Does vertical integration in the U.S. Carbonated Soft Drink industry lead to anticompetitive effects?

Nuwan Indika* and Phillip G. Gayle**

Abstract

This paper empirically investigates how vertical integration impacts prices in the presence of common agency: a downstream firm may also produce and distribute an upstream rival's products. We focused on one of the biggest vertical integrations that took place in the U.S. Carbonated Soft Drink (CSD) industry in 2010, i.e., PepsiCo and Coca-Cola acquired their biggest bottlers. The Federal Trade Commission (FTC) was concerned that the Coca-Cola and PepsiCo acquisition of bottlers might have an anticompetitive effect in the CSD industry. We use the structural econometric models of demand and supply to analyze the recent structural changes in the CSD industry. Our results suggest that for products with eliminated double margins (Coca-Cola and PepsiCo), the integration decreased prices. However, with regards to rival's products (Dr Pepper Snapple Group), prices decreased for 12 oz 6 packs, and prices increased for 20 oz bottles. Specifically, the results show that the vertical integration results in not only an anticompetitive effect but also a procompetitive effect. These mixed findings are consistent with the theoretical concern of pricing behavior in the presence of common agency and suggest caution when evaluating vertical integration in the CSD industry.

Keywords: Vertical integration, Common agency, Carbonated Soft Drink industry

JEL classification codes: L13, L49, L66

*****University of Colombo, Department of Busness Economics, Faculty of Management & Finance
University of Colombo, Colombo 03, Sri Lanka.; email: mgnindika@dbe.cmb.ac.lk

** Kansas State University, Department of Economics. 327 Waters Hall, Manhattan, KS 66506; email: gaylep@ksu.edu

1 Introduction

Over the last two decades, vertical integration has been an important subject of theoretical research in economics. Economic theory suggests that vertical mergers can produce procompetitive and anticompetitive effects in a market (Salinger 1988, Ordover et al.1990, Riodern 1998, Choi and Yi 2000, Chen 2001, Lafontaine and Slade 2007). More specifically, vertical integration can eliminate the problem of double marginalization and improve efficiency. Thus, the pro-competitive effect of vertical integration results in lower price and higher sales of the final product. In contrast, vertical integration can also lead to a higher price of the final product, an anti-competitive effect. Considering a theoretical market model in common agency with two products, Salinger (1991) shows that the effect of eliminating double marginalization for one product can lead to downstream prices: (i) for both products to fall; (ii) for both products to rise; or (iii) the price of the integrated product to fall, and the price of the unintegrated product to rise. In this case, a common agency refers to a downstream distributor/retailer carrying the product of different upstream firms. In other words, upstream firms sell products to final consumers through the same distributor/retailer.

A common agency is a unique feature of the U.S. Carbonated Soft Drink (CSD) industry. In CSD industry, a bottler is typically considered a common agency that bottles and produces the products of both Coca-Cola/PepsiCo and Dr Pepper Snapple Group (DPSG). In other words, most Coca-Cola and PepsiCo franchise bottlers distribute allied brands of DPSG. Due to integration with major bottlers in 2010, there has been an increase in concentration among Coca-Cola and PepsiCo bottlers that changed the strategy and structure of the U.S. CSD industry. Coca-Cola and PepsiCo have facilitated much of the bottler consolidation in this industry as they vertically integrated with bottlers. However, double marginalization is not eliminated for DPSG products that are bottled by vertically integrated PepsiCo or Coca-Cola bottlers. As such, the distribution system of the industry is becoming increasingly imbalanced, and it allows the Coca-Cola and PepsiCo greater power to control that system. For example, DPSG products may not be promoted by Coca-Cola/PepsiCo's bottler and ultimately excluded from the bottling operation. Thus, there is a potential trade-off between gains of efficiency for Coca-Cola/PepsiCo products and possible foreclosure of DPSG products in bottling.

In 2010, the Federal Trade Commission (FTC) was concerned that Coca-Cola's and PepsiCo's acquisitions of bottlers might have an anticompetitive effect in the CSD industry. This study analyses the recent structural changes in the CSD industry to investigate competition by modeling the vertical structure of the upstream (e.g., the Coca-Cola and PepsiCo) and downstream (e.g., bottlers) level. Specifically, we model the firms' behavior in the CSD industry by using a structural econometric model to determine how vertical integration impacts DPSG's prices in the presence of common agency. To best of our knowledge, this is the first study that models the vertical structure in the presence of common agency while considering vertical integration between the manufacturer and bottler in the U.S. CSD industry.

We use monthly retail scanner data on the U.S. CSD industry between 2008 and 2012 from the IRI Marketing Data Set (Bronnenberg et al., 2008). We first estimate consumer demand by using a random coefficient discrete choice model and use those estimates to compute price-cost margins for the upstream manufacturer and the downstream bottler (as in Villas-Boss, 2007, and Bonnet and Dubosis, 2010). Following the spirit of work by Villas-Boas (2007), we estimate the price-cost margin without observing data on wholesale prices. Moreover, we assume that the upstream manufacturers compete with each other in a Nash-Bertrand fashion in wholesale prices and that the bottlers use wholesale prices to compete with each other in a Nash-Bertrand fashion in retail prices. The bottlers set retail prices in our model. In other words, we assume that retailers are passive. That is, rather than engage in strategic price-setting behavior to maximize retail profits; we assume retailers are passive and simply set retail prices just high enough to cover their input costs and per unit prices paid to bottlers. Based on estimated margins from manufacturers and bottlers, we recover the marginal cost by subtracting margins from retail prices. Finally, we perform counterfactual simulations to find the Nash equilibrium prices in the situation of vertical dis-integration between manufacturer and bottler. In other words, how would equilibrium product prices change if a given upstream manufacturer did not own a downstream bottler? Also, we assume no cost efficiency gain results from vertical integration. Finally, our goal is to compare the simulated equilibrium price with actual equilibrium price to assess the price effect due to vertical integration.

The results of demand estimates suggest that a consumer's demand for CSD is significantly influenced by both price and non-price characteristics, such as calories, carbohydrates, sodium, sugar, and caffeine content. The standard deviations of the Random coefficient logit model find that consumer's responses to change in calories and sodium are heterogeneous. Our counterfactual experiment suggests that for products with eliminated double margins (Coca-Cola and PepsiCo), vertical integration decreases prices. However, with regards to the rival's products (DPSG), prices decrease for a 12 oz 6 pack whereas prices increase for 20 oz bottles. Specifically, the results show that the vertical integration of PepsiCo and Coca-Cola with their major bottlers results in not only an anticompetitive effect but also a procompetitive effect. The results of the procompetitive effect do not support the FTC's opposition to the vertical integration between PepsiCo and Coca-Cola with bottlers.

The remainder of the paper is organized as follows:

Section 2 reviews the literature and conceptual discussion of the impact of vertical integration on prices in the presence of common agency; Section 3 describes the CSD market structure and provides a description of the data; Section 4 outlines the structural econometric model of CSD demand and supply, including the estimation procedure; Results are discussed in Section 5. Lastly, Section 6 offers concluding remarks.

2 Literature Review

There are limited formal empirical analyses of the competitive effects of vertical integration in the presence of common agency. In a recent paper, Luco and Marshall (2017) analyze the PepsiCo and Coca-Cola vertical merger with bottlers by using a weekly scanner data. They mainly consider three product sizes: 20 oz bottles, 67.6 oz bottles and 144 oz boxes of cans. The results show that the vertical merger decreased prices for both PepsiCo and Coca-Cola products and increased prices for DPSG products. Further, they suggest that the vertical integration may have hurt consumers.

In contrast, Adachi (2017a) finds that PepsiCo's vertical merger with bottlers is procompetitive in the U.S. CSD industry. The study uses monthly scanner data and focuses on 12 oz products to analyze the competitive effects of vertical integration. The study identifies that the fall in prices is stronger in markets with Coca-Cola common agency than in markets with PepsiCo common agency. Similarly, price reductions on DPSG products are weaker in the markets with PepsiCo common agency than in the markets with Coca-Cola common agency and show the effects of the vertical merger would differ across the mode of common agency.

Adachi (2017b) investigates the effect of the vertical integration of Coca-Cola and its bottler. The paper finds that the Coca-Cola's vertical merger leads to an anticompetitive effect in the CSD industry. However, the study argues that Coca-Cola's vertical merger may have caused transactional conflicts with their major bottler and those conflicts passed through to its final prices. The study uses both retail scanner data and stock market data to confirm the findings. The study further shows that Coca-Cola's acquisition of its biggest bottler is an unsuccessful merger.

In summary, these empirical works present mixed findings of the effects of the vertical merger in the presence of common agency in the U.S. CSD industry. In other words, these studies analyze the competitive effect by using a reduced form approach and elaborate different nature of outcomes of vertical mergers in the CSD industry. However, these studies do not consider the structure of vertical relationships between manufacturers and bottlers and their pricing behavior. Thus, we intend to analyze the vertical mergers on prices in the presence of common agency by using a structural econometric model.

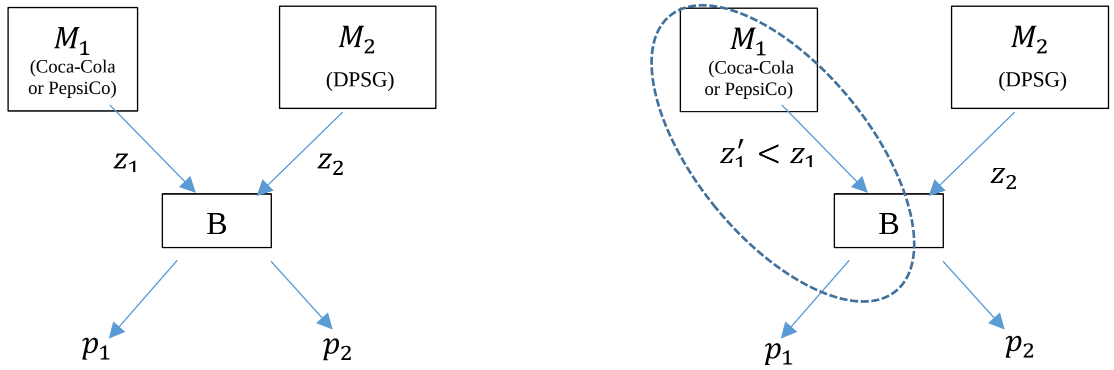
The empirical industrial organization literature presents mixed findings as to whether the anti- or pro-competitive effects of vertical integration dominate in any particular case. Chipty (2001) focuses on the cable television industry and analyzes the effects of vertical integration between programming and distribution. The results suggest that the foreclosure effect dominating in the U.S. pay television industry implies that some program services cannot get access to the vertically integrated distribution networks. However, the study shows that vertical integration benefits the consumer because of the associated efficiency gains. Hastings and Gilbert (2005) by using the wholesale gasoline industries and the relationship between West Coast gasoline refining and retailing markets) present evidence of a foreclosure effect. They find that vertical integration leads to an increase in both wholesale prices and rivals' costs. Hortacsu and Syverson (2007) concentrate on the U.S. cement industry and show that vertically integrated cement and ready-mixed concrete plants lead to lower prices. The evidence suggests that the efficiency gains are dominating potential foreclosure effects.

Furthermore, there are some empirical analysis of vertical relationships between upstream and downstream levels that focus on different industries; [the EU CSD industry, Bonnet and Réquillart (2012); the yogurt industry, Villas-Boas (2007); the coffee industry, Bonnet et.al. (2013); the bottled water industry, Bonnet, and Dubois (2010); the U.S. beer industry; Aschenfelter et al. (2015); the U.S. video rental industry; Mortimer (2008); the U.S. healthcare industry; Gowrisankan et al. (2015), Ho and Lee (2017)]. We contribute to the literature on the effect of vertical integration on prices by modeling the vertical structure between upstream and downstream level in the U.S. CSD industry.

2.1 Common Agency and Vertical Integration

In this section, we briefly explain Salinger's (1991) theoretical model of common agency in a vertical structure context to understand how a vertical merger causes possible different effects on final product prices. The vertical integration of Coca-Cola and PepsiCo with some of their largest franchised bottlers will eliminate the double marginalization of the brands of Coca-Cola and PepsiCo, but it does not eliminate it for the brands owned by DPSG. In other words, DPSG remains independent of selling inputs to the bottlers that are owned by Coca-Cola and PepsiCo. The elimination of double marginalization in Coca-Cola and PepsiCo products but not allied products of DPSG generate the pricing strategies of common agency bottlers.

Figure 1: illustrates the Market Structure.



(i) Framework before Vertical Integration

(ii) Framework after Vertical Integration

Following Salinger (1991), there are two upstream concentrate manufacturers (M_1 and M_2: Coca-Cola or PepsiCo and DPSG) selling differentiated inputs, to the monopolist downstream bottler (B). The downstream bottler is the sole seller of the two particular products (Coca-Cola /PepsiCo and DPSG). The monopolist bottler has an exclusive contract to handle products from the two distinct upstream manufacturers. M_1 sells an input to B at a price denoted by z_1, and B produces and sells canned and bottled carbonated beverages to consumers at prices contained in price vector p_1. Similarly, B purchases inputs from M_2 (DPSG) at price z_2, and then sells products at a price p_2. Thus, the downstream bottler transforms the inputs into final products and sells substitute products from two distinct manufacturers. Also, with B integrated with M_1, z_1' represents the input price of product 1 after the integration. Figure 1 shows the market structure before and after vertical integration.

In this setting and the given demand for the two goods: $Q_i = q_i(p_1, p_2)$, $i = 1{,}2$, and the profit function of downstream bottler: $\Pi_i = \sum_{i=1}^{2}(p_i - z_i)q_i(p_1, p_2)$, we can write the first order conditions for profit maximization equilibrium prices, p_1 and p_2, as follows:

$$\frac{\partial \Pi}{\partial p_1} = q_1 + (p_1 - z_1)\,\frac{\partial q_1}{\partial p_1} + (p_2 - z_2)\,\frac{\partial q_2}{\partial p_2} = 0 \tag{1}$$

$$\frac{\partial \Pi}{\partial p_2} = q_2 + (p_1 - z_1)\,\frac{\partial q_1}{\partial p_2} + (p_2 - z_2)\,\frac{\partial q_2}{\partial p_2} = 0 \tag{2}$$

The vertical integration of upstream manufacturer M_1 and the monopolist bottler will cause an input cost for production of Coca-Cola/PepsiCo to decrease ($z_1' < z_1$) and leaves z_2 at its original values for DPSG products. Thus, we can evaluate the final equilibrium prices due to a change in input prices to identify the pricing strategies of bottler as follow:

$$\frac{\partial \Pi^{VI}}{\partial p_1} = q_1 + (p_1 - z_1')\,\frac{\partial q_1}{\partial p_1} + (p_2 - z_2)\,\frac{\partial q_2}{\partial p_2} = 0 \tag{3}$$

$$\frac{\partial \Pi^{VI}}{\partial p_2} = q_2 + (p_1 - z_1')\,\frac{\partial q_1}{\partial p_2} + (p_2 - z_2)\,\frac{\partial q_2}{\partial p_2} = 0 \tag{4}$$

The decreased input cost to the bottler for the integrated products (Coca-Cola and PepsiCo) causes an increase in the markup ($p_1 - z_1'$) for those products and affects profit maximization of the unintegrated product (DPSG). The increased markup ($p_1 - z_1$ versus the $p_1 - z_1'$) for integrated products will create an incentive to the bottler to increase demand for the integrated products and raises the price of the unintegrated products. However, if the increase in markup is small and the effects of the diversion of demand are small, then it decreases the prices of both products. If the markup is large but the diversion effect is small, then decrease the price of the integrated product and increase the price of other product. However, if the diversion effect is large relative to the markup, then the price of both products will increase. The diversion effect depends on demandthe for substitutes, $\frac{\partial q_i}{\partial p_j}, i = 1{,}2\ j = 2{,}1$ (i.e., the greater $\frac{\partial q_1}{\partial p_2}$, the greater the diversion effect, where q_1 is the sales of the integrated products, and p_2 is the price of the unintegrated product). Thus, the reduction in z_1 (to z_1') on prices depends on the own and cross-price elasticity of demand and the level of the markup of integrated products compared to the markup pre-merger. In summary, considering a theoretical market model with two products, Salinger (1991) shows that the effect of eliminating double marginalization for one product can lead to downstream prices: (i) for both products to fall; (ii) for both products to rise; or (iii) the price of the integrated product to fall, and the price of the unintegrated product to rise.

3 Background and Data

3.1 Industry Background

In this section, we explain the structure and the most recent vertical transactions of the U.S. CSD industry. The CSD industry is characterized by some different actors: concentrate or syrup producers, bottlers, and the retail level. Combinations of these actors are used to make products available to the consumers. Concentrate or syrup producers are characterized by the upstream manufacturer (e.g., Coca-Cola) and sell syrup to downstream bottlers. Bottlers added carbonated water, sweeteners, and other ingredients, and then package the drinks into bottles or cans. Moreover, bottlers distribute canned and bottled soft drink products to the retail trade in their exclusive territories. Retailers such as grocery stores and supermarkets, then make carbonated beverages available to consumers.

Over the past three decades, the CSD industry has changed dramatically. The featured products, package introductions, and non-price promotions have become more complex and volatile. Building brand loyalty and minimizing transportation cost are the most important aspects of the CSD industry. Thus, manufacturers have relied heavily on bottlers concerning new products and packages, promotions, and marketing innovations. Also, PepsiCo and Coca-Cola bottlers adopted the production of allied brands like Dr Pepper and 7-UP to their bottling systems in the 1980s.

Moreover, the introduction of nonreturnable containers, advances in transportation, and technological innovation led to improving the minimum efficient scale in bottling operations which leads to bottling operations that exploit "economies of scope" in production (Muris et al., 1992). Thus, independent bottlers combined and created large multi-franchise operations (MFO) to accommodate increases in minimum efficient scale. However, the formation of MFO scattered and slowed in responding to the new CSD environment. Table 1 presents changes in the number of bottling operations and the average production of CSD bottling plants. It shows that the number of bottlers decreased as other bottlers and their franchisors acquired franchised bottlers.

Table 1: Number and Average Production of U.S. CSD Bottling Plants

Year	Number of Plants	Total Cases	Aver. Cases Per Plant
1970	3054	2,971,000,000	972,823
1980	1859	4,930,000,000	2,651,963
1990	807	7,780,000,000	9,640,644
1998	498	9,880,000,000	19,839,357

Source: Saltzman, Levy, and Hilke, (1999)

"In essence, Coca-Cola and Pepsi-Cola needed to change their distribution systems in order to implement effectively, the strategies that were stimulated by the new environment because the relative transaction costs of the independent bottling systems in the environment were too high" (Muris et al., 1992, 256). Furthermore, to implement new products and packaging using independent bottlers is expensive. "The success of product introductions hinges, first, on the ability of the manufacturer to convince retailers to take on the product and market it effectively and, ultimately, on consumer acceptance. Concentrate manufacturers (CMs) face an additional hurdle in introducing a new product or package – they must convince their independent bottlers to handle the item" (Muris et al., 1992, 272).

In the 1990s, Coca-Cola and PepsiCo continued buying many independent bottlers and combining their territories, allow them to control new product and process innovations. On the other hand, they are operating larger bottlers more manageable and economic scale. Table 2 shows the trend in the number bottling plants consolidate by Coca-Cola and PepsiCo in of the 80s and 90s.

Table 2: Number of Coca-Cola and PepsiCo Bottlers

Year	Coca-Cola Bottlers	PepsiCo Bottlers
1983	319	256
1987	192	180
1998	94	119

Source: Saltzman, Levy, and Hilke, (1999)

In 2009 and 2010, two major vertical integrations took place in the CSD industry: (1) PepsiCo integrated with Pepsi Bottling Group Inc (PBG) and PepsiAmericas (PAS) in August of 2009, and (2) Coca-Cola integrated with Coca-Cola Enterprises Inc (CCE) in February of 2010.

Vertical integration refers to the situation in which an upstream manufacturer (e.g., Coca-Cola or PepsiCo) directly owns a downstream bottler. DPSG has used its bottlers to distribute their products in some areas but mostly rely on the Coca-Cola and PepsiCo bottling systems in most areas in the U.S. More specifically, most Coca-Cola and PepsiCo franchise bottlers distribute allied brands of DPSG.

Before the vertical integration, PBG bottled and distributed 40%, and PAS bottled and distributed 43% of PepsiCo products, as well as 20 % of Pepper Snapple Group’s products, which were bottled, canned and distributed by PBG and PA. Similarly, Coca-Cola Enterprises, Inc. bottled and canned about 75% and 14 % of Coca-Cola and Pepper Snapple Group products in 2009. DPSG is the third largest CSD producer in the industry.

PepsiCo's CEO, Indra Nooyi explained the impetus for the merger that “the fully integrated beverage business will enable us to bring innovative products and packages to market faster, streamline our manufacturing and distribution systems and react more quickly to changes in the marketplace, much like we do with our food business. ” Also, Coca-Cola’s CEO, Muhtar Kent noted the benefit of the acquisition that “fundamental industry forces have altered the consumer, customer and competitive landscape," he said. "Our franchise system cannot remain static. We have to create the next generation of high-return opportunities.”

In 2010, the Federal Trade Commission (FTC) raised concern that Coca-Cola and PepsiCo acquisition of bottlers may have anticompetitive effects in the CSD industry. The FTC expressed the view that Coca-Cola and PepsiCo will have access to DPSG's commercially sensitive marketing plans through the bottlers and it would make DPSG a less effective competitor in the CSD industry. In other words, Coca-Cola and PepsiCo could use sensitive information in ways that weaken competition such as, not promote DPSG brands or ultimately excluded DPSG brands from the bottling operation. However, the FTC approved the acquisitions of PepsiCo and Coca-Cola under the condition of set up the "firewall” to protect the marketing information of DPSG. Under this “firewall” Coca-Cola and PepsiCo could only participate bottling process and cannot access confidential information of DPSG. Thus, PepsiCo and Coca-Cola completed the acquisition process in February 2010 and October 2010 respectively. This merger agreements lead to grant Coca-Cola and PepsiCo exclusive license to sell and distribute DPSG products in CCE, PBG and PAS exclusive territories. Finally, Coca-Cola renamed the sales and operational elements of Coca-Cola Enterprises to Coca-Cola Refreshments (CCR) and

PepsiCo establishing a wholly owned PepsiCo bottler (PBG, PAS), the Pepsi Beverages Company (PBC).

3.2 Data

The data for this study is constructed from the IRI retail Dataset. The data provide product sales information for a large number of stores and cover a wide range of geographic areas across the U.S. A broad array of markets is necessary to explore manufacturer, retailer, and consumer behavior across regions. The market in this study is defined as a combination of geographical area (county) and a period (month and year). The county is chosen as the geographical area.

IRI provided weekly retail data for the 50 IRI geographic markets by Universal Product Codes (UPC). These 50 geographic markets can be differentiated from the store location. Unlikely other research, we use IRI store location (zip code) files to identify in which counties stores locate within the U.S. Thus, we explore 5372 unique stores throughout 685 counties in the US. We use retail store data on CSDs in 685 counties across the U.S., for the period 2008-2012.

We consider the three biggest concentrate sellers: Coca-Cola, PepsiCo, and Pepper Snapple Group. We choose all possible carbonated beverage brands based on these concentrate sellers and availability in the IRI retail Dataset. We aggregate weakly data up to monthly unit sales and revenue. The average retail prices are computed dividing monthly sales revenue by monthly unit sales. The market size is calculated by multiplying a county’s population by its per capita per month consumption of soft drinks. We define a product as a unique combination of brand, packages, sizes, and retailer (stores). Different package sizes of a brand at a store are treated as distinct products within a market (e.g., 12 oz of 6 pack of cans diet coke is a different product than 20 oz of bottle diet coke at a store).

Table 3: Summary statistics: Retail prices ($ per oz)

	N	Mean Price ($ per oz)	S.D.	Max	Min
12 oz 6 pack					
Retail Price	151,366	0.0454	0.0097	0.2043	0.0001
Coca-Cola					
Tab	16,641	0.0487	0.0072	0.1128	0.0098
Diet Coke	11,720	0.0405	0.0115	0.1668	0.0124
Coke Zero	2,165	0.0398	0.0162	0.1558	0.0173
PepsiCo					
Diet Mountain Dew	3,430	0.0393	0.0086	0.1167	0.0122
Diet Pepsi	7,135	0.0411	0.0078	0.1100	0.0122
Caffeine Free Diet Pepsi	1,520	0.0435	0.0079	0.0972	0.0137
DPSG					
Ibc	65,128	0.0474	0.0073	0.2043	0.0164
Canada Dry	14,398	0.0439	0.0111	0.1311	0.0001
Canfield	12,133	0.0457	0.0114	0.1651	0.0124
20 oz bottles					
Retail Price	813,588	0.0755	0.0099	0.0075	0.2801
Coca-Cola					
Caffeine Free Diet Coke	113,503	0.0766	0.0072	0.1126	0.0117
Coke Zero	111,316	0.0766	0.0074	0.1315	0.0124
Diet Black Cherry Vanilla Coke	44,083	0.0766	0.0079	0.1212	0.0104
PepsiCo					
Caffeine Free Diet Pepsi	111,932	0.0759	0.0075	0.1097	0.0079
Diet Mountain Dew	91,583	0.0758	0.0077	0.1149	0.0139
Diet Mountain Dew Caffeine Free	26,353	0.0760	0.0075	0.1097	0.0106
DPSG					
A & W	88,893	0.0760	0.0080	0.1496	0.0090
Caffeine Free Diet Dr Pepper	61,626	0.0712	0.0137	0.1573	0.0164
Caffeine Free Diet Sun Drop	46,815	0.0711	0.0142	0.2338	0.0113

About 61 percent of the CSD sales represents 12 oz, 20 oz, and 67.5 oz bottles and cans. To reduce the computational burden of the econometric estimation, we mainly focus on 12 oz 6 packs and 20 oz bottles for this analysis. Table 3 presents summary statistics on the retail prices of the selected top brands in each manufacturer. The summary statistics of all brands that are included in the analysis are given in the appendix. Table 3 shows that the 12 oz 6 pack and 20 oz bottle products have similar average prices per oz between brands but slightly different prices per oz between product sizes. The average price per oz of the 20 oz bottles is double the average price per oz of the 12 oz 6 pack. Moreover, the results indicate that the carbonated beverages are a differentiated food category.

3.2.1 Product Characteristics Data

Lopez and Fantuzzi (2012) suggest that brand characteristics such that sugar, sodium, and caffeine content can affect consumer choices. The information on brand characteristics is collected by examining the labels on each CSD brand. We obtained this information from manufacturer websites and grocery stores. Table 4 indicates descriptive statistics and correlation among the non-price characteristics across the bands.

Table 4: Average and Correlation of the non-price characteristics

Variable	Mean	S.D	Min	Max	Correlation			
					Sodium	Sugars	Caffeine	Calories
12 oz 6 pack								
Sodium(mg)	46.42	24.28	0	105	1			
Sugars(g)	20.94	21.33	0	50	0.77	1		
Caffeine(mg)	7.07	16.12	0	68.4	-0.11	-0.43	1	
Calories	91.31	82.31	0	190	0.81	0.99	-0.49	1
20 oz bottles								
Sodium(mg)	77.45	21.55	0	210	1			
Sugars(g)	4.78	17.95	0	75	0.66	1		
Caffeine(mg)	41.28	35.69	0	114	-0.20	-0.28	1	
Calories	26.20	69.87	0	290	0.77	0.94	-0.39	1

N=151,366 and 813,588 for 12 oz 6 pack and 20 oz bottles respectively.

Table 4 shows that 12 oz 6 pack products on average have a higher content of sugar and calories whereas 20 oz bottles have a higher content of sodium and caffeine. The average content of sugars in 12 oz 6 pack products is generally about five times larger than the average content of sugars in 20 oz bottles.

There is a higher correlation between calories and sugars. Moreover, sodium highly correlates with sugars and caffeine has a negative correlation with sugar, and sodium within size.

Carbonated Soft Drinks introduced different sizes, shapes, and packages over the last four decades. Research on exploring the taste among different packages reveals there is subtle variation in taste drinking among aluminum cans, plastic and glass bottles[1]. Thus, we include a zero-one dummy variable that takes the value one for cans and zero for bottles (both plastic and glass) in the model to explore the package type that makes different to taste[2].

We also use the Public Use Microdata Sample (PUMS) data (2008 through 2012) to identify the county-level demographic characteristics. An individual's demographics are presumably relevant his or her demand for CSDs. These features of the data are conducive to studying the competitive effects of recent vertical mergers in the U.S. CSD industry. We randomly draw 200 individuals from each county (for each year) under the normal distribution. Thus, the sample includes 200×18500 (for 12 oz 6 pack) and 200×23674 (for 20 oz bottles) consumer observations. The individual's income is considered to allow heterogeneous responses to price and other non-price characteristics. To identify the total population for each county, we use census data. Interactions of price and non-price characteristics with consumer characteristics (e.g., income) are considered in the model.

To identify the bottlers, we assume that carbonated beverages are delivered to each store from the nearest distribution center which connects to the bottler. In other words, distribution centers are used to identify the bottlers because distribution centers are connected to the bottlers. Thus, we calculated the driving distance between each retail store and the closest distribution centers for each of the three concentrate manufacturers. DPSG products are bottled and distributed by either Coca-Cola, PepsiCo or DPSG bottler. Thus, for DPSG products, we choose the nearest distributor among the distribution centers of Coca-Cola, PepsiCo, and DPSG. On the other hand, for Coca-Cola/PepsiCo products, we identify the closest distributor among the distribution centers of Coca-Cola/PepsiCo. We use a database called ReferenceUSA to collect the location addresses for distribution centers.

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[1] http://www.coca-cola.co.uk/stories/bottle-vs-can-how-do-you-prefer-your-coca-cola

[2] Notice that there is no package type for 20 oz bottles because 98% of those products contain as plastic bottles in the sample.

Table 5: Products Distribution of Bottlers

Bottler’s	2008	2009	2011	2012
Coca-Cola				
Coca-Cola Enterprise (CCE)	62.69	61.67	-	-
Coca-Cola Refreshments (CCR)	-	-	64.8	64.21
Other Coca-Cola Bottlers	37.31	38.33	35.21	35.79
PepsiCo				
Pepsi Bottling Group (PBG)	82.19	81.59	-	-
PepsiAmericas(PAS)	15.22	15.55	-	-
Pepsi Bottling Company (PBC)	-	-	96.07	98.07
Other PepsiCo Bottlers	17.8	18.4	3.93	1.93
Dr Pepper distributed by				
Coca-Cola Enterprise(CCE)	31.98	31.65	-	-
Coca-Cola Refreshments (CCR)	-	-	31.62	31.23
Other Coca-Cola Bottlers	23.21	22.19	23.32	23.73
Pepsi Bottling Group (PBG)	28	28.91	-	-
PepsiAmericas(PAS)	5.87	5.98	-	-
Pepsi Bottling Company (PBC)	-	-	33.04	32.86
Other PepsiCo Bottlers	2.54	2.33	2.21	1.88
Dr Pepper Snapple	8.4	8.93	9.79	10.31
Number of Counties	359	385	369	388

The year 2010 is excluded because PepsiCo and Coca-Cola vertical merger took place in the year 2010.

Table 5 presents the information about the distribution of bottlers throughout the sample period. It shows about 98% of counties that PepsiCo products are distributed by vertically integrated PepsiCo bottler (PBG and PAS). Also, 64% of counties that Coca-Cola products are distributed by vertically integrated Coca-Cola bottler (CCE). In the case of DPSG, about 90% of counties that DPSG products are bottled and distributed by PepsiCo and Coca-Cola bottlers, whereas 10% of DPSG products are bottled and distributed by DPSG bottler.

4 The Econometric Model

4.1 Demand Side

This section is based on the demand and supply model. On the demand side, we use the random coefficients logit model. A random coefficient logit model captures unobserved individuals’ heterogeneity and controls the other exogenous factors that can impact to an individual's brand choice. On the supply side, we consider a sequential price-setting game between manufacturers and bottlers in which manufactures first set per-unit wholesale prices to be paid by bottlers, and conditional on these wholesale prices bottlers set per unit prices to charge retailers. We assume Nash-Bertrand competition among both manufacturer and bottlers. We further consider the supply model under the assumption of passive retailers.

We use m to denote market and $j = 1, \ldots, J$ to denote products. In a given beverage market consumer i has $J + 1$ alternative options, i.e., either consumer can choose among $j = 1, \ldots, J$ products or the consumer can choose outside option $j = 0$. The indirect utility V_{ijm} of consumer i from purchasing a CSD product j in market m is given by,:

$$V_{ijm} = d_j + d_m + x_{ijm}\beta_i - \alpha_i p_i + \xi_{jm} + \varepsilon_{ijm} \tag{5}$$

where d_j represents product (brand-store) fixed effects capturing time-invariant product characteristics; d_m is the market (county-year-month) fixed effects that capture the unobserved determinants of demand; and x_{ijm} is a $k \times 1$ vector of observed non-price product characteristics. In this study, we include the amount of sodium, sugar, caffeine, calories and a zero-one indicator variable that takes the value one for cans and zero for bottles (plastic and glass); p_i is the unit price per oz of CSD product j in market m; ξ_{jm} capture unobserved product characteristics; these are observed by consumers and firms but unobserved by the researcher; ε_{ijm} represents the individual-specific random component of utility that captures deviation of the individual's preference from the mean utility.

The random coefficients β_i represent a vector of consumer-specific marginal utilities associated with the different non-price product characteristics in x_{ijm}, and α_i the consumer-specific marginal utility of price. The coefficients of β_i and α_i are vary across consumers; this variation can be explained by m -dimensional column vector of demographic variables (D) and k -dimensional column vector that captures unobserved consumer characteristics (v_i). Formally, this can be modeled as:

$$\begin{pmatrix} \alpha_i \\ \beta_i \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \Gamma D_i + \delta v_i \tag{6}$$

Γ is a $k \times m$ matrix of coefficients that measure how taste characteristics vary with demographic characteristics, and δ is a $k \times k$ diagonal matrix that captures the unobservable heterogeneity due to random shocks v_i. We consider income is a demographic variable and included as a deviation from their respective means. The mean of the demographic variable in D_i is zero. Also, it is assumed that $v_i \sim N(O, I)$. Thus, the indirect utility function (5) can be broken down into three parts:

$$V_{ijm} = \delta_{jm} + \mu_{ijm} + \varepsilon_{ijm} \tag{7}$$

Let, δ_{jm} represents the mean utility level of each of the j products and can be written as:

$$\delta_{jm} = d_j + d_m + x_{jm}\beta_i - \alpha_i p_i + \xi_{jm} \tag{8}$$

We consider outside good option as a no-purchase option, indexed by $j = 0$; $(V_{i0m} = \varepsilon_{i0m})$. Let $\theta = (\Gamma, \delta)$ be a vector of a non-linear parameter. Further, let

$$\mu_{ijm}\left(x_{jm}, p_{jm}, v_i, D_i; \theta\right) = [-p_{jm}, x_{jm}](\Gamma D_i + \delta v_i) \tag{9}$$

Which denotes consumer-specific deviations from the mean utility given by interaction between consumer and product characteristics. Therefore, equation (7) implies the mean utility (δ_{jm}) and a consumer-specific mean-zero deviation from the utility ($\mu_{ijm} + \varepsilon_{ijm}$). Further, ε_{ijm} represented the idiosyncratic tastes and assumed to be i.i.d. type I extreme value distribution. Thus, the predicted market share of product j is given by:

$$s_{jm} = \int \frac{exp^{(\delta_{jm} + \mu_{ijm})}}{1 + \sum_{l=1}^{J} exp^{(\delta_{lm} + \mu_{ilm})}} d\hat{F}(D) dF(v) \tag{10}$$

where $\hat{F}(D)$ is the empirical distribution from the demographic data and $F(v)$ is the multivariate standard distribution. As in Nevo (2000), there is no closed-form solution for the equation in (10) , and thus it must be approximated numerically using random draws from $\hat{F}(D)$ and $F(v)$.

The measure M of the market size is assumed to be the per capita consumption per month of all CSDs multiplied by the population of the county. Thus, the observed market share of product j is given by $S_j = \frac{q_j}{M}$, where q_j are the units sold.

4.2 Supply Side

On the supply model, we assume a concentrate manufacturer (upstream manufacturer) set their per unit wholesale prices (p^w) first, in a Nash-Bertrand manufacturer level, and then downstream bottlers follow, setting per-unit prices (p) for these products in a Nash-Bertrand fashion. We further assume that retailers are passive and bottlers have sole market power in the marketing channel and thus set per unit prices. We first define bottlers profit-maximizing behavior in setting per unit prices that consumer pay, and then define manufacturer behavior in setting wholesale prices.

Let $b = 1 \dots B$ bottlers that compete in the downstream market. Bottler b profit function is given by:

$$\pi_b = \sum_{j \epsilon s_m^b} (p_{jm} - p_{jm}^w - c_{jm}^b) \times q_{jm} \tag{11}$$

where s_m^b is a subset of the $j = 1, \dots, J$ CSD products that are offered for sale by bottler b to the consumer in market m; p_{jm} is the per unit price of product j; c_{jm}^b is the bottler's marginal cost of product j; q_{jm} denotes a quantity of product j sold in market m and $q_{jm} = M_m \times s_{jm}(p)$. Therefore, each bottler solves the following profit maximization problem.

$$\max_{p_{jm} \forall j \in s_m^b} \left[\sum_{j \epsilon s_m^b} (p_{jm} - p_{jm}^w - c_{jm}^b) \times M_m \times s_{jm}(p) \right] \tag{12}$$

Following expressions in Nevo (2000) and Villas-Boas (2007), the set of J first order conditions generated from equation (12) can be solved for the price-cost margin for all products and expressed as the following vector notation:

$$p - p^w - c^b = -[T_b * \Delta_b]^{-1} s(p) \tag{13}$$

where p, p^w, c^b, and $s(p)$ are $J \times 1$ vector of final prices, wholesale prices, bottler's marginal costs, and product share respectively. T_b is a $J \times J$ matrix that has the general element of zero and ones based on the bottler's ownership structure of the J products.; Matrix Δ_b is a $J \times J$

matrix that contains first-order partial derivatives of predicted product share with respect to final prices, i.e

$$\Delta_b = \begin{bmatrix} \frac{\partial s_1}{\partial p_1} & \cdots & \frac{\partial s_J}{\partial p_1} \\ \vdots & \ddots & \vdots \\ \frac{\partial s_1}{\partial p_J} & \cdots & \frac{\partial s_J}{\partial p_J} \end{bmatrix}$$

where $T_b * \Delta_b$ represents element-by-element multiplication of the two matrices.

Now we turn to the problem of upstream concentrate manufacturers. Each concentrate manufacturers maximize profit by choosing the wholesale price (p^w), knowing that bottlers behave under equation (13). Let s_m^f be a subset of the J products that concentrate manufacturer f sells to bottler in market m. Also, let concentrate manufacturers' marginal cost be given by c_{jm}^w. Concentrate manufacturer f solves the following profit maximization problem:

$$\max_{p_{jm}^w \forall j \in s_m^f} \left[\sum_{j \epsilon s_m^b} (p_{jm}^w - c_{jm}^w) \times M_m \times s_{jm}(p(p^w)) \right] \qquad (14)$$

The first order conditions from the concentrate manufacturers' generated a pure strategy Bertrand Nash equilibrium in wholesale prices and using matrix notation implies the following markup equation:

$$p^w - c^w = -\left[T_f * \Delta_f\right]^{-1} s(p) \qquad (15)$$

where p^w and c^w are a $J \times 1$ vector of wholesale prices and concentrate manufacturers marginal cost respectively; T_f is a $J \times J$ matrix of zeros and ones that capture the J products ownership structure of across concentrate manufacturers. Let Δ_p be a $J \times J$ matrix of final prices with respect to wholesale prices, i.e.,

$$\Delta_p = \begin{bmatrix} \frac{\partial p_1}{\partial p_1^w} & \cdots & \frac{\partial p_J}{\partial p_1^w} \\ \vdots & \ddots & \vdots \\ \frac{\partial p_1}{\partial p_J^w} & \cdots & \frac{\partial p_J}{\partial p_J^w} \end{bmatrix}$$

Thus, $\Delta_f = \Delta_p' \Delta_b$, which captures the response of all predicted product share with respect to marginal changes in wholesale prices (Villas-Boas,2007).

Finally, we sum equation (13) and (15) to derive an expression for the overall price-cost margin for CSD products, yields:

$$p - c^f - c^b = -[T_b * \Delta_b]^{-1} s(p) - [T_f * \Delta_f]^{-1} s(p) \tag{16}$$

Note that we recover overall price-cost margin in equation (16) without information regarding wholesale prices, implies that the researcher does not need to know p^w. On the other hand, data on wholesale prices in CSD industries are difficult to obtain.

4.3 Counterfactual simulation of vertical dis-integration Nash equilibrium

We use equation (16) to perform counterfactual situation that how equilibrium prices affected if bottler is not integrated with upstream concentrate manufacturer. The primary purpose of the simulations is to measure market effects relative to a situation where vertical integration eliminates double marginalization of CSD products.

Based on equation (16), we recover the sum of bottlers and concentrate manufacturers' marginal costs as follows:

$$\hat{c}_T = (c^f + c^b) = p - \left[- \underbrace{[T_b * \Delta_b]^{-1} s(p)}_{m_d} - \underbrace{\left[T_f * \Delta_f\right]^{-1} s(p)}_{m_u} \right] \tag{17}$$

where $\hat{c}_T$ is $J \times 1$ vector of aggregate marginal cost for supplying each product; p is actual prices from the data; m_d and m_u are downstream and upstream markup respectively. Assuming that bottlers follow in a Nash-Bertrand pricing game and using recovered $\hat{c}_T$, we simulate a new equilibrium price vector p^* as follow:

$$p^* = \hat{c}_T - \left[T_b^{dis-integration} * \Delta_b\right]^{-1} s(p^*) - \left[T_f * \Delta_f\right]^{-1} s(p^*) \tag{18}$$

where $T_b^{dis-integration}$ is a $J \times J$ matrix of zeros and ones that capture the J products ownership structure of across bottlers under the vertical dis-integration situation.

4.4 Estimation

In the demand estimation, our goal is to derive the coefficient of estimates that produce product market share close to observed market share across all consumer. Following literature on discrete choice models of demand, we assume that unobserved product characteristics, ξ_{jm} are uncorrelated with changes in the observed non-price product characteristics, x_{jm}. Thus, we included brand dummy variables in the mean utility function to captures unobserved product characteristics (ξ_{jm}) and the factors that do not vary by market (x_{jm}) . Following, Nevo (2000), we estimate the demand parameter using the Generalized Method of Movements (GMM). Interacting the instruments with ξ_{jm} in the demand model, we construct moment and formulate the GMM optimization problem as follow;

$$\min_{\alpha,\beta,\theta} \xi' Z \phi^{-1} Z' \xi \tag{19}$$

where Z is the matrix of instruments that are orthogonal to the error term; ϕ^{-1} is the standard weighting matrix, and θ represents the non-linear parameters of Γ and δ. ξ is the function of parameters, where $\delta_{jm} - \left(d_j + x_{jm}\beta_i - \alpha_i p_i\right)$. Notice that δ_{jm} is unknown in equation (19) and its value implicitly depends on parameter vector θ. Following the literature Berry, et. al.,(1995) and Nevo (2000), δ_{jm} can be obtained numerically by solving:

$$S_{jm} = s_{jm}\left(\delta_{jm}, \theta\right) \tag{20}$$

Which implies the form of equating observed share to the estimated product share[3] from the mean utility across all consumers. By guessing the initial values for θ, and using the

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[3] The predicted market share given in equation (10) can be approximated by:

$$s_{jm} = \frac{1}{ns} \sum_{i=1}^{ns} \frac{exp^{\delta_{jm} + [-p_{jm}, x_{jm}](\Gamma D_i + \delta v_i)}}{1 + \sum_{l=1}^{J} exp^{\delta_{jm} + [-p_{jm}, x_{jm}](\Gamma D_i + \delta v_i)}}$$

numerical algorithm, we can solve for the values of δ_{jm} that satisfy equation (20). With the values of δ_{jm}, we can formulate and minimize the optimization problem of equation (19) to recover estimates of α. We then apply minimum distance estimator to recover β by using estimated brand fixed effects as proposed by Nevo (2000).

Using estimated brand fixed effects under the GMM procedure, we apply the GLS regression to estimate the coefficient of β as follow (See Nevo,2000):

$$\hat{\beta} = (x'\psi^{-1}x)^{-1}x'\psi^{-1}\hat{d} \tag{21}$$

where $\hat{d}$ denotes the $J \times 1$ vector of brand coefficients estimated from the GMM procedure; ψ is the variance-covariance matrix of estimated brand dummy coefficients, and x is the $J \times K$ matrix of non-price characteristics that are invariant across the market.

4.5 Instruments:

Price is potentially endogenous because prices will depend on observed and unobserved product and consumer characteristics. As such, the estimated coefficient on price will be inconsistent. Thus, we need to find an appropriate instrument for the price when estimating demand. Other than concentrate, the main components of bottler' costs include high fructose corn syrup (HFCS), packaging (e.g., aluminum for a can), electricity prices, and transportation. The prices of this input-cost are valid instruments for the CSD price in-demand model because price decision is exogenous to the cost side variables. In other words, this input-cost are uncorrelated to CSD demand shocks but correlated with the CSD price through the production cost of CSD. One set of instruments we use for the CSD price is the interaction between brand dummy variables and input-cost prices, as in Villas-Boas (2007). The included input-cost prices are: monthly wholesale prices for both HFCS55 and HFCS42 (USDA Sugar and Sweeteners Yearbook) for Coca-Cola/PepsiCo and DPSG products respectively, and monthly average electricity prices (cents/KWh) on industrial sectors for each state (US Department of Energy, Energy Information Administration). The main intuition of interacting input-cost variables with

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where ns represents random draws of individuals (=200) from the distribution of ν and D.

brand dummy variables is to include the production function of each product differently. The distribution of CSD products is another main component of bottlers cost. Thus, we consider driving distance from the closer distributer to the designated retailer as a proxy of transportation cost. The last set of instrumental variables we consider the characteristics of competing products (the so-called “BLP instruments”) suggested by Berry et al. (1995). These characteristics are appropriate instruments because they are excluded from the indirect utility function and correlated with prices via the markups. Thus, we consider marketing information in the scanner data correspond to the ordinal variables of feature, display, and promotion as characteristics of competing products. We use these variables to compute the BLP instruments as a deviation from the average of other competing products.

4.6 Supply Estimation

After having estimated the demand model, and following equation (13), (15) and (16), we estimate the equation (17) to recover the sum of bottler and concentrate manufacturer marginal cost. Finally, we simulate a new equilibrium price vector p^* in equation (18) to perform counterfactual situation.

5 Results

5.1 Demand

Table 6 and Table 7 show the results of the estimates of the standard logit model and the random coefficient logit model for 12 oz 6 pack and 20 oz bottles. Estimates of the standard logit model are based on OLS and 2SLS methods. The estimates show that there is a significant difference in the OLS price coefficient estimate compared to the 2SLS price coefficient estimates, implying that the price coefficient is biased if instruments are not used for the price. The Wu-Hausman test is statistically significant at 1% level, suggesting that the price is exogenous. However, our discussion mainly focuses on the random coefficient logit model, because the standard logit model does not take to the account of heterogeneity in consumer taste. The parameters estimate of the mean utility for the random coefficient model are presented in column 3, 4 and 5 in Table 6 and Table 7 respectively. The parameters estimate of the price and non-price characteristics are associated with consumer heterogeneity.

5.1.1 Demand Estimation Results of 12 oz 6 pack

In Table 6, on average, the coefficient of price is statistically significant at 1% level of significance, and the negative impact on utility implies that individuals have a strong negative valuation on price. The estimated coefficient of the “package type” dummy variable is negative, suggesting that, on average individual get lower utility consuming soda from can vs. bottle. Research on exploring the reasons[4] for packaging and difference of the taste emphasizes that more than 60% of people like bottles (plastic or glass) than cans. Reasons for this preference are (i) easier to pour from, (ii) able to pop the lid back on in between sips (iii) feel tastes better, and carry easily in a bag. Thus, our results seem to be more consistent with consumer prefer bottle vs. can. As shown in the results of 12 oz 6 pack, the consumer has, on average, significant and a negative valuation of sodium, caffeine and calorie content. Concerning nutrition standpoint, the sugar content is positively related to the average consumers' utility over health concerns. It may reflect the evidence to the link between the carbonated beverage and chronic diseases. The estimated mean parameters for Coca-Cola and PepsiCo company imply that consumers have a higher intrinsic valuation of Coca-Cola and PepsiCo products relative to DPSG products.

The fourth column displays the taste variation parameters for product characteristics, which are unobserved to the researcher. The standard deviations of the calorie and sodium coefficient are significant, suggesting that consumers’ are heterogeneous concerning their taste for calorie and sodium. The fifth column measures how characteristics of taste vary with income. The interaction variable of calorie with income is statistically significant at 1% level, implying that consumers with higher income are smaller disutility on calories.

5.1.2 Demand Estimation Results of 20 oz bottles

In Table 6, the price coefficient is negative and statistically significant at the 1% significance level, suggest that, on average, consumers are less likely to consume 20 oz bottles the higher its price, ceteris paribus. Similar to the results of 12 oz 6 pack, the consumers have the negative valuation of caffeine and calorie content. In contrast, the results show that consumers have, on average, negative valuation of sugar and a positive valuation of sodium content. From a nutrition standpoint, the positive coefficient for sodium may reflect a preference for flavor over

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[4] http://www.coca-cola.co.uk/stories/bottle-vs-can-how-do-you-prefer-your-coca-cola

nutrition concerns. This positive consumer valuation is given the link between the carbonated beverage and blood pressure. As shown by the descriptive statistics, the average content of sodium in 20 oz bottles is two times larger than the average content of sodium in 12 oz 6 pack products. Finally, the results of the fixed effects of CSD company implies that, relative to DPSG products, consumers have a higher intrinsic value of PepsiCo and Coca-Cola products.

5.2 Demand Elasticities

Using the structural demand estimates, we compute the own and cross-price elasticity for each manufacturer during pre and post vertical integration periods of Coca-Cola and PepsiCo. Overall, the own price elasticity estimates do not highly variate across manufacturers. Moreover, Table 7 shows that the estimated own-price elasticities for each manufacturer in the pre-integration period are similar to the post-integration period of both Coca-Cola and PepsiCo. As compared to the 12 oz 6 pack products, Table 7 shows that manufacturers selling 20 oz bottles are less price sensitive in the pre-integration and post-integration period. The own price elasticity for upstream manufacturers (Coca-Cola, PepsiCo, and DPSG) selling 12 oz 6 pack, range between -4.7 to -5.1. In Table 7 for example, the mean own price elasticity for products of 12 oz 6 pack sold by Coca-Cola is -4.76, implying on average that increasing price of Coca-Cola brand by 1% leads to decreases the consumer demand for these products by 4.76%. The magnitude of these estimated own price elasticities is similar to other studies in the CSD market used by scanner data. Dube (2005) reported own price elasticities ranging from -3 to -6 in the Denver area, while Dhar et al. (2005) estimated own price elasticities between -2.7 to -4.4. Chan (2006) reported own price elasticities ranging from -5 to -11 at a household level in CSD. For the CSD in the EU market, Bonnet and Requillart (2012) found elasticities ranging from -2 to -4.

We also report the average of the cross price elasticity of all products across the manufacturer between 12 oz 6 pack and 20 oz bottles in Table 7. All the estimated cross-price elasticities are positive as expected, implying that CSD products are substitutes. There is a variation in mean cross-price elasticity across manufacturers in 12 oz 6 pack. Manufacturers experience lower cross-price elasticity in the post-integration period compared to pre-integration period of both Coca-Cola, PepsiCo, and DPSG for products of 20 oz bottles. In Table 7, for example, the average cross-price elasticity between Coca-Cola and DPSG in the pre-integration of Coca-Cola implies that if the price of Coca-Cola products increases by 1%, then the quantity demand for DPSG products increases by 0.0021%.

It is interesting to note that the cross-price elasticities are quite small when compared to the own price elasticities. Which implies that consumers are highly sensitive to CSD prices for their chosen brands and will substitute to the outside good compares to another brand of CSD. The cross-price elasticity for the Coca-Cola products in 12 oz 6 pack relatively higher compared with other manufacturer's product in both pre-integration and post-integration period implies that consumers consider Coca-Cola's products as closer substitutes to other manufacturer's products.

5.3 Computed Markup and Recovered Marginal Cost Estimates

Using demand estimates, we computed the upstream and downstream price-cost markups for the supply model (See equation 13 and 15) and recovered the total marginal cost by subtracting the estimated total margins from retail prices (See equation 16). Summary statistics on total price-cost markup and recovered marginal costs by the common agency for the pre-integrated and post-integrated period are reported in Table 8 and Table 9 regarding 12 oz 6 pack and 20 oz bottles. The Lerner Index indicates the ratio of markup to price.

Table 8 shows that on average total price-cost margins are significantly greater for CSD products that bottled by the common agency in the pre-integrated period than the post-integrated period for both sizes. For example, of 12 oz 6 pack, upstream PepsiCo and DPSG products that bottled by unintegrated common agency account for 46% and 47% mean total margins as a percent of price respectively. It is noted that average total margins are not significantly different across the unintegrated common agencies that bottled and distributed upstream products (Coca-Cola/PepsiCo and DPSG).

In Table 9, as expected for both sizes, on average Coca-Cola and PepsiCo products bottled and distribute with twice lower total margin as a percent of price by vertically integrated bottlers compared to total margins of upstream rival's products (DPSG). For example, the average total margins of Coca-Cola and PepsiCo products bottled by vertically integrated Coca-Cola and PepsiCo bottlers are 28% and 29% respectively for 20 oz bottles. Also, the estimated mean total margins are not significantly different for DPSG products that bottled and distributed by integrated bottler during the post-integrated period.

However, mean total marginal costs do not significantly differ across common agencies during the pre-integrated and the post-integrated period. Therefore, the decrease in mean total margins of integrated products over the post-integrated period is less likely due to the cost factor.

Table 6: Demand Estimation Results of 12 oz 6 pack and 20 oz bottles

	12 oz 6 pack					20 oz bottles				
	Standard Logit Model		Random coefficient logit model			Standard Logit Model		Random coefficient logit model		
	OLS (Means)	2SLS (Means)	RCM (Means)	Standard Deviations	Interactions with Income	OLS (Means)	2SLS (Means)	RCM (Means)	Standard Deviations	Interactions with Income
Variable	α, β	α, β	α, β	Γ	δ	α, β	α, β	α, β	Γ	δ
Price	-3.4489***	-6.8953***	-109.3401***	-0.4261		-0.3170***	-39.8314***	-46.1316***	-3.887	
	(0.1684)	(1.4300)	(3.8226)	(5.5130)		(0.0279)	(0.9621)	(1.8740)	(8.9303)	
Package Type	-0.2815***	-0.3020***	-1.9431***			-	-	-	-	
	(0.0127)	(0.0145)	(0.0679)							
_Cons	0.0061 [a]	0.0028 [a]	0.2711*** [a]	-0.0486	-0.0328	-0.3281*	-0.3146	-4.2404***	0.2577	-0.4546
	(0.0001)	(0.1068)	(0.0197)	(0.2443)	(0.2928)	(0.1923)	(0.3578)	(0.1560)	(1.6346)	(1.5910)
Sodium	0.00009[a]	0.0002 [a]	-0.0711*** [a]	-5.8113***	0.0035	0.00003*[a]	0.0002***[a]	0.0072***[a]	0.1448	-0.2456
	(0.0001)	(0.0001)	(0.0005)	(0.3907)	(0.3021)	(0.0000)	(0.0001)	(0.0007)	(1.5879)	(2.1360)
Calories	-0.0015*** [a]	-0.0017*** [a]	-0.0107*** [a]	-3.7602*	3.7535***	0.00003***[a]	0.0006*[a]	-0.0052*[a]	8.3896	0.7108
	(0.0002)	(0.0002)	(0.0007)	(2.1119)	(1.7988)	(0.0000)	0.0000	(0.0027)	(5.5446)	(96.695)
Sugar	0.0008 [a]	0.0013* [a]	0.0121*** [a]			-0.0001*** [a]	-0.0026***[a]	-0.0082***[a]		
	(0.0007)	(0.0007)	(0.0022)			0.0000	(0.0001)	(0.0001)		
Caffeine	0.0005** [a]	0.0006*** [a]	-0.0132*** [a]			-0.000017*[a]	-0.000027a	-0.0005*[a]		
	(0.0001)	(0.0001)	(0.0005)			(0.0000)	(0.0000)	(0.0003)		
Coke	0.0098 [a]	0.0009 [a]	0.8232*** [a]			0.0047***[a]	0.06544***[a]	-0.0413***[a]		
	(0.0072)	(0.0085)	(0.0211)			(0.0010)	(0.0032)	(0.0176)		
Pepsi	0.0583*** [a]	0.0543*** [a]	0.8644*** [a]			0.0033***[a]	0.05454***[a]	0.1638***[a]		
	(0.0085)	(0.0087)	(0.0229)			(0.0011)	(0.0030)	(0.0295)		
GMM Objective			0.0218					0.0002		
N	151366	151366	151366			813588	813588	813588		
Fixed effects										
Month	Yes	Yes	Yes			Yes	Yes	Yes		
Year	Yes	Yes	Yes			Yes	Yes	Yes		
County	Yes	Yes	Yes			Yes	Yes	Yes		
Brand	Yes	Yes	Yes			Yes	Yes	Yes		
Store	Yes	Yes	Yes			Yes	Yes	Yes		
Wu -Hausman		8.17878***					5871.63***			

Standard errors in parentheses, ***, **,* are indicate statistical significance at 1%, 5% and 10% respectively, [a] Estimates from a Minimum Distance Procedure, see Nevo (2000).

Table 7: Manufacturer's mean own and cross-price elasticity for all products of 12 oz 6 pack and 20 oz bottles

	12 oz 6 pack			20 oz bottles		
Coca-Cola Pre-integration	Coca-Cola	PepsiCo	Dr Pepper Snapple Group	Coca-Cola	PepsiCo	Dr Pepper Snapple Group
Coca-Cola	-4.763	-	-	-3.3117	-	-
PepsiCo	0.0035	-4.7017	-	0.0022	-3.2847	-
Dr Pepper Snapple Group	0.0164	0.0054	-4.8182	0.0021	0.0022	-3.1601
Coca-Cola Post-integration	Coca-Cola	PepsiCo	Dr Pepper Snapple Group	Coca-Cola	PepsiCo	Dr Pepper Snapple Group
Coca-Cola	-5.1228	-	-	-3.36259	-	-
PepsiCo	0.0038	-5.0325	-	0.0016	-3.5732	-
Dr Pepper Snapple Group	0.0135	0.0055	-5.1911	0.0015	0.0016	-3.4491
PepsiCo Pre-integration	Coca-Cola	PepsiCo	Dr Pepper Snapple Group	Coca-Cola	PepsiCo	Dr Pepper Snapple Group
Coca-Cola	-4.7013	-	-	-3.2609	-	-
PepsiCo	0.0034	-4.6797	-	0.0024	-3.2496	-
Dr Pepper Snapple Group	0.0163	0.0055	-4.7516	0.0023	0.0023	-3.1154
PepsiCo Post-integration	Coca-Cola	PepsiCo	Dr Pepper Snapple Group	Coca-Cola	PepsiCo	Dr Pepper Snapple Group
Coca-Cola	-5.0921	-	-	-3.5873	-	-
PepsiCo	0.0038	-5.0188	-	0.00168	-3.5313	-
Dr Pepper Snapple Group	0.0143	0.0053	-5.1506	0.00161	0.00163	-3.4137

Table 8: Price-cost Markup and Recovered Cost by the common agency for the pre-integrated period of 12 oz 6 pack and 20 oz bottles

Upstream (Concentrate Manufacturer)	Downstream (Bottler)	12 oz of 6 pack			20 oz bottles		
		Total Margin (Upstream + Downstream)		Total Recovered Marginal Cost	Total Margin (Upstream + Downstream)		Total Recovered Marginal Cost
		Mean Levels ($ per oz)	Mean Percent of Price (Lerner Index) (%)	Mean Levels ($ per oz)	Mean Levels ($ per oz)	Mean Percent of Price (Lerner Index) (%)	Mean Levels ($ per oz)
Coca-Cola	Coca-Cola Enterprises (CCE)	0.0193***	46.89***	0.0246***	0.0452***	62.10***	0.0284***
		(0.000)	(0.31)	(0.000)	(0.000)	(0.02)	(0.000)
DPSG	Coca-Cola Enterprises (CCE)	0.0203***	48.17***	0.0242***	0.0456***	67.45***	0.0253***
		(0.000)	(0.19)	(0.000)	(0.000)	(0.12)	(0.000)
Coca-Cola	*Other Coca-Cola*	0.0193***	46.92***	0.0245***	0.0454***	62.50***	0.0281***
		(0.000)	(0.20)	(0.000)	(0.000)	(0.03)	(0.000)
DPSG	*Other Coca-Cola*	0.0208***	49.70***	0.0232***	0.0472***	70.73***	0.0226***
		(0.000)	(0.42)	(0.000)	(0.000)	(0.17)	(0.000)
PepsiCo	Pepsi Bottling Group	0.0192***	46.41***	0.0241***	0.0452***	63.42***	0.0269***
		(0.000)	(0.26)	(0.000)	(0.000)	(0.03)	(0.000)
DPSG	Pepsi Bottling Group	0.0202***	47.93***	0.0238***	0.0458***	69.68***	0.0230***
		(0.000)	(0.20)	(0.000)	(0.000)	(0.14)	(0.000)
PepsiCo	PepsiAmericas	0.0196***	47.80***	0.0235***	0.0457***	64.06***	0.0265***
		(0.000)	(0.37)	(0.000)	(0.000)	(0.07)	(0.000)
DPSG	PepsiAmericas	0.0211***	50.00***	0.0229***	0.0466***	67.94***	0.0237***
		(0.000)	(0.48)	(0.000)	(0.000)	(0.23)	(0.000)
PepsiCo	*Other PepsiCo*	0.0223***	62.15***	0.0162***	0.0449***	63.40***	0.0269***
		(0.000)	(1.93)	(0.000)	(0.000)	(0.16)	(0.000)
DPSG	*Other PepsiCo*	0.0236***	56.90***	0.0202***	0.0455***	67.11***	0.0236***
		(0.000)	(2.48)	(0.000)	(0.000)	(0.33)	(0.000)

Standard errors in parentheses, and * p<0.1, ** p<0.05, *** p<0.01

Table 9: Price-cost Markup and Recovered Cost by the common agency for the post-integrated period of 12 oz 6 pack and 20 oz bottles

		12 oz of 6 pack			20 oz bottles		
		Total Margin Upstream + Downstream)		Total Recovered Marginal Cost	Total Margin Upstream + Downstream)		Total Recovered Marginal Cost
Upstream (Concentrate Manufacturer)	Downstream (Bottler)	Mean Levels ($ per oz)	Mean Percent of Price (Lerner Index) (%)	Mean Levels ($ per oz)	Mean Levels ($ per oz)	Mean Percent of Price (Lerner Index) (%)	Mean Levels ($ per oz)
Coca-Cola	Coca-Cola Refreshments	0.0097***	21.67***	0.0373***	0.0226***	28.67***	0.0581***
		(0.000)	(0.07)	(0.000)	(0.000)	(0.01)	(0.000)
DPSG	Coca-Cola Refreshments	0.0199***	43.88***	0.0274***	0.0459***	63.88***	0.0315***
		(0.000)	(0.18)	(0.000)	(0.000)	(0.25)	(0.000)
Coca-Cola	*Other Coca-Cola*	0.0191***	42.45***	0.0284***	0.0455***	56.67***	0.0353***
		(0.000)	(0.23)	(0.000)	(0.000)	(0.02)	(0.000)
DPSG	*Other Coca-Cola*	0.0230***	50.85***	0.0248***	0.0470***	63.72***	0.0301***
		(0.000)	(1.92)	(0.000)	(0.000)	(0.14)	(0.000)
PepsiCo	Pepsi Bottling Company (PBC)	0.0094***	21.67***	0.0366***	0.0226***	29.04***	0.0561***
		(0.000)	(0.12)	(0.000)	(0.000)	(0.01)	(0.000)
DPSG	Pepsi Bottling Company (PBC)	0.0210***	46.67***	0.0265***	0.0466***	64.37***	0.0292***
		(0.000)	(1.04)	(0.000)	(0.000)	(0.21)	(0.000)
PepsiCo	*Other PepsiCo*	0.0186***	41.34***	0.0286***	0.0449***	58.41***	0.0332***
		(0.000)	(0.90)	(0.000)	(0.000)	(0.16)	(0.000)
DPSG	*Other PepsiCo*	0.0323***	72.86***	0.0145***	0.0459***	61.38***	0.0301***
		(0.000)	(10.89)	(0.000)	(0.000)	(0.21)	(0.000)

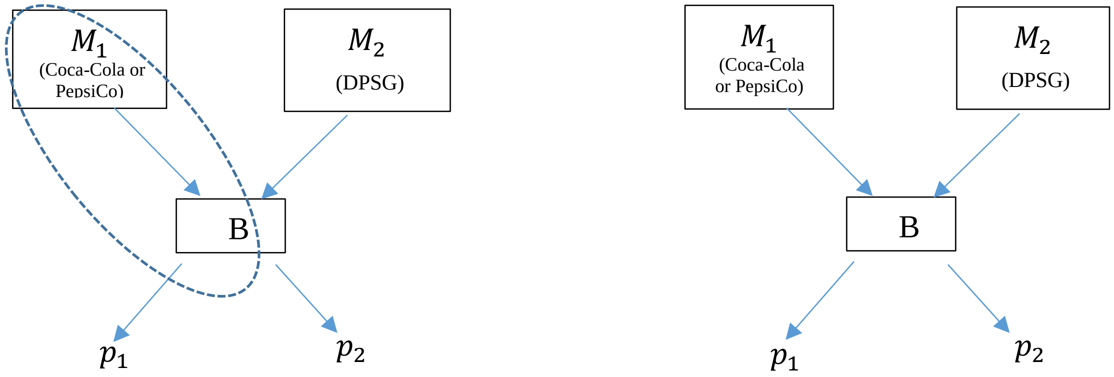
Standard errors in parentheses, and * $p<0.1$, ** $p<0.05$, *** $p<0.01$

5.4 Counterfactual simulations

This subsection is based on the results of counterfactual simulation in vertically integrated markets. We define the vertically integrated market as a downstream bottler which is owned by at least one of the upstream concentrate manufacturer (Coca-Cola or PepsiCo). In other words, if there is no vertically integrated bottler available in the given market, then we do not consider that market as a vertically integrated market.

Figure 2 illustrates the graphical example of the market structure and vertical integration of the CSD industry. We design and implement counterfactual dis-integration experiments to assess the market impacts of vertical integration. For example, a typical counterfactual experiment we ask the question: How would equilibrium product prices change if a given upstream manufacturer did not own a downstream bottler?

Figure 2: The market structure of the CSD industry



(a) Vertical Integration

(b) Counterfactual Situation
(Vertical dis-integration)

Figure 2a illustrates the actual situation in which the downstream bottler (B) is integrated with an upstream manufacturer M_1 (Coca-Cola /PepsiCo), while Figure 2b presents the counterfactual situation in which the bottler is not integrated with uthe pstream manufacturer M_1. We assess the effects of vertical integration by using equation (18) to predict how market equilibrium prices would change if markets that are actually like Figure 2a were to become like Figure 2b.

Table 10: Estimated means and changes in retail prices -common agency and vertically integrated bottler for 12 oz 6 pack and 20 oz bottles

	12 oz of 6 pack			20 oz bottles		
	Mean Predicted Counterfactual Dis-Integration Prices(p^a) ($ per oz)	Mean Actual Prices in Markets with Vertically Integrated Firms(p^b) ($ per oz)	Mean Percentage Price Changes $\left(\frac{p^a - p^b}{p^b}\right) * 100$	Mean Predicted Counterfactual Dis-Integration Prices(p^c) ($ per oz)	Mean Actual Prices in Markets with Vertically Integrated Firms(p^d) ($ per oz)	Mean Percentage Price Changes $\left(\frac{p^c - p^d}{p^d}\right) * 100$
PepsiCo integrated with the downstream bottler						
PepsiCo Products	0.05526*** (0.000)	0.04608*** (0.000)	21.14028*** (0.110)	0.10110*** (0.000)	0.07865*** (0.000)	28.90176*** (0.011)
PepsiCo distributes DPSG Products	0.04746*** (0.000)	0.04734*** (0.000)	0 .25111*** (0.014)	0.07564*** (0.000)	0.07575*** (0.000)	-0.14718*** (0.001)
Coca-Cola integrated with the downstream bottler						
Coca-Cola Products	0.05608*** (0.000)	0.04690*** (0.000)	20.63208*** (0.060)	0.10318*** (0.000)	0.08067*** (0.000)	28.09013*** (0.008)
Coca-Cola distributes DPSG Products	0.04729*** (0.000)	0.04722*** (0.000)	0.16255*** (0.013)	0.07721*** (0.000)	0.07733*** (0.000)	-0.15830*** (0.000)

Standard errors in parentheses, and * p<0.1, ** p<0.05, *** p<0.01

Table 10 represents the estimation results of the effects of Coca-Cola and PepsiCo vertical integration on retail prices for both sizes. For example, column I, column 2 and column 3 report mean predicted counterfactual prices due to vertical dis-integration, mean actual prices in markets with vertically integrated firms and mean changes in prices respectively for 12 oz 6 pack.

The counterfactual price changes are statically significant at the 1% level. The results reveal that for products with eliminated double margins (Coca-Cola and PepsiCo) the average retail price decreases for both sizes, which is in contrast with the effect of vertical integration on the prices of rival products (DPSG) that are bottled by vertically integrated bottlers. With regards to DPSG's products, price decreases for 12 oz 6 pack whereas price increases for 20 oz bottles. Under the assumptions that we made for demand side (e.g., Random coefficient model) and supply side (e.g., estimating price-cost margins under the assumption that retailers are passive, and no-cost efficiency gains), the estimates suggest that vertical integration with bottlers results in procompetitive effects for 12 oz 6 pack and anticompetitive effects for 20 oz bottles. These results empirically support the Salinger's (1991) theoretical argument of vertical integration in a common agency which causes possible different effects on final product prices. Finally, the results reveal that the elimination of double marginalization for one set of products (Coca-Cola/PepsiCo) may or may not benefit consumers in the CSD industry.

6 Conclusion

Economic research on the CSD industry is limited to the analysis of demand, leaving questions about competition and hence consumer welfare. Using structural model, we investigate the price effects of one of the biggest vertical integration in the U.S. CSD industry in the presence of common agency, where a downstream bottler may also distribute its upstream rival's products. In specifically, we model the upstream concentrate manufacturer and downstream bottler's behavior in the CSD industry to determine how vertical integration impacts prices in the presence of common agency.

We use monthly retail scanner data on the U.S. CSD industry from 2008 through 2012 to evaluate the competitive effects. We apply the random coefficient discrete choice model to estimate demand side. Flowing Villas-Boas (2007), we use demand estimates to compute price-cost margin for upstream manufacturer and downstream bottler without observing data on wholesale prices. Moreover, we consider a sequential price-setting game between manufacturers and bottlers and further assume Nash-Bertrand competition among both manufacturer and bottlers. More specifically, we consider linear pricing supply model and assume retailers are passive, such that retailers simply set prices at a level that is just high enough to cover their input costs and per unit prices paid to bottlers. Using counterfactual ownership structure of manufacturers and bottlers (vertical dis-integration), we simulate the Nash equilibrium prices. As a result, we compare the simulated equilibrium price with factual equilibrium the Nash equilibrium prices to access the price effect due to the vertical integration by assuming no cost efficiency gains is resulting from the vertical integration.

The econometric results suggest that the vertical integration of PepsiCo and Coca-Cola with their major bottlers decreases the prices of DPSG for 12 oz 6 pack and increases the prices of DPSG products for 20 oz bottles. However, the vertical integration of the CSD industry caused price decreases for both Coca-Cola and PepsiCo products bottled by vertically integrated bottlers for both sizes. In other words, counterfactual simulations suggest that the vertical integration with bottler’s results in procompetitive effects for 12 oz 6 pack and anticompetitive effects for 20 oz bottles. These mixed findings do not support the FTC’s opposition to the vertical integration between PepsiCo and Coca-Cola with their major bottlers in 2010. However, the results are consistent with theoretical results in vertical integration with common agency pricing literature.

This study can be extended to evaluate various strategic models of vertical structure in the CSD industry. One extension of this paper is to consider models of vertical relationship under the different supply scenarios with linear pricing. For example, assess the welfare effect of vertical integrated collusive upstream manufacturers or downstream bottlers. Moreover, another application of this paper can be model the effect of vertical integration under the presence of non-linear pricing following the modeling procedure proposed by Rey and Vege (2004), and Bonnet and Dubois (2010).

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Appendix:

Summary statistics: Retail prices ($ per oz) for all brands of 12 oz 6 pack

	N	Mean	S.D.	Max	Min
Retail Price ($ per oz)	151,366	0.0455	0.0097	0.0001	0.2044
Coca-Cola					
TAB	16,641	0.0487	0.0072	0.1128	0.0099
DIET COKE	11,720	0.0406	0.0116	0.1668	0.0124
COKE ZERO	2,165	0.0399	0.0162	0.1559	0.0173
SPRITE ZERO	1,526	0.0463	0.0127	0.1282	0.0137
CAFFEINE FREE DIET COKE	441	0.0469	0.0119	0.1107	0.0182
DIET BARQS	248	0.0469	0.0259	0.1922	0.0137
DIET COKE WITH LIME	216	0.0432	0.0075	0.0690	0.0186
SEAGRAMS	44	0.0436	0.0127	0.0687	0.0142
DIET CHERRY COKE	37	0.0381	0.0049	0.0497	0.0267
DIET COKE WITH SPLENDA	32	0.0407	0.0092	0.0684	0.0158
VAULT ZERO	10	0.0379	0.0057	0.0483	0.0276
DIET MELLO YELLO	3	0.0400	0.0014	0.0414	0.0385
DIET SPRITE	2	0.0380	0.0147	0.0484	0.0275
NORTHERN NECK	2	0.0360	0.0079	0.0416	0.0304
PepsiCo					
DIET MOUNTAIN DEW	3,430	0.0394	0.0086	0.1168	0.0123
DIET PEPSI	7,135	0.0412	0.0078	0.1101	0.0123
CAFFEINE FREE DIET PEPSI	1,520	0.0436	0.0079	0.0973	0.0137
SIERRA MIST FREE	371	0.0424	0.0137	0.1089	0.0136
DIET SIERRA MIST	223	0.0441	0.0042	0.0531	0.0356
DIET WILD CHERRY PEPSI	197	0.0405	0.0100	0.0991	0.0139
PEPSI ONE	136	0.0425	0.0057	0.0552	0.0276
DIET PEPSI WITH LIME	31	0.0387	0.0113	0.0485	0.0167
MOUNTAIN DEW CAFFEINE FR	12	0.0405	0.0059	0.0483	0.0300
DIET PEPSI VANILLA	7	0.0273	0.0073	0.0377	0.0173
DPSG					
IBC	65,128	0.0474	0.0073	0.2044	0.0164
CANADA DRY	14,398	0.0439	0.0112	0.1312	0.0001
CANFIELD	12,133	0.0457	0.0115	0.1651	0.0125
A & W	7,258	0.0418	0.0096	0.1657	0.0006
DIET DR PEPPER	3,809	0.0426	0.0123	0.1297	0.0138
DIET RITE	1,072	0.0451	0.0150	0.1387	0.0137
DIET 7 UP	1,044	0.0503	0.0148	0.1452	0.0208
DIET SCHWEPPES	131	0.0425	0.0090	0.0765	0.0174
CRUSH	129	0.0407	0.0084	0.1079	0.0270
CAFFEINE FREE DIET DR PEPPER	52	0.0344	0.0116	0.0626	0.0174
DIET CHERRY 7 UP	29	0.0303	0.0090	0.0414	0.0156
DIET CHERRY VANILLA DR PEPPER	25	0.0256	0.0101	0.0405	0.0174
DIET VERNORS	8	0.0382	0.0067	0.0481	0.0276

Summary statistics: Retail prices ($ per oz) for all brands of 20 oz bottles

	N	Mean	S.D.	Max	Min
Retail Price ($ per oz)	813,588	0.0755	0.0099	0.0075	0.2801
Coca-Cola					
CAFFEINE FREE DIET COKE	113,503	0.0767	0.0072	0.1127	0.0117
COKE ZERO	111,316	0.0767	0.0075	0.1315	0.0125
DIET BLACK CHERRY VANILLA COK	44,083	0.0766	0.0080	0.1212	0.0104
DIET CHERRY COKE	37,190	0.0771	0.0080	0.1118	0.0163
DIET COKE	16,500	0.0776	0.0089	0.1097	0.0125
DIET COKE WITH LEMON	3,711	0.0813	0.0110	0.1222	0.0357
DIET COKE WITH LIME	1,001	0.0653	0.0129	0.0841	0.0242
DIET COKE WITH SPLENDA	126	0.0682	0.0047	0.0843	0.0554
DIET SPRITE	59	0.0716	0.0030	0.0758	0.0645
DIET VANILLA COKE	7	0.0665	0.0066	0.0693	0.0516
FRESCA	6	0.0751	0.0044	0.0832	0.0696
MR PIBB ZERO	4	0.0716	0.0051	0.0793	0.0688
SPRITE ZERO	4	0.0730	0.0025	0.0743	0.0693
VAULT ZERO	1	0.0794		0.0794	0.0794
PepsiCo					
CAFFEINE FREE DIET PEPSI	111,932	0.0760	0.0076	0.1097	0.0079
DIET MOUNTAIN DEW	91,583	0.0758	0.0078	0.1150	0.0140
DIET MOUNTAIN DEW CAFFEINE FR	26,353	0.0761	0.0076	0.1097	0.0106
DIET MOUNTAIN DEW CODE RED	26,158	0.0759	0.0090	0.1097	0.0081
DIET PEPSI	14,630	0.0730	0.0091	0.1097	0.0120
DIET PEPSI JAZZ	1,635	0.0675	0.0114	0.0896	0.0248
DIET PEPSI VANILLA	1,214	0.0659	0.0127	0.0896	0.0075
DIET PEPSI WITH LIME	375	0.0719	0.0077	0.0892	0.0494
DIET WILD CHERRY PEPSI	311	0.0687	0.0081	0.0809	0.0455
PEPSI ONE	183	0.0719	0.0057	0.0843	0.0495
SIERRA MIST FREE	96	0.0712	0.0054	0.0843	0.0595
DPSG					
A & W	88,893	0.0760	0.0080	0.1497	0.0091
CAFFEINE FREE DIET DR PEPPER	61,626	0.0712	0.0137	0.1574	0.0165
CAFFEINE FREE DIET SUN DROP	46,815	0.0712	0.0143	0.2338	0.0114
DIET 7 UP	8,813	0.0765	0.0362	0.2801	0.0169
DIET CHERRY VANILLA DR PEPPER	2,930	0.0688	0.0087	0.1565	0.0167
DIET DR PEPPER	2,204	0.0726	0.0104	0.0947	0.0262
DIET R C	115	0.0530	0.0090	0.0892	0.0490
DIET RITE	81	0.0768	0.0570	0.2796	0.0441
DIET SCHWEPPES	78	0.0653	0.0075	0.0751	0.0448
7 UP PLUS	49	0.0665	0.0055	0.0793	0.0536
DIET SQUIRT	2	0.0794	0.0001	0.0795	0.0794
DIET SUN DROP	1	0.0545		0.0545	0.0545