degree to which manufacturers (and retailers) pass the tax on to consumers. The latter will mainly depend mainly on producers/retailers' market power and price elasticity of demand for SSBs. While most studies highlight a price increase as a consequence of a soda tax implementation, significant heterogeneity on pass-through rates across regions and product groups exists (Rojas & Wang, 2017). Some studies find a pass-through rate close to 100% —e.g., in Mexico (Aguilar et al., 2021; Grogger, 2017), Saudi Arabia (Alsukait et al., 2020), France (Berardi et al., 2016; Capacci et al., 2019), and Philadelphia (Seiler et al., 2021). Others find lower pass-through rates —e.g., in France (Etilé et al., 2018), Boulder (Cawley et al., 2018b), Philadelphia airport (Cawley et al., 2018a), and Berkeley (Bollinger & Sexton, 2018; Cawley & Frisvold, 2017).

Second, most studies find that SSBs consumption decreases as a result of the implementation of a soda tax. The magnitude of the estimated reduction varies widely, from 6% in Mexico

(Aguilar et al., 2021) to 33% in Saudi Arabia (Alsukait et al., 2020), and as much as 46% in Philadelphia (Seiler et al., 2021) —see also Arteaga et al., 2017; Bollinger & Sexton, 2018; Castelló & López-Casasnovas, 2018; Cawley, Frisvold, et al., 2019; Colchero et al., 2016; Colchero et al., 2017; Fichera et al., 2021; Nakamura et al., 2018; Silver et al., 2017; and Taylor et al., 2019 for other settings. At the individual level, the impacts on consumption are also heterogenous, varying with income level, age, and initial consumption amount (Allcott et al., 2019b; Dubois et al., 2020; Fearne et al., 2019).

In summary, soda taxes result in relatively large pass-through rates, and consequently, decreases in the consumption of taxed drinks. The magnitudes of the estimated effects differ widely across countries and studies, which reflects the distinct tax designs across regions and the studies' different data and methodological approaches.

To our knowledge, only one previous study provides insights on the impacts of soda taxes on firms. Law et al. (2020) analyze the stock market reaction to the announcement of a soda tax in the UK. They find short-lived negative stock returns, which indicates an instantaneous reaction by investors, but no major concerns for the industry.

This study contributes with novel findings on the impacts of soda taxes on producers, which are directly relevant for policy makers around the world considering the implementation of soda taxes. Complementing the clearly documented benefits of soda taxes in terms of public health and revenue, we discuss here the consequences of that tax on firms using, for the first time, administrative level data.

I. The Portuguese Soda Tax

A. The Tax Design

The Portuguese soda tax is an excise tax on sweet drinks sold on Portuguese territory, regulated in the *Código dos Impostos Especiais de Consumo* (Chapter I, Section II). It is levied on

producers and importers —imported products are subject to the tax, while exports are not. The tax was first discussed in the Portuguese media in the first quarter of 2016. It was approved by the Parliament in December 2016 and implemented in February 2017.[4]

The tax applies to (1) non-alcoholic drinks with added sugar or other sweeteners, (2) concentrates, in the form of syrup or other liquid form, granules or other solid forms, intended for the preparation of sweetened beverages, and (3) drinks with more than 0.5% and less or equal to 1.2% alcohol. Drinks made from milk, soy or rice; juices and nectars of fruits or vegetables; and drinks considered essential for special dietary needs are exempted from the tax. The taxed drinks are broken down into four categories, based on the grams of sugar they contain per liter, and different tax rates apply to each category. The current amount of the tax is 1 euro cent per liter for drinks with less than 25 grams of sugar per liter, 6 cents for drinks with 25 grams or more sugar per liter and less than 50 grams of sugar per liter, 8 cents for drinks with 50 grams or more sugar per liter and less than 80 grams of sugar per liter, and 20 cents for drinks with 80 grams or more sugar per liter. Different tax rates apply to concentrates in liquid or solid form. The soda tax adds up to the usual 23% VAT.

Modifications to the initial law of January 2017 were implemented in January 2018, January 2019, and October 2019. Compared to the initial tax design, the alterations introduced more brackets, reducing the tax rate for the least sugary drinks and increasing the tax rate for the most sugary ones. They also refined the definition of the tax base, namely concentrates. Table A1 in the Appendix summarizes the current and past tax rates on SSBs (Panel A) and on concentrates (Panel B).

B. Previous Empirical Evidence for Portugal

[4] The stability of the tax was since then reinforced, every fall, with the first draft of the government budget for the following year, which has always contemplated that the tax was "here to stay".

Gonçalves and Pereira dos Santos (2020), using sales data from a large retailer, found tax pass-through to the consumer around 100%, depending on the amount of sugar contained in the drinks. Regarding consumption, the authors found a substantial 18% drop in purchases of drinks with relatively little sugar, but no significant changes in quantities purchased for other, more sugary, SSBs. They highlight, however, an apparent reformulation of drinks' recipes towards lower sugar content in answer to sweeter drinks being taxed more heavily. Goiana-da-Silva et al. (2020) also show that manufacturers modified their recipes to fall within a lower tax bracket. According to industry reports, the content of sugar in carbonated soft drinks has been decreasing since 2016, with the sharpest decrease between 2016 and 2017 (from 6.6% to 6.2% of total ingredients), the year before the implementation of the tax (Euronomitor International, 2021). Similarly, data from PROBEB, the largest SSBs producers' association in Portugal, shows that the SSBs market had been expanding until 2016, but decreased by 4.9% between 2016 and 2017 alone (PROBEB, 2021).

II. Data and Empirical Strategy

A. Data Source

We use rich administrative data from the Central Balance Sheet Harmonized Panel (CBHP), from *Banco de Portugal*, for the years 2012-2019. The data cover the universe of private firms in Portugal and include yearly information on the firms' labor force structure, as well as accounting data from the balance sheet and the P&L statement.

Between 2012 and 2019, there were in Portugal 19 SSBs producers and 27 producers of bottled water, that we identify based on firms' main economic activity (i.e., largest share of turnover).[5] In total, our analyses include 46 firms. The panel is unbalanced, as some firms were created

[5] Economic activities are classified according to NACE rev 2. The relevant code is 1107 - Manufacture of soft drinks and mineral water. This is divided in the 5-digit Portuguese classification system of economic activities (CAE rev 3) between producers of non-alcoholic soft drinks (CAE 11072) and bottled still and sparkling water producers (CAE 11071).

and others dissolved between 2012 and 2019, but we confirm our results on the balanced panel as a robustness check.

B. Treatment and Comparison Groups

Our treatment group encompasses all firms whose main economic activity is the production of drinks subject to the soda tax, as defined above. This includes producers of beverages containing added sugar or other sweeteners, as well as producers of soda concentrates in liquid or solid form.

Our comparison group includes producers of bottled still or sparkling water. We follow Etilé et al. (2018), Taylor et al. (2019), and Gonçalves and Pereira dos Santos (2020), who also use bottled water as a comparison group. We believe that bottled water producers form a suited comparison group for the following reasons. First, water is not directly impacted by the soda tax, as it is not taxed. Further, there is no reason to believe that the tax has an indirect impact on water either, as no substitution effect between soda and water has been found in the literature. Cawley et al. (2019) and Seiler et al. (2021) found that consumption of water remained unchanged after the implementation of a soda tax in Philadelphia. Alsukait et al. (2020) and Capacci et al. (2019) similarly find no substitution effect towards bottled water following the implementation of soda taxes in Saudi Arabia and France, respectively. Lastly, the water bottling and SSBs industries are very similar in terms of cost structures and inputs (except for sugar). So, they are likely to be similarly impacted by other shocks and trends (e.g., substitution of plastic for more sustainable packaging).

C. Empirical Model

To identify the causal effects of the soda tax on producers, we estimate the following event study specification for a series of outcomes:

$$y_{it} = \sum_{2012}^{2014} \beta_t \, SSB * year_t + \sum_{2016}^{2019} \beta_t \, SSB * year_t + \alpha_i + \gamma_t + \varepsilon_{it} \qquad (1)$$

As outcome variables, y_{it}, we consider information from the P&L statement —total income, total expenses, net income (profits after taxes, interests and depreciation), turnover (sales of goods and services)—, sales data —sales to domestic market, exports, imports—, data from the balance sheet —cash, receivables, liabilities—, and information on the employed labor force —average wage, number of (paid and unpaid) employees, and number of employees working in R&D. Lastly, we analyze the impact on the corporate income tax.

In Equation (1), SSB denotes the treatment indicator, which is equal to one if the firm is a SSBs producer and zero if it is a bottled water producer, and $year_t$ represents a set of year dummies. The coefficients of interest are the coefficients of the interactions between the treatment indicator and the year dummies, denoted by β_t. We omit the interaction with the year 2015, the last year of the pre-treatment period. We consider 2016 as the first treatment year because the tax was first publicly discussed early that year and approved by the Parliament in December. Doing so enables us to catch any anticipation effects whereby firms may have adapted aspects of their business before the tax implementation in 2017 (Taylor et al., 2019). Lastly, α_i and γ_t are firm and year fixed effects, respectively, while ε_{it} is the random error term. The standard errors are clustered at the firm level (Bertrand et al., 2004). For comparison, we estimate simpler difference-in-differences (DiD) specifications (i.e., only one interaction between the treatment indicator and the post-treatment dummy instead of interactions with all year dummies) that we report in the Appendix (Tables A3-A6).

D. Identifying Assumption

Our identification strategy assumes that the outcomes would have moved in a common trend for SSBs and bottled water producers, had the soda tax not been implemented. Two assumptions are nested in this crucial identifying assumption. First, the parallel-trends

assumption (PTA) states that, prior to the tax implementation, the trends in the outcomes of SSBs and bottled water producers are comparable. Thanks to our event study design, we can formally test this assumption. In the results section, we show the estimates of the β_t coefficients from equation (1) for the pre-treatment period, along with the 95% and 90% confidence intervals. For all outcomes, those estimates are small and not statistically different from zero, indicating that the PTA holds.

Second, the common shocks assumption states that all other events occurring during or after the tax implementation will affect the outcomes of both groups in a similar manner. The fact that the PTA holds, combined with the great similarity of the SSB and water bottling industries, makes the common shocks assumption reasonable. Moreover, to our knowledge, there was no event between 2016 and 2019, apart from the soda tax, that was likely to cause a shock in only one of the two industries.

E. Other Empirical Challenges and Robustness Checks

It is important to highlight that firms are identified based on their main economic activity (i.e., largest share of turnover). Because the industries of bottled water and SSBs are arguably similar, it is possible that a firm's main activity is the production of SSBs, but that part of its turnover comes from water bottling, or vice versa. Such a firm would compromise the PTA. We address this potential issue in three ways. First, we excluded the only firm to have switched its main economic activity from producing SSBs to bottled water during the period of analysis.[6] Importantly, the average share of turnover generated by the main economic activity of the remaining firms is 96.7%, and that share is below 90% for only four companies. Second, we conduct a robustness check where we drop those four firms that generate less than 90% of their turnover from their main economic activity. Lastly, we rely on the following reasoning. Since

[6] This was a very small firm with only 5 workers.

the tax is defined at the product level, while our data is at the firm level, and given that firms produce more than one drink, there is heterogeneity in treatment intensity within the treatment group. Depending on their product mix, some firms are more impacted by the soda tax than others (e.g., those producing the sweetest drinks). In this context, the presence of a few treated firms having a small share of their economic activity in the water industry merely "dilutes" the treatment effects, but does not harm our identification strategy.

To cope with the right skewness of some outcome variables, we use the inverse hyperbolic sine (IHS) transformation. This transformation is increasingly popular amongst econometricians as it allows to retain nonpositive values in the analysis, as opposed to a log transformation, for which nonpositive values are not defined. The IHS transformation depends on the scale of the variables: for large numbers, the transformation is close to a natural log transformation, while for small magnitudes, it almost does not modify the variable. Following Aihounton and Henningsen (2019), we multiply each outcome variable by a scaling factor. No matter the scaling factor, zero values remain zeros, but we can move the non-zero values "closer to" or "further away from" the zero values. For each variable, we test 9 scaling factors: $10^{-8}, 10^{-6}, 10^{-4}, 10^{-2}, 10^{0}, 10^{2}, 10^{4}, 10^{6}, 10^{8}$. As advised by Aihounton and Henningsen (2019), we use the within R^2 as a criterion to select the most suited scaling factor for each outcome variable. As a robustness check, we compare results when using the natural logarithm (ln) transformation, as well as a ln(y+1) transformation.

Bellemare and Wichman (2020) point out that one should not directly interpret IHS coefficient estimates as percentage changes when the mean of the IHS-transformed outcome variable is below 10. In some cases, doing so could lead to over- or understatements of the effects' magnitudes. The authors do not provide a clear method to address this issue in a fixed effects model. We hence comment on our coefficients without further transforming them, keeping in mind that the magnitudes should be interpreted with a grain of salt.

III. Results

A. Descriptive Statistics

Descriptive statistics are displayed in Table 1, distinguishing between SSBs and bottled water producers, in the pre- and post-tax periods. In Table A2 in the Appendix, we compare the means of outcome variables for SSBs and bottled water producers in 2015 (last year of the pre-treatment period). The results from these balance tests, with two-tailed t-tests indicate that the two groups are very similar.

B. Impact of the Soda Tax on Firms' Economic and Financial Outcomes

Figure 1 exhibits the estimates of equation (1) for three indicators of the P&L statement: net income, total income, and total expenses. It shows a decline in net income starting in 2016, statistically significant in 2016 ($p<0.1$), 2017 ($p<0.05$), and 2019 ($p<0.01$). The tax did not merely create a shock around the time of implementation. Rather, SSBs producers did not manage to recover their pre-tax profit levels, and the reduction in net income exacerbated over the years. Neither total income nor total expenses were significantly impacted by the tax. Non-academic sources suggest that there are additional administrative and one-off costs like contract renegotiations and marketing associated with sin taxes (Grupo de Trabalho, 2018; Petkantchin, 2013). Such costs are fixed to a certain extent, so that proportionally, small and medium-size firms should be more impacted than larger firms (ECSIP Consortium, 2014). On average, SSBs producers are large firms, with mean pre-tax turnover of 40'200'000 euros. The lack of significant effects on total expenses suggests that due to their large size, SSBs producers were able to absorb the adjustment costs associated with the new soda tax.

We find no effects of the soda tax on turnover (Figure 2). However, when we split sales into domestic sales and exports, we find that domestic sales decreased significantly. The plot shows

point estimates that grow increasingly negative over time, indicating that demand for SSBs kept decreasing over the years. A similar behavior was found in other countries —e.g., Mexico (Colchero et al., 2015) and Saudi Arabia (Alsukait et al., 2020).[7] As expected, exports did not significantly change after the tax was implemented, as only SSBs sold on Portuguese territory are subject to the soda tax. We also analyze if firms decided to change the amount of imports in reaction to the introduction of the tax. That does not seem to be the case, as shown in the last panel.

In the post-tax period, firms' most liquid assets, cash and cash equivalents, decreased, while the account receivables inflated (Figure 3). These effects were statistically significant in 2016 and 2018 for cash, and in 2016, 2017, and 2018 for receivables ($p<0.1$). This suggests that the soda tax hindered firms' capacity to convert receivables into cash. Further, firms' liabilities significantly increased starting in 2018.

C. Impact of the Soda Tax on Firms' Workforce

Gonçalves and Pereira dos Santos (2020) and Goiana-da-Silva et al. (2020) highlighted that Portuguese SSBs producers reformulated their drinks towards lower sugar content as a response to the soda tax. Our results suggest that to do so, they did not restructure their workforce towards relatively more skilled employees or higher R&D capacity. Indeed, neither the average wage nor the number of employees allocated to R&D changed after the tax implementation (Figure 4). Firms may have been incentivized to reduce employee expenses to cope with lower net income. Due to the very high downward nominal wage rigidity in Portugal (Martins & Portugal, 2019), the only way to do so would have been through layoffs, but we

[7] The Portuguese study cited previously, that finds lower consumption only for a group of relatively less sweet beverages, only goes up to January 2018 and uses data from one retailer, while here we have the universe of soda producers and importers (Gonçalves and Pereira dos Santos, 2020).

find that the number of (paid and unpaid) employees was not affected. Overall, the implementation of the soda tax had no impact on the labor employed by SSBs producers.

D. Impact of the Soda Tax on Tax Revenue

Finally, tax revenue is considered another advantage of soda taxes, so it is interesting from a public finances point of view to look at forgone corporate income tax. We find that starting in 2017, the amount of income tax paid by SSBs producers significantly declined (last Panel of Figure 3). We estimate the amount of forgone corporate income tax as a consequence of the soda tax based on the more conservative estimate from the DiD regression, shown in Table A4 in the Appendix. Our calculations suggest that only 236'000 euros were forgone in corporate income tax for the period 2017-2019. Official estimates from the Portuguese Ministry of Finance claim that the soda tax generated revenue of 71.4, 72.5 and 60.1 million euros respectively in 2017, 2018, and 2019. Hence, even when accounting for forgone corporate income tax revenue, the soda tax had a large positive impact on Portuguese public finances.

E. Robustness checks

Our results are robust to a series of checks regarding potential outliers and our methodological decisions, namely (1) excluding extreme values of the outcome variables (1% winsorization), (2) dropping the largest firm of the dataset (a SSBs producer that employs above 1,000 employees and has turnover more than ten times larger than mean turnover), (3) dropping the four firms that generate less than 90% of their turnover from their main economic activity, (4) restricting the analyses to the balanced panel, and (5) using the ln(y) or ln(y+1) transformation instead of the IHS transformation (Tables A7-A8 in the Appendix).

Further, since the tax only applies to soda sold in Portugal, SSBs producers that sell a larger share of their products in Portugal are more impacted by the soda tax than those that export a

large part of their products. Based on this reasoning, we create a treatment intensity variable by dividing the pre-treatment, 2015, sales to the Portuguese market by total sales in the same year. By construction, a SSBs producer exporting 40% of its sales has a treatment intensity of 0.6, while a SSBs producer exporting all its products has a treatment intensity of 0 —the same as a water bottling firm. Results using this treatment intensity variable instead of the binary one are highly comparable, once again supporting the validity of our identification strategy (Table A9 in the Appendix).

IV. Conclusion

This study provides the first evidence on the impacts of soda taxes on producers. The advantages of soda taxes in terms of public health, via decreasing sugar intake from soda, had already been extensively documented in the literature, which prompted a large number of countries to implement such taxes. However, evidence was lacking on their economic impacts. We find that soda producers suffered from a significant drop in sales, which translated into lower profits. There is no evidence that employment in the soda industry was affected. At least in Portugal, the soda tax seems to have been lucrative from a public finance standpoint, even after accounting for forgone corporate income tax. Governments considering the implementation or revision of their soda taxes need to balance their advantages in terms of public health and public finances against potential negative impacts on firms, like the ones we document here.

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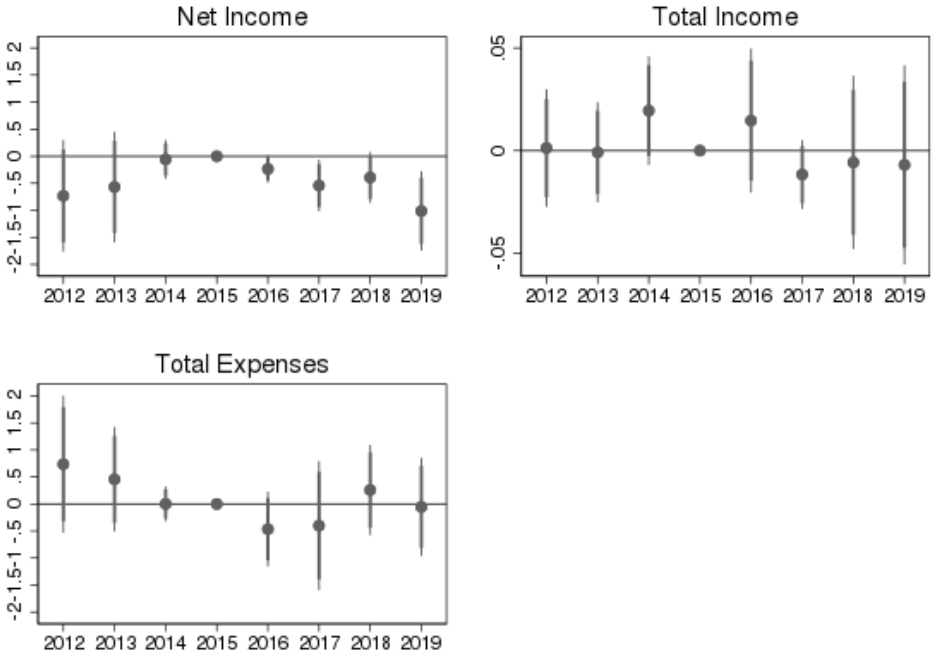
Table 1: **Summary statistics**

	Water Producers (Comparison)					SSBs Producers (Treatment)				
	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
Pre-tax										
Net Income	96	346’882	2’653’941	-5’088’466	11’400’000	48	473’910	3’539’913	-7’839’936	14’800’000
Total Income	96	8’752’184	10’300’000	0	38’600’000	48	42’300’000	96’400’000	0	320’000’000
Total Expenses	96	8’405’302	9’065’132	26’204	30’100’000	48	41’800’000	94’200’000	0	310’000’000
Turnover	96	8’267’268	9’750’781	0	38’400’000	48	40’200’000	91’700’000	0	306’000’000
Domestic Sales	96	7’570’468	8’984’236	0	32’200’000	48	30’600’000	68’400’000	0	233’000’000
Exported Sales	96	195’539	411’316	0	2’851’476	48	8’638’491	21’500’000	0	79’900’000
Imports	96	908’913	1’492’244	0	6’464’912	48	1’156’530	26’748’730	0	104’903’000
Cash	96	220’444	449’128	71	3’100’799	48	590’814	2’343’760	0	15’700’000
Receivables	96	1’646’639	1’955’405	0	9’828’467	48	7’348’327	15’900’000	0	64’300’000
Liabilities	96	12’100’000	22’100’000	8’095	123’000’000	48	38’400’000	109’000’000	86’272	412’000’000
Income Tax	96	-75’090	1’347’197	-12’600’000	2’187’857	48	138’366	854’436	-2’762’697	2’971’260
Average Wage	96	13’013	5’573	0	31’010	48	13’035	10’189	0	62’251
# Employees	96	55	67	0	315	48	142	325	0	1’212
# Employees in R&D	34	0.18	0.46	0	2	18	2	5	0	13
Post-Tax										
Net Income	99	1’109’984	3’393’949	-2’133’503	15’900’000	54	939’923	2’971’643	-1’092’650	13’000’000
Total Income	99	10’200’000	12’400’000	0	55’900’000	54	39’100’000	90’600’000	0	317’000’000
Total Expenses	99	9’052’056	10’300’000	4’912	40’000’000	54	38’100’000	88’300’000	0	309’000’000
Turnover	99	9’522’968	11’800’000	0	55’300’000	54	37’900’000	88’100’000	0	307’000’000
Domestic Sales	99	8’739’701	10’700’000	0	48’200’000	54	32’100’000	76’700’000	0	260’000’000
Exported Sales	99	150’200	259’005	0	968’772	54	5’271’218	10’800’000	0	39’000’000
Imports	99	1’025’069	1’732’040	0	8’180’137	54	9’667’883	23’909’360	0	89’908’670
Cash	99	560’315	1’000’692	0	4’797’750	54	469’200	1’020’181	0	5’080’177
Receivables	99	1’594’349	2’182’461	0	14’800’000	54	11’200’000	23’300’000	0	82’700’000
Liabilities	99	9’655’651	16’500’000	1’437	89’000’000	54	36’000’000	105’000’000	2’776	404’000’000
Income Tax	99	211’702	859’451	-1’057’868	5’623’661	54	320’996	1’009’489	-269’367	4’515’820
Average Wage	99	12’738	6’817	0	29’780	54	16’559	25’077	0	159’987
# Employees	99	53	68	0	333	54	130	330	0	1’264
# Employees in R&D	34	0.09	0.29	0	1	21	2	4	0	10

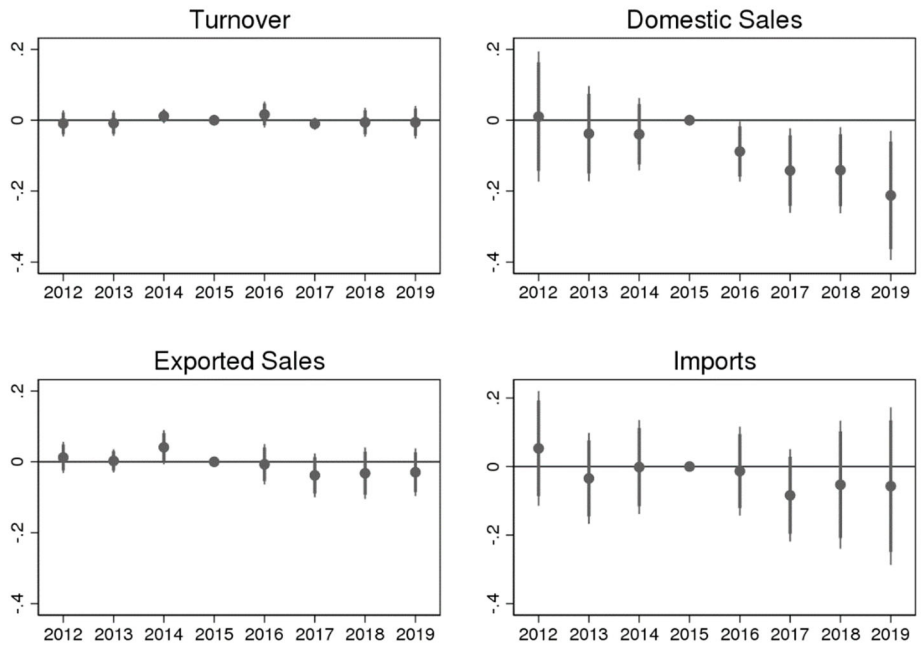
Figures

Figure 1: **Effects of the soda tax on baseline P&L outcomes**



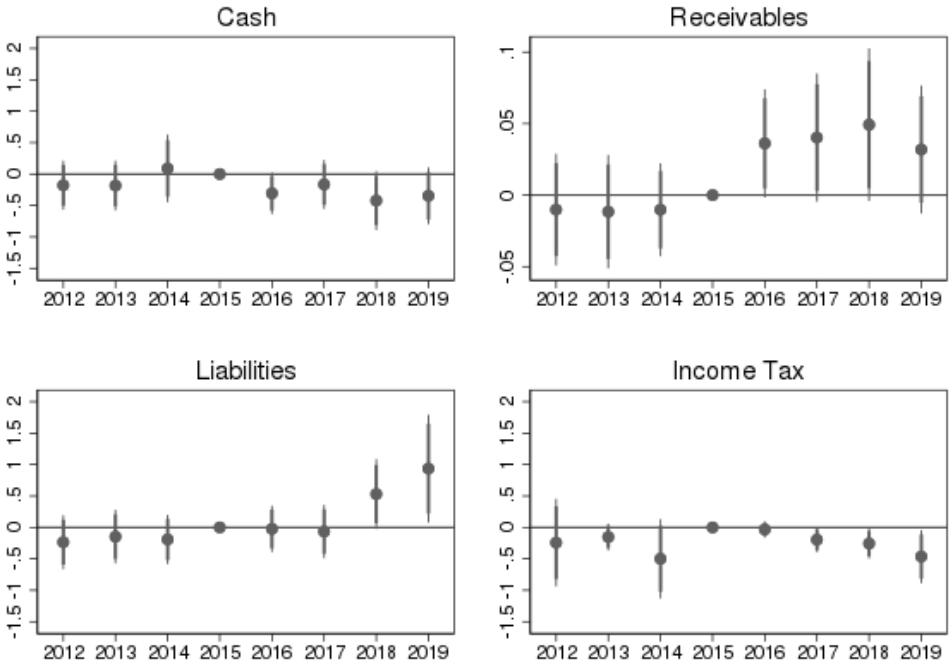
Note: Coefficients from eq. (1) along with the 90% and 95% confidence intervals using standard errors clustered at the firm level. Scaling factors: net income*10^{-6}, total income*10^{-2} , total expenses*10^{-2}. Table A3 in the Appendix reports the DiD results.

Figure 2: **Effects of the soda tax on turnover and sales**



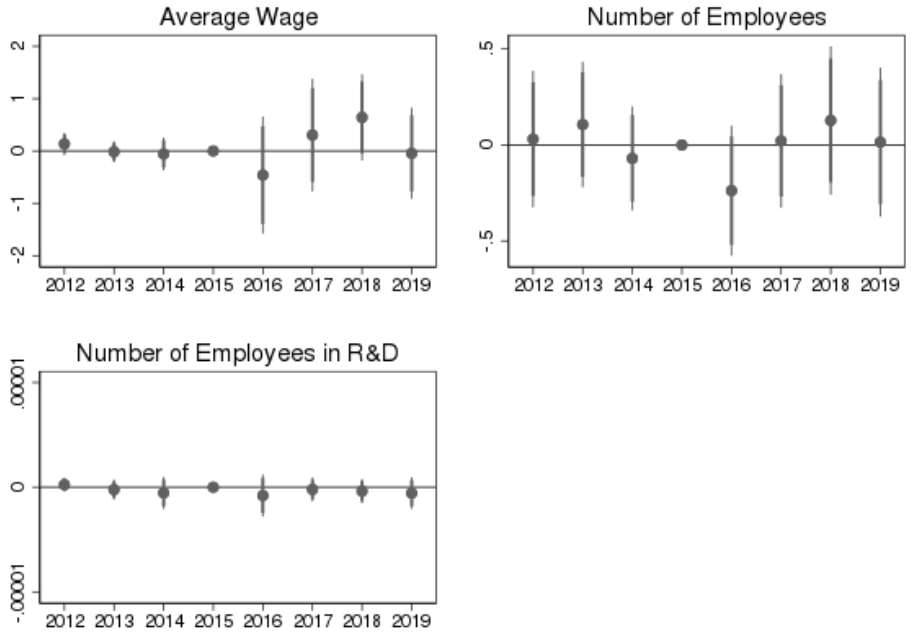
Note: Coefficients from eq. (1) along with the 90% and 95% confidence intervals using standard errors clustered at the firm level. Scaling factors: turnover*10^{-8}, domestic sales*10^{-6}, exported sales*10^{-8}, imports 10^{-6}. Table A4 in the Appendix reports the DiD results.

Figure 3**: Effects of the soda tax on other financial outcomes**



Note: Coefficients from eq. (1) along with the 90% and 95% confidence intervals using standard errors clustered at the firm level. Scaling factors: cash$*10^{-6}$, receivables$*10^{-8}$, liabilities$*10^{0}$, income tax$*10^{0}$. Table A3 in the Appendix reports the DiD results. Table A5 in the Appendix reports the DiD results.

Figure 4**: Effects of the soda tax on labor-related outcomes**



Note: Coefficients from eq. (1) along with the 90% and 95% confidence intervals using standard errors clustered at the firm level. Scaling factors: average wage$*10^{-2}$, number of employees$*10^{0}$, number of employees in R&D$*10^{-6}$. Table A6 in the Appendix reports the DiD results.

Appendix

Table A1: **Soda tax structure and amounts**

	January 2017	January 2018	January 2019
<25 g /L	8.22 €/hl	8.34 €/hl	1 €/hl
>= 25 g/L, <50g /L			6 €/hl
>= 50 g/L, <80g /L			8 €/hl
>= 80 g/L	16.46 €/hl	16.69€/hl	20 €/hl

Panel A: Drinks with added sugar or other sweeteners and drinks with an alcoholic strength between 0.5% and 1.2%

	January 2017	January 2018		October 2019	
	Concentrates	Concentrates in liquid form	Concentrates in solid form	Concentrates in liquid form	Concentrates in solid form
<25 g /L	8.22 €/hl	50 €/hl	83.35 €/100kg nw	6 €/hl	10 €/hl / 100kg nw
>= 25 g/L, <50g /L				36 €/hl	69 €/hl / 100kg nw
>= 50 g/L, <80g /L				48 €/hl	80 €/hl / 100kg nw
>= 80 g/L	16.46 €/hl	100.14 €/hl	166.90 €/100kg nw	120 €/hl	200€/hl / 100kg nw

Panel B: Concentrates intended for the preparation of beverages with added sugar or other sweeteners

Note: Author's own depiction based on *Código dos impostos especiais de consumo* (CIEC) article 87

Table A2: **Balance test**

	P-values	
	(1) Full sample	(2) Excluding largest firm
Net Income	0.225	0.690
Total Income	0.081	0.352
Total Expenses	0.080	0.347
Turnover	0.078	0.336
Domestic Sales	0.090	0.398
Exported Sales	0.034	0.080
Imports	0.056	0.169
Cash	0.164	0.332
Receivables	0.042	0.134
Liabilities	0.211	0.517
Income Tax	0.062	0.205
Average Wage	0.415	0.507
Number of Employees	0.178	0.987
Employees in R&D	0.359	0.267

Note: P-values of t-tests comparing SBBs and water producers in 2015 (last pre-treatment year). In column 1, the test is performed including all firms, and in column 2, the largest firm in the dataset —a soda producer— is removed

Table A3: **Effects of the soda tax on baseline P&L outcomes**: **DiD estimates**

	(1) Net Income	(2) Total Income	(3) Total Expenses
SSB*Post	-0.193	-0.007	-0.477
	(0.205)	(0.014)	(0.335)
Adjusted R^2	0.093	0.075	0.062
N x *T*	297	297	297

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: net income*10^{-6}, total income*10^{-8} , total expenses*10^{-2}.

Table A4: **Effects of the soda tax on turnover and sales: DiD estimates**

	(1) Turnover	(2) Domestic Sales	(3) Exported Sales	(4) Imports
SSB*Post	0.001	-0.125*	-0.039	-0.054
	(0.017)	(0.072)	(0.035)	(0.063)
Adjusted R^2	0.061	0.100	0.068	0.038
N x *T*	297	297	297	297

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: turnover*10^{-8}, domestic sales*10^{-6}, exported sales*10^{-8}, imports 10^{-6}.

Table A5: **Effects of the soda tax on other financial outcomes: DiD estimates**

	(1) Cash	(2) Receivables	(3) Liabilities	(4) Income Tax
SSB*Post	-0.240	0.047	0.444**	-0.005
	(0.167)	(0.028)	(0.182)	(0.123)
Adjusted R^2	0.078	0.162	0.030	0.042
N x *T*	297	297	297	297

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: cash*10^{-6}, receivables*10^{-8}, liabilities*10^{0}, income tax*10^{0}

Table A6: **Effects of the soda tax on labor-related outcomes: DiD estimates**

	(1) Average Wage	(2) Number of Employees	(3) Number of Employees in R&D
SSB*Post	0.073	-0.046	-0.000
	(0.43)	(0.110)	(0.000)
Adjusted R^2	0.011	0.048	0.095
N x *T*	297	297	107

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: average wage*10^{-2}, number of employees*10^{0}, number of employees in R&D*10^{-6}.

Table A7: **Effects of the soda tax on the main outcomes: Robustness**

	(1) Net Income	(2) Total Income	(3) Total Expenses	(4) Turnover	(5) Domestic Sales	(6) Exported Sales
			A. 1% winsorization			
SSB*Post	-0.213	-0.006	-0.477	0.006	-0.130*	-0.033
	(0.190)	(0.014)	(0.335)	(0.014)	(0.071)	(0.029)
Adjusted R^2	0.096	0.073	0.062	0.076	0.101	0.060
N x *T*	297	297	297	297	297	297
			B. Excluding largest firm			
SSB*Post	-0.178	0.001	-0.524	0.007	-0.139*	-0.004
	(0.222)	(0.014)	(0.371)	(0.018)	(0.072)	(0.011)
Adjusted R^2	0.092	0.111	0.066	0.093	0.102	-0.001
N x *T*	289	289	289	289	289	289
			C. Excluding firms with <90% turnover from main activity			
SSB*Post	-0.061	-0.000	-0.537	0.007	-0.137*	-0.004
	(0.213)	(0.014)	(0.373)	(0.018)	(0.078)	(0.011)
Adjusted R^2	0.056	0.113	0.070	0.090	(0.102	0.001
N x *T*	265	265	265	265	265	265
			D. Balanced panel			
SSB*Post	-0.137	-0.005	-0.167*	0.002	-0.180**	-0.011
	(0.255)	(0.016)	(0.089)	(0.021)	(0.080)	(0.011)
Adjusted R^2	0.113	0.143	0.041	0.113	0.150	0.010
N x *T*	224	224	224	224	224	224

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: net income*10^{-6}, total income*10^{-8} , total expenses*10^{-2}, turnover*10^{-8}, domestic sales*10^{-6}, exported sales*10^{-8}.

Table A8: **Effects of the soda tax on the main outcomes: Robustness to alternative transformations**

	(1) Net Income	(2) Total Income	(3) Total Expenses	(4) Turnover	(5) Domestic Sales	(6) Exported Sales
				A. ln(y)		
SSB*Post	-1.825***	-0.234	-0.161	-0.048	-0.212**	0.062
	(0.642)	(0.363)	(0.149)	(0.175)	(0.099)	(0.519)
Adjusted R2	0.218	0.012	0.043	0.005	0.057	0.015
N x *T*	138	283	293	275	261	171
				B. ln(y+1)		
SSB*Post	-1.764***	-0.673	-0.699	-0.552	-0.335	-1.343
	(0.620)	(0.621)	(0.489)	(0.676)	(0.775)	(0.987)
Adjusted R^2	0.151	-0.003	0.054	0.019	0.022	0.005
N x *T*	143	297	297	297	297	297

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: net income*10^{-6}, total income*10^{-8} , total expenses*10^{-2}, turnover*10^{-8}, domestic sales*10^{-6}, exported sales*10^{-8}.

Table A9: **Effect of the soda tax on the main outcomes: DiD with treatment intensity**

	(1) Net Income	(2) Total Income	(3) Total Expenses	(4) Turnover	(5) Domestic Sales	(6) Exported Sales
SSB_int*Post	-0.161	-0.014	-0.611	-0.008	-0.141*	0.040
	(0.192)	(0.013)	(0.383)	(0.016)	(0.073)	(0.031)
Adjusted R2	0.090	0.084	0.072	0.065	0.102	0.062
N x *T*	297	297	297	297	297	297

Note: Standard errors in parentheses clustered at the firm level. *p<0.1, **p<0.05, ***p<0.01. Scaling factors: net income*10^{-6}, total income*10^{-8} , total expenses*10^{-2}, turnover*10^{-8}.