APPENDIX

SUPPLEMENTARY METHODS

1. IRI store selection and coverage. We contracted with the company IRI, which allows researchers to purchase the proprietary data IRI receives from major chain retailers. The authors had no role in the selection of study stores. Retailers in the IRI data either provide sales for all stores or for a statistically representative sample (1). All retail chains are included in IRI for all store types except supermarkets, which must have ≥$2 million in annual sales (these account for ~96% of total sales volume among supermarkets) (1). Compared to Census Bureau estimates, IRI captures 50% of food sales in supermarkets, 119% of food sales in pharmacies (>100% attributed to differences in category definitions), and 79% of food sales in mass merchandisers (1). The same retailers were included for all cities in the study.

Reference:
1. Muth MK, Sweitzer M, Brown D, Capogrossi K, Karns S, Levin D, et al. Understanding IRI household-based and store-based scanner data. U.S. Department of Agriculture, Economic Research Service; 2016.

2. Beverage classification. We classified 47% of beverages based on their IRI subcategory. For the remainder that could not be classified based on broad subcategory alone (e.g., juices, some of which are 100% fruit juice and therefore nontaxed, while others have added sugars and therefore subject to the tax), 2 research assistants independently classified beverages based on beverage ingredients or, when ingredients were unavailable, based on similar products (e.g., same manufacturer and brand but different flavor). Coding discrepancies were reconciled through discussion.

For beverage subtype analyses, we considered 11 subtypes, 7 of which were taxed (regular soda, diet soda, fruit drinks, sports drinks, energy drinks, iced tea/lemonade, and coffee drinks) and 4 of which were nontaxed (water, milk, fruit juice, and sparkling water). We excluded beverages that were classified as "other beverages" because this was a heterogeneous group (e.g., flavored waters, milk alternatives, energy shots, etc.) that comprised many different types of low-selling beverages but only cumulatively made up 2.5% of pre-tax volume sales. We did not analyze energy drink sales because of violations of parallel trends for both Philadelphia vs Baltimore and PA border ZIP codes vs MD border ZIP codes.

3. Weights for price-per-ounce analyses. Our price-per-ounce analyses were weighted by pre-tax volume by UPC and store type. This was done so that our estimates reflected the higher pre-tax demand for some UPCs while also accounting for higher demand in some store types. To create these weights, we first found the total amount of volume sold of a given UPC across all stores of a given store type (e.g., the total volume sold of a UPC across all supermarkets). We then divided this by the total volume sold of all UPCs in the pre-tax period to create the weight. The weights thus reflect the probability of buying a specific UPC in a specific store type.

We have illustrated this with a simplified example, imagining there were only 2 UPCs in the entire dataset:

Pre-tax volume sold (ounces)

	Supermarkets	Mass merchandisers	Pharmacies	**Total**
UPC X	200	150	20	**370**
UPC Y	50	50	5	**105**
Total	**250**	**200**	**25**	**475**

Weights

	Supermarkets	Mass merchandisers	Pharmacies
UPC X	0.42	0.32	0.04
UPC Y	0.11	0.11	0.01

As we demonstrate, the weights reflect the probability of buying that UPC in that store type (e.g., the probability of buying UPC X in a supermarket = 200/475 = 0.42). When applied to our regressions, this weighting allows the difference-in-differences estimate (and hence tax pass-through) to reflect demand for UPCs. Previous beverage tax studies have weighted price analyses by the joint distribution of volume sold with other beverage characteristics (2, 3).

References:
2. Leider J, Li Y, Powell LM. Pass-through of the Oakland, California, sugar-sweetened beverage tax in food stores two years post-implementation: A difference-in-differences study. PLoS One. 2021;16(1):e0244884
3. Falbe J, Lee MM, Kaplan S, Rojas NA, Ortega Hinojosa AM, Madsen KA**.** Higher Sugar-Sweetened Beverage Retail Prices After Excise Taxes in Oakland and San Francisco. Am J Public Health. 2020:e1-e7

4. Calculating percent offset. We calculated the degree to which increased cross-border shopping offset the decreases in Philadelphia as: [(DD percent change) – (percent change adjusted for increased border shopping)]/(DD percent change).

5. Number of comparisons adjusted for. We adjusted for the number of tests conducted within a city. For example, results for change in beverage price per ounce after tax implementation were adjusted for 8 comparisons in Philadelphia and 7 in PA border ZIP codes (because we did not analyze family-sized beverages in PA border ZIP codes).

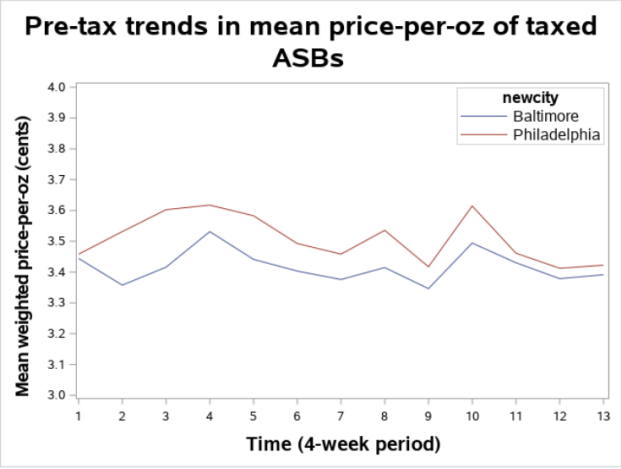
6. Parallel trends tests for price change analyses. Below we present a table with *p*-values for the parallel trends test (i.e., city*time interaction term) for price change analyses. In cases where $p<0.05$, we present the mean baseline price and the coefficient associated with the city*time interaction term to provide context for the extent of the deviation from parallel trends. For all cases where $p<0.05$, the coefficient for city*time is extremely small. For example, although the city*time interaction term that is used to test parallel trends had $p=0.002$ for total taxed beverages for PA border vs MD border stores, the coefficient was –0.002 (95% CI: –0.003, –0.001), suggesting that in the pre-tax period, the price/ounce of taxed beverages in PA border stores decreased by 0.002 cents/ounce per 4-week period vs MD border stores. The mean 2016

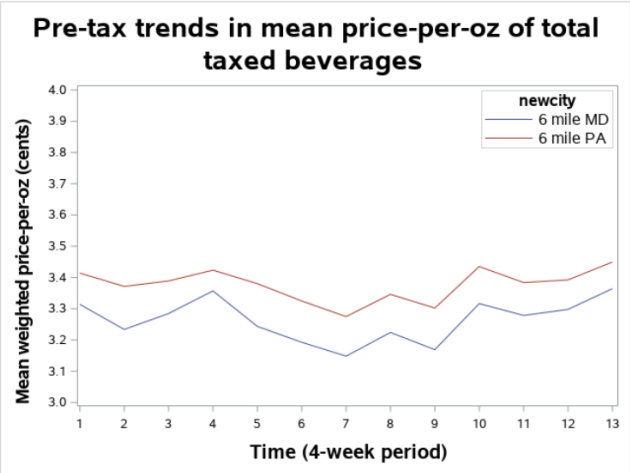
price/ounce of taxed beverages in PA border stores was 3.48 cents/ounce. Over 1 year, the deviation in parallel trends equates to –0.026 cents/ounce (i.e., –0.002*13 four-week periods), which is –0.7% of the baseline price.

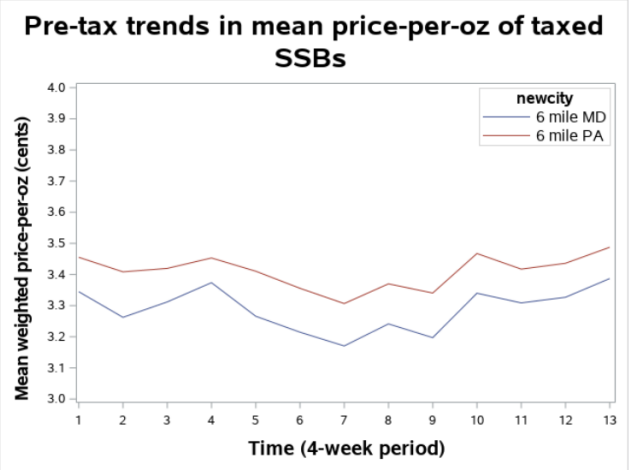
Given the very small deviations we observed, we believe that the controls used in this study for beverage price change analyses are valid controls for all beverage types. The deviations we observed were likely statistically significant only due to the very large sample size of UPCs in this study. When a sample is large, the *p*-value alone is not sufficient to identify *meaningful* violations in the parallel trends assumption.

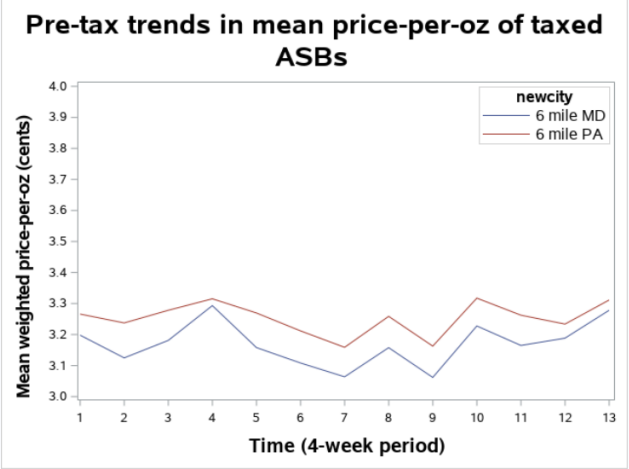
	Philadelphia vs Baltimore			PA border vs MD border		
	Mean 2016 price	**City*Time (95% CI)**	***p*-value**	**Mean 2016 price**	**City*Time (95% CI)**	***p*-value**
Taxed total			0.56	3.48	–0.002 (–0.003, –0.001)	0.002
Taxed individual			0.13			0.61
Taxed family			0.13	2.97	–0.002 (–0.003, –0.001)	0.0004
Taxed SSB			0.75	3.49	–0.002 (–0.003, 0.00)	0.01
Taxed ASB	3.51	–0.007 (–0.010, –0.004)	0.03	3.42	–0.003 (–0.005, –0.001)	0.02
Non-taxed total			0.41	3.40	0.005 (0.003, 0.007)	0.002
Non-taxed individual			0.05	8.75	–0.010 (–0.017, –0.003)	0.005
Non-taxed family			0.13	2.80	0.006 (0.004, 0.007)	0.0004

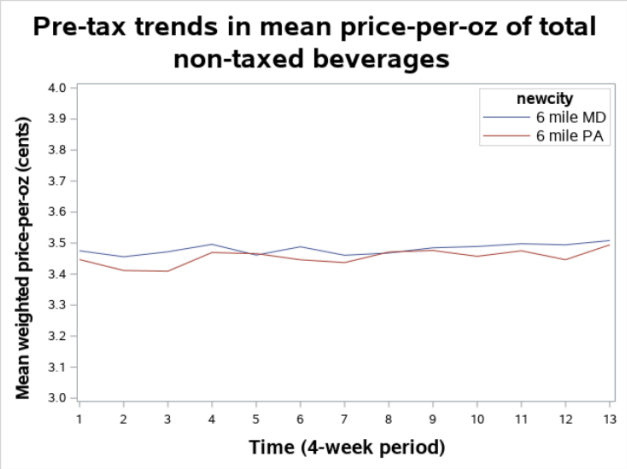
We have also included graphs showing pre-tax trends in beverage prices for those outcomes with $p<0.05$:

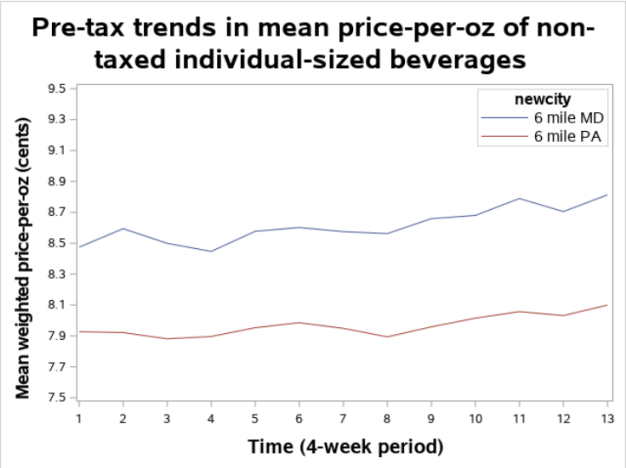


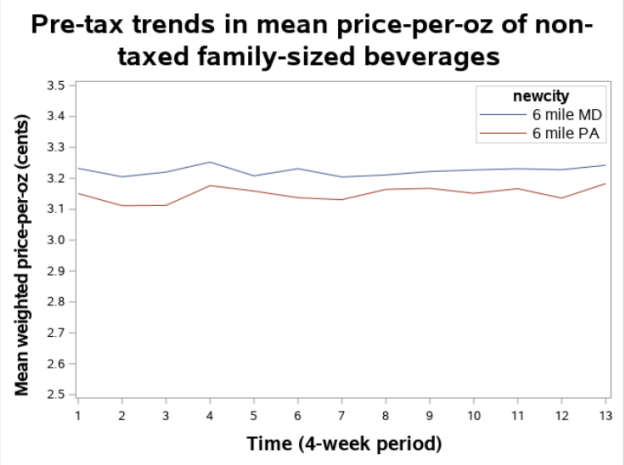

Pre-tax trends in mean price-per-oz of total taxed beverages
newcity
6 mile MD
6 mile PA
Mean weighted price-per-oz (cents)
Time (4-week period)


Pre-tax trends in mean price-per-oz of taxed SSBs
newcity
6 mile MD
6 mile PA
Mean weighted price-per-oz (cents)
Time (4-week period)


Pre-tax trends in mean price-per-oz of taxed ASBs
newcity
6 mile MD
6 mile PA
Mean weighted price-per-oz (cents)
Time (4-week period)

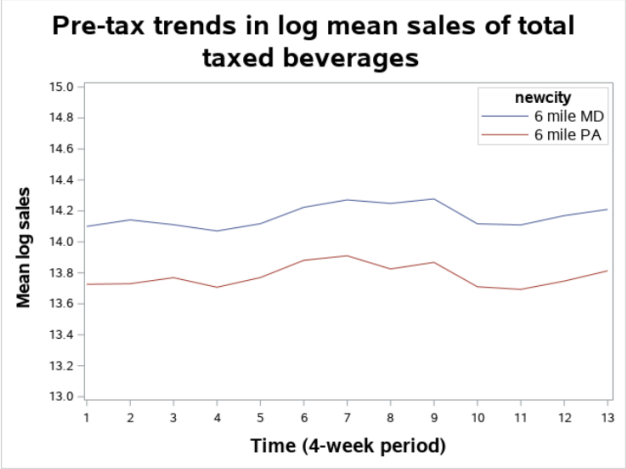

Pre-tax trends in mean price-per-oz of total non-taxed beverages
Mean weighted price-per-oz (cents)
Time (4-week period)
newcity
6 mile MD
6 mile PA


Pre-tax trends in mean price-per-oz of non-taxed individual-sized beverages
Mean weighted price-per-oz (cents)
Time (4-week period)
newcity
6 mile MD
6 mile PA

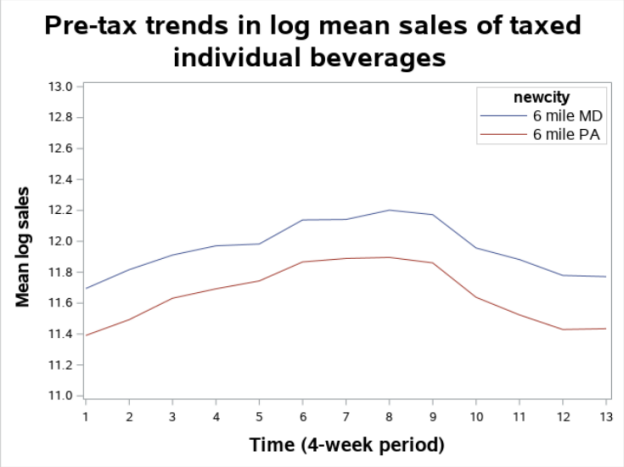

Pre-tax trends in mean price-per-oz of non-taxed family-sized beverages
Mean weighted price-per-oz (cents)
Time (4-week period)
newcity
6 mile MD
6 mile PA

7. Parallel trends test for volume sales analyses. We did not include outcomes that appeared to violate pre-tax parallel trends tests based on the city*time *p*-value *and* visual inspection of pre-tax graphs (in Philadelphia: energy drinks, iced tea and lemonade, and sports drinks; in PA border counties: total ASBs, energy drinks, and milk). However, we included several outcomes that had $p<0.05$ for city*time interaction terms, but that appeared to have parallel trends based on visual inspection. We present the *p*-values and graphs for those outcomes below:

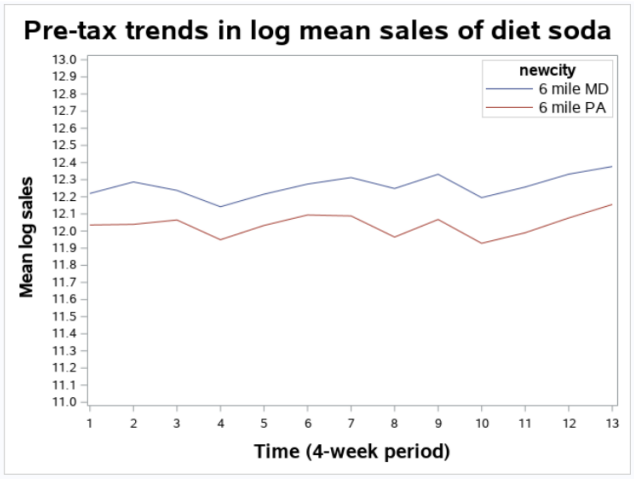
Total taxed beverages for PA border vs MD border ($p=0.03$)



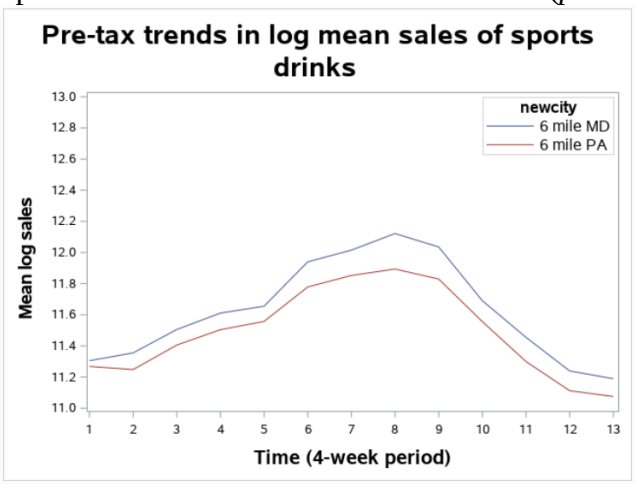
Taxed individual-sized beverages for PA border vs MD border ($p=0.03$)



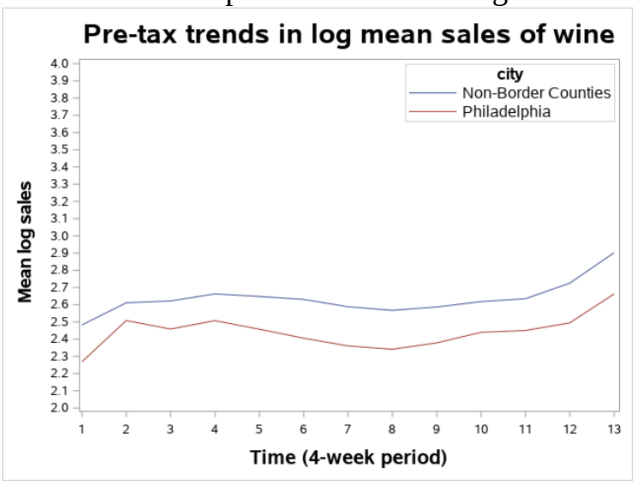
Diet soda for PA border vs MD border (p=0.01)



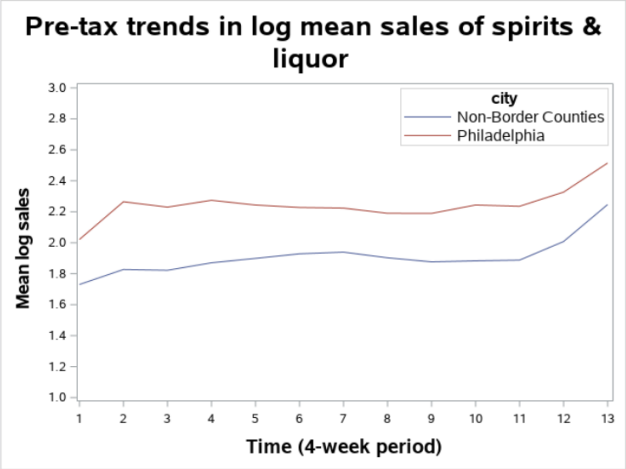
Sports drinks for PA border vs MD border (p=0.002)



Wine for Philadelphia vs non-bordering PA counties (p=0.04)



Spirits/liquor for Philadelphia vs non-bordering PA counties (p=0.02)



Appendix Table 1. Pre-Tax Characteristics of Stores in the IRI Sample in Each Location Overall and by Store Type

Store type	Number of stores	Total volume sales (ounces, millions)
All stores		
Philadelphia	175	5,232
Baltimore	59	1,279
PA border ZIP codes	178	4,970
MD border ZIP codes	92	3,245
Supermarkets		
Philadelphia	23	3,482
Baltimore	16	1,109
PA border ZIP codes	41	3,578
MD border ZIP codes	29	1,812
Mass merchandiser		
Philadelphia	12	1,111
Baltimore	1	36
PA border ZIP codes	17	1,051
MD border ZIP codes	15	1,281
Pharmacies		
Philadelphia	140	640
Baltimore	42	134
PA border ZIP codes	120	341
MD border ZIP codes	48	151

IRI, Information Resources, Inc.

Appendix Table 2. Difference-in-Differences in Beverage Price Per Ounce 2 Years After Philadelphia Beverage Tax Implementation, by Store Type

Outcome	Mean (SD) pre-tax price per ounce[a]				Philadelphia vs Baltimore			PA border vs MD border	
	Philadelphia	Baltimore	PA border	MD border	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]	% pass-through[d]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]
Taxed beverages: all									
Supermarket	3.20 (1.55)	3.23 (1.57)	3.12 (1.53)	3.09 (1.53)	0.72 (0.64, 0.80)	**<0.0001**	48%	0.03 (0.01, 0.05)	**0.01**
Pharmacy	4.15 (2.90)	4.23 (2.99)	4.19 (3.04)	4.18 (3.01)	1.43 (1.34, 1.52)	**<0.0001**	95%	0.01 (–0.02, 0.04)	0.67
Mass merchandiser	–	–	3.14 (1.80)	3.12 (1.80)	–		–	0.00 (–0.01, 0.02)	0.74
Taxed beverages: individual-sized									
Supermarket	5.78 (3.02)	5.77 (3.12)	5.87 (3.04)	5.69 (3.11)	0.67 (0.54, 0.80)	**<0.0001**	45%	–0.07 (–0.12, –0.01)	0.09
Pharmacy	6.79 (3.55)	6.91 (3.61)	6.85 (3.71)	6.85 (3.68)	1.56 (1.45, 1.68)	**<0.0001**	104%	0.03 (–0.02, 0.08)	0.37
Mass merchandiser	–	–	6.96 (3.50)	6.99 (3.59)	–		–	–0.01 (–0.05, 0.02)	0.70
Taxed beverages: family-sized[e]									
Supermarket	2.98 (1.11)	3.02 (1.14)	–	–	0.73 (0.65, 0.82)	**<0.0001**	49%	–	–
Pharmacy	2.79 (0.87)	2.78 (0.84)	–	–	1.27 (1.18, 1.36)	**<0.0001**	85%	–	–
Mass merchandiser	–	–	–	–	–		–	–	–
Taxed beverages: sugar-sweetened									
Supermarket	3.18 (1.84)	3.23 (1.58)	3.14 (1.55)	3.11 (1.54)	0.73 (0.64, 0.82)	**<0.0001**	49%	0.02 (0.00, 0.05)	0.10
Pharmacy	4.19 (2.97)	4.26 (3.07)	4.28 (3.14)	4.24 (3.10)	1.44 (1.35, 1.54)	**<0.0001**	96%	0.01 (–0.02, 0.03)	0.74
Mass merchandiser	–	–	3.14 (1.81)	3.13 (1.81)	–		–	0.00 (–0.01, 0.02)	0.74
Taxed beverages: artificially-sweetened									
Supermarket	3.26 (1.41)	3.23 (1.93)	3.08 (1.43)	3.05 (1.49)	0.73 (0.56, 0.89)	**<0.0001**	49%	0.05 (0.02, 0.08)	**0.01**
Pharmacy	3.98	4.09	3.87	3.90	1.22	**<0.0001**	81%	–0.03	0.17

	(2.52)	(2.57)	(2.58)	(2.57)	(1.12, 1.33)			(–0.06, 0.00)	
Mass merchandiser	–	–	3.10 (1.78)	3.07 (1.75)	–		–	0.00 (–0.03, 0.04)	0.89
Nontaxed beverages: all									
Supermarket	3.20 (2.43)	3.26 (3.16)	3.49 (2.40)	3.54 (2.39)	–0.10 (–0.20, –0.01)	0.05	–	0.15 (0.09, 0.20)	**<0.0001**
Pharmacy	3.46 (3.08)	3.91 (3.71)	3.36 (3.01)	3.40 (3.49)	–0.10 (–0.13, –0.07)	0.31	–	–0.08 (–0.18, 0.01)	0.17
Mass merchandiser	–	–	3.30 (2.28)	3.10 (2.27)	–		–	0.28 (0.10, 0.47)	**0.01**
Nontaxed beverages: individual-sized									
Supermarket	7.90 (5.57)	9.20 (5.57)	8.00 (5.54)	8.84 (5.24)	–0.07 (–0.31, 0.17)	0.57	–	–0.05 (–0.14, 0.05)	0.55
Pharmacy	7.90 (3.99)	8.31 (3.98)	7.88 (3.88)	8.22 (4.00)	0.06 (–0.13, 0.25)	0.55	–	–0.01 (–0.12, 0.11)	0.90
Mass merchandiser	–	–	8.55 (4.48)	8.76 (4.27)	–		–	0.05 (–0.10, 0.20)	0.70
Nontaxed beverages: family-sized									
Supermarket	3.02 (2.01)	2.88 (2.49)	3.30 (1.95)	3.35 (1.99)	–0.08 (–0.17, 0.02)	0.16	–	0.16 (0.10, 0.21)	**<0.0001**
Pharmacy	2.49 (1.70)	2.38 (2.00)	2.42 (1.64)	2.12 (1.84)	–0.07 (–0.22, 0.08)	0.45	–	–0.08 (–0.15, 0.00)	0.13
Mass merchandiser	–	–	3.08 (1.83)	2.89 (1.86)	–		–	0.29 (0.10, 0.47)	**0.01**

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]Means and SDs were weighted by UPC volume sales. Mass merchandisers were not analyzed in Philadelphia and Baltimore because there was only 1 mass merchandiser in Baltimore.

[b]A generalized estimating equation was used with variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction term between the 2, which represents the difference-in-differences, as well as indicator variables for beverage type and beverage size. The UPCs were weighted by volume sales.

[c]*P*-values controlled for the false discovery rate for 16 comparisons for Philadelphia and 21 for PA border ZIP codes.

[d]The percent pass-through was calculated for taxed beverages as the difference-in-differences point estimate divided by 1.50 cents/ounce.

[e]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 3. Difference-in-Differences in Beverage Price Per Ounce 2 Years After Philadelphia Beverage Tax Implementation, Adjusting for Fiscal Quarter

Outcome	Philadelphia vs Baltimore			PA border vs MD border	
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	% pass-through[c]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]
Taxed beverages					
All	1.02 (0.94, 1.11)	**<0.0001**	68%	0.03 (0.01, 0.04)	**0.003**
Individual-sized	1.35 (1.24, 1.45)	**<0.0001**	90%	–0.05 (–0.10, –0.01)	**0.03**
Family-sized[d]	0.93 (0.83, 1.03)	**<0.0001**	62%	–	–
Sugar-sweetened	1.04 (0.94, 1.13)	**<0.0001**	69%	0.02 (0.00, 0.04)	**0.02**
Artificially-sweetened	0.96 (0.79, 1.13)	**<0.0001**	64%	0.04 (0.01, 0.06)	**0.004**
Nontaxed beverages					
All	–0.07 (–0.16, 0.01)	0.14	–	0.16 (0.10, 0.22)	**<0.0001**
Individual-sized	0.06 (–0.11, 0.23)	0.48	–	–0.01 (–0.08, 0.06)	0.71
Family-sized	–0.06 (–0.15, 0.03)	0.23	–	0.16 (0.10, 0.22)	**<0.0001**

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation was used with variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction term between the 2, which represents the difference-in-differences, as well as indicator variables for beverage type and beverage size, and fiscal quarter. The UPCs were weighted by volume sales and store type.

[b]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[c]The percent pass-through was calculated for taxed beverages as the difference-in-differences point estimate divided by 1.50 cents/ounce.

[d]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 4. Difference-in-Differences in Beverage Price Per Ounce 2 Years After Philadelphia Beverage Tax Implementation, Excluding December Sales

Outcome	Philadelphia vs Baltimore			PA border vs MD border	
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	% pass-through[c]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]
Taxed beverages					
All	1.02 (0.94, 1.10)	**<0.0001**	68%	0.02 (0.01, 0.04)	**0.008**
Individual-sized	1.34 (1.23, 1.44)	**<0.0001**	89%	–0.05 (–0.10, –0.01)	**0.02**
Family-sized[d]	0.93 (0.83, 1.03)	**<0.0001**	62%	–	–
Sugar-sweetened	1.04 (0.94, 1.13)	**<0.0001**	69%	0.02 (0.00, 0.04)	**0.03**
Artificially-sweetened	0.96 (0.80, 1.12)	**<0.0001**	64%	0.04 (0.01, 0.06)	**0.008**
Nontaxed beverages					
All	–0.10 (–0.18, –0.01)	**0.04**	–	0.16 (0.09, 0.22)	**<0.0001**
Individual-sized	0.05 (–0.12, 0.23)	0.56	–	–0.01 (–0.08, 0.05)	0.67
Family-sized	–0.08 (–0.17, 0.01)	0.08	–	0.16 (0.10, 0.23)	**<0.0001**

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation was used with variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction term between the 2, which represents the difference-in-differences, as well as indicator variables for beverage type and beverage size. The UPCs were weighted by volume sales and store type. The model also excluded December 2018 to match the pre-tax period.

[b]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[c]The percent pass-through was calculated for taxed beverages as the difference-in-differences point estimate divided by 1.50 cents/ounce.

[d]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 5. Difference-in-Differences in Beverage Price Per Ounce 2 Years After Philadelphia Beverage Tax Implementation, Including Beverages With Extreme Price Per Ounce (<1% or >99%)

Outcome	Philadelphia vs Baltimore				PA border vs MD border		
	Mean (SD) pre-tax price per ounce in Philadelphia[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]	% pass-through[d]	Mean (SD) pre-tax price per ounce in PA border[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]
Taxed beverages							
All	3.55 (2.29)	1.04 (0.95, 1.12)	**<0.0001**	69%	3.37 (2.11)	0.02 (0.01, 0.04)	**0.003**
Individual-sized	6.37 (3.60)	1.37 (1.26, 1.48)	**<0.0001**	91%	6.32 (3.64)	–0.05 (–0.09, 0.00)	**0.04**
Family-sized[e]	2.98 (1.16)	0.93 (0.83, 1.04)	**<0.0001**	62%	–	–	–
Sugar-sweetened	3.57 (2.37)	1.05 (0.96, 1.15)	**<0.0001**	70%	3.41 (2.19)	0.02 (0.00, 0.04)	**0.02**
Artificially-sweetened	3.48 (1.94)	0.96 (0.79, 1.13)	**<0.0001**	64%	3.22 (1.80)	0.04 (0.02, 0.06)	**0.003**
Nontaxed beverages							
All	3.14 (2.65)	–0.07 (–0.17, 0.02)	0.15	–	3.29 (2.54)	0.14 (0.09, 0.20)	**<0.0001**
Individual-sized	7.69 (4.66)	0.04 (–0.13, 0.20)	0.64	–	7.64 (4.90)	–0.02 (–0.08, 0.05)	0.62
Family-sized	2.76 (1.98)	–0.06 (–0.14, 0.03)	0.23	–	3.00 (1.98)	0.15 (0.09, 0.21)	**<0.0001**

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]Per 4-week period; weighted by volume sales and store type.

[b]A generalized estimating equation was used with variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction term between the 2, which represents the difference-in-differences, as well as indicator variables for beverage type and beverage size. The UPCs were weighted by volume sales and store type.

[c]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[d]The percent pass-through was calculated for taxed beverages as the difference-in-differences point estimate divided by 1.50 cents/ounce.

[e]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 6. Difference-in-Differences in Beverage Price Per Ounce After Philadelphia Beverage Tax Implementation, by Year

Outcome	2017 vs 2016			2018 vs 2016		
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	% pass-through[c]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	% pass-through[c]
Taxed beverages						
All	0.95 (0.86, 1.04)	**<0.0001**	63%	1.02 (0.94, 1.11)	**<0.0001**	68%
Individual-sized	1.15 (1.07, 1.23)	**<0.0001**	77%	1.33 (1.23, 1.44)	**<0.0001**	89%
Family-sized	0.86 (0.75, 0.98)	**<0.0001**	58%	0.93 (0.83, 1.04)	**<0.0001**	62%
Sugar-sweetened	0.95 (0.85, 1.06)	**<0.0001**	64%	1.04 (0.94, 1.13)	**<0.0001**	69%
Artificially-sweetened	0.90 (0.75, 1.05)	**<0.0001**	60%	0.96 (0.79, 1.13)	**<0.0001**	64%
Nontaxed beverages						
All	0.05 (0.00, 0.10)	0.07	–	–0.08 (–0.16, 0.00)	0.08	–
Individual-sized	0.11 (0.02, 0.19)	**0.02**	–	0.04 (–0.12, 0.21)	0.62	–
Family-sized	0.08 (0.04, 0.13)	**0.0003**	–	–0.07 (–0.15, 0.02)	0.15	–

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation was used with variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction term between the 2, which represents the difference-in-differences, as well as indicator variables for beverage type and beverage size. The UPCs were weighted by volume sales and store type.

[b]*P*-values controlled for the false discovery rate for 8 comparisons.

[c]The percent pass-through was calculated for taxed beverages as the difference-in-differences point estimate divided by 1.50 cents/ounce.

Appendix Table 7. Store-Level Difference-in-Differences in Beverage Volume Sales After Philadelphia Beverage Tax Implementation, by Store Type

Outcome	Philadelphia vs Baltimore[a]			PA border vs MD border		
	Mean (SD) pre-tax volume sales (ounces, millions) in Philadelphia[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]	Mean (SD) pre-tax volume sales (ounces, millions) in PA border[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]
Taxed beverages: all						
Supermarket	5.18 (2.84)	–62% (–75%, –42%)	**<0.0001**	3.03 (1.19)	13% (5%, 22%)	**0.004**
Pharmacy	0.16 (0.09)	–5% (–16%, 7%)	0.57	0.11 (0.06)	23% (16%, 30%)	**<0.0001**
Mass merchandiser	–	–	–	2.05 (1.37)	30% (16%, 46%)	**<0.0001**
Taxed beverages: individual-sized						
Supermarket	0.39 (0.21)	–45% (–56%, –32%)	**<0.0001**	0.31 (0.14)	12% (6%, 18%)	**<0.0001**
Pharmacy	0.07 (0.05)	–13% (–19%, –8%)	**<0.0001**	0.04 (0.02)	12% (6%, 18%)	**0.0002**
Mass merchandiser	–	–	–	0.22 (0.11)	13% (4%, 24%)	**0.004**
Taxed beverages: family-sized						
Supermarket	4.79 (2.67)	–64% (–77%, –43%)	**<0.0001**	2.72 (1.09)	13% (4%, 23%)	**0.005**
Pharmacy	0.10 (0.06)	1% (–15%, 20%)	0.93	0.07 (0.04)	30% (21%, 39%)	**<0.0001**
Mass merchandiser	–	–	–	1.83 (1.28)	32% (17%, 49%)	**<0.0001**
Taxed beverages: sugar-sweetened						
Supermarket	4.44 (2.54)	–62% (–75%, –41%)	**<0.0001**	2.18 (0.96)	12% (4%, 21%)	**0.005**
Pharmacy	0.13 (0.08)	–5% (–16%, 8%)	0.57	0.08 (0.05)	23% (16%, 31%)	**<0.0001**
Mass merchandiser	–	–	–	1.68 (1.21)	31% (16%, 48%)	**<0.0001**
Taxed beverages: artificially-sweetened[d]						
Supermarket	0.74 (0.50)	–66% (–75%, –52%)	**<0.0001**	–	–	–
Pharmacy	0.03 (0.02)	–4% (–14%, 7%)	0.62	–	–	–
Mass merchandiser	–	–	–	–	–	–
Nontaxed beverages: all						
Supermarket	6.51 (3.52)	6% (–3%, 15%)	0.22	3.67 (1.32)	8% (3%, 14%)	**0.005**
Pharmacy	0.19 (0.12)	–1% (–8%, 6%)	0.77	0.11 (0.06)	19% (10%, 28%)	**<0.0001**
Mass merchandiser	–	–	–	2.67 (1.72)	–6% (–13%, 1%)	0.17
Nontaxed beverages: individual-sized						
Supermarket	0.31 (0.12)	–1% (–7%, 6%)	0.99	0.26 (0.12)	3% (–1%, 7%)	0.30
Pharmacy	0.03 (0.03)	3% (–3%, 10%)	0.57	0.01 (0.01)	9% (2%, 16%)	0.01
Mass merchandiser	–	–	–	0.11 (0.06)	–1% (–10%, 8%)	0.91
Nontaxed beverages: family-sized						
Supermarket	6.20 (3.44)	6% (–3%, 16%)	0.22	3.41 (1.23)	8% (3%, 14%)	**0.005**
Pharmacy	0.16 (0.11)	–2% (–9%, 6%)	0.72	0.10 (0.06)	21% (12%, 30%)	**<0.0001**
Mass merchandiser	–	–	–	2.57 (1.69)	–6% (–14%, 1%)	0.17

Note: Boldface indicates statistical significance (adjusted $p<0.05$).
[a]Mass merchandisers were not analyzed in Philadelphia and Baltimore because there was only 1 mass merchandiser in Baltimore.
[b]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore=0, Philadelphia/PA border ZIP codes=1), and an interaction between them, which represents the difference-in-differences. Percent change was calculated as (exp(difference-in-differences)-1)*100%.
[c]*P*-values controlled for the false discovery rate for 16 comparisons in Philadelphia and 21 in PA border ZIP codes.
[d]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 8. Store-Level Difference-in-Differences in Beverage Volume Sales After Philadelphia Beverage Tax Implementation, Adjusting For Fiscal Quarter

Outcome	Philadelphia vs Baltimore		PA border vs MD border	
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]
Taxed beverages				
All	–50% (–61%, –36%)	**<0.0001**	16% (9%, 24%)	**<0.0001**
Individual-sized	–25% (–32%, –18%)	**<0.0001**	13% (8%, 17%)	**<0.0001**
Family-sized	–53% (–64%, –39%)	**<0.0001**	17% (9%, 25%)	**<0.0001**
Sugar-sweetened	–49% (–60%, –35%)	**<0.0001**	16% (9%, 25%)	**<0.0001**
Artificially-sweetened[c]	–55% (–63%, –44%)	**<0.0001**	–	–
Nontaxed beverages				
All	4% (–3%, 12%)	0.30	0% (–5%, 7%)	0.91
Individual-sized	1% (–4%, 6%)	0.65	2% (–2%, 6%)	0.52
Family-sized	4% (–3%, 12%)	0.30	0% (–6%, 7%)	0.91

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction between them, which represents the difference-in-differences, as well as indicators for fiscal quarter. Percent change was calculated as (exp(difference-in-differences)-1)*100%.

[b]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[c]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 9. Store-Level Difference-in-Differences in Beverage Volume Sales After Philadelphia Beverage Tax Implementation, Excluding December 2016

Outcome	Philadelphia vs Baltimore		PA border vs MD border	
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]
Taxed beverages				
All	–50% (–61%, –37%)	**<0.0001**	16% (9%, 24%)	**<0.0001**
Individual-sized	–26% (–33%, –18%)	**<0.0001**	12% (8%, 17%)	**<0.0001**
Family-sized	–53% (–64%, –39%)	**<0.0001**	16% (9%, 25%)	**<0.0001**
Sugar-sweetened	–49% (–60%, –35%)	**<0.0001**	16% (8%, 24%)	**<0.0001**
Artificially-sweetened[c]	–55% (–63%, –44%)	**<0.0001**	–	–
Nontaxed beverages				
All	5% (–3%, 13%)	0.27	1% (–5%, 7%)	0.82
Individual-sized	1% (–3%, 6%)	0.62	2% (–2%, 5%)	0.53
Family-sized	5% (–3%, 13%)	0.27	1% (–5%, 7%)	0.82

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction between them, which represents the difference-in-differences. Percent change was calculated as (exp(difference-in-differences)-1)*100%. The model also excluded December 2018 to match the pre-tax period.

[b]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[c]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 10. Store-Level Difference-in-Differences in Beverage Volume Sales After Philadelphia Beverage Tax Implementation, by Year

Outcome	Philadelphia vs Baltimore				PA border vs MD border			
	2017 vs 2016		2018 vs 2016		2017 vs 2016		2018 vs 2016	
	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]	Difference-in-differences (95% CI)[a]	Adjusted *p*-value[b]
Taxed beverages								
All	–50% (–59%, –38%)	**<0.0001**	–50% (–61%, –36%)	**<0.0001**	13% (6%, 19%)	**0.0002**	16% (9%, 24%)	**<0.0001**
Individual-sized	–27% (–33%, –21%)	**<0.0001**	–26% (–33%, –18%)	**<0.0001**	10% (6% 14%)	**<0.0001**	13% (8%, 17%)	**<0.0001**
Family-sized	–53% (–63%, –40%)	**<0.0001**	–53% (–64%, –39%)	**<0.0001**	13% (6%, 20%)	**0.0002**	17% (9%, 25%)	**<0.0001**
Sugar-sweetened	–49% (–59%, –37%)	**<0.0001**	–49% (–60%, –35%)	**<0.0001**	14% (7%, 21%)	**0.0001**	17% (9%, 25%)	**<0.0001**
Artificially-sweetened[c]	–53% (–61%, –44%)	**<0.0001**	–55% (–63%, –44%)	**<0.0001**	–	–	–	–
Nontaxed beverages								
All	1% (–4%, 6%)	0.76	4% (–3%, 12%)	0.29	1% (–2%, 5%)	0.45	0% (–5%, 7%)	0.90
Individual-sized	1% (–2%, 4%)	0.76	1% (–4%, 6%)	0.67	2% (–1%, 5%)	0.25	2% (–2%, 6%)	0.50
Family-sized	1% (–4%, 6%)	0.76	4% (–3%, 13%)	0.29	1% (–2%, 5%)	0.45	0% (–6%, 7%)	0.90

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction between them, which represents the difference-in-differences. Percent change was calculated as (exp(difference-in-differences)-1)*100%.

[b]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 7 in PA border ZIP codes.

[c]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 11. City-Level Changes in Beverage Volume Sales Codes 2 Years After Philadelphia Beverage Tax Implementation

Outcome	Mean 2016 volume sales (ounces, millions)	Mean 2018 volume sales (ounces, millions)	Crude percent change	Difference-in-differences (95% CI)[a]	Estimated change in volume sales[b]	Percent change adjusted for cross-border shopping[c]	Percent offset[d]
Total taxed beverages							
Philadelphia	2,318	1,076	–54%	–50% (–61%, –36%)	–1,159	–35%	30%
PA border ZIP codes	2,243	2,461	10%	16% (9%, 24%)	359	–	
Regular soda							
Philadelphia	846.4	394.8	–53%	–50% (–63%, –33%)	–423.2	–27%	46%
PA border ZIP codes	649.8	813.3	25%	30% (16%, 44%)	194.9		
Diet soda							
Philadelphia	210.1	81.1	–61%	–56% (–65%, –46%)	–117.7	–24%	57%
PA border ZIP codes	391.8	421.2	8%	17% (9%, 25%)	66.6		
Fruit drinks							
Philadelphia	506.0	245.7	–51%	–46% (–58%, –31%)	–232.8	–41%	11%
PA border ZIP codes	321.5	328.6	2%	8% (2%, 21%)	25.7		
Coffee drinks							
Philadelphia	30.0	29.7	–1%	–24% (–32%, –16%)	–7.2	–24%	–
PA border ZIP codes	34.3	44.1	29%	–1% (–6%, 4%)	–		
Total nontaxed beverages							
Philadelphia	2,914	3,007	3%	4% (–3%, 12%)	–	–	–
PA border ZIP codes	2,733	2,814	3%	0% (–5%, 7%)	–		
Water							
Philadelphia	1,724.1	1,902.0	10%	6% (–7%, 19%)	–	–	–
PA border ZIP codes	1,245.5	1,367.3	10%	6% (–1%, 14%)	–		
Fruit juice							
Philadelphia	366.5	343.0	–6%	13% (5%, 22%)	47.6	21%	–
PA border ZIP codes	388.9	345.9	–11%	8% (2%, 15%)	31.1		
Sparkling water							
Philadelphia	80.0	99.8	25%	–13% (–29%, 6%)	–	–	–
PA border ZIP codes	103.3	147.9	43%	5% (–3%, 15%)	–		

Note: Boldface indicates statistical significance (adjusted $p<0.05$).
[a]Difference-in-differences are the same estimates as from store-level analyses in Table 3. They are included here so that they can be compared to crude percent changes and percent changes adjusting for cross-border shopping.
[b]Calculated by multiplying the difference-in-differences percent change estimate by pre-tax volume sales. This was done only for beverage types for which there was evidence of increased sales in PA border ZIP codes.
[c]The adjusted percent change in Philadelphia was calculated by summing the change in volume sales in Philadelphia to that in PA border ZIP codes, dividing this by the 2016 total in Philadelphia and multiplying by 100%.
[d]The percent offset represents the percentage of the total decrease in volume sales of taxed beverages in Philadelphia that was offset by increases in volume sales in border ZIP codes. It was calculated as ((DD %change in Philadelphia - adjusted %change in Philadelphia)/DD %change in Philadelphia)*100%. Percent offset was not calculated for coffee drinks because there was no change in coffee drinks sales in PA border stores.

Appendix Table 12. Store-Level Difference-in-Differences in Beverage Volume Sales 2 Years After Philadelphia Beverage Tax Implementation, by Beverage Type

Outcome	Philadelphia vs Baltimore			PA border ZIP codes vs MD border ZIP codes		
	Mean (SD) pre-tax volume sales in Philadelphia (ounces, thousands)[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]	Mean (SD) pre-tax volume sales in PA border (ounces, thousands)[a]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]
Taxed beverages						
Regular soda	374.2 (806.1)	–50% (–63%, –33%)	**<0.0001**	280.8 (425.7)	30% (16%, 44%)	**<0.0001**
Diet soda	92.9 (188.9)	–56% (–65%, –46%)	**<0.0001**	169.3 (248.4)	17% (9%, 25%)	**<0.0001**
Fruit drinks	223.7 (535.5)	–46% (–58%, –31%)	**<0.0001**	138.9 (255.4)	8% (2%, 21%)	**0.02**
Coffee drinks	13.3 (24.0)	–24% (–32%, –16%)	**<0.0001**	14.8 (24.3)	–1% (–6%, 4%)	0.74
Sports drinks[d]	–	–	–	101.5 (158.3)	17% (10%, 24%)	**<0.0001**
Iced tea and lemonade[d]	–	–	–	230.4 (369.0)	11% (6%, 17%)	**<0.0001**
Nontaxed beverages						
Water	757.8 (1670.6)	6% (–7%, 19%)	0.38	538.3 (813.4)	6% (–1%, 14%)	0.12
Milk[e]	319.5 (634.4)	–4% (–10%, 2%)	0.20	–	–	–
Fruit juice	162.0 (365.3)	13% (5%, 22%)	**0.002**	168.1 (278.9)	8% (2%, 15%)	0.63
Sparkling water	35.5 (81.1)	–13% (–29%, 6%)	0.20	44.6 (90.4)	5% (–3%, 15%)	0.30

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]Per 4-week period.

[b]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (Baltimore/MD border ZIP codes=0, Philadelphia/PA border ZIP codes=1), and an interaction between them, which represents the difference-in-differences. Percent change was calculated as (exp(difference-in-differences)-1)*100%.

[c]*P*-values controlled for the false discovery rate for 8 comparisons in Philadelphia and 9 in PA border ZIP codes.

[d]Difference-in-differences not reported for Philadelphia vs Baltimore because of a violation of pre-tax parallel trends.

[e]Difference-in-differences not reported for PA border vs MD border because of a violation of pre-tax parallel trends.

Appendix Table 13. Store-Level Difference-in-Differences in Food and Alcohol Volume Sales in Philadelphia and Control Stores[a] After Philadelphia Beverage Tax Implementation, by Year

Outcome	2017 vs 2016		2018 vs 2016	
	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]	Difference-in-differences (95% CI)[b]	Adjusted *p*-value[c]
Food volume sales (g, millions)				
Candy	–3% (–6%, –1%)	**0.002**	–4% (–8%, –1%)	**0.02**
Sweet snacks	–8% (–10%, –5%)	**<0.0001**	–8% (–12%, –3%)	**0.003**
Salty snacks	–6% (–8%, –3%)	**<0.0001**	–6% (–10%, –1%)	**0.02**
Beverage concentrates (total)	39% (28%, 51%)	**<0.0001**	34% (19%, 51%)	**<0.0001**
Sweetened beverage replacements[e]	36% (24%, 49%)	**<0.0001**	32% (16%, 49%)	**<0.0001**
Other foods	–6% (–9%, –3%)	**0.0002**	–8% (–12%, –3%)	**0.02**
Alcohol sales (ml, thousands)				
Wine	2% (–2%, 6%)	0.31	7% (1%, 14%)	**0.03**
Spirits	–2% (–5%, 1%)	0.17	–2% (–6%, 4%)	0.56

Note: Boldface indicates statistical significance (adjusted $p<0.05$).

[a]The control location was Baltimore for food volume sales and PA non-border ZIP codes for alcohol sales.

[b]A generalized estimating equation with a log link and gamma distribution was used with indicator variables for intervention time (pre-intervention=0, post-intervention=1), city (control=0, Philadelphia=1), and an interaction between them, which represents the difference-in-differences. Percent change was calculated as (exp(difference-in-differences)-1)*100%.

[c]*P*-values controlled for the false discovery rate for 5 comparisons for food volume sales (the number of food categories tested within each year) and 2 comparisons for alcohol sales (the number of alcohol categories).

[d]Excludes coffee, tea, and milk mixes.