SUPPLEMENTARY ONLINE CONTENT

Supplement to: "Effect of tobacco sales bans on retail sales in Beverly Hills and Manhattan Beach, California, USA: A synthetic difference-in-differences analysis"

List of Supplemental Methods, Tables, and Figures

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Supplemental Methods

Data

In our primary cross-border estimates, we define the border area to encompass a commuting area within a 30-minute drive, which is similar to the average commuting times for Beverly Hills (24.5 minutes) and Manhattan Beach (28.9 minutes) based on 2023 ACS five-year estimates. The commuting area was identified using Geoapify's Isoline application program interface (API) from commutetimemap.com.[1] Location, mode of transport, and maximum travel time are input into the API to create isochrone maps that reflect areas that can be reached in equal time, incorporating traffic conditions. We used driving as the mode of transport as it likely represents the most common means of commuting. This approach is similar to one used by Goli and colleagues to study the effect of a menthol ban in Massachusetts on cross-state shopping.[2]

In sensitivity analyses, border areas were created using the ZIP codes contiguous with Beverly Hills and Manhattan Beach (**Figure S1**). The border area for Beverly Hills was comprised of the ZIP codes 90024, 90035, 90046, 90048, 91423, 91604, and 90069, which included 15 stores. The border area for Manhattan Beach was comprised of 90245, 90250, 90254, 90261, and 90278, which also included 15 stores. For cities with at least one ZIP code classified as a border area, stores in the remaining non-bordering ZIP codes contributed data to the potential pool of control units along with all California stores that were not part of a border area.

Analysis

Synthetic difference-in-differences (SDID) is a recently developed statistical method that combines elements of difference-in-differences (DID) and synthetic control (SC) approaches.[3] The SDID

estimator provides a weighted two-way fixed effects model, thereby extending the standard DID approach. The equation takes the following form:

$$\left(\hat{\tau}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}\right) = \underset{\tau,\mu,\alpha,\beta}{\arg\min}\left\{\sum_{i=1}^{N}\sum_{t=1}^{T}(Y_{it} - \mu - \alpha_i - \beta_t - D_{it}\tau)^2 \hat{\omega}_i^{sdid}\hat{\lambda}_t^{sdid}\right\} \qquad (1)$$

where Y_{it} denotes the outcome and D_{it} denotes a binary exposure to the tobacco sales ban policy for unit i at time t. The two-way fixed effect regression includes fixed effects for each unit α_i and each time period β_t, as in a standard DID model. However, the model also includes unit-specific weights $\hat{\omega}_i^{sdid}$ similar to SC to construct a control group that matches the pre-policy trends in outcomes (and covariates) for the treated group. Unlike SC, SDID includes the unit fixed effects that adjust for differences in pre-policy trends and only needs to satisfy the parallel trends assumption for identification. The optimally generated unit weights are fixed over time, and assign zero weight to certain control units and larger weights to more "similar" donor pool units. Unlike SC methods, SDID also includes a second set of time-specific weights $\widehat{\lambda_t^{sdid}}$ to balance post- and pre-policy outcomes for the control group. This provides an improved counterfactual trend, and both sets of weights make it easier to satisfy the parallel trends assumption. Under this assumption, τ represents the estimated average treatment effect on the treated (ATT). The SDID approach has been shown to produce less biased and more precise estimates than both the DID and SC methods under similar empirical settings.[3]

Arkhangelsky and colleagues proposed three different options for conducting statistical inference using the SDID estimator: clustered bootstrap, jackknife, and placebo inference.[3] All three inference options are available in the user-generated -sdid- package in Stata we used for estimation.[4] Bootstrap inference is a resampling approach that involves performing the analysis on multiple samples of the data, consisting of a subset of treated and control units, to create a vector of the treatment effect from which the variance is calculated. In the jackknife approach, which is less

computationally intensive, one observation is omitted from each analysis iteration. The bootstrap and jackknife approaches are infeasible with a single treated unit, including with block assignment when multiple units (stores) are treated at the same time, as in our data. Thus, we used placebo inference. In this approach, the treated unit is omitted, and controls are randomly assigned the same treatment structure as the treated units. We replicated this process 100 times to calculate the variance of the resultant treatment effect vector.

We estimated SDID event studies following the approach suggested in Ciccia (2024).[5] This produces period-by-period estimates of the policy's effect, i.e., the difference in outcomes between the treated group and its synthetic control.

References

1. Geoapify. Isoline API Playground 2025 [Available from: https://commutetimemap.com accessed April 15, 2025

2. Goli A, Mummalaneni S, Chintagunta PK. Making a Smooth Exit? Menthol Bans and Cigarette Sales in Massachusetts. *Marketing Science* 2024;43(3):564-89. doi: 10.1287/mksc.2022.0361

3. Arkhangelsky D, Athey S, Hirshberg DA, et al. Synthetic Difference-in-Differences. *Am Econ Rev* 2021;111(12):4088-118. doi: 10.1257/aer.20190159

4. Clarke D, Pailañir D, Athey S, et al. On synthetic difference-in-differences and related estimation methods in Stata. *The Stata Journal* 2024;24(4):557-98. doi: 10.1177/1536867x241297914

5. Ciccia D. A Short Note on Event-Study Synthetic Difference-in-Differences Estimators. *arXiv preprint arXiv:240709565* 2024

Table S1. Descriptive information about unit-specific weights in synthetic difference-in-differences estimation

	"Synthetic" Beverly Hills	"Synthetic" Manhattan Beach
No. (%) stores contributing:		
Positive weight	1,284 (85.4%)	2,189 (99.8%)
Zero weight	220 (14.6%)	5 (0.2%)
No. (%) positively weighted stores, by store type		
Grocery	898 (87.5%)	874 (99.9%)
Drug	386 (80.8%)	0
Convenience	0	1315 (99.7%)
Top weights assigned to a store (its city)		
1	6.2% (Roseville)	3.1% (Imperial)
2	2.9% (Pittsburg)	2.7% (Paso Robles)
3	2.9% (Palm Springs)	2.6% (Menlo Park)
4	2.1% (Visalia)	1.9% (Stockton)
5	2.0% (Long Beach)	1.8% (Ventura)
No. cities with positively weighted stores	351	353
No. ZIP codes with positively weighted stores	635	714

Note: This table shows descriptive information regarding the unit-specific weights assigned to control cities in constructing the synthetic control for each treated city for estimation of the SDID model of all tobacco sales.

Table S2. Pre-ban differences in all tobacco sales between the treated group and its synthetic control by quarter (coefficients from SDID event study)

Coefficients	Beverly Hills	Manhattan Beach	Beverly Hills border	Manhattan Beach border
t-1	0.6	-2.9	0.2	-0.1
	(-1.8, 2.9)	(-3.8, -1.9)	(-0.3, 0.7)	(-0.6, 0.4)
	[0.623]	[0.000]	[0.454]	[0.774]
t-2	4.7	1.8	0.2	-0.5
	(-3.2, 12.6)	(-1.5, 5.1)	(-1.3, 1.7)	(-2.0, 1.0)
	[0.247]	[0.286]	[0.813]	[0.512]
t-3	-1.6	2.6	-2.4	1.0
	(-10.5, 7.3)	(-0.6, 5.8)	(-4.2, -0.6)	(-0.4, 2.5)
	[0.726]	[0.109]	[0.008]	[0.170]
t-4	-8.5	-0.2	-0.6	0.4
	(-17.9, 0.8)	(-3.8, 3.4)	(-2.0, 0.8)	(-1.3, 2.1)
	[0.074]	[0.916]	[0.406]	[0.629]
t-5	-3.8	18.1	-1.4	0.8
	(-12.3, 4.8)	(14.8, 21.4)	(-3.1, 0.3)	(-1.0, 2.6)
	[0.387]	[0.000]	[0.100]	[0.399]
t-6	-5.2	8.4	0.6	2.1
	(-15.7, 5.2)	(5.0, 11.8)	(-1.2, 2.3)	(0.4, 3.8)
	[0.325]	[0.000]	[0.543]	[0.017]
t-7	16.0	7.7	1.9	0.7
	(7.2, 24.8)	(4.9, 10.5)	(0.4, 3.5)	(-1.1, 2.4)
	[0.000]	[0.000]	[0.014]	[0.452]
t-8	-5.3	6.8	-0.6	1.3
	(-14.3, 3.6)	(4.5, 9.1)	(-2.3, 1.1)	(-0.2, 2.8)
	[0.243]	[0.000]	[0.489]	[0.084]
t-9	10.4	4.8	-3.2	-0.0
	(0.9, 20.0)	(2.0, 7.6)	(-5.1, -1.4)	(-1.8, 1.8)
	[0.032]	[0.001]	[0.001]	[0.983]
t-10	7.4	3.5	-3.6	0.3
	(-2.8, 17.6)	(0.4, 6.6)	(-5.3, -2.0)	(-1.2, 1.8)
	[0.154]	[0.028]	[0.000]	[0.675]
t-11	5.1	8.3	-1.9	0.3
	(-4.8, 14.9)	(5.4, 11.3)	(-3.6, -0.3)	(-1.5, 2.1)
	[0.311]	[0.000]	[0.023]	[0.735]
No. observations	24,396	41,591	52,535	54,321
Mean outcome	285.86	776.37	532.94	534.26
Diagnostics of pre-ban fit				
RMSPE (% of pre-ban mean)	7.46	7.56	1.91	0.88
RMSPE (in pre-ban SDs)	0.117	0.102	0.024	0.012

Note: This table shows pre-ban coefficients with 95% CIs in parentheses and p-values in brackets from the SDID event study, denoting the difference in unit sales of all tobacco products between the treated group and its synthetic control by quarter. Mean outcome = mean outcome variable of the treated group during the pre-policy period. RMSPE (% of pre-ban mean) = root mean squared prediction error (RMSPE) as a % of the mean outcome in the treated group pre-ban. RMSPE (in pre-ban SDs) = RMSPE standardized by the pre-ban standard deviation for the outcome.

Table S3. Effect of tobacco sales bans on store-level quarterly dollar sales, in thousands, of tobacco products following the tobacco sales ban effective date

		By product category			
	All Tobacco	Cigarettes	Cigars	SLT	ENDS
A. Beverly Hills					
ATT	-2048.9***	-1786.3***	-405.0***	-40.5	12.6
	(-2952.8, -1145.0)	(-2283.4, -1289.2)	(-594.9, -215.1)	(-431.0, 350.0)	(-56.6, 81.9)
No. obs.	24,434	23,845	16,378	13,699	7,999
Mean outcome	2791.65	1990.14	538.74	77.21	202.86
ATT as % change	-73.4	-89.8	-75.2	-52.5	6.2
	[-105.8, -41.0]	[-114.7, -64.8]	[-110.4, -39.9]	[-558.2, 453.3]	[-27.9, 40.4]
B. Manhattan Beach					
ATT	-4297.8***	-1787.5***	-296.6	-2988.2***	22.1
	(-6208.4, -2387.3)	(-2732.2, -842.8)	(-692.4, 99.3)	(-4344.3, -1632.2)	(-220.1, 264.4)
No. obs.	41,686	41,097	33,972	31,312	34,618
Mean outcome	6800.26	2003.22	250.86	4876.66	695.01
ATT as % change	-63.2	-89.2	-118.2	-61.3	3.2
	[-91.3, -35.1]	[-136.4, -42.1]	[-276.0, 39.6]	[-89.1, -33.5]	[-31.7, 38.0]
C. Beverly Hills commuting border					
ATT	-479.6***	-91.8	17.9	-401.3***	-24.4
	(-717.8, -241.5)	(-262.1, 78.4)	(-46.8, 82.6)	(-590.8, -211.9)	(-61.7, 13.0)
No. obs.	57,323	56,715	48,925	45,809	49,685
Mean outcome	3855.33	1997.92	340.08	826.86	850.63
ATT as % change	-12.4	-4.6	5.3	-48.5	-2.9
	[-18.6, -6.3]	[-13.1, 3.9]	[-13.7, 24.3]	[-71.4, -25.6]	[-7.3, 1.5]
D. Manhattan Beach commuting border					
ATT	-380.2***	-80.5	17.0	-335.1***	-21.8
	(-601.0, -159.4)	(-240.7, 79.7)	(-42.7, 76.7)	(-523.7, -146.5)	(-57.5, 13.8)
No. obs.	58,235	57,627	49,476	46,379	50,426
Mean outcome	3688.98	1990.99	375.66	917.08	644.56
ATT as % change	-10.3	-4.0	4.5	-36.5	-3.4
	[-16.3, -4.3]	[-12.1, 4.0]	[-11.4, 20.4]	[-57.1, -16.0]	[-8.9, 2.1]
E. Beverly Hills border					
ATT	-462.2***	-89.2	17.1	-383.6***	-21.7
	(-732.7, -191.7]	(-274.2, 95.8)	(-41.2, 75.4)	(-578.7, -188.6)	(-55.6, 12.3)
No. obs.	60,021	59,413	51,243	47,975	52,193
Mean outcome	3855.33	1997.92	340.08	826.86	850.63
ATT as % change	-12.0	-4.5	5.0	-46.4	-2.5
	[-19.0, -5.0]	[-13.7, 4.8]	[-12.1, 22.2]	[-70.0, -22.8]	[-6.5, 1.4]
F. Manhattan Beach border					
ATT	-347.7***	-77.4	16.5	-321.6***	-11.5
	(-607.9, -87.5)	(-229.3, 74.5)	(-46.2, 79.1)	(-497.9, -145.2)	(-52.0, 29.1)
No. obs.	60,021	59,413	51,205	47,975	52,193
Mean outcome	3688.98	1990.99	375.66	917.08	644.56
ATT as % change	-9.4	-3.9	4.4	-35.1	-1.8
	[-16.5, -2.4]	[-11.5, 3.7]	[-12.3, 21.1]	[-54.3, -15.8]	[-8.1, 4.5]

Note: This table shows changes in total dollar sales, in thousands, for each product category following local tobacco sales bans going into effect, based on synthetic difference-in-differences estimates. 95% confidence intervals, derived from permutation-based inference, are provided in parentheses. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores. Stores used in creating the synthetic controls for Beverly Hills were restricted to the channels present in Beverly Hills: grocery and drug stores. Stores used in creating the synthetic controls for Manhattan Beach were restricted to the channels present in Manhattan Beach: grocery and convenient stores. ATT = average treatment effect on the treated. CI = confidence interval. Mean outcome = mean outcome variable of the treated group during the pre-policy period. ATT as % change = the ATT expressed as a percent change relative to the mean baseline outcome variable, and its 95% CI is in brackets. SLT = smokeless tobacco. Significance: * p<0.10 ** p<0.05 *** p<0.01

Table S4. Leave-one-out analysis of the policy effects on all tobacco sales, sequentially omitting cities

		Leave-one-out estimates			
	Base ATT	Mean ATT	Minimum ATT	Maximum ATT	Δ ATT Mean (SD)
Beverly Hills	-127.93	-127.93	-129.43	-126.08	-0.005 (0.209)
Manhattan Beach	-496.15	-496.12	-500.25	-490.66	0.032 (0.798)
Beverly Hills border	-17.05	-17.04	-18.51	-15.74	0.009 (0.209)
Manhattan Beach border	-20.02	-20.02	-21.09	-19.03	0.009 (0.164)

Note: This table shows the results from a leave-one-out analysis, dropped each donor city sequentially to produce a new ATT estimate. ATT = average treatment effect on the treated, in unit sales. Base ATT = the ATT from the primary analysis. Mean ATT = the mean ATT from the leave-one-out analysis. Minimum ATT = the minimum ATT from dropping one of the donor cities in the leave-one-out analysis. Maximum ATT = the maximum ATT after dropping one of the donor cities in the leave-one-out analysis. Δ ATT = the difference between the base ATT and the mean leave-one-out

Table S5. Effect of tobacco sales bans on store-level quarterly unit sales in adjacent border areas, by tobacco product category

		Unit sales by product category			
	All Tobacco	Cigarettes	Cigars	SLT	ENDS
A. Beverly Hills adjacent border					
ATT	37.3	-3.2	3.0	24.8	27.0***
	(-39.0, 113.6)	(-31.0, 24.6)	(-22.6, 28.6)	(-27.4, 76.9)	(12.1, 41.9)
No. obs.	60,021	59,413	51,243	47,975	40,926
Mean outcome	547.74	273.41	114.12	121.22	60.58
ATT as % change	6.8	-1.2	2.6	20.4	44.6
	[-7.1, 20.7)	[-11.3, 9.0)	[-19.8, 25.1)	[-22.6, 63.5)	[20.0, 69.1)
B. Manhattan Beach adjacent border					
ATT	-43.8	-1.0	-0.2	-30.3	-16.0**
	(-119.9, 32.4)	(-28.8, 26.9)	(-26.9, 26.4)	(-82.5, 21.8)	(-30.8, -1.1)
No. obs.	60,021	59,413	51,205	47,975	40,945
Mean outcome	627.39	277.93	157.36	177.01	64.80
ATT as % change	-7.0	-0.3	-0.1	-17.1	-24.6
	[-19.1, 5.2)	[-10.4, 9.7)	[-17.1, 16.8)	[-46.6, 12.3)	[-47.6, -1.7)

Table S6. Effect of tobacco sales bans on dollar sales of non-tobacco products in treated and border areas, overall and by store type

	All stores	Convenience stores	Drug stores	Grocery stores
A. Beverly Hills				
ATT	160		110***	216
	[-125, 444)		(67, 154)	(-246, 678)
ATT as % change	10.2		7.5	13.1
	[-8.0, 28.5]		[4.5, 10.4]	[-15.0, 41.2]
B. Manhattan Beach				
ATT	-41	-15**		-176
	(-186, 104)	(-27, -3)		(-633, 281)
ATT as % change	-12.4	-18.7		-13.2
	[-56.2, 31.4]	[-33.8, -3.6]		[-47.3, 21.0]
C. Beverly Hills commuting border				
ATT	-5	-3**	-14***	3
	(-27, 16)	(-5, -0)	(-22, -5)	(-45, 51)
ATT as % change	-0.6	-4.2	-2.8	0.1
	[-2.9, 1.8]	[-8.1, -0.3]	[-4.5, -1.1]	[-1.9, 2.1]
D. Manhattan Beach commuting border				
ATT	9	-3**	-14***	32
	(-10, 28)	(-5, -1)	(-22, -7)	(-11, 75)
ATT as % change	1.0	-4.5	-3.3	1.4
	[-1.2, 3.1]	[-7.9, -1.0]	[-5.0, -1.6]	[-0.5, 3.3]
E. Beverly Hills adjacent border				
ATT	-39	-9*	-7	-103
	(-127, 49]	(-21, 2)	(-36, 22)	(-355, 149)
ATT as % change	-3.4	-9.1	-0.9	-3.5
	[-11.1, 4.2]	[-19.9, 1.6]	[-4.3, 2.6]	[-12.0, 5.0]
F. Manhattan Beach adjacent border				
ATT	-47	-8*	-7	-148
	(-135, 42)	(-18, 1)	(-43, 28)	(-443, 146)
ATT as % change	-5.7	-11.6	-1.3	-5.0
	[-16.5, 5.1]	[-25.1, 1.9]	[-7.8, 5.1]	[-14.8, 4.9]

Note: This table shows estimates from synthetic difference-in-differences models of the change in total dollar sales per store, in thousands, overall and for each store type. 95% confidence intervals, derived from permutation-based inference, are provided in parentheses. The commuting border area comprises areas within a 30-minute drive of the treated city, and the adjacent border area comprises adjacent ZIP codes to the treated city. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores. ATT = average treatment effect on the treated. CI = confidence interval. Mean outcome = mean outcome variable of the treated group during the pre-policy period. ATT as % change = the ATT expressed as a percent change relative to the mean baseline outcome variable, and its 95% CI is in brackets. SLT = smokeless tobacco. Significance: * p<0.10 ** p<0.05 *** p<0.01

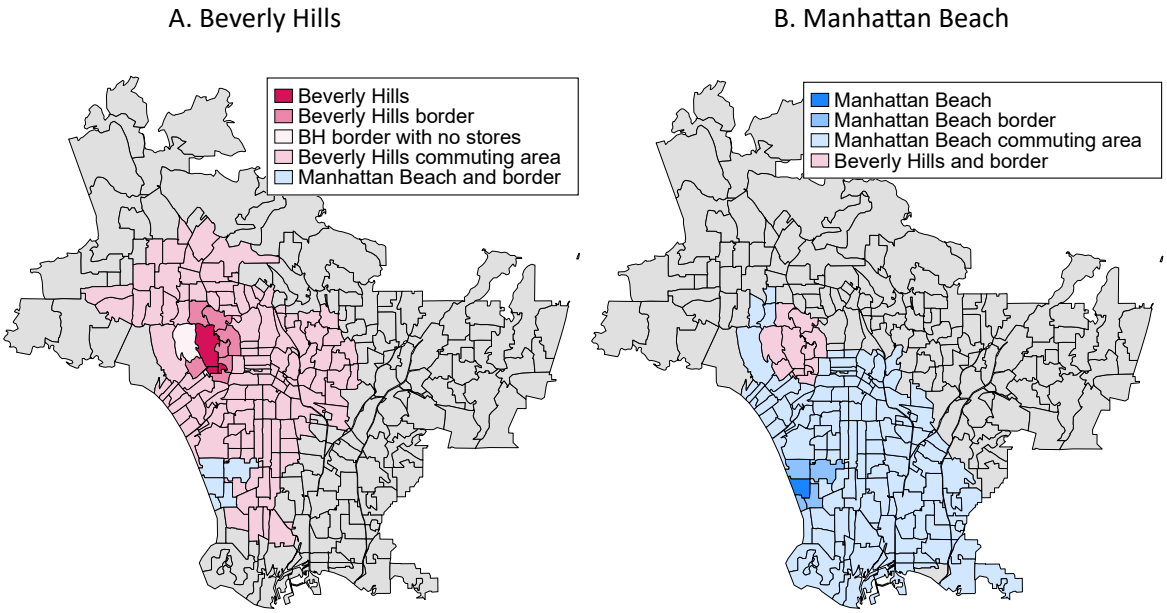
Table S7. Effect of tobacco sales bans on dollar sales of non-tobacco products in treated and border areas, by store department

	Beverly Hills	Manhattan Beach	Beverly Hills border	Manhattan Beach border
Total non-tobacco sales				
ATT	150	-43	-5	9
	(-106, 405)	(-186, 100)	(-27, 16)	(-10, 28)
ATT as % change	28,956	42,104	57,437	58,653
	1,561	330	916	891
Sales by store department				
Baby care				
ATT	0	0	0	0
	(-5, 5)	(-8, 8)	(-1, 0)	(-0, 1)
ATT as % change	-2.0	-1.9	-2.2	1.3
	[-32.6, 28.6]	[-113.8, 110.0]	[-6.8, 2.3]	[-2.5, 5.2]
Bakery				
ATT	6	0	0	0
	(-6, 18)	(-5, 5)	(-1, 1)	(-0, 1)
ATT as % change	25.1	-7.7	-0.6	2.5
	[-24.5, 74.6]	[-166.9, 151.5]	[-5.8, 4.6]	[-2.6, 7.5]
Dairy				
ATT	22	-4	-2	2
	(-32, 76)	(-32, 25)	(-7, 2)	(-2, 7)
ATT as % change	16.0	-7.7	-1.5	1.7
	[-23.2, 55.3]	[-67.0, 51.7]	[-4.7, 1.7]	[-1.4, 4.8]
Deli				
ATT	11	-6	-1	1
	(-15, 38)	(-19, 7)	(-3, 1)	(-1, 3)
ATT as % change	23.1	-39.6	-3.3	3.0
	[-31.7, 77.9]	[-121.5, 42.2]	[-9.3, 2.8]	[-2.7, 8.8]
Frozen				
ATT	11	-4	1	3*
	(-31, 53)	(-27, 19)	(-2, 4)	(-0, 6)
ATT as % change	13.7	-16.0	1.2	3.4
	[-39.4, 66.8]	[-107.4, 75.5]	[-2.8, 5.1]	[-0.1, 7.0]
General merchandise				
ATT	-4	-1	0	0*
	(-12, 5)	(-6, 3)	(-0, 1)	(-0, 1)
ATT as % change	-7.9	-22.3	0.5	2.4
	[-25.3, 9.6]	[-93.7, 49.1]	[-2.3, 3.2]	[-0.2, 4.9]
Grocery				
ATT	42	-25	1	4
	(-84, 167)	(-88, 39)	(-9, 10)	(-4, 12)
ATT as % change	9.2	-15.6	0.2	1.1
	[-18.3, 36.7]	[-55.2, 24.0]	[-2.3, 2.7]	[-1.1, 3.2]
Health & beauty care				
ATT	44***	1	-3***	-2**
	(23, 64)	(-7, 8)	(-4, -1)	(-3, -0)
ATT as % change	8.2	4.5	-2.9	-2.2

	[4.4, 12.0]	[-42.7, 51.6]	[-4.8, -1.1]	[-4.0, -0.4]
Household care				
ATT	3	1	-1	1
	(-21, 27)	(-18, 20)	(-3, 2)	(-1, 3)
ATT as % change	2.5	4.1	-0.6	1.3
	[-17.2, 22.1]	[-66.4, 74.6]	[-2.7, 1.4]	[-0.8, 3.4]
Meat				
ATT	-2	-16	0	1
	(-27, 24)	(-45, 14)	(-3, 4)	(-2, 5)
ATT as % change	-5.8	-25.4	0.5	1.8
	[-83.0, 71.5]	[-74.0, 23.1]	[-4.3, 5.2]	[-2.2, 5.8]
Produce				
ATT	-3	-24	-5	0
	(-58, 53)	(-70, 22)	(-12, 2)	(-5, 6)
ATT as % change	-1.7	-18.8	-3.1	0.2
	[-38.7, 35.4]	[-54.8, 17.3]	[-7.4, 1.2]	[-4.0, 4.4]
Seafood				
ATT	2	-1	0	0
	(-1, 4)	(-3, 2)	(-0, 0)	(-0, 0)
ATT as % change	23.4	-25.0	2.5	3.3
	[-14.0, 60.8]	[-133.9, 83.8]	[-3.8, 8.9]	[-4.9, 11.4]

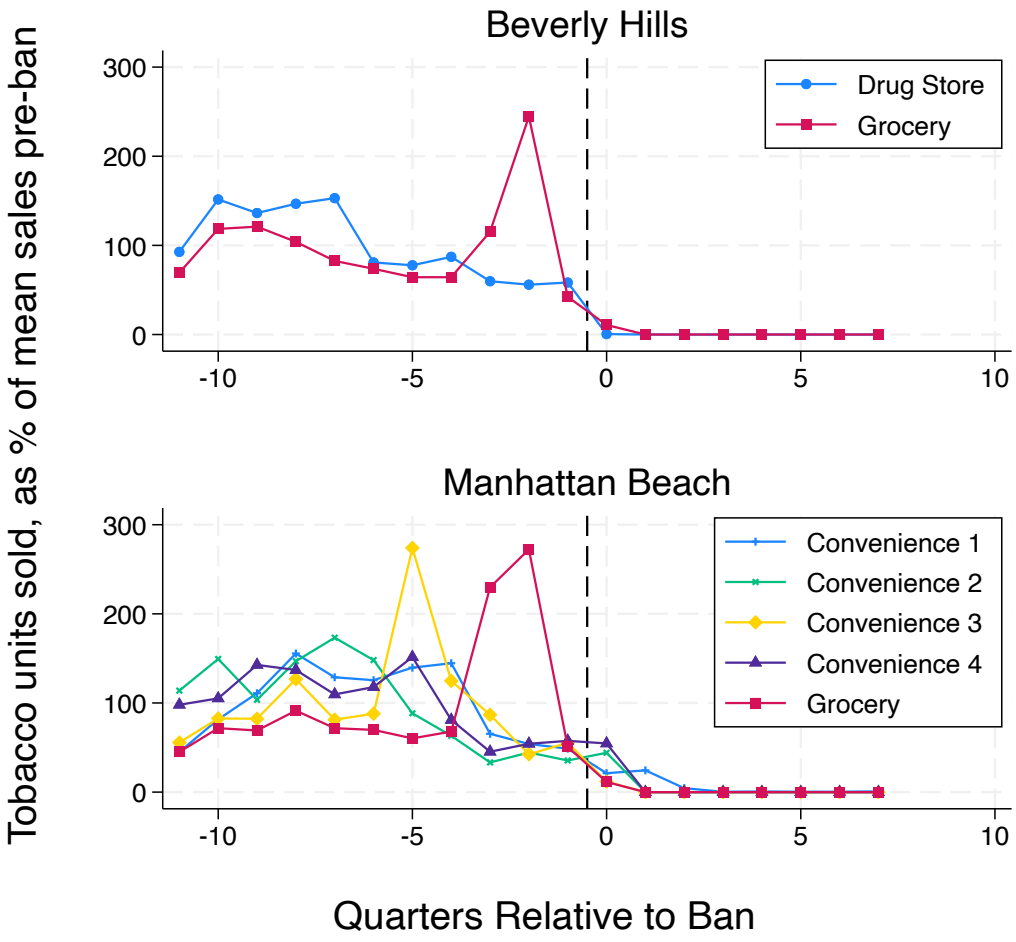
Note: This table shows estimates from synthetic difference-in-differences models of the change in total dollar sales per store, measured in thousands, for each store department. 95% confidence intervals, derived from permutation-based inference, are provided in parentheses. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores. ATT = average treatment effect on the treated. CI = confidence interval. Mean outcome = mean outcome variable of the treated group during the pre-policy period. ATT as % change = the ATT expressed as a percent change relative to the mean baseline outcome variable, and its 95% CI is in brackets. SLT = smokeless tobacco. Significance: * p<0.10 ** p<0.05 *** p<0.01

Figure S1. Map of Beverly Hills, Manhattan Beach, and their border areas



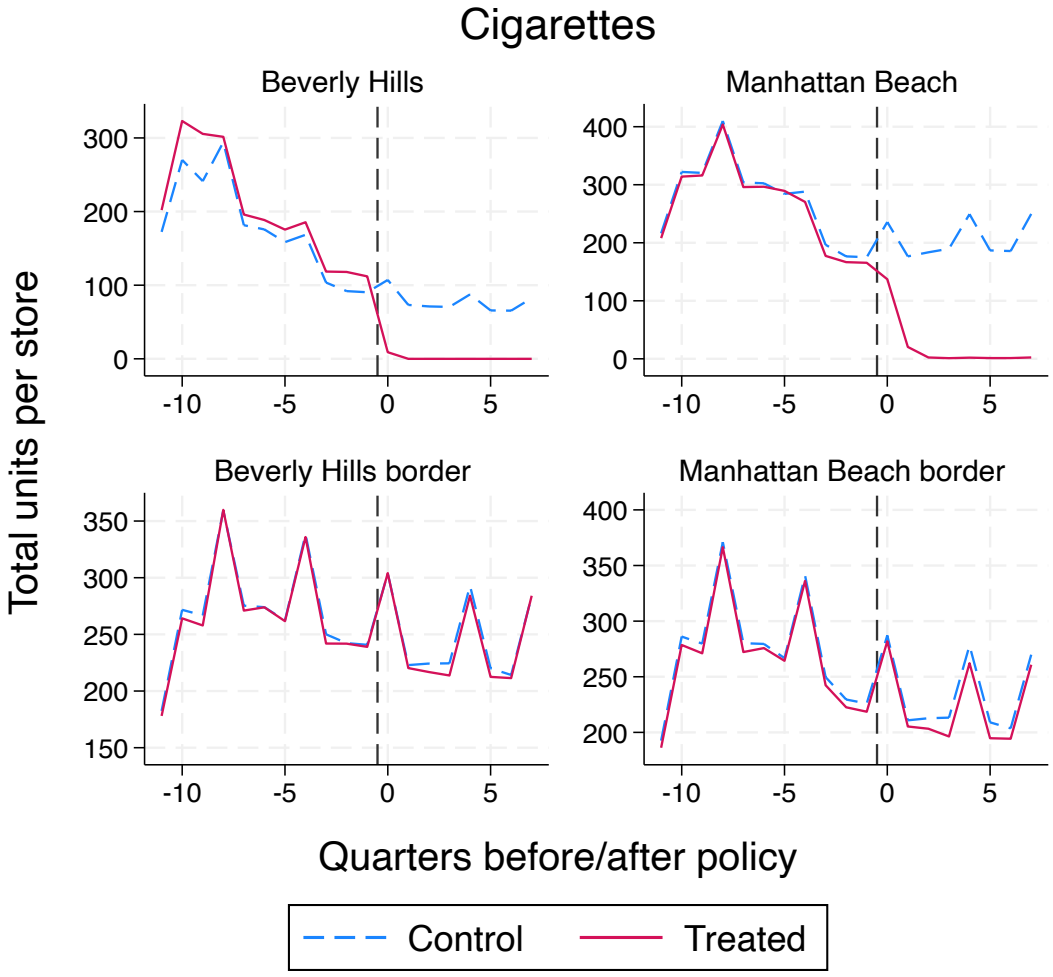
Note: This figure shows a map of the geographic area included in the city proper, adjacent border, and commuting area for Beverly Hills (A) and Manhattan Beach (B). Two Beverly Hills border ZIP codes, shown in light pink, did not have any sample stores located within them. Gray areas represent five-digit ZIP codes in Los Angeles County or Orange County. The control group included ZIP codes in all of California, which are not shown in the map.

Figure S2. Quarterly tobacco unit sales over time as a percent of pre-ban mean sales



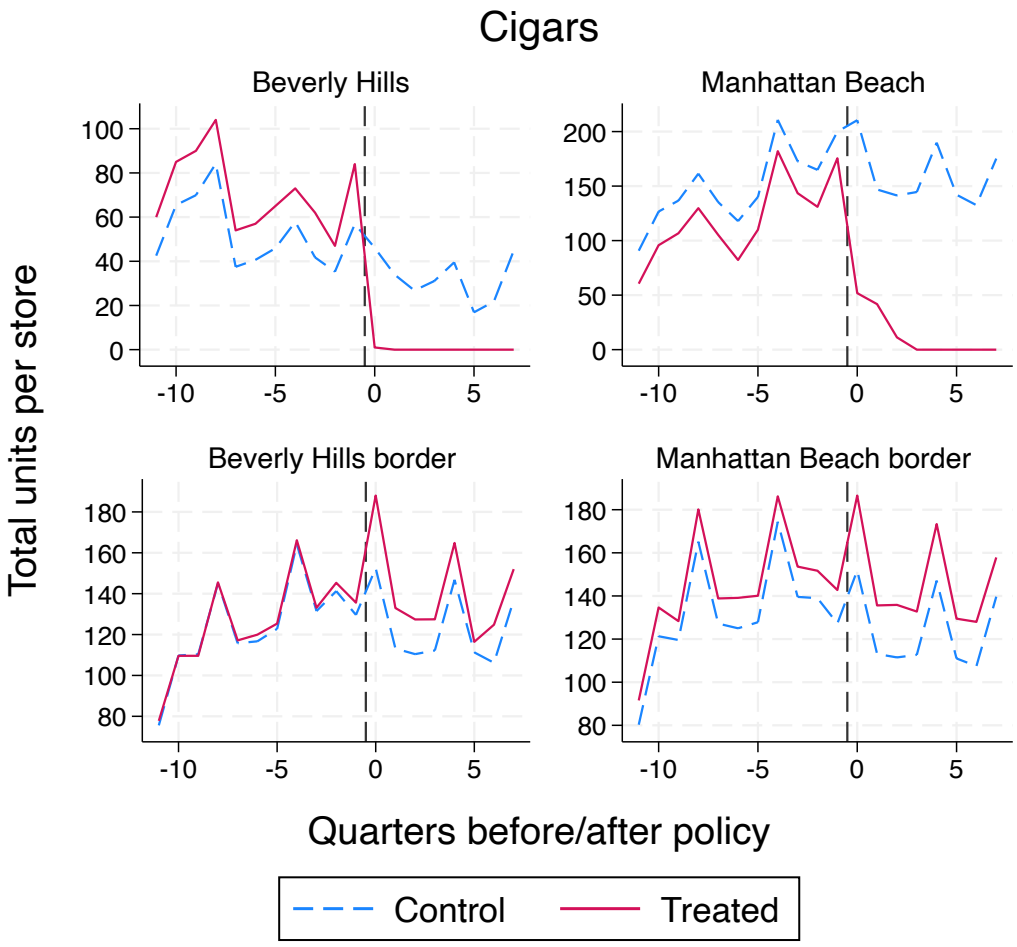
Note: This figure shows mean quarterly unit sales of all tobacco products in a sample of convenience, drug, and grocery stores in Beverly Hills (top) and Manhattan Beach (bottom). Sales are expressed as a percent of mean tobacco units sold during the pre-ban period.

Figure S3. Trends in unit sales of cigarettes between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans



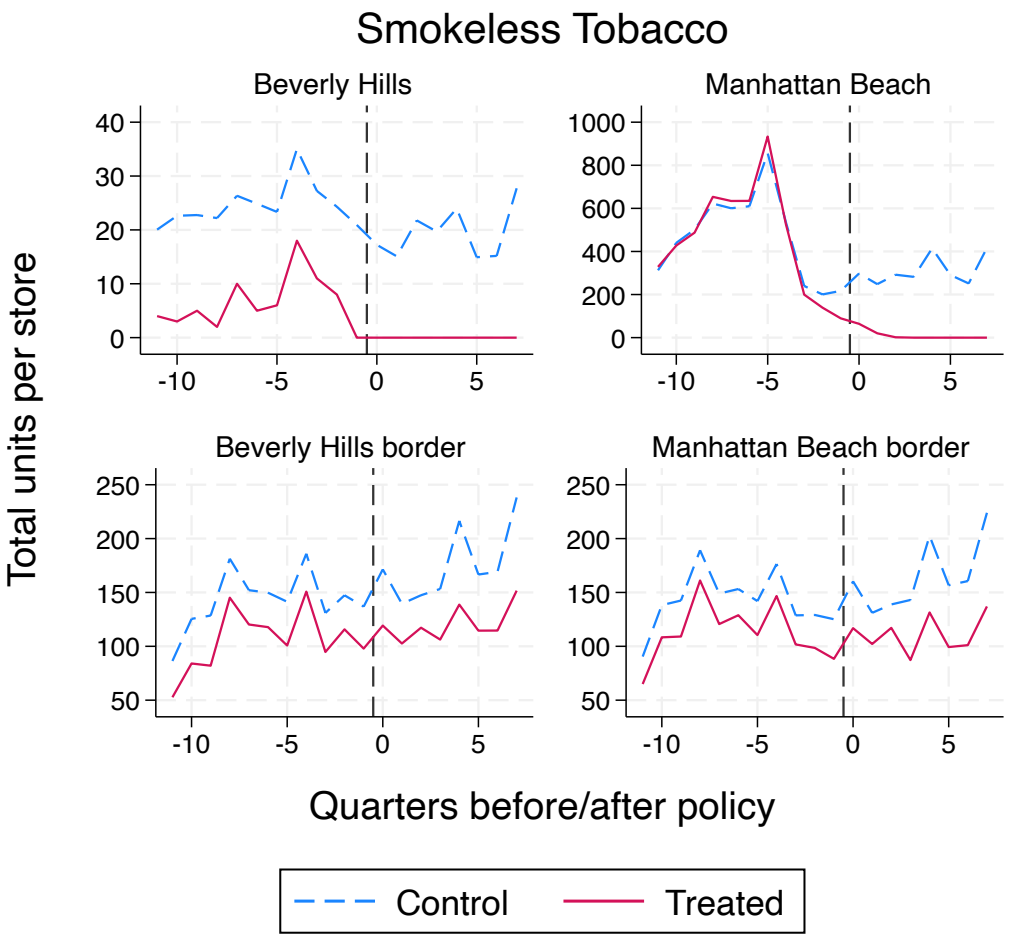
Note: This figure shows trends over time in quarterly total unit sales of cigarettes per store for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S4. Trends in unit sales of cigars between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans



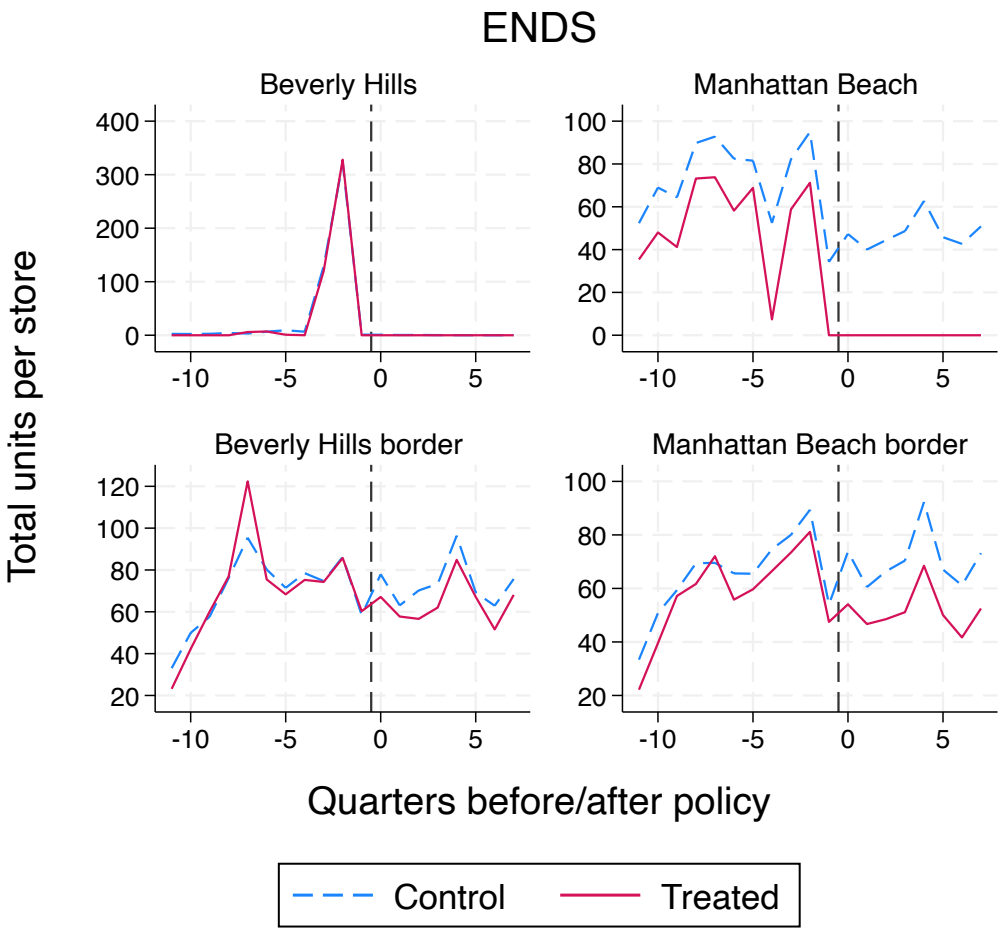
Note: This figure shows trends over time in quarterly total unit sales of cigars per store for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S5. Trends in unit sales of smokeless tobacco products between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans



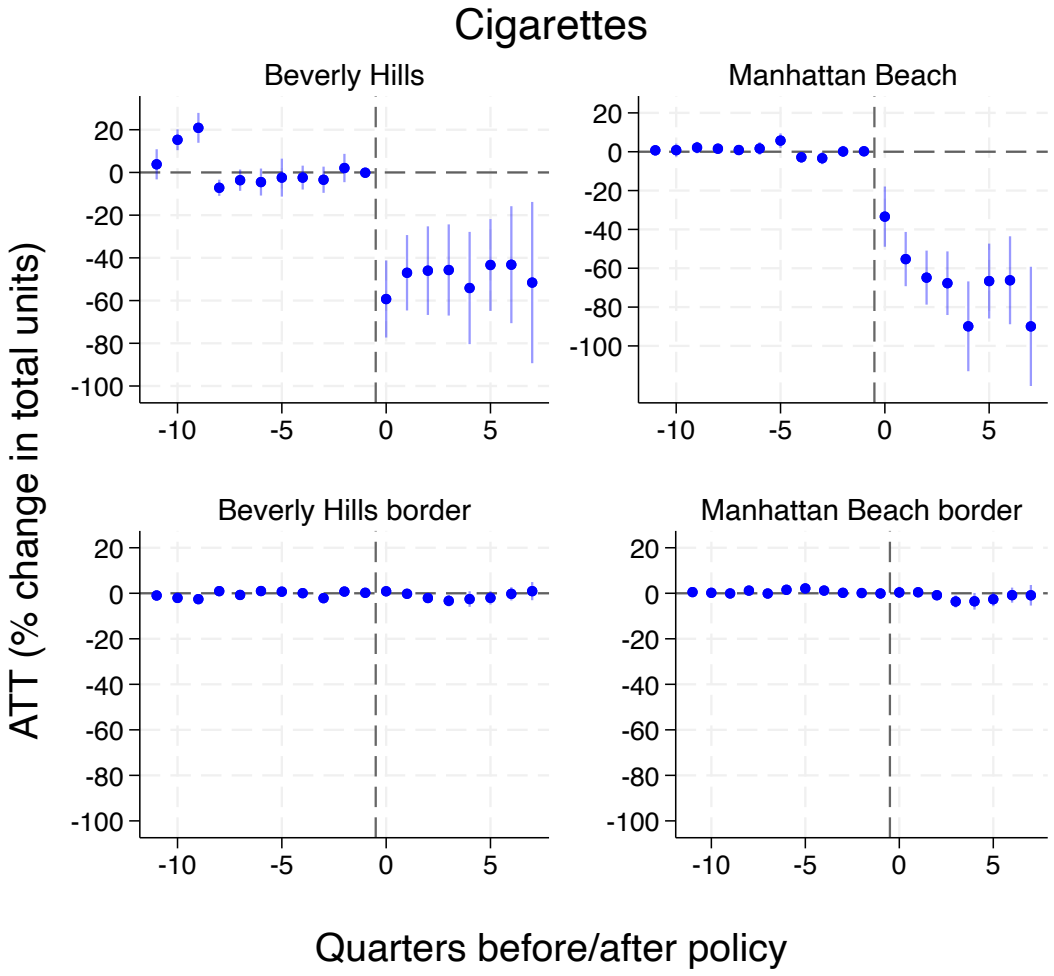
Note: This figure shows trends over time in total unit sales of smokeless tobacco products per store for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S6. Trends in unit sales of ENDS products between treated and border areas with their synthetic controls before and the effective date of local tobacco sales bans



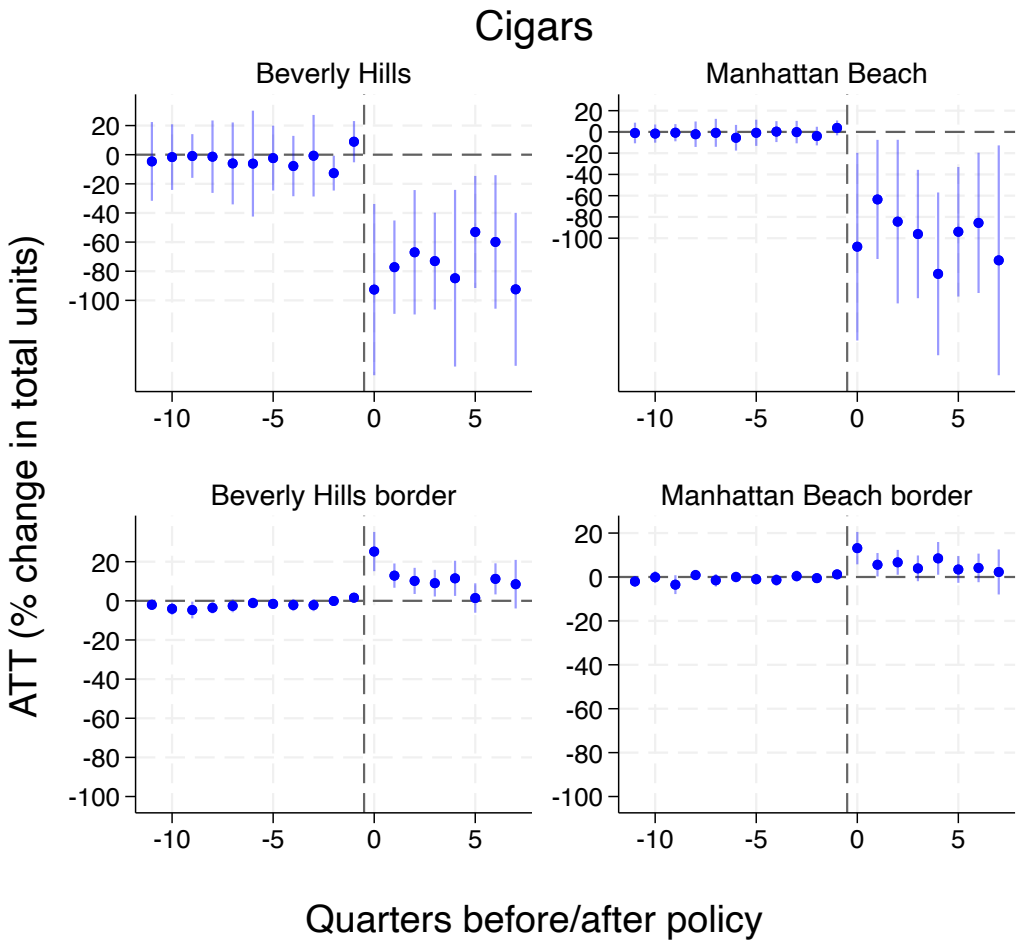
Note: This figure shows trends over time in total unit sales of ENDS per store for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S7. Change over time in the effects of local tobacco sales bans on the sale of cigarettes in treated and border areas



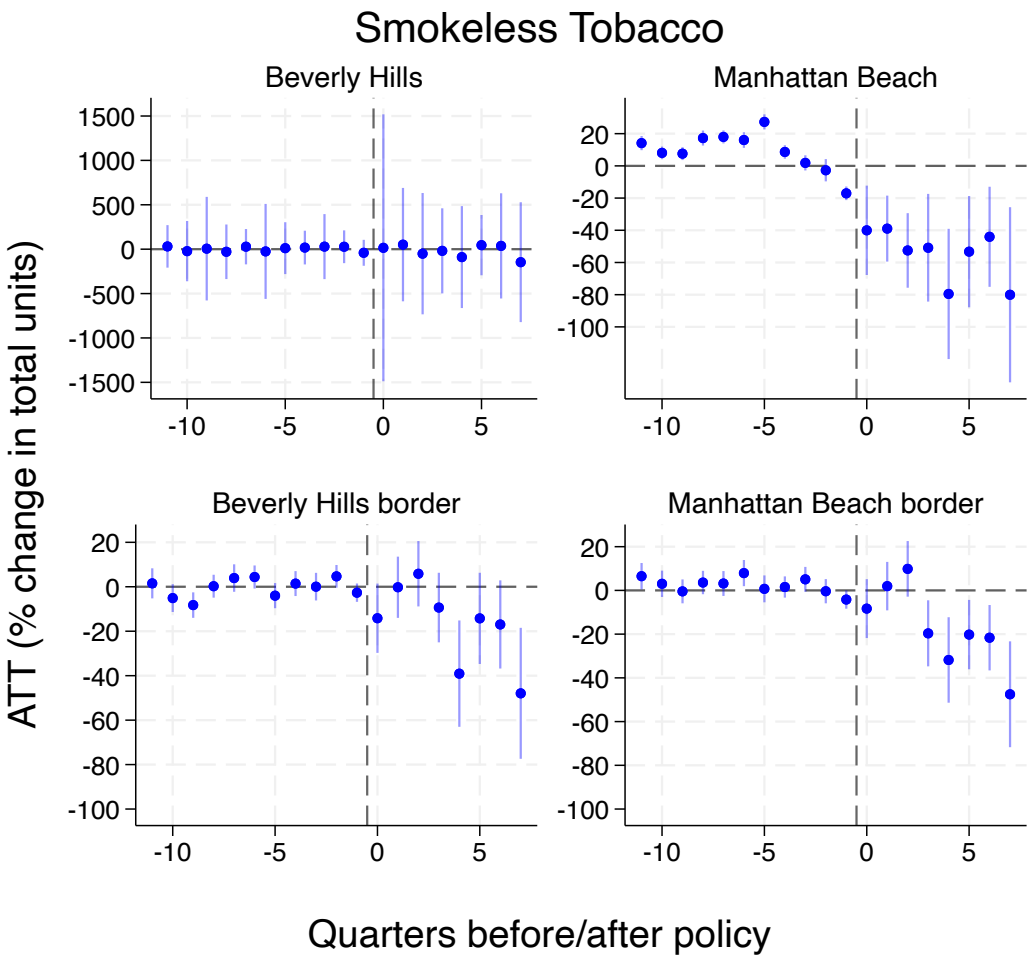
Note: This figure displays event-study coefficients and 95% confidence intervals, derived from permutation-based inference, for the effects of local tobacco sales bans relative to the quarter when the policy went into effect, indicated by the vertical dotted line. The vertical axis displays the average treatment effect on the treated (ATT), representing the difference in total unit sales per store between the treated or commuting border area and its synthetic control, expressed as a percent change relative to the outcome in the pre-policy period. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S8. Change over time in the effects of local tobacco sales bans on the sale of cigars in treated and border areas



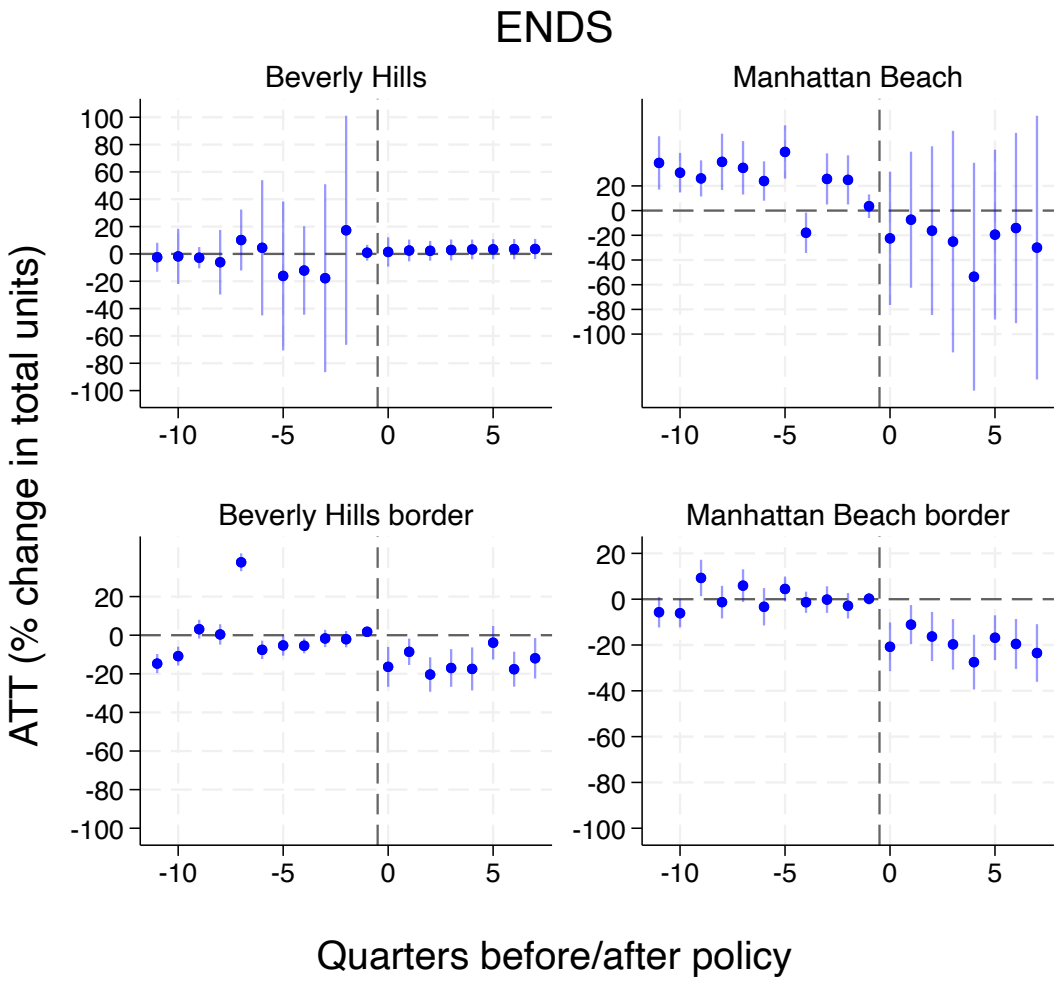
Note: This figure displays event-study coefficients and 95% confidence intervals, derived from permutation-based inference, for the effects of local tobacco sales bans relative to the quarter when the policy went into effect, indicated by the vertical dotted line. The vertical axis displays the average treatment effect on the treated (ATT), representing the difference in total unit sales per store between the treated or commuting border area and its synthetic control, expressed as a percent change relative to the outcome in the pre-policy period. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S9. Change over time in the effects of local tobacco sales bans on the sale of smokeless tobacco products in treated and border areas



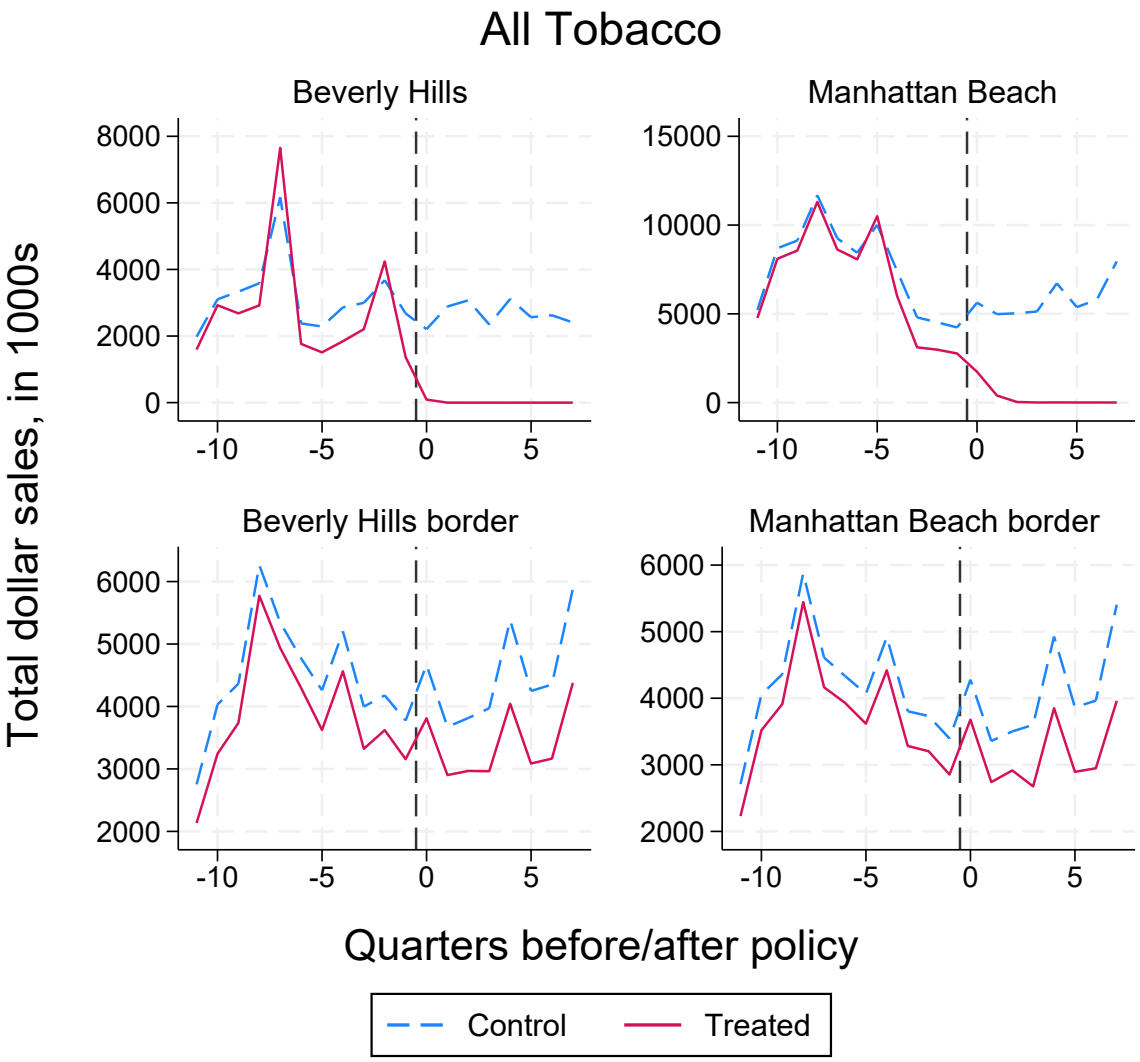
Note: This figure displays event-study coefficients and 95% confidence intervals, derived from permutation-based inference, for the effects of local tobacco sales bans relative to the quarter when the policy went into effect, indicated by the vertical dotted line. The vertical axis displays the average treatment effect on the treated (ATT), representing the difference in total unit sales per store between the treated or commuting border area and its synthetic control, expressed as a percent change relative to the outcome in the pre-policy period. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S10. Change over time in the effects of local tobacco sales bans on the sale of ENDS products in treated and border areas



Note: This figure displays event-study coefficients and 95% confidence intervals, derived from permutation-based inference, for the effects of local tobacco sales bans relative to the quarter when the policy went into effect, indicated by the vertical dotted line. The vertical axis displays the average treatment effect on the treated (ATT), representing the difference in total unit sales per store between the treated or commuting border area and its synthetic control, expressed as a percent change relative to the outcome in the pre-policy period. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S11. Trends in quarterly dollar sales of all tobacco products between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans



Note: This figure shows trends over time in total dollar sales per store, in thousands, of all tobacco products for the treated or border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S12. Trends in unit sales and change over time in the effects of local tobacco sales bans on the sale of all tobacco between treated and adjacent border areas with their synthetic controls before and after the effective date of local tobacco sales bans

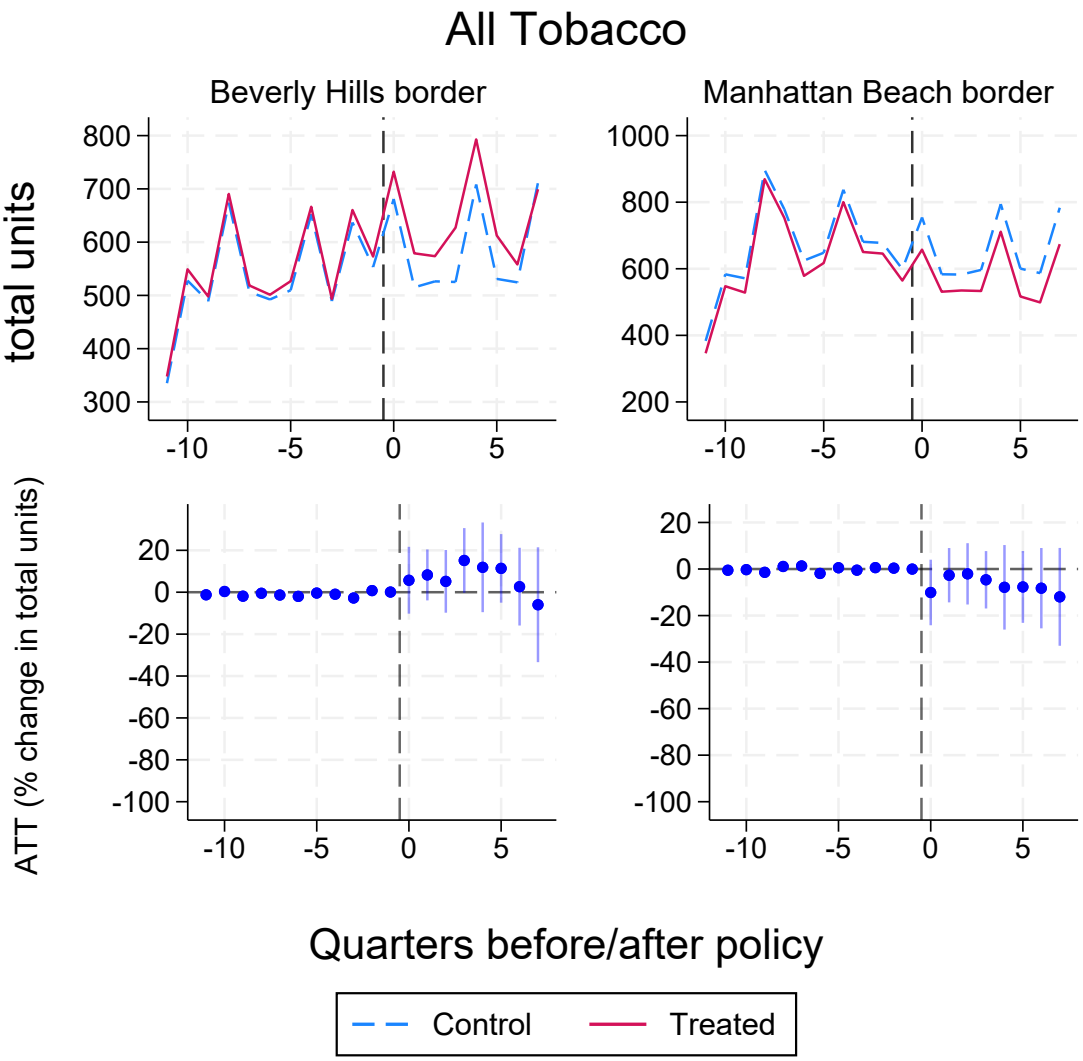
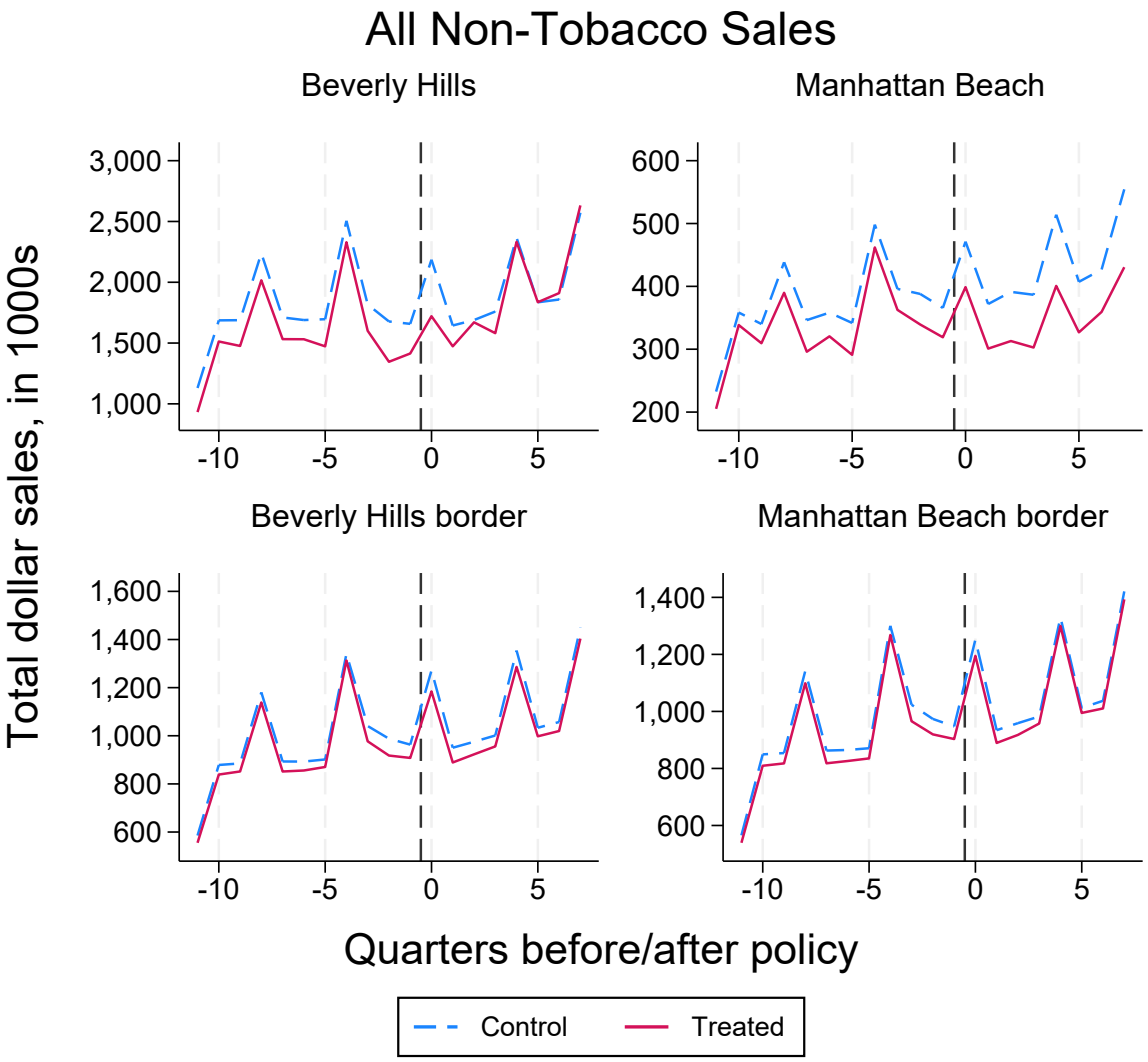
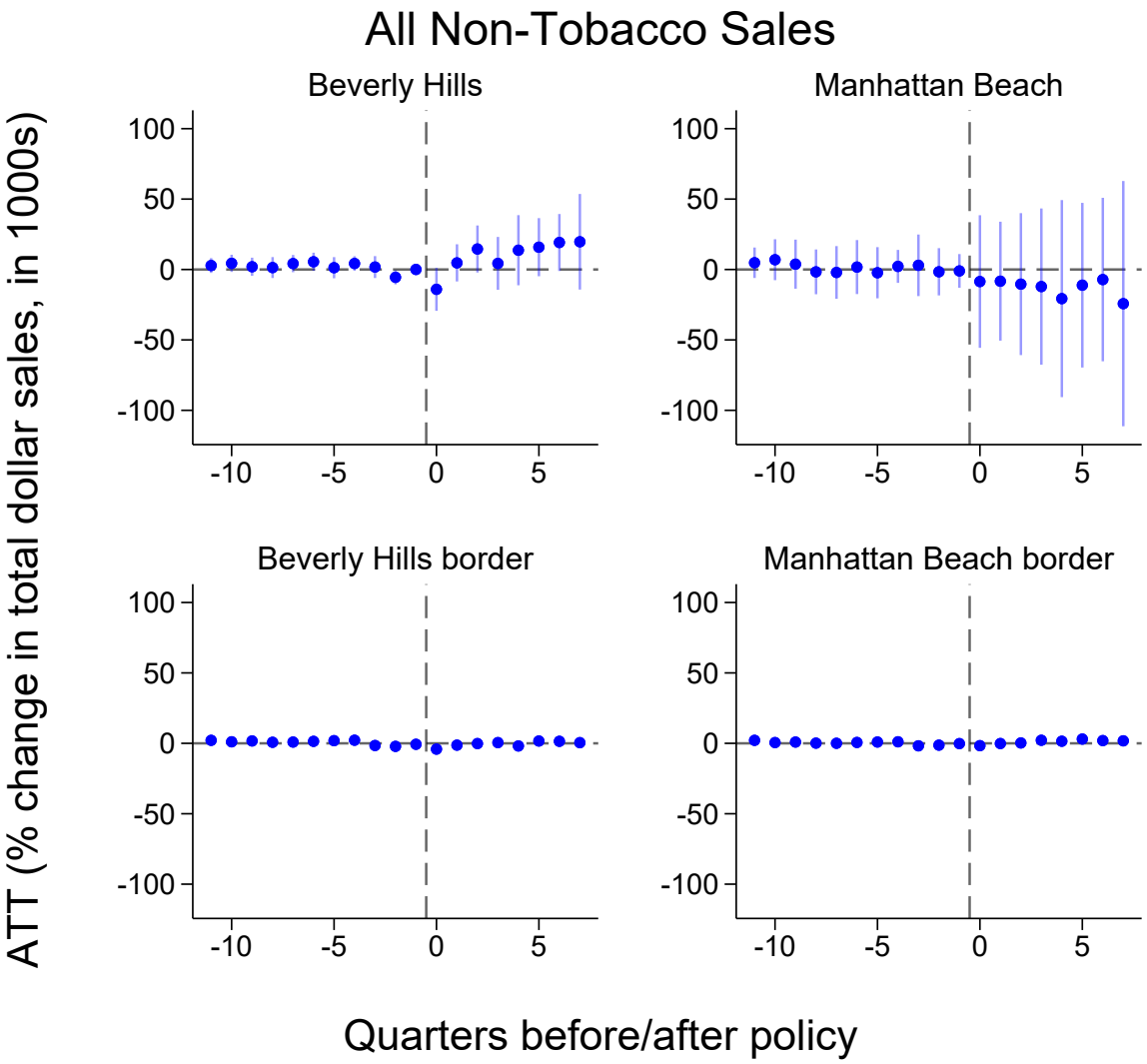


Figure S13. Trends in dollar sales of all non-tobacco products between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans



Note: This figure shows trends over time in total dollar sales per store, in thousands, of non-tobacco products for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S14. Change over time in the effects of tobacco sales bans on total dollar sales of all non-tobacco products in treated and border areas



Note: This figure displays event-study coefficients and 95% confidence intervals, derived from permutation-based inference, for the effects of local tobacco sales bans relative to the quarter when the policy went into effect, indicated by the vertical dotted line. The vertical axis displays the average treatment effect on the treated (ATT), representing the difference in total dollar sales, in thousands, between the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.

Figure S15. Trends in dollar sales of all non-tobacco products by store type between treated and border areas with their synthetic controls before and after the effective date of local tobacco sales bans

Note: This figure shows trends over time in total dollar sales, in thousands, of non-tobacco products by store type for the treated or commuting border area and its synthetic control. Estimates are derived from synthetic difference-in-differences models that include covariates for store type (convenience, grocery, and drug) and whether the city had a flavor policy implemented during the study period, as well as store and quarter-year fixed effects. Data were analyzed at the store-quarter level and included a set of convenience, grocery, and drug stores.