

Vertical Integration with Multiproduct Firms: When Eliminating Double Marginalization May Hurt Consumers

Based on Luco and Marshall (2018)

Minhae Kim

The Ohio State University

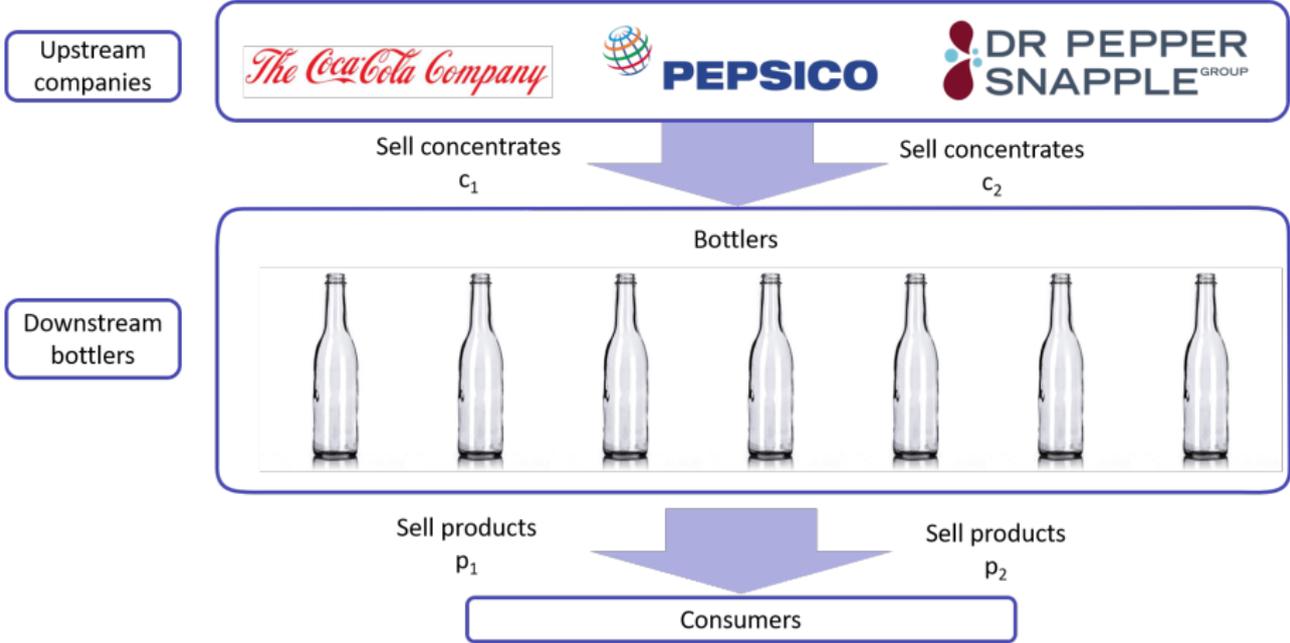
kim.6488@osu.edu

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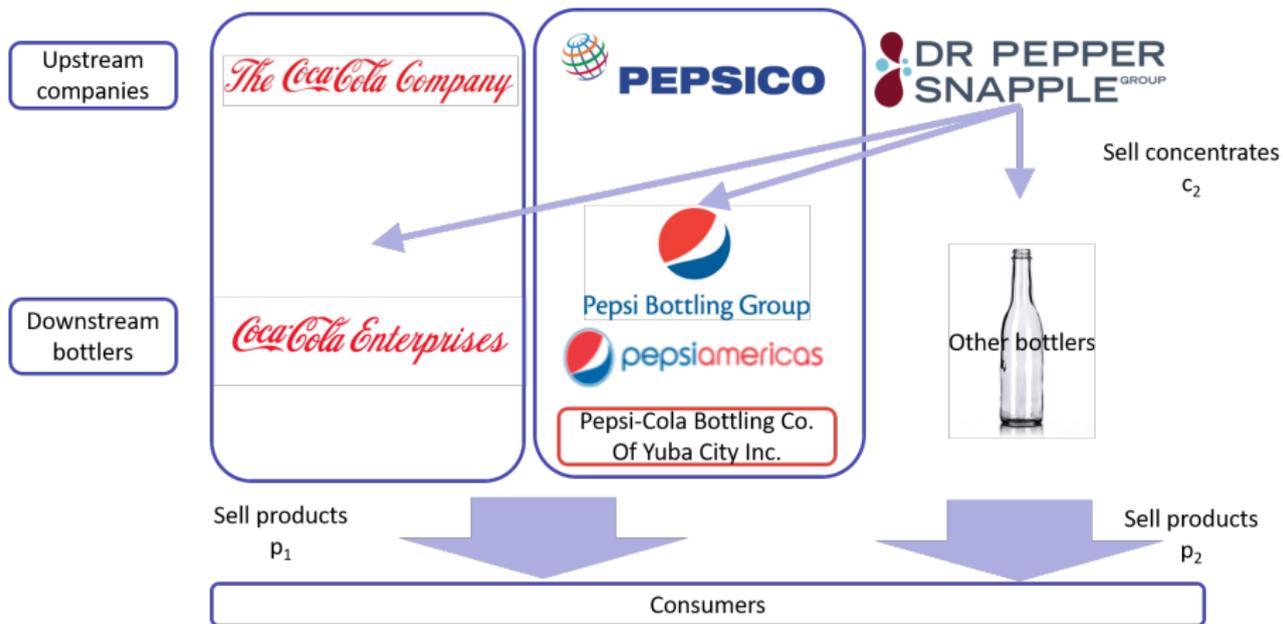
Outline

- 1 Introduction
- 2 Model
- 3 Background and Data
- 4 Empirical Framework and Estimation
- 5 Conclusion

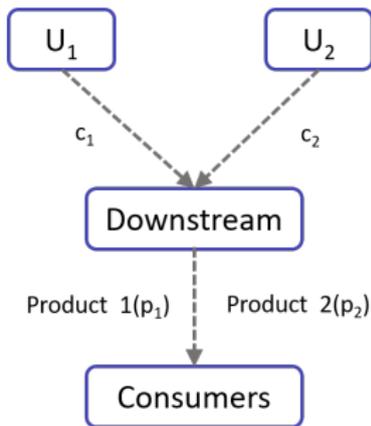
Before vertical integration



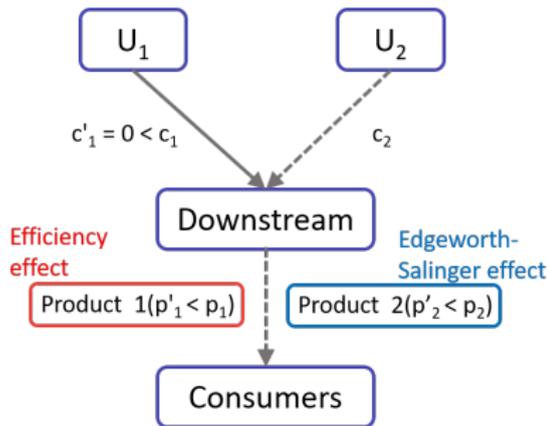
After vertical integration



Effects of eliminating double marginalization



(a) Before vertical integration



(b) After vertical integration

- Efficiency effect
The products with eliminated double margins become cheaper to sell.
- Edgeworth-Salinger effect
The firms have incentives to divert demand towards products with eliminated double margins by increasing the prices of the products for which double marginalization was not eliminated.

Literature review

Effects of VI	Arguments	Literature
Procompetitive	VI is likely to create efficiencies that are transaction specific.	Hortaçsu and Syverson (2007)
Anticompetitive	VI may incentivize the vertically integrated firm to exclude a downstream or upstream rival (i.e., market foreclosure).	Chipty (2001) Hastings and Gilbert (2005)
Mixed findings	The sign of welfare effect of VI depends on whether the nonintegrated distributors have access to integrated content.	Crawford et al. (2015)

Research question

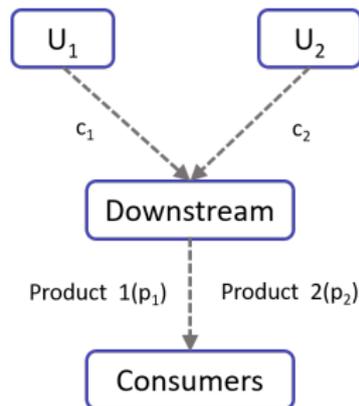
How do vertical mergers impact consumers?

Model - before VI

- How does VI impact the pricing incentives of a multiproduct firm?
- Before VI: the monopolist produces product 1[2] using inputs it purchases from the upstream firm $U_1[U_2]$.
- FOCs before VI

$$q_1(p_1^*, p_2^*) + (p_1^* - c_1) \frac{\partial q_1}{\partial p_1} + (p_2^* - c_2) \frac{\partial q_2}{\partial p_1} = 0$$

$$q_2(p_1^*, p_2^*) + (p_2^* - c_2) \frac{\partial q_2}{\partial p_2} + (p_1^* - c_1) \frac{\partial q_1}{\partial p_2} = 0$$



Model - after VI

- After VI: Now a vertical merger eliminates the double margin for product 1, causing $c_1 = 0$, and leaves c_2 at its original value.
- FOCs before VI

$$q_1(p_1^*, p_2^*) + (p_1^* - c_1) \frac{\partial q_1}{\partial p_1} + (p_2^* - c_2) \frac{\partial q_2}{\partial p_1} = 0$$

$$q_2(p_1^*, p_2^*) + (p_2^* - c_2) \frac{\partial q_2}{\partial p_2} + (p_1^* - c_1) \frac{\partial q_1}{\partial p_2} = 0$$

- Remember that demand is downward sloping ($\partial q_1 / \partial p_1 < 0$) and that the products are substitutes ($\partial q_1 / \partial p_2 > 0$).
- At the premerger prices p_1^* and p_2^* ,

$$q_1(p_1^*, p_2^*) + p_1^* \frac{\partial q_1}{\partial p_1} + (p_2^* - c_2) \frac{\partial q_2}{\partial p_1} < 0$$

$$q_2(p_1^*, p_2^*) + (p_2^* - c_2) \frac{\partial q_2}{\partial p_2} + p_1^* \frac{\partial q_1}{\partial p_2} > 0$$

Model - Effects of VI

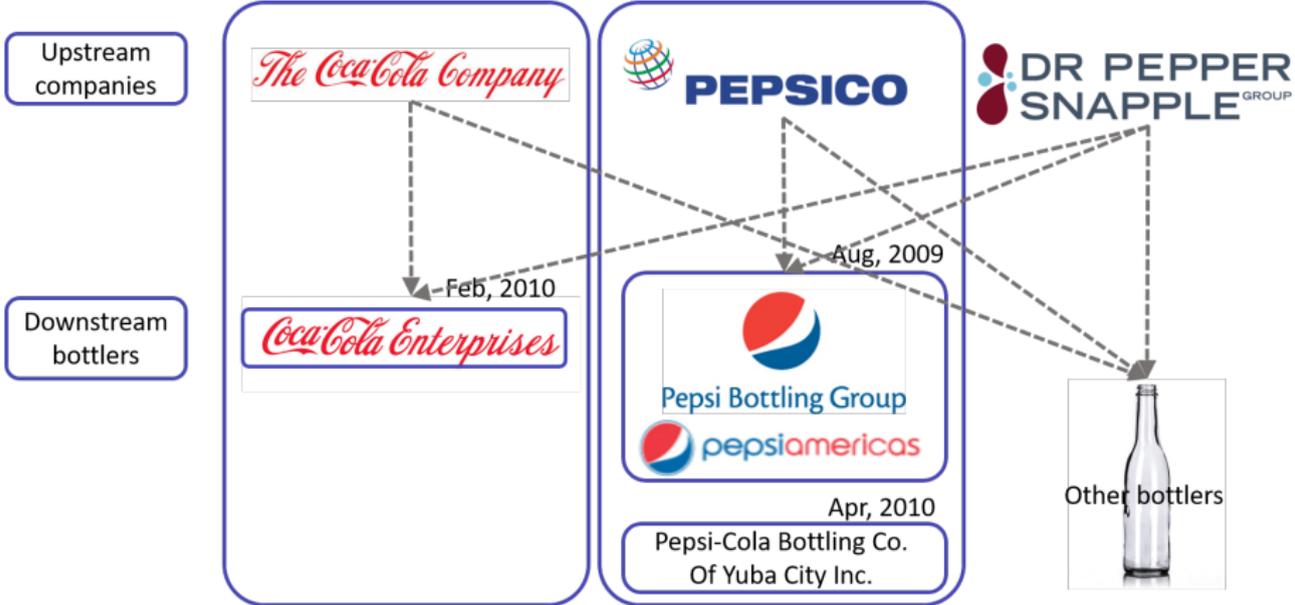
- At the premerger prices p_1^* and p_2^* ,

$$q_1(p_1^*, p_2^*) + p_1^* \frac{\partial q_1}{\partial p_1} + (p_2^* - c_2) \frac{\partial q_2}{\partial p_1} < 0 \quad (1)$$

$$q_2(p_1^*, p_2^*) + (p_2^* - c_2) \frac{\partial q_2}{\partial p_2} + p_1^* \frac{\partial q_1}{\partial p_2} > 0 \quad (2)$$

- Price 1 should decrease and price 2 should increase.
- Efficiency effect:** Elimination of c_1 decrease the price of product 1 because of its lower marginal costs.
- Edgeworth-Salinger effect:** Now the margin is greater for product 1 ($p_1^* - c_1$ vs p_1^*), the monopolist increase the price of product 2 to induce consumers to substitute to product 1 (eq (2)).

Background



Background

- Counties where PBG-PAS-PYC and CCE bottled PepsiCo and Coca-Cola products, respectively

	Other Pepsi bottler	PBG-PAS-PYC	Total
Other Coca-Cola bottler	16	61	77
CCE	20	339	359
Total counties	36	400	436

- Counties where PBG-PAS-PYC and CCE bottled Dr Pepper SG products

	Bottled Dr Pepper SG products		Total
	No	Yes	
CCE	256	103	359
PBG-PAS-PYC	67	333	400

Data

- Sources: IRI Marketing Data Set, FTC documents, Beverage Digest
- Store-week-product level data (2007-2012)
- Product = brand-size combination (20oz bottles, 67.6oz bottles, 144oz box of cans)
- Summary statistics (selected data from Table 1)

	20oz			67.6oz			144oz		
Brand	N	Mean	SD	N	Mean	SD	N	Mean	SD
Coca Cola	533,963	1.51	0.21	528,580	1.49	0.29	526,331	4.14	0.9
Dr Pepper	475,946	1.49	0.18	495,583	1.43	0.3	478,767	4.02	0.89
Pepsi	531,426	1.5	0.17	527,856	1.41	0.3	518,216	3.9	0.87
Sprite	524,813	1.51	0.15	431,691	1.5	0.3	497,830	4.09	0.93

Empirical framework

- How does VI impact the prices of multiproduct firms?
- ① Variation in vertical structure that was caused by vertical mergers (before and after merger)
- ② Variation in whether the vertical integrated bottlers distributed Dr Pepper brands to measure the differential impact of VI on own and Dr Pepper SG brands (efficiency and Edgeworth-Salinger effects)
⇒ **Generalized Diff-in-diff research design**

Generalized Diff-in-diff approach

$$\begin{aligned}\log(\text{price}_{j,s,w}) = & VI_{CocaCola, \text{county}(s), w} \cdot \text{CocaColaProduct}_j \beta_1 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{PepsiCoProduct}_j \beta_2 \\ & + VI_{CocaCola, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByCocaCola}_j \beta_3 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByPepsiCo}_j \beta_4 \\ & + \lambda_s + \gamma_{w, \text{county}(s)} + \delta_{j, \text{county}(s), \text{season}(w)} + \phi_{\text{firm}(j), w} + \epsilon_{j,s,w}\end{aligned}$$

- How the price of product j at store s and week w was impacted by VI
- $VI_{CocaCola[PepsiCo], \text{county}(s), w}$: indicators for whether Coca-Cola[PepsiCo] were integrated with their bottlers in $\text{county}(s)$ at week w
- $\text{DrPepperSGProductBottledByCocaCola}[PepsiCo]_j$: indicators for whether product j was a Dr Pepper SG product bottled by a Coca-Cola or PepsiCo bottler

Generalized Diff-in-diff approach

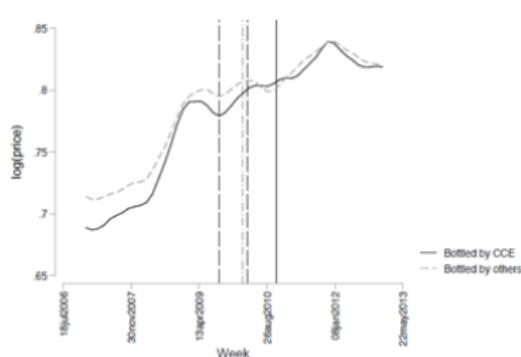
$$\begin{aligned}\log(\text{price}_{j,s,w}) = & VI_{CocaCola, \text{county}(s), w} \cdot \text{CocaColaProduct}_j \beta_1 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{PepsiCoProduct}_j \beta_2 \\ & + VI_{CocaCola, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByCocaCola}_j \beta_3 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByPepsiCo}_j \beta_4 \\ & + \lambda_s + \gamma_{w, \text{county}(s)} + \delta_{j, \text{county}(s), \text{season}(w)} + \phi_{\text{firm}(j), w} + \epsilon_{j,s,w}\end{aligned}$$

- β_1, β_2 : how the elimination of double margins affect prices of own brands – **Efficiency effect**
- β_3, β_4 : how the elimination of own-brand double margins affects prices of Dr Pepper SG brands bottled by the vertically integrated bottlers – **Edgeworth-Salinger effect**

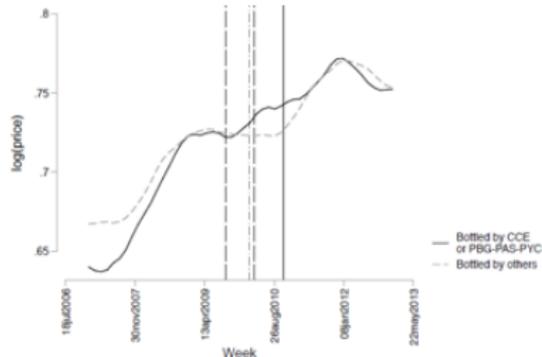
Fixed effects

Concerns	Arguments	Solutions
Concern 1	Existence of time effects that were specific to PepsiCo, Coca-Cola, or Dr Pepper SG	Upstream firm-specific week fixed effects $\phi_{firm(j),w}$
Concern 2	Existence of demand shocks concurrent with vertical mergers	County-week fixed effects $\gamma_{w, county(s)}$
Concern 3	VI may have happened in markets where PepsiCo and Coca-Cola enjoyed greater market power.	*Product-county-season-of-year fixed effects $\delta_{j, county(s), season(w)}$ * Store fixed effects γ_s
Concern 4	Existence of time varying factors that are specific to products that started being bottled by vertically integrated bottlers after the mergers	Figure in next slide

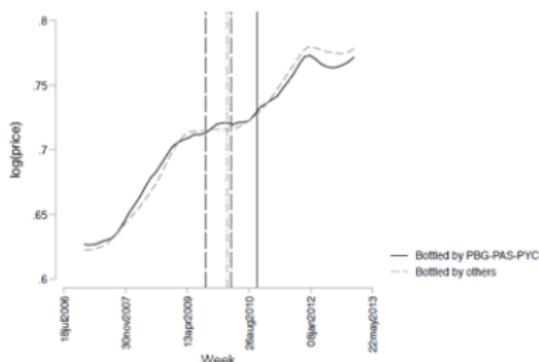
Evolution of prices before and after mergers



(a) Coca-Cola products



(c) Dr Pepper SG products



(b) PepsiCo products

- Obs: firm-VI status-week combination
- Dotted lines: products affected by VI
- Solid lines: products not affected by VI
- Vertical lines: mergers

Dynamics of the impact of VI on prices

$$\begin{aligned}\log(\text{price}_{j,s,w}) &= \sum_{k=-L}^0 VI_{j \times \text{county}(s)} \times 1\{k \text{ quarters before time of VI}\} \beta_k \\ &+ \sum_{k=1}^U VI_{j \times \text{county}(s)} \times 1\{k \text{ quarters after time of VI}\} \beta_k \\ &+ \lambda_s + \gamma_{w \times \text{county}(s)} + \delta_{j \times \text{county}(s) \times \text{season}(w)} + \phi_{\text{firm}(j) \times w} + \epsilon_{jsw}\end{aligned}$$

- $VI_{j \times \text{county}(s)}$: an indicator for whether product j in $\text{county}(s)$ was eventually sold by a vertically integrated bottler
- β_k : the evolution of the prices of products that were eventually sold by a vertically integrated bottler relative to the prices of products that were never impacted by vertical integration, both before and after vertical integration

The effect of VI on prices

$$\begin{aligned} \log(\text{price}_{j,s,w}) = & VI_{CocaCola, \text{county}(s), w} \cdot \text{CocaColaProduct}_j \beta_1 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{PepsiCoProduct}_j \beta_2 \\ & + VI_{CocaCola, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByCocaCola}_j \beta_3 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByPepsiCo}_j \beta_4 \\ & + \lambda_s + \gamma_{w, \text{county}(s)} + \delta_{j, \text{county}(s), \text{season}(w)} + \phi_{\text{firm}(j), w} + \epsilon_{j, s, w} \end{aligned}$$

	(1)	(2)	(3)	(4)
	log(price)			
<i>VI</i> · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.018*** (0.003)			
<i>VI</i> · Own product bottled by Coca-Cola or PepsiCo bottler		-0.014*** (0.003)		
<i>VI</i> · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler		0.039*** (0.002)		
<i>VI</i> · Own or Dr Pepper SG product bottled by Coca-Cola bottler			0.019*** (0.004)	
<i>VI</i> · Own or Dr Pepper SG product bottled by PepsiCo bottler			0.018*** (0.004)	
<i>VI</i> _{CocaCola} · Coca-Cola product				-0.010*** (0.004)
<i>VI</i> _{CocaCola} · Dr Pepper SG product bottled by Coca-Cola bottler				0.042** (0.004)
<i>VI</i> _{PepsiCo} · PepsiCo product				-0.021*** (0.006)
<i>VI</i> _{PepsiCo} · Dr Pepper SG product bottled by PepsiCo bottler				0.031*** (0.003)
Observations	37,106,025	37,106,025	37,106,025	37,106,025
R ²	0.893	0.893	0.893	0.893

The effect of VI on prices

$$\begin{aligned} \log(\text{price}_{j,s,w}) = & VI_{CocaCola, \text{county}(s), w} \cdot \text{CocaColaProduct}_j \beta_1 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{PepsiCoProduct}_j \beta_2 \\ & + VI_{CocaCola, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByCocaCola}_j \beta_3 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByPepsiCo}_j \beta_4 \\ & + \lambda_s + \gamma_{w, \text{county}(s)} + \delta_{j, \text{county}(s), \text{season}(w)} + \phi_{\text{firm}(j), w} + \epsilon_{j, s, w} \end{aligned}$$

	(1)	(2)
		$\log(\text{price})$
<i>VI</i> · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.018*** (0.003)	
<i>VI</i> · Own product bottled by Coca-Cola or PepsiCo bottler	Efficiency effect	-0.014*** (0.003)
<i>VI</i> · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	Edgeworth-Salinger effect	0.039*** (0.002)

- Column (1): $\beta = \beta_1 = \beta_2 = \beta_3 = \beta_4$
- Column (2): $\beta_1 = \beta_2$, $\beta_3 = \beta_4$, Efficiency < Edgeworth-Salinger

The effect of VI on prices

$$\begin{aligned} \log(\text{price}_{j,s,w}) = & VI_{CocaCola, \text{county}(s), w} \cdot \text{CocaColaProduct}_j \beta_1 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{PepsiCoProduct}_j \beta_2 \\ & + VI_{CocaCola, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByCocaCola}_j \beta_3 \\ & + VI_{PepsiCo, \text{county}(s), w} \cdot \text{DrPepperSGProductBottledByPepsiCo}_j \beta_4 \\ & + \lambda_s + \gamma_{w, \text{county}(s)} + \delta_{j, \text{county}(s), \text{season}(w)} + \phi_{\text{firm}(j), w} + \epsilon_{j,s,w} \end{aligned}$$

	(3)	(4)
VI · Own or Dr Pepper SG product bottled by Coca-Cola bottler	0.019*** (0.004)	
VI · Own or Dr Pepper SG product bottled by PepsiCo bottler	0.018*** (0.004)	
$VI_{CocaCola}$ · Coca-Cola product		-0.010*** (0.004)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler		0.042** (0.004)
$VI_{PepsiCo}$ · PepsiCo product		-0.021*** (0.006)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler		0.031*** (0.003)

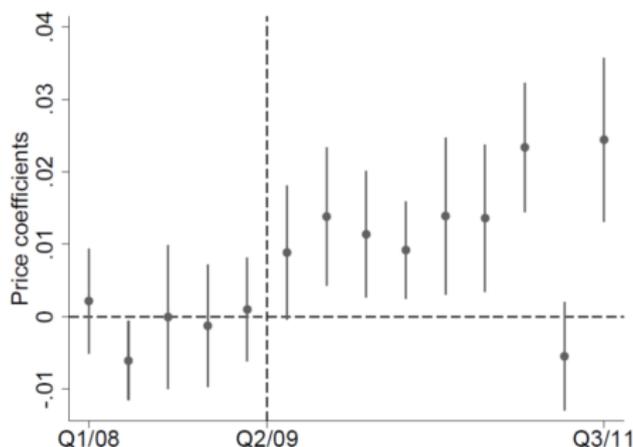
Efficiency effect (red bracket) groups the two rows with positive coefficients in column (4): $VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler and $VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler.

Edgeworth-Salinger effect (blue bracket) groups the two rows with negative coefficients in column (4): $VI_{CocaCola}$ · Coca-Cola product and $VI_{PepsiCo}$ · PepsiCo product.

- Column (3): $\beta_1 = \beta_3, \beta_2 = \beta_4$
- Column (4): No restrictions on coefficients

Dynamics of the impact of VI on prices

$$\log(\text{price}_{j,s,w}) = \sum_{k=-L}^0 VI_{j \times \text{county}(s)} \times 1\{k \text{ quarters before VI}\} \beta_k + \sum_{k=1}^U VI_{j \times \text{county}(s)} \times 1\{k \text{ quarters after VI}\} \beta_k \\ + \lambda_s + \gamma_w \times \text{county}(s) + \delta_j \times \text{county}(s) \times \text{season}(w) + \phi_{\text{firm}(j)} \times w + \epsilon_{jsw}$$



- No evidence of differential trends before the vertical mergers that were not impacted by VI
- Price increase only started after the first VI

Conclusion

- The vertical integration of The Coca Cola Company and PepsiCo on average increased the prices of products sold by these firms.
- The price increase was driven by the prices of Dr Pepper SG brands bottled by the integrated firms for which double marginalization was not eliminated.

Back to our research question

- Q: How do vertical mergers impact consumers?

An answer to our research question

- Q: How do vertical mergers impact consumers?
- A: Eliminating double marginalization may potentially hurt consumers in multiproduct industries.

Q & A

Thank you.