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

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Abstract

How do vertical mergers impact prices in multiproduct industries? We address this question by exploiting vertical mergers that took place in the carbonated beverage industry in 2010, and eliminated double marginalization for a subset of the products sold by the firms involved. We find that for products with eliminated double margins, vertical integration decreased prices by 1.7 percent. However, for all other products, prices increased by 3.9 percent, causing a price increase on average. These results are consistent with theoretical results in the multiproduct pricing literature, and suggest caution when evaluating vertical mergers in multiproduct industries.

Keywords: Vertical integration, multiproduct firms, carbonated beverage industry

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1 Introduction

How vertical integration impacts consumer welfare and market efficiency is a long-standing question in competition policy. Vertical mergers are often evaluated based on whether the efficiencies gains of eliminating double marginalization dominate the welfare consequences of market foreclosure (e.g., Chipty 2001, Hastings and Gilbert 2005, Hortaçsu and Syverson 2007).[1] In multiproduct industries, however, a third effect also comes into play when a firm merges with a subset of its suppliers and double margins are eliminated for only some of its products. This third effect may create scenarios where consumers are hurt by vertical integration even when market foreclosure is not a concern (Edgeworth, 1925, Salinger, 1991).

Theoretically, eliminating double margins for a subset of the substitute products offered by a multiproduct firm has two effects on prices. 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. We call this second effect the *Edgeworth-Salinger effect*, and it may lead to price increases that hurt consumers (Salinger, 1991). How vertical integration impacts welfare therefore depends on the relative magnitude of these effects.

In this paper, we address the question of how vertical integration impacts prices in a multiproduct industry. In particular, we are the first to study the economic relevance of the Edgeworth-Salinger effect for the evaluation of vertical mergers. To do this, we exploit a number of vertical transactions that took place in 2009 and 2010, which involved The Coca Cola Company, PepsiCo, and some of their bottlers. In this industry, bottlers are multiproduct firms that purchase inputs (i.e., concentrate) from one or more upstream companies (e.g., PepsiCo), and produce and sell canned and bottled carbonated beverages. For example, The Coca Cola Company's main bottler bottled both The Coca Cola Company brands ("own brands") and Dr Pepper Snapple Group

[1] In practice, vertical mergers are often presumed to cause efficiencies. For this reason, Motta (2004, p.378) calls for clearing vertical mergers that are unlikely to cause market foreclosure. Relatedly, Riordan and Salop (1995) argue that if a vertical merger is unlikely to cause consumer injury (e.g., input foreclosure), gauging efficiency gains is unnecessary when evaluating a proposed merger.

brands ("rival brands"), before and after vertical integration, in many locations across the United States. After the vertical mergers, double marginalization was eliminated 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 (i.e., unintegrated), double marginalization was not eliminated for Dr Pepper Snapple Group's brands bottled by the bottling divisions of PepsiCo and The Coca Cola Company. These rival brands included Dr Pepper, Canada Dry, Crush, and Schweppes.

The carbonated beverage industry is ideal for this study for at least two reasons. First, 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. Second, market foreclosure effects after vertical integration are likely absent in this environment, providing us with a setting where vertical integration impacts prices only through the elimination of double marginalization. The lack of foreclosure incentives facilitates the identification of the Edgeworth-Salinger effect.[2]

We use weakly data on retail prices at the product–store level for a number of markets in the United States from the IRI Marketing Data Set (Bronnenberg et al., 2008). We exploit the rich longitudinal and cross-sectional variation in vertical structure generated by the vertical mergers and the panel structure of the data to identify the effect of vertical integration on prices. Our analysis is based on comparing 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 brands and rival brands 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 1.7 percent (e.g., Diet Pepsi bottled by PepsiCo) and it increased the prices of rival brands bottled by a vertically-integrated bottler by 3.9 percent (e.g., Dr Pepper bottled by PepsiCo). The overall impact of vertical integration was to *increase* the prices of products bottled by vertically-integrated bottlers by 1.6 percent. Dynamic effects estimates show that the price increases in products bottled

[2]Though the transactions we study in this paper are specific to the carbonated soda industry, vertical integration between retailers and some of their upstream providers are not rare. For example, Safeway and Meijer have vertically integrated with dairy producers in the past.

by a vertically-integrated bottler only started after the vertical transactions took place, and the price increases persisted in time.

These results suggest that vertical integration with multiproduct firms has the potential of harming consumers because of how the vertically-integrated multiproduct firms use rival-brand prices to divert demand to their (more profitable to sell) own brands. That is, the evidence suggests that the Edgeworth-Salinger effect is economically relevant, and multiproduct-pricing incentives must not be ignored when evaluating the impact of vertical integration in multiproduct industries. From a policy point of view, these findings suggest that merger simulation is as relevant for the evaluation of vertical mergers in multiproduct industries as it is for the evaluation of horizontal mergers, as the absence of market foreclosure does not guarantee that a vertical merger will be welfare enhancing.

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. 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 rival by increasing the price of an input sold by the vertically-integrated firm (i.e., market foreclosure). On the other hand, the procompetitive argument is that vertical integration are likely to create efficiencies that are transaction specific (e.g., the elimination of double margins).

Whether the pro- or anticompetitive effect dominates has been a matter 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 non-integrated distributors have access to integrated content.[3]

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 that are specific to a subset of the goods sold by a multiproduct firm. 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

The vertical integration of The Coca Cola Company and PepsiCo with some of their main bottlers eliminated double margins for brands owned by The Coca Cola Company and PepsiCo in the territories where there was vertical integration. The vertical mergers did not eliminate the double margins of brands owned by Dr Pepper Snapple Group, as Dr Pepper Snapple Group remained independent in selling inputs to bottlers in all territories (i.e., unintegrated). The elimination of double margins in some products but not in others affected the pricing incentives of the multiproduct bottlers (see Salinger 1991).

To see how vertical integration impacts the pricing incentives of a multiproduct firm,

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

consider the example presented in Figure 1. Before vertical integration (Figure 1a), a monopolist bottler 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 pre-merger 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. First, the elimination of the double margin creates an incentive to decrease the price of product 1 because of its lower marginal cost. This effect corresponds to the efficiency gains often present in vertical mergers. Second, the elimination of the double margin in product 1 gives the bottler greater marginal incentives to sell this product because it now earns the monopolist a higher margin (i.e., p_1^* versus the pre-merger 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, and it can only arise in the context of multiproduct firms selling substitute products. 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).[4]

Depending on the relative magnitude of each of these effects on prices, consumers may

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

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., PepsiCo), and bottlers who purchase the concentrate to produce, market, and distribute canned and bottled carbonated beverages. 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.[5]

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. 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;[6] 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.[7]

After the firms entered into their respective merger agreements, both Coca-Cola and PepsiCo acquired exclusive licenses to continue selling and distributing some of Dr

[5]We provide a summary of the FTC's complaints and decision orders in the Online Appendix.
[6]See https://www.ftc.gov/sites/default/files/documents/cases/2010/11/101105cocacolacmpt.pdf.
[7]See https://www.ftc.gov/sites/default/files/documents/cases/2010/09/100928pepscocmpt.pdf.

Pepper SG's brands in some territories. The licenses granted Coca-Cola exclusive rights to sell and distribute Dr Pepper and Canada Dry in former CCE territories, and PepsiCo exclusive rights to sell and distribute Dr Pepper, Crush, and Schweppes in former PBG and PAS territories. 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.

The vertical mergers and the agreements with Dr Pepper SG generated variation in 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 had an impact on vertical structure that affected some territories but not others. Second, neither PepsiCo nor Coca-Cola bottled Dr Pepper SG brands in all of the territories served by a vertically-integrated bottler, implying that not all areas impacted by vertical integration were exposed to the Edgeworth-Salinger effect.

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 rival brands. The vertically-integrated bottlers could have chosen to drop these rival 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 rival 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 rival 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 prices with the mergers.[8] 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 prices,

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

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,[9] and territory maps of the US bottling system in The Coke System and The Pepsi System books by Beverage Digest (Stanford, 2016a,b).[10]

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.[11] 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 ounce box of cans is generally about three times larger than the average price of a 67.6 oz bottle, even

[9] 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.

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

[11] 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 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, 357 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. 337 counties were served both by CCE in the case of Coca-Cola and by PBG, PAS, or PYC in the case of PepsiCo. 99 were served by at most one bottler that merged, while 16 counties were served by no bottlers that merged. Panel B of Table 2 shows that about 30 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 within county–product variation in vertical structure that was caused by the vertical mergers (e.g., product A in store s was bottled by an independent bottler before the merger and then 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 rival brands to measure the differential impact of vertical integration on own and rival brands. 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 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.[12]

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–quarter-of-year fixed effects, $\delta_{j,county(s),quarter(w)}$, where $quarter(w)$ is the quarter-of-the-year that corresponds to week w. These fixed effects capture that the relative popularity of each product may have varied across markets 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 can also examine the existence of differential trends before the vertical mergers using summary statistics. 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 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,

[12]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.

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 rival 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. However, 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

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

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; $Rival\,Product\,Bottled\,By\,CocaCola_j$ and $Rival\,Product\,Bottled\,By\,PepsiCo_j$ are indicators for whether product j was a rival 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. β_1 and β_2 measure how the elimination of double margins affects prices of own brands, while the coefficients β_3 and β_4 measure how the elimination of own-brand double margins affects prices of rival 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,

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

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 from 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 rival 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 1.6 percent relative to the prices of products bottled by bottlers that did not vertically integrate. This

suggests that vertical integration may have hurt 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 rival 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 1.7 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. 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 rival brands to divert demand to the brands that become more attractive to sell after vertical integration (i.e., own brands).

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 rival 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 to 2 percent, with no significant difference across firms ($p = 0.47$).

Lastly, in the fourth column we relax all the parameter restrictions and allow the price effects to vary both by brand type (i.e., own or rival) 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 1.4 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 4.1 and 3.1 percent, respectively.[13]

[13]We cannot reject that the coefficients measuring the effect of vertical integration on own brands are equal across firms ($p = 0.37$). We do however reject the hypothesis that the coefficients measuring the effect of vertical integration on rival brands is the same across firms ($p = 0.01$).

These effects are consistent with the change in pricing 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. On the other hand, prices of rival brands faced an upward pressure due to the incentive to divert demand to own brands (i.e., the Edgeworth-Salinger effect).

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 rival brands) and the prices of products that were never impacted by vertical integration, both before and after vertical integration. The estimates suggest no evidence of differential trends before the vertical mergers that were specific to products eventually sold by a vertically integrated bottler. The results also show 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 weight each observation (i.e., a product–store–week combination) by quantity sold (i.e., how many units of the product were sold in a given store–week combination). The weighted regressions give greater importance to the price effects of more popular products. The weights allow us to get closer to measuring the impact of vertical integration on the average price paid by a consumer when purchasing a carbonated beverage. Table 4 shows that the weights do not significantly impact the results, with vertical integration causing an overall increase in the prices of products bottled by vertically-integrated bottlers of about 1 percent.

We report the results of additional exercises in the Online Appendix. In the analysis we have presented so far, we define the post-merger period from the moment when the transactions took place. In Table A.1, 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.2, we progressively vary the set of fixed effects that we include in Table 3. The table shows that controlling for differences in prices across product–county combinations is important for measuring the negative impact of

vertical integration on the prices of own brands bottled by vertically-integrated bottlers. This is in contrast with the effect of vertical integration on the prices of rival brands bottled by a vertically-integrated bottler, which remains stable both in magnitude and statistical significance when varying the set of controls. Lastly, in Table A.3 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, these are mitigated by the Edgeworth-Salinger effect since prices are strategic complements.

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. On average, prices increased for products bottled by vertically-integrated bottlers after the vertical mergers. We take these results as empirical support for the Edgeworth-Salinger effect, and its economic relevance for the evaluation of vertical mergers. While these price effects are not per-se anticompetitive—similar price effects would result from technology upgrades that create cost reductions specific to own brands—they were caused by the vertical mergers. This suggests that the vertical mergers may have hurt consumers.

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 between 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 rival brands bottled by the integrated firms for which double marginalization was not eliminated. These results show that eliminating double marginalization may 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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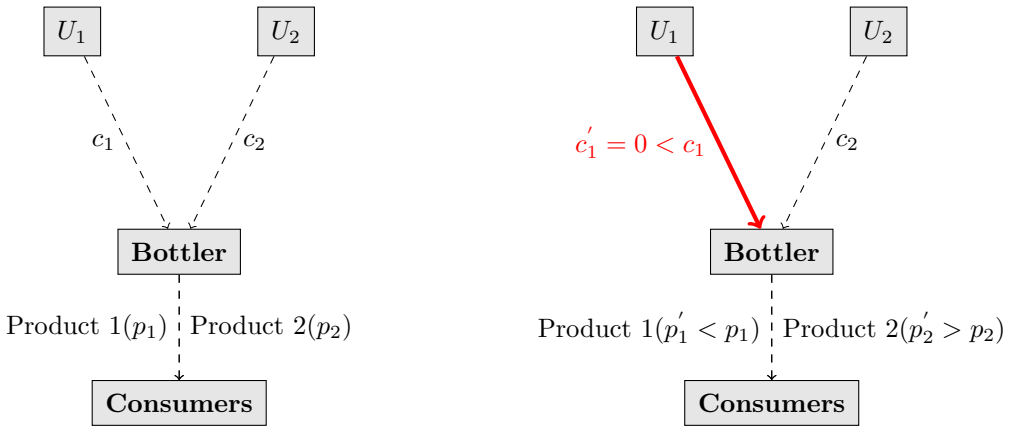
Tables and Figures

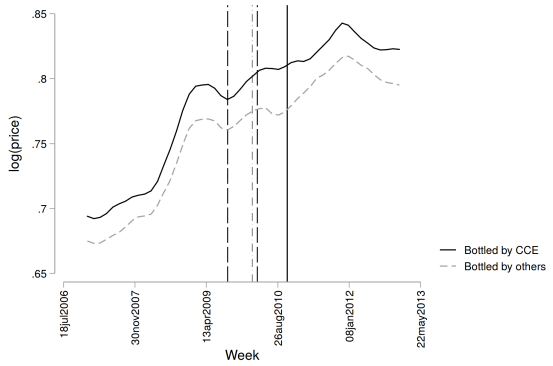


(a) Before vertical integration

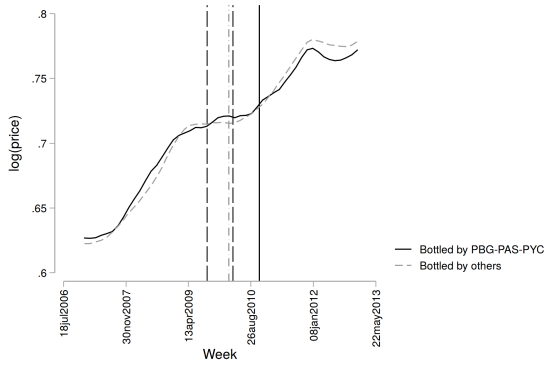
(b) After vertical integration

FIGURE 1: Illustrating the Edgeworth-Salinger Effect

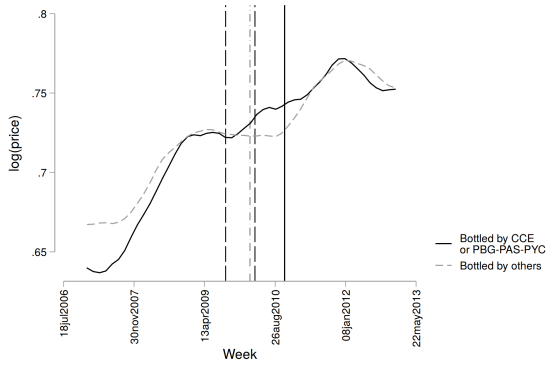
Notes: The figure presents an example that illustrates the Edgeworth-Salinger effect. Figure 1a shows a downstream bottler that produces Product 1 and Product 2 using inputs purchased from the upstream firms U_1 and U_2 at prices c_1 and c_2. Figure 1b illustrates what happens if the Bottler integrates 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 bottler 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 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 black–discontinuous vertical lines indicate PepsiCo mergers. The gray–discontinuous–dotted vertical line indicates the Coca-Cola merger. The black–continuous vertical line indicates when the mergers were cleared by the FTC.

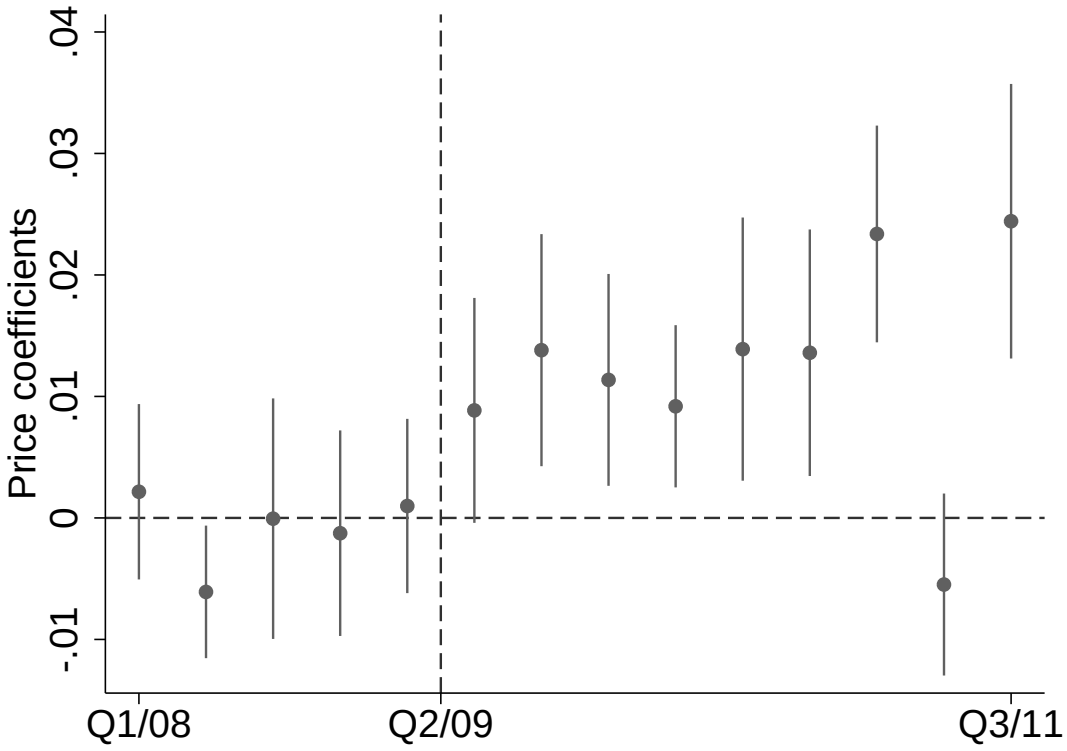


FIGURE 3: The dynamics of the impact of vertical integration on prices: OLS regressions.

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–quarter-of-year fixed effects.

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	.25	419,563	1.38	.33	430,677	4.06	.91
A & W	Dr Pepper	332,835	1.39	.29	494,576	1.38	.31	453,423	4.11	.87
Caffeine Free Coke Classic	Coke	8	.39	.49	258,465	1.43	.28	381,193	4.1	.94
Caffeine Free Diet Coke	Coke	159,796	1.52	.17	467,189	1.47	.29	464,532	4.08	.91
Caffeine Free Diet Pepsi	Pepsi	130,781	1.48	.15	442,667	1.38	.3	431,846	3.85	.9
Caffeine Free Pepsi	Pepsi	9,799	1.43	.14	387,122	1.38	.29	380,765	3.92	.95
Canada Dry	Dr Pepper	162,995	1.48	.37	497,235	1.42	.31	453,707	4.19	.86
Cherry Coke	Coke	207,155	1.52	.16	373,830	1.46	.28	407,591	4.06	.96
Coca Cola	Coke	533,963	1.51	.21	528,580	1.49	.29	526,331	4.14	.9
Coke Cherry Zero	Coke	109,654	1.51	.19	208,296	1.44	.28	367,184	4.08	.94
Coke Zero	Coke	487,079	1.51	.16	470,550	1.47	.29	468,109	4.1	.92
Crush	Dr Pepper	191,637	1.48	.23	306,956	1.4	.31	278,434	4.1	.93
Diet 7 Up	Dr Pepper	249,137	1.4	.28	480,120	1.36	.31	415,126	4.08	.9
Diet Coke	Coke	532,174	1.51	.15	521,255	1.48	.29	518,348	4.12	.89
Diet Dr Pepper	Dr Pepper	403,162	1.5	.18	466,501	1.42	.31	456,564	4	.89
Diet Mountain Dew	Pepsi	410,024	1.5	.15	442,132	1.39	.3	427,725	3.89	.92
Diet Pepsi	Pepsi	527,794	1.5	.15	515,905	1.4	.3	505,778	3.87	.85
Diet Sierra Mist	Pepsi	2,347	1.66	.2	317,431	1.37	.31	299,564	4.05	1.03
Diet Sunkist	Dr Pepper	151,155	2.91	2.65	381,735	1.34	.31	383,816	4.05	.93
Diet Wild Cherry Pepsi	Pepsi	110,370	1.51	.17	372,792	1.37	.29	368,506	3.91	.99
Dr Pepper	Dr Pepper	475,946	1.49	.18	495,583	1.43	.3	478,767	4.02	.89
Fanta	Coke	179,444	1.51	.18	389,343	1.4	.3	366,719	4.06	.97
Fresca	Coke	15,111	1.6	.22	326,044	1.45	.28	381,304	4.16	.89
Mountain Dew	Pepsi	519,248	1.5	.17	505,820	1.41	.3	488,515	3.89	.9
Mug	Pepsi	41,214	1.54	.38	355,710	1.38	.29	352,509	3.99	.99
Pepsi	Pepsi	531,426	1.5	.17	527,856	1.41	.3	518,216	3.9	.87
Pepsi Max	Pepsi	311,743	1.49	.21	342,318	1.39	.31	327,381	3.93	1
Schweppes	Dr Pepper	546,92	1.54	.19	341,113	1.4	.31	272,378	4.08	.95
Seagrams	Coke	20,150	4.44	3.64	267,565	1.44	.31	217,840	4.2	1
Sierra Mist	Pepsi	255,091	1.42	.16	294,823	1.34	.29	274,336	3.74	.9
Sprite	Coke	524,813	1.51	.15	431,691	1.5	.3	497,830	4.09	.93
Sprite Zero	Coke	188,689	1.51	.16	439,476	1.45	.29	434,485	4.11	.95
Squirt	Dr Pepper	136,769	1.42	.27	272,584	1.37	.3	234,350	3.97	.91
Sunkist	Dr Pepper	351,349	1.46	.35	475,504	1.36	.32	424,075	4.01	.94
Wild Cherry Pepsi	Pepsi	177,379	1.51	.17	411,074	1.39	.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	63	79
CCE	20	337	357
Total counties	36	400	436

Panel B: Counties where PBG–PAS–PYC and CCE bottled rival products

	Bottled rival products		Total counties
	No	Yes	
CCE	254	103	357
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 rival product bottled by Coca-Cola or PepsiCo bottler	0.016***			
	(0.003)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.017***		
		(0.003)		
VI · Rival product bottled by Coca-Cola or PepsiCo bottler		0.039***		
		(0.002)		
VI · Own or rival product bottled by Coca-Cola bottler			0.014***	
			(0.005)	
VI · Own or rival product bottled by PepsiCo bottler			0.018***	
			(0.004)	
$VI_{CocaCola}$ · Coca-Cola product				-0.014***
				(0.003)
$VI_{CocaCola}$ · Rival product bottled by Coca-Cola bottler				0.041**
				(0.004)
$VI_{PepsiCo}$ · PepsiCo product				-0.021***
				(0.006)
$VI_{PepsiCo}$ · Rival 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 × Quarter-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 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 times.

TABLE 4: The effect of vertical integration on prices: OLS regressions. Quantity-weighted observations.

	(1)	(2)	(3)	(4)
	log($price$)			
VI · Own or rival product bottled by Coca-Cola or PepsiCo bottler	0.008**			
	(0.004)			
VI · Own product bottled by Coca-Cola or PepsiCo bottler		-0.020***		
		(0.004)		
VI · Rival product bottled by Coca-Cola or PepsiCo bottler		0.034***		
		(0.005)		
VI · Own or rival product bottled by Coca-Cola bottler			0.009	
			(0.006)	
VI · Own or rival product bottled by PepsiCo bottler			0.012*	
			(0.007)	
$VI_{CocaCola}$ · Coca-Cola product				-0.019***
				(0.004)
$VI_{CocaCola}$ · Rival product bottled by Coca-Cola bottler				0.043***
				(0.007)
$VI_{PepsiCo}$ · PepsiCo product				-0.020***
				(0.006)
$VI_{PepsiCo}$ · Rival product bottled by PepsiCo bottler				0.027***
				(0.007)
Observations	37,106,025	37,106,025	37,106,025	37,106,025
R^2	0.903	0.903	0.903	0.903
Prod × County × Quarter-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
Weights	Number of units sold			

Notes: Standard errors clustered at the county level 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 times. Observations are weighted by the number of units sold for each product in a given store–week combination.

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 rival brands.

B Tables

TABLE A.1: The effect of vertical integration on prices: OLS regressions. Post-merger period starts after regulatory clearance.

	(1)	(2)	(3)	(4)
		log(*price*)		
$VI \cdot$ Own or rival product bottled by Coca-Cola or PepsiCo bottler	0.014***			
	(0.002)			
$VI \cdot$ Own product bottled by Coca-Cola or PepsiCo bottler		-0.011***		
		(0.002)		
$VI \cdot$ Rival product bottled by Coca-Cola or PepsiCo bottler		0.030***		
		(0.002)		
$VI \cdot$ Own or rival product bottled by Coca-Cola bottler			0.012***	
			(0.004)	
$VI \cdot$ Own or rival product bottled by PepsiCo bottler			0.016***	
			(0.003)	
$VI_{CocaCola} \cdot$ Coca-Cola product				-0.010***
				(0.003)
$VI_{CocaCola} \cdot$ Rival product bottled by Coca-Cola bottler				0.032***
				(0.003)
$VI_{PepsiCo} \cdot$ PepsiCo product				-0.012**
				(0.005)
$VI_{PepsiCo} \cdot$ Rival product bottled by PepsiCo bottler				0.024***
				(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 × Quarter-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 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.2: The effect of vertical integration on prices: OLS regressions. Alternative sets of fixed effects.

	(1)	(2)	(3)	(4)
	log(*price*)			
VI · Own product	-0.004	-0.004	-0.016***	-0.017***
bottled by Coca-Cola or PepsiCo bottler	(0.005)	(0.005)	(0.003)	(0.003)
VI · Rival product	0.032***	0.031***	0.042***	0.039***
bottled by Coca-Cola or PepsiCo bottler	(0.004)	(0.004)	(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 × Quarter-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 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 times.

TABLE A.3: 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***	-0.017***
bottled by Coca-Cola or PepsiCo bottler	(0.004)	(0.003)
VI · Rival 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 × Quarter-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 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 times. 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.