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

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Abstract

How do vertical mergers impact consumers? Though often presumed to eliminate double marginalization and generate efficiencies, theory predicts that vertical integration in multiproduct industries may cause price changes that hurt consumers even in the absence of market foreclosure. We measure the causal effects of vertical integration on prices by exploiting variation in vertical structure caused by vertical mergers in the carbonated-beverage industry. We find that vertical integration caused a decrease in the prices of products with eliminated double margins, but a price increase on average, raising the question of whether consumers necessarily benefit from vertical mergers.

Keywords: vertical integration, multiproduct firms, carbonated-beverage industry

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1 Introduction

How vertical integration affects consumer welfare and market efficiency is a long-standing question in competition policy. Because vertical integration often eliminates double margins and generates efficiencies, economists have argued that vertical mergers are welfare enhancing in the absence of market foreclosure.[1] However, economic theory suggests that vertical mergers in multiproduct industries may lead to price increases even in the absence of market foreclosure (Edgeworth, 1925, Salinger, 1991). These prices increases, caused by the elimination of double marginalization, raise the question of whether consumers necessarily benefit from vertical mergers.

Theoretically, vertical integration impacts pricing incentives in two ways when double margins are eliminated for some of the products sold by a firm. On the one hand, the products with eliminated double margins become cheaper to sell, which creates a downward pressure on the prices of these goods. This is the *efficiency effect* associated with the elimination of double marginalization. On the other hand, the products with eliminated double margins become relatively more profitable to sell. This gives the firm incentives to divert demand towards these products by increasing the prices of the products for which double marginalization was not eliminated (Edgeworth, 1925, Salinger, 1991). We call this second effect the *Edgeworth-Salinger effect*. The Edgeworth-Salinger effect counteracts the efficiency effect of vertical integration, and it may lead to price increases that hurt consumers (Hotelling, 1932, Salinger, 1991).[2]

In this paper, we measure the efficiency and Edgeworth-Salinger effects of vertical integration and discuss their relative importance for competition policy. To the best of our knowledge, we are the first to provide causal evidence of the magnitude of the Edgeworth-Salinger effect. We perform our analysis in the context of the carbonated-beverage industry in the United States and exploit a recent wave of vertical integration

[1] For example, Motta (2004, p.378) and Riordan and Salop (1995) call for clearing vertical mergers that are unlikely to cause market foreclosure.

[2] A partial elimination of double marginalization (and thus the Edgeworth-Salinger effect) is relevant for a broad set of vertical transactions in multiproduct industries. These transactions include, for example, health insurance companies buying hospitals and clinics (e.g., Humana's acquisition of Concentra in 2010, WellPoint Inc's acquisition of CareMore Health Group in 2011); drug manufacturers acquiring pharmacy benefit managers (e.g., Merck & Co., Inc.'s acquisition of Medco Managed Care, L.L.C. in 1993, Eli Lilly and Company's acquisition of McKesson Corporation in 1995); retailers integrating with one of their suppliers (e.g., McKesson Canada Corporation's proposed acquisition of Rexall Pharmacy Group Ltd., Brown Shoe Co., Inc.'s acquisitions of Wohl Shoe Company and Wetherby-Kayser in 1951 and 1953, respectively); mergers in network industries (e.g., MCI Communications Corporation's joint venture with British Telecommunications PLC in 1994); among others.

in this industry to identify the effects of vertical mergers.

The carbonated-beverage industry is ideal for this study for at least two reasons. First, a number of vertical transactions took place in 2009 and 2010, involving The Coca Cola Company, PepsiCo, and some of their bottlers. In this industry, bottlers purchase concentrate from one or more upstream firms, and produce and sell canned and bottled carbonated beverages. For example, The Coca Cola Company's main bottler has bottled both The Coca Cola Company brands ("own brands") and Dr Pepper Snapple Group brands in many locations across the United States. The transactions that took place in 2009 and 2010 eliminated double marginalization for the brands owned and bottled by PepsiCo and The Coca Cola Company (i.e., own brands). However, because Dr Pepper Snapple Group remained independent in selling inputs to bottlers, double marginalization was not eliminated for Dr Pepper Snapple Group's brands bottled by the bottling divisions of PepsiCo and The Coca Cola Company.[3] As a consequence of this partial elimination of double marginalization, we expect these transactions to have caused a manifestation of the efficiency and Edgeworth-Salinger effects of vertical integration.

Second, because PepsiCo and The Coca Cola Company merged with only a subset of their independent bottlers, vertical integration took place in only some parts of the country. This geographical variation in vertical integration generates rich longitudinal and cross-sectional variation in vertical structure that is key for our identification strategy. In addition, market-foreclosure effects after vertical integration are likely absent in this environment, facilitating the identification of the Edgeworth-Salinger effect.[4]

To measure the effects of vertical integration on prices, we use a unique combination of data sources. First, we use weekly data on retail prices at the product–store level for 50 markets in the United States from the IRI Marketing Data Set (Bronnenberg et al., 2008). Second, we use an industry publication and Federal Trade Commission documents to identify how each store in the scanner data was impacted by vertical integration: unaffected by vertical integration; exposed to a partial elimination of double marginalization; or exposed to a full elimination of double marginalization.

Our strategy to identify the causal effect of vertical integration on prices exploits the rich longitudinal and cross-sectional variation in vertical structure generated by

[3]These Dr Pepper Snapple Group brands included Dr Pepper, Canada Dry, Crush, and Schweppes.
[4]We discuss the lack of market foreclosure in Section 3.

the vertical mergers as well as the panel structure of the data. We use a generalized differences-in-differences research design, which compares the within-product price changes in places that were affected by the vertical mergers with the within-product price changes in places unaffected by the vertical mergers. To quantify the relevance of the Edgeworth-Salinger effect, we distinguish between own and Dr Pepper Snapple Group brands bottled by a vertically integrated bottler when measuring the impact of vertical integration on prices.

We find that vertical integration decreased the prices of own brands bottled by a vertically integrated bottler by 1.4 percent (e.g., Diet Pepsi bottled by PepsiCo), and it increased the prices of Dr Pepper Snapple Group brands bottled by a vertically integrated bottler by 3.9 percent (e.g., Dr Pepper bottled by PepsiCo).[5] The overall impact of vertical integration was to *increase* the prices of products bottled by vertically integrated bottlers by an average of 1.8 percent. Dynamic-effect estimates show that the price increases in products bottled by a vertically integrated bottler only started after the vertical transactions took place, and the price increases persisted in time. Lastly, a heterogeneity analysis shows that vertical integration caused an increase in the price of most Dr Pepper Snapple Group brands bottled by vertically integrated bottlers.

Our results are consistent with a manifestation of the efficiency and Edgeworth-Salinger effects of vertical integration, and have important policy implications. First, our findings show that the Edgeworth-Salinger effect is of the same order of magnitude as the efficiency effect—but of the opposite sign. Because the vertical integration of multiproduct firms has the potential of harming consumers, multiproduct pricing incentives should not be ignored when evaluating vertical mergers. Second, because vertical integration may cause price increases for some products and price decreases for others, merger simulations are as relevant for the evaluation of the welfare impact of vertical mergers as they are for the evaluation of horizontal mergers.

The rest of the paper is organized as follows. Section 2 presents a conceptual discussion of the impact of vertical integration on the pricing incentives of a multiproduct firm. Industry background as well as a description of the data are presented in Section 3. Section 4 presents our empirical framework. Our results showing that vertical integration led to an increase (decrease) in the prices of the goods for which the double margins were not (were) eliminated after vertical integration are discussed in Section

[5]Unless otherwise noted, our measure of price is the product's list price.

5. Lastly, in Section 6, we discuss the implications of our findings and conclude.

1.1 Literature Review

The question of whether vertical mergers are pro- or anticompetitive has been a matter of debate for decades (see, for example, Salinger, 1988, Perry, 1989, Ordover et al., 1990, Hart et al., 1990, Bolton and Whinston, 1991, Reiffen, 1992, Riordan, 1998, Choi and Yi, 2000, Chen, 2001, Lafontaine and Slade, 2007). The main argument suggesting that vertical mergers are anticompetitive is that a vertical merger may incentivize the vertically integrated firm to exclude a downstream or upstream rival (i.e., market foreclosure). On the other hand, the procompetitive argument is that vertical integration is likely to create efficiencies that are transaction specific (e.g., the elimination of double margins).

Whether the pro- or anticompetitive effect dominates has been the subject of empirical work with mixed findings. Hortaçsu and Syverson (2007) show that vertical integration in the cement and ready-mixed concrete industries led to lower prices, consistent with efficiency gains dominating potential foreclosure effects. Chipty (2001) and Hastings and Gilbert (2005) present evidence in favor of the foreclosure effect dominating in both the U.S. pay television and the wholesale gasoline industries, respectively. Crawford et al. (2015) provide an empirical framework to study the welfare gains of vertical integration and use it to evaluate the vertical integration of regional sports networks with programming distributors in the U.S. pay-television industry. The authors find that the sign of the welfare effect of vertical integration depends on whether the nonintegrated distributors have access to integrated content.[6]

A less studied effect of vertical mergers is that they may also result in price increases that are not caused by foreclosure incentives. Salinger (1991) shows that when a multiproduct downstream firm vertically integrates with one of its suppliers and double margins are eliminated for a subset of its products, the firm has greater incentives to sell the products with eliminated double margins. As a consequence, the firm responds by increasing the prices of its other products to boost the sales of the products with eliminated double margins, potentially harming consumers. The economics behind this effect was originally discussed by Edgeworth (1925) in the context of excise taxes

[6]Other recent empirical studies on vertical integration include Villas-Boas (2007), Mortimer (2008), Houde (2012), Lee (2013), Atalay et al. (2014), and Asker (2016).

that are specific to a subset of the goods sold by a multiproduct firm, and Hotelling (1932) discusses the welfare implications of the effect. We contribute to the literature by measuring the economic relevance of this effect for vertical-merger evaluation.

2 Multiproduct Pricing and Vertical Integration

To see how vertical integration impacts the pricing incentives of a multiproduct firm, consider the example presented in Figure 1. Before vertical integration (Figure 1a), a downstream monopolist sells two substitute products, product 1 and product 2, at prices p_1 and p_2. In the example, the monopolist produces product 1 using inputs it purchases from the upstream firm U_1, and it produces product 2 using inputs it purchases from the upstream firm U_2. In this setting, the first-order necessary conditions for the equilibrium prices, p_1^* and p_2^*, are given by

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

where c_1 and c_2 are the input costs of the bottler.

Consider now a vertical merger that eliminates the double margin for product 1, causing the effective input cost of product 1 to drop to zero (i.e., the assumed marginal cost of production of the input producer), and leaves c_2 at its original value (see Figure 1b). Then, at the premerger prices, p_1^* and p_2^*, we have that

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

both because demand is downward sloping and the products are substitutes. These inequalities suggest two effects on prices. First, the elimination of the double margin creates an incentive to decrease the price of product 1 because of its lower marginal cost. This corresponds to the *efficiency effect* of eliminating double marginalization. Second, the elimination of the double margin in product 1 gives the downstream monopolist greater marginal incentives to sell this product because it now earns the monopolist a higher margin (i.e., p_1^* versus the premerger margin of $p_1^* - c_1$). This creates an incentive

to increase the price of product 2 to induce consumers to substitute to product 1. As discussed above, we call this the *Edgeworth-Salinger effect*.[7] This change in incentives due to the merger may result in an increase in the price of product 2 and even in an increase in the price of both goods (Salinger, 1991).[8]

Depending on the relative magnitude of each of these effects on prices, consumers may be hurt by vertical integration. An example where consumers are hurt by vertical integration is provided in Salinger (1991), who shows that the prices of all goods can increase after double marginalization is eliminated for good 1. Similarly, but in the context of taxation, Hotelling (1932) provides examples for when an excise tax on one good can result in price decreases for all goods.

3 Background and Data

3.1 Vertical Transactions

The U.S. carbonated-beverage industry is characterized by upstream companies selling concentrate or syrup (e.g., The Coca Cola Company, PepsiCo, and Dr Pepper Snapple Group) and bottlers who purchase the concentrate to produce, market, and distribute canned and bottled carbonated beverages. Upstream firms grant bottlers exclusive territories to sell the canned and bottled carbonated beverages that derive from their concentrates.[9] Most bottler agreements that govern the vertical relationships between upstream firms and bottlers provide upstream firms with complete flexibility to determine the prices of concentrates and grant bottlers flexibility to choose the prices at which they sell the canned and bottled carbonated beverages to retailers. Under these agreements, upstream firms face no obligation to participate with bottlers in the bottlers' marketing expenditures, though bottlers still benefit from the upstream firms'

[7] Numerical examples using a logit demand model suggest that the price of product 2 may increase even after U_2 reoptimizes its wholesale cost.

[8] We acknowledge that input transactions along the vertical chain may involve nonlinear prices. We note, however, that the Edgeworth-Salinger effect will arise as long as the unit price in the vertical contract has a nonzero markup.

[9] The use of local bottling companies to produce and distribute carbonated soft drinks started in the late 20th century. In 1950 there were more than six thousand bottlers, but this number dropped to less than a thousand by 1990 due to bottler consolidation. Bottler consolidation was incentivized by decreasing transportation costs and economies of scale (Saltzman et al., 1999).

national marketing campaigns.[10] Bottlers may transact with more than one upstream firm (e.g., Pepsi Bottling Group transacted with both PepsiCo and Dr Pepper Snapple Group prior to 2009).[11]

In 2009 and 2010, a number of vertical transactions took place in the industry involving upstream companies and bottlers. The Federal Trade Commission (henceforth, FTC) reviewed the transactions and cleared them in October and November of 2010 subject to some behavioral remedies related to information management and compensation (Federal Trade Commission, 2010a,b).[12] First, PepsiCo Inc entered into agreements to merge with Pepsi Bottling Group Inc (PBG) and Pepsi Americas Inc (PAS) in August of 2009. Second, The Coca Cola Company (henceforth, Coca-Cola) merged with Coca-Cola Enterprises Inc (henceforth, CCE), its main bottler, in February of 2010. Lastly, PepsiCo acquired Pepsi-Cola Bottling Co of Yuba City Inc (PYC) in April of 2010. Before these vertical mergers, Coca-Cola, PepsiCo, and Dr Pepper Snapple Group (henceforth, Dr Pepper SG) relied heavily on these and other independent bottlers to produce and distribute bottled and canned carbonated beverages.[13] According to the FTC, CCE accounted for about 75 and 14 percent of Coca-Cola's and Dr Pepper SG's sales of bottled and canned soft drinks in 2009, respectively, while PBG and PAS accounted for about 75 and 20 percent of PepsiCo's and Dr Pepper SG's sales of bottled and canned soft drinks in 2009, respectively.[14]

After the firms entered into their respective merger agreements, both Coca-Cola and PepsiCo acquired new exclusive licenses to continue to sell and distribute some of Dr Pepper SG's brands in some territories. The licenses granted Coca-Cola exclusive rights to continue selling Dr Pepper and Canada Dry in former CCE territories, and it granted PepsiCo exclusive rights to continue selling Dr Pepper, Crush, and Schweppes in former PBG and PAS territories.[15] These new licenses were acquired because the

[10]For more details about the bottler agreements, see, for instance, The Coca Cola Company (2009), PepsiAmericas, Inc. (2009), The Pepsi Bottling Group, Inc. (2009).

[11]This practice is known as cross-franchising, and it has been an important aspect of the industry since at least the 1980s (Saltzman et al., 1999).

[12]We provide a summary of the FTC's complaints and decision orders of these transactions in the Online Appendix. The complaints can be accessed at
https://www.ftc.gov/sites/default/files/documents/cases/2010/11/101105cocacolacmpt.pdf and https://www.ftc.gov/sites/default/files/documents/cases/2010/09/100928pepscocmpt.pdf.

[13]Coca-Cola and PepsiCo partially owned CCE and PBG, respectively, prior to the vertical mergers. Our analysis will therefore measure the effect of partial vertical integration on prices, potentially underestimating the effect of full integration.

[14]See the complaints filed by the FTC for more details about the industry (Federal Trade Commission, 2010a,b).

[15]See points 17 and 24 of the FTC's complaints of the Coca-Cola and PepsiCo transactions, re-

change in ownership of the bottlers triggered the termination of the original licenses.

The vertical mergers eliminated the incentive of Coca-Cola and PepsiCo to sell concentrate to their integrated bottlers at a price greater than marginal cost (i.e., double marginalization). Double marginalization, however, was not eliminated for Dr Pepper Snapple Group's brands bottled by PepsiCo and Coca-Cola because Dr Pepper SG remained independent in selling inputs to bottlers. As a consequence, the vertical mergers and the agreements with Dr Pepper SG had an impact on vertical structure along two dimensions. First, because not all territories were served by CCE in the case of Coca-Cola, and PBG, PAS, and PYC in the case of PepsiCo, the vertical mergers only exposed some territories to vertical integration. Second, neither PepsiCo nor Coca-Cola bottled Dr Pepper SG brands in all of the territories served by a vertically integrated bottler. This resulted in a partial elimination of double marginalization in some of the areas impacted by vertical integration.

With respect to market foreclosure, two facts suggest that it is unlikely that the vertical mergers had foreclosure effects. First, the acquisition of the licenses to continue selling Dr Pepper SG brands suggests that it was in the best interest of Coca-Cola and PepsiCo to continue selling Dr Pepper SG brands. The vertically integrated bottlers could have chosen to drop these Dr Pepper SG brands to potentially increase Dr Pepper SG's cost of selling these products, but this did not happen. Second, the bottlers had control over the prices of own and Dr Pepper SG brands both before and after the mergers, and Dr Pepper SG remained independent in providing inputs to bottlers throughout. The pricing problem therefore did not change for the vertically integrated bottlers after the vertical mergers other than through the elimination of the double margins for own brands, suggesting no incentive to increase the prices of the Dr Pepper SG brands after vertical integration other than the Edgeworth-Salinger effect (see the discussion in Section 2).

Lastly, regarding the motives behind the vertical mergers, industry observers argue that Coca-Cola and PepsiCo were seeking to reduce costs and gain control over retail prices with the mergers.[16] Eliminating double marginalization was a way to compensate for the increase in input costs faced by the firms in the 2000s (e.g., plastic, high-fructose corn syrup). By both lowering costs and gaining control over downstream

spectively, for details (Federal Trade Commission, 2010a,b).

[16]See https://www.wsj.com/news/articles/SB10001424052748704240004575085871950146304 and https://www.wsj.com/articles/SB10001424052748704131404575117902451065876 for media coverage of the mergers.

prices, Coca-Cola and PepsiCo could market their products at lower prices, giving the firms greater flexibility to counter a decline in demand partly driven by substitution to noncarbonated soft drinks.

3.2 Data

Our data come from three sources: the IRI Marketing Data Set (see Bronnenberg et al. 2008 for details), public documents produced by the FTC's investigation of the PepsiCo and Coca-Cola vertical mergers,[17] and territory maps of the U.S. bottling system in The Coke System and The Pepsi System books by Beverage Digest (Stanford, 2016a,b).[18]

We use price and sales information at the store–week–product level for the years 2007 to 2012 from the IRI Marketing Data Set. We define a product as a brand–size combination (e.g., Diet Pepsi 20 oz bottle). In our analysis, we only include carbonated-beverage brands with at least 0.5 percent of the market and restrict attention to three product sizes: the 20 and 67.6 oz bottles and the 144 oz box of cans. These sample restrictions leave us with about 37 million store–week–product combinations, which comprise 35 brands and represent 61.4 percent of the total revenue in this time period (or 60 percent of all units sold).

We use the Beverage Digest territory maps to identify the bottling territories of PBG, PAS, and PYC in the case of PepsiCo, and CCE in the case of Coca-Cola. This information is crucial to determine which counties were affected by vertical integration. Lastly, from the FTC documents, we identify the counties where Dr Pepper, Crush, and Schweppes were bottled by either PBG, PAS, or PYC (in the case of PepsiCo), and the counties where Dr Pepper and Canada Dry were bottled by CCE (in the case of Coca-Cola).

Table 1 presents summary statistics for the prices of the 105 products that are included in our analysis.[19] The table shows that the 20 and 67.6 oz products on average have similar prices both between brands and within size, although the larger size generally has greater within-product variance. The average price of the 144 oz box of cans is generally about three times larger than the average price of a 67.6 oz bottle, even

[17] See https://www.ftc.gov/enforcement/cases-proceedings/091-0133/pepsico-inc-matter and https://www.ftc.gov/enforcement/cases-proceedings/101-0107/coca-cola-company-matter.

[18] See http://www.beverage-digest.com/systembooks for details.

[19] Variation in product availability across store–week combinations explains the differences in the number of observations across products.

though the box of cans has only a little over two times the fluid capacity of the 67.6 oz bottle. This average price difference between the box of cans and the 67.6 oz bottle likely reflects the extra convenience of the can format as well as potential cost differences.

Table A.1 in the Online Appendix presents a decomposition of the variance of price. The table shows that the within store–week price variation represents a significant portion of the overall price variation, even when the analysis is restricted to close substitutes sold at nonsale prices.[20] For example, when restricting the analysis to 67 oz bottles of Coca-Cola, Diet Coke, Dr Pepper, Diet Dr Pepper, Pepsi, and Diet Pepsi that were sold at nonsale prices, we find that 13.1 percent of the overall price variation was within-store–week variation.[21]

Table 2 presents information about the territories that were affected by the vertical integration of both Coca-Cola and PepsiCo. Panel A shows that of the 436 counties in our data, 359 were served by CCE and 400 by PBG, PAS, or PYC (labeled PBG–PAS–PYC in the table). That is, a majority of the counties in our sample were somehow affected by vertical integration in 2010. Three hundred and thirty nine counties were served both by CCE in the case of Coca-Cola and by PBG, PAS, or PYC in the case of PepsiCo. Eighty one counties were served by at most one bottler that merged, while 16 counties were served by no bottlers that merged.[22] Panel B of Table 2 shows that about 29 percent of counties that were served by CCE were counties where CCE also bottled and distributed Dr Pepper or Canada Dry, whereas in 83 percent of the counties served by PBG, PAS, or PYC, the PepsiCo bottler distributed Dr Pepper, Crush, or Schweppes.

4 Empirical Framework and Identification

How does vertical integration impact the prices of multiproduct firms? Is the Edgeworth-Salinger effect economically significant? To answer these questions, we exploit the vari-

[20] We further discuss sale and nonsale prices in Section 5.2.

[21] Table A.2 in the Online Appendix shows the prices at different stores for a given week and illustrates the within store–week variation in prices that consumers may face. Figure A.1 in the Online Appendix plots the distribution of the within-store–week standard deviation of price, and it shows that price variation is significant even within same-size products.

[22] The small number of counties that were not impacted by vertical integration does not affect our ability to measure the Edgeworth-Salinger effect of vertical integration, which is the main focus of this study.

ation in vertical structure that was caused by the vertical mergers (e.g., product j in store s was bottled by an independent bottler before the merger and by a vertically integrated bottler after the merger). This variation allows us to compare the within-product price changes in places that were affected by the vertical mergers with the within-product price changes in places unaffected by the vertical mergers. Moreover, we exploit variation in whether the vertically integrated bottlers distributed Dr Pepper SG brands to measure the differential impact of vertical integration on own and Dr Pepper SG brands (i.e., efficiency and Edgeworth-Salinger effects, respectively). We use a generalized differences-in-differences research design for our baseline analysis, and we conduct the analysis at the product–store–week level (i.e., we study how the price of product j at store s and week w was impacted by vertical integration).

To identify the effects of vertical integration on prices, a number of threats must be addressed. One concern is the existence of time effects that were specific to PepsiCo, Coca-Cola, or Dr Pepper SG. For instance, some of these upstream firms may have changed their advertising intensity or rebate policy at the time of the vertical mergers, or they may have experienced differential input cost shocks after the vertical mergers. We exploit the panel structure of the data to tackle these concerns by allowing for upstream firm-specific week fixed effects, $\phi_{firm(j),w}$, where $firm(j)$ is the upstream firm of product j. We also control for the store–product level advertising intensity reported in the scanner data.[23]

A second concern is the existence of demand shocks concurrent with vertical mergers in the counties where there was vertical integration. These shocks may have been caused by weather changes, local festivities, or other factors. We address this concern by exploiting the existence of multiple stores selling carbonated beverages in each county–week combination and allowing for county–week fixed effects, $\gamma_{w,county(s)}$, where $county(s)$ is the county of store s.

Another concern is that vertical integration may have happened in markets where PepsiCo and Coca-Cola enjoyed greater market power. We again exploit the panel structure of the data to tackle this concern in two ways. First, we allow for product–county–season-of-year fixed effects, $\delta_{j,county(s),season(w)}$, where $season(w)$ is the season of the year that corresponds to week w (e.g., fall or summer). These fixed effects capture that the relative popularity of each product may have varied across markets

[23]The advertising-intensity information in the scanner data correspond to the ordinal variables feature and display. We include indicators for the different values that these variables can take.

and throughout the season of the year. Second, we also control for store fixed effects, λ_s, which capture how the local retail configuration affected market power.

A last concern is the existence of time varying factors that are specific to products that started being bottled by vertically integrated bottlers after the mergers. While we address this possibility more formally when presenting estimates for a model that allows for time-varying effects, we also use summary statistics to examine the existence of differential trends before the vertical mergers. Figure 2 shows the evolution of the average price both before and after the vertical mergers for Coca-Cola, PepsiCo, and Dr Pepper SG products. The graphs distinguish between products that started being bottled by a vertically integrated bottler after the mergers from those that were never bottled by a vertically integrated bottler. The figure shows no differential trends in the year prior to the first vertical transaction. As mentioned previously, we reexamine this issue when presenting our estimates.

With respect to possible confounders that we cannot directly address in the estimation, we first have that the vertical mergers could have increased the bargaining power of the vertically integrated bottlers. We note, however, that an increase in the bargaining power of the vertically integrated firm (if anything) should have decreased the price at which the vertically integrated bottlers purchased inputs from Dr Pepper SG. These lower input prices should have exerted a downward pressure on the prices of Dr Pepper SG brands bottled by vertically integrated bottlers and would thus have operated in the opposite direction of the Edgeworth-Salinger effect. This implies that our estimates for the Edgeworth-Salinger effect may be biased downwards. Second, differential changes in rebate policies between areas with and without vertical integration that took place at the same time as the vertical transactions would not be captured by the set of fixed effects described above and would be a cause of concern. To our knowledge, changes in rebate policy of this type were not implemented.

To measure how vertical integration impacted prices in the carbonated-soda industry, we use a generalized differences-in-differences approach that takes into account the

threats that we just described. Specifically, we estimate

$$\begin{aligned}\log(price_{j,s,w}) =& VI_{CocaCola,county(s),w} \cdot CocaCola\,Product_j\beta_1 \\ &+ VI_{PepsiCo,county(s),w} \cdot PepsiCo\,Product_j\beta_2 \\ &+ VI_{CocaCola,county(s),w} \cdot DrPepperSG\,Product\,Bottled\,By\,CocaCola_j\beta_3 \\ &+ VI_{PepsiCo,county(s),w} \cdot DrPepperSG\,Product\,Bottled\,By\,PepsiCo_j\beta_4 \\ &+ \lambda_s + \gamma_{w,county(s)} + \delta_{j,county(s),season(w)} + \phi_{firm(j),w} + \varepsilon_{j,s,w}, \end{aligned} \quad (1)$$

where $VI_{CocaCola,county(s),w}$ and $VI_{PepsiCo,county(s),w}$ are indicators for whether Coca-Cola and PepsiCo were integrated with their bottlers in county $county(s)$ at week w; $CocaCola\,Product_j$ and $PepsiCo\,Product_j$ are indicators for whether product j is a Coca-Cola or PepsiCo product, respectively; $DrPepperSG\,Product\,Bottled\,By\,CocaCola_j$ and $DrPepperSG\,Product\,Bottled\,By\,PepsiCo_j$ are indicators for whether product j was a Dr Pepper SG product bottled by a Coca-Cola or PepsiCo bottler (e.g., Dr Pepper or Crush in some counties); and ε_{jsw} is an error term clustered at the county level.

The coefficients of interest in Equation 1 are β_1, β_2, β_3, and β_4. The coefficients β_1 and β_2 measure how the elimination of double margins affects prices of own brands (i.e., efficiency effect), while β_3 and β_4 measure how the elimination of own-brand double margins affects prices of Dr Pepper SG brands bottled by the vertically integrated bottlers (i.e., the Edgeworth-Salinger effect). These effects must be interpreted relative to products that were not impacted by vertical integration (conditional on a vector of controls).

We also estimate a version of Equation 1 that allows us to measure the dynamics of the impact of vertical integration on prices,

$$\begin{aligned}\log(price_{jsw}) =& \sum_{k=-L}^{0} VI_{j\times county(s)} \times 1\{k \text{ quarters before time of VI}\}\beta_k \\ &+ \sum_{k=1}^{U} VI_{j\times county(s)} \times 1\{k \text{ quarters after time of VI}\}\beta_k \\ &+ \lambda_s + \gamma_{w\times county(s)} + \delta_{j\times county(s)\times season(w)} + \phi_{firm(j)\times w} + \varepsilon_{jsw}, \end{aligned} \quad (2)$$

where $VI_{j\times county(s)}$ is an indicator for whether product j in county $county(s)$ was eventually sold by a vertically integrated bottler. The coefficients $\{\beta_k\}$ measure the

evolution of the prices of products that were eventually sold by a vertically integrated bottler relative to the prices of products that were never impacted by vertical integration, both before and after vertical integration. Estimates for this model will also allow us to statistically test for the existence of differential trends before the mergers between products that started being bottled by a vertically integrated bottler after the mergers and those that never were.

5 Measuring the Impact of Vertical Integration on Prices

To measure the impact of vertical integration on prices, we first present estimates for several versions of Equation 1 in Table 3. The differences across columns are given by parameter restrictions that we impose to decompose the price effects of vertical integration. We then measure the impact of vertical integration on prices over time by presenting estimates for Equation 2 in Figure 3.

In the first column of Table 3, we impose $\beta = \beta_1 = \beta_2 = \beta_3 = \beta_4$. With this restriction, β must be interpreted as the average impact of vertical integration on the prices of all brands bottled by a vertically integrated bottler (i.e., both own and Dr Pepper SG brands). The estimates in Table 3 (Column 1) show that vertical integration on average increased the prices of the products bottled by vertically integrated bottlers by 1.8 percent relative to the prices of products bottled by bottlers that did not vertically integrate. However, we note that these price effects are not quantity-weighted, which implies that the average price paid by a consumer may have decreased as a consequence of vertical integration, even though the average price increased. Regardless, this estimate suggests that vertical integration may have hurt some consumers in this industry, and the Edgeworth-Salinger effect is economically relevant in this setting.

In the second column, we impose $\beta_1 = \beta_2$ and $\beta_3 = \beta_4$. These parameter restrictions allow us to separately measure the impact of vertical integration on own brands (i.e., with the coefficient $\beta_1 = \beta_2$) and Dr Pepper SG brands (i.e., with the coefficient $\beta_3 = \beta_4$). The restrictions, however, do not allow for these effects to differ by firm. Table 3 (Column 2) shows that vertical integration decreased the prices of Coca-Cola and PepsiCo products that started being bottled by vertically integrated bottlers on average by 1.4 percent after the vertical mergers. This effect is consistent with the downward pressure

on own-brand products caused by the elimination of the upstream margin for those brands (i.e., efficiency effect). Column 2 also shows that vertical integration increased the prices of Dr Pepper SG products bottled by either a vertically integrated Coca-Cola or PepsiCo bottler by an average of 3.9 percent. This second effect is consistent with the Edgeworth-Salinger effect, which captures that the vertically integrated firm has an incentive to increase the prices of Dr Pepper SG brands to divert demand to the brands that become more attractive to sell after vertical integration (i.e., own brands).

The results in Table 3 (Column 2) suggest that the Edgeworth-Salinger effect is large relative to the efficiency effect, and economically relevant. As mentioned above, however, these changes in prices are not one to one with the changes in prices paid by consumers. Weighting these estimated coefficients with premerger market shares suggest that vertical integration caused a decrease in the average price paid by consumers of 0.9 percent. We show below that this decrease in prices would have been larger in the absence of the Edgeworth-Salinger effect, because the Edgeworth-Salinger effect operates against efficiency gains (see Section 5.3).

In the third column, we impose $\beta_1 = \beta_3$ and $\beta_2 = \beta_4$, which gives β_1 and β_3 the same interpretation as in the first column but with the exception that the effects are allowed to vary by whether the product is bottled by a Coca-Cola or PepsiCo bottler. That is, β_1 and β_3 must be interpreted as the average effect of vertical integration on the prices of own and Dr Pepper SG brands bottled by Coca-Cola and PepsiCo, respectively. The decomposition of this effect in Table 3 (Column 3) shows that vertical integration increased the prices of the products bottled by vertically integrated Coca-Cola and PepsiCo bottlers by an average of 1.8 to 1.9 percent, with no significant difference across firms ($p = 0.95$).

Lastly, in the fourth column we relax all of the parameter restrictions and allow the price effects to vary both by brand type (i.e., own or Dr Pepper SG brands) and by upstream company (i.e., Coca-Cola or PepsiCo). The results in Table 3 (Column 4) suggest that vertical integration decreased the prices of Coca-Cola and PepsiCo products bottled by vertically integrated bottlers by an average of 1 and 2.1 percent, respectively. The average increase in the prices of Dr Pepper SG products bottled by a vertically integrated Coca-Cola and PepsiCo bottler is measured to be 4.2 and 3.1 percent, respectively.[24] These effects are consistent with the change in pricing

[24]We cannot reject that the coefficients measuring the effect of vertical integration on own brands are equal across firms ($p = 0.13$). We do, however, reject the hypothesis that the coefficients measuring the effect of vertical integration on Dr Pepper SG brands are the same across firms ($p = 0.01$).

incentives caused by the partial vertical integration of multiproduct firms. On the one hand, prices of own brands faced a downward pressure due to the elimination of double margins (i.e., efficiency effect). On the other hand, prices of Dr Pepper SG brands faced an upward pressure due to the incentive to divert demand to own brands (i.e., Edgeworth-Salinger effect). The estimates suggest that the Edgeworth-Salinger effect is larger than the efficiency effect for both upstream firms.

To study both when the changes in the prices of products bottled by vertically integrated bottlers took place and whether there were differential trends before the vertical mergers, we present estimates for Equation 2 in Figure 3, where we allow for time-varying effects. Figure 3 resembles Table 3 (Column 1) in that the coefficients must be interpreted as time-specific average price differences between prices of products that were eventually sold by a vertically integrated bottler (i.e., own or Dr Pepper SG brands) and prices of products that were never impacted by vertical integration, both before and after vertical integration. The estimates show no evidence of differential trends before the vertical mergers that were specific to products eventually sold by a vertically integrated bottler. This evidence suggests that the areas that were not impacted by vertical integration are a good control group for the areas that were impacted by vertical integration. The results also indicate that the price increases only started after the first vertical transaction. In line with Table 3, the figure suggests price increases caused by vertical integration of about 1 to 2 percent on average, and price increases that were lasting.

In Table 4 we repeat the analysis presented in Table 3 but restrict the sample to neighbor counties that were differentially impacted by vertical integration. That is, two neighboring counties are included in the subsample if i) they were both impacted by vertical integration but only one was exposed to the Edgeworth-Salinger effect, or ii) only one was impacted by vertical integration. This restriction limits the sample to 132 counties (out of 436 counties in the baseline analysis). This subsample analysis allows us to compare within-product price changes in counties that are very similar except for having been differentially impacted by vertical integration. The estimates remain unchanged, suggesting that our main results are not impacted by unobserved heterogeneity across counties that is not captured by the set of fixed effects included in our estimating equations.

In summary, we find that the vertical integration of the carbonated-beverage industry caused price increases for Dr Pepper SG products and price decreases for both Coca-

Cola and PepsiCo products bottled by vertically integrated bottlers. These results are consistent with manifestations of the efficiency and Edgeworth-Salinger effects of vertical integration and suggest that the Edgeworth-Salinger effect is large relative to the efficiency effect. Because the Edgeworth-Salinger effect works against efficiency gains, these results suggest that the Edgeworth-Salinger effect is relevant for the evaluation of vertical mergers.

5.1 Product-Level Analysis

We repeat the analysis at the product level to examine heterogeneous effects of vertical integration. To do this, we restrict the sample to those products that were exposed to vertical integration in at least one county, and estimate

$$\log(price_{j,s,w}) = VI_{bottler(j,s),w}\beta^{j}_{VI} + \lambda_s + \phi_w + \varepsilon_{j,s,w} \quad \forall j, \tag{3}$$

where $VI_{bottler(j,s),w}$ is an indicator for whether product j at store s was bottled by a vertically integrated bottler at week w, and λ_s and ϕ_w are store and week fixed effects, respectively.

We report the CDF of the estimated coefficients on the vertical-integration indicator in Figure 4, where we categorize the coefficients by whether the product is an own or Dr Pepper SG brand. The figure shows that the Edgeworth-Salinger effect impacted most of the Dr Pepper brands bottled by a vertically integrated bottler, as the distribution is concentrated on positive values. On the other hand, the results for own brands are mixed, with a distribution concentrated around zero, suggesting that the efficiency gains of vertical integration were limited to a subset of the products owned by the vertically integrated firms.[25]

We also estimate a version of Equation 3 but with $\log(quantity_{j,s,w})$ as the dependent variable, where $quantity_{j,s,w}$ is the number of units of product j sold at store s in week w. We perform this exercise to assess whether the conjunction of price and quantity changes caused by vertical integration is in line with the elasticity estimates in the literature. Figure 5 (Panel A) presents the distribution of product-level estimates of the impact of vertical integration on quantity. These coefficients are more easily

[25]The price increases for some of the own brands can be explained by the interaction between price complementarities and the economic forces behind the Edgeworth-Salinger effect.

interpreted when expressed as elasticities, that is, when each coefficient is divided by the corresponding product-level coefficient measuring the impact of vertical integration on price. Figure 5 (Panel B) presents the empirical distribution of these elasticities and shows median product-level price elasticities of -1.83 and -2.66 for brands owned by vertically integrated bottlers and Dr Pepper brands bottled by vertically integrated bottlers, respectively. These values are similar to the elasticities reported in Dubé (2004), Patel (2012), and Hendel and Nevo (2013).

5.2 Regular- and Sale-Price Analysis

Previous research has documented the prevalence of temporary price reductions in a number of categories of consumer packaged goods, with prices alternating between a "regular" and a "sale" price (see, for example, Pesendorfer 2002, Hendel and Nevo 2006, 2013). This raises the question of whether the regular and sale price of each product in our sample were equally impacted by vertical integration. We address this question by using a variable in our dataset that indicates temporary reductions in the prices of products of at least 5 percent. This variable is defined at the product–store–week level, and we use it as our measure of "sale." Table A.3 in the Online Appendix presents summary statistics for the sale indicator and shows that there were temporary price reductions in 41.6 percent of the product–store–week combinations in our data.

In Table 5 we present estimates of our main estimating equation, restricting the sample to the product–store–week combinations that were not on sale (column 1), and the product–store–week combinations that were on sale (column 2). Table 5 (Column 1) shows that vertical integration caused a 1.8 percent decrease in the regular price of products owned by a vertically integrated bottler and a 5.2 percent increase in the regular price of Dr Pepper SG products bottled by a vertically integrated bottler. Table 5 (Column 2) shows similar results for the sale price, although the magnitudes are smaller in absolute value. We conclude that the Edgeworth-Salinger effect of vertical integration impacted both the sale and regular prices.

5.3 Additional Exercises

We report the results of additional exercises in the Online Appendix. In Table A.4, we restrict the analysis to areas where the Coca-Cola and PepsiCo bottlers did not bottle

Dr Pepper Co brands (i.e., areas not exposed to the Edgeworth-Salinger effect), and we find that the effect of vertical integration on the prices of own brands was larger than when using the full sample. These results suggest that even if welfare gains exist, they are mitigated by the Edgeworth-Salinger effect, since prices are strategic complements.

Table A.5 analyzes whether the effects of vertical integration are stronger in areas where both Coca-Cola and PepsiCo vertically integrated. Price complementarities may, for instance, reinforce the efficiency effect of vertical integration in these areas if the Coca-Cola and PepsiCo products are close substitutes. The table shows that both the efficiency effect and the Edgeworth-Salinger effect are larger in absolute value in areas where there was overlap in the vertical integration of Coca-Cola and PepsiCo. The table also shows that the prices of products sold by a nonintegrated bottler in areas where at least one firm vertically integrated decreased by 0.8 percent as a consequence of vertical integration, although the effect is not statistically significant.

In the analysis we have presented so far, we define the post-merger period as the period from the moment when the transactions took place. In Table A.6, we replicate Table 3, redefining the post-merger period to start from the moment when the FTC cleared the vertical mergers. The results remain unchanged. In Table A.7, we progressively vary the set of fixed effects that we include in Table 3. The table shows that the Edgeworth-Salinger effect remains larger than the efficiency effect across all of the specifications. Lastly, we discuss clustering of standard errors in Section C of the Online Appendix.

5.4 Alternative Hypotheses

Though the results that we have presented in this paper are consistent with the efficiency and Edgeworth-Salinger effects of vertical integration, there might be alternative hypotheses that can explain these findings. In what follows we discuss three alternative hypotheses and argue why these cannot explain our results.

A first alternative hypothesis is that market foreclosure caused the increase in the prices of Dr Pepper SG brands sold by a vertically integrated bottler. Two facts rule this out. First, the pricing incentives of the vertically integrated bottlers did not change other than through the elimination of double marginalization. That is, the ability and incentives of the integrated bottlers to limit Dr Pepper SG's access to consumers did not change with the vertical mergers (see Section 2). Second, the decision of Coca-Cola

and PepsiCo to acquire licenses to continue selling Dr Pepper SG brands suggests that the vertically integrated bottlers had no incentives to limit Dr Pepper SG's access to consumers (see Section 3.1).

A second alternative hypothesis is that capacity constraints might have played a role. The efficiency effect of vertical integration—and the corresponding decrease in the prices of own brands—led to an increase in the demand for brands owned by a vertically integrated bottler. A capacity-constrained bottler may have chosen to reduce production of Dr Pepper SG products in order to liberate capacity to increase the production of own brands and meet the higher demand for own brands. One way of reducing the quantity of Dr Pepper SG products is by increasing the prices of these products. In principle, these changes in prices would be consistent with those that we have reported above. However, the demand for carbonated beverages is seasonal, making us expect that the bottlers would only be constrained in some months of the year. Figure 3 suggests that the price increases are uniform across seasons, making the constrained capacity explanation unlikely.

A last alternative hypothesis is that our results are explained by a post-merger increase in the frequency of temporary price reductions specific to Dr Pepper SG products that *were not* bottled by a vertically integrated bottler. We address this possibility in Table 5 (Column 4), where we measure the impact of vertical integration on the frequency of sales. The table shows that vertical integration caused an increase in temporary price reductions of Dr Pepper SG products that *were* bottled by vertically integrated bottlers, which rules out this alternative hypothesis.

6 Discussion

Measuring the impact of vertical integration on prices has attracted the attention of economists because of its implications for competition policy. While most empirical research has focused on the tension between the elimination of double marginalization and market foreclosure, we evaluate a third mechanism that arises with multiproduct firms. When integrating with a supplier, vertical integration may eliminate double margins for only a subset of the products of the downstream firm. The products with eliminated double margins become relatively more profitable to sell, which gives the multiproduct firm incentives to divert demand towards these by increasing the prices

of the products for which double marginalization was not eliminated. We evaluate this mechanism by studying vertical mergers among The Coca Cola Company, PepsiCo, and their main bottlers, which only eliminated double margins for the brands owned by these companies.

We find that the vertical integration of The Coca Cola Company and PepsiCo on average increased the prices of products sold by these firms, and the price increase was driven by the prices of Dr Pepper SG brands bottled by the integrated firms for which double marginalization was not eliminated. These results show that eliminating double marginalization may potentially hurt consumers in multiproduct industries—or at least mitigate potential benefits—and thus suggest caution when evaluating vertical mergers in these industries.

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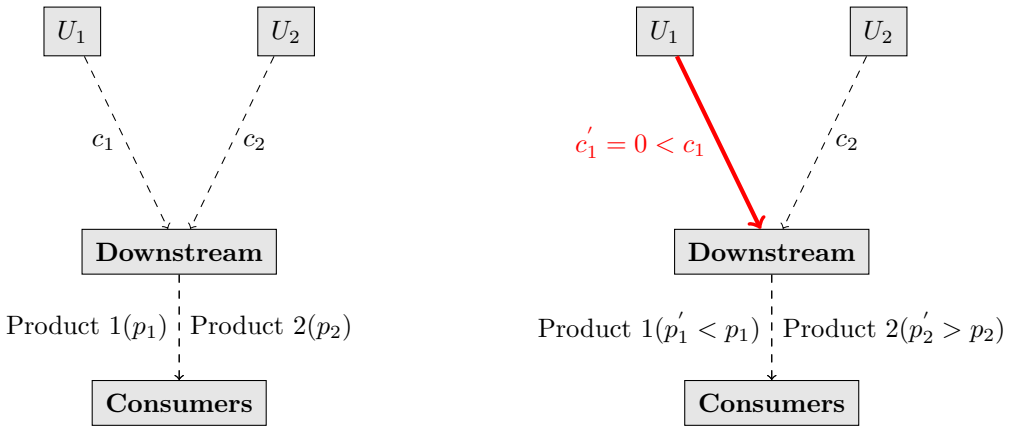
Tables and Figures

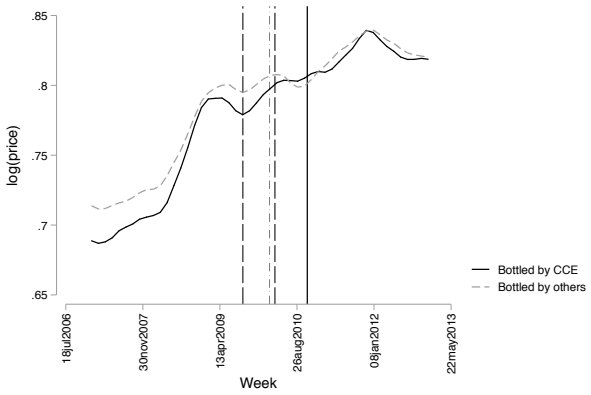


(a) Before vertical integration

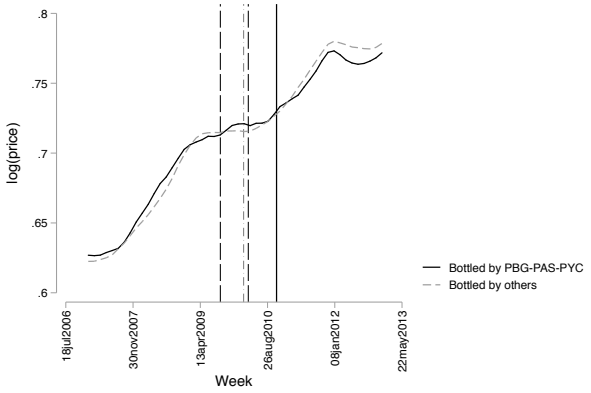
(b) After vertical integration

FIGURE 1: Illustrating the Edgeworth-Salinger effect

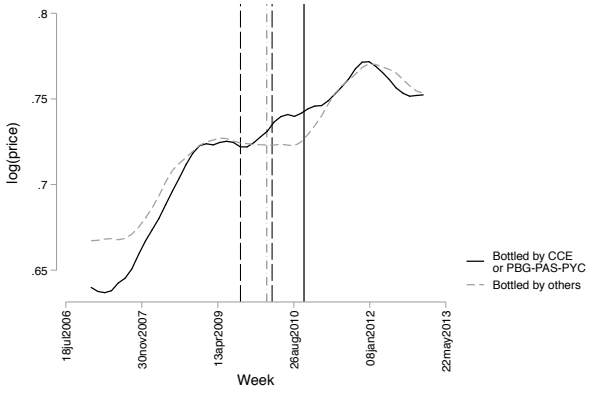
Notes: The figure presents an example that illustrates the Edgeworth-Salinger effect. Figure 1a shows a downstream firm that produces Product 1 and Product 2 using inputs purchased from the upstream firms U_1 and U_2 at prices c_1 and c_2. Figure 1b illustrates what happens if the downstream firm integrates with the upstream firm U_1. Specifically, in the example, the input price c_1 decreases to zero, the assumed marginal cost for U_1. Because of this, Product 1 faces a downward pressure on its price. This is the efficiency gain associated with the elimination of double marginalization. At the same time, this makes Product 1 relatively more profitable to sell, inducing the downstream firm to increase the price of Product 2 to divert demand to Product 1. This is the *Edgeworth-Salinger effect.*



(a) Coca-Cola products



(b) PepsiCo products



(c) Dr Pepper SG products

FIGURE 2: The evolution of prices before and after the mergers by whether the products were ever sold by a VI firm

Notes: An observation is a firm–VI status–week combination, where VI status takes the value of one if the product was ever bottled by a VI firm (e.g., Coke bottled by CCE or Dr Pepper bottled by CCE). The price variable is measured in logs. The dotted black vertical lines indicate PepsiCo mergers. The dotted gray vertical line indicates the Coca-Cola merger. The solid black vertical line indicates when the mergers were cleared by the FTC.

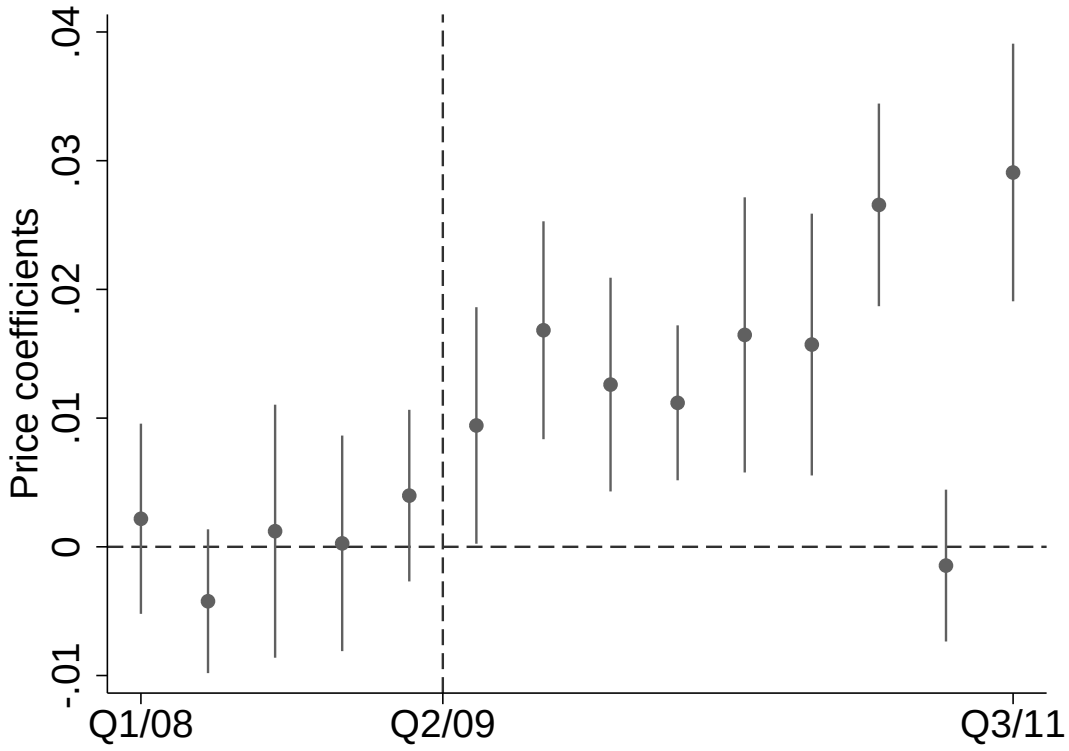


FIGURE 3: The dynamics of the impact of vertical integration on prices: OLS regressions

Notes: Standard errors clustered at the county level. The figure reports estimates for five quarters before the first transaction (i.e., Q3/2009) and five quarter after the last transaction (i.e., Q2/2010) as well as 95 percent confidence intervals. The coefficient for Q2/2009 is normalized to zero. All specifications include controls for feature and display as well as county–week, firm–week, and product–county–season-of-year fixed effects.

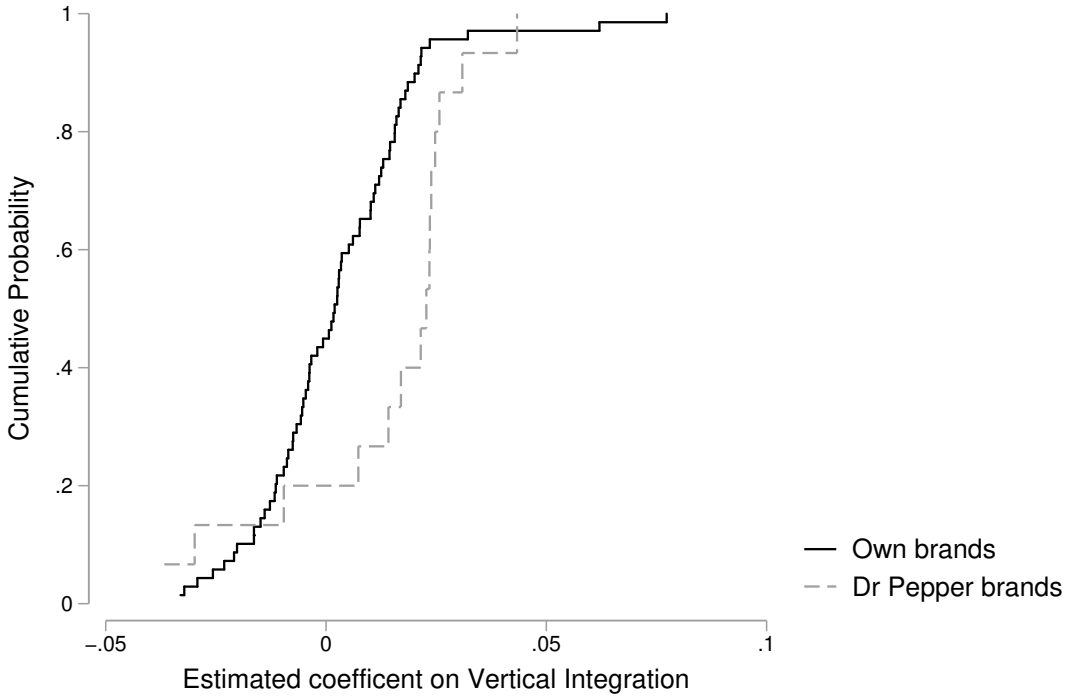
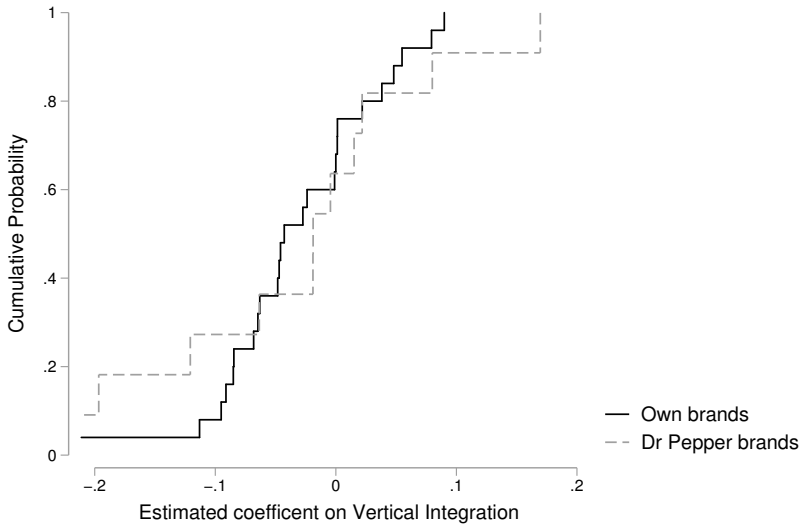
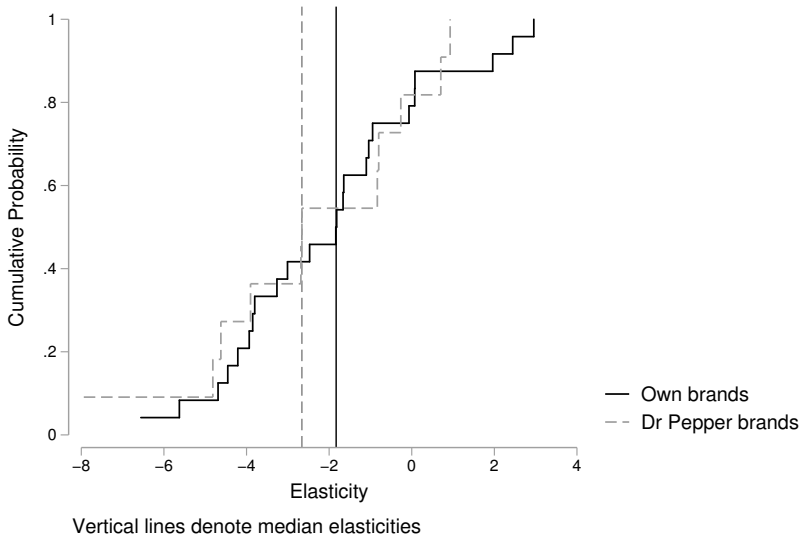


FIGURE 4: Empirical CDF of estimated product-level coefficients on vertical integration: OLS regressions

Notes: The figure reports the empirical CDF of the estimated coefficients on vertical integration for own and Dr Pepper SG brands. The underlying regressions are at the product level and include store and week fixed effects.



A) Empirical CDF of estimated product-level quantity effects of vertical integration (OLS regressions)



B) Empirical CDF of estimated product-level elasticities

FIGURE 5: Quantity effects of vertical integration and implied elasticities

Notes: Panel A reports the empirical CDF of the estimated coefficients on vertical integration for own and Dr Pepper SG brands when the dependent variable is quantity. The underlying regressions are at the product level and include store and week fixed effects as well as controls for price promotions in the same and previous week. Panel B reports the empirical CDF of the product-level ratio between the coefficients on vertical integration in the quantity and price regressions (i.e., $\beta_{VI}^{j,quantity}/\beta_{VI}^{j,price}$). The ratio provides a measure of the price elasticity of demand for each product. The vertical lines indicate the median elasticities for each category. Both panels restrict attention to products with statistically significant vertical integration coefficients in the price regressions.

TABLE 1: Summary statistics: Price

		20 oz			67.6 oz			144 oz		
Brand	Firm	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
7 Up	Dr Pepper	315,833	1.4	0.25	419,563	1.38	0.33	430,677	4.06	0.91
A & W	Dr Pepper	332,835	1.39	0.29	494,576	1.38	0.31	453,423	4.11	0.87
Caffeine Free Coke Classic	Coke	8	0.39	0.49	258,465	1.43	0.28	381,193	4.1	0.94
Caffeine Free Diet Coke	Coke	159,796	1.52	0.17	467,189	1.47	0.29	464,532	4.08	0.91
Caffeine Free Diet Pepsi	Pepsi	130,781	1.48	0.15	442,667	1.38	0.3	431,846	3.85	0.9
Caffeine Free Pepsi	Pepsi	9,799	1.43	0.14	387,122	1.38	0.29	380,765	3.92	0.95
Canada Dry	Dr Pepper	162,995	1.48	0.37	497,235	1.42	0.31	453,707	4.19	0.86
Cherry Coke	Coke	207,155	1.52	0.16	373,830	1.46	0.28	407,591	4.06	0.96
Coca Cola	Coke	533,963	1.51	0.21	528,580	1.49	0.29	526,331	4.14	0.9
Coke Cherry Zero	Coke	109,654	1.51	0.19	208,296	1.44	0.28	367,184	4.08	0.94
Coke Zero	Coke	487,079	1.51	0.16	470,550	1.47	0.29	468,109	4.1	0.92
Crush	Dr Pepper	191,637	1.48	0.23	306,956	1.4	0.31	278,434	4.1	0.93
Diet 7 Up	Dr Pepper	249,137	1.4	0.28	480,120	1.36	0.31	415,126	4.08	0.9
Diet Coke	Coke	532,174	1.51	0.15	521,255	1.48	0.29	518,348	4.12	0.89
Diet Dr Pepper	Dr Pepper	403,162	1.5	0.18	466,501	1.42	0.31	456,564	4	0.89
Diet Mountain Dew	Pepsi	410,024	1.5	0.15	442,132	1.39	0.3	427,725	3.89	0.92
Diet Pepsi	Pepsi	527,794	1.5	0.15	515,905	1.4	0.3	505,778	3.87	0.85
Diet Sierra Mist	Pepsi	2,347	1.66	0.2	317,431	1.37	0.31	299,564	4.05	1.03
Diet Sunkist	Dr Pepper	151,155	2.91	2.65	381,735	1.34	0.31	383,816	4.05	0.93
Diet Wild Cherry Pepsi	Pepsi	110,370	1.51	0.17	372,792	1.37	0.29	368,506	3.91	0.99
Dr Pepper	Dr Pepper	475,946	1.49	0.18	495,583	1.43	0.3	478,767	4.02	0.89
Fanta	Coke	179,444	1.51	0.18	389,343	1.4	0.3	366,719	4.06	0.97
Fresca	Coke	15,111	1.6	0.22	326,044	1.45	0.28	381,304	4.16	0.89
Mountain Dew	Pepsi	519,248	1.5	0.17	505,820	1.41	0.3	488,515	3.89	0.9
Mug	Pepsi	41,214	1.54	0.38	355,710	1.38	0.29	352,509	3.99	0.99
Pepsi	Pepsi	531,426	1.5	0.17	527,856	1.41	0.3	518,216	3.9	0.87
Pepsi Max	Pepsi	311,743	1.49	0.21	342,318	1.39	0.31	327,381	3.93	1
Schweppes	Dr Pepper	546,92	1.54	0.19	341,113	1.4	0.31	272,378	4.08	0.95
Seagrams	Coke	20,150	4.44	3.64	267,565	1.44	0.31	217,840	4.2	1
Sierra Mist	Pepsi	255,091	1.42	0.16	294,823	1.34	0.29	274,336	3.74	0.9
Sprite	Coke	524,813	1.51	0.15	431,691	1.5	0.3	497,830	4.09	0.93
Sprite Zero	Coke	188,689	1.51	0.16	439,476	1.45	0.29	434,485	4.11	0.95
Squirt	Dr Pepper	136,769	1.42	0.27	272,584	1.37	0.3	234,350	3.97	0.91
Sunkist	Dr Pepper	351,349	1.46	0.35	475,504	1.36	0.32	424,075	4.01	0.94
Wild Cherry Pepsi	Pepsi	177,379	1.51	0.17	411,074	1.39	0.3	378,868	3.91	1.02

Notes: An observation is a brand–size–store–week combination.

TABLE 2: Summary statistics: Vertical structure

Panel A: Counties where PBG–PAS–PYC and CCE bottled PepsiCo and Coca-Cola products, respectively

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

Panel B: Counties where PBG–PAS–PYC and CCE bottled Dr Pepper SG products

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

Notes: An observation is a county. A county is labeled as PBG–PAS–PYC if PBG, PAS, or PYC bottled PepsiCo products in the county before vertical integration. A county is labeled as CCE if CCE bottled Coca-Cola products in the county before vertical integration.

TABLE 3: The effect of vertical integration on prices: OLS regressions

	(1)	(2)	(3)	(4)
	log($price$)			
VI · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.018***			
	(0.003)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.014***		
		(0.003)		
VI · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler		0.039***		
		(0.002)		
VI · Own or Dr Pepper SG product bottled by Coca-Cola bottler			0.019***	
			(0.004)	
VI · Own or Dr Pepper SG product bottled by PepsiCo bottler			0.018***	
			(0.004)	
$VI_{CocaCola}$ · Coca-Cola product				-0.010***
				(0.004)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler				0.042**
				(0.004)
$VI_{PepsiCo}$ · PepsiCo product				-0.021***
				(0.006)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler				0.031***
				(0.003)
Observations	37,106,025	37,106,025	37,106,025	37,106,025
R^2	0.893	0.893	0.893	0.893
Prod × County × Season-of-year FE	Yes	Yes	Yes	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time.

TABLE 4: The effect of vertical integration on prices: OLS regressions. Neighbor-counties subsample

	(1)	(2)	(3)	(4)
		log($price$)		
VI · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.017***			
	(0.003)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.012***		
		(0.003)		
VI · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler		0.037***		
		(0.003)		
VI · Own or Dr Pepper SG product bottled by Coca-Cola bottler			0.012**	
			(0.005)	
VI · Own or Dr Pepper SG product bottled by PepsiCo bottler			0.021***	
			(0.005)	
$VI_{CocaCola}$ · Coca-Cola product				-0.015***
				(0.005)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler				0.031**
				(0.005)
$VI_{PepsiCo}$ · PepsiCo product				-0.006
				(0.005)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler				0.029***
				(0.005)
Observations	14,285,223	14,285,223	14,285,223	14,285,223
R^2	0.886	0.886	0.886	0.886
Prod × County × Season-of-year FE	Yes	Yes	Yes	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the county level (132 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The neighbor-counties subsample restricts attention to bordering counties that were differentially impacted by vertical integration. For example, counties that did not experience vertical integration but that had at least one neighboring county impacted by vertical integration would all be included in the subsample. All specifications include controls for feature and display. Post-merger period starts at transaction time.

TABLE 5: The effect of vertical integration on prices: OLS regressions. Regular-sale-price analysis.

	(1)	(2)	(3)	(4)
		log(*price*)		Sale indicator
	Regular Price Subsample	Sale Price Subsample	Full Sample	Full Sample
$VI \cdot$ Own product	-0.018***	-0.013***	-0.014***	-0.006
bottled by Coca-Cola or PepsiCo bottler	(0.003)	(0.003)	(0.003)	(0.005)
$VI \cdot$ Dr Pepper SG product	0.052***	0.026***	0.039***	0.009**
bottled by Coca-Cola or PepsiCo bottler	(0.003)	(0.003)	(0.002)	(0.003)
Observations	21,679,165	15,422,052	37,106,025	37,124,313
R^2	0.935	0.921	0.893	0.383
Prod × County × Season-of-year FE	Yes	Yes	Yes	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time. The sale-price subsample (regular-price subsample) includes product–store–week combinations for which the product was (was not) being sold at a reduced price, i.e., the *pr* variable in the IRI dataset (Bronnenberg et al., 2008). Sale indicator takes the value when there was a temporary reduction in the price of a product of 5 percent or greater (i.e., *pr* variable). The sale indicator is defined at the product–store–week level.

Online Appendix: Not For Publication

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

Fernando Luco and Guillermo Marshall

A FTC's Complaints and Decision Orders

The FTC reviewed the transactions in 2010 and cleared them in October and November of that year subject to some behavioral remedies. The FTC's main concerns were related to Coca-Cola and PepsiCo having access to confidential information provided by Dr Pepper SG to the vertically integrated bottlers. In particular, the FTC argued that the agreements between Coca-Cola/PepsiCo and Dr Pepper SG could lessen competition because, first, they could eliminate competition between Coca-Cola/PepsiCO and Dr Pepper SG; second, they could increase the likelihood of unilateral exercise of market power by Coca-Cola and PepsiCo; and third, they could facilitate coordinated interaction. That is, the concerns raised by the FTC were based on potential violations of Section 5 of the FTC Act and Section 7 of the Clayton Act. The FTC did not raise arguments related to the Edgeworth-Salinger effect.

The remedies imposed by the FTC included, among others, that Coca-Cola/PepsiCo employees that would gain access to confidential information had to be "firewalled," could only participate in the bottling process, and could not receive bonuses or benefits incentivizing them to increase sales of own brands relative to Dr Pepper SG brands.

B Additional Tables and Figures

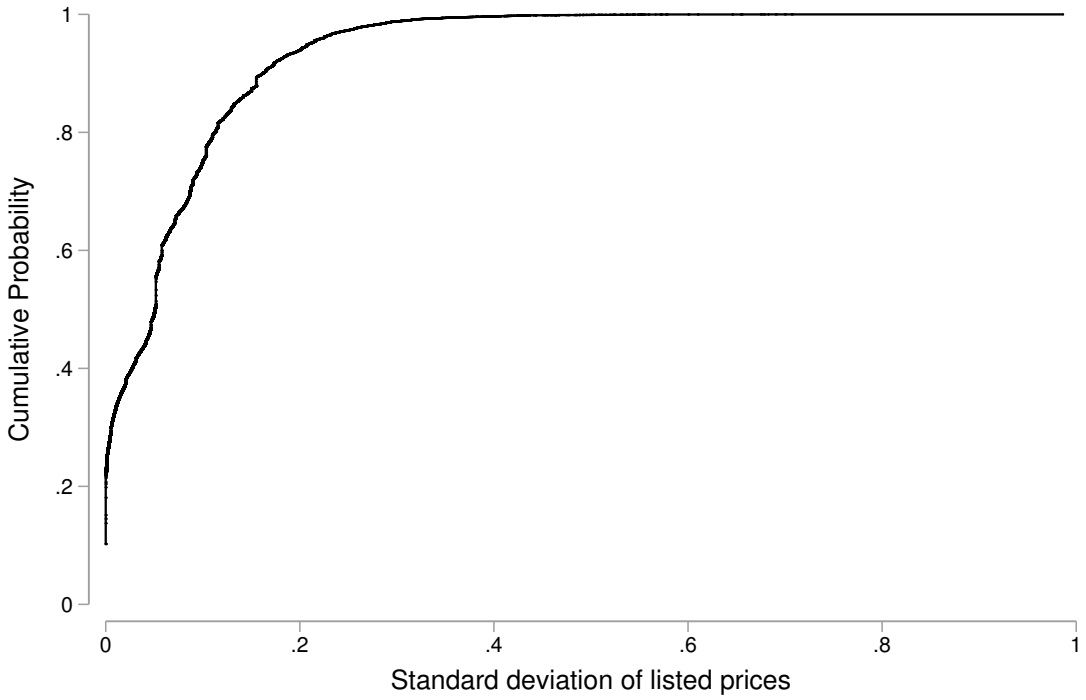


FIGURE A.1: Within store–week standard deviation of prices: Cumulative distribution function

Notes: The standard deviation of price is calculated using the prices of the 67 oz bottles of Coca-Cola, Diet Coca-Cola, Dr Pepper, Diet Dr Pepper, Pepsi, and Diet Pepsi. The figure restricts attention to store–week combinations where none of the prices are flagged as a "sale price" (see Section 5.2).

TABLE A.1: Price variance decomposition

Sample	Between store–week	Within store–week
All 67 oz products	0.401	0.599
All 67 oz products (nonsale prices)	0.704	0.296
Select 67 oz products	0.503	0.497
Select 67 oz products (nonsale prices)	0.869	0.131

Notes: The variance of price is decomposed using the identity $p_{jst} = p_{st} + (p_{jst} - p_{st})$, where p_{jst} is the price of product j at store–week (s,t), and p_{st} is the average price at store–week (s,t). The variance of p_{jst} is the sum of $var(p_{st})$ (between store–week variation) and $var(p_{jst} - p_{st})$ (within store–week variation). The table reports the between and within store–week variation relative to total variance (i.e., $var(p_{st})/var(p_{jst})$ and $var(p_{jst} - p_{st})/var(p_{jst})$, respectively). Select 67 oz products include Coca-Cola, Diet Coke, Pepsi, Diet Pepsi, Dr Pepper, and Diet Dr Pepper.

TABLE A.2: Price variation within store–week: Examples of pricing patterns

	Store				
Product	1	2	3	4	5
Coca Cola (67 oz)	1.49	1.59	1.49	1.49	1.69
Diet Coke (67 oz)	1.49	1.59	1.49	1.49	1.69
Pepsi (67 oz)	1.39	1.49	1.39	1.39	1.59
Diet Pepsi (67 oz)	1.39	1.49	1.39	1.39	1.59
Dr Pepper (67 oz)	1.29	1.59	1.39	1.29	1.59
Diet Dr Pepper (67 oz)	1.29	1.59	1.39	1.29	1.59

Notes: All of these examples correspond to IRI week 1429 (January 15-21, 2007). Each column corresponds to a different store. None of the prices in the table were flagged as a "sale price" in the data (see Section 5.2).

TABLE A.3: Frequency of temporary price reductions by upstream firm

	Share of product–store–weeks with a temporary price reduction
Coca-Cola products	0.408
Dr Pepper SG products	0.385
PepsiCo products	0.450
Total	0.416

Notes: An observation is a product–store–week combination. An observation is classified as being on sale if the temporary price reduction is 5 percent or greater.

TABLE A.4: The effect of vertical integration on prices: OLS regressions. Subsample analysis.

	(1)	(2)
	log(*price*)	
	No Edgeworth-Salinger Effect Sample	Full Sample
VI · Own product	-0.024***	-0.014***
bottled by Coca-Cola or PepsiCo bottler	(0.004)	(0.003)
VI · Dr Pepper SG product	-	0.039***
bottled by Coca-Cola or PepsiCo bottler	-	(0.002)
Observations	2,967,386	37,106,025
R^2	0.910	0.893
Prod × County × Season-of-year FE	Yes	Yes
Week × County FE	Yes	Yes
Week × Firm FE	Yes	Yes
Store FE	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time. No Edgeworth-Salinger Effect sample only includes areas where the Coca-Cola and PepsiCo bottlers do not bottle Dr Pepper SG brands. These areas were not exposed to the Edgeworth-Salinger effect.

TABLE A.5: The effect of vertical integration on prices: OLS regressions. Heterogeneity by vertical integration intensity in each county.

	(1)	(2)
	log(*price*)	
VI · Own product	-0.010***	-0.017*
	(0.003)	(0.009)
VI · Own product · CC and P integrated	-0.010*	-0.009*
	(0.005)	(0.005)
VI · Dr Pepper SG product	0.036***	0.036***
bottled by Coca-Cola or PepsiCo bottler	(0.003)	(0.003)
VI · Dr Pepper SG product	0.005**	0.005**
bottled by Coca-Cola or PepsiCo bottler · CC and P integrated	(0.002)	(0.002)
VI · Product sold by non-integrated bottler		-0.008
		(0.009)
Observations	37106025	37106025
R^2	0.893	0.893
Prod × County × Season-of-year FE	Yes	Yes
Week × County FE	Yes	Yes
Week × Firm FE	Yes	Yes
Store FE	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time. CC and P integrated is an indicator for whether both Coca-Cola and PepsiCo vertically integrated in the county of store s.

TABLE A.6: The effect of vertical integration on prices: OLS regressions. Post-merger period starts after regulatory clearance.

	(1)	(2)	(3)	(4)
	log(*price*)			
VI · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.016***			
	(0.002)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.007***		
		(0.003)		
VI · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler		0.030***		
		(0.002)		
VI · Own or Dr Pepper SG product bottled by Coca-Cola bottler			0.016***	
			(0.004)	
VI · Own or Dr Pepper SG product bottled by PepsiCo bottler			0.016***	
			(0.003)	
$VI_{CocaCola}$ · Coca-Cola product				-0.004
				(0.003)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler				0.032***
				(0.003)
$VI_{PepsiCo}$ · PepsiCo product				-0.012***
				(0.005)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler				0.025***
				(0.003)
Observations	37,106,025	37,106,025	37,106,025	37,106,025
R^2	0.893	0.893	0.893	0.893
Prod × County × Season-of-year FE	Yes	Yes	Yes	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts after regulatory clearance.

TABLE A.7: The effect of vertical integration on prices: OLS regressions. Alternative sets of fixed effects.

	(1)	(2)	(3)	(4)
	log(*price*)			
VI · Own product	-0.001	-0.002	-0.013***	-0.014***
bottled by Coca-Cola or PepsiCo bottler	(0.005)	(0.005)	(0.003)	(0.003)
VI · Dr Pepper SG product	0.032***	0.031***	0.042***	0.039***
bottled by Coca-Cola or PepsiCo bottler	(0.003)	(0.003)	(0.002)	(0.002)
Observations	37,106,832	37,106,832	37,106,679	37,106,025
R^2	0.875	0.882	0.892	0.893
Prod FE	Yes	Yes	No	No
Prod × County FE	No	No	Yes	No
Prod × County × Season-of-year FE	No	No	No	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	No	Yes	Yes	Yes

Notes: Standard errors clustered at the county level (436 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time.

C Clustering

In our main analysis we cluster errors at the county level. This choice is primarily driven by the fact that treatment is at the county level and not at the MSA level. That is, two neighbor counties may have been differentially impacted by vertical integration. While pricing incentives vary at the county level, one may be concerned about within-MSA residual price correlation due to shocks at the MSA-level. As a robustness check, we replicate our main table with clustering at the MSA level in Table A.8. All of the coefficients remain statistically significant.

TABLE A.8: The effect of vertical integration on prices: OLS regressions. Clustering at the MSA level.

	(1)	(2)	(3)	(4)
	log(*price*)			
VI · Own or Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler	0.018***			
	(0.006)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.014**		
		(0.006)		
VI · Dr Pepper SG product bottled by Coca-Cola or PepsiCo bottler		0.039***		
		(0.004)		
VI · Own or Dr Pepper SG product bottled by Coca-Cola bottler			0.019**	
			(0.008)	
VI · Own or Dr Pepper SG product bottled by PepsiCo bottler			0.018**	
			(0.008)	
$VI_{CocaCola}$ · Coca-Cola product				-0.010*
				(0.005)
$VI_{CocaCola}$ · Dr Pepper SG product bottled by Coca-Cola bottler				0.042***
				(0.005)
$VI_{PepsiCo}$ · PepsiCo product				-0.021*
				(0.012)
$VI_{PepsiCo}$ · Dr Pepper SG product bottled by PepsiCo bottler				0.031***
				(0.005)
Observations	37,106,025	37,106,025	37,106,025	37,106,025
R^2	0.893	0.893	0.893	0.893
Prod × County × Season-of-year FE	Yes	Yes	Yes	Yes
Week × County FE	Yes	Yes	Yes	Yes
Week × Firm FE	Yes	Yes	Yes	Yes
Store FE	Yes	Yes	Yes	Yes

Notes: Standard errors clustered at the MSA level (49 clusters) in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All specifications include controls for feature and display. Post-merger period starts at transaction time.