



**Universidad del
Rosario**

**To Warn or to Tax? Evidence on the demand for sugar-sweetened beverages in
Colombia.**

Autor

Isabella Valencia Prado

Director

Paul Andrés Rodríguez Lesmes

Magíster en Economía

Facultad de Economía

Maestría en Economía

Universidad del Rosario

Bogotá - Colombia

2026

To Warn or To Tax? Evidence on the demand for sugar-sweetened beverages in Colombia.

Isabella Valencia

February 2026

Abstract

This study examines the impact of front-of-package warning labels (FOPLs) and the Tax on Ultra-Processed Sugar-Sweetened Beverages (IBUA) on consumer demand and firm pricing strategies in Colombia. Using high-frequency scanner data from a major supermarket chain in the Valle del Cauca region (2021–2024), I exploit product-level variation in treatment status to evaluate how these policies affected the soft drink market. Given the potential for substitution effects and pricing spillovers, the empirical strategy combines an event-study design with a synthetic difference-in-differences (SDID) estimator. We find no evidence that food labels, in isolation, reduced demand for soft drinks. The event-study results show a clear relative increase in prices of high-sugar beverages, with evidence of anticipatory pricing prior to the tax’s implementation, and a gradual decline in quantities sold of approximately 40% following the policy rollout. However, synthetic difference-in-differences (SDID) estimates suggest that the aggregate reduction in demand is modest and not statistically significant under the baseline specification. Redefining the post-treatment period to begin in January 2023 yields a larger estimated effect ($\beta = 0.341$, s.e. = 0.186; $p = 0.067$), indicating a stronger but still borderline response.

1 Introduction

As a major source of free sugars in diets worldwide (WMA, 2023), sugar-sweetened beverages are a public health concern. Their consumption has been strongly linked to weight gain in children and adults (WHO, 2014) and aligns with a global trend in which 40% of adults are overweight (WHO, 2018). This pattern is also observed in Colombia, where 31.5% of the population consumes sugar-sweetened beverages two to three times per week (DANE, 2021), and 37.7% of adults are overweight while 18.7% are obese (ENSIN, 2015). In response, governments worldwide have implemented policies to curb the consumption of foods associated with obesity. Two of the most common measures are taxes on unhealthy products and front-of-package labels (FOPLs), which provide visual warnings on packaging to inform consumers about key nutritional characteristics.

Since 2016, more than 25 countries have implemented or are in the process of implementing national food labeling policies (Barahona et al., 2022), and over the past decade more than 85 countries have adopted some form of sugar-sweetened beverage (SSB) tax (WHO, 2023). Alongside the global rollout of these policies, a growing literature has examined their effects across different institutional and market settings. In Colombia, front-of-package warning labels were introduced in 2021 for ultra-processed foods and sugar-sweetened beverages, with full compliance required by June 2023 for products exceeding regulatory thresholds of sugar, fat, and sodium. In parallel, the country approved a tax on these products that took effect in November 2023 and is scheduled to increase progressively through 2025.

Colombia offers a particularly informative setting to study these interventions. Warning labels and the SSB tax were introduced within a short time frame and under a progressive tax schedule, creating an environment in which informational and fiscal instruments overlap. Moreover, these measures were implemented in a post-pandemic context characterized by high food inflation, which may weaken the impact of policy-induced price changes. This combination makes Colombia a natural laboratory to study how labels and taxes jointly shape prices and consumption, and to assess whether insights from other settings generalize to markets facing substantial macroeconomic pressures.

Therefore, this study analyzes the joint impact of front-of-package warning labels (FOPLs) and the Tax on Ultra-Processed Sugar-Sweetened Beverages (IBUA) on consumer behavior and firm pricing strategies. Focusing on the soft drink market between 2021 and 2024, I use high-frequency scanner data from a major retailer in the Valle del Cauca region and exploit product-level variation in tax exposure. I provide novel evidence on how the rollout of FOPLs and the subsequent implementation of the IBUA influenced prices and quantities sold during the post-pandemic period. To account for substitution patterns and pricing spillovers, the empirical strategy combines an event-study design with a synthetic difference-in-differences approach to identify causal effects on demand.

In the context of this research, front-of-package warning labels are expected to reduce demand for labeled products. However, the extent of this reduction may be limited, as consumers are often aware of the high sugar content in these products before the introduction of labeling. Barahona et al. (2023) show that in Chile, consumers substituted labeled products with unlabeled ones, primarily due to shifts in their perceptions about product healthfulness. Additionally, firms responded by reformulating products and increasing the prices of unlabeled items by 5.5% relative to labeled ones. These strategic adjustments align with broader evidence on firms' responses to informational policies. Villas-Boas et al. (2020) highlight price adjustments as a common reaction to labeling regulations, while Moorman et al. (2012) and Lim et al. (2020) document reformulation efforts aimed at avoiding warning labels. Pachali et al. (2023) further show that after the introduction of front-of-package labels in Chile, prices of labeled cereals increased, possibly reflecting changes in consumer demand and firm pricing strategies. Consistent with this evidence, this paper shows that warning labels alone do not lead to a statistically significant reduction in soft drink demand. By jointly analyzing labels and taxation, the results suggest that informational policies mainly reshape relative prices and substitution patterns within the category, while meaningful reductions in consumption only emerge once fiscal incentives are introduced.

Beyond price and product reformulation, labeling regulations can also reshape market dynamics. Moorman et al. (2005) find that the 1990 Nutrition Labeling and Education Act in the U.S. led to higher exit rates among smaller firms while strengthening the position of market leaders, likely due to the costs of compliance. This suggests that while food labeling may serve public health objectives, it can also impose a regulatory burden on firms, alter competitive structures, and, in some cases, contribute to market power and higher prices. Bernheim and Taubinsky (2018) argue that in contexts where some consumers make suboptimal choices, informational interventions such as labels may be more effective than taxes, as they directly target decision-making without distorting prices. However, the effectiveness of such policies remains an empirical question, particularly given firms' ability to adapt through pricing and product strategies. In this paper, I focus exclusively on price and quantity responses, abstracting from entry, exit, and broader market structure effects. The results show that prices of treated products increase following the introduction of warning labels, but these increases cannot be fully attributed to labeling alone, as they are also consistent with firms anticipating the subsequent implementation of the sugar-sweetened beverage tax.

When it comes to taxation, this measure appears to be highly effective in reducing consumption and raising revenue. Aguilar et al. (2019) find that a fiscal reform in Mexico targeting sugar-sweetened beverages and caloric foods led to a 2.7% and 3% reduction in calorie intake, respectively. Cawley et al. (2019) provide a comprehensive review of the economic effects of such taxes, showing that while they generally increase retail prices and reduce sales, their effectiveness depends on pass-through rates and consumer behavior, including cross-border shopping. Furthermore, although sugar taxes are considered a key instrument against obesity, they may be regressive (Allcott et al., 2019a), and in many cases, tax rate decisions do not account for their effect on market power,

leading to lower welfare gains (O’Connell and Smith, 2022). Ultimately, all of this aligns with the classical economic principle that taxation inevitably generates welfare losses (Pigou, 1920). In Colombia, sugar-sweetened beverage taxes may have reduced consumption by directly impacting consumers’ budgets. By increasing the prices of these products, particularly for low- and middle-income households, many consumers are expected to opt for healthier alternatives or substitutes within the same category. In this paper, I document a clear increase in prices of taxed beverages and a relative decline in quantities following the introduction of the IBUA in Colombia. However, using a synthetic difference-in-differences approach to account for broader market dynamics, I find that the aggregate reduction in consumption is modest and noisier. One plausible explanation is that the tax was introduced in a context of unusually high food inflation—reaching peaks of around 27% by late 2022 and averaging above 15% throughout 2023—which may have reduced the salience of the tax-induced price changes and attenuated consumers’ behavioral responses.

2 Context and Data

2.1 Context

Colombia introduced front-of-package warning labels for ultra-processed foods and sugar-sweetened beverages through Resolution 810 of 2021, establishing an 18-month period for the mandatory incorporation of circular, monochromatic warning labels on products with high levels of added sugars, sodium, or saturated fats. Since the resolution was published on June 16, 2021, the deadline for compliance was December 16, 2022. However, studies conducted by the University of Antioquia concluded that octagonal labels are more effective in capturing consumer attention and communicating risks associated with excessive consumption of sugar, fats, or sodium. Based on these findings, the government issued Resolution 2492 in December 2022, modifying the label design to adopt an octagonal format with a black background and white lettering, making it more visible and effective in alerting consumers. The new regulation also prohibited nutritional claims on products bearing these labels to avoid contradictions in the presented information. As a result, from June 2023 onward, all products exceeding certain sugar, fat, and sodium levels were required to include front-of-package warning labels.

On the other hand, the Tax on Ultra-Processed Sugar-Sweetened Beverages (IBUA) came into effect in November 2023, as part of the tax reform approved in November 2022, introducing a gradual taxation scheme based on the sugar content of beverages. Products with less than 4 grams of sugar per 100 ml are exempt from the tax, while those containing between 4 and 8 grams per 100 ml are subject to an intermediate rate, and beverages exceeding 8 grams per 100 ml face the highest tax rate. This tax will increase progressively until 2025, as shown in the following table.

Content in 100 ml	2023	2024	2025
Less than 6 g of added sugars	\$0	\$0	\$0
6 g - 10 g of added sugars	\$18	\$28	\$38
More than 10 g of added sugars	\$35	\$55	\$65

2.2 Data

To estimate the impact of the tax and warning labels on demand, I use scanner data at the product level from a regional supermarket chain in Valle del Cauca, Colombia, covering the period from 2021 to 2024. This chain, with nearly 50 years in the market, operates 13 stores across different cities in the department and generates over 300 billion Colombian pesos in annual revenue. While it has recently expanded its customer base to higher-income segments, its primary target remains consumers from socioeconomic strata 2, 3, and 4.

The transaction-level data includes detailed information on all purchases made in the supermarket's branches for 7,800 food products, excluding meat and grains. Each observation records the purchase date, price paid, and quantity purchased, along with the store location and payment method.

To estimate the effect on demand, I focus on the supermarket's "Liquid Refreshing Beverages" category. Within this category, I include only carbonated beverages and iced teas, which are closer to the international definition of soft drinks and are direct substitutes for each other. I exclude bottled water, juices, and energy drinks. The transaction-level purchases are then consolidated into a product-time dataset, aggregating total sales in Colombian pesos and quantities sold (in the form of total liters and units), disaggregated by product, store and month. The dataset covers the full years of 2021, 2022, and 2023, as well as January to August 2024, totaling 15,194 individual observations, 44 months, and 601 products.

To provide an initial overview of the data and market behavior before and after the introduction of the policies, Figures 1 and 2 present the evolution of quantities sold for treated and non-treated beverages. Figure 1 displays total liters sold over time, capturing variation in aggregate purchasing volumes, while Figure 2 shows the corresponding evolution in unit transactions, both in levels and logarithmic form. Together, these figures illustrate important differences between total volumes and the frequency of purchases, which are informative for understanding both the potential health implications of consumption patterns and the behavioral responses that precede formal policy evaluation.

Figure 1: Evolution of Liters Sold Over Time by Treatment Group for the Soft Drinks category.

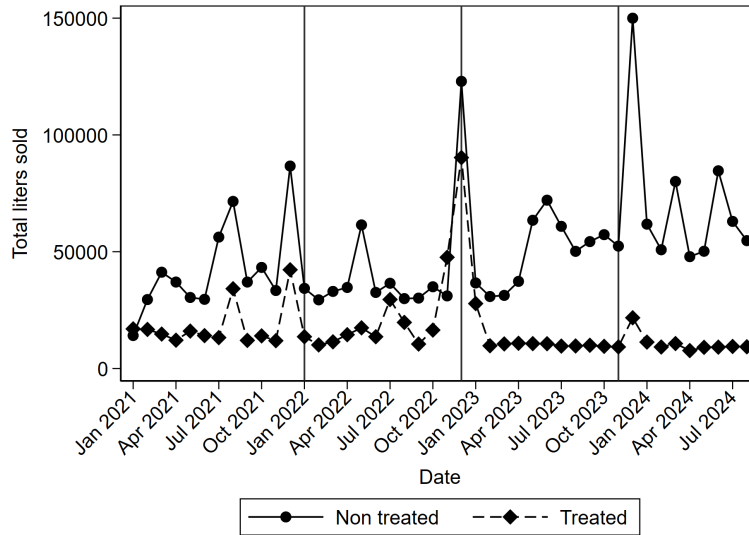
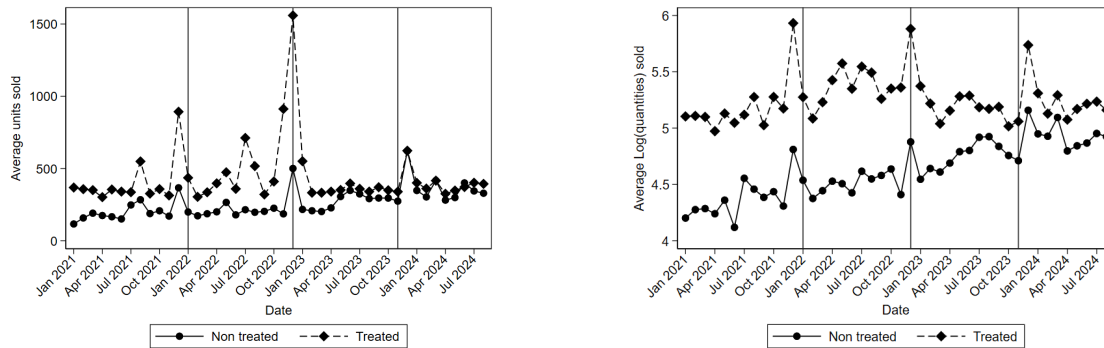


Figure 2: Evolution of Quantities Over Time by Treatment Group for the Soft Drinks category.



(a) Quantities

(b) log(Quantities)

Note: The first vertical line indicates the date when the FOPL started circulating under **Resolution 810 of 2021**. The second marks the date when the resolution for the tax and the octagonal FOPL was signed under **Resolution 2492 of 2022** and **Law 2277**, and the third represents the month when the tax came into effect. The circles show the trend for beverages that do not exceed the sugar limit, while the diamonds represents those that do.

Both graphs point to the same underlying pattern: the demand for high-sugar beverages declines relative to that of non-high-sugar alternatives over the sample period. However, the initial gap between the two groups differs depending on how demand is measured. When looking at total liters sold, high-sugar beverages dominate the market until early 2023, after which the gap begins to narrow and eventually converges once front-of-package warning labels start to be implemented. In contrast, the transaction-based measures show that high-sugar products are purchased more

frequently but in smaller amounts per purchase, while low-sugar beverages are bought less often but in larger volumes per transaction.

These differences reflect variation across the intensive margin (liters purchased) and extensive margin (transactions) rather than conflicting trends. Importantly, both metrics show a consistent decline in the relative demand for high-sugar beverages. As will be shown in the empirical analysis, the main results are robust to either definition of demand, but the distinction remains relevant for interpreting how consumers adjust their purchasing behavior in response to informational and fiscal policies.

A descriptive look at prices shows that throughout 2021 both categories (high-sugar and low-sugar beverages) remained relatively stable. Beginning in early 2022, however, prices for both groups start to rise steadily. As expected and intended, the increase is more pronounced for high-sugar beverages. However, low-sugar products also display a noticeable upward trend over the same period.

Figure 3: Evolution of Price per Liter Over Time by Treatment Group.

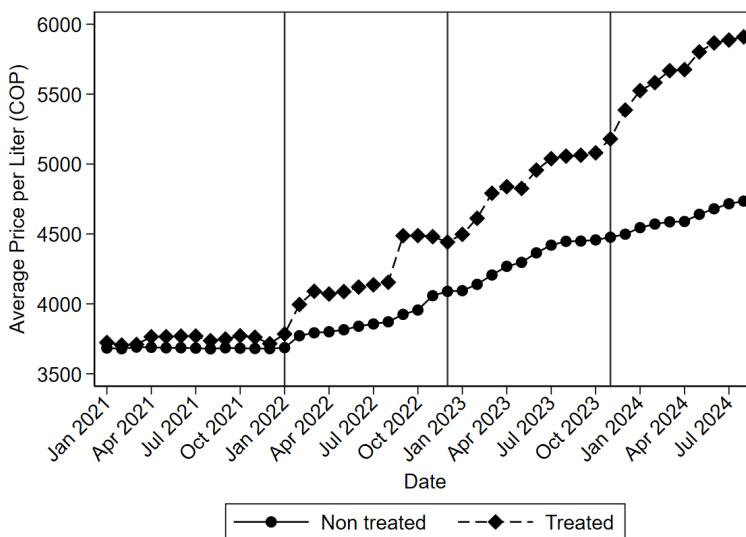
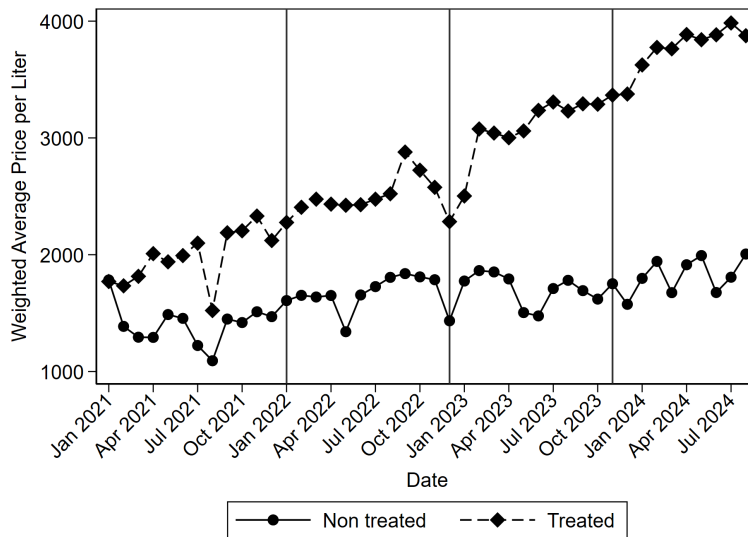


Figure 3 shows that, on average, the price of high-sugar beverages rose from approximately 3,750 COP per liter in early 2021 to about 5,900 COP by mid-2024, an increase of 2,150 COP (roughly 57.3%). Low-sugar beverages increased from around 3,680 COP to 4,730 COP over the same period, corresponding to a 28.5 % increase (approximately 1,050 COP). For reference, under the IBUA structure, the maximum statutory tax per liter for years 2023 and 2024 ranges from 180 to 550 COP depending on sugar content and year.

Figure 4 presents the evolution of weighted average prices, where each product’s price is weighted by the quantity of liters sold in each period. This weighting reflects the prices actually faced by consumers for the products they purchase most frequently. In contrast to the unweighted averages, the weighted series shows that the increase in prices for low-sugar beverages is considerably smaller. High-sugar beverages, on the other hand, continue to exhibit a marked upward trend, reaching levels above 4,000 COP per liter by mid-2024. Overall, weighting by quantities sold highlights that the most popular low-sugar products experienced relatively modest price changes compared with the more pronounced increases observed among high-sugar beverages.

Figure 4: Evolution of Weighted Price per Liter Over Time by Treatment Group.



Taken together, both the unweighted and weighted price series show substantial increases in average prices over the period, with the rise being consistently larger for high-sugar beverages. In both cases, the magnitude of the observed increases exceeds the statutory tax amounts established under the IBUA. In the unweighted series, prices for low-sugar beverages appear to rise more sharply, which could be interpreted as firms adjusting prices across the entire category. However, this pattern is not consistent when prices are weighted by quantities sold. In other words, the apparent increase among low-sugar products is not robust to the choice of aggregation method, as it diminishes once the analysis places greater weight on the products consumers purchase most frequently.

Given this lack of robustness across figures, we cannot conclude that firms are transferring part of the tax to exempt products within the category. Nor can we draw conclusions about tax pass-through or pricing behavior more generally, since this descriptive comparison does not account for inflation, supply-side cost shocks, changes in input prices, or broader market conditions that may have shaped these trends. Instead, the figures simply document that the overall rise in prices

is substantial and exceeds what would be expected from the statutory tax alone. The potential drivers of these patterns, and their implications for consumer behavior and market outcomes, will be discussed in greater detail in the concluding section.

3 Analysis

Event-Study Specification

The main objective of the empirical analysis is to study how the gap between treated and non-treated beverages evolves over time and how the dynamics of the category respond to the introduction of warning labels and the sugar-sweetened beverage tax. To examine these relative changes rather than absolute trends, and to track how the gap opens, narrows, or reverses at different points in time, I rely on an event-study design. This framework allows the treated and non-treated groups to follow their own pre-policy trajectories and then compares their evolution around the implementation of each policy.

The baseline specification is given by the following regression:

$$\log(q_{jst}) = \sum_k \beta_k \cdot L_j \cdot 1\{k = t\} + \delta_{js} + \delta_t + \varepsilon_{jst}, \quad (1)$$

where q_{jst} denotes the liters of product j sold in store s at time t . The variable L_j is a time-invariant treatment indicator defined differently in each analysis: it equals one if the product carries one or more warning labels in the labeling analysis, and one if the product is subject to the sugar-sweetened beverage tax in the taxation analysis. In practice, treatment status is determined using the set of products subject to the tax as of July 2024. I assume that the same subset of products was treated with labels, which provides the only observable and consistent classification over the sample period. This definition serves as a reasonable proxy, since the thresholds for the tax and the labels are the same, but it may not fully capture products that initially had labels but were reformulated to avoid the tax. Moreover, I am unable to implement a staggered DiD analysis of the labeling rollout, which occurred gradually during the early stages of the regulation. Nonetheless, this approach allows studying the early stages under the assumption that, by the cutoff date, all products currently subject to the tax had already carried a warning label. And any contamination, where some treated products are included in the control group, would likely lead to an underestimation of the coefficients β_k , which trace the evolution of the treated–control gap relative to the omitted pre-policy period.

Finally, the term δ_{js} represents product–store fixed effects, absorbing any time-invariant heterogeneity across products and locations, such as baseline popularity, brand attributes, or store-specific characteristics. Time fixed effects δ_t control for aggregate shocks common to all observations, including inflationary pressures, seasonality, and macroeconomic fluctuations. And ε_{jst} captures idiosyncratic variation not explained by the model.

Synthetic difference-in-differences with a larger control pool

The event-study above compares treated beverages with non-treated beverages within the same category. This comparison may violate SUTVA, because non-treated beverages can respond to warning labels applied to similar products. For example, demand for Coke Zero may increase once regular Coke carries a label or raises its price, and the price of Coke Zero could also respond due to shared brand ownership. As a result, a standard DiD would only capture the treated-control gap, rather than isolating the causal effect of the treatment itself. To address this issue, I estimate a synthetic difference-in-differences (SDID) model using the `synthdid` framework (Arkhangelsky et al., 2021). In this specification, I construct a counterfactual path for the treated beverages using product categories that are never exposed to the warning labels or to the tax as the donor pool. I drop all the non-treated products in the soft drinks category and then aggregate item-level quantities to the category level and use these category-level series as the units of observation. I exclude all categories that are partially or fully affected by either policy.

Formally, Let $y_{it} = \log(q_{it})$ denote the log quantity for unit i in period t . Let \mathcal{T} be the set of treated units (i.e., only the category of soft drinks), \mathcal{C} the set of control units, and let T_0 be the last pre-treatment period. I define time weights $\lambda_t = 1/T_0$ for all $t \leq T_0$, and $\lambda_t = 1/T_1$ for all $t > T_0$, where $T_1 = T - T_0$.

The synthetic difference-in-differences estimator I use is:

$$\hat{\tau}_{\text{sdid}} = \sum_{i \in \mathcal{T}} \omega_i \sum_{t > T_0} \lambda_t y_{it} - \sum_{i \in \mathcal{C}} \omega_i \sum_{t > T_0} \lambda_t y_{it} - \left[\sum_{i \in \mathcal{T}} \omega_i \sum_{t \leq T_0} \lambda_t y_{it} - \sum_{i \in \mathcal{C}} \omega_i \sum_{t \leq T_0} \lambda_t y_{it} \right], \quad (2)$$

where the unit weights ω_i are chosen by the `synthdid` procedure to match the pre-treatment paths of treated and control units.

The identifying assumption is that, conditional on the weights chosen by the `synthdid` procedure, the untreated categories provide a valid approximation to the counterfactual evolution of the treated beverages in the absence of the policy. This approach allows me to study how the gap between the observed and synthetic paths of the beverages category changes over time and to assess the extent to which the dynamics documented in the event-study analysis remain when a broader control group is used.

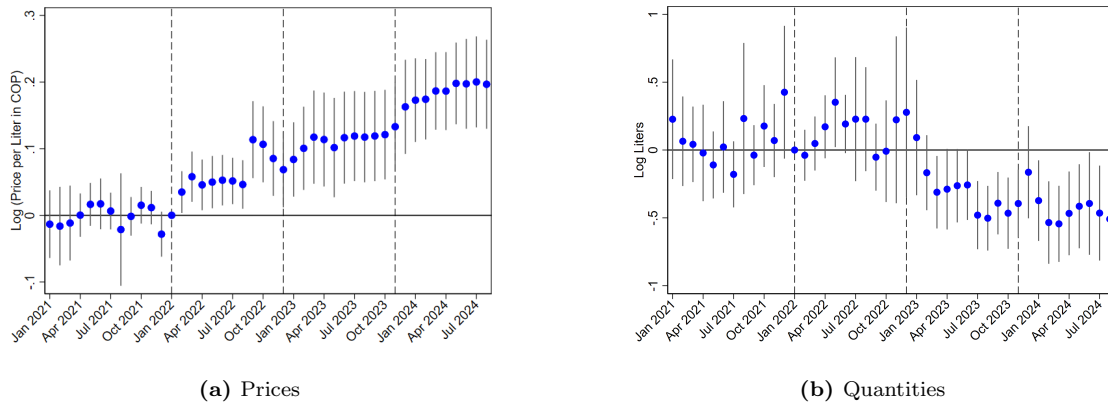
4 Results

Event-Study Results

The event-study estimates allow us to move beyond the aggregate descriptive patterns and examine how the treated-control gap evolves around the introduction of each policy. Figure 5 plots the esti-

mated coefficients β_k from equation (1), which trace the relative dynamics of prices and quantities between treated and non-treated beverages over time. Each point represents the difference between the two groups in a given month, normalized to zero in the omitted pre-policy period, while the confidence intervals reflect the uncertainty around these estimates. This framework therefore provides a detailed view of how the gap opens or narrows following the implementation of the warning labels in mid-2022 and the IBUA tax in early 2023.

Figure 5: Difference-in-Differences: Log Prices and Log Liters in Soft Drinks



Note: The first vertical line indicates the date when the FOPL started circulating under **Resolution 810 of 2021**. The second marks the date when the resolution for the tax and the octagonal FOPL was signed under **Resolution 2492 of 2022** and **Law 2277**, and the third represents the month when the tax came into effect. The circles show the trend for beverages that do not exceed the sugar limit, while the diamonds represents those that do.

Figure 5a shows a clear and sustained increase in the treated–control price gap. A particularly striking feature is that prices for treated beverages begin to rise well before the sugar-sweetened beverage tax becomes effective. The upward trend starts as early as January 2022 and continues throughout 2022 and most of 2023, a period during which only the warning-label regulation was in place and the tax had not yet been implemented. Once the tax finally takes effect in late 2023, the gap widens further and the increase becomes steeper, consistent with the statutory adjustments scheduled for 2023 and 2024. The fact that prices rise long before the fiscal component of the policy is introduced suggests the presence of anticipatory pricing. Although the tax only becomes effective in late 2023, it had been under public discussion for some time, which may have prompted firms to adjust prices in advance. Additionally, the operational burden associated with implementing the warning labels may have generated cost increases that were reflected in prices even before the tax was applied.

Figure 5b displays the corresponding dynamics for quantities sold. The treated–control gap remains relatively stable throughout the pre-policy period, indicating that parallel trends hold reasonably well prior to the introduction of the regulations. One notable exception is the month

of December, during which quantities for high-sugar soft drinks show atypical spikes. This can be attributed to seasonal consumption patterns associated with Christmas and New Year’s celebrations, as well as the Cali Fair, given that the data comes from supermarkets in the Valle del Cauca region. For this reason, January 2023 is used as the reference period instead of December 2022. Excluding this seasonal anomaly, the pre-trends appear flat and supportive of the identifying assumption.

After the labeling regulation comes into effect, the treated–control gap shows a temporary increase, with treated beverages experiencing a short-lived rise in quantities relative to the non-treated group. Although this pattern is somewhat unexpected, it is not entirely inconsistent with the introduction of labels, particularly given anecdotal evidence that the initial circular labeling requirement under Resolution 810 was not strictly applied. This first treatment window corresponds to the period in which the circular labels began to circulate, but compliance times and deadlines differed across products. Some noise in the estimated coefficients is therefore expected, in part due to the staggered implementation of the labeling regulation, which occurred at different moments across products.

It is also important to recall that in my analysis, treatment status is defined using the set of products that are subject to the tax in July 2024, which does not account for the precise timing of label adoption at the product level. These factors may help explain the temporary increase in quantities demanded for high-sugar beverages. Nevertheless, this initial uptick dissipates quickly, and quantities begin to decline once the octagonal warning labels are introduced. The decrease becomes more pronounced after the IBUA tax takes effect in late 2023, and the treated–control gap continues to widen throughout the subsequent months.

While the event-study analysis provides a detailed and informative description of how the treated–control gap evolves around the introduction of each policy, it does not by itself allow for a fully causal interpretation of the effects of warning labels or the IBUA tax. This limitation is mainly driven by the structure of the market and the nature of the treatment. Treated and non-treated beverages belong to the same product category, are often produced by the same firms, and compete within the same shelf space. As a consequence, any change induced by the regulation on one group of products can spill over to the other through mechanisms such as category-wide pricing strategies, brand repositioning, or shifts in consumer substitution patterns. If these indirect channels are present, the independence assumptions underlying the event-study design, including SUTVA, may not hold: the potential outcome of a non-treated product may itself change as a result of the treatment applied to the treated products. In such settings, the event-study framework remains highly valuable for documenting the evolution of the gap, but it is not sufficient to isolate the causal effect of the policies.

For this reason, it is necessary to complement the event-study results with an alternative

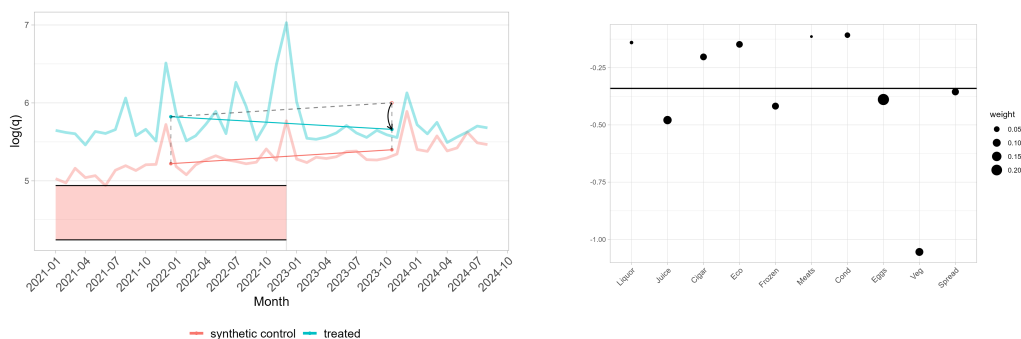
strategy that constructs a counterfactual path for the treated products using units that are not exposed to either the labels or the tax and therefore are less likely to be affected by within-category spillovers. This motivates the use of the synthetic difference-in-differences estimator, which leverages the broader set of product categories in the supermarket that remain policy-free to build a more credible comparison group and to estimate the counterfactual trajectory that treated beverages would have followed in the absence of the regulations.

Synthetic Difference-in-Differences

The synthetic difference-in-differences estimates indicate no general detectable effect of the policy. Using the full donor pool of never-treated categories, the estimated average treatment effect is close to zero. The `synthdid` estimate is $\hat{\tau} = -0.023$ (s.e. = 0.229), with effective sample sizes (effective $N_0/N_0 = 17.2/23$ and effective $T_0/T_0 = 13.0/13$) suggesting that the synthetic control relies on a broad set of donor categories and fully exploits the available pre-treatment periods. This aggregate estimate pools the effects of both the food labeling policy and the subsequent tax. Consistent with the event-study evidence, disaggregating the post-treatment period reveals larger effects once the tax is introduced. We therefore for now, only conclude that there is no evidence that the food labeling policy, in isolation, affected soft drink consumption.

Assuming that periods prior to the onset of the tax debate are unaffected, we redefine the treatment to isolate the effect of taxation. Specifically, we shift the start of the post-treatment period to January 2023. Under this alternative definition, the synthetic difference-in-differences estimate increases in magnitude: $\hat{\tau} = -0.341$ with a standard error of 0.186, corresponding to a p-value of 0.0668. The effective sample sizes (effective $N_0/N_0 = 10.0/23 \approx 0.4$ and effective $T_0/T_0 = 24.0/24 \approx 1.0$) indicate that a relatively concentrated subset of donor categories receives most of the weight, while all pre-treatment periods contribute to the temporal alignment. Although the estimate remains imprecise relative to conventional significance thresholds, it suggests a nontrivial decrease in quantities once the tax discussion begins, consistent with the stabilizing patterns observed in the treated-control gap in the event-study analysis.

Figure 6: Synthetic Difference-in-Differences: Log Quantities in Soft Drinks



(a) Observed vs Synthetic Counterfactual

(b) Donor Weights (Top Controls)

The fact that the synthdid estimate is smaller in magnitude than the gaps observed in the event study, and that it is not statistically significant, suggests that the effects detected earlier may largely reflect within-category dynamics rather than a clear causal reduction in the overall consumption of sugar-sweetened beverages. In other words, the event study captures how the treated and non-treated products evolve relative to each other, whereas the synthetic DID compares the treated beverages to a counterfactual constructed from entirely different product categories that are unaffected by either the labels or the tax. The resulting estimate therefore provides little evidence of a strong aggregate reduction in sugary beverage demand once broader market trends are taken into account.

5 Conclusion

Taken together, the event–study and synthetic DID results provide a coherent account of how front-of-package warning labels and the IBUA tax affected the soft-drinks market. Both approaches yield no evidence that food labels, in isolation, reduced demand for soft drinks. This finding is consistent with the food-labeling literature. Evidence from Chile shows that warning labels primarily affect products for which consumers were previously misinformed about nutritional content, inducing substitution within categories rather than large reductions in aggregate consumption (Barahona, Otero, and Otero, 2023). In the case of soft drinks, the estimated effects of labeling are modest (10%), with confidence intervals that include zero and even positive effects. This pattern is consistent with the notion that consumers already hold accurate beliefs about the sugar content of products such as carbonated soft drinks, rendering warning labels largely informationally redundant in this category.

Regarding the fiscal policy, the event–study analysis reveals a clear widening of the treated–control gap following implementation. Prices of high-sugar beverages increase sharply relative to their low-sugar counterparts, and quantities exhibit a gradual decline. However, the synthetic DID estimates indicate that these effects are weaker than suggested by the event–study and do not

necessarily translate into a statistically significant causal reduction in aggregate consumption of sugar-sweetened beverages. Once broader market dynamics are accounted for through a synthetic comparison unit constructed from the remainder of the supermarket's product assortment, the estimated treatment effects become smaller and noisier, though not negligible. Importantly, the event-study results primarily capture relative adjustments between high- and low-sugar beverages rather than a large contraction in overall demand for the treated products. While a total reduction in consumption does appear to exist, it is modest once general market trends are properly controlled for.

These results should also be interpreted in light of the broader macroeconomic environment prevailing in Colombia during the period of analysis, which was characterized by elevated inflationary pressures. Inflation was not confined to soft drinks or sugar-sweetened beverages but affected a wide range of food and non-food items, leading to a generalized increase in consumer prices. In such a context, price increases driven by the tax on sugar-sweetened beverages may have been less salient to consumers, as they were embedded in a broader episode of rising prices across the consumption basket. This generalized inflationary environment may therefore have attenuated the behavioral response to the tax, making it harder to detect large changes in consumption patterns attributable solely to the fiscal intervention. Nevertheless, even if the price signal was partially obscured by economy-wide inflation, the tax still generates fiscal revenues through a broad tax base, implying that the policy can contribute to public finances even when its short-run effects on consumption are modest.

And finally, several limitations of the analysis are worth noting. First, the empirical strategy does not allow for separately identifying the causal effect of the tax in isolation, as the fiscal intervention is implemented alongside other contemporaneous policy and market changes. In particular, the reduced-form estimates capture the joint equilibrium response of prices and quantities but do not recover the underlying demand elasticities needed to isolate the pure effect of the tax. As a result, the analysis cannot quantify how consumption would have evolved under the tax alone, holding other factors constant. Future work could structurally isolate the effect of the tax by embedding estimated demand elasticities into a differentiated-products demand framework. Standard approaches in the industrial organization literature, such as random coefficients discrete-choice models (Berry, Levinsohn and Pakes, 1995; Nevo, 2001), would allow me to disentangle the standalone impact of the tax, assess welfare implications more precisely, and evaluate how fiscal instruments interact with information policies in shaping consumption and health outcomes.

References

- Arkhangelsky, D. et al. (2021). Synthetic difference-in-differences. *American Economic Review*, 111:4088–4118.
- Aguilar, A., Gutierrez, E., & Seira, E. (2021). The effectiveness of sin food taxes: Evidence from Mexico. *Journal of Health Economics*, 77, 102455. <https://doi.org/10.1016/j.jhealeco.2021.102455>
- An, R., Shi, Y., Shen, J., Bullard, T., Liu, G., Yang, Q., Chen, N., & Cao, L. (2021). Effect of front-of-package nutrition labeling on food purchases: A systematic review. *Public Health*, 191, 59–67. <https://doi.org/10.1016/j.puhe.2020.06.035>
- Barahona, N., Otero, C., Otero, S. (2023). Equilibrium Effects of Food Labeling Policies. *Econometrica*, 91(3), 839-868.
- Berardi, N., Sevestre, P., Tepaut, M., & Vigneron, A. (2012). *The impact of a “soda tax” on prices: Evidence from French micro data* (Working Paper No. 415). Banque de France.
- Caro, J. C., Ng, S. W., Bonilla, R., Tovar, J., and Popkin, B. M. (2017). Sugary drinks taxation, projected consumption and fiscal revenues in Colombia: Evidence from a QUAIDS model. *PLoS One*, 12(12), e0189026. <https://doi.org/10.1371/journal.pone.0189026>
- Colchero, M. A., Rivera, J. A., Popkin, B. M., and Nigenda, G. (2016). In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Affairs*, 35(3), 464-471. <https://doi.org/10.1377/hlthaff.2015.0891>
- Moorman, C., Diehl, S., and Brinberg, D. (2012). The impact of front-of-pack nutrition labels on consumer product evaluation and choice: an experimental study. *Public Health Nutr.*, 18(12), 2126-2134. <https://doi.org/10.1017/S1368980014002997>
- Villas-Boas, S. B., Chintagunta, P. K., and Choi, H. (2020). The effects of front-of-package nutrition labels on consumer choices. *Marketing Science*, 39(4), 615-635. <https://doi.org/10.1287/mksc.2020.1250>