What happens to consumer purchases and sales after a sugary drink tax?

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Disclosure

• No conflicts of interest to disclose
Tom already explained why tax sugary drinks, but if you don’t believe Tom,… …the Father of Economics also says so

"Sugar, rum, and tobacco, are commodities which are nowhere necessaries of life, [but] which are ... objects of almost universal consumption, and which are therefore extremely proper subjects of taxation."

~ Adam Smith

An Inquiry into the Nature and Causes of The Wealth of Nations
Outline of talk

1. Predictions on how consumers might respond to tax
2. Real world experiences to date & lessons learned
   - Mexico
   - Berkeley
3. Lessons yet to be learned
4. Takeaways
Excise taxes: levied on producers/manufacturers

Models assume:
- 100% pass-through of tax onto prices consumers see
- No counter-action from industry

- Mexico: 10% ↑ price → 11-12%↓
- Meta-analysis: 10% ↑ price → 6-12%↓
- Recommendations show 20% excise tax needed to have meaningful impact on lowering SSB intake

Predicting change in purchase/sales of sugary drinks (focus has been on SSBs)

Colchero et al, 2015 Economics & Human Biology 19;
Powell, et al, 2013 Obesity Review 14(2);
Mexico’s Real-world Experience

• One of world’s highest prevalence of diabetes & SSB consumption
• Since Jan 1\textsuperscript{st}, 2014
  – 1 peso/liter tax (~ 9-10%) on sugary drinks
  – Concurrent 8% junk food tax
• National, so no comparison group
• Multi-year evaluation design:
  – Price change: To what degree did the tax pass-through? Was it uniform?
  – Purchase & sales changes: Did purchases/sales change meaningfully? How long will it last?
  – Health changes: weight, cardio-metabolic measures (HbA1c, etc)
    [currently: model-based estimates; by 2020: empirical results]
Mexico: Variation in price change after tax

- Urban areas average 95-112% price “pass-through”
- Variability in:
  - beverage type
  - package size (lower for larger package sizes)
  - region: 7% pass-through in South (lowest baseline prices)

Colchero MA, JC Salgado, M Unar, M Molina, SW Ng, JA Rivera. 2015. "Changes in prices after an excise tax to sugar sweetened beverages was implemented in Mexico: evidence from urban areas". *PLOS ONE.*
Want to determine whether there was significant change in trends in beverages purchased (ml/capita/day) during the post-tax period compared to the pre-tax period

- Taxed sugary drinks & untaxed drinks
- Overall and by socio-economic status (SES)

Pre-post comparison of volume purchased using panel of urban MX households’ purchases from Jan 2012-Dec 2014

- Adjust for pre-existing trend, seasonality, socio-demographic measures (household composition, socio-economic status) and macroeconomic measures (unemployment rates, min wage)

Mexico: Changes in beverage purchases

Colchero MA, BM Popkin, JA Rivera, SW Ng. 2016. “Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study”. The BMJ (British Medical Journal) 352.
Difference in Difference approach: Graphical illustration

Beverage purchased (ml/capita/day)

Pre-tax

Post-tax

Pre-tax observed
Post-tax counterfactual
Post-tax observed

Diff1: Adjusted
Observed rate of change in beverage purchase (% per month) during pre-tax period

Diff2: Adjusted
Observed rate of change in beverage purchase (% per month) during post-tax period

DinD = Diff2 - Diff1
Average SSB purchases was 6% (-12ml/cap/d) lower vs counterfactual in 2014;
Average untaxed beverages (driven by bottled water) purchases rose

Decline more pronounced (9%; -19ml/cap/d) among low socio-economic households

Colchero MA, BM Popkin, JA Rivera, SW Ng. 2016. BMJ.
2-year post-tax evaluation: Change in SSB purchases in year 1 were consistent and greater in year 2

Average 2-year post-tax difference (relative to counterfactual) = -7.6%

Average for 2014: -5.5%  Average for 2015: -9.7%

Consistent results using national sales of beverages (manufacturing data)

Impact on sugary drink sales consistent with reductions in purchases:

- 6.2% drop in 2014
- 8.7% drop in 2015
- 9.6% drop (through Nov 2016)

6.9% increase in bottled water sales

OLS- Log of sales in liters per capita, compared taxed years with 2007-2013, adjusted for seasonality (quarters) and the global indicator of the economic activity


Model-based estimates on health and cost savings are impressive

- 10% reduction in SSB consumption (with 39% calorie compensation) among Mexican adults from 2013 to 2022 would result in:
  - ≈189,300 fewer incident type 2 diabetes cases
  - 20,400 fewer incident strokes and myocardial infarctions
  - 18,900 fewer deaths occurring
  - 983 million international dollars saved in Mexico

- 1-time constant 6% reduction in SSB consumption, 10 years later:
  - Average BMI reduction of 0.15 kg/m² per person
  - 2.54% reduction in obesity prevalence
  - By 2030, 1 peso/litre tax would prevent 86,000-134,000 cases of diabetes
  - Largest reductions for lowest SES
  - 2-peso/litre scenario expected to produce twice as much of a reduction.

Romero et al, 2016; Barrientos-Gutierrez et al, PlosOne 2017
Berkeley SSB tax

• Key measures:
  – Beverage Prices
  – Store point-of-sales volume
  – Store revenue/ grocery bills

Silver, Ng, et al. 2017. Plos One
https://doi.org/10.1371/journal.pmed.1002283
$1/\text{oz}$ tax pass-through onto prices
(Distributor $\rightarrow$ Retailer $\rightarrow$ Consumer)

- **COMPLETE pass-through**
  - Large and small chain supermarkets: $+1.07\,\text{c/oz}$, $p=0.001$
  - Chain gas stations: $+1.31\,\text{c/oz}$, $p=0.004$
  - Pharmacies: $+0.45\,\text{c/oz}$, $p=0.03$

- **PARTIAL pass-through**
  - Independent corner stores & independent gas stations: $-0.64\,\text{c/oz}$, $p=0.004$

Silver, Ng, et al. 2017. Plos One
[https://doi.org/10.1371/journal.pmed.1002283](https://doi.org/10.1371/journal.pmed.1002283)
Taxed beverage sales

Berkeley stores

Non-Berkeley stores

- PRE TAX
- POST TAX

oz. per transaction per day

Jan 2013

March 2015

Feb 2016

Silver, Ng, et al. 2017. Plos One
https://doi.org/10.1371/journal.pmed.1002283
Untaxed beverage sales

Non-Berkeley stores

Berkeley stores

Jan 2013

March 2015

Feb 2016

oz. per transaction per day

0.5%

3.5%

Silver, Ng, et al. 2017. Plos One
https://doi.org/10.1371/journal.pmed.1002283
Untaxed beverage sales

- Berkeley stores
- Non-Berkeley stores

PRE TAX  POST TAX

0.5%  3.5%  -4.4%  +15.6%

Stacked area chart showing changes in oz. per transaction per day for bottled water at Berkeley and non-Berkeley stores.

Silver, Ng, et al. 2017. Plos One
https://doi.org/10.1371/journal.pmed.1002283
Win-win-win in Berkeley

• Increase in prices of SSBs (but varies by store types)

• In Berkeley’s larger grocery chains, SSB sales fell 10%, but untaxed beverages sales rose 3.5%, such that overall beverage sales rose slightly.

• No change in store revenue or grocery bill spending in Berkeley stores

Silver, Ng, et al. 2017. Plos One
https://doi.org/10.1371/journal.pmed.1002283
Tax generated $13/capita in year 1

Measure D included creation of SSB Product Panel of Experts (SSBPPE) Commission

FY 2016: $250,000 to Berkeley Unified School District

FY 2017:
  – $637,500: Berkeley Unified School District
  – $125,000: Berkeley Youth Alternatives
  – $245,874: Healthy Black Families
  – $125,000: Lifelong Medical Care
  – $115,266: The Ecology Center
  – $151,360: YMCS Central Bay Area

Funded programs being independently evaluated
No net change in employment

- Monthly and quarterly data on overall unemployment and employment by sector in Mexico showed **no meaningful effect on employment** (Colchero)
  - Sugar-sweetened beverages and nonessential energy dense food manufacturing industries (EMIM 2007-2015)
  - Commercial establishments (EMEC, 2011-2015)
  - National unemployment rate (ENOE 2005-2015)

- Macroeconomic simulation model on employment impact of 20% SSB tax in CA & IL (Powell)
  - accounting for changes in SSB demand, substitution to non-SSBs, income effects, and government expenditures of tax revenues for Illinois and California in 2012
  - **increased employment** of 4406 jobs/0.06% (IL), and 6654 jobs/0.03% (CA)
  - declines in employment within the beverage industry **offset by new employment** in non-beverage industry and government sectors.


What do these findings in Mexico & Berkeley suggest?

• Industry can pass-through differentially to cost-shift across portfolio:
  o Package size / Beverage types / Store types
  o Depends on market share (varies by location, beverage type)
  o For local taxes also need to consider manufacturer vs retailer behavior

• Price responsiveness: Grows over time, and lower income more responsive (*progressive for health*, especially if tax revenue used wisely)

• Taxes can help dampen demand for sugary drinks and shift demand to healthier alternatives: Substitutions towards bottled water

• No net change in employment due to substitutions and offsetting effects

• Robustness of findings
SSB taxes around the world
UK (& Ireland)’s tiered tax based on sugar content

- Announced March 2016, to start 1 April 2018.
- Excluded: 100% fruit juices, milk- and milk-sub based drinks and the smallest producers.
- Encourages reformulations, but probably only until just below 5g and 8g.
- Reformulations are already purportedly occurring.
Continued evaluation of SSB taxes & integrating policies

- Need to continue building evidence-base to consider various policy tools, designs and how they work with each other (e.g., common/unified definitions)
- Various tax designs (what are pros & cons of each given context)
- Food/beverage marketing regulations (especially targeting children)
- Nutrition profiling & labeling (especially Front-of-Pack)
- Public spaces/facilities (especially schools)
3 main takeaways

1) Taxing sugary drinks can work to change supply and demand

2) The design (given the context) matters due to how industry and consumers can/might respond

3) Revenue should be reinvested towards improving related policies to maximize impact
Collaborators & Funders

- UNC: Barry Popkin, Lindsey Smith Taillie, Jennifer Poti, Donna Miles, Emily Yoon, Emily Busey, Julie Wandell
- Mexico’s National Institute of Public Health (INSP): Arantxa Colchero, Juan Rivera, Carolina Batis, Simon Barquera
- Berkeley (PHI): Lynn Silver, Suzanne Ryan-Ibara
Thank you!

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Tax design considerations

- Industry’s market power (oligopolies vs perfect competition)
- Where levied & ‘seen’: Excise vs Sales
- Type: Ad valorem (%) vs Specific ($ per mL/ $ per g of sugar)
- Based on foods, nutrients or both
- Level: How high to truly have impact?
- Elasticities of demand (own- and cross-price, and income)
  - Who ‘bears the cost’
- Scope of coverage: National? State? Local?
  - potential ‘leakage’/cross-boundary purchasing
- Implementation
  - Who collects & enforce?
  - Definition of taxed item & ability to identify
- Use of revenue: Earmark or not?
- Impact on employment?
- Long-term vs short-term
- Timing: Political/ Societal acceptance
A better design?
Tiered with rates within each tier also based on sugar content

- Threshold for tiers: 4 to 5g of sugar/100g?
- Rates within tiers:
  - <5g sugar/100g: exempt from tax
  - ≥5g and <8g sugar/100g: tax rate based on sugar content (e.g., 1¢ per g of sugar/100g of product)
  - ≥8g sugar/100g of product: tax rate based on sugar content (e.g., 1.5¢ per g of sugar/100g of product)
  - Doubly penalized when in highest tier
  - Encourages continued lowering of sugar content within each tier
- Same rates for syrups, concentrates & powders
  - Tends to be cheaper substitutes
- Implementation challenges depends on context
Mexico: Decline in sugary drink consumption from tax (-12ml) is small relative to growth in earlier years

Source: All data were derived from the Passport Global Market of Euromonitor International. RTD, ready-to-drink.
Recent declines in US are also tiny relative to prior increase

Note: Data for carbonated soft drinks (1947-2003) are from Census of Manufactures. ERS has data from 2004 from the Beverage Marketing Corporation, but does not post/share this information as requested by the BMC.

### Recent excise taxes (equivalent to ≥10%, levied on manufacturers/distributors) implemented elsewhere

<table>
<thead>
<tr>
<th>Location &amp; start date</th>
<th>Tax based on</th>
<th>Rate</th>
<th>What is included/taxed</th>
<th>What is excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philadelphia PA</td>
<td>Volume (specific)</td>
<td>1.5 ¢/oz</td>
<td>non-alcoholic beverage, syrup, or other concentrate used to prepare a beverage that lists as an ingredient any form of sweetener (caloric or non-caloric)</td>
<td>drink containing &gt;50% milk or milk substitute, drink containing &gt;50% fresh fruit or vegetable, unsweetened drinks, medical food, baby formula</td>
</tr>
<tr>
<td>(1 Jan 2017)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>% price (ad valorem)</td>
<td>10%</td>
<td>non-alcoholic beverages with sugar content ≤6.25g/100mL</td>
<td>100% fruit juice, bottled water, tea, powdered coffee, &amp; dairy are untaxed</td>
</tr>
<tr>
<td>(1 Oct 2014)</td>
<td></td>
<td>18%</td>
<td>non-alcoholic beverages with sugar content ≥6.25g/100mL</td>
<td></td>
</tr>
</tbody>
</table>
What qualifies as an sugary drink tax ‘working’?

*Depends on the objective/s*

- Short- vs long-term objectives? What is the time horizon?
- Encourage industry to reformulate and sell/market less unhealthy products
- Improve overall diet quality? Just reduce SSB consumption?
- Improve (or at least limit deterioration of) health outcomes
- Equal effect or greater reduction among higher consumers?
- Raise revenue: how will it be used?
- Industry's counter-moves can dampen effect (promotions, marketing strategies)