The Competitive Impact of Vertical Integration by Multiproduct Firms

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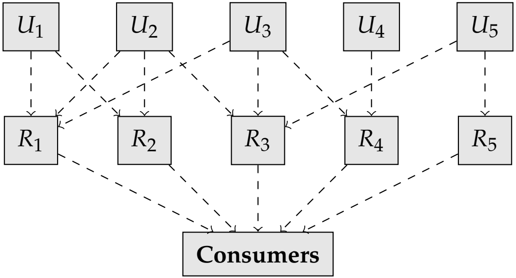
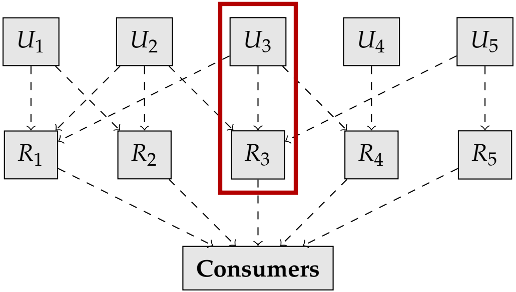
Vertical mergers in the last years

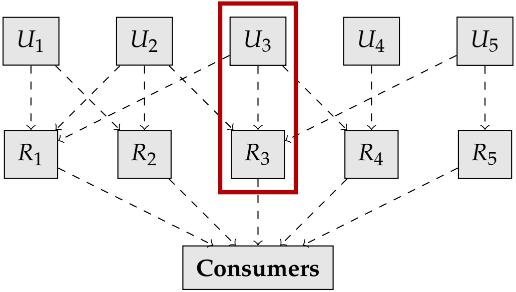
“Mega” vertical mergers proposed in the last years have reinvigorated the long-standing debate on the competitive impact of vertical mergers.

- AT&T and Time Warner, Disney and 21st Century Fox, Aetna and CVS, Humana and Concentra, Luxottica and Essilor, Comcast and NCBU, Google and ITA Software, among others.


U_1
U_2
U_3
U_4
U_5
R_1
R_2
R_3
R_4
R_5
Consumers

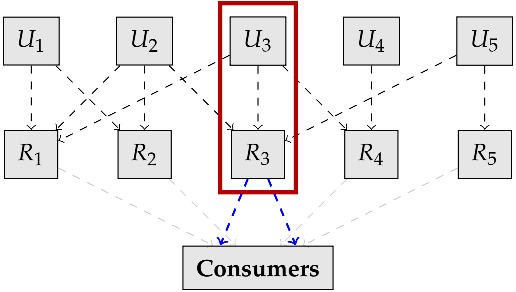


What is the competitive impact of vertical integration?



Vertical mergers are often evaluated based on the trade-off between

- Efficiencies
- Market foreclosure



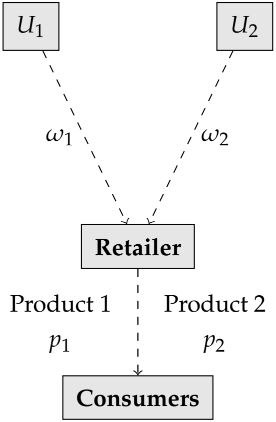
Vertical mergers are often evaluated based on the trade-off between

- Efficiencies
- Market foreclosure

A third effect comes into play in multiproduct industries

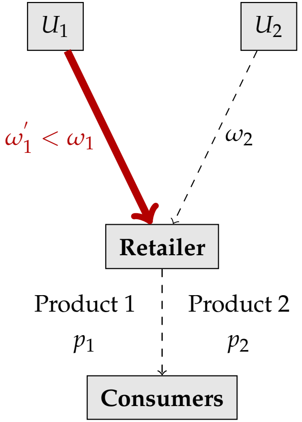
- Partial vertical integration introduces anticompetitive pricing incentives.
- Cannot presume the elimination of double margins to be procompetitive.

Example



Extended model

Example

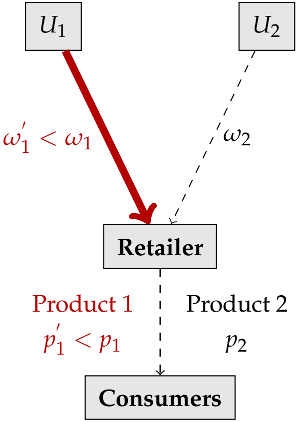


Suppose the Retailer integrates with U_1, partially eliminating double margins.

ω_1 decreases, causing

Extended model

Example



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ω_1 decreases, causing

- a *downward* pressure on p_1
  - **Efficiency effect**

Extended model

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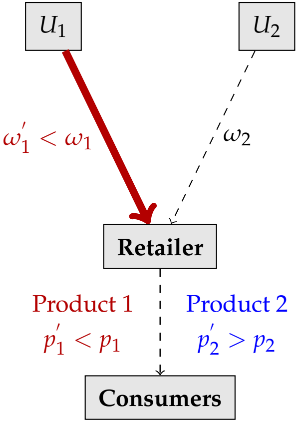

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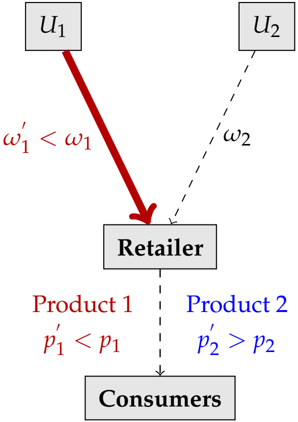
  - **Efficiency effect**

- an *upward* pressure on p_2 to divert demand to product 1, if products are substitutes

Extended model

Example



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ω_1 decreases, causing

- a *downward* pressure on p_1
  - **Efficiency effect**
- an *upward* pressure on p_2 to divert demand to product 1, if products are substitutes
  - **Edgeworth-Salinger effect**

Extended model

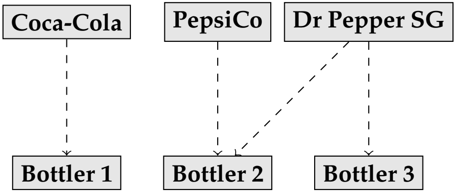
This Paper

Is the Edgeworth-Salinger effect relevant for the evaluation of vertical mergers?

- What is its magnitude?
- How does it interact with efficiency gains?

Context: Carbonated Beverage Industry in the U.S.

- Upstream firms sell concentrate to downstream bottlers
  - Bottlers can work with more than one upstream firm and have exclusive territories.



- In 2009 and 2010, PepsiCo and The Coca-Cola Company integrated with some of their bottlers.
  - Not all areas of the country were affected by vertical integration
  - VI bottlers bottled some Dr Pepper Snapple Group brands in some areas of the country

Contributions, Findings, and Implications

Main contribution:

- Identify source of variation in vertical structure that allows to quantify anticompetitive and efficiency effects associated with the EDM.

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Findings

- Prices of DPSG products increased by 1.2–1.5 percent, and the effects were lasting.
- Prices of Coca-Cola and PepsiCo products decreased by 1 percent.
- Revenues of DPSG *decreased* by 1.3 percent.

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- Revenues of DPSG *decreased* by 1.3 percent.

Policy implications:

1. **The elimination of double margins cannot be presumed to be procompetitive with multiproduct firms,**
2. **The Edgeworth-Salinger should be incorporated in the examination of vertical mergers**

Where is the Edgeworth-Salinger Effect Relevant?

- **Retailers integrating with one of their suppliers**
  - E.g., McKesson Canada Corporation's acquisition of Rexall Pharmacy Group Ltd. and Uniprix, Brown Shoe Co., Inc.'s acquisitions of Wohl Shoe Company and Wetherby-Kayser in 1951 and 1953, respectively
- **Drug manufacturers acquiring pharmacy benefit managers**
  - E.g., Merck & Co., Inc.'s acquisition of Medco Managed Care, L.L.C. in 1993, Eli Lilly and Company's acquisition of McKesson Corporation in 1995
- **Health insurance companies buying hospitals and clinics**
  - E.g., Humana's acquisition of Concentra in 2010, WellPoint Inc's acquisition of CareMore Health Group in 2011
- **Media industry**
  - E.g., AT&T's acquisition of Times Warner, Disney's acquisition of Fox

Literature Review

- Pricing incentives in bilateral oligopolies: Ho and Lee (2017), Crawford et al (2018)
- Anti- and procompetitive effects of VI
  - Theory: Theory: Salinger (1988), Perry (1989), Ordover et al (1990), Hart el al (1990), Bolton and Whinston (1991), Reiffen (1992), Riordan and Salop (1995), Riordan (1998), Choi and Yi (2000), Chen (2001), Lafontaine and Slade (2007), Levy et al (2018), and others
  - Empirical evidence: Chipty (2001), Hastings and Gilbert (2005), Hortacsu and Syverson (2007), Houde (2012), Crawford et al (2018), and others
- Ongoing debate on antitrust enforcement: Salop (2017), FTC Hearings (2018), Baker et al (2019)

Edgeworth paradox + vertical integration

- Edgeworth (1925), Hotelling (1932), Salinger (1991)

Outline

1. The industry and the transactions
2. Data
3. Research design and identification threats
4. Results and discussion

The U.S. Carbonated Beverage Industry

Background

- The industry was born in 1886.

- Two sets of players:
  - Concentrate producers (e.g., PepsiCo, Coca-Cola Co, Dr Pepper SG).
  - Local bottlers. Example

- Industrial organization motivated by logistical difficulties.

- Bottlers were granted exclusive territories and were responsible for local advertising, retail pricing, and production.

- Originally, concentrate was sold at a fixed linear price ($1.30 per gallon).
  - More price flexibility over time Bottler Agreement

- Over time, bottlers have consolidated.

The Transactions

- In 2009 and 2010, Coca-Cola and Pepsi acquired some of their independent bottlers. Why?
    - Consumption of carbonated sodas in decline.
    - Input cost increases (e.g., plastic, high-fructose corn syrup).

The Transactions

- Despite the large footprint of the bottlers, not all areas of the country were affected by vertical integration (70% of sales)
- VI bottlers bottled some Dr Pepper Snapple Group brands in some areas of the country impacted by vertical integration (35 % of sales)
    - These brands included Dr Pepper, Crush, Canada Dry, among others.
    - Partial vertical integration in these areas.
- Coca Cola and PepsiCo acquired licenses to continue selling Dr Pepper SG products.
- The FTC cleared the transactions subject to behavioral remedies

Hypothesis: Partial VI Changes Pricing Incentives

What do we expect to see? The mergers

- eliminated double marginalization for Coca-Cola and PepsiCo brands bottled by VI bottlers

$\implies$ Expect a **decrease** in prices of own brands,

- did not eliminate double marginalization for Dr Pepper brands bottled by VI bottlers

$\implies$ Expect an **increase** in prices of Dr Pepper brands

Overall price effect is ambiguous.

Data and Research Design

Data (1)

1. IRI Marketing Data Set

    - Weekly scanner data for the years 2007 to 2012 across 50 MSAs
    - An observation is a store–week–brand–size combination
    - We focus on popular products: 72 brands, 216 products
        - Example of product: 67.6 oz bottle of Diet Coke
        - Sample coverage: 89 percent of carbonated products sales.

Within-store price dispersion Variance decomposition

Data (2)

2. Territory maps for each bottler
    - Beverage Digest

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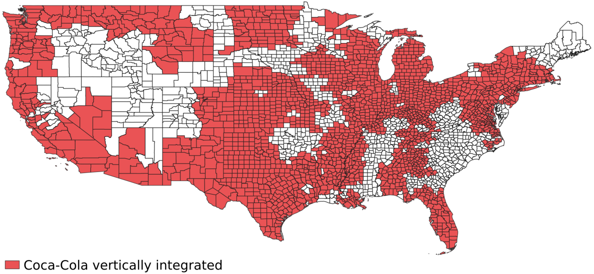
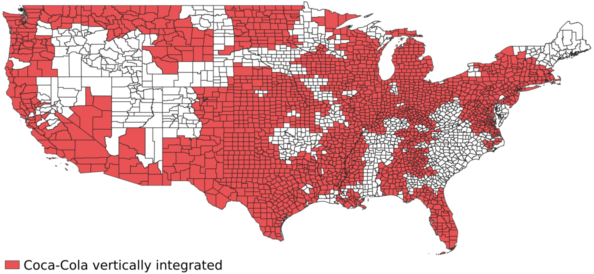


Data (3)

3. FTC documents
   - Counties that were exposed to Edgeworth-Salinger effect



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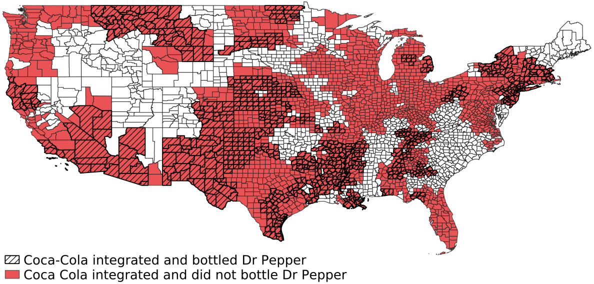
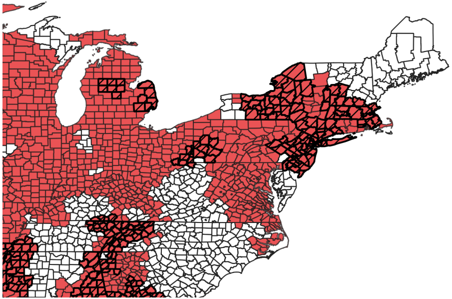


VI gives us two sources of identification

1. Within-product price variation across locations



2. Within-store price variation across products

Threats to Identification

1. Changes at the upstream firm level (e.g., advertising, rebate policies, or input costs)

2. Preexisting price trends specific to areas eventually impacted by VI.

We use the panel structure to tackle (1); and address (2) using summary statistics, testing for diverging pre-trends, and using a dynamic difference-in-difference framework.

Threats to Identification

3. Selection
    - Large footprint covering diverse regions.
        - Panel structure allows us to control for unobservables at the product–store level
    - No divestitures post VI.
        - Suggests PepsiCo and TCCC were not targeting specific locations.
    - No differential change in observables over time. Table

Summary statistics: Average price changes

Dr Pepper SG prices

	Before VI	After VI	Change
Treated	1.44	1.51	0.07
Untreated	1.34	1.37	0.03

- Increase in the prices of Dr Pepper SG in treated areas (p<0.01)
- Decrease in the prices of PepsiCo in treated areas

Summary statistics: Price trends

a) Coca-Cola

b) PepsiCo

c) Dr Pepper

More

Specifications and Results

Two complementary research designs

The vertical mergers generated two sources of variation in vertical structure

1. A given product is bottled by integrated and nonintegrated bottlers across the country
    - Within-product analysis (differences-in-differences)
2. Products sold in the same store are differentially exposed to vertical integration
    - Within-store analysis

Differences-in-differences

An observation is a product-store-week combination (j, s, w).

We estimate

$$\log(price_{j,s,w}) = VI_{j,s,w}\beta_k + \eta_{j,s} + \phi_{j,w} + x'_{j,s,w}\delta + \epsilon_{j,s,w},$$

for $k \in \{PepsiCo, Coca-Cola, DPSG\}$.

Treatment and control groups

Let's focus on the case of Coke

Option 1: Broadest definitions

<u>Store 1</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment
Pepsi

<u>Store 2</u>

Coke $\rightarrow$ Control
$\boxed{\textit{Pepsi}}$

<u>Store 3</u>

Coke $\rightarrow$ Control
Pepsi

<u>Store 4</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment
$\boxed{\textit{Pepsi}}$

Edgeworth-Salinger Effect is Economically Relevant

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.003	0.015***	-0.006
	(0.005)	(0.003)	(0.005)
Observations	15,756,886	15,935,207	17,051,189
R^2	0.910	0.903	0.891

Treatment and control groups

Let's focus on the case of Coke

Option 2: Restrict controls

<u>Store 1</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment

Pepsi

~~<u>Store 2</u>~~

~~Coke $\rightarrow$ Control~~

~~$\boxed{\textit{Pepsi}}$~~

<u>Store 3</u>

Coke $\rightarrow$ Control

Pepsi

<u>Store 4</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment

$\boxed{\textit{Pepsi}}$

Why drop store 2?

- Coke was indirectly treated because of the VI of Pepsi.

Dropping indirectly affected products doesn't change results

Dependent variable: log(price)			
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical Integration	-0.002	0.015***	-0.007*
	(0.006)	(0.003)	(0.004)
Observations	14,181,874	14,776,605	16,003,752
R^2	0.908	0.902	0.890

Treatment and control groups

Let's focus on the case of Coke

Option 3: Restrict controls and treatment

<u>Store 1</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment

Pepsi

<u>Store 2</u>

Coke $\rightarrow$ Control

$\boxed{\textit{Pepsi}}$

<u>Store 3</u>

Coke $\rightarrow$ Control

Pepsi

<u>Store 4</u>

$\boxed{\textit{Coke}}$ $\rightarrow$ Treatment

$\boxed{\textit{Pepsi}}$

Why drop stores 2 and 4?

- VI of Pepsi

Edgeworth-Salinger Effect is Economically Relevant

Dependent variable: log(price), only direct effects			
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	-0.009	0.012**	-0.008
	(0.006)	(0.003)	(0.005)
Observations	1,750,697	2,458,215	1,665,107
R^2	0.936	0.923	0.924

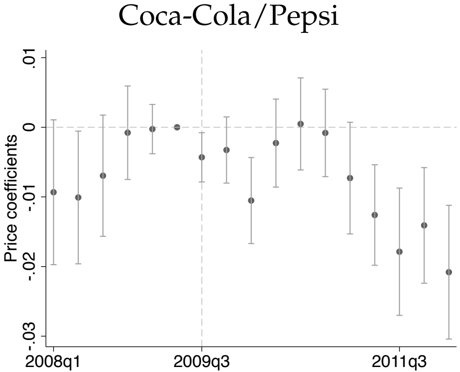
Price effects may vary with the popularity of the products

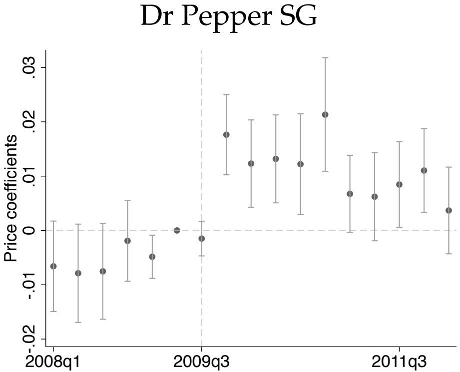
Dependent variable: log(price). Price indexes specification

	All	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)	(4)
Vertical integration	-0.001	-0.006	0.048***	-0.022***
	(0.006)	(0.007)	(0.008)	(0.006)
Observations	528,838	528,491	526,527	524,762
R^2	0.809	0.860	0.867	0.878

National weights

Dr Pepper SG price effects persisted in time





Within-store analysis

Measure changes in relative prices caused by VI within a store.

We pool all products and estimate

$$\log(price_{j,s,w}) = VI_{j,s,w}^{\text{CC/Pepsi}}\beta_1 + VI_{j,s,w}^{\text{Dr P}}\beta_2 + \eta_{j,s} + \phi_{j,w} + \gamma_{s,w} + x'_{j,s,w}\delta + \varepsilon_{j,s,w}$$

Price effects are measured relative to changes in prices of nonintegrated products.

Relationship between estimators

Similar results with the within-store analysis

	Dependent variable: log(price)	
	(1)	(2)
Vertical integration	-0.012***	
$\times$ Coca-Cola/PepsiCo product	(0.003)	
Vertical integration	0.015***	
$\times$ Dr Pepper SG product	(0.002)	
Vertical integration (Coca-Cola)		-0.011***
$\times$ Coca-Cola product		(0.003)
Vertical integration (Coca-Cola)		0.022***
$\times$ Dr Pepper SG product		(0.003)
Vertical integration (PepsiCo)		-0.012**
$\times$ PepsiCo product		(0.005)
Vertical integration (PepsiCo)		0.007**
$\times$ Dr Pepper SG product		(0.003)
Observations	48,743,027	48,743,027
R^2	0.911	0.911

Robustness, Inference, and Sub-sample Analyses

Selection

1. Propensity score differences-in-differences
2. Neighboring counties

Aggregation

1. Chain pricing
2. Bertrand et. al. (2004)

Inference

1. Placebos
2. Clustering

Subsample

1. Regular vs. sale prices
2. Heterogeneity by chain size

Revenue diversion

Pre- and post-merger revenues of upstream firm f

$$R_0^f = \sum_{j \in f} p_{0j}^f q_{0j}^f$$
$$R_1^f = \sum_{j \in f} p_{1j}^f q_{1j}^f = \sum_{j \in f} p_{0j}^f (1 + \Delta_{p_j}) q_{0j}^f (1 + \Delta_{q_j})$$

The percentage change in revenues caused by VI is

$$\Delta_{R^f} = \sum_{j \in f} s_{0j}^f (\Delta_{q_j} + \Delta_{p_j} + \Delta_{q_j} \Delta_{p_j})$$

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The percentage change in revenues caused by VI is

$$\Delta_{R^f} = \sum_{j \in f} s_{0j}^f (\Delta_{q_j} + \Delta_{p_j} + \Delta_{q_j} \Delta_{p_j})$$

Revenues of Coca-Cola and PepsiCo increased by 2.2 and 1.7 percent. **Revenues of Dr Pepper SG decreased by 1.3 percent.** Product-level estimates

Discussion and Policy Implications

- We present evidence of anticompetitive pricing incentives that arise when a subset of products is directly exposed to VI.
- Exploiting rich variation in vertical structure across time and space, we show that the anticompetitive effects of VI are as large or larger in abs. value than the efficiency effects.
- In contrast to common intuition, the elimination of double marginalization cannot be presumed to be procompetitive when multiproduct firms integrate.
- Because these pricing incentives were present in many recent vertical mergers, the Edgeworth-Salinger effect should be incorporated in the evaluation of vertical-merger enforcement actions.

Thank you!

Examples of a three-tier model

Consider a model with upstream input producers, bottlers, and a retailer. Assume retail prices are determined by

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

for every $j \in J$ and where $\lambda \in [0, 1]$ scales retail markups between zero and monopoly markups (Miller and Weinberg 2017).

Bottler i solves

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

where J_B^i corresponds to the set of products sold by bottler i.

Upstream firm i solves

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

Examples of a three-tier model

Assume two upstream firms, one bottler, two products, and logit demand

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

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Pepsi Cola Champaign-Urbana Bottling Co.

Back

Bottlers and concentrate producers

1. After changing the orRegular vs. sale pricesiginal contracts (with fixed prices), concentrate producers have the right to change the price of concentrate at their discretion.
2. Bottlers choose the price at which they sell, with two exceptions
   - CP may establish maximum prices in some cases
   - CP may suggest prices to the bottlers
3. Over the years, bottlers have protested against price increases as "their price-cost margin decreases".
4. Over time, there has been a movement to incorporate non-linearities in the price paid by bottlers.
5. The first contract that suggests full non-linearity is from 2018 and refers to a sub-bottling territory and agreement.

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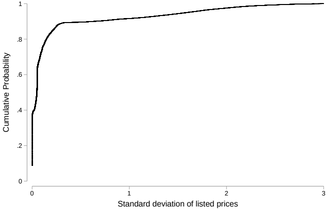
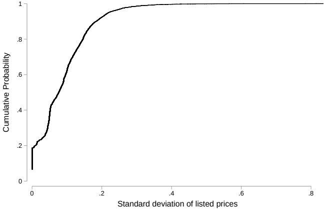
Within-store price dispersion I

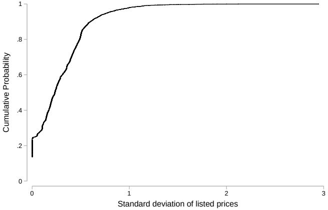
a) 20oz



b) 67.6oz



a) 144oz



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Within-store price dispersion II: An example

	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" or rounded.

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Decomposition of the variance of price

	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 $p_{jst} = p_{ct} + (p_{st} - p_{ct}) + (p_{jst} - p_{st})$. The table reports the variance of each of these components relative to total variance.

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Data: Beverage Digest

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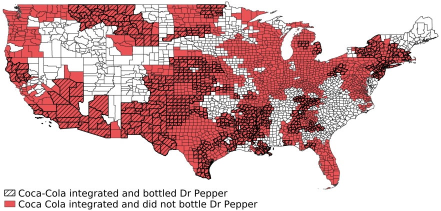
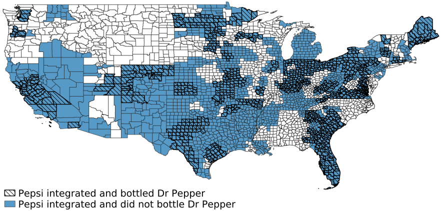
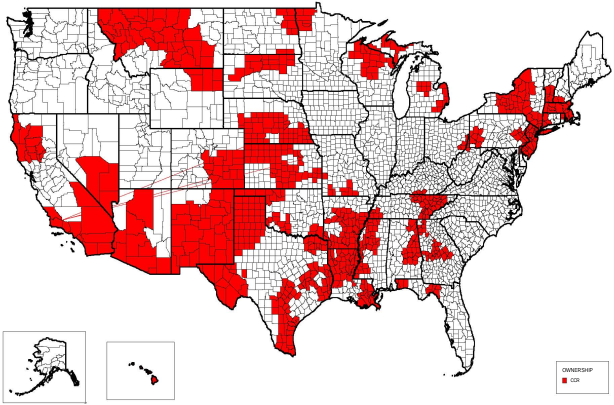




Sources: *The Coke System* and *The Pepsi System*, by Beverage Digest, and FTC (2010a,b).

Data: FTC Documents

Counties where Dr Pepper was bottled by the bottler acquired by Coca Cola (this is one of many maps) Go back



Source: FTC's Complaint, Appendix B.

Covariate balance

	(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	61.81	54.24	-7.56	64.31	55.5	-8.8	-1.24
	(6.96)	(7.34)	[0.000]	(2.19)	(6.79)	[0.000]	[0.136]

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 parantheses. *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's American Community Survey (2007-2012). The number of convenience stores and supermarkets in each county–year were drawn from the US Census Bureau's County Business Patterns database. Temperature at the county–month level was retrieved from NOAA's National Climatic Data Center database. Go back

Testing divergence pre-integration

Dependent variable: Residualized prices

	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Week	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Ever integrated	-0.088	-0.053	0.118
	(0.067)	(0.057)	(0.076)
Ever integrated $\times$ Week	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Constant	0.067	0.007	-0.093
	(0.060)	(0.049)	(0.072)
Observations	7,417,588	7,058,387	7,714,048
R^2	0.000	0.000	0.000

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Summary statistics: Average price changes (67oz)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Before VI			After VI			
Firm	Untreated	Treated	(2)-(1)	Untreated	Treated	(5)-(4)	(6)-(3)
Coca-Cola	1.38	1.44	0.06	1.48	1.54	0.06	0
	(0.17)	(0.15)	[0]	(0.14)	(0.15)	[0]	[0.99]
Dr Pepper SG	1.34	1.44	0.09	1.37	1.51	0.14	0.05
	(0.17)	(0.16)	[0]	(0.18)	(0.17)	[0]	[0]
PepsiCo	1.33	1.37	0.04	1.43	1.44	0.01	-0.03
	(0.13)	(0.13)	[0]	(0.10)	(0.14)	[0.13]	[0]

Notes: An observation is a store–product–period combination, where period $\in \{premerger, postmerger\}$. The table reports average prices before and after vertical integration, for treated and untreated counties. Back

Market shares across counties

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Before VI			After VI			
Variable	Untreated	Treated	(2)-(1)	Untreated	Treated	(5)-(4)	(6)-(3)
Coca-Cola	0.044	0.042	-0.002	0.043	0.045	0.002	0.003
	(0.031)	(0.026)	[0.147]	(0.024)	(0.029)	[0.143]	[0.039]
Dr Pepper SG	0.014	0.009	-0.005	0.02	0.01	-0.01	-0.005
	(0.015)	(0.007)	[0]	(0.021)	(0.008)	[0]	[0]
PepsiCo	0.036	0.036	0	0.034	0.035	0.001	0.002
	(0.032)	(0.029)	[0.868]	(0.025)	(0.028)	[0.334]	[0.387]

Notes: An observation is a store–product–period combination, where period $\in \{premerger, postmerger\}$. The table reports averages market shares, before and after vertical integration, for treated and untreated counties. The Coca-Cola products include 67 oz Coca-Cola and Diet Coke; the Dr Pepper SG products include 67 oz Dr Pepper and Diet Dr Pepper; the PepsiCo products include 67 oz Pepsi and Diet Pepsi. Standard deviations are in parantheses. p-values of two-sided tests for equality of means in brackets. Go back

Price indexes with national weights

Dependent variable: log(price). Price indexes specification

	All	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

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Relationship between estimators

Consider an example with two markets and two observations per market (i.e., one before and one after VI).

In market A, one product starts being produced by a VI bottler, the other does not. In market B, no products are exposed to integration.

Our estimators correspond to

- Differences-in-differences: $(p_{j,A,1} - p_{j,B,1}) - (p_{j,A,0} - p_{j,B,0})$
- Within-store: $(p_{j,A,1} - p_{NoVI,A,1}) - (p_{j,A,0} - p_{NoVI,A,0})$,

where $p_{NoVI,A,t}$ is the average price of nonintegrated products in market A at time t.

The estimators are equivalent if the changes in the prices of nonintegrated products is the same across markets: $p_{j,B,1} - p_{j,B,0} = p_{NoVI,A,1} - p_{NoVI,A,0}$. Can we test this? Yes

Relationship between estimators

We use the sample that minimizes equilibrium feedback effects to test if the estimators are similar.

Dependent variable: log(price), only direct effects

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

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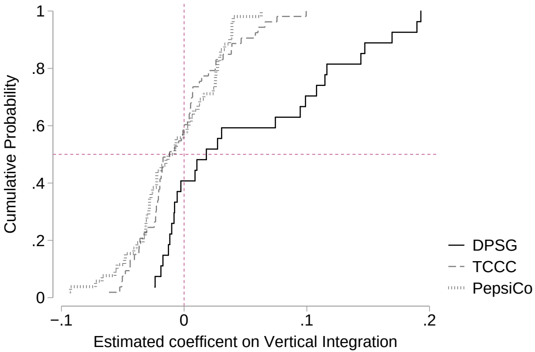
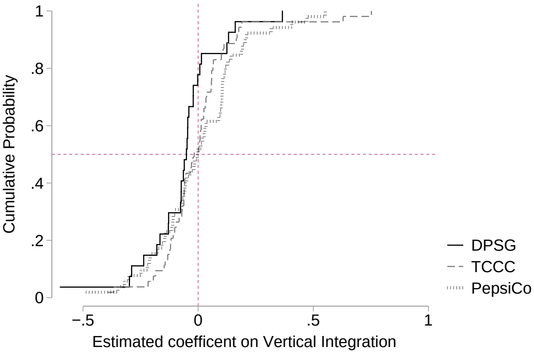
Product-level analysis



A) Price regressions



B) Quantity regressions

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Blocking regression (propensity score)

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.003	0.014***	-0.008**
	(0.006)	(0.002)	(0.004)
Observations	15,727,691	14,909,921	16,909,793

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Neighboring counties I

	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

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Neighboring counties II

	Dependent variable: log(price)	
	(1)	(2)
VI · Own product	-0.009***	
bottled by Coca-Cola or PepsiCo bottler	(0.003)	
VI · Dr Pepper SG product	0.013***	
bottled by Coca-Cola or PepsiCo bottler	(0.004)	
$VI_{CocaCola}$ · Coca-Cola product		-0.014***
		(0.005)
$VI_{CocaCola}$ · Dr Pepper SG product		0.015***
bottled by Coca-Cola bottler		(0.005)
$VI_{PepsiCo}$ · PepsiCo product		-0.002
		(0.005)
$VI_{PepsiCo}$ · Dr Pepper SG product		0.007
bottled by PepsiCo bottler		(0.005)
Observations	18,557,740	18,557,740
R^2	0.905	0.905

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Aggregation I: chain pricing

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
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
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

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Aggregation II : chain pricing

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
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
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

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Aggregation III : chain pricing

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
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
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

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Bertrand et. al (2004)

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
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

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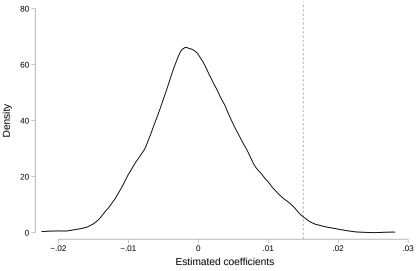
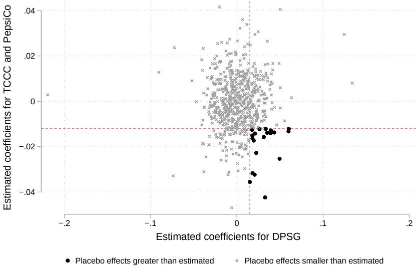
Placebos I

a) DPSG DiD (p-value 0.015)



b) Within-store (p-value 0.054)



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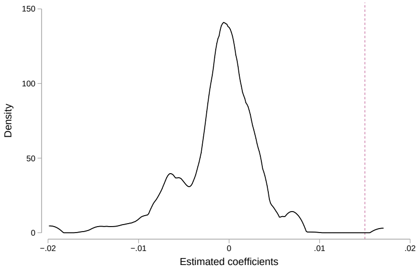
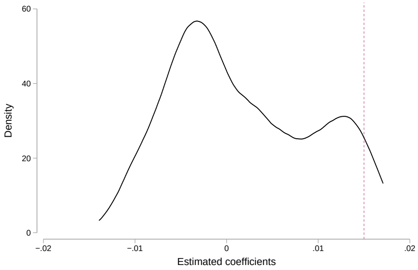
Placebos II

a) Milk (p-value 0.006)



b) Beer (p-value 0.044)



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Clustering I

	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

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Clustering II

	(1)	(2)
VI · Own product	-0.011**	
bottled by Coca-Cola or PepsiCo bottler	(0.005)	
VI · Dr Pepper SG product	0.014***	
bottled by Coca-Cola or PepsiCo bottler	(0.004)	
$VI_{CocaCola}$ · Coca-Cola product		-0.011**
		(0.005)
$VI_{CocaCola}$ · Dr Pepper SG product		0.021***
bottled by Coca-Cola bottler		(0.005)
$VI_{PepsiCo}$ · PepsiCo product		-0.012
		(0.010)
$VI_{PepsiCo}$ · Dr Pepper SG product		0.005
bottled by PepsiCo bottler		(0.004)
Observations	48743206	48743206
R^2	0.905	0.905

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Regular and sale prices I

	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

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Regular and sale prices II

	Dependent variable: log(price)			
	(1)	(2)	(3)	(4)
	Subsample			
	Regular		Sale	
VI · Own product bottled by Coca-Cola or PepsiCo bottler	-0.010***		-0.016***	
	(0.003)		(0.003)	
VI · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.015***		0.019***	
	(0.002)		(0.003)	
$VI_{CocaCola}$ · Coca-Cola product		-0.011***		-0.018***
		(0.004)		(0.004)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler		0.017***		0.031***
		(0.002)		(0.003)
$VI_{PepsiCo}$ · PepsiCo product		-0.008**		-0.012***
		(0.004)		(0.004)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler		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

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Heterogeneity: Small vs Large chains

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	-0.000	0.018***	-0.008
	(0.005)	(0.005)	(0.005)
Vertical integration · Large	0.005	-0.004	-0.004
	(0.005)	(0.005)	(0.005)
Observations	15,797,101	15,975,949	17,097,916
R^2	0.910	0.903	0.891

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Heterogeneity: Grocery stores subsample

	Dependent variable: log(price)		
	Coca-Cola	Dr Pepper SG	PepsiCo
	(1)	(2)	(3)
Vertical integration	0.003	0.024***	-0.009
	(0.005)	(0.003)	(0.005)
Observations	13,393,903	13,698,982	14,667,062
R^2	0.910	0.905	0.891

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Heterogeneity

Comparing directly treated counties with indirectly and untreated counties

	Dependent variable: log(price)	
	(1)	(2)
	Subsample	
	All	Border
Vertical integration	0.016***	0.014**
	(0.003)	(0.006)
VI by rival firm not involving Dr Pepper SG products	0.003	0.004
	(0.005)	(0.007)
Observations	15,935,207	5,984,326
R^2	0.903	0.897

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Frequency of promotions

	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

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