Vertical Integration in the Carbonated Soft Drinks Industry

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Abstract

This study examines the impacts of vertical integration between Coca-Cola, PepsiCo, and their formerly partially-owned bottlers. Besides efficiency gains, the FTC was concerned about foreclosure affecting Dr Pepper. Using DID, I find lower prices for integrated drinks and higher prices for Dr Pepper after integration. Then I use a structural model to estimate demand and quantify the brand-level elasticities, which shows that consumers primarily substitute within diet and sugary categories, with low brand-level price elasticities. Finally, I develop a vertical model of syrup producers and bottlers that incorporates partial ownership and estimate the pricing effects of vertical integration, which highlights that foreclosure incentives may outweigh the efficiency gains.

1 Introduction

The impacts of vertical integration have received significant attention. This phenomenon is characterized by two opposing forces: efficiency and foreclosure. An integrated upstream firm no longer charges positive margins to downstream firms, potentially reducing retail prices through the elimination of double marginalization (Spengler, 1950). However, unintegrated rivals may be subject to foreclosure effects, where integrated firms may engage in practices such as raising input or retail prices to rivals, creating entry barriers, or even refusing to deal (Asker and Bar-Isaac, 2014). The ultimate implications of vertical integration on prices, profits, and consumer welfare will thus depend on the specific market structure of the industry in question.

The aim of this study is to empirically evaluate the impact of vertical integration in the carbonated soft drinks (CSD) industry by analyzing two recent vertical integration events involving PepsiCo and the Coca-Cola Company (henceforth TCCC). In 2009, PepsiCo acquired two of its largest bottlers, Pepsi Bottling Group and Pepsi Americas; in 2010, TCCC acquired its largest bottler Coca-Cola enterprises. The elimination of double marginalization theory suggests that integrated bottlers can purchase inputs at zero markup, leading to lower prices for consumers. However, the integrated bottlers may charge higher prices for Dr Pepper Snapple Group (DPSG) drinks to its consumers in order to steer demand towards their integrated products. As a result, the equilibrium prices for both unintegrated and integrated drinks may be higher, known as the Edgeworth-Salinger effect, which is a form of foreclosure studied by Luco and Marshall (2020). In addition, before the integration events occurred, PepsiCo and Coca-Cola had already partially-owned the acquired bottlers, so the magnitude of the effects may differ from a vertical integration case going from zero to full ownership. Therefore, if we fail to disentangle elimination of double marginalization and foreclosure, and account for partial ownership, we risk generating inaccurate estimates of price change channels, misinterpreting the effects of the vertical integration events, and drawing incorrect policy implications.

To explore these effects, this study uses a comprehensive retail dataset and auxiliary data on bottlers' operating areas. I first conduct a difference-in-differences study to quantify changes in prices and shares of integrated and unintegrated drinks prior and post integration. Vertical integration results in small and insignificant price decreases for integrated drinks, with reductions of 0.013% after PepsiCo Event and 0.007% after TCCC event. In contrast, it leads to larger and significant price increases for piggybacking Dr Pepper drinks, rising by 0.07% and 0.008% respectively To quantify the mechanisms behind the changes, I estimate a discrete choice model to recover consumers' taste parameters for prices and other product characteristics, and develop a vertical pricing model that incorporates exclusive territories, partial ownership, and other key features of the industry to analyze the firms' pricing strategies. I find that consumers are relatively insensitive to prices, with the magnitude of brand-level price elasticities less than 0.81. Estimation results at the bottler level suggest that bottlers' markups (Lerner index) center around 1%, which may limit the downward pricing effects of vertical integration. Integrated bottlers show higher marginal production costs, suggesting that vertical integration may not have led to cost savings in bottlers' production. Estimation at the syrup producer level, accounting for partial ownership, reveals a slight decrease in Pepsi syrup costs following PepsiCo's integration, while Coke syrup costs fluctuated, with an initial increase followed by a drop after TCCC's integration. The next step involves conducting counterfactual analysis using alternative integration scenarios. This includes simulating full divestiture between bottlers and syrup producers, adjusting production costs based on integration status to assess efficiency effects, and limiting bottlers' pricing power on piggybacking drinks to examine foreclosure.

This paper is related to several strands of literature. To begin with, recent empirical studies on changes in market structure in the markets of bilateral oligopolies (Berto Villas-Boas, 2007; Crawford, Lee, Whinston and Yurukoglu, 2018; Yang, 2020) build vertical structure models using consumer taste parameters from demand estimation, incorporating rich institutional details while remaining estimable. I draw on their approach in this paper.

Moreover, this paper contributes to the empirical literature of the CSD industry. Several studies have estimated demand with scanner data to reveal consumers' substitution patterns (Dubé, 2005; Dhar, Chavas, Cotterill and Gould, 2005; Chan, 2006; Lopez, Liu and Zhu, 2015; Chen, Reinhardt and Syed Shah, 2022). I adopt a discrete choice model which generates similar price elasticities to these studies, and use the estimates in the vertical model of suppliers. On the other hand, the vertical integration of PepsiCo and Coca-Cola is the subject of only two studies, Luco and Marshall (2020) and Adachi (2020), both of which use difference-in-differences designs. The first study finds that vertical integration causes price decreases in products with eliminated double margins but price increases in Dr Pepper drinks sold by the integrated bottlers; the second finds that vertical integration contributed to efficiency gains in PepsiCo drinks and had little effects on Dr Pepper drinks, but did not improve TCCC's internal process. Compared with these two studies, my paper aims to disentangle the mechanisms behind the price changes using a model of vertical structure. In addition, both studies assume a binary vertical integration status in their event study, which does not consider the partial ownership that was present before integration. This paper aims to understand the role of partial ownership by using a structural model to conduct counterfactuals of alternative ownership structures and pricing strategies.

Finally, this paper is relevant to the theoretical literature studying partial ownership in vertical relations (Levy, Spiegel and Gilo, 2018; Hunold, 2020). It also contributes to the empirical studies that incorporate the possibility of partial alignment of firms' incentives. For example, Miller and Weinberg (2017) examines horizontal mergers in the beer industry by allowing non-binary values in the ownership matrix. Crawford et al. (2018) and Cuesta, Noton and Vatter (2019) examines vertical integration in the multichannel television and hospital-insurer industries respectively, in which they develop models of Nash-in-Nash bargaining and assume the integrated firms consider a weighted sum of its own and the partner's profits. The former incorporates a foreclosure parameter, while the latter represent foreclosure incentives using differences in profits. Given the institutional details of the CSD industry, I adopt a supply model without bargaining, and assume a similar weighted sum of profits.

The remainder of the paper is organized as follows. Section 2 describes the market structure and major vertical acquisitions in the CSD industry, Section 3 describes data, Section 4 describes some reduced-form analysis of the effects of vertical integration on prices of integrated and piggybacking products, Section 5 presents the demand-side model and elasticity estimates, Section 6 presents the supply-side model and results of producers marginal costs and markups, Section 7 (ongoing) presents the counterfactuals, and Section 8 (ongoing) concludes.

2 Background

2.1 Vertical Structure of the CSD industry

The supply chain in the CSD industry is characterized by a two-layer vertical structure, comprised of syrup producers and bottlers. Syrup producers, including industry giants such as the Coca-Cola Company (TCCC), PepsiCo, and Dr Pepper Snapple Group (DPSG), produce syrup concentrates, which are then sold to bottlers at wholesale prices. Bottlers, on the other hand, are responsible for producing and distributing CSD drinks by mixing the syrup concentrates with water, carbon dioxide, and other ingredients, before packaging the mixture in bottles or cans and distributing the final products to retailers and other customers. In contrast to warehouse delivery, the majority of CSD drinks are delivered via the direct-store-door (DSD) system, where the employees of the bottlers deliver the products to the store and keep the shelves stocked (Fry, Spector, Williamson and Mujeeb, 2011).

TCCC and PepsiCo have each established their own franchised systems of bottlers to facilitate the production and distribution of CSD drinks. This strategic move was driven by the high costs associated with establishing independent distribution networks, including transportation costs and the limitations posed by the use of glass bottles, which were the primary packaging material at the time. [1] In contrast, DPSG, initially a regional brand based in Texas, adopted a different approach by relying on the parts of TCCC's or PepsiCo's franchised systems, as well as independent bottlers for production and distribution. This practice is commonly referred to as piggybacking within the industry, which enabled DPSG to expand its national presence without incurring the substantial costs to establish its own distribution network.

It is important to note that both TCCC and PepsiCo impose flavor restrictions on their bottlers. That is, one bottler cannot produce drinks from two syrup producers of the same flavor. PepsiCo, for example, has a "no other cola" provision in the Pepsi-Cola franchise agreements with bottlers (Court of Appeals, 2005).

> The Bottler will not bottle, distribute or sell, directly or indirectly, any other cola beverage or beverages with the name cola... or any other beverage which could be confused with Pepsi-Cola's.

However, this flavor restriction does not prevent DPSG's piggybacking behavior, because it has been ruled by a federal court in 1963 that Dr Pepper was not a cola product, since it did not contain any kola nut. Figure 1 illustrates the two-layer vertical structure. In this illustration, both TCCC and PepsiCo have their own bottling systems that do not overlap, while DPSG relies on parts of both systems.

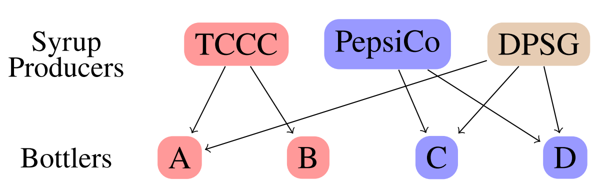

Figure 1: Typical Vertical Structure of CSD Industry

[1] TCCC retains exclusive rights to produce and distribute fountain drinks, while PepsiCo has delegated this responsibility to its bottlers. I have chosen to focus solely on the retailer channel in my analysis due to its larger volumes compared with fountain drinks and the data limitations surrounding fountain drinks.

The bottlers distribute their products in exclusive territories, a perpetual arrangement dictated by contractual terms between syrup producers and bottlers. For example, Coca-Cola USA's bottling contract dictates as below (Saltzman, Levy and Hilke, 1999).

> The Bottler has the sole, exclusive and perpetual right and license in the Bottler's territory (i) to manufacture and market all Covered Products for ultimate consumer purchase in such territory, and (ii) to use and vend on all Covered Products the trademarks and trade names associated with such Covered Products and any Modifications thereof, and all labels, designs, distinctive containers or other trade symbols associated therewith.

The rights to these exclusive territories are protected by the Soft Drinks Interbrand Competition Act of 1980.

Figure 2 provides a snapshot of the bottlers' territories in the distribution of Coke, Pepsi, and Dr Pepper drinks in the Philadephia Designated Media Markets (DMA), with bottler names retained due to proprietary concerns. There are 2 Coke bottlers and 3 Pepsi bottlers operating in this area, dividing the territories using county borders. Intriguingly, Dr Pepper piggybacks on 1 Coke bottler and 2 Pepsi bottlers, which means that the same bottler operates in different territories for its franchised products (Coke or Pepsi) and piggybacking products (Dr Pepper). As a result, foreclosure incentives may only occur in the overlapping territories, which influences the overall magnitude of vertical integration effects. Exclusive territories are relevant for assessing vertical integration for two reasons. First, they enable us to track sales volumes by each bottler in every county using retail data. Second, they offer geographic variation in the magnitude of vertical integration's impacts. For instance, efficiency gains may occur in territories of vertically integrated bottlers, while foreclosure risks are heightened in piggybacking territories of integrated bottlers. Conversely, when DPSG piggybacks on unintegrated bottlers in rival franchising systems or independent bottlers, foreclosure concerns are less pronounced.

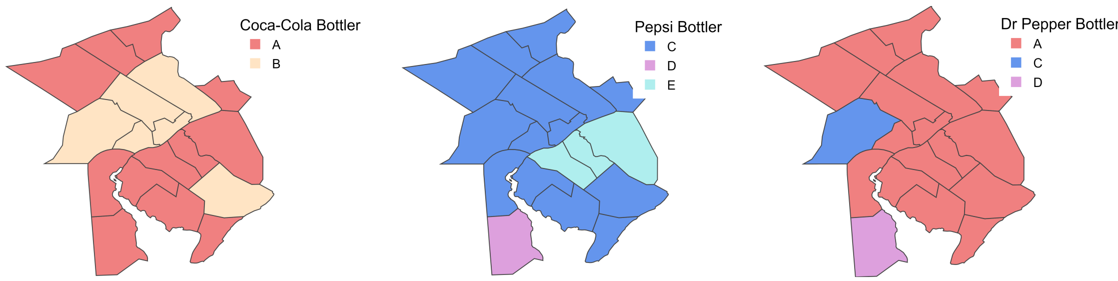

Figure 2: Exclusive Territories: Example

2.2 Pricing Dynamics and Ownership Structure

The syrup producers charge bottlers a wholesale price for concentrates. Wholesale prices reported by industry publications are expressed as annual prices per 128 ounces, thus including a linear component. Since evidence of nonlinear pricing such as lump-sum transfers is rare (Luco and Marshall, 2020), I proceed with the assumption of linear pricing, uniformly set annually across all bottlers. [2]

In terms of bottlers' pricing, I assume that bottlers choose retail prices in each market while handling the distribution and stocking of drinks at retailers. Consequently, I abstract from the interactions between the bottlers and the retailers, focusing solely on bottlers' pricing decisions. There is also practical concerns in that I only observe the retail prices at the bottle level of the vertical structure.

Both TCCC and PepsiCo have partial or full ownership of certain bottlers within their franchising systems, as illustrated in Table 1. The data is from Beverage Digest described in Section 3. Before the integration cases described below, TCCC held 38.4% equity in CCE and 30% in Coke Consolidated, with the former reaching 100% ownership post-acquisition. Similarly, PepsiCo owned approximately 40% of PBG and PAS, which also transitioned to complete ownership following acquisition. Additionally, PepsiCo holds a 35% stake in PBV. These partially-owned bottlers collectively account for a

[2]Starting from 2008, TCCC has introduced incidence-based pricing through contracts with bottlers, linking prices to bottlers' revenue [3]. This introduces variation in prices across bottlers within a year. However, due to limited information on the implementation specifics, I maintain the linear pricing assumption.

significant volume share of drinks for both TCCC and PepsiCo, with CCE representing over 75% of TCCC volume, and PBG and PAS combined contributing to 75% of PepsiCo volume. Although Coke Consolidated and PBV have smaller proportions, their quantities remain notable. These bottlers also play a crucial role in distributing DPSG drinks, with CCE's distribution share increasing from 14% to 21% post-integration. While data is unavailable for DPSG volume distributed by Coke Consolidated and PBV, they do distribute Dr Pepper drinks in certain territories.

This table offers several insights. First, it suggests that the alignment of incentives between syrup producers and their key bottlers may already be partially established before integration, thereby influencing the magnitude of effects. Secondly, the equity shares indicate that both TCCC and PepsiCo wield influence over franchised bottlers crucial for DPSG, potentially facilitating foreclosure practices.

Table 1: Syrup Producers' Ownership and Volumes by Bottler (Percentage)

Parent	Bottlers	Equity Before	Equity After	Own Volume Before	Own Volume After	DPSG Volume Before	DPSG Volume After
TCCC	CCE	38.4	100	75.7	76.8	14	21
	Coke Consolidated	30	30	7.3			
PepsiCo	PBG	41	100	56	75.3	15	30
	PAS	43	100	19.2		5	
	PBV	35	35	4.1			

2.3 TCCC and PepsiCo Vertical Integration Cases

In 2009 and 2010, several vertical integration events occurred between syrup producers and bottlers. In August 2009, PepsiCo acquired PBG and PAS. The two bottlers were merged into Pepsi Beverages Company (PBC) to enable PepsiCo to innovate and distribute new products, as well as respond quickly to changes in consumer tastes. [4] In February 2010, TCCC acquired the North American territories of CCE, and established Coca-Cola Refreshments (CCR). The primary objective was to reduce costs and driving

[4]See `https://www.nytimes.com/2009/08/05/business/05pepsi.html`.

profitability over the long term by developing an evolved franchising system [5].

The changes in the bottlers' ownership automatically triggered the termination of the piggybacking contracts of DPSG and the integrated bottlers, but both PepsiCo and TCCC reached agreement with DPSG to obtain new exclusive licenses to distribute DPSG products. Specifically, PepsiCo obtained the exclusive right to distribute Dr Pepper, Crush, and Schweppes in the former PBG and PAS territories, while TCCC retained the exclusive rights to distribute Dr Pepper and Canada Dry in the former CCE territories (Federal Trade Commission, 2010a,b). Despite PepsiCo and TCCC finding it more aligned to their interests to carry DPSG brands, the FTC was concerned that PBC or CCR might disclose confidential information about DPSG's brand and marketing strategies. Both acquisitions were approved by the FTC, on the condition that PepsiCo and TCCC establish a "firewall" to prevent their employees from accessing DPSG's confidential information (Federal Trade Commission, 2010a,b). However, due to challenges in obtaining data on the effectiveness of the firewall and quantifying information spillover between syrup producers, I abstract from this aspect.

3 Data

This section provides an overview of the data used in this paper. To identify the effects of vertical integration, I need to determine the territories served by each bottler, measure consumer prices and quantities in those territories, and estimate bottlers' costs using bottler locations as a proxy (since transportation is a key cost factor), alongside syrup producers' wholesale prices.

[5]See https://investors.coca-colacompany.com/news-events/press-releases/detail/471/the-coca-cola-company-and-coca-cola-enterprises.

3.1 Territory Maps of Major TCCC and PepsiCo bottlers

To accurately determine the areas affected by vertical integration, it is vital to pinpoint the territories of both integrated and unintegrated bottlers handling TCCC and PepsiCO products, on which DPSG also piggybacks. I have acquired two sets of territory maps: firstly, the US bottling-system maps provided by Beverage Digest, a prominent data analysis company in the industry. Table 2 displays the county coverage for each major bottler that distributes the franchised products, as well as their intersections within my sample. In the first two rows and three columns, each entry is the number of overlapping counties in the territories of the row (TCCC) and column (PepsiCo) bottler. The last row and column shows the total number of counties in their territories. Specifically, out of 2533 counties in my sample, CCE covers 1704 counties, and PBG and PAS covers 1017 and 446 counties respectively. In total, 1185 [6] counties were affected by both events, and 1982 [7] counties were affected by at least one event. This underscores the necessity of investigating their effects thoroughly.

Table 2: County Coverage of Major TCCC and PepsiCo Bottlers in Coke and Pepsi

		PepsiCo				
		PBG	PAS	PBV	Other	Total
TCCC	CCE	792	393	17	502	1704
	Coke Consolidated	114	6	42	104	266
	Other	111	47	14	391	563
	Total	1017	446	73	997	2533

While the bottling system maps encompass territories of major bottlers distributing Dr Pepper, I supplement them with maps from the FTC's investigation into both cases. These FTC maps delineate regions where integrated bottlers distribute Dr Pepper drinks. Reassuringly, the maps largely align, and I rely on the FTC's maps in instances of

[6] It is the sum of overlapping counties of CCE and PBG (792), and those of CCE and PAS (393)

[7] It is the sum of the number of counties affected by both events (1185) and those affected by only 1 event (PepsiCo: 114 + 111 + 6 + 47 = 278; TCCC: 17 + 502 = 519)

slight misalignment. Table 3 displays the number of counties where integrated bottlers distribute Dr Pepper. In my sample of 2533 counties, DPSG piggybacks on CCE, PBG and PAS in 625 (24.67%), 509 (20.09%) and 250 (9.87%) of the counties respectively. Therefore, it is important to consider the potential foreclosure effects on Dr Pepper when DPSG relies on bottlers fully owned by rivals for the distribution of more than 50% of its most prominent brand.

Table 3: County Coverage of Major TCCC and PepsiCo Bottlers in Dr Pepper

CCE	Coke Consolidated	PBG	PAS	PBV	Other	Total
625	86	509	250	37	1026	2533

3.2 Nielsen Retail Scanner Data

To analyze the pricing behavior of bottlers, it is essential to have retail prices and quantities of their products. Note that since bottlers have exclusive territories, it is possible to track the quantities produced and retail prices set by bottlers from the retail scanner data. For this purpose, I use the Nielsen Retail Scanner Data, which comprises weekly pricing, volume, and store environment information obtained from point-of-sale systems across over 90 retail chains nationwide. The dataset covers the years 2009 to 2011, coinciding with the occurrences of the TCCC and PepsiCo vertical integration cases. Geographically, the data encompasses counties served by the major bottlers listed in Table 1 and additional areas, spanning 2533 counties in 48 continental states and encompassing 205 Designated Media Areas (DMA). Given that bottlers' territories are delineated at the county level, I define a market as a county-quarter pair. Aggregating weekly sales data to quarters helps mitigate potential stockpiling behavior (Hendel and Nevo, 2006). Market size is quantified as the total sales within the soft drinks category as per the Nielsen dataset.

To investigate the interactions among TCCC, PepsiCo, and DPSG, my analysis focuses on six flagship brands: regular (sugary) coke, diet coke, regular Pepsi, diet Pepsi, regular Dr Pepper, and diet Dr Pepper. By leveraging product characteristics such as packaging, volume, and sugary/diet indicators, products are aggregated from the UPC level to the brand-package-volume level (e.g., 12-pack 12-oz diet coke), resulting in a total of 46 distinct products. Table 4 shows the mean price per 100 oz and market share of the products sorted by popularity within each brand. It is evident that 12-pack 12-oz drink is the most popular package for all six brands. In addition, the prices of larger packages are lower. Including packages is crucial to capture the consumers' substitution patterns within and between brands, as well as to account for the variation in production costs.

3.3 Wholesale Prices of Flagship Products

To precisely gauge the extent of reducing double marginalization, it is essential to differentiate between the wholesale margin and the retail margin. I have incorporated the wholesale prices of the six brands mentioned earlier from Beverage Digest (reported in $ per 144 oz) after converting the prices to $ per 100 oz. These wholesale prices are reported to change annually and remain uniform across bottlers. However, to accommodate the variation induced by TCCC's incidence-based pricing scheme and the possibility that integrated bottlers receive unreported discounts, I have adopted more flexible specifications when integrating these wholesale prices into the supply side of the model.

3.4 Bottlers' Plant Locations

To approximate the transportation costs borne by bottlers, I have used the plant locations of bottlers sourced from Beverage Digest. Under the assumption that bottlers distribute

Table 4: Mean Prices and Shares of Products

Brand	Pack	Size per Pack	Price ($/ 100 oz)	Share (%)
Regular Coke	12	12	2.434129	6.61654
Regular Coke	1	67.6	1.946428	3.699938
Regular Coke	1	20	6.809952	1.014974
Regular Coke	20	12	2.407024	0.916767
Regular Coke	8	12	3.696722	0.51784
Regular Coke	6	12	1.731665	0.383792
Diet Coke	12	12	2.432625	4.136524
Diet Coke	1	67.6	1.862616	2.648681
Diet Coke	32	12	2.382205	1.186832
Diet Coke	24	12	2.373245	0.717761
Diet Coke	1	20	6.841077	0.645542
Diet Coke	6	16.9	2.960116	0.627413
Diet Coke	6	24	2.443001	0.576641
Diet Coke	20	12	2.404194	0.499929
Diet Coke	8	12	3.693576	0.302173
Regular Pepsi	12	12	2.306922	5.163414
Regular Pepsi	1	67.6	2.008721	2.232753
Regular Pepsi	1	67.2	1.83274	1.78792
Regular Pepsi	24	12	2.205806	1.68786
Regular Pepsi	36	12	2.195816	1.596452
Regular Pepsi	6	24	2.388994	0.91778
Regular Pepsi	20	12	2.377448	0.545501
Regular Pepsi	1	20	7.141491	0.536569
Regular Pepsi	6	16.9	2.809635	0.356503
Regular Pepsi	6	8	0.891186	0.343035
Regular Pepsi	8	12	3.617033	0.288582
Diet Pepsi	12	12	2.293036	2.578166
Diet Pepsi	6	24	2.335923	0.990238
Diet Pepsi	1	67.2	1.816025	0.915062
Diet Pepsi	24	12	2.195668	0.788214
Diet Pepsi	1	20	7.142978	0.341086
Diet Pepsi	6	16.9	2.824095	0.244299
Diet Pepsi	8	12	3.632767	0.166038
Regular Dr Pepper	12	12	2.455425	2.831789
Regular Dr Pepper	1	67.6	1.875196	1.762048
Regular Dr Pepper	1	20	6.928152	0.588056
Regular Dr Pepper	24	12	2.275898	0.548197
Regular Dr Pepper	6	24	2.307736	0.403605
Regular Dr Pepper	6	16.9	2.863567	0.354571
Regular Dr Pepper	8	12	3.644564	0.217883
Diet Dr Pepper	12	12	2.454528	1.070576
Diet Dr Pepper	1	67.6	1.845527	0.654729
Diet Dr Pepper	6	24	2.297676	0.347562
Diet Dr Pepper	6	16.9	2.851457	0.277009
Diet Dr Pepper	24	12	2.248538	0.26913
Diet Dr Pepper	1	20	6.967564	0.254733

drinks to counties within their territories from the closest plant, I calculated the distance as the distance between the center of the county where the drinks are consumed and the center of the county where the plant is located, using NBER County Distance Database. On average, the distance is 101.83 miles.

4 Evidence from Event Study

The FTC focused on the information aspect of the vertical integration cases, speculating that the benefits from elimination of double marginalization would outweigh the foreclosure effects. Among the studies on pricing effects, Luco and Marshall (2020) does not distinguish the two events. Moreover, they use a different scanner dataset and coverage. To test the validity of their results in my data, I use an event-study design similar to this paper.

Since the data spans from 2009 to 2011, it allows me to test both cases. I define the treatment as vertical integration cases, and the time of treatment as the quarter when the cases consummated, which is 2009Q3 for PepsiCo case and 2010Q2 for TCCC case. Since each observation is a product-market pair, the treated group of the TCCC case include the observations in counties in the territory of CCE, and the treated group of the PepsiCo case include the observations in counties in the territories of PBG and PAS. The control group are observations in counties in the territories of unintegrated bottlers. In addition, within the treated or control group, I distinguish the counties where Dr Pepper drinks distributed by TCCC bottlers versus those distributed other bottlers in the TCCC case, and those by PepsiCo bottlers versus other bottlers in the PepsiCo case.

I use difference-in-differences method to examine the impacts of vertical integration. The regression equation is Equation 1, with the outcomes focusing on prices and market shares. I regress them for Coke, Pepsi and Dr Pepper respectively.

$$\begin{aligned}\log y_{jcq} = \eta_1 Post_q + \eta_2 Treat_{jc} + \eta_3 Treat * Post_{jcq} \\ + \eta_4 Piggybacking * Treat * Post_{jcq} + c + FE_{DMA} + FE_{Quarter} \quad (1)\end{aligned}$$

In Equation 1, $\log y_{jcq}$ is the outcome variable of product j in county c and quarter q, which can be prices $\log p_{jcq}$ or shares $\log s_{jcq}$. $Post_q$ equals 1 if the quarter is past the treatment, $Treat_{jc}$ equals 1 if j is an integrated product sold by an integrated bottler in c. $Piggybacking_{jcq}$ equals 1 if j is a product piggybacking on an integrated bottler in c and q. To interpret the parameters, the changs of integrated products in treated counties is $\eta_1 + \eta_3$, while those of the same products in untreated counties are η_1, so that η_3 can be interpreted as the impact of vertical integration on the integrated products. The changes of piggybacking products in treated counties are $(\eta_1 + \eta_3 + \eta_4)$, while those of the same non-piggybacking products in treated counties are $\eta_1 + \eta_3$, so that η_4 can be interpreted as the impact of vertical integration on the piggybacking products.

Table 5 and 6 show the results of the regressions with data on PepsiCo event and TCCC event. First, Both events have contributed to lower and insignificant price drops of the integrated drinks, while resulting in higher and significant prices increases of piggybacking products. For example, Pepsi drinks sold by integrated bottlers have experienced 0.013% lower prices compared with those sold by unintegrated bottlers. This magnitude is 0.0069% for Coca-Cola. Meanwhile, Dr Pepper drinks produced by PBG or PAS have experienced 0.066% increase in price after they were integrated, compared with those produced by other bottlers. The magnitude is higher for Dr Pepper produced by CCE after the TCCC integration at 0.008%. Second, in terms of changes in market shares, both integration events have contributed to higher market shares of integrated products and lower shares of the piggybacking products. Compared with existing work (Luco and Marshall, 2020; Adachi, 2020), the qualitative implications are similar, although the magnitude of the coefficients are smaller in my results.

Table 5: Effects on Prices and Shares of PepsiCo Integration

	(1) Log Price	(2) Log Share
Post PepsiCo VI	-0.00307	-0.183***
	(0.00288)	(0.00859)
PepsiCo Treat	-0.0934***	-0.286***
	(0.00245)	(0.00730)
PepsiCo Treat * Post	-0.0127***	0.100***
	(0.00282)	(0.00841)
Piggybacking * Treat * Post	0.0664***	-0.532***
	(0.00247)	(0.00736)
Constant	1.173***	-5.165***
	(0.00805)	(0.0240)
DMA FE	Yes	Yes
Quarter FE	Yes	Yes
Num. Obs	847253	847253

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The above results provide evidence for both efficiency and foreclosure effects of vertical integration. However, to disentangle the mechanisms behind these changes, as well as taking partial ownership into account, I develop a structural model that consists of both a demand and a supply side.

Table 6: Effects on Prices and Shares of TCCC Integration

	(1) Log Price	(2) Log Share
Post TCCC VI	0.000690	-0.193***
	(0.00282)	(0.00843)
TCCC Treat	0.0914***	0.356***
	(0.00196)	(0.00585)
TCCC Treat * Post	-0.00687***	0.0613***
	(0.00256)	(0.00763)
Piggybacking * Treat * Post	0.00801**	-0.366***
	(0.00317)	(0.00946)
Constant	1.121***	-5.354***
	(0.00800)	(0.0239)
DMA FE	Yes	Yes
Quarter FE	Yes	Yes
Num. Obs	847253	847253

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 Demand

5.1 Model and Estimation

A demand-side model is necessary to capture consumer substitution patterns and quantify their responses to price changes due to shifts in market structure. These responses are later used to back out the costs and markups for bottlers and syrup producers in Section 6.

I use a nested logit model to capture flexible consumer substitution behavior across CSD products. Berry (1994) introduced this approach, estimating supply and demand models in oligopoly markets with differentiated products. This framework was extended by Berry, Levinsohn and Pakes (1995) and Nevo (2000), though I focus on a version without random coefficients due to computational constraints.

The model addresses price endogeneity and unobserved characteristics, assuming Bertrand competition. By inverting market share equations, it derives implied mean utility, allowing for instrumental variable estimation. Compared to the simple logit model, the nested logit offers richer substitution patterns, enabling consumers to shift toward specific product groups. Recent applications of this model include studies by Brenkers and Verboven (2006) and Miller and Weinberg (2017).

Assume that in market t, a consumer c's indirect utility of consuming product j is a function of its price, product characteristics, and consumer's idiosyncratic tastes, expressed in Equation 2 (for simplicity, we omit the notation t). In Equation 2, p_j is the price of product j, the observable characteristics x_j include diet/sugary indicator and small/family size indicator, where I define a small- or individual-sized products as single-unit beverages that are no more than one liter (33.8 oz) in volume following Powell and Leider (2022). ξ_j is the product-level unobservable characteristics. The last two terms denote the idiosyncratic taste, which is allowed to be correlated among products within the same nest h. Cardell (1997) shows that if $\bar{\varepsilon}$ follows extreme value distribution, then $\bar{\varepsilon} + (1-\rho)\bar{\varepsilon}$ is also an extreme value random variable. I assume it follows Type I Extreme Value distribution.

$$u_{ij} = \alpha p_j + \beta x_j + \xi_j + \bar{\varepsilon}_{ih(j)} + (1-\rho)\bar{\varepsilon}_{ij}. \tag{2}$$

I assume the nest structure is based on diet and sugary drinks, with each nest containing various package sizes of three brands (Coke, Pepsi, and Dr Pepper), while a separate nest includes the outside good ($j = 0$), representing other CSD brands. Figure 3 illustrates this structure, with three nests at level 1 (diet/sugary/outside good) and multiple products (brand/package-size pairs) at level 2. ρ represents the within-group correlation of utility levels, which goes up to 1 as ρ approaches 1, and goes to 0 as ρ approaches 0.

The consumer chooses the product that gives them the highest indirect utility. Denote

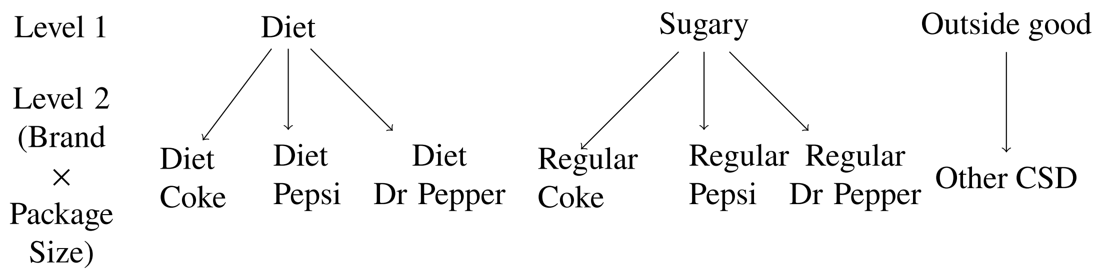

Figure 3: Nest Structure of the Demand Model

J_h as the set of products in the nest h, the selection probability of product j conditional on group h being selected is

$$\bar{s}_{j|h} = \frac{exp\left(\frac{\delta_j}{1-\rho}\right)}{D_h}, \tag{3}$$

where

$$\delta_j = \alpha p_j + \beta x_j + \xi_j,$$

and

$$D_h = \sum_{k \in J_h} exp\left(\frac{\delta_k}{1-\rho}\right)$$

The probability that group h is selected is

$$\bar{s}_h = \frac{D_h^{1-\rho}}{\sum_h D_g^{1-\rho}}. \tag{4}$$

Thus the unconditional selection probability of product j in group h equals

$$s_j = \bar{s}_{j|h}\bar{s}_h = \frac{exp\left(\frac{\delta_j}{1-\rho}\right)}{D_h\left[\sum_h D_g^{1-\rho}\right]}. \tag{5}$$

Rearranging Equation 5, and adding the market notation t, equalizing the selection probability with the market shares, we can derive an estimable equation that takes the form

$$ln(s_{jt}) - ln(s_{0t}) = x_{jt}\beta - \alpha p_{jt} + (1-\rho)ln(s_{j|ht}) + \xi_{jt}. \tag{6}$$

We need instruments for both the within-group market shares $s_{j|h}$ and the prices p_j, both of which can be correlated with the unobservable product characteristics. It is common practice to use the number of products in a nest in each market as an instrument for $s_{j|h}$ (Brenkers and Verboven, 2006; Miller and Weinberg, 2017), which is relevant to the competition within the nest, and is uncorrelated with individual product characteristics, since the formula of the brands has been fixed for decades. Moreover, it varies across the markets due to different offering of the packages. On the other hand, there are several sets of instruments for prices. The first set is differentiation IVs from Gandhi and Houde (2019). The intuition is that the closeness of product j and the other products in the characteristic space influences demand only through supply equilibrium on the bottler level. Gandhi and Houde (2019) prove that these instruments are the most efficient in any linear random utility models. Suppose product j produced by firm f (so that $j\ inJ_{ft}$) has characteristics x_jlt, the IV takes the form of

$$Z^{\text{Local, Other}}_{jtl}(X) = \sum_{k \in J_{ft}\{j} \mathbf{1}(|d_{jktl}| < SD_l),$$

$$Z^{\text{Local, Rival}}_{jtl}(X) = \sum_{k \notin J_{ft}\{j} \mathbf{1}(|d_{jktl}| < SD_l),$$

where $d_{jktl} = x_{jlt} - x_{klt}$ is the difference in l between products j and k, SD_l is the standard deviation of these pairwise differences across all markets, and $\mathbf{1}(|d_{jktl}| < SD_l)$ indicates the closeness between products j and k in terms of characteristics l. The second set is the product-specific vertical relation status, which takes 1 if the product was bottled by an vertically integrated bottler after the integration occurred, and 0 otherwise. This instrument influences demand through the vertical supply relations. The third set is the distance (1000 miles) between the market and the closet plant of the bottler whose territory includes the market, which is a bottler-level cost shifter because the bottlers are responsible for delivery. Table 7 displays the first-stage results showing that the instruments are relevant.

Table 7: First-Stage Results of Instruments

	(1) prices	(2) Within-Group Shares
Num. Prod. in Nest		-0.0598*** (0.000256)
Differentiation IV 1	0.0289*** (0.000351)	
Differentiation IV 2	0.00343*** (0.000301)	
Differentiation IV 3	0.0256*** (0.000338)	
Differentiation IV 4	0.0142*** (0.000295)	
VI Status	0.0334*** (0.00153)	
Transportation Distance	0.000000402*** (0.00000786)	
Observations	847253	847253

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The parameters to be estimated are the price coefficient α, characteristics coefficients β, and nesting parameter ρ. I use a two-step GMM method, where the moments are constructed using the lack of correlation between ξ and the instruments described above, and the optimal instruments are used in the second step. I use the PyBLP package that incorporates many of the best practices in estimation (Conlon and Gortmaker, 2020).

5.2 Results

Table 8 displays the parameter estimates. The negative sign of the price coefficient is as expected. Consumers derive higher utility from small-sized drinks compared with family-sized drinks, and lower utility from diet drinks than sugary drinks. The nesting parameter is high, indicating that the consumers are loyal to the diet or sugary category, and mainly substitute among the brands and packages within the same nest.

Table 8: Demand Estimates

	Estimates
Prices	-0.7565
	(0.0076)
Small	3.4944
	(0.0341)
Diet	-0.4331
	(0.0014)
Nesting Parameter	0.99
	(0.0025)

Using these estimates, we can derive the price elasticities of demand. The product-level elasticities are provided in the appendix. Given that the FTC's decisions focus on the syrup producer level, it is informative to examine the elasticities at an aggregated level. Table 9 displays the brand-level elasticities, which represent the percentage change in quantities sold at the row brand level following a 1% increase in the price of all packages of the column brand. For example, if all packages of regular Coke increase the price by 1%, the quantity of regular Coke sold would drop by 0.73%, and that of diet Coke would increase by 0.0012%, and regular Pepsi by 0.5%. This table reveals three insights. First, All own-price elasticities are negative and slightly below 1, indicating that in spite of low consumer sensitivity to price changes on the brand level, consumers substitute among different package sizes within the same brand. Second, There is minimal cross-price effect between diet and non-diet categories, suggesting consumers mainly substitute within the same category. Third, Cross-price elasticities are positive among the three regular and diet brands, with consumers being less responsive to price changes for regular Dr. Pepper compared to Coke and Pepsi. The magnitudes of the elasticities are relatively small, and are slightly lower than, if not similar to, those found in existing literature that estimates CSD demand using scanner data.

Table 9: Brand-Level Price Elasticities of Demand

Brand	R. Coke	D. Coke	R. Pepsi	D. Pepsi	R. Dr Pepper	D. Dr Pepper
Regular Coke	-0.729	0.001	0.5482	0.0005	0.2288	0.0002
Diet Coke	0.0012	-0.648	0.0009	0.385	0.0005	0.1407
Regular Pepsi	0.5009	0.0009	-0.6897	0.0005	0.2109	0.0002
Diet Pepsi	0.0009	0.8229	0.0011	-0.737	0.0005	0.1364
Regular Dr Pepper	0.5259	0.0009	0.5738	0.0005	-0.7882	0.0002
Diet Dr Pepper	0.001	0.8621	0.001	0.4021	0.0006	-0.8055

The demand estimates are helpful for us to understand consumers' behavior in the industry, and to recover the parameters in the supply model to understand the effects of vertical integration. Specifically, the bottlers' and syrup producers' production costs are inferred by solving their profit maximization problems. Additionally, Section 7 will present counterfactual scenarios, assuming the consumer substitution patterns are fixed.

6 Supply

In this section, I use a two-tier vertical model of bottlers and syrup producers, derive their profit-maximizing conditions, and estimate their marginal costs of production, as well as the relationships between the costs and vertical integration status.

6.1 Bottlers

Assume bottlers have Nash-Bertrand competition to maximize their profit, which includes its revenue from sales and costs of production, and do not internalize the syrup producers' profits. Assume the bottlers set a linear per 100 oz retail price for each product, pay the syrup producer a linear wholesale price $p^{f(j)}$, where $f(j)$ corresponds to the type of syrup used to produce product j. It incurs a constant marginal cost mc_j^b for each ounce of drink sold. The marginal cost may include transportation and product-specific packaging materials. The profit of a bottler b is

$$\Pi_t^b = \sum_{j \in \mathcal{J}_t^b} (p_{jt} - p_t^{f(j)} - mc_{jt}^b) s_{jt}(p), \tag{7}$$

where $\mathcal{J}_t^b$ is the bottler's product offering, including both franchised products and piggybacking products (if any). This suggests the bottler internalizes the loss in the rival products' sales if vertical integration had exerted foreclosure effects on them, and may make up for the loss by diverting sales to the franchised products. The profit-maximizing condition, written in vector form, is

$$p_t - p_t^f - mc_t^b = -(T_t * \Delta_{bt})^{-1} s_t(p), \tag{8}$$

where T_t is the $|\mathcal{J}_t|$ by $|\mathcal{J}_t|$ ownership matrix at the bottler level, which takes 1 if the column and row products are produced by the same bottler. Δ_t^b is the consumers' response matrix on the bottler level, with element (j,k) = $\Delta_{j,k} = \frac{\partial s_{kt}}{\partial p_{jt}}$.

With data on wholesale price, We can deduce the bottlers' markups and marginal costs from Equation 8, allowing us to analyze the disparities in bottlers' markups before and after integration. It sheds light on whether and to what extent the bottlers derived benefits from the integration, and the impact on rival bottlers' markups. The marginal costs are important for several reasons. First, by incorporating parameters on the vertical integration, we can estimate the cost efficiencies brought by the vertical integration. Second, by holding these parameters constant with alternative market structures in the counterfactuals, we can see how equilibrium quantities and prices change with alternative market structures.

Figure 4 shows the histogram of the marginal costs ($/100 oz) and markups (Lerner Index) on the bottler level derived from Equation 8. The left panel displays the distribution of marginal costs categorized by small or family size, which is also an important indicator of retail prices. The small sized drinks have higher marginal costs, around $7 per 100 oz, and the family-sized drinks have lower marginal costs, around $2 per 100 oz. The right panel shows that drinks of both size have low markups, around 1%. This may suggest that the bottlers are in adequate competition with one another.

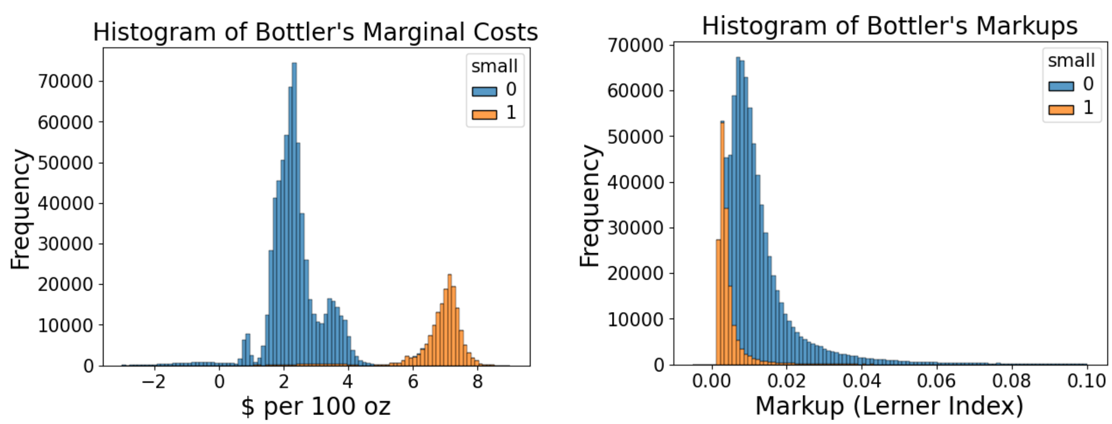

Figure 4: Distribution of Bottlers' MC and Markups

Assume the integrated bottlers receive a different wholesale price that is a proportion (λ_3) of the reported wholesale price. Then we can parameterize mc_t^b as in equation

$$mc_{jt}^b = \lambda_1 p_t^f + \lambda_2 \mathrm{VI}_{bjt} + \lambda_3 \mathrm{dist}_{bt} + \lambda_4 \mathrm{Small}_j + \sigma_b + \sigma_t + \eta_{bjt} \tag{9}$$

To interpret Equation 9, λ_1 recognizes that the bottlers may receive a different wholesale price than reported, regardless of the integration status. This captures the unobserved variation in incidence-based pricing prevalent in the TCCC bottling system, but the details are lacking in the contract terms. λ_2 captures the potential coordination benefits that may reduce the bottlers' marginal costs, and a negative coefficient indicates efficiency gains. λ_3 captures the part of marginal costs incurred due to transportation costs, approximated by the distance between the bottler's nearest plant and the market. This is in accordance with the Direct Store Delivery (DSD) systems adopted by the bottlers, in which the bottlers incur transportation costs. λ_4 captures differences in marginal costs across products due to package sizes. In addition, σ_b and σ_t are bottler and quarter fixed effects, and η_{bjt} is a structural error term.

With the marginal costs backed out from Equation 8, Table 10 shows the estimates of Equation 9 using OLS regression. The wholesale price is closely linked to marginal costs, as expected, with a one-dollar increase in concentrate prices leading to a 73-cent rise in production costs. Integrated bottlers show higher marginal production costs, suggesting that production cost savings through improved coordination may not materialize, unlike in the cement industry studied by Hortaçsu and Syverson (2007), where vertical integration led to better logistics coordination. Finally, as expected, smaller products and those requiring longer transportation distances have higher marginal costs.

After estimating bottlers' costs and how their profits relate to vertical integration, we can apply this information to analyze syrup producers' incentives. This is relevant because syrup producers account for bottlers' responses (as in standard vertical models), and the partial internalization of bottlers' profits may alter their incentives to integrate.

6.2 Syrup Producers

This section uses the bottlers' results to estimate the syrup producers' costs, which remain constant throughout the counterfactual analysis. I present a model where syrup producers

Table 10: Bottlers' MC Components

	(1) Bottlers' MC ($/100oz)
Concentrate Price	0.7339 ***
	(.0368)
Integrated	0.0798***
	(0.0027)
Distance (1000 Miles)	.00013***
	(0.00001)
Small	4.5005***
	(0.0023)
Bottler FE	Yes
Quarter FE	Yes
Num. Obs	847253

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

maximize their profits not only from syrup sales but also by partially incorporating the bottlers' profits. These estimates provide the foundation for evaluating counterfactual scenarios in the next section.

Assume each syrup producer f competes in setting linear wholesale prices p^f (measured in 100 ounces), and have a constant marginal cost of production (mc^{f_r} for sugary syrup and mc^{f_d} for diet syrup). To be consistent with the institutional details presented in Section 2, assume the price is uniform across all bottlers for product of the same sugary/diet category, so each syrup producer sets two prices p^{f_r} and p^{f_c} in each quarter. The syrup producer's profit function is

$$\Pi_q^f = \sum_t M_t \Bigg\{ (p^{f_r} - mc^{f_r}) \sum_{j \in \mathcal{J}_t^{f_r}} s_{jt}(p) + (p^{f_d} - mc^{f_d}) \sum_{j \in \mathcal{J}_t^{f_d}} s_{jt}(p) + O_t^{fb} \times \sum_{j \in \mathcal{J}_t^b} \left[(p_{jt} - p_t^{f(j)} - mc_{jt}^b) s_{jt}(p) \right] \Bigg\} \quad (10)$$

where t denotes counties in a given quarter, $\mathcal{J}_t^{f_r}$ is the set of products that use f's sugary syrup, which are the set of drinks of the same regular brand and different package sizes, and $\mathcal{J}_t^{f_d}$ is the set of products that use its diet syrup. In each county, f takes two elements into account in their profit function: syrup sales and affiliated bottlers' profits. The first element is its own profit of selling syrup that are used to produce $\mathcal{J}^{f_r}$ and $\mathcal{J}^{f_d}$, calculated by aggregating their market shares. The second element is its affiliated bottler's profit weighted by equity ownership $O_t^{f_b} \in [0, 1]$. As explained in Section 2,both TCCC and PepsiCo consider this element while DPSG does not. It is important to note that the bottler's set of products $\mathcal{J}_t^b$ includes both the profit from selling the syrup producers' own brand and the piggybacking Dr Pepper drinks. The former partially offsets the double marginalization, while the latter provides additional incentives to induce price increases of the rival products in order to divert sales to its own products, which may in turn induce the increase in costs of its own products known as Edgeworth-Salinger effect explained by Luco and Marshall (2020).

Unlike the bottler's problem, due to the assumption that the syrup price is uniform across bottlers, we cannot solve the problems market by market. The first-order conditions with respect to p^{f_r} and p^{f_d} are

$$\sum_t M_t \Bigg\{ \sum_{j\in\mathcal{J}_t^{f_r}} s_{jt} + (p^{f_d} - mc^{f_d}) \sum_{j\in\mathcal{J}_t^{f_r}} \frac{\partial s_{jt}}{\partial p^{f_r}} + (p^{f_r} - mc^{f_r}) \sum_{j\in\mathcal{J}_t^{f_d}} \frac{\partial s_{jt}}{\partial p^{f_r}} + $$
$$+ O_t^{fb} \times \Bigg[- \sum_{j\in\mathcal{J}_t^{f_r}} s_{jt}(p) + \sum_{j\in\mathcal{J}_t^{b}} \Bigg(\frac{\partial s_{jt}(p)}{\partial p^{f_r}} (p_{jt} - p^{f(j)} - mc_{jt}^b) + \frac{\partial p_{jt}}{\partial p_{f_r}} s_{jt}(p) \Bigg) \Bigg] \Bigg\} = 0 \tag{11}$$

$$\sum_t M_t \Bigg\{ \sum_{j\in\mathcal{J}_t^{f_d}} s_{jt} + (p^{f_d} - mc^{f_d}) \sum_{j\in\mathcal{J}_t^{f_r}} \frac{\partial s_{jt}}{\partial p^{f_d}} + (p^{f_r} - mc^{f_r}) \sum_{j\in\mathcal{J}_t^{f_d}} \frac{\partial s_{jt}}{\partial p^{f_d}} + $$
$$+ O_t^{fb} \times \Bigg[- \sum_{j\in\mathcal{J}_t^{f_r}} s_{jt}(p) + \sum_{j\in\mathcal{J}_t^{b}} \Bigg(\frac{\partial s_{jt}(p)}{\partial p^{f_d}} (p_{jt} - p^{f(j)} - mc_{jt}^b) + \frac{\partial p_{jt}}{\partial p^{f_d}} s_{jt}(p) \Bigg) \Bigg] \Bigg\} = 0 \tag{12}$$

In both Equations 11 and 12, the first line is the impact of syrup price changes on the profit of selling syrup. Specifically, an increase in the syrup price contributes to an increase in the profits of the infra-marginal sales for the same brand, as well as a loss in its market shares due to a higher margin. The syrup producer also internalizes the increase in the sales of its other brand due to the substitution effects. The second line is the impact on affiliated bottlers' profit, weighted by equity ownership. Specifically, an increase in syrup prices raises retail prices due to pass-through effects, potentially reducing sales of this brand and lowering the bottler's margins. By internalizing these profit changes, the syrup producer has less incentive to raise syrup prices, reducing double marginalization—considered a positive effect of vertical integration. Conversely, the syrup producer also internalizes the effect on rival brands including Dr Pepper, suggesting an incentive to set a syrup price to decrease Dr Pepper's market share to divert sales to its own brands. The specific magnitude of the impacts depends on the demand estimates in Section 5, as well as the syrup producer's costs of production, which can be estimated by solving Equations 11 and 12.

Figure 5 presents estimates of the syrup producers' marginal costs and markup. From the left panel, we can note several key points. First, diet syrup is generally more expensive to produce than sugary syrup, aligning with industry knowledge that the use of artificial sweeteners increases production costs. Second, production costs have been largely stable, except for a sharp decrease in both Coke's diet and regular syrups after their integration in 2010Q1, and a slight decrease in Pepsi's regular syrup following their integration in 2009Q3.

From the right panel, key takeaways include: first, syrup markups have remained stable overall, except for a drop and subsequent rise in regular Coke syrup following its integration, and a rise and subsequent drop in regular Dr Pepper syrup during the same period. Notably, Pepsi's regular syrup markup increased after its integration. Second, markups for most syrups are low, with diet Pepsi and Dr Pepper maintaining around a 10% markup, while other syrups have near-zero or negative markups.

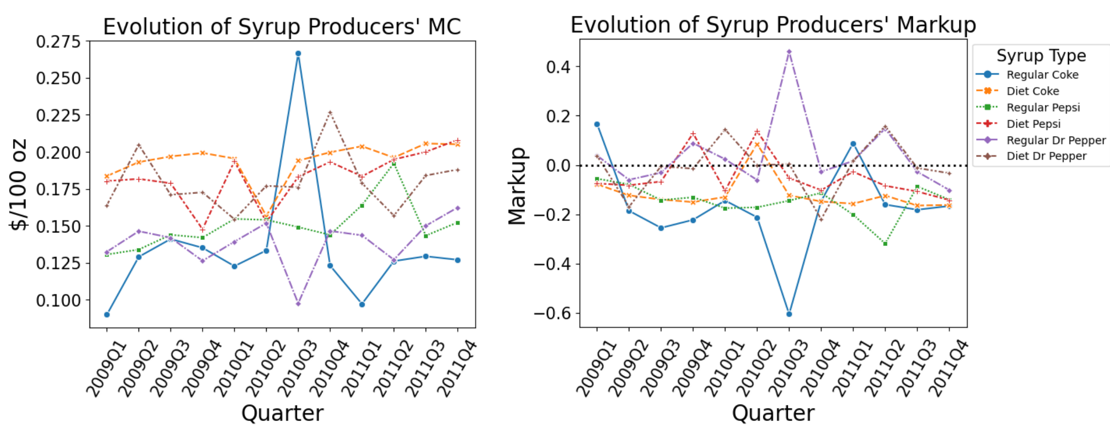

Figure 5: Estimates of the Syrup Producers' MC and Markups

Equipped with both demand- and supply-side estimates, we can simulate the counterfactual scenarios of alternative market structures.

7 Counterfactual Exercises

As a counterfactual exercise, I consider the scenario of full divestiture between syrup producers and bottlers. Specifically, this involves imposing a parameter constraint for all quarters and all pairs of syrup producers and bottlers. The analysis is based on the observed market data. The estimation process follows a two-step approach: the inner loop calculates the downstream equilibrium in each market given the syrup prices, while the outer loop determines the syrup producers' optimal pricing under the new market structure. By removing the partial internalization incentive for the syrup producers, I expect to find higher syrup price charged by TCCC and DPSG, as well as lower Dr Pepper retail price in periods after integration.

8 Conclusions

In this paper, I have analyzed both the efficiency and foreclosure effects of vertical integration by the Coca-Cola Company and PepsiCo, while considering the partial ownership structure before integration. Using a causal inference approach (difference-in-differences), I found that PepsiCo vertical integration led to a 0.06% increase in the prices of piggybacking products and up to a 0.013% decrease for Pepsi, while the magnitude is smaller for TCCC integration. Through a structural model of consumer behavior, the analysis shows that consumers primarily substitute within diet and sugary categories, with low brand-level price elasticities. Estimation results at the bottler level show that bottlers' markups (Lerner index) center around 1%, suggesting adequate competition among bottlers. Integrated bottlers exhibit higher marginal production costs, indicating that vertical integration may not have resulted in production cost savings. At the syrup producer level, estimates that account for partial ownership show a slight reduction in Pepsi syrup costs following PepsiCo's integration, while Coke syrup costs fluctuated, initially increasing and then decreasing after TCCC's integration. Overall, the results highlight that foreclosure incentives from vertical integration may outweigh the efficiency gains. This complements existing findings, such as those of Luco and Marshall (2020), and underscores the importance of considering foreclosure in policy discussions related to vertical integration.

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