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by

Takanori Adachi

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Vertical Integration and Common Agency: An Empirical Analysis of the U.S. Carbonated Soft Drink Industry*

Takanori Adachi†

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Abstract

This paper empirically examines the price and share effects of vertical integration with emphasis on the role of *common agency* in vertical relationships: a downstream distributor may also distribute its upstream rival's products. By using the unique feature of the U.S. carbonated soft drink industry, I find that PepsiCo's 2010 vertical merger lowered its retail prices by 4.4%. More importantly, these price effects are *stronger* in the markets with Coca-Cola's common agency than in the markets with PepsiCo's common agency: I find a price reduction of 2.5% for the markets where neither Coca-Cola's nor PepsiCo's bottler is a common agent for Dr Pepper. PepsiCo's prices are additionally lowered by 2.3–2.5% if Coca-Cola's bottler is a common agent for Dr Pepper, or by 1.1–1.3% if PepsiCo's bottler is a common agent. It is also shown that the price effects of PepsiCo's vertical merger on Dr Pepper's products are weaker in the markets with PepsiCo's common agency, whereas the price effects on Coca-Cola's products are stronger in these markets, suggesting that the welfare effects of PepsiCo's vertical integration differ across the mode of common agency in an important way.

Keywords: Vertical Integration; Common Agency; Difference-in-Differences Estimation.

JEL Classification: L13; L49; L66.

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†School of Economics, Nagoya University, 1 Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan. E-mail: adachi.t@soec.nagoya-u.ac.jp

1 Introduction

Firms merge because they expect their joint surplus to become higher. This efficiency-based view is simple yet powerful, and it has been the dominating doctrine at least since Coase (1937) when one studies various aspects of organizations such as the boundary of a firm. More specifically, since Spengler (1950), it has been widely held that vertical mergers are generally efficiency improving not only for firms but for consumers as well. Notably, it has been stressed that vertical mergers eliminate so-called *double marginalization*, which arises due to externalities in pricing decisions by upstream and downstream firms (Bork, 1978). In addition, vertical mergers may entail cost savings via synergies and bring better discipline vis-a-vis firm-level corporate governance. As a result, the final price decreases, sales rise, and consumers benefit as a consequence of efficiency gains. In contrast to horizontal mergers, these benefits are not offset by upward pricing pressures as a vertical merger is not associated with a change in competition at the horizontal level. In this respect, it is well recognized that vertical mergers are fundamentally different from horizontal mergers in evaluating their effects on consumers.

However, one may still wonder whether these positive effects are monotonously passed through across the integrated firm and other rival firms. Does the mode of competition matter? Are there any losers from a vertical merger? This paper empirically studies how the effects of a vertical merger are influenced by the mode of competition, a topic which has been somewhat overlooked, but should be important in predicting and evaluating the effects of a vertical merger as a whole. More specifically, in determining the effects of vertical integration of the supply-chain, I examine the role of *common agency*, where a downstream supply-chain distributor may also distribute its *upstream rival's* products in some areas, For this purpose, I focus on the unique feature of the U.S. carbonated soft drink industry: in about 80% of the markets (population-weighted) in my sample, either Coca-Cola or PepsiCo bottler is a common agent because they also distribute Dr Pepper Snapple's products. As I show below, this institutional feature appears to play a different role with respect to the effects of PepsiCo's vertical integration in 2010, depending on whether a PepsiCo or a Coca-Cola bottler is a common agent.

In this paper, I make use of the fact that PepsiCo acquired its two biggest bottlers (Pepsi Bottling Group and PepsiAmericas) in 2010, but other bottlers remained independent. Thus, in the post-merger period, there are effectively two separate groups: treatment markets, where the integrated subsidiary of PepsiCo distributed its products, and control markets. This is because the 2010 PepsiCo merger was not nationwide. This feature is advantageous as compared to many other studies that use the difference-in-differences (DID) methodology where, for example, a control group consists of private-brand products which, supposedly unrelated to a merger of a major brand, may possibly be affected by such a merger through competition. At the same time, in PepsiCo's vertical merger, no specific local markets were targeted to reorganize its chain bottlers and then integrate such geographically divided bottling parts into a newly established subsidiary. If this were the case, PepsiCo's choice could have been influenced by geographic factors in a way unobservable to the researcher. Fortunately, this did not happen.

Overcoming these endogeneity concerns, I conduct an DID analysis to examine the price and share effects of PepsiCo's 2010 vertical merger. If competitive pressure is higher for the integrated entity, then the price effects may be larger because the vertical merger triggers rivals' further aggressiveness, and thus additionally lowers the integrated firm's prices. At the same time, however, the price effects may be smaller because the downward pressure is already lower before the vertical merger. As I argue in Subsection 4.3 below, competitiveness and common agency are found to be closely associated from the observation that PepsiCo's prices are lower when a Coca-Cola bottler is a common agent (Table 10): Coca-Cola's common agency induces higher competitive pressure on PepsiCo. Since theoretical predictions on the relationship between the price effects of a vertical merger and the intensity of competition would be ambiguous,[1] this issue should be examined as an empirical question.

Empirical analysis based on DID estimation reveals that the answer to the question above is "larger." That is, the downward price effects are *stronger* in the markets with Coca-Cola's common agency than in the markets with PepsiCo's common agency. More specifically, while PepciCo's vertical integration on average lowered its retail prices by 4.4%, *these effects are different across the mode of common agency*: although the price reduction is 2.5% for the markets where neither Coca-Cola's nor PepsiCo's bottler is a common agent for Dr Pepper, PepsiCo's prices are additionally lowered by 2.3–2.5% if Coca-Cola's bottler is a common agent for Dr Pepper, and by 1.1–1.3% if PepsiCo's bottler is a common agent. The price reduction in

[1] In the context of entry deterrence, it is well known that a firm's investment can make itself either severe or lenient to a new entry under price competition (Fudenberg and Tirole, 1984; and Bulow, Geanakoplos, and Klemperer, 1985). Here, PepsiCo's vertical merger could be interpreted as such a precommitment by an incumbent.

Coca-Cola's and Dr Pepper's products is weaker in the markets with PepsiCo's or Coca-Cola's common agency. Thus, the welfare effects of PepsiCo's vertical integration would differ across the mode of common agency. To fully investigate this issue, a structural approach is required; this is left for future research.

Common agency is particularly common in vertical relationships: a retail chain usually sells products of competing brands (e.g., McGuire and Staelin, 1983; Choi, 1991; Choi, 1996; and Sudhir, 2001). Herein, a Coca-Cola or PepsiCo bottler may transact not only with its own concentrate seller but also with Dr Pepper Snapple. Another example from the context of vertical relationships is where a regional car dealer sells automobiles of rival companies.[2] Such occurrences are becoming more common because in many countries increasing consolidation of supermarket chains has concomitantly increased common agency (see, e.g., Allain, Chambolle, Turolla, and Villas-Boas, 2017).[3] However, in vertical relationships in many industries such as the grocery industry, upstream and downstream firms have various ties. Systems of operation and distribution are complex in many industries, and thus not readily observable to outsiders.

In this respect, as Muris, Scheffman, and Spiller (1992) point out, the U.S. carbonated soft drink (CSD) industry has a relatively simple structure, in terms of both operation and distribution, which provides an ideal opportunity to study the effects of vertical integration across the modes of competition. First, the manufacturing process consists principally of two discrete parts: syrup production by upstream concentrate sellers and bottling and packaging by downstream regional bottlers. Second, owing to the 1980 Soft Drink Interbrand Competition Act (SDICA), there are no other competing bottlers of the same concentrate seller's products in a regional territory. Since I focus on the big three concentrate sellers (Coca-Cola, PepsiCo, and Dr Pepper Snapple), this means that there are no more than three distributors in the geographical market.

This paper is mainly related to extant empirical studies of vertical relationships: how institutional settings prior to final sales affect retail competition and their anti-trust consequences.

[2] However, in terms of car dealers, it may be the case that there are no common agents: each car manufacturer transacts exclusively with one dealer in a market, so-called exclusive dealing. See, e.g., Bernheim and Whinston (1997) and Nurski and Verboven (2016).

[3] Other examples in economic and political contexts where a common agent has substantial responsibility on behalf of competing principals include financial contracting where multiple lenders transact with a single borrower (e.g., Parlour and Rajan, 2001; Tirole, 2003; and Khalil, Martimort, and Parigi, 2007) and political lobbying where multiple groups decide how much they contribute to the government (e.g., Grossman and Helpman, 1994; Dixit, Grossman, and Helpman, 1997; and Baron and Hirsch, 2012).

To the best of my knowledge, Corts (2001) is the only empirical study of *common agency in a vertical structure context*. Using U.S. motion picture industry release-date data, Corts (2001) finds that common agency, in which films created by different producers are released by the same distributor, does not achieve the same level of coordination to avoid cannibalization of two films (measured as the differences in the two films' release dates) as in the case where two films are produced by the same producer. However, Corts (2001) does not study the effects of *vertical integration* in the presence of common agency, which is this paper's focus.

Hastings (2004) also employs a similar empirical strategy to that adopted herein in order to study the effects of independent market share on retail gasoline prices by invoking the event whereby a number of independent gasoline stations in Southern California were purchased by a branded chain in 1997. The treatment and control groups consist of areas that did and did not experience this change, respectively. Hastings (2004) revealed that the loss of an independent station raised local retail prices by 5 cents per gallon. Then, as also in this paper, Hastings (2004) looks into structural causes behind this result. More specifically, gasoline stations in the treatment group are classified by brand quality, and the negative effects of losing an independent station are largest for low-quality gasoline stations. This result lends support for the hypothesis consumers' preferences are heterogeneous so that some consumers prefer non-branded gasoline, rather than the hypothesis that consumers have similar preferences for quality. If the latter were the case, entry of a branded chain would lead to fiercer competition with existing stations, resulting in lower retail prices. Although Hastings (2004) focuses on the *demand structure* (i.e., preference heterogeneity), this paper categorizes treatment effects by the mode of common agency to examine the consequences of *supply-side* differences in determining the price and the market share effects of vertical integration.

The two industries often studied by existing studies are the U.S. healthcare industry, where hospitals transact with health insurance companies (Gowrisankaran, Nevo, and Town, 2015; and Ho and Lee, 2017) or medical device companies (Grennan, 2013), and the U.S. cable television industry, where cable distributors transact with content channels (Crawford and Yurukoglu, 2012; and Crawford, Lee, Whinston, and Yurukoglu, 2015).[4] In contrast to these industries, the U.S. CSD industry exhibits a relatively simple vertical structure mainly due to, as stated

[4]Other studies of the U.S. cable television industry include Waterman and Weiss (1996), Chipty (2001), and Suzuki (2009).

above, the 1980 SDICA. This research aims to be a starting point for studying a more complex structure of vertical relationships observed in many other industries.[5]

One might argue that my focus on the CSD category alone could be too restrictive, assuming away any important substitutions between carbonated soft drinks and other categories of beverages such as mineral water that have gained more popularity in recent years. Obviously, it is important to study how beverage companies are shifting emphasis to non-CSDs, in response to consumers' increasing health awareness. As *The Wall Street Journal*, March 27, 2015, "Soft Drinks Hit 10th Year of Decline" reports, "U.S. bottled-water consumption totaled 10.87 billion gallons in 2014, up 7.3% from 2013, its fastest growth rate since 2006, according to Beverage Marketing. Soda consumption in the U.S., meanwhile, slid 1% to 12.76 billion gallons, the 10th straight yearly decline." This restriction is mainly because the original data set used herein (i.e., the IRI Academic Data Set; see Section 3) does not include beverages other than carbonated soft drinks. In addition, the information on Coca-Cola's and PepsiCo's plants producing beverages other than CSDs were not available. More agents are involved in the production of other beverages, and it is less structured than the system that we study here. Of course, it would be possible that a vertical merger of a soft drink chain might improve consumer welfare in much newer categories such as mineral water, while lowering consumer welfare in more traditional categories such as soda. This issue is left for future research.

More importantly, from a competition policy perspective, it would be more appropriate to define the category in a seemingly narrower way. As White (1994) describes, in the aforementioned challenge by the Coca-Coca Company to acquire the Dr Pepper Company in 1986, the CSD category was deemed as the relevant market by the Federal Trade Commission (FTC) and trial judge. In particular, there were arguably no substitutable products for concentrate, and thus the usual "Small but Significant and Non-transitory Increase in Price" (SSNIP) test applies: if concentrate sellers jointly raise their prices by 5%, they still do not suffer from a significant decline in their sales. Therefore, the CSD category alone is an appropriate market to study the price effects of a vertical merger and its welfare consequences.

The rest of the paper is organized as follows. The next section provides further details

[5] Other structural studies of vertical relationships focus on cases in the U.S. yogurt industry (Villas-Boas, 2007); the U.S. video rental industry (Mortimer, 2008); the U.S. vending industry (Conlon and Mortimer, 2013); the U.S. beer industry (Chen, 2014; and Asker, 2016); and the Japanese fMRI industry (Onishi, Wakamori, Bessho, and Hashimoto, 2017).

concerning the U.S. carbonated soft drink industry. In particular, I describe the characteristic features of the industry's distribution system, as well as PepsiCo's 2010 vertical merger. After the data set for this study is described including some related statistics in Section 3, empirical results based on reduced-form equations are presented and interpreted in Section 4. Finally, Section 5 concludes.

2 Industry Background

In this section, I describe the main characteristics of the U.S. CSD industry's distribution system. This draws heavily from case studies at the University of Michigan's Ross School of Business (Kilibarda, 2010) and Harvard Business School (Yoffie and Kim, 2011), complemented by newspaper articles, FTC's documents, and other relevant information.

2.1 The Industry's Distribution System

The U.S. carbonated soft drink industry is probably one of the most important industries in the 20th century. It is characterized by a unique franchise business model. In its traditional form, national beverage companies sell and ship concentrate, syrup, and so on, to independent bottlers that are spread across the states. Then, bottlers produce beverages in their plants by adding water and sweeteners, and distribute filled bottles and cans directly to retail stores in their geographical territories.[6] They also deliver concentrate and sweetener without water to local restaurants. Although national concentrate sellers focus on branding and promotional efforts across the nation, regional bottlers concentrate on locally targeted marketing activities. Historically, since the early stage around the late 19th century, CSD companies had granted exclusive bottling and distribution rights to independently-owned local bottlers in specific geographical territories.[7] However, as explained below, under the current system, some areas are under the control of independent bottlers, and other areas are subject to subsidiary bottlers

[6]This channel is also called the *direct store delivery* (DSD) system. The bottler's sales staff regularly visit stores to maintain stocks. Although other types of distribution channels are also used, especially for other categories, carbonated soft drinks are usually distributed by the DSD system for Coca-Cola, Pepsi, and Dr Pepper.

[7]According to Butler and Tischler (2015), the origin of the franchise business model is ascribed to Benjamin Franklin Thomas and Joseph Brown Whitehead, two lawyers from Chattanooga, TN, who, in 1899, purchased the right to bottle and distribute Coca-Cola (the price was one dollar). They then started to sell Coca-Cola's secret concentrates to regional bottlers.

merged by upstream concentrate sellers.

The industry's exclusive territory system became institutionally supported when President Carter signed the Soft Drink Interbrand Competition Act (SDICA) in July 1980. This is largely considered a result of the soft drink companies' success in persuading Congress, in response to the Federal Trade Commission's challenge in 1978 against Coca-Cola and Pepsi with the claim that their exclusive territory systems violated Section 5 of the FTC Act. According to White (1994, p.79), Yoffie and Kim (2011), and Salinger and Elbittar (2013), the action was initiated by the FTC in 1971 with the claim that the industry-wide territory system prevented *intra*brand competition, and the investigation had continued for nearly 10 years. The industry refuted that *inter*brand competition was not sufficiently weak to invalidate the territory system. To date, the industry's territory system has been maintained and no more than one bottler is in charge of one concentrate seller's product in a territory.

Importantly, SDICA guarantees that an exclusive territory between a concentrate seller and a bottler is exempted from anti-trust laws such as the Clayton Act, provided that bottlers are under "substantial and effective"[8] competition. It is usually deemed that "substantial and effective" competition is guaranteed if there is more than one brand in a geographical territory. Thus, as Salinger and Elbittar (2013) sarcastically point out, this is usually satisfied because at least Coca-Cola and Pepsi are sold in almost all the geographical territories. Thus, the bottler in a certain territory is effectively a monopolistic wholesaler of the brand. In other words, the intrabrand competition is absent for local retailers such as supermarkets, convenience stores, and restaurants. This institutional feature would simplify a structural approach because interlocking relationships between manufacturers and bottlers do not have to be taken into account.[9]

The industry is currently dominated by three giants, namely, The Coca-Cola Company (Atlanta, GA), PepsiCo Inc (Purchase, NY), and Dr Pepper Snapple (Plano, TX).[10] Until the mid-1980s, Coca-Cola and PepsiCo had been vigorously acquiring small independent local

[8] See http://uscode.house.gov/view.xhtml?path=/prelim@title15/chapter61&edition=prelim.

[9] See Nocke and Rey (2014) for a theoretical analysis of interlocking vertical relationships.

[10] It is reported that as of 2010, there were 151 companies in the U.S. soft drink industry that sold syrup concentrates (Kopylovsky D. Syrup & Flavoring Production in the US. IBISWorld Industry Report, 31193: 2010; available at: www.ibisworld.com/industry/default.aspx?indid=275). According to Beverage Digest's *Fact Book* 2012 (Table 17, p.36), Coca-Cola, PepsiCo, and Dr Pepper Snapple's all-channel shares in 2011 were 41.9, 28.5, and 16.7, respectively; far above the fourth largest, Cott Corporation (5.2%).

bottlers.[11] Then, in the late 1980s, Coca-Cola started to spin off its bottling parts, retaining a non-negligible portion of ownership, to focus on product development and marketing, leaving logistic decisions to the independent bottlers. In 1986, Coca-Cola Enterprises (CCE) was established as a publicly-owned bottling company; 51% of the shares were sold to the public. CCE then continued acquiring large and small independent bottlers, including Johnston Coca-Cola Bottling Company in 1991, and then the second largest independent bottler. On the other hand, PepsiCo, which was established in 1965 as a result of the merger of Pepsi-Cola Company and Frito-Lay, Inc, started to spin off its bottling part in 1999, creating Pepsi Bottling Group (PBG), which was then a subsidiary of PepsiCo. In 2000, PepsiAmericas also became a prominent bottler when Whitman Corp purchased the smaller PepsiAmericas.

However, Dr Pepper Snapple, which was established in May, 2008 as a spin-off from Cadbury PLC, pursued its own strategy regarding distribution. Although it owned "independent and in-house distribution" (*The Wall Street Journal*, June 7, 2010) in some areas,[12] its distribution relied on Coke's or Pepsi's bottling system in many areas, as I explain below in Section 3. According to Beverage Digest's *Fact Book* 2012, per capita consumption of CSDs during the sample period (2008 to 2012; see Section 3) continued to decline by about 10% annually, reflecting consumers' concerns for health. However, the CSD category was still dominant: in 2011, it accounted for 75%, 64%, and 91% of Coca-Cola's, PepsiCo's, and Dr Pepper Snapple's sales volume in the United States.

2.2 PepsiCo's 2010 Vertical Merger

On April 20, 2009, it was reported by *The Wall Street Journal* that PepsiCo had revealed a plan for a takeover bid to acquire Pepsi Bottling Group (Somers, NY) and PepsiAmericas (Minneapolis, MN) in order to transfer its bottling and distribution operations to itself. These represented PepsiCo's two largest independent bottlers: Pepsi Bottling Group (PBG) distributed 56% of PepsiCo's sales volume in the United States in the carbonated soft drink category,

[11] According to Elmore (2014, p.231), "[t]he number of Coca-Cola bottlers operating in the United States had dropped dramatically from roughly 1,200 in 1929 to an estimated 500 in 1979, and the total number of bottlers in the soft drink industry declined from over 4,000 in 1960 to under 3,000 by 1972." White (1994, p.90) also provides a similar account. See Muris, Scheffman, and Spiller (1992) for an explanation based on transaction cost theory.

[12] The name of this distribution system is Dr Pepper Snapple Group Company-Owned Bottling Operations (DPSG COBO).

and its operations ranged across (all or a part of) 41 states and Washington, D.C., whereas PepsiAmericas (PAS) accounted for 19%, spanning (all or a part of) 19 states and Washington, D.C. According to an FTC press-release document issued on February 26, 2010, PepsiCo, when the agreement was made public, "already owned about 40 percent of Pepsi Bottling Group and about 43 percent of PepsiAmericas, which together account for" "20 percent of all U.S. bottler-distributed sales of Dr Pepper Snapple carbonated soft drinks." On August 4, 2009, PepsiCo finally reached a deal to acquire PBG and PAS. Four months later (on December 7, 2009), PepsiCo also revealed its plan to take over the production and distribution of Dr Pepper Snapple's products that were operated by PBG and PAS.

PepsiCo completed the acquisition process on February 26, 2010. On the same day, as a condition for approving PepsiCo's acquisition of PBG and PAS, the FTC required PepsiCo to "set up a "firewall" in response to its concern that Dr Pepper Snapple's ability to compete with PepsiCo could be weakened because PepsiCo's headquarters was now "closer" to Dr Pepper's headquarters. Subsequently, on September 27, 2010, Eric A. Croson was appointed by the Federal Trade Commission as the monitor for the order that required limited access by PepsiCo to confidential business information of Dr Pepper Snapple. Finally, after the period for public comments, on September 28, 2010, the Federal Trade Commission approved PepsiCo's acquisition of PBG and PAS.[13] It seems that the FTC's concerns were not only on the pricing but also on marketing activities such as promotions for newly introduced products. As already stated in the Introduction, this paper focuses on the pricing aspect.

As Beverage Digest's *Fact Book* 2012 describes, PepsiCo's acquisition of its two biggest bottlers (PBG and PepsiAmericas) in 2010 was one of the biggest vertical mergers in the industry's history. This vertical merger would be ascribed to PepsiCo's recognition of the need of quickly adjust to changes in consumers' tastes, as expressed in Chairwoman Indra Nooyi's statement released on August 4, 2009 ("PepsiCo Reaches Merger Agreements with Pepsi Bottling Group and PepsiAmericas"). However, the bottlers may have been reluctant to work cooperatively with their upstream counterparts to distribute such a wider line of new products, because, as Zhou and Wan (2017) argue, their assets were customized to bottle traditional soda, and scale economy effects would be best achieved if they concentrated on

[13] Between February 26 and September 28, 2010, PepsiCo purchased the Pepsi-Cola Bottling Company of Yuba City on April 19, which was a relatively small bottler operating in Yuba City, CA, and surrounding areas.

production of a small number of beverages. Under this situation, it is not surprising that PepsiCo came to recognize the need for vertical integration to increase control over the bottling and distributing part. Hypothetically, after the integration is fully achieved, the downstream part will become a subsidiary of the newly established organization, and as economic theory such as Spengler (1950) supposes, the control rights should be centralized. In this way, a vertical merger is expected to reduce the costs of management and operations.

Lastly, it should be noted that on February 25, 2010, just a day before the consummation of PepsiCo's vertical merger, Coca-Cola also announced a plan to acquire its largest bottler, Coca-Cola Enterprises (Atlanta, GA), which accounted for 80% of Coca-Cola's sales volumes in the United States. The acquisition process was completed on October 1, 2010, and it was approved by the Federal Trade Commission on November 5, 2010. PepsiCo's and Coca-Coca's vertical mergers were similar in the sense that Coca-Cola Enterprises also distributed Dr Pepper's products in a large portion of the territories across the nation, and therefore the FTC also expressed a similar concern. However, this paper does not study Coca-Cola's vertical merger mainly because another analysis by Adachi (2017) suggests that it raised Coca-Cola's own retail prices as well as Pepsi's. This could indicate that Coca-Cola's 2010 vertical merger might have been a failure, or something else. This issue could be fruitfully investigated in a separate study.[14]

3 Data

3.1 Sample Construction

The sample for this study is constructed from the IRI Academic Data Set (see Bronnenberg, Kruger, and Mela (2008) for an introduction to this data set), supplemented by various sources covering demographic and cost information. The IRI Academic Data Set is a store-level scanned data set that covers a wide range of geographic areas across the United States. Information accrues on a weekly basis, and is collected from participating retailers, who are major supermarket and drugstore chains, although Walmart is not included. Independent stores of small-scale operation are also not covered. The period covered by the IRI Data Set spans from 2001 through

[14]Indeed, it was reported by *The Wall Street Journal* on December 12, 2013, that Coca-Cola initiated actions to detach some bottling parts and grant them distribution franchise status, which may imply that Coca-Cola's vertical integration was not as successful as anticipated. See Adachi (2017) for more on this issue.

2012. I select the first week of January 2008 through the last week of December 2012 for the sample period, so that the event of PepsiCo's vertical merger lies in the middle. Unfortunately, 2012 is the last year covered by the IRI Academic Data Set; hence, this precluded a longer sample. Throughout the paper, monetary values are expressed in 2008 U.S. dollars.

From the carbonated beverages category in the IRI Academic Data Set, I select six products from the three biggest concentrate sellers: Coke Classic and Diet Coke from Coca-Cola, Pepsi and Diet Pepsi from PepsiCo, and Dr Pepper and Diet Dr Pepper from Dr Pepper Snapple.[15] The store-level information in this data set records the sales revenue and the units sold for each scan. Thus, the average price is computed from the revenue divided by the units sold. Products are categorized Universal Product Codes (UPC). For example, different packages with the same content are considered as different products.[16] To construct my sample, I aggregate the same product across different package sizes, and choose 12 ounces (355 ml) as a base unit.

A "market" is defined by a combination of a geographical area and a time period. In this study, I use county for the former, and month for the latter. County is chosen as the geographical area in order to exploit cost heterogeneity across bottlers therein. As explained further below, I use the distance between a county and the county where a bottler's nearest plant is located to measure that bottler's cost. Accordingly, a set of relevant county-level demographic characteristics is utilized in the following empirical analysis. An individual's household income is presumably relevant for his or her demand for CSDs. In addition, an individual's age may also matter. When market demands are estimated if a structural approach is combined with the current analysis, annual information from the Public Use Microdata Sample (PUMS) of the American Community Survey (2008 through 2012) is used to randomly select 50 individuals from each county (and for each year).[17] Thus, an individual's income and age are taken into account to allow heterogeneous responses to price and other product characteristics (more precisely, whether the product is diet drink). I also use annual projections

[15] Other representative products include Sprite and Fanta (Coca-Cola), Mountain Dew and Sierra Mist (Pepsi), and Canada Dry and 7 Up (Dr Pepper Snapple). These products would be considered as different from the traditional soda category which is the focus of this study.

[16] According to Yoffie and Kim (2011), about 98% of all packages of CSDs are made of metal cans (56%) and plastic bottles (42%), while the remaining 2% are glass bottles. It would be possible to compute the ratio of cans to bottles for each observation (a combination of a market (county $\times$ month) and a product), so that one could use this ratio as a weighted index for packaging costs. However, this additional information would not significantly alter the empirical results presented below.

[17] I exclude individuals who are 11 years old or younger, and those who are 90 years old or older. I also exclude individuals with zero household income.

from the Census (https://www.census.gov/popest/index.html) for the total population of the county in the reduced-form analysis below.

A monthly time-step is used for practical reasons. I plan to consider a bargaining game over the wholesale price of concentrate. Arguably, concentrate sellers not only sell concentrate but also provide bottlers with various resources targeted for local marketing. The "wholesale price" in a structural model would include all these pecuniary expenses, which are inherently unobservable to researchers. Thus, using a shorter, weekly time-step could incur responsiveness issues. Indeed, a monthly time-step could be associated with such issues, albeit to a lesser degree; this choice is partly a compromise to ensure a sufficient sample size.[18] In total, there are 50,661 observations at the product-county-month-year level.

In the reduced-form analysis below, I use aggregated demographic variables at the county-level. Annual data on median income and median age are taken from the American Community Survey (ACS). I also use ACS to calculate the proportion of those with a bachelor degree or higher as a measure for educational attainment in a county. Income, age, and education, and variables are expressed in annual terms: they cannot capture monthly variations. Thus, I also use two monthly variables related to market demands, motivated by Muris, Scheffman, and Spiller's (1992) analysis of the determination of soda prices. One is the county-level unemployment rate, which is available from the Local Area Unemployment Statistics (LAUS) provided by the U.S. Bureau of Labor Statistics (BLS). The second variable is the average temperature determined using online climate data from the Global Summary of Month maintained by the U.S. National Oceanic and Atmospheric Administration (NOAA). I take the arithmetic mean of recorded average temperatures of all observation points in a county to represent the average temperature for the county.[19]

To measure a bottler's cost of distribution as well as production, I use data on the distance between a county and the county where a bottler's nearest plant is located, as well as quarterly data on weekly average wages for the manufacturing sector in each county of the plant (from

[18] Hosken, O'Brien, Scheffman, and Vita (2002) point out that weekly purchase data may lead to overestimation of elasticities because consumers tend to purchase large amounts in discount sales, and CSDs are often sold as "loss leaders." This effect could be substantial for storable products such as CSDs. Thus, consumption aggregation would serve to estimate "robust" elasticities that rule out such instantaneous shocks.

[19] In exceptional cases, a county has no observation points. In this case, I identify for a neighboring county (not necessarily an IRI county) to impute the mean temperature for the county.

the BLS's Quarterly Census of Employment and Wages).[20] As in Ashenfelter, Hosken, and Weinberg's (2015, p.335) study of beer, I assume that beverages are delivered to stores from the closest plant. Thus, I calculate the distance between each county (a market) in my sample and the county where the nearest bottler is located for each of the three brands, with the help of the National Bureau of Economic Research's County Distance Database.[21] If the plant is located in the same county, then the "radius" of the county is used as the distance between the county and plant.[22]

The principal source used for plant locations is the *Beverage Digest*'s *Bottling System Books* (2008 to 2012).[23] Since 2005, *Beverage Digest* has annually issued *The Coke System Book* and *The Pepsi System Book*. Both *System Books* list all operating plants for Coca-Cola's and PepsiCo's products. Notably, *The Coke System Book* and *The Pepsi System Book* contain graphical information on which territories Dr Pepper's products are distributed by a Coke or Pepsi bottler. In about 80% of the markets in my sample (see Table 5 below), Dr Pepper's products are produced and distributed by either a Coca-Cola bottler or a PepsiCo bottler. However, it is observed that in some counties, Dr Pepper's products are not distributed by a Dr Pepper bottler.

As Yoffie and Kim (2011) describe, the main components of bottlers' costs, other than concentrate, include sweeteners (high fructose corn syrup), packaging, which needs aluminum (for cans), plastic (for bottles), and water, and transportation, which consumes gasoline. In this respect, I also add monthly data on weekly retail diesel prices for each census division (available from the U.S. Energy Information Administration's (EIA) website). For indirect electricity measures, I use the EIA's annual report on Electric Sales, Revenue, and Average Price (more specifically, Table 8 therein), which provides the average retail price (cents/kWh) for industrial sectors at the utility level. I select the utility that is judged to be the dominant

[20]However, the inner process of how concentrate is handled in the integrated chain (e.g., whether it is embedded with transfer pricing) is less clear, and almost no information is available as to syrup manufacturing, including locations of each concentrate seller's plant. Although concentrate production requires caffeine and coca-leaf extract, the actual process is usually opaque probably because it is each company's trade secret.

[21]The URL is http://www.nber.org/data/county-distance-database.html. Over the 5 years in the sample, the number of closed or newly opened plants is small, but not zero. These events are taken into account when the distances are calculated.

[22]The county's radius is computed by dividing its land area (available from the 2010 Census Gazetteer Files) by 3.14 before taking its square root.

[23]See *Beverage Digest*'s website (http://www.beverage-digest.com/systembooks/) for more information on *Bottling System Books*.

Table 1: Summary Statistics (Retail Prices and Market Shares)

Variable	Mean	Median	Standard Deviation	Min	Max
Retail Price ($ per 12 oz)	0.3078	0.2995	0.0555	0.0801	0.9922
Market Share	0.1485	0.1313	0.1011	0.0008	0.7520
Within the 6 products	0.1667	0.1478	0.1130	0.0009	0.8272
Outside Good's Market Share	0.1088	0.0909	0.0377	0.0909	0.4439

Notes: The observation unit is "product $\times$ county $\times$ year $\times$ month." The number of observations is 54,876.

provider for the county where each plant is located. As for water rates, I use (the inverse of) county-level water use as a proxy variable. The United States Geological Survey's (USGS) website publishes Estimated Use of Water in the United States County-Level Data every 5 years. I use its 2010 version to calculate per-capita water use (total of fresh withdrawals; million gallons per day) for each plant county.

Finally, recall that the six selected products are categorized as either regular-flavor or the diet alternative. According to Bonnet and Réquillart (2013, p.79), the two main ingredients for regular drinks are "water (approximately 90%) and sweetener (approximately 10%)." Sweetener is not used in diet drinks, and as a result, "water (99.7%)" is the primary ingredient. Thus, while sweeteners in regular soda are added by bottlers, non-calorific sweeteners are contained in the process of syrup manufacturing by concentrate sellers. *Beverage Digest*'s *Fact Book* (Appendix E for each year) reveals that for regular drinks, HFCS55 (55% High Fructose Corn Syrup) is used by Coca-Cola and Pepsi, whereas HFCS42 (42% High Fructose Corn Syrup) is used for Dr Pepper. The U.S. Department of Agriculture, Economic Research Service's annual Sugar and Sweeteners Yearbook (Table 9 therein) lists monthly wholesale prices (cents per pound) for both HFCS55 and HFCS42. These sweetener prices are common across markets (i.e., all counties in the same month). I also collect monthly prices of aluminum and WTI (West Texas Intermediate) crude oil from the Federal Reserve Bank of St. Louis (FRED) website to capture time variations in the bottling production.

Table 2: Average Retail Prices and Market Shares (By Product and Year)

		2008-9	2010	2011-12
Coke	Price ($ per 12 oz)	0.3051	0.3324	0.3332
		(0.0438)	(0.0528)	(0.0543)
	Market share	0.2643	0.2330	0.2226
		(0.0762)	(0.0774)	(0.0737)
	Within the 6 products	0.2917	0.2575	0.2571
		(0.0847)	(0.0862)	(0.0859)
Diet Coke	Price ($ per 12 oz)	0.3102	0.3334	0.3348
		(0.0429)	(0.0503)	(0.0552)
	Market share	0.1776	0.1648	0.1560
		(0.0655)	(0.0691)	(0.0687)
	Within the 6 products	0.1959	0.1819	0.1796
		(0.0720)	(0.0760)	(0.0772)
Pepsi	Price ($ per 12 oz)	0.2802	0.2809	0.2843
		(0.0399)	(0.0420)	(0.0426)
	Market share	0.2281	0.2506	0.2402
		(0.0970)	(0.1102)	(0.1083)
	Within the 6 products	0.2516	0.2767	0.2759
		(0.1068)	(0.1213)	(0.1219)
Diet Pepsi	Price ($ per 12 oz)	0.2888	0.2917	0.2935
		(0.0382)	(0.0428)	(0.0443)
	Market share	0.1219	0.1300	0.1234
		(0.0512)	(0.0536)	(0.0541)
	Within the 6 products	0.1344	0.1435	0.1416
		(0.0562)	(0.0588)	(0.0606)
Dr Pepper	Price ($ per 12 oz)	0.3121	0.3127	0.3127
		(0.0568)	(0.0533)	(0.0542)
	Market share	0.0738	0.081	0.0820
		(0.0542)	(0.0570)	(0.0510)
	Within the 6 products	0.0814	0.0898	0.0950
		(0.0597)	(0.0628)	(0.0590)
Diet Dr Pepper	Price ($ per 12 oz)	0.3108	0.3146	0.3193
		(0.0701)	(0.0720)	(0.0744)
	Market share	0.0408	0.0459	0.0441
		(0.0217)	(0.0245)	(0.0222)
	Within the 6 products	0.0449	0.0506	0.0509
		(0.0239)	(0.0269)	(0.0253)

Notes: For each product, the number of observations is 3698 in 2008-2009, 1839 in 2010, and 3609 in 2011-2012. Each product's market share is relative to these six products (so that the sum is 100%). Standard deviations are shown in parentheses.

Table 3: Market Concentration

		Mean	Median	Standard Deviation	Min	Max
	2008-9	2009.2	1954.1	331.3	1413.8	4616.3
HHI	2010	1994.5	1902.4	402.4	1412.8	5736.2
	2011-12	1833.7	1776.2	432.5	790.6	4863.7

Notes: The observation unit is "county × year × month," and the number of observations is 3698 in 2008-2009, 1839 in 2010, and 3609 in 2011-2012. The HHI is scaled from 0 to 10,000.

3.2 Summary Statistics

Table 1 displays the summary statistics on the retail prices and market shares of the six products. The average price of a 12 ounce soda is 31 cents with a standard deviation of 6 cents. The average market share is 15% if the outside good is included, or 11% if it is excluded. Table 2 shows the average prices and market shares for each product across the county-month pairs. The 5-year sample period is divided into (i) the pre-merger years (2008 and 2009) (ii) the year of the vertical merger (2010), and (iii) the post-merger years (2011 and 2012). All of six products exhibit reasonably stable retail prices. The price of Coke and Diet Coke increased most markedly, by 9% and 8%, respectively, between 2009-9 and 2011-12. Price increases associated with the four other products were milder, ranging from 0% to 3%. Between these periods, Coke and Diet Coke lost 14% and 12% of their market shares, respectively, although within the six products these numbers are smaller: 12% and 8% respectively. On the other hand, Pepsi and PepsiCo increased their market shares by 10% and 5% respectively within the six products (5% and 1% if the outside good is included), and Dr Pepper and Diet Dr Pepper had the largest within-product share increases of 17% and 13%, respectively. These numbers are still large if the outside good is included (11% and 8%). To observe market concentration trends in the CSD industry, I calculate the Herfindahl–Hirschman Index (HHI) for each market (county × month), defined by the sum of the squares of individual firms' market shares. Table 3 shows that the median HHI decreased across the sample period from 2000 to 1800, that is, the industry became less concentrated, reflecting the decrease in Coca-Cola's market shares.

Characteristics of the counties in the sample are shown in Panel (a) of Table 4. These

Table 4: Summary Statistics on Market Characteristics

(a) Demand Side	Mean	Median	Standard Deviation	Min	Max
Population	721,814	365,275	1,081,084	106,302	9,962,789
Median Income	55,674	52,965	14,324	30,016	101,171
Median Age	37.0	37.1	3.4	23.3	45.6
Unemployment Rate (%)	8.2	8.1	2.5	2.0	18.7
Bachelor's Degree (%)	19.2	18.4	5.6	7.0	34.5
Average Temperature (F)	56.3	56.9	16.3	5.0	94.5

(b) Supply Side	Mean	Median	Standard Deviation	Min	Max
Distance from Plant (miles)					
Coke	54.9	34.3	59.9	4.3	479.4
Pepsi	77.8	40.1	181.5	4.4	2101.4
Dr Pepper	50.1	33.5	49.5	4.4	300.8
Weekly Wage ($)					
Coke	1132.3	1098.0	220.7	360.2	1921.2
Pepsi	1097.0	1070.3	222.3	496.0	2653.0
Dr Pepper	1107.9	1088.0	221.8	360.2	2653.0

Notes: For Panel (a), Population, Median Income, Median Age, and Bachelor's Degree are observed annually. The observation unit is "county × year," and the number of observations is 764. For Unemployment Rate and Average Temperature, which are observed monthly, the observation unit is "county × year × month," and the number of observations is 9146. For Panel (b), the number of observations is 9146. "Coke", "Pepsi", and "Dr Pepper" are identities of bottlers. If Dr Pepper's products are distributed by a Coke bottler in a county (see Table 5 below), "Coke" is also used for "Dr Pepper", and the same for "Pepsi".

Table 5: Distribution of Bottlers

	2008	2009	2011	2012
Pepsi Bottling Group (PBG)	0.769	0.766	–	–
PepsiAmericas (PAS)	0.077	0.078	–	–
Pepsi Bottling Company (PBC)	–	–	0.842	0.846
Other PepsiCo Bottlers	0.154	0.156	0.158	0.154
Dr Pepper distributed by				
Coca-Cola bottler	0.410	0.409	0.408	0.409
PepsiCo bottler	0.391	0.390	0.401	0.396
Dr Pepper Snapple	0.199	0.201	0.191	0.195
Number of counties	156	154	152	149

Note: The year 2010, when PepsiCo's vertical merger took place, is excluded.

county-level variables are used as explanatory variables in the difference-in-differences estimation below. They vary across the treatment counties and the control counties as well as over time. Recall that the unemployment rate and average temperature vary month-by-month. Other variables, however, change only annually. Next, Panel (b) of Table 4 shows descriptive statistics for the two main components of bottlers' costs in each county. Note that if a PepsiCo (or Coca-Cola) bottler takes charge of Dr Pepper's distribution in a county, PepsiCo (or Coca-Cola) and Dr Pepper share the same values for these cost variables. Relative to weekly wage, the distance between the bottler's plant and the market varies within and across the brands. Table 5 shows that 85% of counties had a PepsiCo bottler (Pepsi Bottling Group or PepsiAmericas) that was vertically integrated in February 2010. In about 80% of counties, Coca-Cola or PepsiCo took charge of distribution of Dr Pepper's products.[24]

In the empirical analysis in the next section, PepsiCo's vertical merger is considered as a treatment; thus, counties which experience this treatment belong to the treatment group, else to the control group. Table 6 shows the prices and market shares for the period 2008 through 2009 and 2011–2012, where the treated counties are those with PBG or PAS bottlers prior

[24] In this sample, 67% of counties had a Coca-Cola bottler (Coca-Cola Enterprises) that was vertically integrated in October 2010. I use this event of another vertical integration as one of the control variables in the empirical analysis below.

Table 6: Comparison of Treatment and Control Groups

		Treatment		Control	
		2008-9	2011-12	2008-9	2011-12
Coke	Retail Price ($ per 12 oz)	0.3041	0.3305	0.3103	0.3483
		(0.0416)	(0.0520)	(0.0539)	(0.0633)
	Market Share	0.2646	0.2238	0.2625	0.2156
		(0.0757)	(0.0721)	(0.0791)	(0.0816)
	Within the 6 products	0.2923	0.2576	0.2888	0.2544
		(0.0843)	(0.0829)	(0.0870)	(0.1006)
Diet Coke	Retail Price ($ per 12 oz)	0.3094	0.3320	0.3146	0.3498
		(0.0409)	(0.0512)	(0.0525)	(0.0714)
	Market Share	0.1803	0.1604	0.1629	0.1320
		(0.0656)	(0.0695)	(0.0630)	(0.0584)
	Within the 6 products	0.1990	0.1840	0.1792	0.1554
		(0.0721)	(0.0779)	(0.0693)	(0.0686)
Pepsi	Retail Price ($ per 12 oz)	0.2799	0.2820	0.2821	0.2972
		(0.0374)	(0.0394)	(0.0511)	(0.0548)
	Market Share	0.2258	0.2372	0.2408	0.2564
		(0.0940)	(0.1003)	(0.1112)	(0.1433)
	Within the 6 products	0.2492	0.2725	0.2649	0.2945
		(0.1035)	(0.1136)	(0.1223)	(0.1582)
Diet Pepsi	Retail Price ($ per 12 oz)	0.2885	0.2908	0.2903	0.3080
		(0.0367)	(0.0416)	(0.0458)	(0.0546)
	Market Share	0.1240	0.1264	0.1104	0.1070
		(0.0519)	(0.0535)	(0.0451)	(0.0546)
	Within the 6 products	0.1368	0.1449	0.1215	0.1233
		(0.0570)	(0.0601)	(0.0496)	(0.0603)
Dr Pepper	Retail Price ($ per 12 oz)	0.3109	0.3120	0.3188	0.3165
		(0.0541)	(0.0528)	(0.0692)	(0.0611)
	Market Share	0.0714	0.0792	0.0867	0.0975
		(0.0545)	(0.0502)	(0.0510)	(0.0524)
	Within the 6 products	0.0788	0.0912	0.0954	0.1156
		(0.0600)	(0.0576)	(0.0561)	(0.0622)
Diet Dr Pepper	Retail Price ($ per 12 oz)	0.3091	0.3185	0.3198	0.3236
		(0.0712)	(0.0756)	(0.0635)	(0.0676)
	Market Share	0.0399	0.0433	0.0456	0.0482
		(0.0211)	(0.0217)	(0.0242)	(0.0243)
	Within the 6 products	0.0440	0.0498	0.0502	0.0568
		(0.0232)	(0.0245)	(0.0267)	(0.0287)
Observations		3122	3047	576	562

	Treatment	Control	t-value
HHI (2008-9)	2005.4	2029.9	1.63
HHI (2011-12)	1821.9	1898.0	3.84
t-value	-21.07	-3.97	

Notes: The observation unit is "county × month." The numbers of observations are: 3122 (treatment, 2008-9); 576 (control, 2008-9); 3047 (treatment, 2011-12); and 562 (control, 2011-12).

Table 7: Mean Comparison of Treatment and Control Groups

(a) Demand Side	Treatment	Control	t-value
Population	748,945	574,761	-1.62
Median Income	56,869	49,195	-5.47
Median Age	36.9	37.3	1.28
Unemployment Rate (%)	8.2	8.5	5.01
Bachelor's Degree (%)	19.5	17.6	-3.31
Average Temperature (F)	55.8	58.9	6.60

(b) Supply Side	Treatment	Control	t-value
Distance from Plant (miles)			
Coke	49.8	63.3	2.20
Pepsi	71.0	97.3	1.45
Dr Pepper	44.2	60.3	3.13
Weekly Wage ($)			
Coke	1167.0	1020.8	-5.91
Pepsi	1137.9	927.5	-8.55
Dr Pepper	1136.0	972.3	-6.82

Notes: The number of observations is: for the treatment group, 7720 (Unemployment Rate and Average Temperature) and 645 (all other variables); for the control group 1426 (Unemployment Rate and Average Temperature) and 119 (all other variables).

to PepsiCo's vertical merger. Pepsi's price increase is lower in the treatment group (0.7%) than in the control group (5%). However, both groups experienced similar increases in market share (5% for the treatment group and 6% for the control group). Table 6 also shows that the degree of market concentration in the treatment group is similar to that in the control group (the t-value is 1.63). However, the treated counties became *less* concentrated after PepsiCo's merger than the controlled counties, and the difference is statistically significant. Finally, Table 7 compares the treatment and control groups in terms of demographic characteristics as well as the supply side. Median income and the proportion of those with a bachelor's degree are significantly higher in the treatment group, reflecting the fact that Pepsi Bottling Group and PepsiAmericas mainly operated in metropolitan areas. The temperature comparison shows that control counties are located in lower latitude counties. Difference in terms of weekly wage and electricity price indicate that the treated counties were mainly located in metropolitan areas. The comparison in terms of distance between the county and its nearest plant indicates that plants are located in areas close to the center of the populated areas.

4 Empirical Analysis

In this section, a difference-in-differences (DID) analysis is employed to quantify the reduced-form effects of PepsiCo's 2010 vertical merger, in part to motivate structural analysis for future research. I take advantage of the fact that this vertical merger was not nationwide: if that were the case, one would need to consider "control products" (products of the merged chain) and "treatment products" (products of other chains).[25] In the following analysis, a treatment group consists of the counties where a bottler was a target of the vertical integration, and a control group consists of the counties where bottlers remained independent. Note that in the following DID analysis, the *average treatment effect* (ATE) is measured, that is, the average change (i.e., the difference) in the treatment group is compared to the average change in the control group. Heterogeneous effects are considered as interactive terms with the treatment variable. I also consider a modification of this standard DID analysis, by which each observation is re-weighted using the propensity score to better account for observational differences between the treatment

[25] However, since both product types coexist in the same market, it might be the case that the treatment also has some effects on the control group. See, e.g., Ashenfelter and Hosken (2010) and Greenfield (2015) for alternative methods for choosing a control group in the case of nationwide mergers.

and control counties.

To control for possible advertisement effects, I use Kantar Media's Ad$pender Database from 2008 through 2012 to compute monthly per-capita advertisement expenditures for each product. It covers information on the Coca-Cola Company, PepsiCo, and Dr Pepper Snapple's monthly expenditures for advertising in representative metropolitan areas,[26] including TV, radio, local newspapers and magazines, and on-site advertisements. This is because the vertical mergers might have been associated with targeted advertising, which supposedly affected the local demand for soda products after PepsiCo's vertical merger. If these advertising effects are not controlled for, the effects of the vertical merger on retail prices and market shares are not adequately estimated due to these confounding factors. Some advertisement units are targeted for either the regular or the diet product, although many of them are non-specific. When aggregating advertisement units within a month-MSA (Metropolitan Statistical Area) pair, I distinguish between the regular and the diet categories whenever possible. Finally, each county from the IRI Academic Data Set is connected to the closest MSA in Kantar Media's Ad$pender. Fortunately, it appears that advertising effects are not important. Even if the analysis is not supplemented by Ad$pender data, the empirical results shown below do not change significantly.

4.1 Difference-in-Differences Estimation

Now, I consider PepsiCo's vertical merger in 2010 as a treatment. A county is categorized into the treatment group if it has a bottler that was integrated after the merger, otherwise, it is categorized into the control group.[27] First, j indexes for product, r for county, and t is a time index. Let $\textit{Post-merger}_t$ be a dummy variable that takes 1 if t is a post-merger month and 0 if it is a pre-merger month. Similarly, define T_r as a dummy variable that takes 1 it r belongs to the treatment group, and 0 if it belongs to the control group. Then, I consider the following two specifications:

$$\log p_{j,(r,t)} \quad = \quad \beta_0^p + \beta_1^p \left\{ \textit{Post-merger}_t \times T_r \right\}$$

[26] The geographical unit of Ad$pender is MSA (Metropolitan Statistical Area), and the total number of MSAs covered is 101.

[27] In a similar spirit, Allain, Chambolle, Turolla, and Villas-Boas (2017) make use of the fact the some markets were not served by either of the merging supermarket chains. This enables them to use these markets as a control group in their DID analysis to study the price effects of a horizontal supermarket merger in France.

$$+\beta_2^p Post\text{-}merger_t + \beta_3^p T_r + \mathbf{z}'_{(r,t)}\boldsymbol{\gamma}^p + \mathbf{c}'_{j,(r,t)}\boldsymbol{\chi}^p + \phi_r + \tau_t + \varepsilon^p_{j,(r,t)}$$

and

$$\begin{aligned}\log p_{j,(r,t)} &= \beta_0^p + \beta_{11}^p \{Post\text{-}merger_t \times T_r\} \\ &+\beta_{12}^p \{Post\text{-}merger_t \times T_r \times 1(\text{In county } r, \text{ Dr P is distributed by PepsiCo})\} \\ &+\beta_{13}^p \{Post\text{-}merger_t \times T_r \times 1(\text{In county } r, \text{ Dr P is distributed by Coca-Cola})\} \\ &+\beta_2^p Post\text{-}merger_t + \beta_3^p T_r + \mathbf{z}'_{(r,t)}\boldsymbol{\gamma}^p + \mathbf{c}'_{j,(r,t)}\boldsymbol{\chi}^p + \phi_r + \tau_t + \varepsilon^p_{j,(r,t)},\end{aligned}$$

where ϕ_r captures county fixed effects, and τ_t time fixed effects. In addition, I also include time-varying demographic and cost variables, $\mathbf{z}_{(r,t)}$ and $\mathbf{c}_{j,(r,t)}$, which are already explained in Section 3. In my sample, $p_{j,(r,t)}$ is a quantity-adjusted price. The second specification is used to explore whether common agency (i.e., whether Dr Pepper's products are distributed by PepsiCo or Coca-Cola) matters to the price effects.

I also conduct a DID analysis for market shares by considering:

$$\begin{aligned}\log s_{j,(r,t)} &= \beta_0^s + \beta_1^s \{Post\text{-}merger_t \times T_r\} \\ &+\beta_2^s Post\text{-}merger_t + \beta_3^s T_r + \mathbf{z}'_{(r,t)}\boldsymbol{\gamma}^s + \phi_r + \tau_t + \varepsilon^s_{j,(r,t)}\end{aligned}$$

and

$$\begin{aligned}\log s_{j,(r,t)} &= \beta_0^s + \beta_{11}^s \{Post\text{-}merger_t \times T_r\} \\ &+\beta_{12}^s \{Post\text{-}merger_t \times T_r \times 1(\text{In county } r, \text{ Dr P is distributed by PepsiCo})\} \\ &+\beta_{12}^s \{Post\text{-}merger_t \times T_r \times 1(\text{In county } r, \text{ Dr P is distributed by Coca-Cola})\} \\ &+\beta_2^s Post\text{-}merger_t + \beta_3^s T_r + \mathbf{z}'_{(r,t)}\boldsymbol{\gamma}^s + \phi_r + \tau_t + \varepsilon^s_{j,(r,t)},\end{aligned}$$

where $s_{j,(r,t)}$ is the market share of product j in market (r,t). Note that market shares, rather than quantities sold, are used to capture the effects of rivalry, and they are computed with inclusion of the market share of outside goods.

The ordinary least squares (OLS) estimation for β_1^p and β_1^s provides an estimate for the ATEs of vertical integration on the retail prices and market shares, respectively. The additional differences from common agency are captured by β_{12}^p and β_{13}^p for the retail prices, and β_{12}^s and β_{13}^s for the market shares. To take into account possible heteroskedasticity across counties and possible correlation of the error terms within counties, Huber-White robust standard errors, clustered by county, are shown in all results below.

4.2 Discussions on the Parallel Trend Assumption

Before presenting the empirical results, I briefly argue their validity. The fundamental identifying assumption in a DID analysis is the *parallel trend assumption*: treatment and control groups had experienced similar trends prior to a vertical merger, and absent the treatment similar patterns would have been maintained across the treatment and control groups. If the treatment and control groups had different time trends in an unobserved way, the ATEs would be estimated with bias. It is expected that PepsiCo's 2010 vertical merger in this study is less susceptible to endogeneity concerns than other smaller mergers because PepsiCo did not particularly target bottlers with poor performance in an unobservable way. However, the treated counties may have experienced unobserved exogenous changes differently from the control counties.

To consider this issue, I follow Kaplan, Taylor, and Villas-Boas (2016) to estimate the following equation:

$$\begin{aligned} & \log p_{j,(r,t)} \text{ or } \log s_{j,(r,t)} \\ = \quad & \beta_0 + \sum_{\tau=1}^{\bar{t}} \beta_\tau (T_r * D_\tau) + \mathbf{z}'_{(r,t)}\boldsymbol{\gamma} + \phi_r + \tau_t + \varepsilon_{j,(r,t)}, \end{aligned} \tag{1}$$

where $\bar{t}$ denotes the last period covered in the data (December 2012) and D_t is a dummy variable that takes one if period is t and zero otherwise, to determine whether there is a systematic discrepancy in the unobservable trends between the treatment and the control groups in the pre-merger period for PepsCo's products. The term $\mathbf{c}'_{j,(r,t)}\boldsymbol{\chi}$ is included in the right hand side if the dependent variable is $\log p_{j,(r,t)}$. Figure 1 plots $\{\beta_\tau\}$, and the dashed lines show the 95% confidence intervals. If there are no unobservable trend differences between the treatment and the control groups prior to the vertical merger, then β_τ, $\tau = 1, ..., t_0 - 1$, where t_0 is the period when PepsiCo's vertical merger was completed (February 2010), should be close to zero. Fortunately, Figure 1 shows that β_τ lies in the 95% confidence interval in most of the periods: β_τ, $\tau = 1, ..., t_0 - 1$ are not systematically different from zero. Thus, although the treatment group exhibits a slightly negative retail price trend (Panel (a)) and a positive trend for market share (Panel (b)), these small trends should not lead to significant bias.[28]

[28] In contrast, a similar analysis of Coca-Cola's vertical merger reveals less validity of the parallel trend assumption (see Adachi, 2017). Thus, and together with the reasoning in Section 2, I have decided to solely study the effects of PepsiCo's vertical integration.

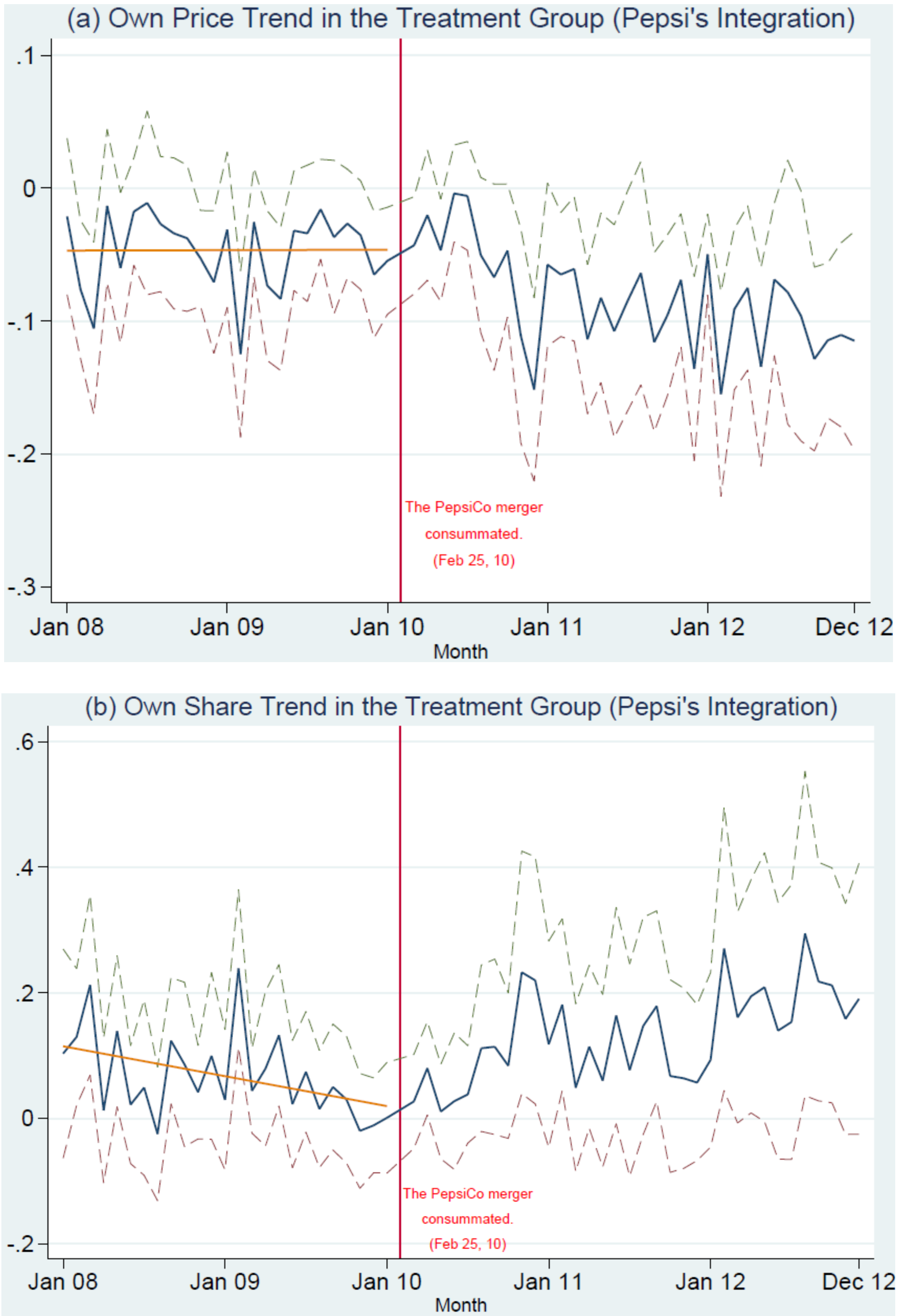

Figure 1: Price and Market Share Trends in the Treatment Group of PepsiCo's Integration

Notes: Coefficient estimates for β_τ in Equation (1) are plotted for each month τ. The dependent variable is the log of PepsiCo's own retail prices for Panel (a) and log of PepsiCo's own market shares for Panel (b). The dashed lines show 95% confidence intervals, calculated by using robust standard errors clustered by county.

4.3 Estimation Results

Tables 8 and 9 show the estimation results of the effects of PepsiCo's vertical merger on retail prices and market shares, respectively. I employ the two estimation methods: one is the standard DID by which the equations above are estimated by OLS, and the other is a re-weighing method motivated by, among others, Hastings, Kane, Staiger, and Weinstein (2007), Suzuki (2009), and Allain, Chambolle, Turolla, and Villas-Boas (2017). This method utilizes propensity score matching in a way proposed by Barsky, Bound, Charles, and Lupton (2002), Hirano, Imbens and Ridder (2003), and Imbens (2004) to re-weight the observations in the control group to match the covariates in the treatment group as closely as possible. Notably, in contrast to the standard methods using matching, all observations are used in estimation with this re-weighting method. I first compute propensity scores using a Probit model where a dummy for counties that experienced a vertical merger is regressed on county covariates as well as month dummies and year dummies. Then, in a second step, I conduct a DID estimation using a re-weight $PS/(1-PS)$ for observations from control counties, where PS is the corresponding propensity score. In this way, whether a county experiences a treatment is not dealt as purely a random weight. This method is particularly appealing in this paper's context because treated counties belong to relatively large metropolitan areas (see Table 7 (a) above).

For each table, I first show the ATEs (β_1^p and β_1^s above) for each brand , and the estimation results using the re-weighting method are also shown. Then, I show the results interacting the treatment term with whether Dr Pepper's products are distributed by PepsiCo or Coca-Cola (β_{12}^p and β_{13}^p, and β_{12}^s and β_{13}^s above). The estimation results using the re-weighting method are also shown for this specification as well. First, it is observed from Table 8 that PepsiCo's vertical merger lowered its own prices by 4.4%, which is statistically different from zero at the 5% significance level for both methods. This observation is consistent with the efficiency-based view of vertical integration: vertical integration, *ceteris paribus*, mitigates double marginalization.[29] However, Table 8 also shows that these treatment effects are not homogeneous with respect to the mode of common agency. Specifically, the effects of PepsiCo's vertical merger on its own prices are the largest in the markets where Coca-Cola also distributes Dr Pepper's products. Although the price reduction is 2.5% in the markets where neither Coca-Cola's nor PepsiCo's

[29] A similar finding is also obtained by Muris, Scheffman, and Spiller (1992) who show that metropolitan areas where PepsiCo acquired the ownership of bottlers in 1987 experienced a 4% reduction in the bottler's prices.

Table 8: Treatment Effects of PepsiCo's Vertical Merger on Retail Prices

	Average Effects				Interacted with Common Agency			
	Standard DID		Re-Weighting		Standard DID		Re-Weighting	
	Est	p-val	Est	p-val	Est	p-val	Est	p-val
Dep Var: $\log p_{\text{pepsi}}$								
Post Merger × T	-0.0435 (0.0169)	**0.011**	-0.0437 (0.0151)	**0.004**	-0.0250 (0.0196)	0.205	-0.0257 (0.0188)	0.174
× Pepsi distributes Dr P	–	–	–	–	-0.0113 (0.0112)	0.312	-0.0133 (0.0125)	0.290
× Coke distributes Dr P	–	–	–	–	-0.0251 (0.0127)	**0.049**	-0.0228 (0.0135)	**0.093**
R^2	0.5856		0.6064		0.5865		0.6067	
Dep Var: $\log p_{\text{coke}}$								
Post Merger × T	-0.0110 (0.0207)	0.596	-0.0166 (0.0199)	0.405	-0.0192 (0.0250)	0.443	-0.0277 (0.0236)	0.243
× Pepsi distributes Dr P	–	–	–	–	0.0022 (0.0161)	0.890	0.0065 (0.0161)	0.688
× Coke distributes Dr P	–	–	–	–	0.0135 (0.0156)	0.388	0.0157 (0.0156)	0.315
R^2	0.6029		0.6693		0.6032		0.6694	
Dep Var: $\log p_{\text{dr\_p}}$								
Post Merger × T	0.0031 (0.0192)	0.871	-0.0034 (0.0192)	0.861	-0.0105 (0.0222)	0.638	-0.0191 (0.0222)	0.393
× Pepsi distributes Dr P	–	–	–	–	0.0151 (0.0158)	0.340	0.0178 (0.0161)	0.270
× Coke distributes Dr P	–	–	–	–	0.0137 (0.0141)	0.331	0.0155 (0.0150)	0.302
R^2	0.6455		0.7415		0.6547		0.7415	
Time FE	✓		✓		✓		✓	
County FE	✓		✓		✓		✓	
CCE→CCR counties, and its interaction with the Coca-Cola merger	✓		✓		✓		✓	
Market Covariates	✓		✓		✓		✓	
Cost Covariates	✓		✓		✓		✓	

Notes: For each regression, the number of observations is 18,292. A dummy variable for diet drinks is also included (the estimate is not presented). Standard errors, clustered by county, are shown in parentheses, and p-values less than 0.1 are emboldened.

Table 9: Treatment Effects of PepsiCo's Vertical Merger on Market Shares

	Average Effects				Interacted with Common Agency			
	Standard DID		Re-Weighting		Standard DID		Re-Weighting	
	Est	p-val	Est	p-val	Est	p-val	Est	p-val
Dep Var: $\log s_{\text{pepsi}}$								
Post Merger × T	0.0659 (0.0390)	**0.093**	-0.0350 (0.0531)	0.511	0.0218 (0.0442)	0.623	-0.0692 (0.0549)	0.210
× Pepsi distributes Dr P	–	–	–	–	0.0352 (0.0260)	0.178	0.0280 (0.0266)	0.294
× Coke distributes Dr P	–	–	–	–	0.0537 (0.0195)	**0.007**	0.0411 (0.0202)	**0.044**
R^2	0.8001		0.7521		0.8003		0.7521	
Dep Var: $\log s_{\text{coke}}$								
Post Merger × T	0.01000 (0.0366)	0.785	0.0419 (0.0407)	0.306	0.0453 (0.0415)	0.276	0.0769 (0.0460)	**0.096**
× Pepsi distributes Dr P	–	–	–	–	-0.0423 (0.0259)	0.104	-0.0417 (0.0260)	0.111
× Coke distributes Dr P	–	–	–	–	-0.0314 (0.0216)	0.149	-0.0313 (0.0219)	0.154
R^2	0.6949		0.6452		0.6951		0.6454	
Dep Var: $\log s_{\text{dr\_p}}$								
Post Merger × T	0.0085 (0.0345)	0.805	-0.0372 (0.0379)	0.329	0.0046 (0.0411)	0.911	-0.0376 (0.0437)	0.390
× Pepsi distributes Dr P	–	–	–	–	0.0045 (0.0249)	0.858	0.0025 (0.0259)	0.924
× Coke distributes Dr P	–	–	–	–	0.0037 (0.0257)	0.886	-0.0012 (0.0275)	0.966
R^2	0.8304		0.8061		0.8304		0.8061	
Time FE	✓		✓		✓		✓	
County FE	✓		✓		✓		✓	
CCE→CCR counties, and its interaction with the Coca-Cola merger	✓		✓		✓		✓	
Market Covariates	✓		✓		✓		✓	

Notes: For each regression, the number of observations is 18,292. A dummy variable for diet drinks is also included (the estimate is not presented). Standard errors, clustered by county, are shown in parentheses, and p-values less than 0.1 are emboldened.

bottler is a common agent for Dr Pepper, PepsiCo's prices are additionally lowered by 2.3–2.5% if Coca-Cola's bottler is a common agent for Dr Pepper, and by 1.1–1.3% if PepsiCo's bottler is a common agent. In addition, the coefficient for Coke's common agency is statistically significant under both the standard DID and the re-weighting methods, although the F statistic for $\beta_{12}^{p} = \beta_{13}^{p}$ (with 1 numerator and 156 denominator degrees of freedom) is 1.33 under the standard DID and 0.48 under the re-weighing method, which implies that the significance level is 24.5% and 48.8%, respectively; the hypothesis cannot be rejected at a reasonable level of statistical significance.

As for the effects on PepsiCo's own market shares, the results are less clear (see Table 9). Although the standard DID indicates a share increase of 6.6%, the re-weighting method suggests that PepsiCo's vertical integration lowers its own market share by 3.5%. These mixed results might imply that PepsiCo's vertical merger triggered the "price war" against Coca-Cola. Recall that the treatment counties are relatively populated and urbanized areas whose population presumably favors Pepsi rather than Coke (see Panel (a) of Table 7). If these demographic characteristics are properly weighted as per the re-weighting method employed herein, then Coca-Cola's market share increase becomes more apparent, as shown in Table 9. Tables 8 and 9 also show that PepsiCo's vertical merger had a similar impact on Coca-Cola's products: it lowers Coca-Cola's prices by 1.1–1.7%, while it raises Coca-Cola's market shares by 1.0–4.1%. It is, thus, inferred that the reduction of PepsiCo's prices caused by its vertical merger led to fiercer competition between PepsiCo and Coca-Cola. However, these results are not statistically significant. This is also the case for Dr Pepper's products in terms of both price and market share. In particular, the price changes are almost negligible for both methods, less than 0.1%. Thus, it could be inferred that Dr Pepper is less affected than Pepsi presumably because Dr Pepper is not as strong a substitute for Coca-Cola compared to Pepsi. This conjecture could be supported through estimation of substitution patterns using a structural analysis. However, the estimation results in Table 9 also show that the mode of common agency also matters here. The negative effects are indeed offset by the price increases in the markets with PepsiCo's or Coca-Cola's common agency. With regard to the effects on Dr Pepper's market shares, less clear results are obtained.

The empirical finding that the price effect is weaker in the markets with Pepsi's common agency than in the markets with Coke's common agency would suggest that the bottling part of

Table 10: The Means of Pepsi's Retail Prices and Market Shares Before and After PepsiCo's Vertical Merger

Before (in 2008 and 2009)

(A) Regular Pepsi	Price ($)	Market Share (%)	Number of Observations
No Common Agency	0.2754	18.47	744
Pepsi distributes Dr Pepper	0.2937	22.43	1440
Coke distributes Dr Pepper	0.2697	25.30	1514

(B) Diet Pepsi	Price ($)	Market Share (%)	Number of Observations
No Common Agency	0.2796	12.02	744
Pepsi distributes Dr Pepper	0.2994	12.57	1440
Coke distributes Dr Pepper	0.2831	11.91	1514

After (in 2011 and 2012)

(A) Regular Pepsi	Price ($)	Market Share (%)	Number of Observations
No Common Agency	0.2817	19.25	696
Pepsi distributes Dr Pepper	0.2987	23.09	1437
Coke distributes Dr Pepper	0.2717	27.18	1476

(B) Diet Pepsi	Price ($)	Market Share (%)	Number of Observations
No Common Agency	0.2870	11.46	696
Pepsi distributes Dr Pepper	0.3030	12.65	1437
Coke distributes Dr Pepper	0.2872	12.46	1476

Note: The observation unit is "product × county × year × month."

PepsiCo's chain may have stronger price control over its own prices because it also controls Dr Pepper's products, or it might simply indicate that its wholesale price may be higher, perhaps reflecting the bottler's stronger position in the transaction with PepsiCo's headquarters due to its transactional relationship with Dr Pepper's headquarters. The top panel of Table 10 shows that before PepsiCo's vertical merger, the average price is highest in the markets with PepsiCo's common agency in both the Regular and Diet categories. Mean differences are all statistically significant at the 1% level. This also applies after the vertical merger (see the bottom panel of Table 10), excepting that "No Common Agency" and "Coke's Common Agency" in the Diet category are no longer different to a reasonable level of statistical significance. The results in terms of mean market shares are less clear, though. Both before and after PepsiCo's vertical merger, Pepsi's market share is lower in the markets with Pepsi's common agency than in the markets with Coke's common agency in the Regular category, whereas the opposite is true for the Diet category. This similarity between the pre- and post-merger periods may suggest that the FTC's concerns are partly validated (see Subsection 2.2 above) in the sense that if PepsiCo bottlers transact with Dr Pepper, then its retail prices increase, hampering the benefits from vertical integration. However, this does not arise uniquely from vertical merger *per se*, as the top panel of 10 shows. Thus, other inherent and structural reasons may be more important.

Then, what is the difference between PepsiCo's common agency and the other two modes when demand factors are controlled for? The welfare effects of PepsiCo's vertical merger would probably be different across the mode of common agency. At this point, one would expect that the welfare change is higher in the markets with Coke's common agency than in the markets with Pepsi's common agency. It becomes possible to quantify these welfare differences if one estimates a structural model. In addition, it may also be associated with cost savings in the bottling process, although it is unclear solely from these results. The ambiguity in the results above provide a rationale for disentangling the managerial effects on margins from the effects of cost savings, using a structural model of vertical relationships with a bargaining process. This analysis is left for future research.

In sum, it is observed that PepsiCo's vertical merger lowered its retail prices. Whether it raised its market shares is less clear. More importantly, it appears that this effect depends on the structure of common agency in the market: PepsiCo lowered its own prices and raised its market shares greatest in the markets where Coca-Cola bottlers were common agents for

Table 11: Treatment Effects of PepsiCo's Vertical Merger on Retail Prices and Market Shares (13 Months around the Completion of the Merger are Excluded)

	Retail Prices				Market Shares			
	Average		Common Agency		Average		Common Agency	
	Est	p-val	Est	p-val	Est	p-val	Est	p-val
Dep Var: $\log s_{\text{pepsi}}$								
Post Merger × T	-0.0578 (0.0195)	**0.003**	-0.0378 (0.0239)	0.116	-0.0280 (0.0582)	0.631	-0.0688 (0.0608)	0.260
× Pepsi distributes Dr P	–	–	-0.0122 (0.0156)	0.437	–	–	0.0321 (0.0329)	0.331
× Coke distributes Dr P	–	–	-0.0273 (0.0163)	**0.096**	–	–	0.0499 (0.0231)	**0.033**
R^2	0.6064		0.6068		0.7656		0.7657	
Dep Var: $\log s_{\text{coke}}$								
Post Merger × T	-0.0271 (0.0244)	0.269	-0.0390 (0.0284)	0.172	0.0434 (0.0474)	0.362	0.0770 (0.0546)	0.161
× Pepsi distributes Dr P	–	–	0.00466 (0.0191)	0.808	–	–	-0.0414 (0.0317)	0.194
× Coke distributes Dr P	–	–	0.0188 (0.0194)	0.322	–	–	-0.0288 (0.0258)	0.266
R^2	0.6783		0.6785		0.6525		0.6526	
Dep Var: $\log s_{\text{dr\_p}}$								
Post Merger × T	-0.00667 (0.0239)	0.781	-0.0297 (0.0273)	0.279	-0.0523 (0.0438)	0.235	-0.0542 (0.0520)	0.299
× Pepsi distributes Dr P	–	–	0.0294 (0.0197)	0.138	–	–	-0.00408 (0.0309)	0.895
× Coke distributes Dr P	–	–	0.0209 (0.0190)	0.272	–	–	0.00689 (0.0324)	0.832
R^2	0.7474		0.7475		0.8056		0.8056	
Time FE	✓		✓		✓		✓	
County FE	✓		✓		✓		✓	
CCE→CCR counties, and its interaction with the Coca-Cola merger	✓		✓		✓		✓	
Market Covariates	✓		✓		✓		✓	

Notes: For each regression, the number of observations is 14,300. A dummy variable for diet drinks is included (the estimate is not presented). The estimation method is the re-weighting method. Standard errors, clustered by county, are shown in parentheses, and p-values less than 0.1 are emboldened.

Dr Pepper. With regard to the effects on Dr Pepper's retail prices, common agency has the effects of raising them after the vertical merger, although these changes are relatively small and the p-values are relatively high, implying that Dr Pepper is less affected by PepsiCo's vertical integration. It also seems that whether a PepsiCo or a Coca-Cola bottler distributes Dr Pepper's products is less important to these results regarding Dr Pepper's retail prices and market shares.

The results herein on the price effects of PepsiCo's vertical merger on its own products are in line with Gil (2015), who also conducts a DID analysis of vertical integration from data on movie theaters' prices, revenues, and ownership in 26 U.S. cities for the period 1945 to 1955. Gil (2015, p.162) finds that "vertically integrated theaters charged lower prices and sold more admission tickets than nonintegrated theaters." Then, Gil (2015) spells out three possible channels through which vertical integration affects final retail prices: (i) double-marginalization, (ii) downstream competition, and (iii) productivity, which may be attained through better scale and scope economies in production and distribution. Again, these issues could be investigated with a structural model in consideration of the structure of common agency.

Finally, Table 11 explores the robustness of the empirical results. They do not change significantly even if 13 months around the completion of PepsiCo's vertical merger (February 2010, and 6 months before and after) are removed. The estimation is implemented by the re-weighting method. Unfortunately, statistical significance disappears for the market share effect on Coca-Cola in the markets where neither a PepsiCo nor a Coca-Cola distributes Dr Pepper's products. However, the price and share effects of Coca-Cola's common agency on PepsiCo's products remain statistically significant.

5 Concluding Remarks

In this paper, I analyze the price and market share effects of one of the biggest vertical mergers in the U.S. carbonated soft drink (CSD) industry. In particular, in determining the effects of vertical integration, this paper focuses on the unique feature of the U.S. CSD industry to study the role of common agency, where a downstream distributor may also distribute its upstream rival's products in some areas, Empirical results suggest that PepsiCola's vertical merger is consistent with the efficiency-based view: it lowered its retail prices by 4.4%. More importantly, these downward price effects are *stronger* in the markets with Coca-Cola's common agency than in the markets with PepsiCo's common agency. The price effects of PepsiCo's vertical merger on Dr Pepper's products are also weaker in the markets with PepsiCo's common agency. However, the price effects on Coca-Cola's products are stronger in these markets. Obviously, the welfare effects of PepsiCo's vertical integration would differ across the mode of common agency, which should be investigated by a structural approach. More specifically, these empirical results suggest a structural analysis of a vertical merger in a bargaining model with an emphasis on how trade with multiple sellers affects the bargaining outcome, and hence consumer welfare. Then, it becomes possible to evaluate vertical as well as horizontal mergers with vertical relationships explicitly taken into account.

In this paper, I have not considered non-price effects of vertical integration such as the effects on introduction of new products, mainly due to the fact that the IRI Academic Data Set unfortunately does not include the non-CSD category. In this respect, Zhou and Wan (2017) provide an interesting study examining the effects of a vertical merger on product quality by using product-level data, including carbonated non-carbonated soft drinks, from 264 distribution centers of one (anonymous) major bottling company that owns 50 plants in the U.S. Zhou and Wan (2017) empirically establish that vertical integration (again, the identity of the integrated entity is kept anonymous) was beneficial to the integrated entity's coordination (in terms of, for example, the frequency of stockout that a product experiences) for their own products, although it worked negatively for rival products. In contrast, I directly study price and share effects, holding the quality dimension fixed. I thus leave the quality effects of vertical mergers to future research.

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