

Supplemental material

Supplemental Table 1 Map of dates for events of Interest, point-of-sales data and Google search queries indicative of shopping interest

Time period	Regulatory context	Calendar dates	Monthly Nielsen Point-Of-Sales	Weekly Relative Search Volume for Google search queries indicative of shopping interest
T1	Both JUUL and Puff Bar sold and marketed as tobacco-derived nicotine-containing products	3/24/19 - 9/10/19	3/24/19 - 9/7/19	3/24/19 - 9/1/19
T2	Trump Administration announced plans to ban flavors; JUUL Labs announced to halt online sales of its sweet and fruity e-cigarette products	9/11/19 - 1/1/20	9/8/19 - 12/28/19	9/8/19 - 12/22/19
T3	FDA published enforcement guidance policy on unauthorized flavored cartridge-based e-cigarettes; House approved flavor e-cigarette ban bill	1/2/20 - 6/14/20	12/29/19 - 6/13/20	12/29/19 - 6/7/20
T4	Puff Bar battled counterfeit sales, received FDA warning letter and suspended sale	6/15/20 - 3/1/21	6/14/20 - 2/20/21	6/14/21 - 2/27/21
T5	Puff Bar resumed sales as a synthetic nicotine containing product	3/2/21 - 5/22/21	2/21/21 - 5/22/21	2/28/21 - 5/22/21

Supplemental Note 1 Skewness and Kurtosis tests for JUUL and Puff Bar NPOS and Google search queries data

The final analytic sample for JUUL's NPOS data included 28 monthly observations. The p-value for kurtosis was 0.92, indicating that it was not significantly different from the kurtosis of a normal distribution. The p-value for skewness was 0.02, indicating that it was significantly different from the skewness of a normal distribution. The p-value for the joint test (chi-square) was 0.07 which suggested that the hypothesis that JUUL's NPOS data is normally distributed at the 5% significance level could not be rejected.

The final analytic sample for Puff Bar's NPOS data also included 28 monthly observations. The p-value for kurtosis was 0.13, indicating that it was not significantly different from the kurtosis of a normal distribution. The p-value for skewness was 0.12, indicating that it was also not significantly different from the skewness of a normal distribution. The p-value for the joint test (chi-square) was 0.0940 which suggested that the hypothesis that Puff Bar's NPOS data is normally distributed could not be rejected.

The final analytic sample for JUUL's Google search queries data included 113 weekly observations. The p-value for kurtosis was 0.10, indicating that it was not significantly different from the kurtosis of a normal distribution. The p-value for skewness was 0.001, indicating that it was significantly different from the skewness of a normal distribution. The p-value for the joint test (chi-square) was 0.004 which suggested that the hypothesis that JUUL's Google search queries data was normally distributed could be rejected. Please refer to Supplemental Table 2 for comparison of parametric and non-parametric estimates of shopping interest RSV for JUUL.

The final analytic sample for Puff Bar's Google search queries data included 113 weekly observations. The p-value for kurtosis was 0.18, indicating that it was not significantly different from the kurtosis of a normal distribution. The p-value for skewness was 0.12, indicating that it was also not significantly different from the skewness of a normal distribution. The p-value for the joint test (chi-square) was 0.12 which lead to the conclusion that the hypothesis that Puff Bar's Google search queries data is normally distributed could not be rejected.

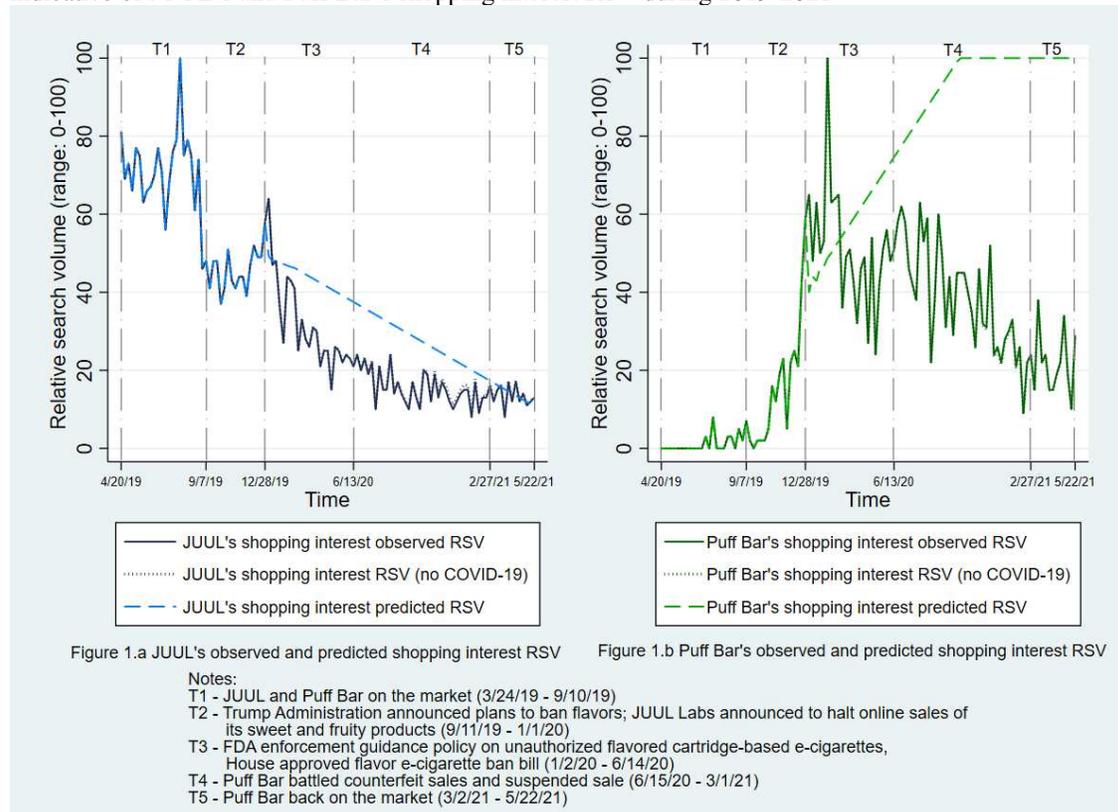
Supplemental Table 2 Comparison of estimates from simple linear regression and non-parametric regression on JUUL's shopping interest RSV

	Shopping Interest Relative Search Volume for JUUL (n=113 weeks)	
	Simple linear regression B [95% CI]	Non-parametric regression B [95% CI]
T2: Trump Administration announced plans to ban flavors; JUUL Labs announced to halt online sales of its sweet and fruity e-cigarette products	-23.77*** [-31.56, -15.98]	-23.77*** [-31.56, -15.98]
T3: FDA published enforcement guidance policy on unauthorized flavored cartridge-based e-cigarettes; House approved flavor e-cigarette ban bill	-42.06*** [-46.77, -37.35]	-42.06*** [-46.77, -37.35]
T4: Puff Bar battled counterfeit sales and suspended sale	-54.46*** [-62.17, -46.74]	-54.46*** [-62.17, -46.74]
T5: Puff Bar back on the market	-53.38*** [-59.54, -47.21]	-53.38*** [-59.54, -47.21]
EVALI cases	-17.65 [-35.78, 0.49]	-17.65 [-35.78, 0.49]
COVID-19 cases	-0.00* [-0.01, -0.00]	-0.00* [-0.01, -0.00]
Intercept	84.68*** [78.03, 91.32]	84.68*** [78.03, 91.32]

Supplemental Note 2 Technical details for ARIMA analysis

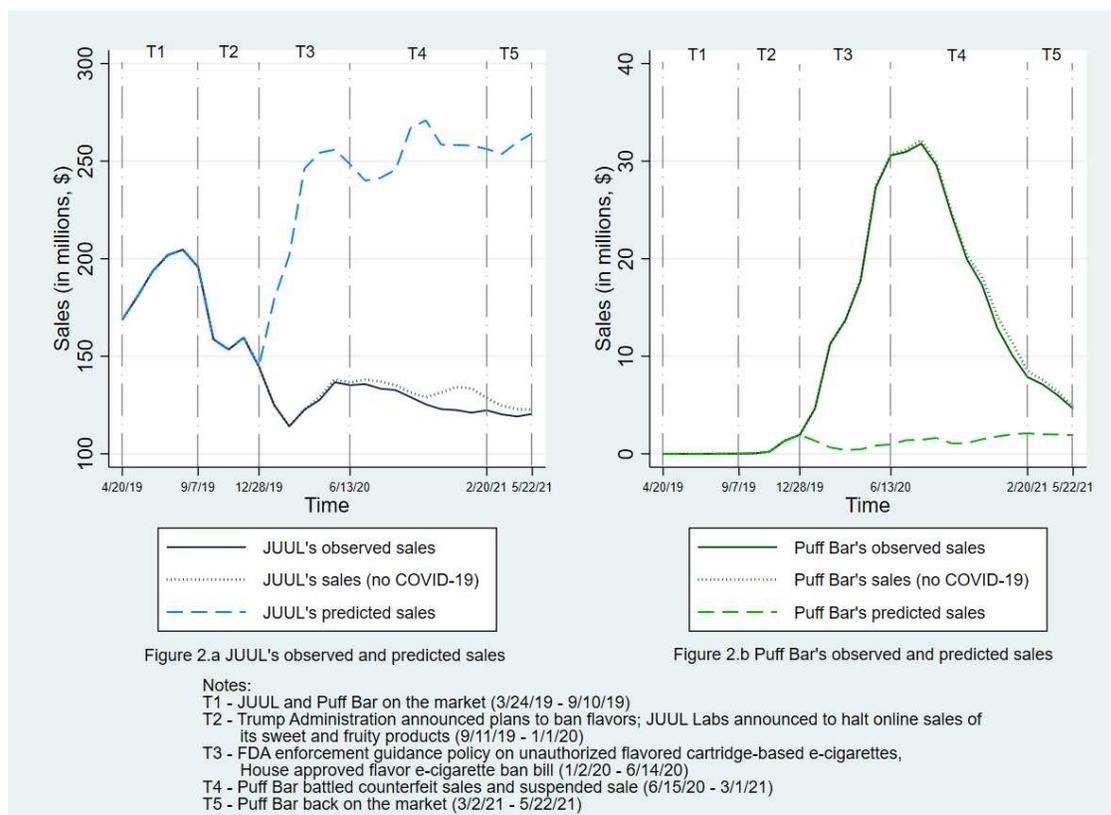
We first used the augmented Dickey-Fuller (ADF) test to detect whether the time series is stationary. The first order difference for NPOS and Google search queries for both JUUL and Puff Bar is stationary. We then used the autocorrelation (ACF) graph and partial autocorrelation (PACF) graph to determine the values of p and q. An ARIMA (2,1,1) model was developed to predict both the JUUL's Google search queries and Puff Bar's Google search queries after T2. An arima(1,1,1) model was developed to predict both the JUUL's sales and Puff Bar's sales after T2

Supplemental Figure 1 Google search query trends excluding the impact of the COVID-19 pandemic¹ indicative of JUUL's and Puff Bar's shopping interest RSV during 2019-2021



¹ Observed Google search queries trends without the effects of the COVID-19 pandemic were arrived at by using the following: Actual Google search queries minus the coefficient of the COVID-19 control variable multiplied by total COVID-19 cases per million individuals for a given time period [i.e., Actual Google search queries - (COVID-19 pandemic co-efficient * Total COVID-19 cases per million individuals)].

Supplemental Figure 2 Point-Of-Sales trends excluding the impact of the COVID-19 pandemic² for JUUL and Puff Bar during 2019-2021



² Observed point-of-sales trends without the effects of the COVID-19 pandemic were arrived at by using the following: Actual sales minus the coefficient of the COVID-19 control variable multiplied by total COVID-19 cases per million individuals for a given time period [i.e., Actual Sales - (COVID-19 pandemic co-efficient * Total COVID-19 cases per million individuals)].