Online Appendix: Not For Publication

The Competitive Impact of Vertical Integration by Multiproduct Firms

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A Model

Consider a market with N_U upstream firms, N_B bottlers, and a retailer. There are J inputs produced by the N_U upstream firms and J final products produced by the N_B bottlers. Each final product makes use of one (and only one) input product. All J final products are sold by the retailer. The set of products produced by each upstream firm i and bottler j are given by J_U^i and J_B^j, respectively. In what follows, we restrict to the case in which the sets in both $\{J_B^j\}_{j \in N_B}$ and $\{J_U^j\}_{j \in N_U}$ are disjoint (i.e., Diet Dr Pepper cannot be produced by two separate bottlers or upstream firms). We allow for a bottler to transact with multiple upstream firms (e.g., a PepsiCo bottler selling products based on PepsiCo and Dr Pepper SG concentrates).

The model assumes that linear prices are used along the vertical chain. That is, linear prices are used both by upstream firms selling their inputs to bottlers and by bottlers selling their final products to the retailer. The price of input product j set by an upstream firm is given by c_j; the price of final good k set by a bottler is w_k; and the retail price of product j is p_j. We assume that the input cost of upstream firms is zero, and the marginal costs of all other firms equals their input prices. The market share of product j, given a vector of retail prices p, is given by $s_j(p)$.

We describe the pricing problem of each type of firm in reverse order. With respect to the retail sector, we assume that the retailer sets its prices taking as given the vector of wholesale prices set by the bottlers, w. We follow Miller and Weinberg (2017) in assuming that the retail prices are determined by

$$0 = \lambda s_j + \sum_{k \in J} \frac{\partial s_k(p)}{\partial p_j}(p_k - w_k) \tag{A.1}$$

for every $j \in J$ and where $\lambda \in [0, 1]$. This equation is the first-order condition of a multiproduct monopolist except for the presence of the retail scaling parameter λ. The parameter λ scales the retail markups between zero ($\lambda = 0$) and the monopoly markups ($\lambda = 1$), and allows us to capture the competitive pressure faced by the retailer in a simple way.

Every bottler i chooses a wholesale price w_j for each product $j \in J_B^i$, where J_B^i corresponds to the set of products sold by bottler i. We assume that the bottlers choose their wholesale prices taking as given the vector of input prices set by the upstream firms, c. When solving their problems, the bottlers use backward induction and take into consideration how their wholesale prices will affect the equilibrium retail prices, $p(w)$. Bottler i then solves

$$\max_{\{w_j\}_{j \in J_B^i}} \sum_{j \in J_B^i} (w_j - c_j) s_j(p(w)), \tag{A.2}$$

where J_B^i corresponds to the set of products sold by bottler i. The first-order necessary condition for product j sold by bottler i is given by

$$0 = s_j(p(w)) + \sum_{k \in J_B^i} \sum_{h \in J} \frac{\partial s_k(p(w))}{\partial p_h} \frac{\partial p_h(w)}{\partial w_j} (p_k - w_k).$$

Lastly, every upstream firm i chooses the input price c_j for each of their products $j \in J_U^i$. The upstream firms take into consideration how their input prices will impact both the wholesale prices set by the bottlers, $w(c)$, and the retail prices set by the retailer, $p(w)$, via the effect of input prices on wholesale prices. Upstream firm i solves

$$\max_{\{c_j\}_{j \in J_U^i}} \sum_{j \in J_U^i} c_j s_j(p(w(c))),$$

where J_U^i corresponds to the set of products sold by upstream firm i. The first-order necessary condition for product j sold by upstream firm i is given by

$$0 = s_j(p(w(c))) + \sum_{k \in J_U^i} \sum_{h \in J} \sum_{l \in J} \frac{\partial s_k(p(w(c)))}{\partial p_h} \frac{\partial p_h(w)}{\partial w_l} \frac{\partial w_l}{\partial c_j} c_k, \tag{A.3}$$

for every $j \in J_U^i$.

Equilibrium strategies are given by the correspondences $p(w)$, $\{w_i(c)\}_{i \in N_B}$, and $\{c_i\}_{i \in N_U}$ that simultaneously solve equations (A.1) - (A.3).

Example

We consider a set of numerical examples. We assume the existence of two products $J = 2$, where the demand for product j is given by

$$s_j(p) = \frac{\exp\{ap_j\}}{\exp\{\delta\} + \sum_{k \in J} \exp\{ap_k\}},$$

with $a < 0$ and $\delta \in \mathbb{R}$.[1] We assume the existence of a single bottler producing both final products, and the existence of two upstream firms selling a single input product each.

In these examples, we compare the equilibria without vertical integration (as described in the previous section) with the equilibrium with vertical integration. In the case of vertical integration, we consider the case in which one of the upstream firms vertically integrates with the bottler. The only difference in this case is that

[1] We use values of λ that are similar to the ones used in Miller and Weinberg (2017).

Table A.1: Numerical examples: Equilibrium prices

Example 1: $a = -1.5$, $\delta = -2$, $\lambda = 0.2$

	Upstream		Bottler		Retailer	
	No VI	VI	No VI	VI	No VI	VI
Product 1	1.0882	0	2.1392	1.4618	2.3321	1.6993
Product 2	1.0882	0.8734	2.1392	2.1575	2.3321	2.3949

Example 2: $a = -1.6$, $\delta = -1.9$, $\lambda = 0.1$

	Upstream		Bottler		Retailer	
	No VI	VI	No VI	VI	No VI	VI
Product 1	0.9458	0	1.9412	1.3268	2.0359	1.4439
Product 2	0.9458	0.8229	1.9412	2.0436	2.0359	2.1607

Example 3: $a = -1.25$, $\delta = -1.75$, $\lambda = 0.1$

	Upstream		Bottler		Retailer	
	No VI	VI	No VI	VI	No VI	VI
Product 1	1.1468	0	2.4004	1.6357	2.5199	1.7813
Product 2	1.1468	1.0379	2.4004	2.5505	2.5199	2.6960

with vertical integration, the integrated upstream firm transfers the input product to the bottler at marginal cost (i.e., zero). These examples allow us to quantify the impact of vertical integration on prices in equilibrium.

The examples in Table A.1 show a manifestation of both the efficiency and Edgeworth-Salinger effects of vertical integration, with an increase in the equilibrium price of product 2 at both the bottler and retail level. The increase in the price of product 2 at the bottler level is motivated by the eliminated double margin in product 1. That is, product 1 becomes relatively more profitable to sell for the bottler, incentivizing the bottler to increase the price of product 2 to divert demand toward product 1. Similarly, the effect at the retailer level is caused by the changes in the wholesale prices faced by the retailer (i.e., the bottler sells product 1 for less after vertical integration). These increases in the price of product 2 arise despite a decrease in the concentrate price of product 2.

B Contracts between bottlers and concentrate producers

Contracts between bottlers and upstream firms are proprietary data. However, some of these contracts are stored in online repositories. In addition, the financial information of publicly traded bottlers and concentrate producers is publicly available. In this section, we provide links to documents we have had access to during the preparation of this paper. These documents allow us to argue that:

1. Upstream firms have the right to change the price of concentrate at their sole discretion.[2] An example of this is provided by historical events. In the 1990s, Coca-Cola bottlers protested against increases in the price of concentrate, as the price-cost margin of bottlers was decreasing.[3]

2. Bottlers have the right to choose the price at which they sell to their customers, with two exceptions: i) in some cases, upstream firms have the right to establish a price ceiling, and ii) upstream firms may suggest prices to the bottlers.[4]

3. Our review of these documents suggests that concentrate prices had a linear component at least until the end of our sample period. The only evidence of lump-sum transfers between bottlers and upstream firms is from a contract from

[2]See https://caselaw.findlaw.com/us-10th-circuit/1206491.html (2005, paragraph 4), https://www.lawinsider.com/contracts/2IyU2LWKs28SWYZuccejEZ/coca-cola-bottling-co-consolidated/317540/2010-11-12 (1990, paragraph 14), https://www.sec.gov/Archives/edgar/data/317540/000095014408001899/g12161ke10vk.htm (2008, page 2) https://www.lawinsider.com/contracts/4WlNJy9FdLu4pAtimh4GXe/coca-cola-bottling-co-consolidated/317540/2014-08-08 (2014, paragraph 23), https://www.lawinsider.com/contracts/1FrM3nPpXoZ2U2inKtRJCy/coca-cola-bottling-co-consolidated/317540/2017-05-11 (2017, paragraph 16.5), and https://www.sec.gov/Archives/edgar/data/1418135/000095012308001483/y42891a2exv10w9.htm (see point 4. Note, however, that this is a blank aggreement). In parenthesis we present the year of the document (when available) and the paragraph in which the document refers to pricing by the concentrate producer. All links were accessed on September 14th, 2018.

[3]See "Pepsi to Lift Price of Soda Concentrate, Following Coca-Cola's Strategic Shift," *The Wall Street Journal*, November 22, 1999, and "Coca-Cola seeks to supersize its bottlers," *Financial Times*, March 23, 2013.

[4]See https://caselaw.findlaw.com/us-10th-circuit/1206491.html (2005, paragraph 7), and https://www.sec.gov/Archives/edgar/data/317540/000095014408001899/g12161ke10vk.htm (2008, page 3). Also, contracts with other beverage companies have a similar structure. See the previous link, page 5.

2018 that covers a sub-bottling agreement in a sub-territory.[5] Two additional pieces of evidence are consistent with our reading of the documents. First, our results are a test for the existence of double marginalization, and these results suggest the existence of double margins. Second, industry publications report concentrate prices as prices per 288 oz case, suggesting a linear component to prices as well.[6]

From our examination of these documents, we conclude that while the original prices charged by the upstream firms were linear prices (Muris, Scheffman and Spiller, 1993), there has been a recent movement toward incorporating nonlinearities in the terms of the contracts. However, our examination of the documents does not allow us to rule out the existence of a linear component in the price paid by the bottlers, at least until 2018.[7]

[5]https://www.lawinsider.com/contracts/3M2VLnui7IKkkY0NgoibXd/coca-cola-bottling-co-consolidated/317540/2018-02-28 (2018, paragraph 8).

[6]See, for example, *Beverage Digest* Volume 54, No. 11 (May 15, 2009).

[7]See, for example Coca-Cola's 2010 and 2013 10Ks, pp. 7 and 6, respectively: https://www.coca-colacompany.com/content/dam/journey/us/en/private/fileassets/pdf/2012/12/form_10K_2008.pdf and https://www.coca-colacompany.com/annual-review/2013/img/2013-annual-report-on-form-10-k.pdf.

C FTC complaints and decision orders

The FTC reviewed the transactions in 2010 and cleared them in October and November of that year subject to some behavioral remedies. The FTC's main concerns were related to Coca-Cola and PepsiCo having access to confidential information provided by Dr Pepper SG to vertically integrated bottlers. In particular, the FTC argued that the agreements between Coca-Cola/PepsiCo and Dr Pepper SG could lessen competition because, first, they could eliminate competition between Coca-Cola/PepsiCo and Dr Pepper SG; second, they could increase the likelihood of unilateral exercise of market power by Coca-Cola and PepsiCo; and third, they could facilitate coordinated interaction. That is, the concerns raised by the FTC were based on potential violations of Section 5 of the FTC Act and Section 7 of the Clayton Act. The FTC did not raise arguments related to the Edgeworth-Salinger effect in its complaints.

The remedies imposed by the FTC included, among others, that Coca-Cola/PepsiCo employees who would have access to confidential information had to be "firewalled," could only participate in the bottling process, and could not receive bonuses or benefits incentivizing them to increase the sales of own brands relative to Dr Pepper SG brands.

The material related to the FTC's investigations can be accessed at

- https://www.ftc.gov/enforcement/cases-proceedings/091-0133/pepsico-inc-matter, and
- https://www.ftc.gov/enforcement/cases-proceedings/101-0107/coca-cola-company-matter.

D Additional summary statistics

In this Appendix, we provide additional summary statistics and information regarding the extent of vertical integration in the U.S. carbonated beverage industry.

D.1 Summary statistics

Table D.1: Summary statistics: Price (part I)

		20 oz			67.6 oz			144 oz		
Brand	Firm	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
7 Up	Dr Pepper	315798	1.4	0.24	420559	1.39	0.33	432133	4.06	0.91
A & W	Dr Pepper	332805	1.39	0.29	495688	1.38	0.31	454634	4.11	0.87
Barqs	Coke	40720	1.47	0.21	258862	1.41	0.28	347614	4.06	0.98
Caffeine Free Coke Classic	Coke	37	0.25	0.23	260251	1.43	0.28	383256	4.1	0.94
Caffeine Free Diet Coke	Coke	159921	1.51	0.17	468478	1.47	0.29	465918	4.08	0.9
Caffeine Free Diet Dr Pepper	Dr Pepper	386	1.27	0.15	78752	1.27	0.26	287195	4.04	0.93
Caffeine Free Diet Pepsi	Pepsi	130193	1.48	0.15	441642	1.38	0.3	432654	3.85	0.9
Caffeine Free Pepsi	Pepsi	9697	1.43	0.14	386572	1.38	0.29	381796	3.92	0.95
Canada Dry	Dr Pepper	160770	1.48	0.36	498073	1.42	0.31	454557	4.18	0.86
Cherry 7 Up	Dr Pepper	33089	1.32	0.34	310752	1.32	0.29	189856	3.89	0.95
Cherry Coke	Coke	206548	1.52	0.16	374474	1.46	0.28	408951	4.06	0.96
Coca Cola	Coke	535042	1.51	0.21	529313	1.49	0.29	526899	4.13	0.9
Coke Cherry Zero	Coke	109190	1.51	0.19	208736	1.44	0.28	368158	4.08	0.93
Coke Zero	Coke	488084	1.51	0.16	471515	1.47	0.29	468872	4.09	0.91
Crush	Dr Pepper	190937	1.48	0.23	307422	1.4	0.31	278953	4.1	0.92
Diet 7 Up	Dr Pepper	249729	1.4	0.28	481428	1.36	0.31	416338	4.08	0.89
Diet Barqs	Coke	1630	1.45	0.14	29669	1.35	0.27	273348	4.07	0.98
Diet Cherry 7 Up	Dr Pepper	226	3.19	0.54	242214	1.31	0.29	153544	3.81	0.92
Diet Cherry Coke	Coke	734	1.3	0.09	1282	1.26	0.22	222507	3.99	0.93
Diet Cherry Vanilla Dr Pepper	Dr Pepper	23728	1.34	0.15	67015	1.29	0.27	149419	3.8	0.87
Diet Coke	Coke	533073	1.51	0.15	521944	1.48	0.29	518848	4.12	0.89
Diet Coke With Lime	Coke	68041	1.49	0.17	153463	1.41	0.27	363190	4.06	0.94
Diet Coke With Splenda	Coke	1176	1.31	0.08	10902	1.29	0.22	256848	4.02	0.89
Diet Dr Pepper	Dr Pepper	404050	1.5	0.18	467563	1.42	0.3	457437	4	0.89
Diet Mountain Dew	Pepsi	411141	1.5	0.15	443204	1.39	0.3	428846	3.89	0.91
Diet Mountain Dew Caffeine Fr	Pepsi	1486	1.35	0.28	75774	1.38	0.28	77189	3.86	0.81
Diet Mug	Pepsi	9	1.29	0	114301	1.39	0.3	197862	4.03	1.01
Diet Pepsi	Pepsi	527909	1.5	0.15	516303	1.4	0.3	505935	3.87	0.85
Diet Pepsi Jazz	Pepsi	21378	1.34	0.17	79244	1.29	0.26	80978	3.68	0.83
Diet Pepsi With Lime	Pepsi	6670	1.38	0.19	102956	1.35	0.28	204097	3.92	1.01
Diet Rite	Dr Pepper	14149	3.46	2.12	276901	1.3	0.28	175716	3.89	0.79
Diet Schweppes	Dr Pepper	84	1.52	0.16	160331	1.36	0.3	102541	4.23	0.99
Diet Sierra Mist	Pepsi	2346	1.66	0.2	318569	1.37	0.3	301042	4.05	1.03
Diet Sierra Mist Cranberry Sp	Pepsi	30677	1.36	0.26	75288	1.35	0.31	49875	4.08	0.93
Diet Squirt	Dr Pepper	9231	1.43	0.21	114671	1.33	0.29	167313	3.98	0.88
Diet Sun Drop	Dr Pepper	25797	1.56	0.8	86704	1.25	0.3	58665	4.02	0.91
Diet Sunkist	Dr Pepper	151871	2.91	2.66	382738	1.34	0.31	385239	4.05	0.93

Notes: An observation is a brand–size–store–week combination.

Table D.1: Summary statistics: Price (part II)

		20 oz			67.6 oz			144 oz		
Brand	Firm	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
Diet Vernors	Dr Pepper	12228	1.55	0.87	77604	1.55	0.4	52919	4.02	0.97
Diet Wild Cherry Pepsi	Pepsi	109859	1.51	0.17	371608	1.37	0.29	367639	3.91	0.98
Dr Pepper	Dr Pepper	476714	1.49	0.18	496559	1.43	0.3	479838	4.02	0.89
Fanta	Coke	178632	1.51	0.18	390753	1.4	0.3	368379	4.06	0.96
Fresca	Coke	14547	1.6	0.22	325198	1.45	0.28	382544	4.16	0.89
Manzanita Sol	Pepsi	14185	1.39	0.21	61639	1.32	0.27	57111	3.7	0.87
Mello Yello	Coke	50343	6.5	3.59	24353	1.26	0.27	136670	4.02	0.92
Mountain Dew	Pepsi	519875	1.5	0.17	506505	1.41	0.3	489342	3.89	0.9
Mountain Dew Code Red	Pepsi	92306	1.48	0.34	236518	1.37	0.28	278790	3.9	0.97
Mountain Dew Throwback	Pepsi	66743	1.41	0.28	12838	1.44	0.3	112274	4.08	1.02
Mountain Dew Voltage	Pepsi	94610	1.45	0.24	160664	1.4	0.29	181766	4.06	1.01
Mug	Pepsi	41320	1.54	0.38	357551	1.38	0.29	354697	3.99	0.99
Pepsi	Pepsi	531774	1.5	0.17	528315	1.41	0.3	518629	3.9	0.87
Pepsi Max	Pepsi	311016	1.49	0.21	342304	1.39	0.31	327517	3.93	0.99
Pepsi Next	Pepsi	38781	1.5	0.27	53334	1.29	0.34	47463	3.85	1.03
Pepsi One	Pepsi	2564	1.35	0.12	208701	1.35	0.29	314400	3.92	0.99
Pepsi Throwback	Pepsi	83036	1.43	0.27	23590	1.47	0.29	141714	4.09	1
Pibb Xtra	Coke	25866	1.43	0.18	48456	1.34	0.27	125295	3.96	0.89
R C	Dr Pepper	43099	1.2	0.38	244893	1.26	0.28	202901	3.84	0.83
Schweppes	Dr Pepper	53970	1.54	0.19	339935	1.4	0.31	272106	4.08	0.95
Seagrams	Coke	19573	4.46	3.63	265112	1.44	0.31	216035	4.19	1
Sierra Mist	Pepsi	255442	1.42	0.16	295841	1.34	0.29	275171	3.74	0.9
Sierra Mist Cranberry Splash	Pepsi	55905	1.39	0.26	102603	1.36	0.31	74311	4.02	0.95
Sierra Mist Free	Pepsi	73193	1.42	0.16	67950	1.25	0.25	103503	3.58	0.8
Sierra Mist Natural	Pepsi	140485	1.52	0.24	173222	1.41	0.33	153299	4.05	1.02
Sprite	Coke	525923	1.51	0.15	432152	1.5	0.3	498676	4.09	0.93
Sprite Zero	Coke	189673	1.5	0.16	440937	1.45	0.29	435877	4.1	0.95
Squirt	Dr Pepper	137354	1.42	0.27	273682	1.37	0.3	235008	3.98	0.91
Sun Drop	Dr Pepper	53992	1.4	0.28	118015	1.27	0.31	95340	4.05	0.96
Sunkist	Dr Pepper	352410	1.46	0.35	476905	1.36	0.32	425571	4.01	0.94
Vanilla Coke	Coke	54182	1.42	0.18	17827	1.3	0.25	240326	4.1	0.97
Vault	Coke	98225	1.34	0.21	66704	1.28	0.26	148527	3.87	0.86
Vernors	Dr Pepper	19129	1.43	0.28	93776	1.55	0.4	64943	4.08	0.97
Welchs	Dr Pepper	54194	1.31	0.34	158751	1.28	0.29	157569	3.8	0.84
Wild Cherry Pepsi	Pepsi	176707	1.51	0.17	410239	1.39	0.3	378463	3.91	1.01

Notes: An observation is a brand–size–store–week combination.

D.2 Price variance decomposition

To examine the sources of price variation in our data, we perform a decomposition of the variance of price for the subsample of 67.6 oz products, where an observation is a store–week–product combination. Table D.2 presents a decomposition into three week-level components: a chain component (capturing the average price level at the store's chain level), a within-chain store–level component (capturing store–level deviations from the average price of its chain), and a within-store component (capturing differences across products within a store). The table shows that the two most significant factors explaining overall price variation are the within-store and the chain components (61.2% and 32.3% of the overall price variation when the analysis considers both sale and non-sale prices). The analysis suggests that consumers face significant price variation when comparing prices in a given store–week, and stores of the same chain tend to set similar prices (see DellaVigna and Gentzkow 2019 for related findings).[8] The latter finding will lead us to study the robustness of our results to various levels of data aggregation (e.g., MSA–chain–year–product).

TABLE D.2: Price variance decomposition (67 oz products)

	Sample	
	All	Nonsale
Chain–week component	0.323	0.538
Store–week (within chain–week) component	0.065	0.105
Within store–week component	0.612	0.357

Notes: The variance of price is decomposed using the identity $p_{jst} = p_{ct} + (p_{st} - p_{ct}) + (p_{jst} - p_{st})$, where p_{jst} is the price of product j at store–week (s,t), p_{ct} is the average price at chain–week (c,t), and p_{st} is the average price at store–week (s,t). The variance of p_{jst} is the sum of $var(p_{ct})$ (chain–week variation), $var(p_{st} - p_{ct})$ (store-level variation within chain–week), and $var(p_{jst} - p_{st})$ (within store–week variation). The table reports each of these components relative to total variance (i.e., $var(p_{ct})/var(p_{jst})$, $var(p_{st} - p_{ct})/var(p_{jst})$, and $var(p_{jst} - p_{st})/var(p_{jst})$, respectively).

[8] Table D.3 presents examples of non-sale prices at different stores for the same week, and shows that even when restricting to the most popular products, consumers face significant within store–week price variation. We generalize this in Figure D.1, where we plot the distribution of the within-store–week standard deviation of price. The figure shows that within-store price variation is significant even within products of the same size.

D.3 Within-store price dispersion

In this section, we provide evidence on the extent of within-store price dispersion. We do this in two steps. First, Table D.3 presents examples of prices that consumers faced when visiting different stores for one week in our sample. The table restricts the analysis to "round number" prices (e.g., 1.15 as opposed to 1.13414) of products that were not flagged as being on sale. Because our measure of prices is the average price paid by consumers for a product in a given store–week combination, non-rounded prices may arise when some consumers use coupons or when the store changed the price of a product in the middle of a week. The table shows that even when considering the most popular products, price dispersion across brands is not trivial.

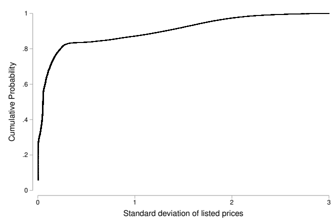
Second, Figure D.1 reports the within-store price dispersion for products of different sizes, using the full sample of regular prices as well as the subsample of round number regular prices. The figure shows that prices vary significantly across products of the same size, even when restricting attention to products that were not on sale.

Table D.3: Price variation within store–week: Examples of pricing patterns

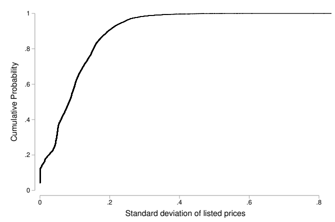
	Store				
Product	1	2	3	4	5
Coca Cola (67 oz)	1.49	1.59	1.49	1.49	1.69
Diet Coke (67 oz)	1.49	1.59	1.49	1.49	1.69
Pepsi (67 oz)	1.39	1.49	1.39	1.39	1.59
Diet Pepsi (67 oz)	1.39	1.49	1.39	1.39	1.59
Dr Pepper (67 oz)	1.29	1.59	1.39	1.29	1.59
Diet Dr Pepper (67 oz)	1.29	1.59	1.39	1.29	1.59

Notes: All of these examples correspond to IRI week 1429 (January 15-21, 2007). Each column corresponds to a different store. None of the prices in the table were flagged as a sale price in the data.

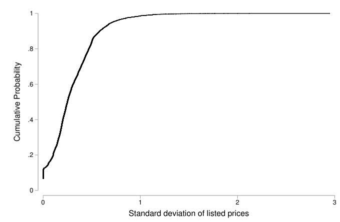
All products and prices



(a) 20 oz

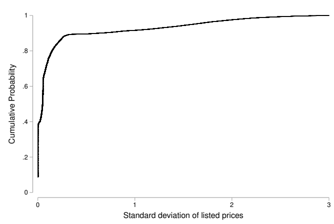


(b) 67 oz

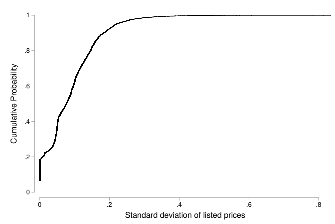


(c) 144 oz

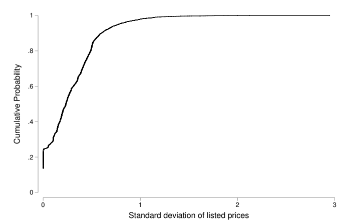
All products, round number prices



(d) 20 oz



(e) 67 oz



(f) 144 oz

FIGURE D.1: Within store–week standard deviation of prices: Cumulative distribution function

Notes: The upper panel presents the within-store standard deviation of price across products of the same size, considering prices that are not flagged as a sale price. The lower panel repeats the analysis restricting the sample to round number prices.

D.4 Covariate balance before and after vertical integration

Table D.4 and Table D.5 explore differences in demographics, retail configuration, and consumption of substitute products (i.e., beer and milk) both before and after the vertical mergers between areas differentially impacted by vertical integration. Table D.4 shows differences between areas impacted and not impacted by vertical integration (e.g., the treated areas are on average wealthier, more populated, and have a larger number of retail stores than the untreated areas), and also shows that there were no differential changes in these variables across areas affected and unaffected by vertical integration.

Table D.5 reports averages of the number of liters of beer and milk (in logs) sold in a store–week combination. The table shows similar levels of consumption of beer, both before and after vertical integration, in areas impacted and not impacted by vertical integration. The table also suggests that a greater amount of milk was consumed in areas impacted by vertical integration throughout the sample period. Statistical tests cannot reject the hypothesis of no differential changes in the consumption of these goods in areas impacted by vertical integration (the p-values are 0.64 and 0.85 for beer and milk, respectively).

TABLE D.4: Covariate balance before and after vertical integration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Before VI			After VI		
Variable	Untreated	Treated	(2)-(1)	Untreated	Treated	(5)-(4)	(6)-(3)
Mean income	56574.03	69909.15	13335.12	59010.22	70923.56	11913.34	-1421.78
	(12424.17)	(18879.13)	[0.000]	(11326.73)	(19037.87)	[0.000]	[0.501]
Population (in logs)	11.38	12.27	0.88	11.63	12.28	0.65	-0.23
	(0.8)	(1.12)	[0.000]	(0.85)	(1.12)	[0.000]	[0.110]
Convenience stores	8.25	39.09	30.84	10.4	39.14	28.74	-2.1
	(11.33)	(64.73)	[0.000]	(12.82)	(67.04)	[0.000]	[0.538]
Supermarkets	20.36	92.63	72.27	22.6	96.43	73.82	1.56
	(20.92)	(197.95)	[0.000]	(21.7)	(219.07)	[0.000]	[0.868]
Temperature	61.68	54.24	-7.44	64.2	55.54	-8.66	-1.21
	(7.29)	(7.41)	[0]	(2.19)	(6.84)	[0]	[.158]

Notes: An observation is a county–year combination. The table reports averages of county–level characteristics for treated and untreated counties. Standard deviations are in parentheses. *p*-values of two-sided tests for equality of means in brackets. Income and population data at the county–year level were obtained from the U.S. Census Bureau (2018*a*). The number of convenience stores and supermarkets in each county–year were drawn from U.S. Census Bureau (2018*b*). Temperature at the county–month level was retrieved from National Oceanic and Atmospheric Administration (2018).

Table D.5: Average number of liters (in logs) sold in a store–week combination

	Before VI	After VI
Untreated	7.276	7.252
Treated	7.283	7.143

A) Beer

	Before VI	After VI
Untreated	7.775	7.590
Treated	8.337	8.218

B) Milk

Notes: The table reports averages of the number of liters sold in every store–week combination based on the IRI Marketing Data Set.

D.5 Evolution of average prices

Here we present the evolution of the average prices of both 20 oz and 144 oz products, separating by whether the products were bottled by vertically integrated bottlers. Similar to what is reported in Figure 2, the figure shows that the prices of treated and untreated products tracked each other before vertical integration, suggesting that there were no differential preexisting trends in these sets of products.

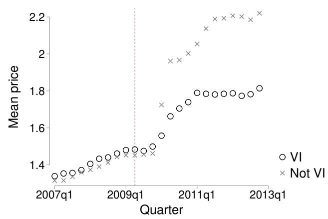
We complement the figures with a formal test for the existence of differential trends. Table D.6 presents regression estimates of residualized prices on a week indicator, an indicator that identifies products that started being produced by an integrated bottler after the vertical mergers, and the interaction of the two indicators. In the first stage, prices are residualized with respect to the other covariates included in our analysis (e.g., indicators for feature and display and county-level covariates). The table shows no evidence of differential trends before the vertical mergers.

Table D.6: Testing divergence of price trends before vertical mergers: OLS regressions

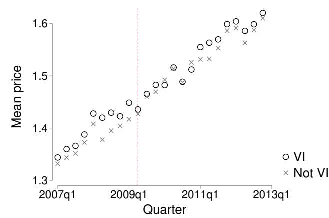
	Dependent variable: residualized prices		
	Coca-Cola	Dr Pepper SG	Pepsi
	(1)	(2)	(3)
Ever integrated×Trend	0.0001	0.0000	-0.0001
	(0.0000)	(0.0000)	(0.0001)
Ever integrated	-0.0878	-0.0530	0.1184
	(0.0672)	(0.0571)	(0.0758)
Week	-0.0000	-0.0000	0.0001
	(0.0000)	(0.0000)	(0.0000)
Observations	7,417,588	7,058,387	7,714,048
R^2	0.0000	0.0001	0.0001

Notes: Standard errors clustered at the county level. All specifications regress residualized prices on a week indicator, an indicator that identifies products that started being produced by an integrated bottler after the vertical mergers, and the interaction of the two indicators. In the first stage, prices are residualized with respect to the other covariates included in our analysis (e.g., indicators for feature and display and county-level covariates).

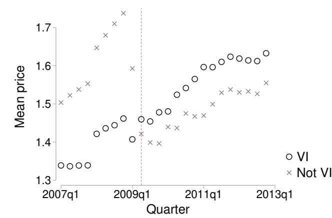
20 oz products



(a) Coca-Cola 20 oz

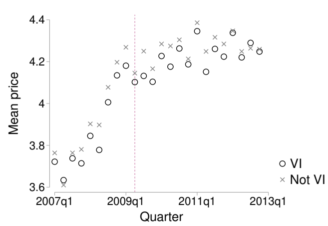


(b) PepsiCo 20 oz

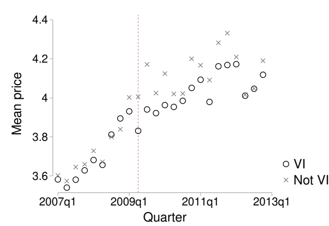


(c) Dr Pepper SG 20 oz

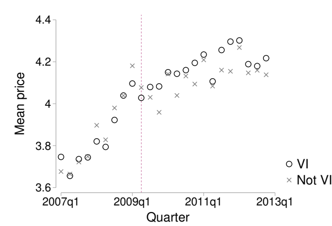
144 oz products



(d) Coca-Cola 144 oz



(e) PepsiCo 144 oz



(f) Dr Pepper SG 144 oz

Figure D.2: The evolution of prices before and after the mergers by whether the products were ever sold by a VI firm (products of 20 and 144 oz)

Notes: An observation is a firm–VI status–week combination, where VI status takes the value of one if the product was ever bottled by a VI firm (e.g., Coke bottled by CCE or Dr Pepper bottled by CCE). The dotted vertical lines indicate the first transaction.

E Comparing estimates across research designs

With respect to the connection between the differences-in-differences and within-store estimators, we note that both estimators would deliver the same point estimates if the prices of nonintegrated products evolved similarly across all markets. To see this, suppose we have a sample of two markets with two time observations per market (i.e., one observation before and one after vertical integration). In the first market (market A), a subset of the products became integrated. In the second market (market B), vertical integration does not take place. In this context, the differences-in-differences estimator for product j would be $(p_{j,A,1} - p_{j,B,1}) - (p_{j,A,0} - p_{j,B,0})$, while the within-store estimator would be $(p_{j,A,1} - p_{NoVI,A,1}) - (p_{j,A,0} - p_{NoVI,A,0})$, where $p_{NoVI,A,t}$ is the average price of nonintegrated products in market A at time t. From these expressions, it is clear that the estimates are equivalent when the changes in the prices of nonintegrated products is the same across markets: $p_{j,B,1} - p_{j,B,0} = p_{NoVI,A,1} - p_{NoVI,A,0}$.

The estimates would for example differ if vertical integration caused changes in the prices of nonintegrated products in markets where at least one firm became integrated (e.g., via equilibrium feedback effects). Because these effects of vertical integration on the prices of nonintegrated products cannot exist in markets where vertical integration did not take place, these price effects could have made the prices of nonintegrated products to diverge across areas differentially impacted by vertical integration.

To examine this connection between estimators, we re-compute the within-store estimator on the same subsample used in Table 4 (Panel B), which is designed to minimize the role of equilibrium feedback effects. We report the estimates in Table E.1. A comparison between Table 4 (Panel B) and Table E.1 reveals that the estimates are almost identical, which is to be expected in the absence of equilibrium feedback effects.[9] The similarity between the estimates is a strength of our paper, as both research designs rely on different sources of variation and identification assumptions.

[9] We note that these tables have different sample sizes because the within-store analysis pools the products of all upstream firms while the differences-in-differences analysis is at the upstream firm level.

Table E.1: The effect of vertical integration on prices (within-store estimates): Restricted treatment subsamples

	Dependent variable: log(price)		
	Coca-Cola	Coca-Cola/DPSG or PepsiCo/DPSG	PepsiCo
	(1)	(2)	(3)
Vertical integration × Coca-Cola/PepsiCo product	-0.009	-0.006	-0.006
	(0.003)	(0.003)	(0.003)
Vertical integration × Dr Pepper SG product	-	0.012	-
		(0.005)	
Observations	5,306,197	7,853,553	4,759,626
R^2	0.935	0.931	0.938

Notes: Standard errors clustered at the county level (Column 1: 197 clusters; Column 2: 217 clusters; Column 3: 201 clusters). All specifications include store–week, product–week, and product–store fixed effects, as well as controls for feature and display. Column 1 restricts the sample to counties that were either untreated or in which only Coca-Cola integrated (and the Coca-Cola bottler did not bottle Dr Pepper SG products); column 2 restricts the sample to counties that were untreated and counties in which either Coca-Cola or PepsiCo integrated while bottling Dr Pepper SG products; and column 3 restricts the sample to counties that were either untreated or in which only PepsiCo integrated (and the PepsiCo bottler did not bottle Dr Pepper SG products).

F Additional analyses

F.1 Price indexes with national weights

In this subsection, we first explain the computation of the price indexes used in estimation and then replicate our price index differences-in-differences analysis using national rather than store-level indexes. This analysis will help us shed light on whether vertical integration caused an increase or decrease in quantity-weighted prices.

We construct the store–week price indexes as follows. For each store, we compute the average weekly quantity of each product in the period before vertical integration. For each store–week combination, we weigh each price by its average quantity in the period before vertical integration. For each store–week combination, we sum the weighted prices (i.e., price multiplied by its pre-vertical integration average quantity) and normalize the price index by dividing by the sum of weights of the products available in that store–week combination. We compute price indexes considering the full set of products in a store–week combination as well as price indexes on the subsets of Coca-Cola, Dr Pepper SG, and PepsiCo products.

Finally, we also use national rather than store-level price indexes. The results, which we present in Table F.1 are similar to those presented in the main text as we do not find significant price changes on average or for Coca-Cola products, while the price of PepsiCo products bottled by integrated bottlers decreased by 1.6 percent and the price of Dr Pepper SG products increased by 5.3 percent.

Table F.1: The effect of vertical integration on national price indexes (differences-in-differences estimates)

	Dependent variable: log(price index)			
	All products	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)	(4)
Vertical integration	0.006	0.005	0.053	-0.016
	(0.007)	(0.007)	(0.009)	(0.006)
Observations	542,668	542,282	540,319	538,465
R^2	0.664	0.429	0.651	0.359

Notes: Standard errors clustered at the county level (431 clusters). An observation is a store–week combination. Price indexes are computed based on pre-vertical integration average quantities at the product level, where the weight of each product in a given store–week combination is its average quantity across all store–week combinations in the pre-merger period. The price index in column 1 includes all products, whereas the price indexes in column 2 to 4 restrict the set of products to Coca-Cola, Dr Pepper SG, and PepsiCo products, respectively. All specifications include store and week fixed effects, as well as time-varying county-level controls.

F.2 Addressing potential selection

F.2.1 Blocking regression

In this section, we implement a blocking regression approach to ensure that control and treatment groups are comparable. To do this, we first estimate the likelihood of a county being exposed to treatment based on its demographics and market outcomes prior to the transactions. We do this by estimating the probability that a county is treated via maximum likelihood estimation of a logit model. The dependent variable is equal to one if a county is going to be exposed to vertical integration and zero otherwise. The independent variables are the same demographics included in the analyses presented above, in addition to the average shares, volume, and prices of the products of each firm (all measured using county-level averages over the pre-integration period).

We then use the estimated logit specification to predict the propensity score of each county of being exposed to treatment. We use this propensity score to assign both treated and untreated counties to bins, ensuring that both the propensity score and the explanatory variables included in the propensity score specification are balanced within each bin.

Once all counties, treated and untreated, have been assigned to propensity-score bins, we replicate Table 4 for each bin and estimate the effect of vertical integration on prices within each bin. Finally, we compute the overall price effect of vertical integration on the products of each upstream firm as the weighted average of the bin-specific price effects. Table F.2 reports the results and shows that our estimates do not change significantly relative to Table 4.

TABLE F.2: The effect of vertical integration on prices (differences-in-differences estimates): Propensity-score matching

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.002	0.012	-0.009
	(0.006)	(0.003)	(0.004)
Observations	15,751,752	15,810,500	15,292,417

Notes: Standard errors clustered at the store level. All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display. Estimation is by blocking regressions. First, we compute the propensity score of each county of being exposed to vertical integration by Coca-Cola, PepsiCo, and Dr Pepper SG. We do this by estimating a logit model via maximum likelihood. We then group counties by propensity score, subject to the mean propensity score and covariates being balanced within each group. Then, we estimate Equation 1 for each firm and blocking group. Estimates reported in the table correspond to the weighted estimates according to the number of counties in each blocking group. Because under some specifications there are groups with fewer counties than parameters to be estimated, we cluster standard errors at the store rather than county level. Finally, we lose observations relative to Table 4, because estimation is performed on the subsample for which the common support assumption holds within each propensity-score group.

F.2.2 Neighboring counties

In Table F.3 and Table F.4 we repeat our differences-in-differences and within-store analyses (respectively), restricting the sample to neighbor counties that were differentially impacted by vertical integration. That is, two neighboring counties are included in the subsample if (i) they were both impacted by vertical integration but only one was exposed to the Edgeworth-Salinger effect, or (ii) only one was impacted by vertical integration. This restriction limits the sample to 132 counties (out of 443 counties in the baseline analysis). This subsample analysis allows us to compare price changes in counties that are very similar except for having been differentially impacted by vertical integration. The estimates remain largely unchanged, suggesting that our main results are not impacted by unobserved heterogeneity across counties that is not captured by the set of fixed effects included in our estimating equations.

Table F.3: The effect of vertical integration on prices (differences-in-differences estimates): Neighboring counties subsample

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	-0.000	0.013	0.005
	(0.008)	(0.005)	(0.006)
Observations	6,072,345	5,984,326	6,501,197
R^2	0.905	0.897	0.882

Notes: Standard errors clustered at the county level (130 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display. The neighboring-counties subsample restricts attention to bordering counties that were differentially impacted by vertical integration. For example, counties that did not experience vertical integration but had at least one neighboring county impacted by vertical integration would be included in the subsample.

Table F.4: The effect of vertical integration on prices (within-store estimates): Neighboring counties subsample

	Dependent variable: log(price)	
	(1)	(2)
Vertical integration	-0.009	
× Coca-Cola/PepsiCo product	(0.003)	
Vertical integration	0.013	
× Dr Pepper SG product	(0.004)	
Vertical integration (Coca-Cola)		-0.014
× Coca-Cola product		(0.005)
Vertical integration (Coca-Cola)		0.015
× Dr Pepper SG product		(0.005)
Vertical integration (PepsiCo)		-0.002
× PepsiCo product		(0.005)
Vertical integration (PepsiCo)		0.007
× Dr Pepper SG product		(0.005)
Observations	18,557,740	18,557,740
R^2	0.905	0.905

Notes: Standard errors clustered at the county level (132 clusters). All specifications include store–week, product–week, and product–store fixed effects, as well as controls for feature and display. The neighboring-counties subsample restricts attention to bordering counties that were differentially impacted by vertical integration. For example, counties that did not experience vertical integration but had at least one neighboring county impacted by vertical integration would be included in the subsample.

F.3 Aggregation

We explore the robustness of our results to different levels of aggregation in Table F.5 (differences-in-differences) and Table F.6 (within-store). Two reasons motivate this analysis. First, the serial correlation of prices may lead to inconsistent estimates of standard errors (see Bertrand, Duflo and Mullainathan 2004).[10] Second, chains set similar prices across their stores (see Table D.2 and DellaVigna and Gentzkow 2019), suggesting that there may be spillover effects when two nearby counties are differentially exposed to vertical integration. These analyses suggest robustness to both serial correlation of prices and spatial spillovers.

[10] We emphasize that throughout our analysis, we cluster standard errors at the treatment-unit level (i.e., county), which is an alternative solution to the problem of serially correlated outcomes (see Bertrand, Duflo and Mullainathan 2004 for details).

Table F.5: The effect of vertical integration on prices (differences-in-differences estimates): Aggregation results

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Panel A: Bertrand–Duflo–Mullainathan aggregation			
Integration	0.004	0.011	-0.006
	(0.005)	(0.003)	(0.004)
Observations	120002	128340	153568
R^2	0.992	0.989	0.990
Panel B: Chain–county–week aggregation			
Integration	0.005	0.012	-0.007
	(0.005)	(0.003)	(0.004)
Observations	9777190	9773005	10631305
R^2	0.902	0.902	0.884
Panel C: Chain–county–quarter aggregation			
Integration	0.003	0.009	-0.006
	(0.005)	(0.003)	(0.003)
Observations	847925	886362	980844
R^2	0.976	0.970	0.968
Panel D: Chain–county–year aggregation			
Integration	-0.000	0.007	-0.009
	(0.005)	(0.003)	(0.003)
Observations	219092	230853	268383
R^2	0.986	0.983	0.981
Panel E: Chain–MSA–week aggregation			
Integration	0.009	0.015	-0.004
	(0.011)	(0.006)	(0.008)
Observations	3301297	3458186	3641613
R^2	0.917	0.916	0.900
Panel F: Chain–MSA–quarter aggregation			
Integration	0.007	0.012	0.002
	(0.011)	(0.006)	(0.006)
Observations	280185	298901	325932
R^2	0.977	0.970	0.969
Panel G: Chain–MSA–year aggregation			
Integration	0.001	0.012	0.002
	(0.011)	(0.007)	(0.007)
Observations	71960	76483	87787
R^2	0.985	0.982	0.980

Notes: Standard errors clustered at the county level (panels A-D with 443 clusters) or MSA level (panels E-G with 50 clusters) in parentheses. All specifications include (aggregated) time-varying county-level controls. All specifications include product–time period and product–store/county/MSA fixed effects.

TABLE F.6: The effect of vertical integration on prices (within-store estimates): Aggregation results

	Dependent variable: log(price)						
	Aggregation level						
	Store	County	County	County	MSA	MSA	MSA
	Pre/Post	Week	Quarter	Year	Week	Quarter	Year
	Product	Product	Product	Product	Product	Product	Product
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Vertical integration	-0.011	-0.010	-0.010	-0.008	-0.010	-0.006	-0.007
× Coca-Cola/PepsiCo product	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)
Vertical integration	0.011	0.010	0.007	0.006	0.010	0.008	0.007
× Dr Pepper SG product	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.003)
Observations	401,908	30,181,251	2,715,122	718,325	10,400,894	905,010	236,227
R^2	0.992	0.907	0.976	0.986	0.921	0.976	0.985

Notes: Standard errors clustered at the county level (columns 1-4, 442 clusters) or MSA level (columns 5-7, 50 clusters). All specifications include store–time period, product–time period, and product–store fixed effects, as well as controls for feature and display.

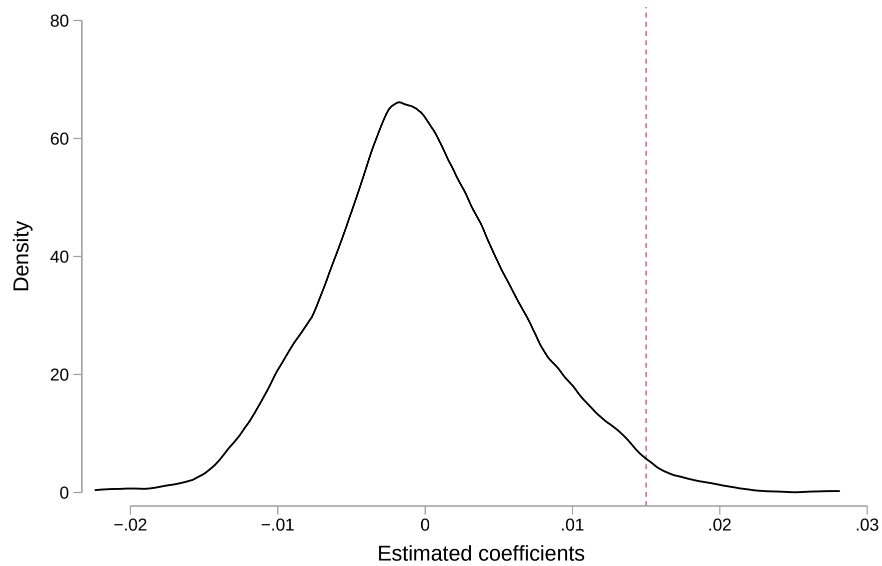
F.4 Placebos

To examine whether the estimated price effects of vertical integration on Dr Pepper SG products could be caused by chance, we perform four placebo exercises. Each of these exercises consists of 1,000 replications.

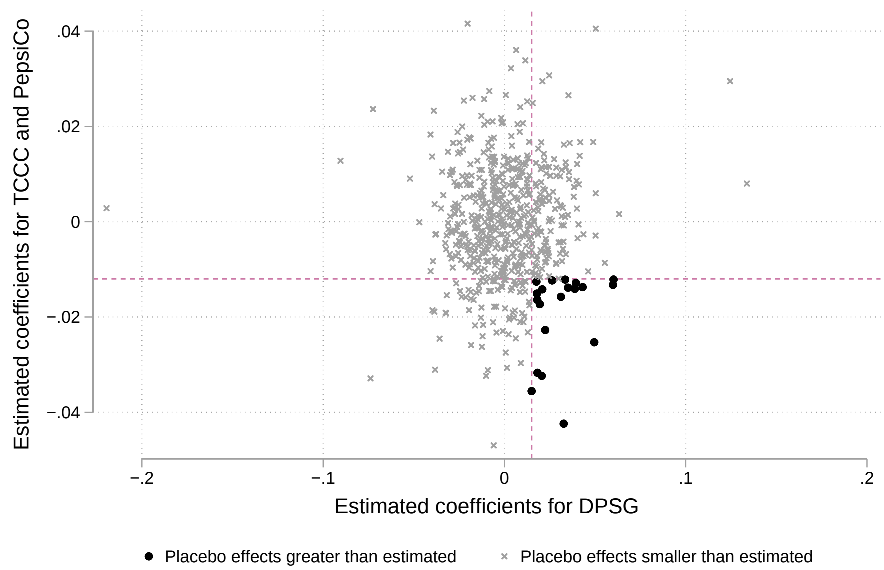
In the first exercise, we randomly draw the counties exposed to vertical integration, the moment at which vertical integration took place, and the subset of Dr Pepper SG products that were affected by vertical integration. Figure F.1a reports our findings and shows that the estimate effect reported in Table 4 (Panel A, Column 2) lies on the right tail of the distribution of placebo estimates, with an associated p-value of 0.015. This suggests that the estimated price increase of Dr Pepper SG products caused by vertical integration is unlikely to have occurred by chance.

In the second exercise, we repeat the analysis but now for Table 6. In this case, we estimate the impact of vertical integration on both own and Dr Pepper SG products that are sold within the same store. We report our findings in Figure F.1b. Though the figure omits some extreme values that would make it uninformative, the figure shows that few placebo estimates lie in the area in which they suggest that the relative price of own brands decreased more—and the relative price of Dr Pepper SG brands increased more—than the estimates we reported in the main text. In this case the p-value is 0.054, which also suggests that it is unlikely that the estimated price effects happened by chance.

Finally, we also estimate Table 4 for two product categories different from carbonated soda: beer and milk. We do this to examine whether the price effects estimated for Dr Pepper SG products also took place in these categories that were not affected by vertical integration. In these cases, we performed 1,000 placebo replications, holding fixed the counties in which vertical integration took place, and when it occurred, and we randomize the firm and its subset of products that were affected by vertical integration. Figure F.2 shows that, as it was the case above, the estimated price change for Dr Pepper SG products bottled by a vertically integrated bottler lies on the right tail of the distributions of placebo estimates, suggesting it is unlikely that the estimated effect was caused by chance.



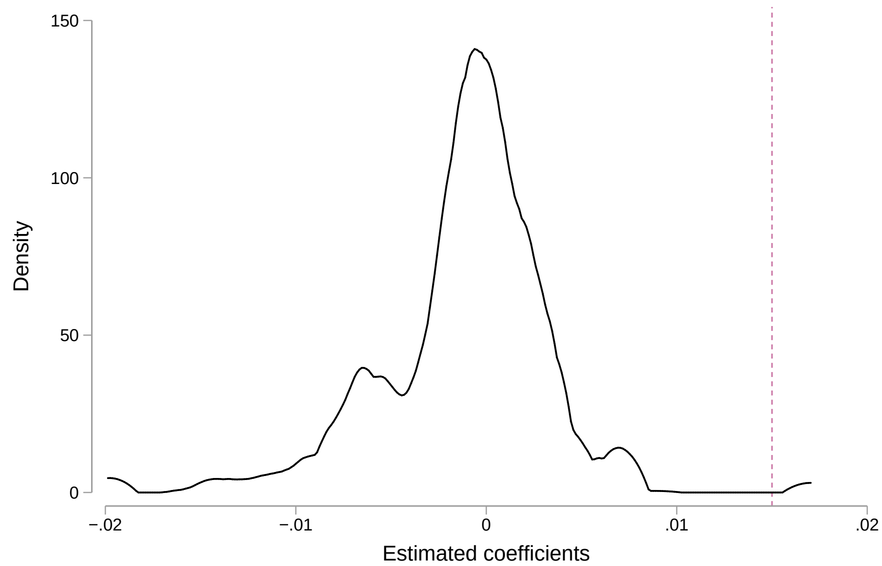
(a) Differences-in-Differences Dr Pepper SG



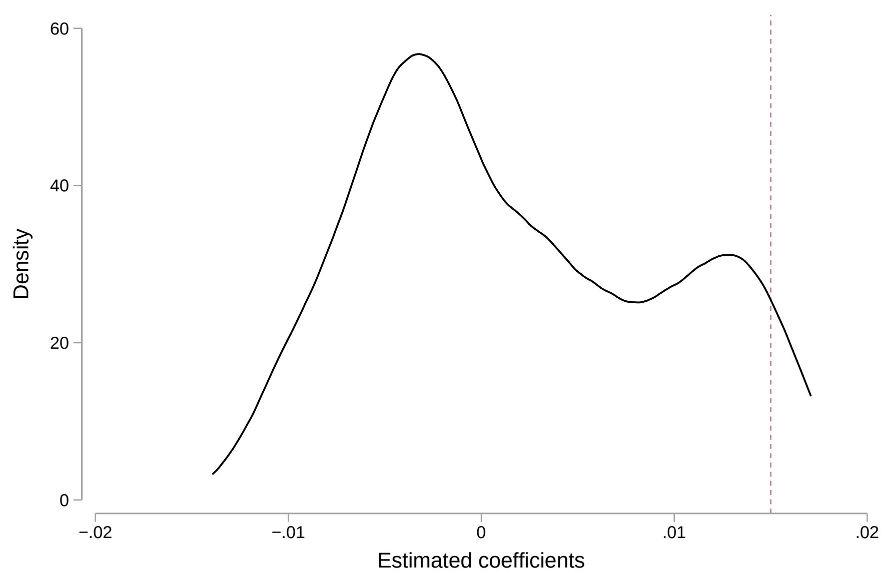
(b) Within-store analysis

Figure F.1: Placebo exercises

Notes: The upper panel presents the distribution of placebo estimates for the differences-in-differences analysis of Dr Pepper SG prices. The dashed vertical line corresponds to the estimated effect reported in Table 4 (Panel A, Column 2). The p-value for this estimate is 0.015. We implement the placebo exercises randomizing on three dimensions: when vertical integration took place, where it took place, and which products were affected. The lower panel repeats the analysis for the within-store analysis. In this case, the dashed vertical and horizontal lines report the estimated coefficients reported in Table 6 (Column 1). The black dots reported in the scatter plot correspond to placebo estimates that are larger than those reported in Table 6. The associated p-value is 0.054. The figure leaves out extreme values, but computation of the p-values considers the 1,000 placebo exercises.



(a) Differences-in-Differences (milk)



(b) Differences-in-Differences (beer)

FIGURE F.2: Placebo exercises

Notes: The upper panel presents the distribution of placebo estimates for the differences-in-differences analysis using milk products. The dashed vertical line corresponds to the estimated effect reported in Table 4 (Panel A, Column 2). The p-value for this estimate is 0.006. The lower panel repeats the analysis for beer products. In this case the p-value of the estimated effect is 0.044.

F.5 Clustering

In our main analysis we cluster errors at the county level. This choice is primarily driven by the fact that treatment is at the county level and not at the MSA level. That is, two neighboring counties may have been differentially impacted by vertical integration. While pricing incentives vary at the county level, one may be concerned about within-MSA residual price correlation due to shocks at the MSA level. As a robustness check, we replicate our main table with clustering at the MSA level in Table F.7 and Table F.8. The only notable difference is that we lose precision in Table F.8 (Column 2), where we decompose the impacts of vertical integration by upstream firm.

TABLE F.7: The effect of vertical integration on prices (differences-in-differences estimates): MSA clustering

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.003	0.015	-0.006
	(0.006)	(0.004)	(0.010)
Observations	15,756,886	15,935,207	17,051,189
R^2	0.910	0.903	0.891

Notes: Standard errors clustered at the MSA level (50 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display.

Table F.8: The effect of vertical integration on prices (within-store estimates): MSA clustering

	Dependent variable: log(price)	
	(1)	(2)
Vertical integration	-0.012	
× Coca-Cola/PepsiCo product	(0.005)	
Vertical integration	0.015	
× Dr Pepper SG product	(0.004)	
Vertical integration (Coca-Cola)		-0.011
× Coca-Cola product		(0.005)
Vertical integration (Coca-Cola)		0.022
× Dr Pepper SG product		(0.005)
Vertical integration (PepsiCo)		-0.012
× PepsiCo product		(0.010)
Vertical integration (PepsiCo)		0.007
× Dr Pepper SG product		(0.004)
Observations	48,743,206	48,743,206
R^2	0.905	0.905

Notes: Standard errors clustered at the county level (50 clusters). All specifications include store–week, product–week, and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display.

G Sub-sample analyses

G.1 Regular and sales prices

In this section, we first document the extent of temporary price reductions in the carbonated-beverage industry. Table G.1 shows that between 39 and 45 percent of the time, a product may be on sale. Table G.2 and Table G.3 show that the results of our differences-in-differences and within-store analyses, respectively, do not vary depending on whether a product is on sale or not. Further, Table G.4 examines whether vertical integration had any impact on the frequency with which vertically integrated bottlers implemented price promotions relative to nonintegrated bottlers. We find no evidence of vertical integration causing a change in the frequency of promotions.

Table G.1: Frequency of temporary price reductions by upstream firm

	Share of product–store–weeks with a temporary price reduction
Coca-Cola products	0.418
Dr Pepper SG products	0.393
PepsiCo products	0.451
Total	0.422

Notes: An observation is a product–store–week combination. An observation is classified as being on sale if the temporary price reduction is 5 percent or greater.

Table G.2: The effect of vertical integration on prices (differences-in-differences estimates): Regular and sale prices

	Dependent variable: log(price)					
	Coca-Cola		Dr Pepper SG		PepsiCo	
	(1)	(2)	(3)	(4)	(5)	(6)
	Subsample					
	Regular	Sale	Regular	Sale	Regular	Sale
Vertical integration	0.006	0.002	0.013	0.015	-0.009	-0.005
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.006)
Observations	9,165,010	6,587,902	9,653,494	6,278,308	9,348,662	7,697,017
R^2	0.954	0.924	0.950	0.928	0.933	0.923

Notes: Standard errors clustered at the county level (443 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display.

Table G.3: The effect of vertical integration on prices (within-store estimates): Regular and sale prices

	Dependent variable: log(price)			
	(1)	(2)	(3)	(4)
	Subsample			
	Regular		Sale	
Vertical integration × Coca-Cola/PepsiCo product	-0.010		-0.016	
	(0.003)		(0.003)	
Vertical integration × Dr Pepper SG product	0.015		0.019	
	(0.002)		(0.003)	
Vertical integration (Coca-Cola) × Coca-Cola product		-0.011		-0.018
		(0.004)		(0.004)
Vertical integration (Coca-Cola) × Dr Pepper SG product		0.017		0.031
		(0.002)		(0.003)
Vertical integration (PepsiCo) × PepsiCo product		-0.008		-0.012
		(0.004)		(0.004)
Vertical integration (PepsiCo) × Dr Pepper SG product		0.010		0.008
		(0.002)		(0.003)
Observations	28,166,818	28,166,818	20,560,389	20,560,389
R^2	0.952	0.952	0.942	0.942

Notes: Standard errors clustered at the county level (443 clusters). All specifications include store–week, product–week, and product–store fixed effects, as well as controls for feature and display.

Table G.4: The effect of vertical integration on the frequency of price promotions (differences-in-differences estimates)

	Dependent variable: Price promotion indicator		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.007	-0.007	-0.009
	(0.011)	(0.005)	(0.011)
Observations	15,773,639	15,952,984	17,058,040
R^2	0.388	0.307	0.400

Notes: Standard errors clustered at the county level (443 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display.

G.2 Heterogeneity results by type of chain

To examine heterogeneity across different types of chains—for example, because of time-invariant heterogeneity in exposure to rebate policies—we repeat our differences-in-differences analysis allowing for the effects of vertical integration on prices to vary by type of chain. Specifically, we define two chain-level indicators, large (i.e., more than 20 stores) and national (i.e., presence in more than one census region), and interact these indicators with the vertical integration indicator in Equation 1. Table G.5 presents estimates for this heterogeneity analysis. The table shows that vertical integration caused a larger increase in the prices of Dr Pepper SG products in stores belonging to small and local chains, though the differences are not statistically significant. The table also shows that the decrease in prices of PepsiCo products caused by vertical integration was larger in stores belonging to small and local chains.

TABLE G.5: The effect of vertical integration on prices (differences-in-differences estimates): Heterogeneity results by type of chain

	Dependent variable: log(price)								
		Coca-Cola			Dr Pepper			PepsiCo	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VI	-0.000	0.001	-0.000	0.018	0.018	0.017	-0.008	-0.010	-0.011
	(0.005)	(0.005)	(0.005)	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)
VI × Large	0.005			-0.004			0.004		
	(0.005)			(0.005)			(0.005)		
VI × National		0.003			-0.005			0.008	
		(0.004)			(0.004)			(0.004)	
VI × (Large & National)			0.008			-0.004			0.011
			(0.004)			(0.004)			(0.004)
Observations	15,797,101	15,797,101	15,797,101	15,975,949	15,975,949	15,975,949	17,097,916	17,097,916	17,097,916
R^2	0.910	0.910	0.910	0.903	0.903	0.903	0.891	0.891	0.891
Prod-Week FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prod-Store FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value $VI + VI \times Char = 0$	0.299	0.308	0.115	0.000	0.001	0.000	0.380	0.764	0.937

Notes: Standard errors clustered at the county level (443 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display. The treatment and control group are the same as in Table 4 (Panel A). Large chains are chains with more than 20 stores. National chains are chain that are present in more than one census region. The last row of the table reports the p-value of an F-test for whether $VI + VI \times Char = 0$, with $Char \in \{Large, National, Large\&National\}$.

G.3 Differences-in-differences estimates excluding the 20 oz product category

In this section we replicate our differences-in-differences analysis excluding the 20 oz product category in light of the data presented in Section D.5, which suggests that integrated and nonintegrated products in this category may have followed different price trends before vertical integration. The results, presented in Table G.6, show that excluding the 20 oz product category does not have material impact on our findings.

TABLE G.6: The effect of vertical integration on prices (differences-in-differences estimates; 67 and 144 oz products only)

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Panel A: Baseline estimates			
Vertical integration	-0.000	0.017	-0.007
	(0.005)	(0.004)	(0.006)
Observations	12,456,338	12,819,915	13,302,545
R^2	0.895	0.902	0.882
Panel B: Restricted treatment subsample			
Vertical integration	-0.012	0.013	-0.006
	(0.007)	(0.005)	(0.006)
Observations	1,377,376	1,988,718	1,293,243
R^2	0.925	0.919	0.916

Notes: Standard errors clustered at the county level (443 clusters). All specifications include product–week and product–store fixed effects, as well as time-varying county-level controls and controls for feature and display. Panel A includes the full sample of 67 and 144 oz products. Panel B drops the observations that were indirectly treated (i.e., products bottled by nonintegrated bottlers in store–week combinations where at least one product was bottled by an integrated bottler) and restricts the sample to counties that were either untreated or where only Coca-Cola integrated and the Coca-Cola bottler did not bottle Dr Pepper SG products (column 1); counties in which either Coca-Cola or PepsiCo integrated while bottling Dr Pepper SG products (column 2); and counties where only PepsiCo integrated and the PepsiCo bottler did not bottle Dr Pepper SG products (column 3).

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