# Did high sugar-sweetened beverage purchasers respond differently to the excise tax on sugar-sweetened beverages in Mexico?

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## Abstract

*Objective:* To estimate changes in taxed and untaxed beverages by volume of beverage purchased after a sugar-sweetened beverage (SSB) tax was introduced in 2014 in Mexico.

*Design:* We used household purchase data from January 2012 to December 2015. We first classified the sample into four groups based on pre-tax purchases of beverages: (i) higher purchases of taxed beverages and lower purchases of untaxed beverages (HTLU-unhealthier); (ii) higher purchases of both types of beverages (HTHU); (iii) lower purchases of taxed and untaxed beverages (LTLU); and (iv) lower purchases of taxed beverages and higher purchases of untaxed beverages (LTHU-healthier). Next, we estimated differences in purchases after the tax was implemented for each group compared with a counterfactual based on pre-tax trends using a fixed-effects model.

*Setting:* Areas with more than 50 000 residents in Mexico.

*Participants:* Households (*n* 6089).

*Results:* The HTLU-unhealthier and HTHU groups had the largest absolute and relative reductions in taxed beverages and increased their purchases of untaxed beverages. Households with lower purchases of untaxed beverages (HTLU-unhealthier and LTLU) had the largest absolute and relative increases in untaxed beverages. We also found that among households with higher purchases of taxed beverages, the group with lowest socio-economic status had the greatest reduction in purchases of taxed beverages.

*Conclusions:* Evidence associating the SSB tax with larger reductions among high purchasers of taxed beverages prior to the tax is relevant, as higher SSB purchasers have a greater risk of obesity, diabetes and other cardiometabolic outcomes.

In Mexico the prevalence of overweight and obesity has reached 70 % among adults and 30 % among children[1–3]. Mexico is second only to Chile in consumption of sugar-sweetened beverages (SSB), at nearly 150 litres per capita annually[4]. Analysis of the 2012 National Nutrition and Health Survey has shown that beverages accounted for 17·5 % of total energy intake among Mexican children aged 1–19 years and 19·0 % among Mexican adults[5]. SSB consumption has been strongly associated with weight gain and type 2 diabetes[6–10].

In this context, on 1 January 2014, the Mexican Government implemented an excise tax of 1 peso per litre on all non-alcoholic beverages with added sugar. The tax passed through prices completely: prices increased by the amount of the tax for all SSB and more than 1 peso for carbonated beverages[11]. Studies have shown reductions in taxed beverage purchases and sales close to 6 % in the first year[12–14], with reductions becoming higher in the second year[13,14]. Simultaneously, sales and purchases of untaxed beverages increased after the tax was implemented[12,15,16]. Additionally, SSB purchase reductions were greater among households with lower socio-economic status (SES)[12,13,17], households with children and in urban areas[17]. However, previous studies have not evaluated whether the tax has had a differential effect among higher SSB consumers.

Evidence in Mexico shows that children who consume the highest amounts of SSB or energy-dense foods have greater risks of obesity[18,19]. Studies elsewhere show that high SSB consumers are more likely to have obesity, to develop diabetes and to have related chronic diseases[20,21]. Thus, evaluating higher taxed beverage consumers' response to the excise tax is relevant, because although the SSB tax targets all consumers, the potential health benefits for higher consumers may be greater if they reduce their consumption.

On one hand, economic theory suggests that heavier consumers would be more responsive as SSB spending accounts for greater shares of their budgets and, all else constant, elasticity is expected to be greater as the budget share is higher[22]. On the other hand, it is possible that higher SSB consumers may be relatively unresponsive to price changes brought by the SSB tax compared with lower consumers due to habituation to SSB. Studies on price elasticities of the demand for SSB in Australia and Norway found that although the demand is less elastic among higher consumers, greater absolute reductions could be observed given their very high absolute levels of consumption[23,24]. For other goods, such as alcohol, another study found non-significant differences in response to price changes across low, moderate and heavy adult drinkers in the USA[25]. In contrast, a different study among older individuals showed that heavy drinkers were unresponsive to price changes[26]. For tobacco, a US study found that heavier smokers were more responsive to state cigarette taxes[27]. A recent paper showed that two years after implementation of a tax on non-essential high-energy-dense foods in Mexico, high purchasers of taxed foods had larger reductions[28]. To our knowledge, no previous studies in Mexico or any other country have assessed the responses of higher SSB consumers or purchasers to an SSB tax.

The objective of the present paper was to estimate the differential changes in taxed and untaxed beverages by volume of purchases associated with the implementation of the SSB tax, using data on beverage purchases among urban Mexican households in two pre-tax years (2012, 2013) and two post-tax years (2014, 2015). Identifying sub-populations with differential changes in beverage purchases after the tax can inform the design of policies aimed at helping reduce obesity and chronic diseases among the most vulnerable populations.

## Methods

### Data

We used purchase data between January 2012 and December 2015 from a sample of Mexican households in areas with more than 50 000 residents in Nielsen's Mexico Consumer Panel Services. The data contain information on household purchases of foods and beverages from stores

and sociodemographic variables, as described elsewhere[12,29]. Our study was exempted as non-human subjects research by the University of North Carolina at Chapel Hill, Office of Human Research Ethics (internal review board number 14-0176).

### Empirical model

To estimate changes in beverages associated with the SSB tax by purchase level, we first identified groups with higher and lower purchases of taxed and untaxed beverages based on pre-tax beverage purchases. Next, we estimated differences in post-tax purchases for each group compared with a counterfactual based on pre-tax trends using a fixed-effects model, following an earlier approach[13].

### Identifying groups using pre-tax purchases of taxed and untaxed beverages

Taxed beverages included carbonated soft drinks, fruit drinks, flavoured waters, sport drinks, teas, and other beverages with added sugar. We excluded sweetened milk/dairy beverages only because information on dairy beverages was not collected for the entire pre-tax period (collection of that information started in October 2012). Untaxed beverages included only diet sodas and bottled water, but again excluded untaxed dairy beverages as noted above. Diet sodas and bottled water represent 83 % of the untaxed beverages purchased between October 2012 and December 2013.

We first calculated the mean per capita purchases of taxed and untaxed beverages for each household over the pre-tax period (January 2012–December 2013). We then estimated the median per capita purchase of taxed and untaxed beverages for the complete sample over the pre-tax period to use as the cut-off points to assign each household to a higher or lower purchase group. Based on this, households with purchases of taxed beverages above the median of 150·3 ml/capita per d were classified as higher taxed beverage shoppers, and below that cut-off point as lower taxed beverage purchasers. For untaxed beverages, we classified households above the median purchase of 645·1 ml/capita per d as higher untaxed and below this median as lower untaxed beverage purchasers. From these classifications, we identified four groups of households combining taxed and untaxed beverages: (i) higher purchases of taxed beverages and lower purchases of untaxed beverages (unhealthier beverage shoppers: HTLU-unhealthier); (ii) higher purchases of both types of beverages (higher taxed/higher untaxed beverage shoppers: HTHU); (iii) lower purchases of taxed and untaxed beverages (lower taxed/lower untaxed beverage shoppers: LTLU); and (iv) lower purchases of taxed beverages and higher purchases of untaxed beverages (healthier beverage shoppers: LTHI-healthier). This approach allowed us to have similar a number of households

represented in each group and follow the same set of households within each group into the post-tax periods (see baseline distributions of taxed and untaxed beverages in the online supplementary material, Supplemental Figs 1 and 2).

### Estimating changes in purchases by group

Using the four groups identified by pre-tax beverage purchases, we estimated changes in purchases of taxed and untaxed beverages after the tax was implemented. We used fixed-effects models to take into account pre-tax trends in the beverage category modelled (taxed or untaxed beverages) and included macroeconomic variables associated with changes in purchases over time, as described in detail elsewhere[13]. The model compares adjusted monthly purchases during the post-tax period with the expected purchases during 2014 or 2015 if the tax had not been implemented based on pre-tax trends (counterfactual). The dependent variable is the average monthly volume of taxed or untaxed beverages purchased expressed as millilitres per capita per day (ml/capita per d), log-transformed due to a skewed distribution (see online supplementary material, Supplemental Figs 3 to 6). The independent variables were a post-tax period indicator ($1 = 2014$ or 2015; $0 = 2012$ and 2013); months dummies to adjust for seasonality; household composition (number of household members by age groups and gender); SES (low, middle, high) based on household assets;

monthly inflation; state-month-level unemployment rate; and state-quarter-level minimum salary adjusted according to the consumer price index. We stratified the models by the four purchase groups. Finally, because we want to learn if there were differences in purchases made among households with unhealthier beverage purchase levels after the tax policy by SES, we estimated changes in beverage purchases for higher taxed beverage purchasers and lower untaxed beverage purchasers overall and by SES.

The final analytic sample included 263 494 month-year observations representing 6089 households from an original sample of 6286 households in urban areas with more than 50 000 inhabitants. The analytic sample excluded less than 3 % of the observations due to missing values on group and other covariates.

### Results

Table 1 shows average purchases in ml/capita per d in the pre-tax period (2012–2013) and socio-economic characteristics for the overall sample and by group. Average purchases of taxed beverages for the complete sample were 213·9 ml/capita per d and ranged from 80·8 ml/capita per d for LTLU shoppers to 338·4 ml/capita per d for HTHU shoppers. Average purchases of untaxed beverages were 812·5 ml/capita per d for all, 289·6 ml/capita per d for

**Table 1** Weighted per capita purchases and socio-economic characteristics by beverage purchase group at pre-tax period (2012 and 2013)

| Variable/group | All (n 6089; 100·0 %) | | HTLU-unhealthier (n 1479; 24·3 %) | | HTHU (n 1787; 29·3 %) | | LTLU (n 1437; 23·6 %) | | LTHU-healthier (n 1386; 22·8 %) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean or % | 95 % CI | Mean or % | 95 % CI | Mean or % | 95 % CI | Mean or % | 95 % CI | Mean or % | 95 % CI |
| Taxed beverage purchases (ml/capita per d)* | 213·9 | 212·3, 215·6 | 321·5 | 317·9, 324·9 | 338·4 | 334·9, 341·8 | 80·8 | 79·6, 81·9 | 82·7 | 81·4, 84·0 |
| Untaxed beverage purchases (ml/capita per d)*,† | 812·5 | 805·9, 819·0 | 289·6 | 284·9, 294·2 | 1362·0 | 1348·5, 1376·2 | 303·1 | 298·4, 307·7 | 1206·0 | 1193·8, 1218·4 |
| Education (%)* | | | | | | | | | | |
| No education | 17·2 | 16·8, 17·5 | 21·4 | 20·7, 22·0 | 17·6 | 17·0, 18·2 | 15·7 | 15·1, 16·2 | 13·8 | 13·2, 14·4 |
| Primary school | 21·8 | 21·4, 22·0 | 25·1 | 24·4, 25·7 | 22·1 | 21·5, 22·7 | 21·5 | 20·3, 22·1 | 18·0 | 17·3, 18·7 |
| Secondary school | 27·4 | 27·0, 27·7 | 28·0 | 27·3, 28·7 | 27·5 | 26·7, 28·1 | 26·5 | 25·7, 27·1 | 27·8 | 26·9, 28·5 |
| High school | 21·1 | 20·8, 21·4 | 18·9 | 18·2, 19·4 | 20·5 | 19·8, 21·0 | 21·3 | 20·6, 21·9 | 24·3 | 23·1, 25·0 |
| University of higher | 12·5 | 12·2, 12·7 | 6·6 | 6·2, 6·9 | 12·3 | 11·8, 12·8 | 15·0 | 14·4, 15·5 | 16·1 | 15·1, 16·7 |
| Socio-economic status (%)* | | | | | | | | | | |
| Low | 21·7 | 21·4, 22·0 | 27·0 | 26·2, 27·7 | 19·8 | 19·1, 20·4 | 22·5 | 21·8, 23·2 | 17·9 | 17·2, 18·5 |
| Middle | 55·4 | 54·9, 55·7 | 58·2 | 57·3, 58·9 | 57·2 | 56·4, 57·9 | 53·4 | 52·6, 54·1 | 52·1 | 51·2, 53·0 |
| High | 22·9 | 22·5, 23·2 | 14·8 | 14·3, 15·3 | 23·0 | 22·4, 23·6 | 24·1 | 23·3, 24·6 | 30·0 | 29·1, 30·7 |

HTLU-unhealthier, higher purchases of taxed beverages and lower purchases of untaxed beverages (unhealthier beverage shoppers); HTHU, higher purchases of both types of beverages (higher taxed/higher untaxed beverage shoppers); LTLU, lower purchases of taxed and untaxed beverages (lower taxed/lower untaxed beverage shoppers); LTHU-healthier, lower purchases of taxed beverages and higher purchases of untaxed beverages (healthier beverage shoppers). Authors' own analyses and calculations based on data from Nielsen though its Mexico Consumer Panel Service for foods and beverages, January–December 2012–2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. Weights provided by Nielsen to represent populations in areas with more than 50 000 inhabitants.
*Statistically significant difference between groups at $P < 0·05$ using linear regression for continuous variables and probit for binary variables, using HTLU-unhealthier group as a reference.
†Untaxed beverages include diet sodas and bottled water.

**Table 2** Differences between estimated and counterfactual volume of taxed and untaxed beverages purchased per capita per day in Mexico, by level of purchase, 2014 and 2015

| Group | 2014 Absolute (ml/capita per d) | Relative (%) | 2015 Absolute (ml/capita per d) | Relative (%) |
|---|---|---|---|---|
| **Taxed beverages** | | | | |
| HTLU-unhealthier (*n* 1479) | −23·5** | −7·5 | −46·4** | −16·1 |
| HTHU (*n* 1787) | −26·2** | −8·6 | −55·7** | −20·0 |
| LTLU (*n* 1437) | −0·5** | −0·6 | 1·3** | 1·9 |
| LTHU-healthier (*n* 1386) | −2·7** | −3·4 | 0·4** | 0·6 |
| **Untaxed beverages†** | | | | |
| HTLU-unhealthier (*n* 1479) | 30·2** | 9·4 | 30·7** | 11·3 |
| HTHU (*n* 1787) | −19·9** | −1·2 | −161·9** | −11·6 |
| LTLU (*n* 1437) | 59·8** | 19·2 | 43·0** | 14·0 |
| LTHU-healthier (*n* 1386) | −21·6** | −1·4 | −168·6** | −13·2 |

HTLU-unhealthier, higher purchases of taxed beverages and lower purchases of untaxed beverages (unhealthier beverage shoppers); HTHU, higher purchases of both types of beverages (higher taxed/higher untaxed beverage shoppers); LTLU, lower purchases of taxed and untaxed beverages (lower taxed/lower untaxed beverage shoppers); LTHU-healthier, lower purchases of taxed beverages and higher purchases of untaxed beverages (healthier beverage shoppers). Authors' own analyses and calculations based on data from Nielsen though its Mexico Consumer Panel Service for foods and beverages, January–December 2012–2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein.
\*\*$P < 0.01$. Adjusted for education, socio-economic status, months dummies, household composition (number of household members by age groups and gender), monthly inflation, state-month-level unemployment rate and state-quarter-level minimum salary adjusted according to the consumer price index.
†Untaxed beverages include diet sodas and bottled water.

the HTLU-unhealthier group to 1362·0 ml/capita per d for the HTHU group. The HTLU-unhealthier group had the lowest educational and SES levels. In contrast, the LTHU-healthier group had the highest educational and SES levels.

Table 2 shows the average absolute and relative differences in beverage purchases between the estimated counterfactual and the post-tax adjusted volumes by group. The HTLU-unhealthier and HTHU groups had the highest reductions of taxed beverages in 2014 (−7·5 and −8·6 %, respectively) and 2015 (−16·1 and −20·1 %, respectively). The HTLU-unhealthier and LTLU groups increased their purchases of untaxed beverages in 2014 (9·4 and 19·2 %, respectively) and in 2015 (11·3 and 14·0 %, respectively).

The groups with higher untaxed beverages (HTHU and LTHU-healthier) had small reductions of untaxed beverages in 2014 (−1·2 and −1·4 %, respectively) but larger in 2015 (−11·6 and −13·2 %, respectively). To understand this pattern, we looked at changes in taxed and untaxed beverages among the group with higher untaxed beverage purchases by SES (see online supplementary material, Supplemental Table 1). Results show that the reduction of untaxed beverages in this group was higher among low-SES households (average decline of −13·5 % in 2014/2015). We also found that the low-SES households had a higher reduction of taxed beverages (−15·0 % average decline in 2014/2015).

Next, we focus on two subsets of households: the combined set of all higher purchasers of taxed beverages; and the combined set of all lower purchasers of untaxed beverages. Based on the results above we should expect that the first subset of households would lower their taxed beverage purchases meaningfully and the second subset of household might increase their untaxed beverage purchases. In particular, we want to understand if

there are important SES differences within these two subsets.

Table 3 shows average absolute and relative differences in beverage purchases between the estimated counterfactual and the post-tax adjusted volumes for higher taxed beverage purchasers and lower untaxed beverage purchasers. All higher taxed beverage purchasers had reductions in taxed beverages (−7·1 % on average in 2014 and −18·8 % in 2015) but low-SES households had the largest reductions (−10·3 % in 2014 and −23·7 % in 2015) compared with middle- and high-SES households. Lower untaxed beverage purchasers had increases of untaxed beverages of over 12 % in both years and these increases were similar by SES, except for a smaller increase for high-SES households in 2015.

## Discussion

We grouped households based on their relative pre-tax beverage purchase levels (HTLU-unhealthier, HTHU, LTLU and LTHU-healthier) and estimated changes in purchases of taxed and untaxed beverages after the SSB tax was implemented. We found that households with higher taxed beverage purchases at baseline (HTLU-unhealthier and HTHU) had the largest absolute and relative reductions in taxed beverages. These households increased their purchases of untaxed beverages by 12 % on average, reflecting substitution away from taxed towards untaxed beverages. These findings are consistent with model-based estimates done in Australia and Norway that while higher consumers of SSB have a less elastic demand for SSB, their very high consumption levels imply that a tax would be associated with higher absolute reductions in consumption and higher health gains[23,24].

**Table 3** Differences between estimated and counterfactual volume of taxed and untaxed beverages purchased per capita per day in Mexico, by socio-economic status (SES), 2014 and 2015

| | 2014 | | 2015 | |
|---|---|---|---|---|
| SES group | Absolute (ml/capita per d) | Relative (%) | Absolute (ml/capita per d) | Relative (%) |
| Taxed beverages among higher taxed beverage shoppers | | | | |
| All (n 3266) | −21·6** | −7·1 | −53·3** | −18·8 |
| Low SES (n 777) | −33·1** | −10·3 | −73·9** | −23·7 |
| Mid SES (n 2135) | −25·7** | −7·8 | −58·4** | −19·6 |
| High SES (n 976) | −14·8** | −5·3 | −28·1** | −11·3 |
| Untaxed beverages† among lower untaxed beverage shoppers | | | | |
| All (n 3266) | 38·1** | 12·3 | 36·3** | 12·7 |
| Low SES (n 777) | 37·1** | 11·2 | 37·2** | 11·2 |
| Mid SES (n 2135) | 48·6** | 12·9 | 48·6** | 12·9 |
| High SES (n 976) | 41·5** | 13·5 | 21·1** | 6·7 |

Authors' own analyses and calculations based on data from Nielsen though its Mexico Consumer Panel Service for foods and beverages, January–December 2012–2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein.
**$P < 0.01$. Adjusted for education, socio-economic status, months dummies, household composition (number of household members by age groups and gender), monthly inflation, state-month-level unemployment rate and state-quarter-level minimum salary adjusted according to the consumer price index.
†Untaxed beverages include diet sodas and bottled water.

Meanwhile, those with lower purchases of untaxed beverages (HTLU-unhealthier and LTLU) had the largest absolute and relative increases in untaxed beverages. We also found that among households with higher purchases of taxed beverages, the low-SES group had the greatest reduction in purchases of taxed beverages. These results are in line with findings from a previous study documenting the highest reductions in taxed beverages among the lowest-SES groups[12] and earlier price elasticity research[30].

Interestingly, households with higher untaxed beverage purchases prior to the tax lowered their purchases of untaxed beverages in the first two years of the tax, with much greater reductions in 2015. Additional analyses showed that among the group with higher purchases of untaxed beverages in the pre-tax period, low-SES households had the largest reductions of untaxed beverages and the highest reductions of taxed beverages. One potential explanation is that despite reducing purchases of taxed beverages, these households compensated for a potential loss associated with the SSB tax by also reducing their purchases of untaxed beverages. It could also be that the industry spread the cost of the tax to untaxed beverages; however, studies indicate that the prices of untaxed beverages did not change after the tax was implemented, not even sodas with artificial sweeteners that are more expensive[11]. Consumers could be switching to purchase 100 % juices, but they are more expensive and rarely sold. Also, refills are not captured in the data set, but they barely exist in Mexico. Another reason is the potential substitution for untaxed beverages, not reported in the survey, towards tap water or flavoured water prepared at home. Households may have increased tap water for drinking, but the data do not include that information and there are no other data available in the country to track changes in potable water for drinking over time.

As described by Barnett et al.[31], random measurement error in repeated measures, particularly in the higher or lower values of a distribution, could lead to an over- or underestimation of the true mean change, which is known as regression to the mean. In our study, this potential bias is minimized for two reasons. First, we are using twenty-four measurements per household in the pre-tax period, which gives confidence about within-household variation (the deviation from each household average in ml/capita per d for taxed beverages goes from −2411 to 10 806) and pre-tax means vary for each group (in ml/capita per d: 57·2 for the lowest group, 64·4 for the low, 162·2 for the middle and 418·4 for the high purchase group). Second, we are using a fixed-effects model that would correct for a potential regression to the mean. For instance, Barnett et al. propose to include in the model a fixed variable that measures, for each individual (or household, in our case), the difference between the baseline value and the baseline mean of the outcome. This adjustment is already taken into account in our specification as fixed-effects models adjust for all observable and unobservable time-invariant variables.

We classified households in four groups based on the levels of purchases prior to the tax because it distinguishes lower v. higher levels of purchases and the combinations between taxed and untaxed beverages. We acknowledge the limitations of using cut-off points to classify households. For example, households in the higher range of purchases within the lower taxed group could also be classified in the higher taxed group if a different cut-off point was chosen. However, because we are looking at average changes and differences between groups, this is a reasonable approach. We are using cut-off points from pre-tax distribution of purchases, and thus are conducting relative comparisons across households rather than applying an absolute standard of what high or low could be. Also, we are using median purchases to define the cut-off points, so we have groups with comparable sample sizes. Moreover, we did not distinguish more than four groups to have reasonable sample sizes for the analyses.

We were not able to include all categories of untaxed beverages because information on purchases of dairy beverages was not collected until October 2012. Still, bottled water and diet sodas represent 83 % of the untaxed beverages. Another potential limitation has to do with differential misreporting across the groups. In these data on household purchases collected from packaging and receipts, under-reporting is more probable than over-reporting. Thus, it is possible that households with lower purchasing of taxed beverages might more consistently under-report purchases than higher purchasing households for the entire period, but this should not bias the findings if the degree of under-reporting is consistent over time. However, households with higher pre-tax purchases of taxed beverages may feel the pressure to under-report more after the tax was implemented if the fiscal policy is perceived as a recommendation to reduce consumption. If so, we acknowledge that our results for reductions by higher shoppers of taxed beverages may be overestimated. Finally, as this is a quasi-experimental study of a national-level policy without an appropriate control group, we are unable to establish causality in any of our results and thus all findings should be interpreted as associations.

Evidence that the SSB tax was associated with a greater reduction in SSB purchases among higher purchasers of taxed beverages is relevant because higher consumers of taxed beverages have a greater risk of obesity, diabetes and other cardiometabolic outcomes, and a greater likelihood of undiagnosed or poorly treated cardiometabolic diseases[21]. Likewise, greater increase in purchases of untaxed beverages (water and diet sodas) among households with lower purchases of these beverages and higher purchases of taxed beverages prior to the tax suggests substitution towards healthier beverages. Although the tax is relatively low (roughly 10 % price increase), the greater relative and absolute reductions of taxed beverages among higher consumers may impact health outcomes countrywide, assuming no substitutions for beverages with high sugar content or any other food. This could lead to reductions of non-communicable disease disparities in terms of health-care spending savings among the poor as universal coverage has not been reached[32] and the Seguro Popular (a volunteer subsidized health insurance for the poor) covers only some complications[33]. Future research is needed on the longer-term associations of the tax on purchases with health that account for habit formation and how different groups respond or adapt over time.

## Acknowledgements

## Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/S136898001800321X
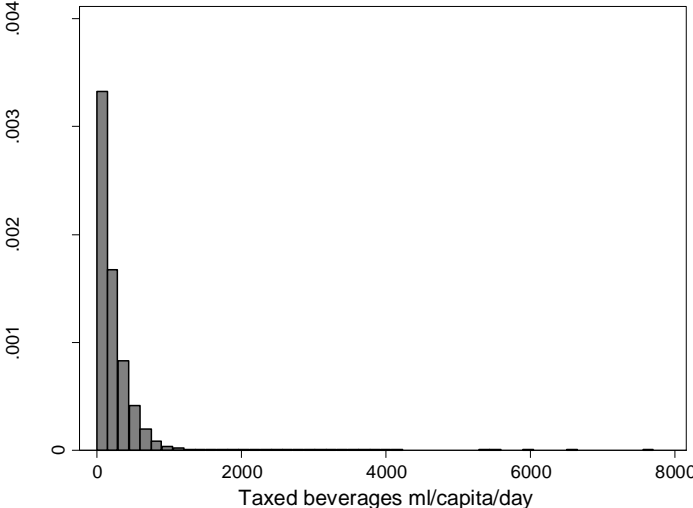
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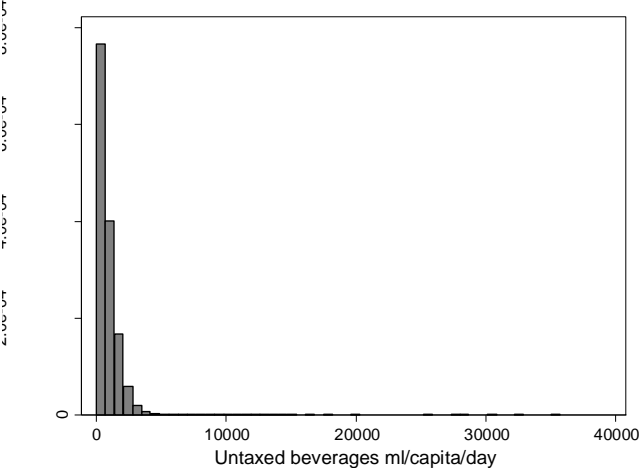
**Supplemental material**

**Figure 1- Baseline distribution of taxed beverages (2012-2013)**



| Mean | 214.6 ml/capita/day |
| Median | 150.3 ml/capita/day |
| Variance | 48103.59 |
| Skewness | 3.235977 |
| Kurtosis | 40.77338 |

**Figure 2- Baseline distribution of untaxed beverages (2012-2013)**



| Mean | 820.7 ml/capita/day |
|---|---|
| Median | 645.1 ml/capita/day |
| Variance | 680085.8 |
| Skewness | 4.241236 |
| Kurtosis | 92.16854 |

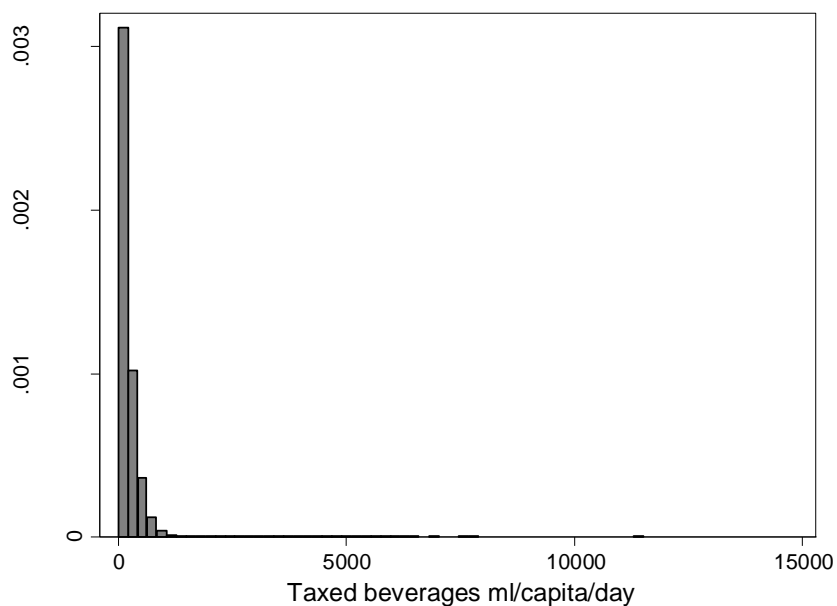**Figure 3- Distribution of taxed beverages (2012-2015)**



**Figure 4- Distribution of log-transformed taxed beverages (2012-2015)**
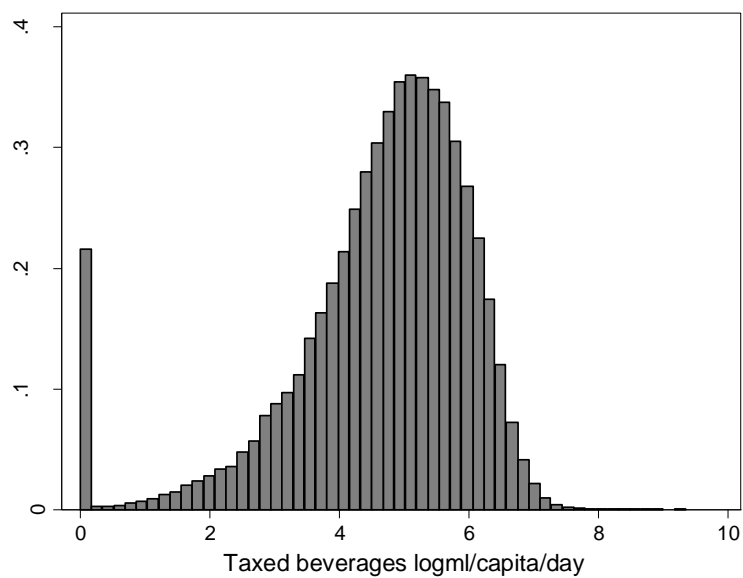


Figure 3 shows that the distribution of taxed beverages in ml/day/capita between January 2012 and December 2015 is skewed, with a long right tail. When we logged transformed the variable, the distribution becomes normal (Figure 4).

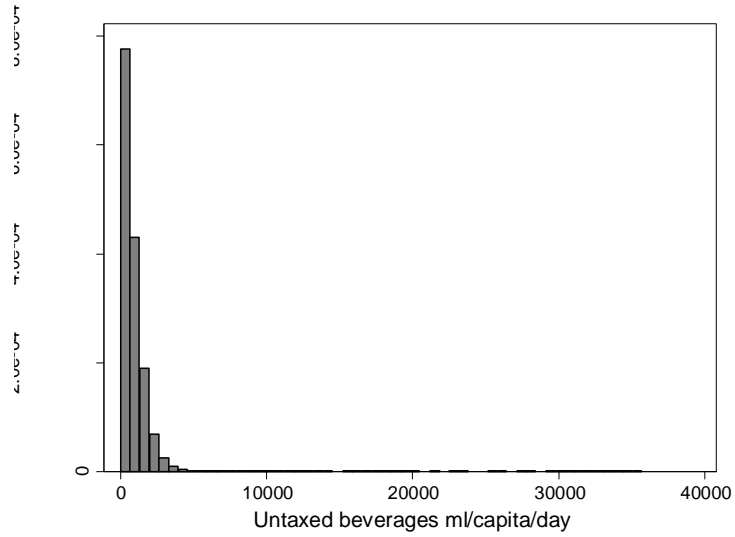**Figure 5- Distribution of untaxed beverages (2012-2015)**



**Figure 6- Distribution of log-transformed untaxed beverages (2012-2015)**
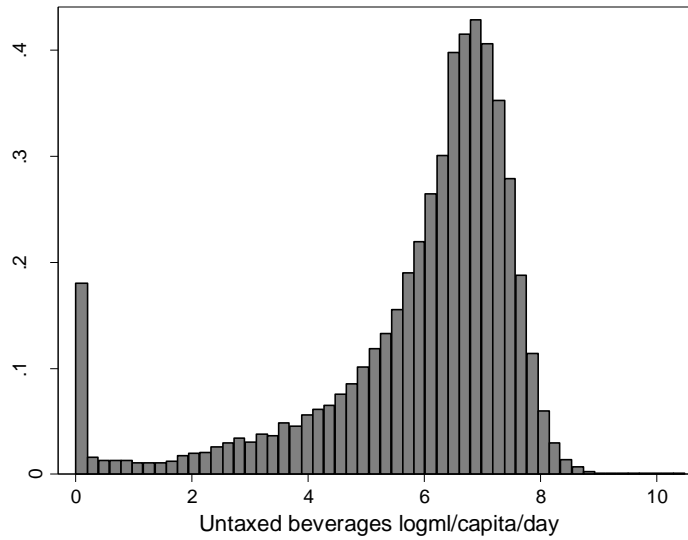


Figure 5 shows that the distribution of untaxed beverages in ml/day/capita between January 2012 and December 2015 is skewed, with a long right tail. When we logged transformed the variable, the distribution becomes normal (Figure 6).

**Table 1- Differences between estimated and counterfactual volume of taxed and untaxed beverages purchased per capita per day in Mexico by socioeconomic status, 2014 and 2015, for high untaxed beverage shoppers**

| Socioeconomic Status (SES) group | Taxed beverages | | | |
|---|---|---|---|---|
| | **2014** | | **2015** | |
| | **Absolute** | **Relative** | **Absolute** | **Relative** |
| All (N=3,173) | -12.4** | -6.3% | -20.7** | -11.5% |
| Low SES (N=623) | -25.0** | -11.6% | -37.1** | -18.4% |
| Mid SES (N=1,917) | -15.3** | -7.0% | -29.2** | -14.3% |
| High SES (N=1,228) | -6.5** | -4.0% | -5.5** | -3.7% |
| | **Untaxed beverages[+]** | | | |
| | **2014** | | **2015** | |
| | **Absolute** | **Relative** | **Absolute** | **Relative** |
| All (N=3,173) | -20.5** | -1.3% | -161.4** | -12.1% |
| Low SES (N=623) | -105.3** | -7.10% | -291.3** | -20.0% |
| Mid SES (N=1,917) | -2.4** | 0.2% | -166.6** | -11.9% |
| High SES (N=1,228) | -6.6** | 0.4% | -86.4** | -7.1% |

Source: Authors' own analyses and calculations based on data from Nielsen though its Mexico Consumer Panel Service for foods and beverages, January–December 2012-2015. The Nielsen Company, 2016. Nielsen is not responsible for and had no role in preparing the results reported herein. [+] Untaxed beverages include diet sodas and bottled water. ** $p < 0.01$. Adjusted for education, socioeconomic status, months dummies household composition (number of household members by age groups and genders), monthly inflation, state-month-level unemployment rate and state-quarter-level minimum salary adjusted according to the consumer price index.