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

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Disclosure

- No conflicts of interest to disclose

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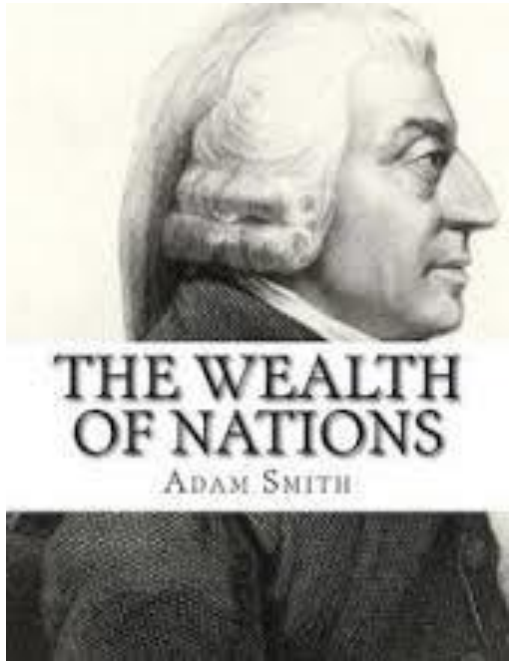
Tom already explained why tax sugary drinks, but if you don't believe Tom,… …the Father of Economics also says so



"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

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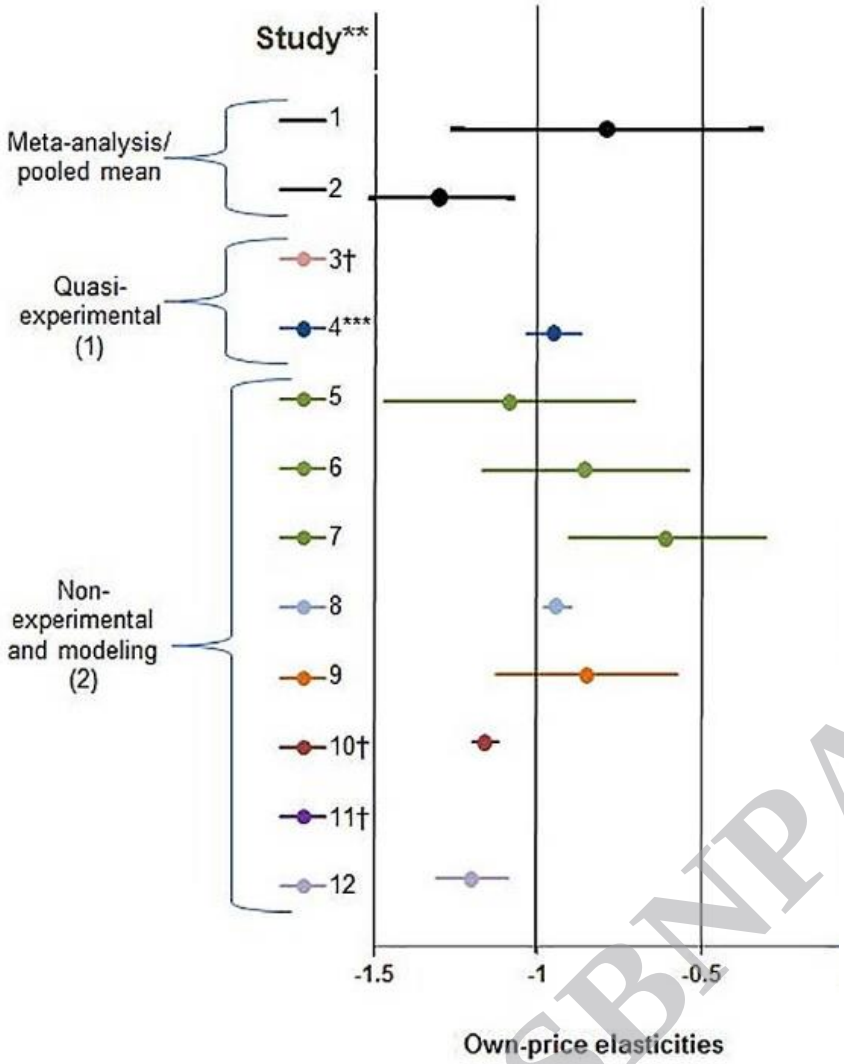
Outline of talk

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

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



- 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

Colchero et al, 2015 Economics & Human Biology 19;
Powell, et al, 2013 Obesity Review 14(2);
Nakhimovsky et al. 2016 PLoS One 11(9)

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Mexico's Real-world Experience

- One of world's highest prevalence of diabetes & SSB consumption
- Since Jan 1st, 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]

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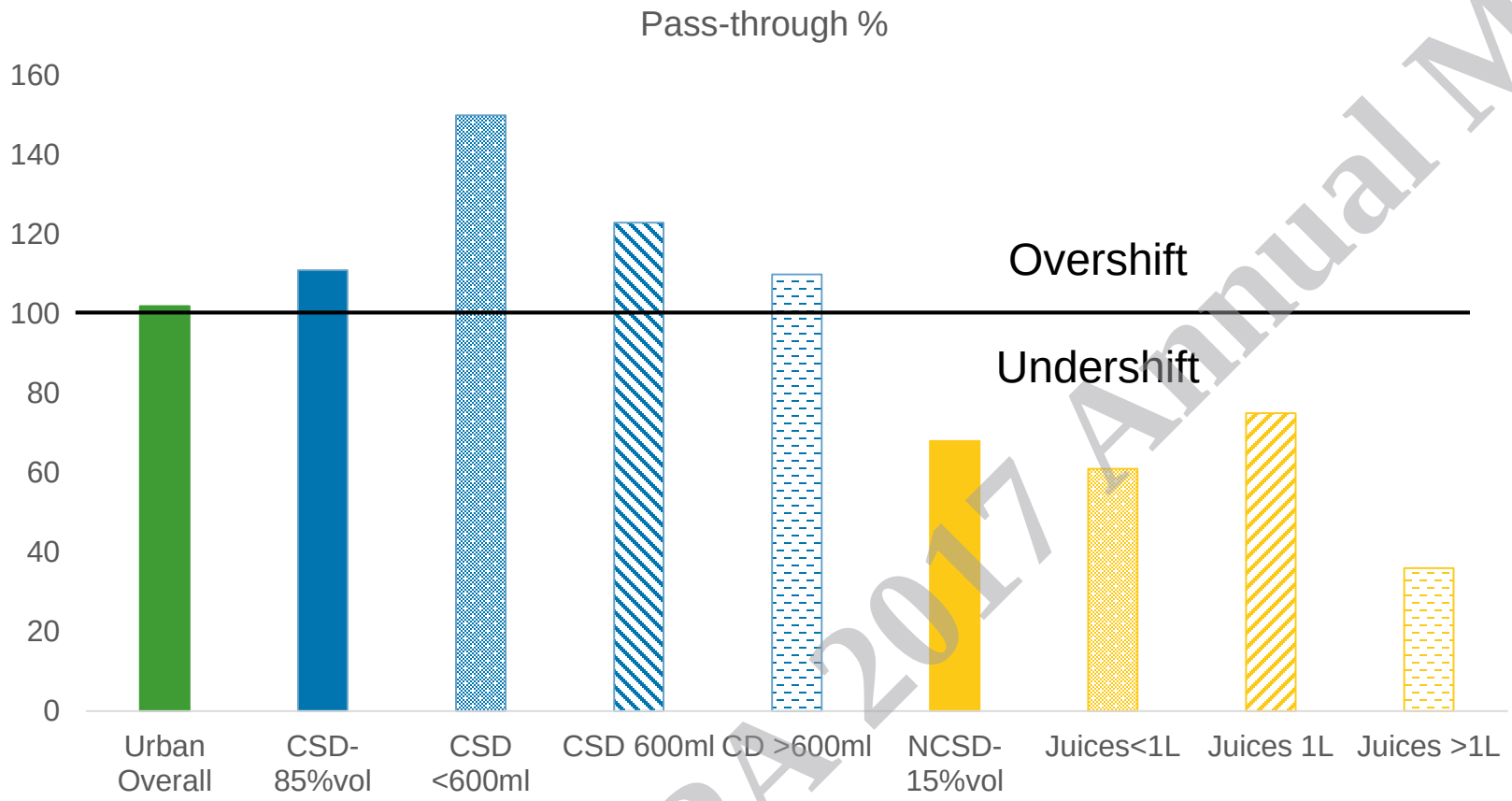
Mexico: Variation in price change after tax



- 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)

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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*.

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Mexico: Changes in beverage purchases

- 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)

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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.

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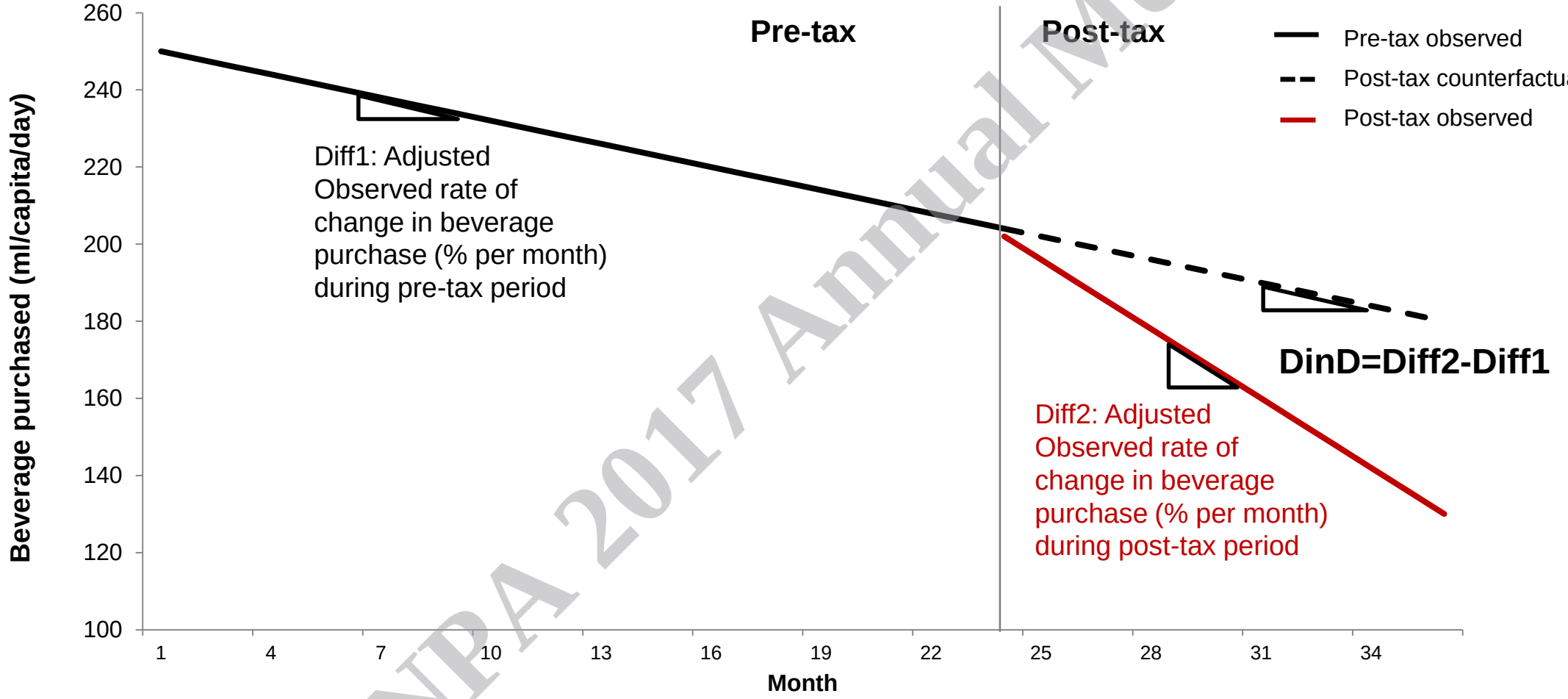
Difference in Difference approach: Graphical illustration



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Average SSB purchases was 6% (-12ml/ cap/d) lower vs counterfactual in 2014;

Average untaxed beverages (driven by bottled water) purchases rose

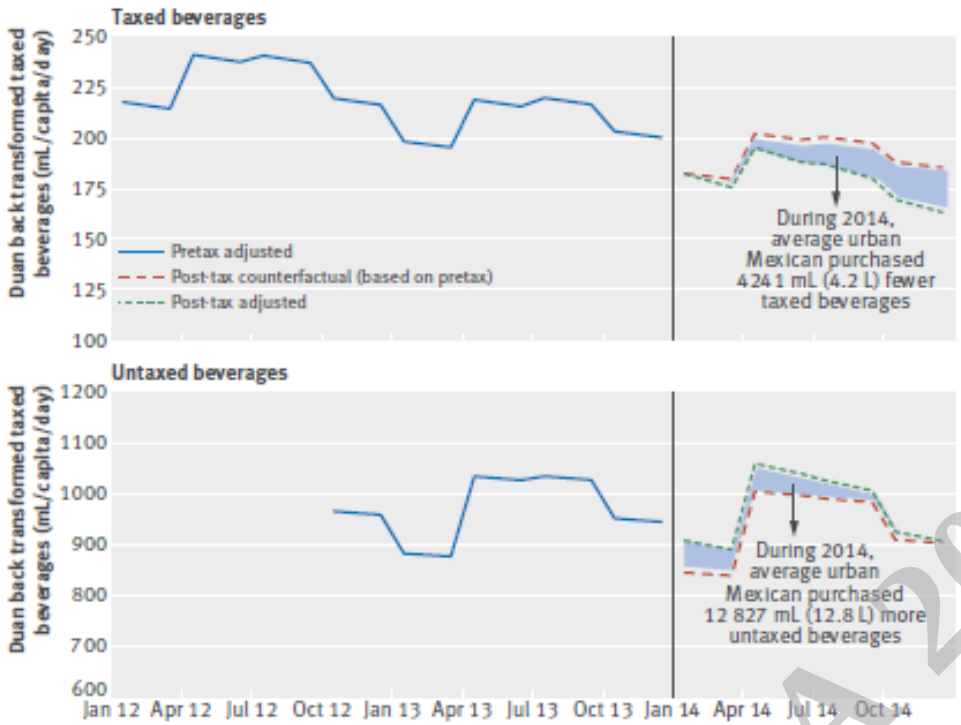

Fig 1 | Monthly predicted purchases of beverages comparing counterfactual with post-tax from full sample models (to show seasonal trends in beverage purchases, predictions do not adjust for quarter). Total 2014 changes calculated using only months with significant differences (P<0.001) by taking summation of product of difference for month and number of days in month. Source: authors' own analyses and calculations based on data from Nielsen through its Mexico Consumer Panel Service for food and beverage categories, January 2012 to December 2014

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

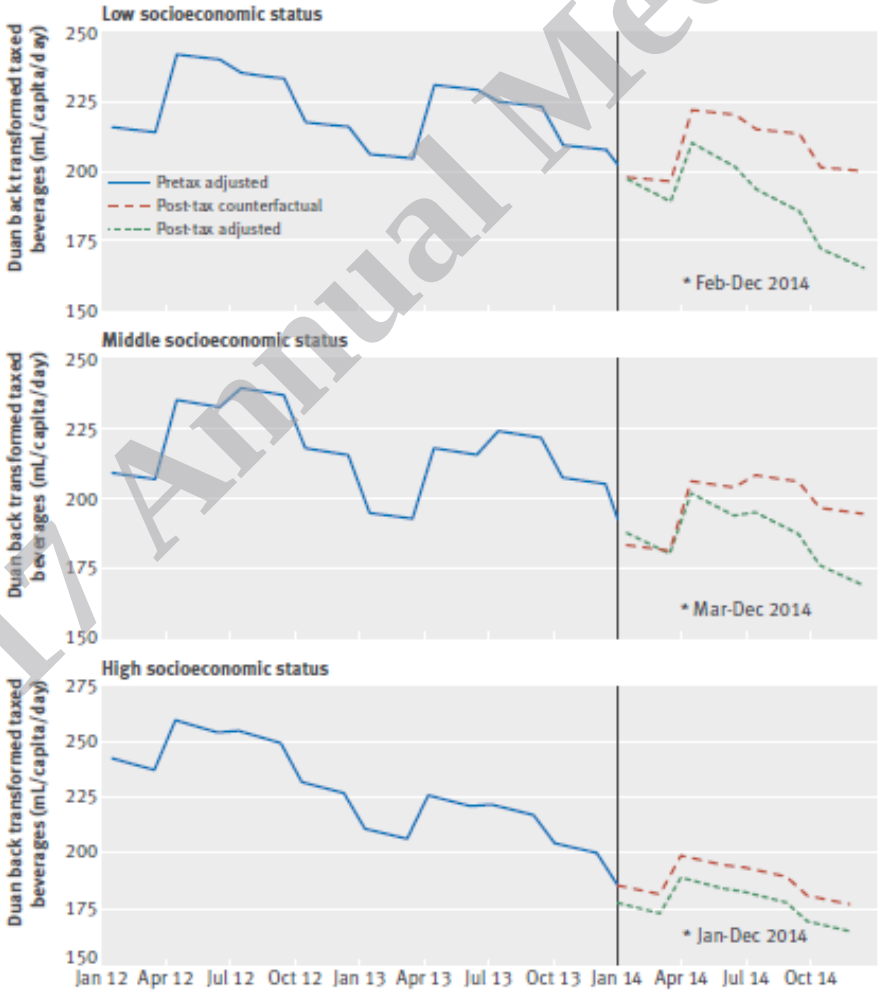

Fig 2 | Monthly predicted purchases of taxed beverages comparing counterfactual with post-tax from socioeconomic status stratified models (to show seasonal trends in beverage purchases, predictions do not adjust for quarter). Source: authors' own analyses and calculations based on data from Nielsen through its Mexico Consumer Panel Service for food and beverage categories, January 2012 to December 2014. *P<0.001

Colchero MA, BM Popkin, JA Rivera, SW Ng. 2016. *BMJ*.

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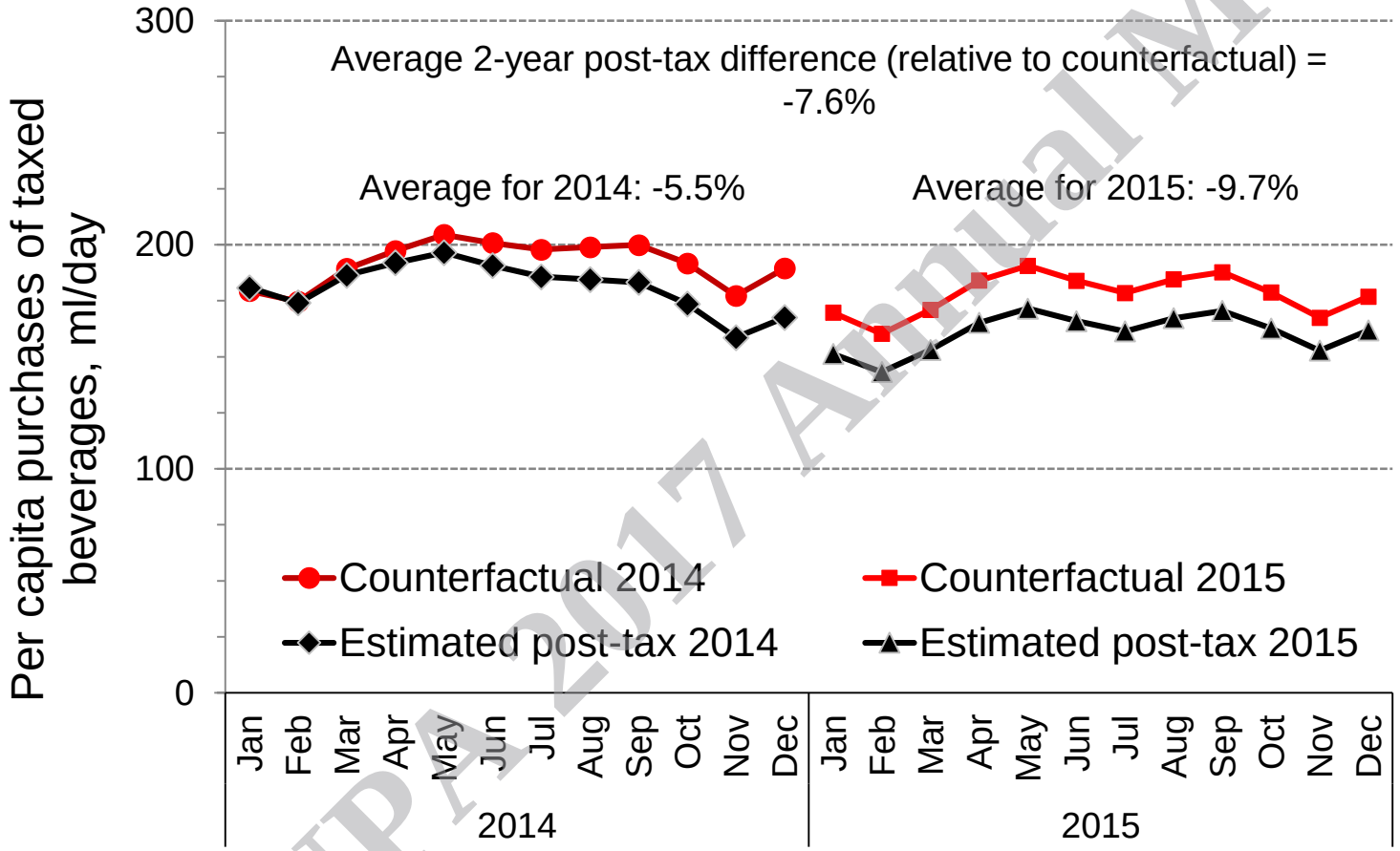
2-year post-tax evaluation: Change in SSB purchases in year 1 were consistent and greater in year 2



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Colchero MA, Rivera J, Popkin B, Ng SW. 2017. Sustained consumer response: evidence from two-years after implementing the sugar sweetened beverage tax in Mexico. *Health Affairs*36(3): 564-571.

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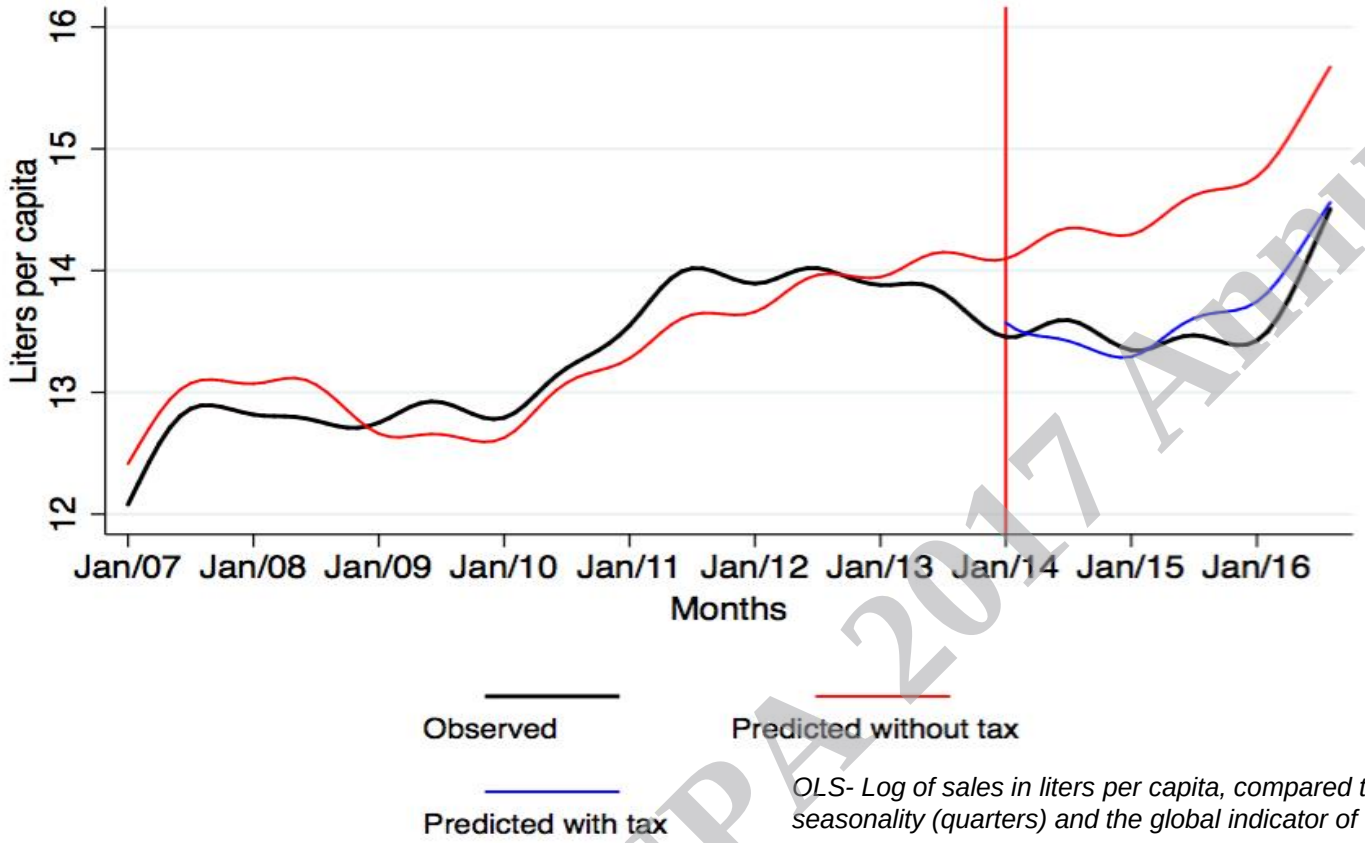
Consistent results using national sales of beverages (manufacturing data)



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

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

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Colchero MA, Guerrero Lopez C, Molina M, Rivera J . Beverage sales in Mexico before and after implementation of a sugar sweetened beverages tax. 2016. PLoS ONE. 11(9).
Changes in sales of sugar-sweetened beverages in Mexico before (2007-2013) and after the tax (2014-2016): https://www.insp.mx/epppo/blog/4278-changes-sales-beverages.html

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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/m^2 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.

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Romero et al, 2016; Barrientos-Gutierrez et al, PlosOne 2017

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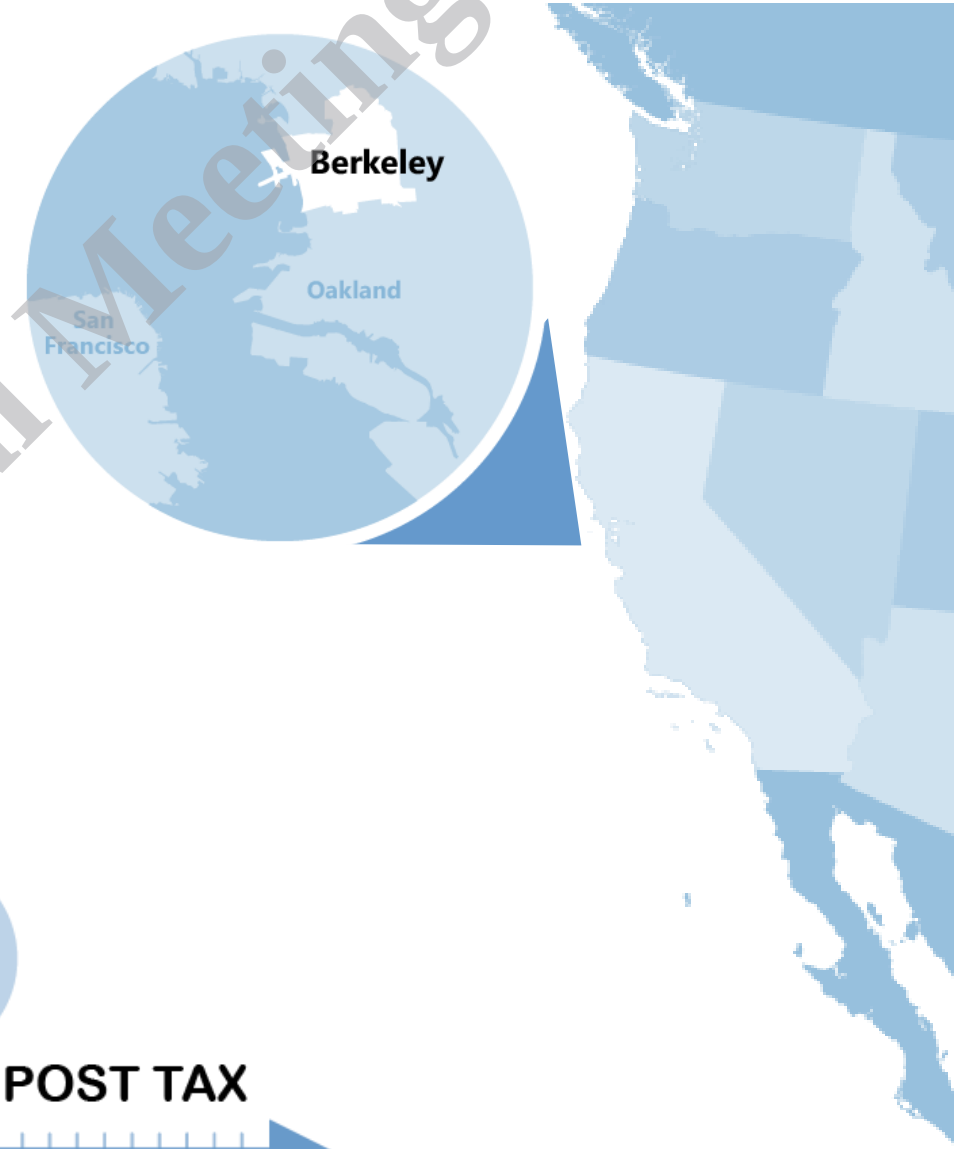
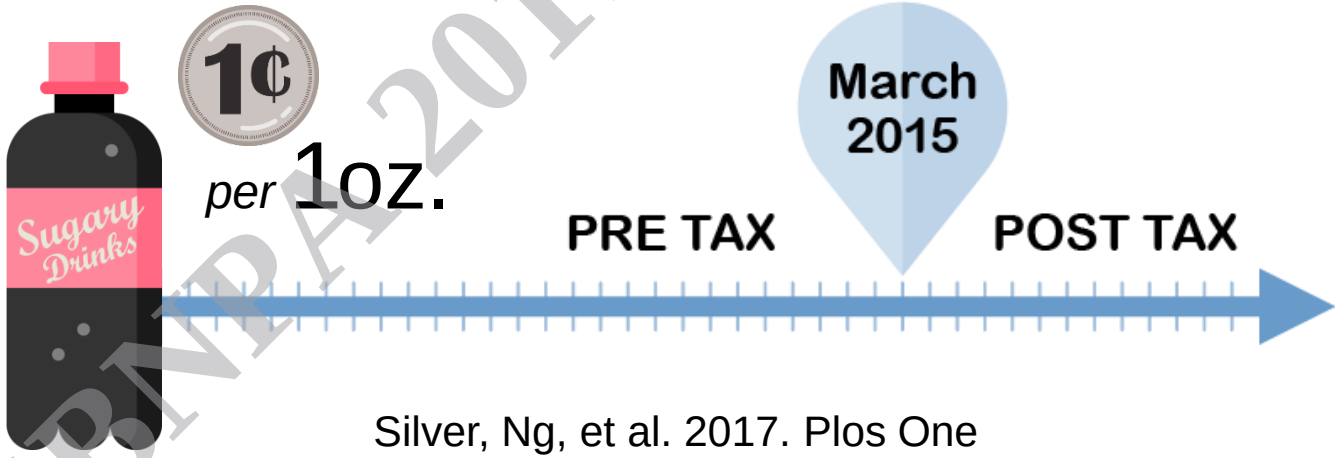
Berkeley SSB tax

- 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

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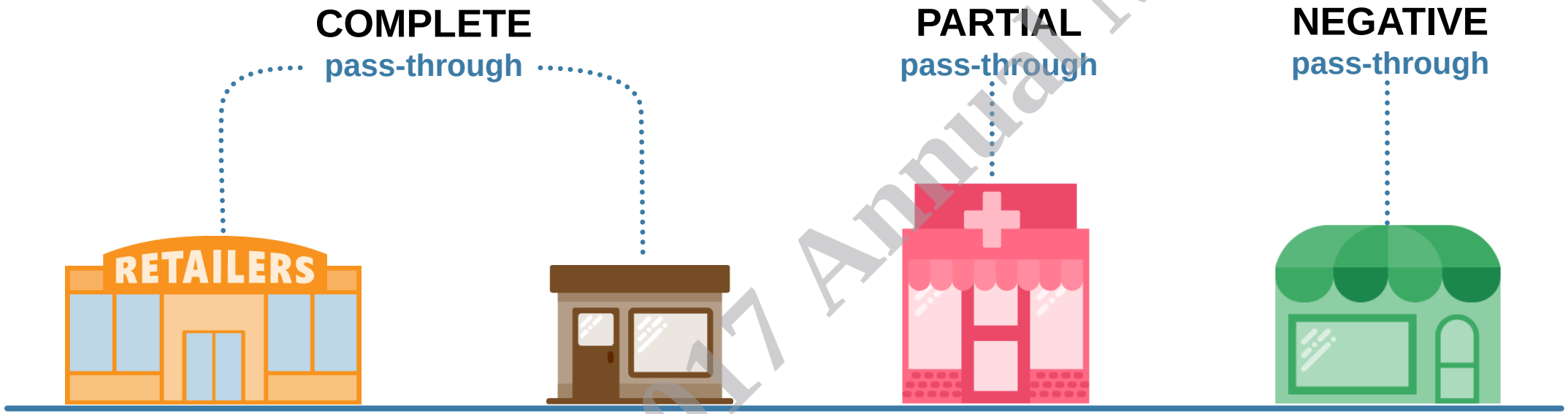
1¢/oz tax pass-through onto prices

(Distributor → Retailer → Consumer)



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

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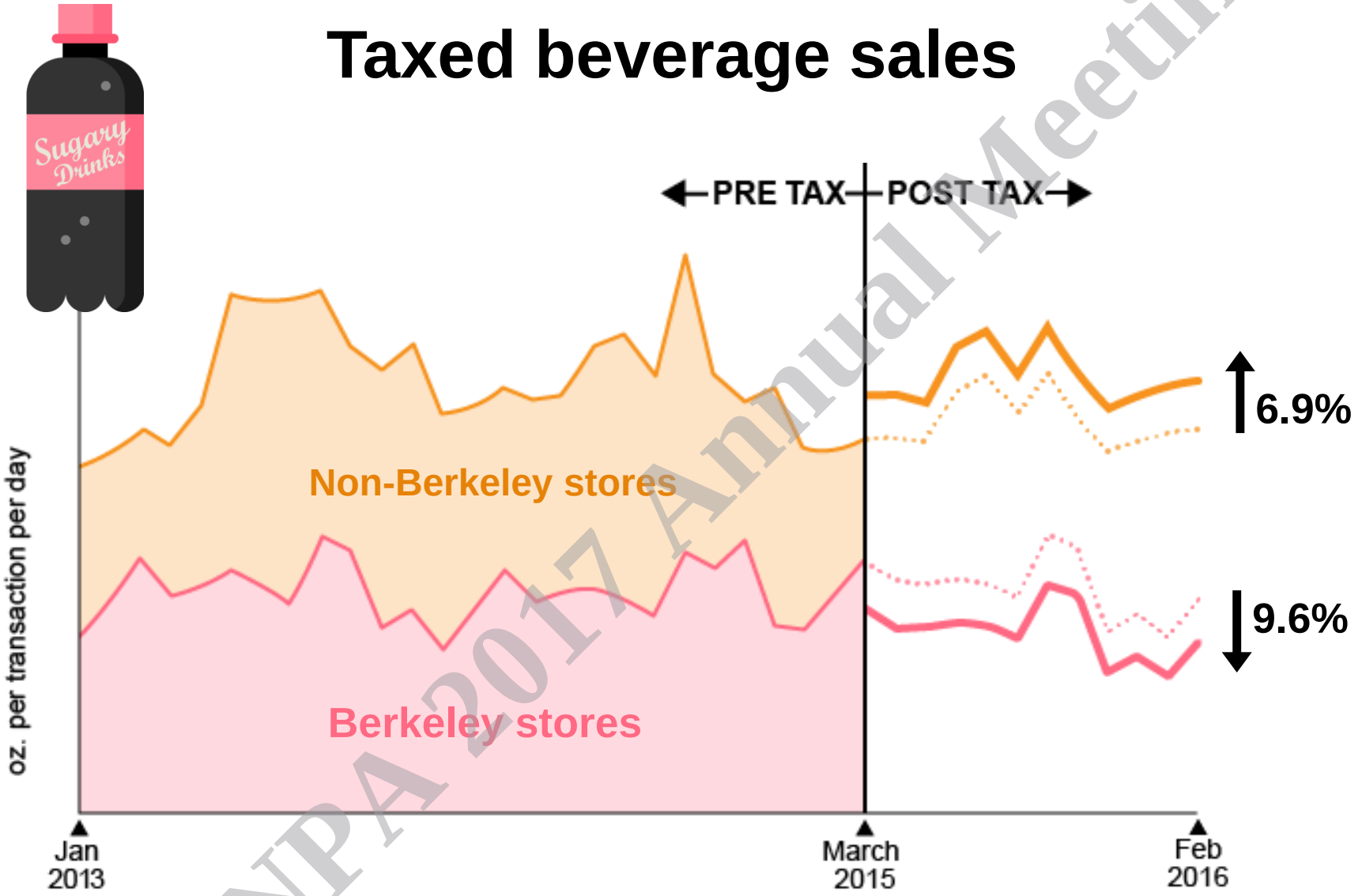
Taxed beverage sales



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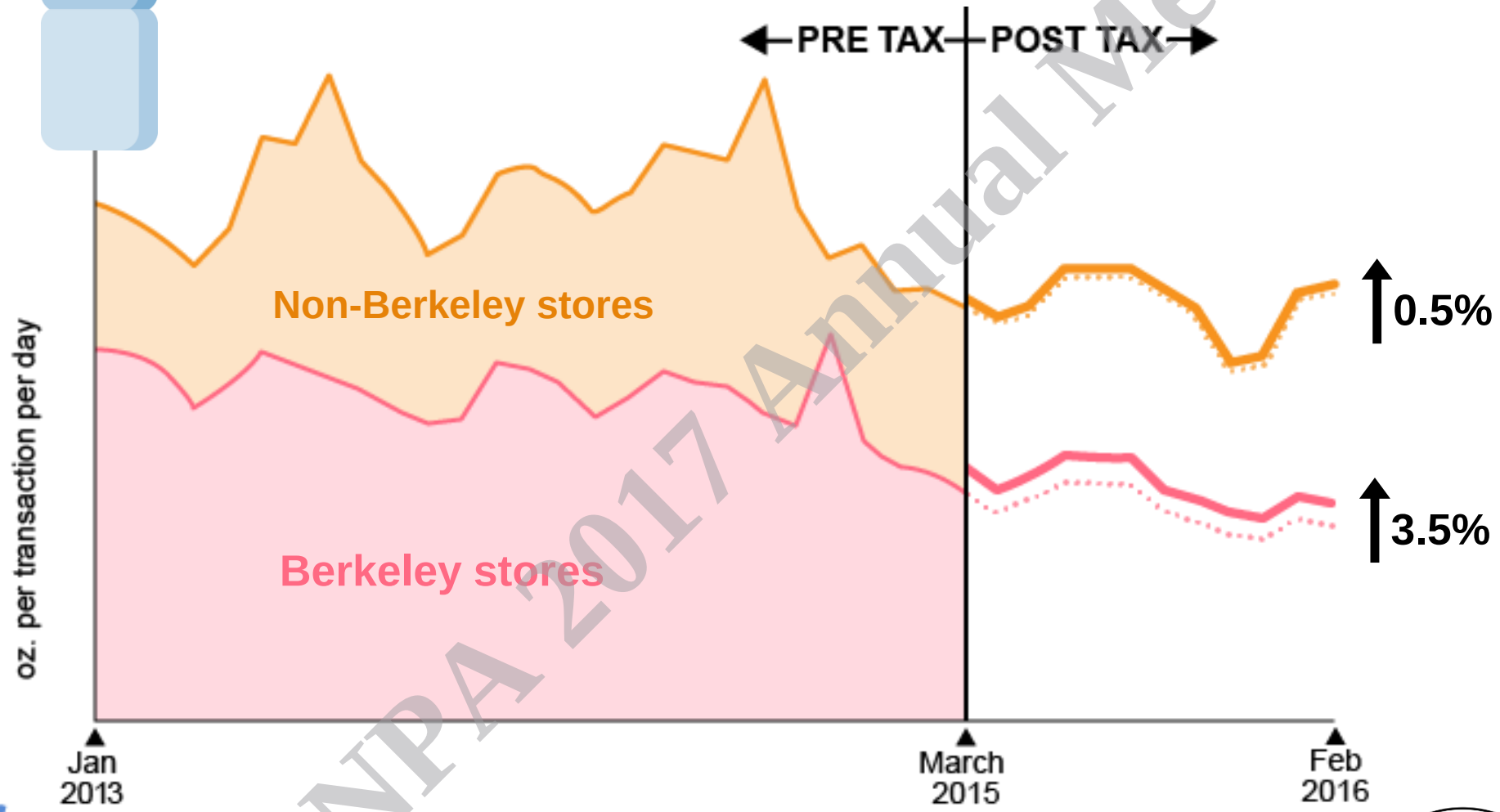
Untaxed beverage sales



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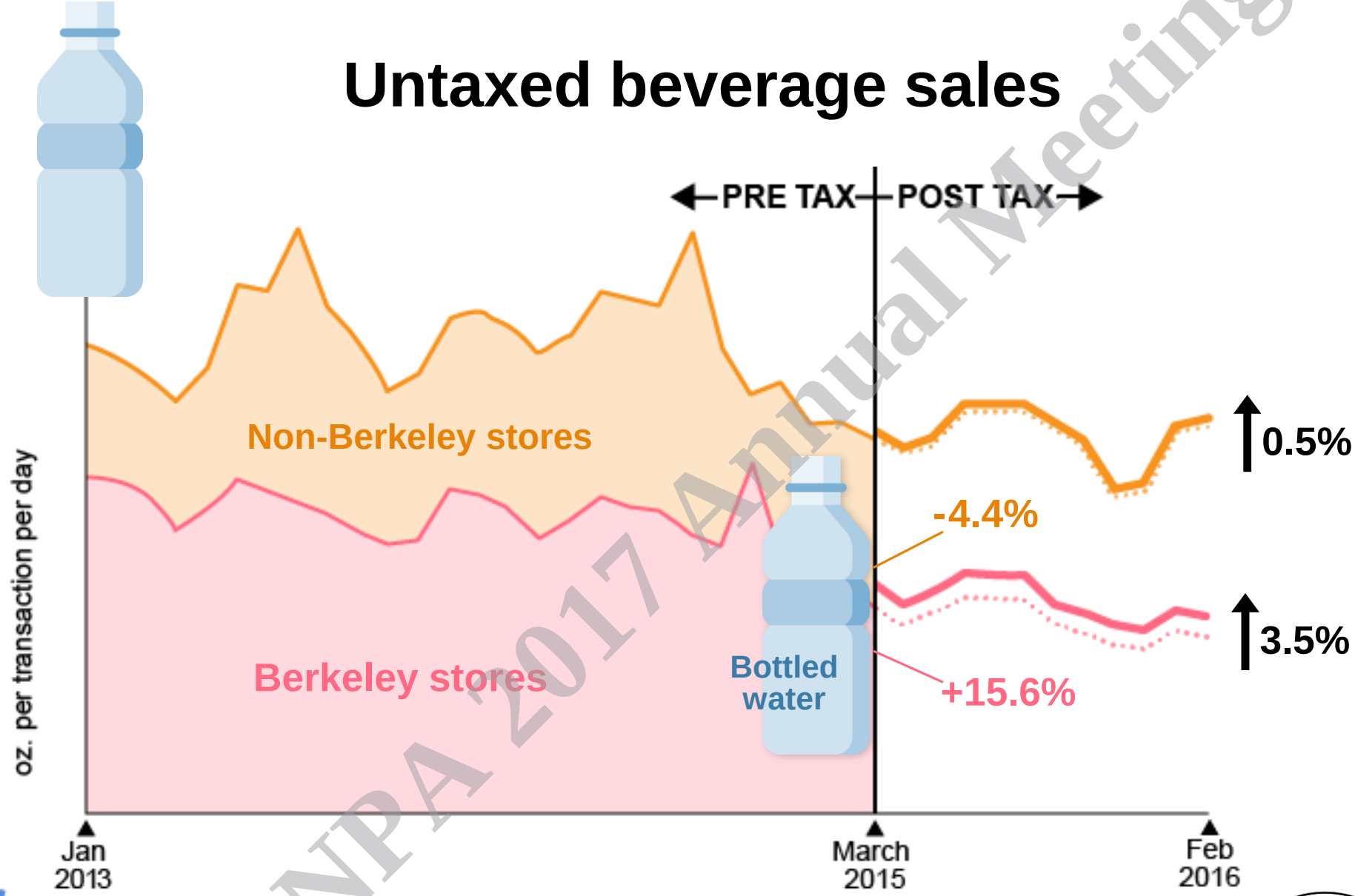
Untaxed beverage sales



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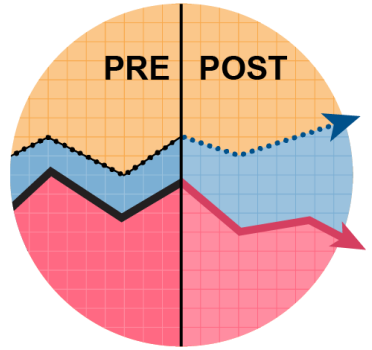
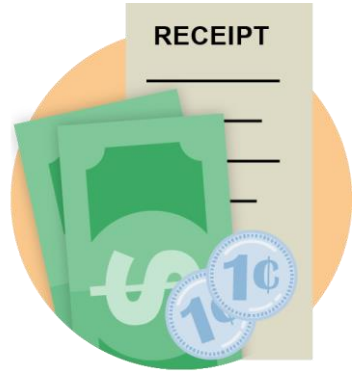
https://doi.org/10.1371/journal.pmed.1002283

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





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…and WIN: Use of revenue in Berkeley

- 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

Healthy Berkeley
Public Health Working for You

Source: http://www.healthyberkeley.com/funded-organizations/

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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.

Colchero et al, 2017 Under review. https://www.insp.mx/epppo/blog/4206-sugar-sweetened-beverages.html

Lisa M. Powell, Roy Wada, Joseph J. Persky, and Frank J. Chaloupka. Employment Impact of Sugar-Sweetened Beverage Taxes. American Journal of Public Health: April 2014, Vol. 104, No. 4, pp. 672-677. doi: 10.2105/AJPH.2013.301630

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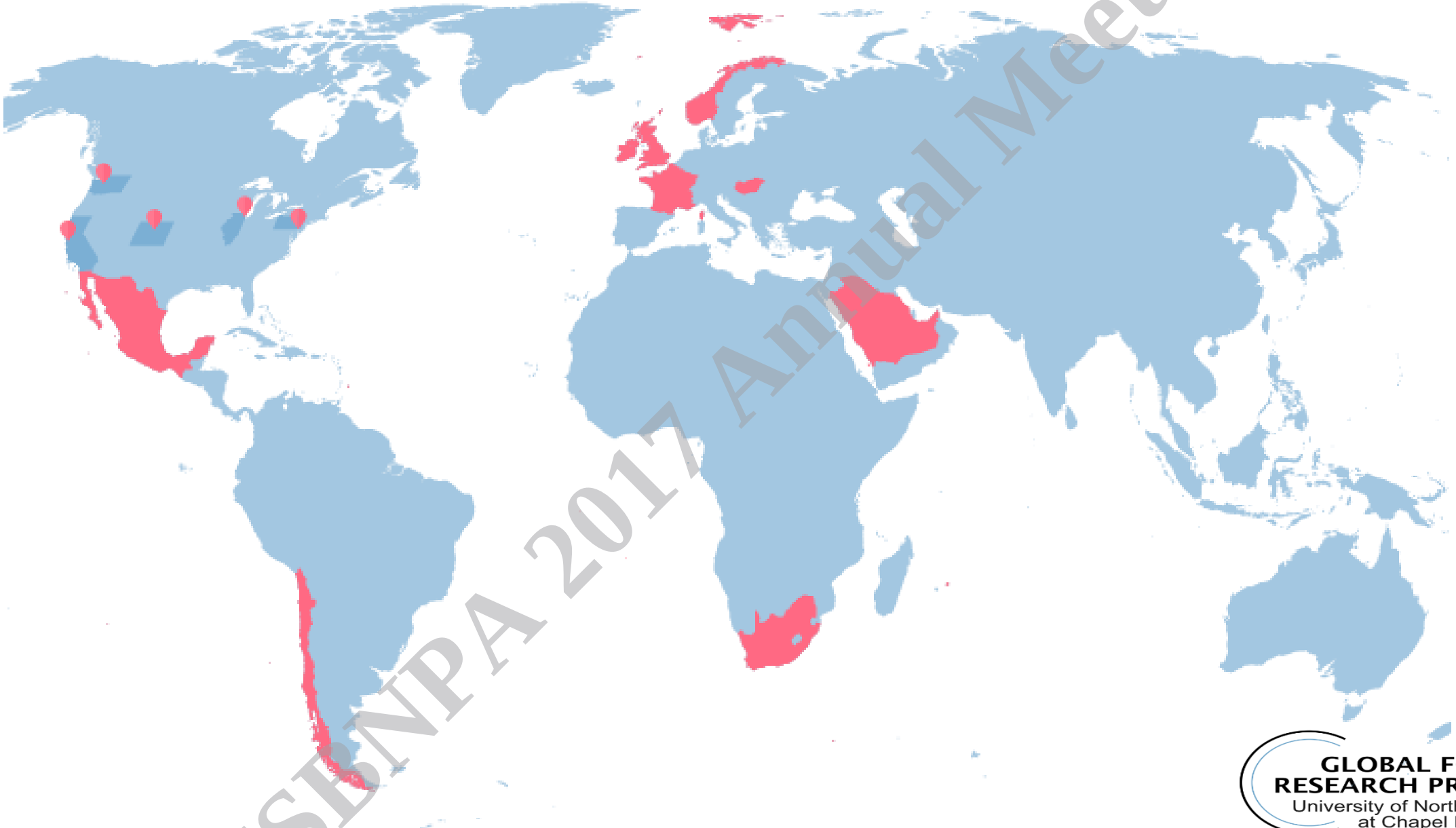
What do these findings in Mexico & Berkeley suggest?

- Industry can pass-through differentially to cost-shift across portfolio:
  - Package size / Beverage types / Store types
  - Depends on market share (varies by location, beverage type)
  - 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 is 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



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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

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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

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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
- Funders: Bloomberg Philanthropies, Robert Wood Johnson Foundation, US NIH

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Thank you!

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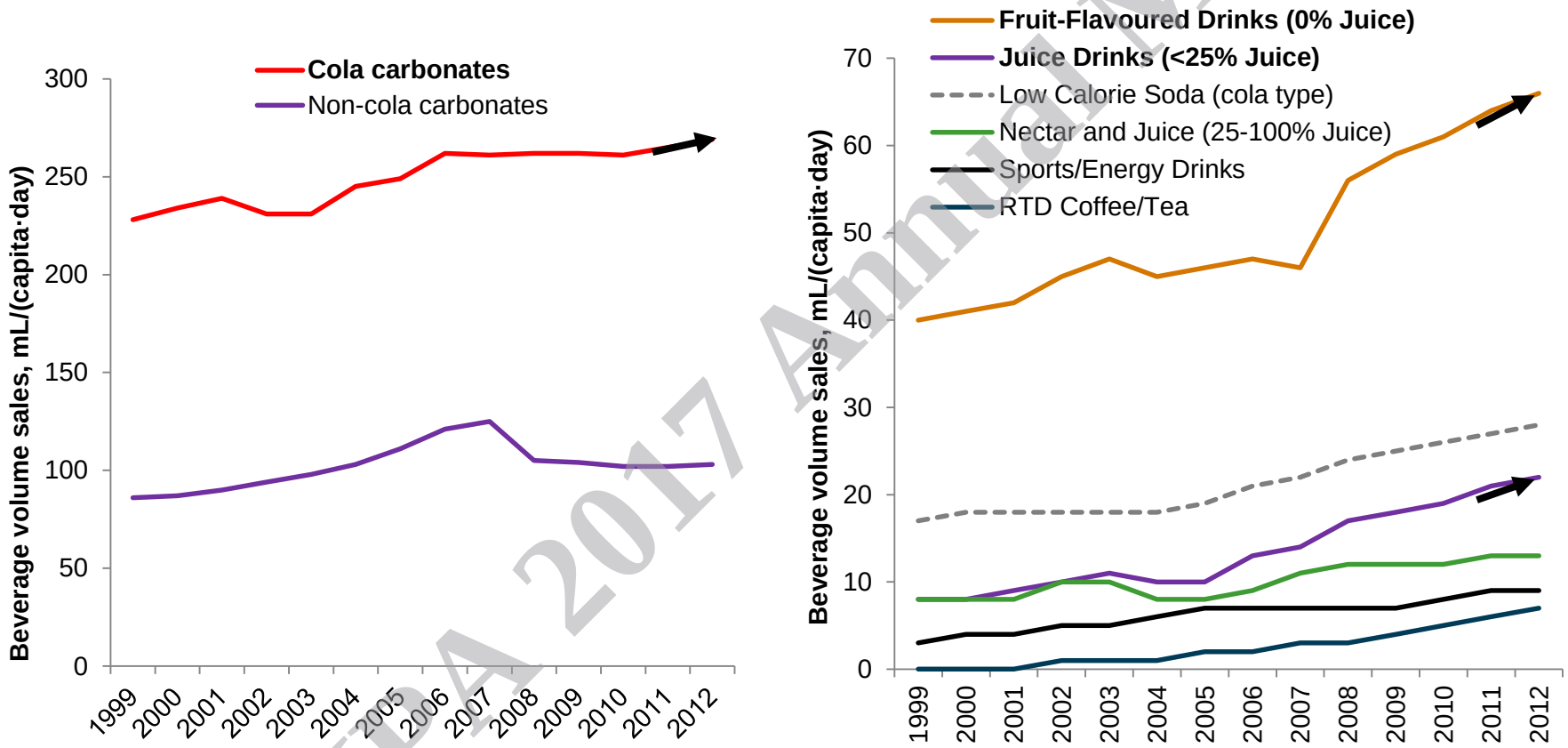
Tax design considerations

- 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

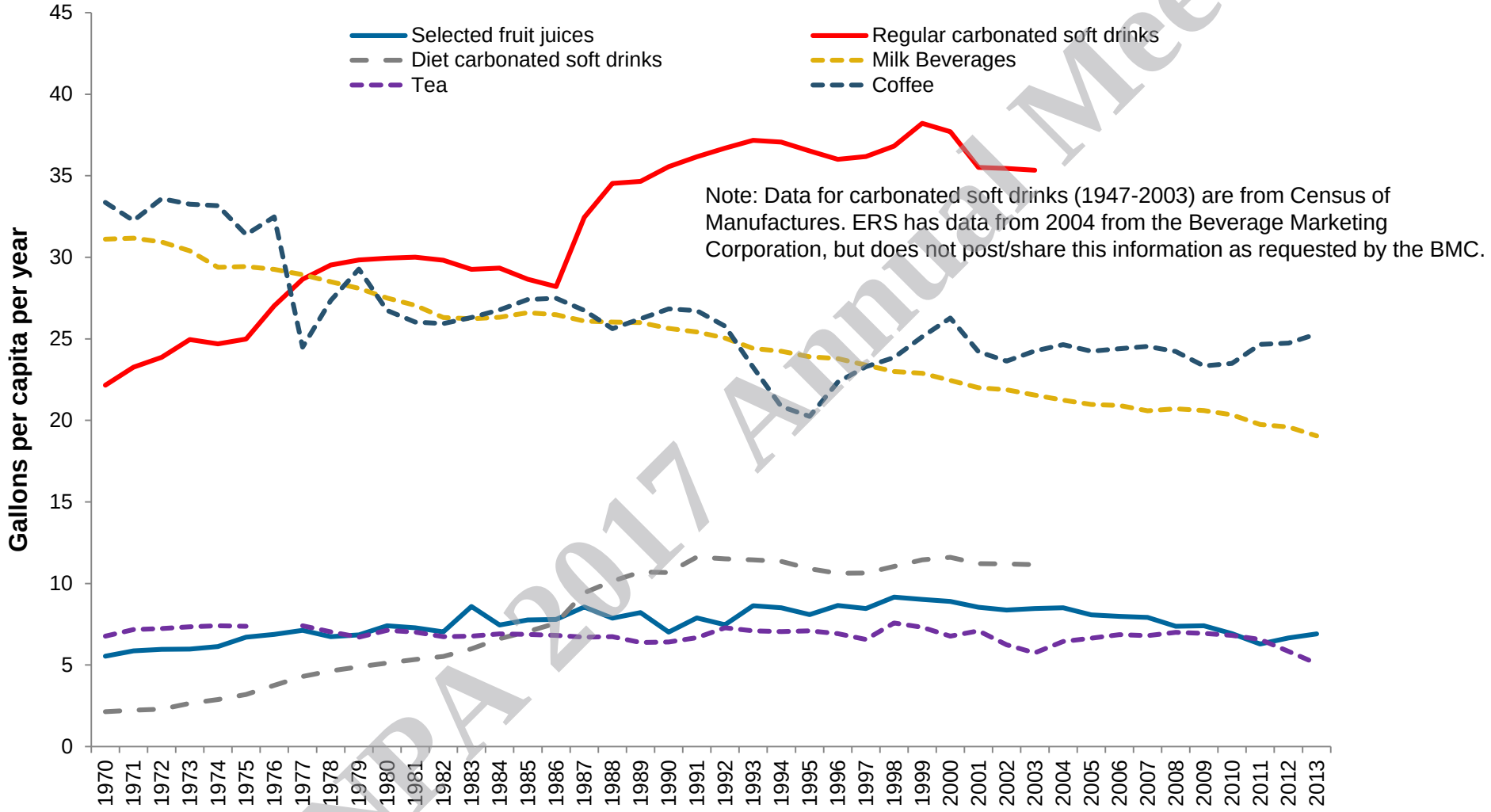
Mexico: Decline in sugary drink consumption from tax (-12ml) is small relative to growth in earlier years



Trends in daily per-capita total volume sales, 1999–2012 for regular cola carbonates and caloric and noncaloric non-cola carbonates (*A*) and caloric and noncaloric other beverages (*B*). Values represent aggregate sales in volume and are not linked to individuals. **Figure 4 from: Stern D, et al, 2014. "Caloric Beverages Were Major Sources of Energy among Children and Adults in Mexico, 1999–2012". J Nutr 144(6): 949–956.**

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.

Source: Calculated by ERS/USDA based on data from various sources (see http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/food-availability-documentation.aspx). Data last updated Feb. 1, 2015.

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

Location & start date	Tax based on	Rate	What is included/ taxed	What is excluded
Philadelphia PA (1 Jan 2017)	Volume (specific)	1.5 ¢/oz	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)	drink containing >50% milk or milk substitute, drink containing >50% fresh fruit or vegetable, unsweetened drinks, medical food, baby formula
Chile (1 Oct 2014)	% price (ad valorem)	10%	non-alcoholic beverages with sugar content <6.25g/100mL	100% fruit juice, bottled water, tea, powdered coffee, & dairy are untaxed
		18%	non-alcoholic beverages with sugar content ≥6.25g/100mL	

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)

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