The Cost of an Inefficient Vertical Contract*

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Abstract

Vertical contracts govern firms' incentives along the supply chain. Contracts such as revenue-sharing agreements are used to satisfy incentive constraints but may be inefficient, leading to profit losses relative to vertical integration. We leverage variation in vertical structure and institutional knowledge to estimate the parameters of a revenue-sharing agreement used in the U.S. yogurt industry. Using these estimates in conjunction with an empirical model of supply and demand, we quantify the profit losses of an inefficient vertical contract relative to vertical integration. Our findings speak to incentive issues along the supply chain and the benefits of vertical integration.

Keywords: Boundaries of the firm, vertical contracts, revenue-sharing agreement, vertical integration

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1 Introduction

Firms face the challenge of designing contracts to align incentives along the vertical supply chain. Factors such as monitoring problems or asymmetries of information may prevent vertically independent firms from replicating the outcomes of an integrated supply chain that maximizes its overall profits (i.e., the first-best contract). The second-best contract, which maximizes profits subject to all incentive constraints, will generally feature inefficiency, affecting profits and consumers. A natural empirical question to ask is: How large is the profit loss of a supply chain relative to the first best? Or put differently: What are the costs of vertical independence?

Revenue-sharing agreements are an example of a commonly used vertical contract that may create inefficiency. Consider a revenue-sharing agreement between an upstream and downstream firm in which the downstream firm keeps a fraction $\mu \in (0, 1)$ of the downstream revenue, with the rest going to the upstream firm. For simplicity, assume that the upstream firm transfers intermediate inputs to the downstream firm at marginal cost (i.e., no double marginalization). Under the revenue-sharing agreement, the downstream firm will maximize profits by setting $\mu \times \text{MR} = \text{MC}$, whereas a vertically-integrated supply chain would set $\text{MR} = \text{MC}$ (where MR and MC are the marginal revenue and marginal cost functions of an integrated supply chain, respectively). In particular, the revenue-sharing agreement affects marginal incentives as though marginal costs were scaled up, $\text{MR} = \text{MC}/\mu > \text{MC}$, creating an upward pressure on prices that may lead to a lower quantity demanded and profits.

In an oligopoly setting, revenue-sharing agreements may also relax the intensity of price competition. The upward pressure on prices mentioned in the previous paragraph creates an incentive for rivals to increase prices due to strategic complementarities, even when these rivals are not subject to a revenue-sharing agreement. These equilibrium effects may lessen (or even reverse) the negative impact of a revenue-sharing agreement on the profits of a supply chain.[1]

In this paper, we empirically quantify the profit loss and distortions in market outcomes caused by a revenue-sharing agreement relative to vertical integration. Our contributions are two-fold. First, we exploit variation in vertical structure and institutional knowledge to identify the parameters of a revenue-sharing agreement, which is typically confidential information unavailable to researchers. Second, we use the estimates of the revenue-sharing agreement, in conjunction with an equilibrium model of demand and supply, to show that an inefficient vertical contract can significantly impact supply chain outcomes.

[1] A similar effect arises when supply chains make use of transfer pricing. See Alles and Datar (1998) for details.

Our setting is the U.S. yogurt industry. The supply chain of top-selling Yoplait products in the U.S. has featured two firms: Société de Diffusion de Marque (Sodima, hereafter) and General Mills. General Mills has manufactured, distributed, and sold Yoplait products in the U.S. since 1976. Between 1976 and 2011, Sodima owned the Yoplait brand, and General Mills sold Yoplait in the U.S. under a licensing contract that featured a revenue-sharing agreement. General Mills then acquired the Yoplait brand in July 2011. Before the transaction, Sodima was a supplier of intangible inputs (e.g., brand or image rights) to General Mills; after the transaction, the supply chain became vertically integrated, terminating the revenue-sharing agreement.

The U.S. yogurt industry is ideal for our analyses for two reasons. First, public documents describe the structure of the vertical contract between General Mills and Sodima (though the exact contract terms are not disclosed). Second, the industry features a change in vertical structure caused by General Mills' acquisition of Yoplait in 2011. The 2011 acquisition impacted General Mills' pricing incentives directly, while all other firms' pricing incentives were impacted in equilibrium.

To quantify the impact of the revenue-sharing agreement on market efficiency, we use weekly scanner data from 50 metropolitan areas in the U.S. from the IRI Marketing Data Set (Bronnenberg et al., 2008). We focus on the largest three yogurt manufacturers in the U.S., covering 75.6% of the category revenues between 2010 and 2012. We complement these data with public documents that reveal the structure of the revenue-sharing agreement between General Mills and Sodima.

In our work, we follow a two-step research design. First, we exploit variation in vertical structure to measure the equilibrium price effects of revenue-sharing agreements. Specifically, we compare within-product price changes among products that were subject to the revenue-sharing agreement, with those of products that were not subject to the agreement (e.g., Dannon products), before and after the transaction. We show that prices of Yoplait products decreased by 1.8 to 3 percent after General Mills acquired the Yoplait brand, relative to the prices of products that were not subject to the agreement. Importantly, we show that the price changes took place after the transaction was finalized and that these price reductions lasted through the end of our sample period.

Second, after establishing that the shift from a revenue-sharing contract to vertical integration impacted the prices of Yoplait products, as the theory predicts, we turn to quantifying the impact of the contract on market efficiency. We do this in three steps. First, we estimate demand for yogurt following the standard approach in the literature (Conlon and Gortmaker, 2020), including previous work in the U.S. yogurt industry (Villas-Boas, 2007; Hristakeva, 2022, among others). We then use the demand estimates, together with the first-order conditions of the pricing problem of yogurt manufacturers, to recover the firms' marginal costs and estimate the revenue-sharing parameters of the contract between General Mills and Yoplait. We estimate this parameter using two complementary approaches. In the first one, we use the demand estimates to recover the unobserved ratio of marginal costs and the revenue-sharing parameter (i.e., the marginal cost mc_{jt} for products of other manufacturers, and the ratio mc_{jt}/μ for Yoplait products before July 2011, and mc_{jt} afterward). We then use this ratio as the dependent variable in a linear regression that allows us to identify μ under the assumption that there were no systematic changes in the marginal costs of Yoplait products around the time of the transaction. We estimate that Sodima received about 3 percent of General Mills' Yoplait revenues.

In our second strategy to identify the revenue-sharing parameter, we follow an indirect inference approach. Specifically, we use our estimated model of demand and supply to compute equilibrium prices for different values of the revenue-sharing parameter. For each value of the revenue-sharing parameter, we replicate our price comparison exercise above: we compare within-product price changes among products that were subject to the revenue-sharing agreement, with those of products that were not subject to the agreement, before and after the transaction. If the only factor that impacted Yoplait products through July 2011 was the termination of the revenue-sharing contract, the true value of the revenue-sharing parameter would induce a null effect in prices. Using this approach, we estimate that Sodima received about 3 to 5 percent of General Mills' Yoplait revenues (i.e., these are the values that induce a null effect in different subsamples).

With these estimates of the revenue-sharing parameter in hand, we turn to quantify the impact of the revenue-sharing contract on the entire market. To do this, we first compute market outcomes when the revenue-sharing contract was in place. Then, we compare these outcomes with the market outcomes under vertical integration (i.e., when the revenue-sharing contract is no longer in effect).

Replacing the revenue-sharing contract with vertical integration led to price decreases for Yoplait products of between 1.95 to 3.3 percent, depending on which estimate of the revenue-sharing parameter we consider. The price decreases in Yoplait products led to an increase in Yoplait's market share of between 6.3 and 10.5 percent. We also find that General Mills' profits increased by 9.3 to 15.7 percent when eliminating the revenue-sharing agreement. Finally, we find that the presence of downstream competitors lessens General Mills' gains of implementing an efficient vertical contract, but the effect is of second order.

Our estimates imply that General Mills' annual profits increased by between $103 million and $173 million after eliminating the revenue-sharing agreement. Overall, our findings show that vertical integration led to lower prices, higher quantities, and higher profits, showing that inefficient vertical contracts can impact supply chains.

Why do Firms use Revenue-sharing Agreements?

Given the impact of revenue-sharing agreements on pricing incentives and profits, a natural question is, 'Why do firms use them?' The literature has identified benefits to revenue-sharing agreements that may outweigh the above-mentioned costs.

Gallini and Wright (1990) consider the problem of a seller transferring a technology to a buyer in the presence of asymmetric information and the possibility of imitation. The uninformed buyer may refuse to make relationship-specific investments if not reassured about the value of the technology.[2] The authors show that in equilibrium the informed seller will use a contract with output-related royalty to signal the value of a technology, which is not possible using only lump-sum payments. Beggs (1992) makes a similar point.

Revenue-sharing agreements (where compensation increases with output) can also be profitable to use as a tool to incentivize costly effort (Bhattacharyya and Lafontaine, 1995; Lazear, 2000).

Mortimer (2008) considers the vertical relationship between the movie distributor and the downstream video rental firms, where the latter purchase video cassettes from the former. In particular, the author considers a transition from linear contracts (a lump sum payment for every cassette) to revenue-sharing agreements, in which the rental revenue of a video cassette was shared between the movie distributor and the downstream video rental firm. The author shows that a revenue-sharing agreement can improve the profits of the supply chain, as it leads to more efficient inventory choices.[3]

As discussed, profit-sharing and revenue-sharing agreements can signal the value of a technology, incentivize effort, or coordinate investments in some cases. A key difference between profit-sharing and revenue-sharing agreements, however, is that the latter distorts pricing incentives, which impacts the profits of the supply chain. Although pricing incentives are not distorted when using a profit-sharing agreement, economic profits are harder to monitor than revenue. When monitoring costs are greater than the profit loss due to distorted pricing incentives, a revenue-sharing agreement will be preferred.

Rather than analyzing the reasons for using a revenue-sharing agreement in the U.S. yogurt industry, our contribution lies in uncovering the details of a revenue-sharing agreement and quantifying its impact on market outcomes. More broadly, we contribute to the literature studying the impacts of vertical arrangement on market efficiency.[4]

[2]Gil and Lafontaine (2012) make a similar point in the context of movie exhibition contracts.

[3]Mortimer (2008) considers a setting where the revenue-sharing agreement does not distort output decisions given an inventory choice.

[4]See, for example, Villas-Boas (2007); Hortaçsu and Syverson (2007); Gil (2009); Bonnet and Dubois

2 The Impacts of Revenue-sharing Agreements

To examine the impact of a revenue-sharing agreement on supply chain outcomes, consider the following Hotelling-style example (Hotelling, 1929). Two downstream firms compete with each other selling one product each: firm A and firm B. Firm A's product requires an input product supplied by an upstream firm (for simplicity, firm B's product does not). Firm A compensates the upstream firm by paying a fraction $1-\mu$ of its downstream revenue, where $\mu \in [0, 1]$.[5] We assume that the marginal cost of the input product is zero, which, for example, may capture that the input is intangible (e.g., brand or image rights). The marginal cost of production of firms A and B is given by c.

The products of firm A and B are horizontally differentiated, and a consumer with a preference parameter x will choose firm A's product if and only if:

$$v + \delta - p_A - \tau \cdot x \geq v - p_B - \tau \cdot (1 - x),$$

where v, δ, and τ are preference parameters, δ captures the asymmetry between products, and p_A and p_B are the prices of firms A and B, respectively. We assume x is uniformly distributed on the unit interval.[6] The demand for firm A and firm B's products are given by $x(p_A, p_B)$ and $1 - x(p_A, p_B)$, respectively, where

$$x(p_A, p_B) = \frac{1}{2} + \frac{\delta + p_B - p_A}{2\tau}.$$

The firms simultaneously choose their prices by maximizing $\pi_j(p_A, p_B)$. Firm A's problem is given by $\max_{p_A} \pi_A(p_A, p_B) = (\mu \cdot p_A - c)x(p_A, p_B)$, where μ is the coefficient of the revenue-sharing agreement.

How does the revenue-sharing agreement impact profits and pricing incentives? On the one hand, the revenue-sharing agreement creates inefficiency. To see this, divide $\pi_A(p_A, p_B)$ by μ, and the objective function becomes $\tilde{\pi}_A(p_A, p_B) = (p_A - c/\mu)x(p_A, p_B)$. One can immediately notice that a revenue-sharing agreement (i.e., $\mu < 1$) is equivalent, from an incentive perspective, to scaling up the marginal cost by $1/\mu$, which creates upward pressure on prices that creates inefficiency and distorts profits.

The profit of firm A's supply chain is given by $\pi_A^{SC}(p_A, p_B; \mu) = (p_A - c)x(p_A, p_B)$ since the production cost of the input is zero and the upstream and downstream firms share the revenue. Whenever $\mu < 1$, the downstream firm chooses $p_A^*(\mu, p_B) = \arg\max(p_A -$

(2010); Crawford and Yurukoglu (2012); Houde (2012); Asker (2016); Crawford et al. (2018); Luco and Marshall (2020); Chen et al. (2024); Gil et al. (2024).

[5]We abstract away from lump-sum payments, as they do not impact marginal pricing incentives.

[6]We assume v is sufficiently large that every consumer is served by one of the firms.

$c/\mu)x(p_A, p_B)$, which does not equal the price that solves $\max_{p_A}(p_A - c)x(p_A, p_B)$. That is, the revenue-sharing agreement decreases the profit of the entire supply chain relative to what it would earn without a revenue-sharing agreement, holding the prices of the rival fixed.[7]

On the other hand, the revenue-sharing agreement relaxes the intensity of price competition. The Nash equilibrium of the game features

$$p_A^* = \tau + \frac{\delta}{3} + \frac{2}{3}\frac{c}{\mu} + \frac{c}{3} \quad \text{and} \quad x^* = \frac{1}{2} + \frac{\delta - c/\mu + c}{6\tau},$$

which shows that the price of firm A decreases in μ.[8] Note that the effect of the revenue-sharing agreement on profits is different than that of a higher marginal cost, as the revenue-sharing agreement changes pricing incentives (of all downstream firms) but does not impact the actual marginal cost of production of firm A.[9]

Using these equilibrium values, we can compute the profit of the supply chain, $\pi_A^{*,SC} = (p_A^* - c)x^*$, and derive the impact of the revenue-sharing agreement on the profits of the supply chain:

$$\frac{\pi_A^{*,SC}}{\partial \mu} = \frac{\mu^2 6\tau}{c}\left(-\tau - \frac{\delta}{3} + \frac{4}{3}\frac{c}{\mu} - \frac{4}{3}c\right),$$

which can be positive or negative. That is, a revenue-sharing agreement may increase supply chain profits despite causing inefficiency.

In summary, a revenue-sharing agreement distorts pricing incentives, making it an inefficient vertical arrangement and lessening downstream price competition's intensity.[10] Because these effects impact the supply chain's profit differently, a revenue-sharing agreement has an ambiguous effect on equilibrium supply chain profits.

[7] Cachon and Lariviere (2005) argue that a revenue-sharing agreement where the downstream firm pays the upstream firm a particular wholesale price for each unit sold, w, in addition to a fraction $1-\mu$ the revenue can lead to supply chain coordination (i.e., outcomes that equal those of a vertically-integrated supply chain). Setting $w = \mu c - c < 0$ in the example above would imply that the profit function of the downstream firm equals $\pi(p;\mu) = \mu \cdot p \cdot q(p) - (c + w) \cdot q(p) = \mu \cdot (p - c) \cdot q(p)$, effectively converting the revenue-sharing agreement into a profit-sharing agreement, aligning pricing incentives along the supply chain.

[8] The equilibrium price of product B is given by $p_B^* = \tau - \delta/3 + 2c/3 + c/(3\mu)$.

[9] This is, while firm A operates as if its marginal cost is c/μ, the effective marginal cost is still c.

[10] Krishnan and Winter (2011) argue that a revenue-sharing agreement can lead to coordination of a supply chain in dynamic settings with inventory carryover.

3 Industry and Data

3.1 Industry Overview

In 1964, in France, farmers of various co-ops formed the "Société de Diffusion de Marque" (Sodima, hereafter). In 1965, Sodima combined two of their brands to form Yoplait. It was not until 1974 that a U.S. company, Michigan Cottage Cheese Co., acquired the rights to produce and market Yoplait in the United States. Yoplait was launched in the United States in 1976 (General Mills, 2015).

General Mills started exploring the possibility of producing yogurt in 1975. In 1977, upon discovering Yoplait in the United States, General Mills acquired the production and marketing rights for the United States, and it acquired the production facility built by Michigan Cottage Cheese Co. in Reed City, Michigan (General Mills, 2015).

In 1989, Sodima became Sodiaal (the acronym for "Société de diffusion internationale agro-alimentaire"). In 2002, PAI Partners (a private equity firm) and Sodiaal established a 50/50 partnership based on the Yoplait brand.

The contractual relationship between General Mills and Sodima/Sodiaal The 1977 license agreement between Sodima and General Mills granted General Mills a license to manufacture, distribute, and sell Yoplait in the United States.

The agreement had two main financial components.[11] First, the contract established that General Mills had to pay Sodima an annual licensing fee.[12] Second, General Mills also had to pay a royalty over Yoplait's revenues in the United States. The values associated with these terms are redacted in the public records and, as is generally the case with this type of contract, are unknown to researchers. However, public records do allow us to learn the structure of the licensing agreement.

In addition to these financial terms, the licensing agreement also established that Sodima had to assist General Mills in selecting and installing equipment and machinery, planning and adjusting the production process, quality control, and product development. Under the agreement, General Mills was responsible for production and promoting the Yoplait brand in the United States.[13]

With respect to product development, Sodima could develop new products and ask General Mills to introduce these in the United States, General Mills had the right to decline to do so based on expected profitability. At the same time, General Mills granted Sodima the

[11] See Yoplait Manufacturing and Distribution License Agreement. Accessed on January 29th, 2024.

[12] Though the 1977 licensing agreement was amended several times, it retained its basic structure with a licensing fee and a royalty rate.

[13] See footnote 11.

royalty-free right to manufacture, distribute, and sell any products developed by General Mills during the duration of the contract.[14]

The 2011 acquisition of Yoplait by General Mills In September 2010, General Mills filed for arbitration over its contract with Sodiaal after the latter announced its intention to terminate the agreement. This announcement was followed by a new one in March 2011, in which General Mills announced its intention to acquire 51.5% of Yoplait S.A.S. (the operating company) and 50% of Yoplait Marques S.A.S which held the Yoplait brand worldwide.[15] The agreement between General Mills and Sodiaal was signed in May 2011 and completed on July 1st, 2011, after securing regulatory approval.[16] The transaction amount was 1.1 billion (USD).

3.2 Data

We use price and sales information on the U.S. Yogurt industry at the store–week–product level from 2010 to 2012 from the IRI Marketing Data Set. We define a product as a brand–size combination (e.g., Yoplait Original 0.375 lbs). We measure quantities sold (and market shares) in terms of servings (a serving is defined as 0.375 lbs). That is, one 1 lb or one 1.5 lb product is equivalent to 2.67 and 4 servings, respectively. Prices are measured as total revenue divided by total servings sold, and these are measured for each product–store–week combination. We define a market as a store–week combination and define the market size as 1.5 times the maximum number of servings sold in that store across all weeks.

In our analysis, we restrict attention to three firms—General Mills, Groupe Danone, and Chobani—comprising 75.6% of the category revenue during our sample period. This leaves us with 22 brands (30 products). Table A.1 in the Online Appendix presents the list of products in our sample and product-level summary statistics.

We complement these data with the 2011 American Community Survey. For every geographic area in the IRI data, we take 500 random draws of the distribution of income per person. We include these in our demand system.

[14] See footnote 11.

[15] See "General Mills nears $1.1 billion deal to buy half of Yoplait," The New York Times, March 18th 2011. Accessed on January 29th, 2024.

[16] See "General Mills Completes Yoplait Acquisition," BusinessWire, July 1st 2011. Accessed on January 29th, 2024.

4 Price Effects of Revenue-Sharing Agreements

How does the revenue-sharing agreement (RSA) impact prices? As a first approach to answering this question, we compare within-product price changes among products that were subject to the RSA (i.e., Yoplait products) and those that were not, before and after the RSA was discontinued. This analysis allows us to measure the impact of eliminating the RSA net of the competitive response of other firms (or, in other words, the equilibrium effect of eliminating the RSA).

The baseline specification is given by

$$\log(\text{price}_{jst}) = 1\{\text{RSA termination}\}_{jst}\beta + \eta_{js} + \phi_{ts} + \varepsilon_{jst}, \tag{1}$$

where price_{jst} is the price of product j at store s in week t, $1\{\text{RSA termination}\}_{jst}$ is an indicator that takes the value one for Yoplait products after the RSA was terminated, η_{js} and ϕ_{ts} are fixed effects at the product–store and store–week level, and ε_{jst} is an error term clustered at the store level. Note that the product and time fixed effects are allowed to vary at the store level (i.e., we include fixed effects at the product–store and week–store level). This gives the model greater flexibility in capturing that the popularity of products can vary across locations and time-varying local demand factors that can affect prices.

We also estimate a version of Equation 1 where we allow for Yoplait-specific time-varying effects to examine when the price effects took place and the existence of differential trends before the RSA was terminated. We consider two dates for the RSA termination: March 2011 (General Mills announced its intention to acquire Yoplait) and July 2011 (actual acquisition date).

Table 1 shows estimates for Equation 1 for the two RSA termination dates. Column 1 shows that the prices of Yoplait products decreased by 1.1 percent relative to rival products *after* General Mills announced its decision to acquire Yoplait. Column 2 shows that the prices of Yoplait products decreased by 1.8 percent relative to rival products *after* the RSA was terminated (i.e., the acquisition was completed). These results align with the theory suggesting that an RSA distorts incentives, leading to higher prices. Columns 3 and 4 repeat the analysis, excluding quarters 3 and 4 of 2011, to consider the possibility that the response to the change in incentives was delayed due to a transition period after the transaction. The estimates suggest a decrease in prices of 1.6 to 3 percent on average following the elimination of the RSA.

Figure 1 repeats the analysis allowing for time-varying effects. Panel A considers the full sample, while Panel B restricts the sample to product–store–week combinations flagged

Table 1: The Impact of Revenue Sharing on Prices

	(1)	(2)	(3)	(4)
	Price (in logs)			
	Full sample		Excluding Q3/Q4 2011	
General Mills * Post March 2011	-0.011		-0.016	
	(0.002)		(0.002)	
General Mills * Post July 2011		-0.018		-0.030
		(0.002)		(0.002)
N	3,199,520	3,199,520	2,659,893	2,659,893

Notes: Standard error clustered at the store level in parentheses. An observation is a store–week–product combination. All columns include product–store and week–store fixed effects. Columns 3 and 4 exclude quarters 3 and 4 of 2011.

as *not* having a price promotion.[17] The vertical lines identify July 2011, when the Yoplait acquisition was completed. Both panels show no evidence of differential trends before July 2011 and immediate price decreases after July 2011, providing further evidence supporting the theory.

5 Model

5.1 Demand

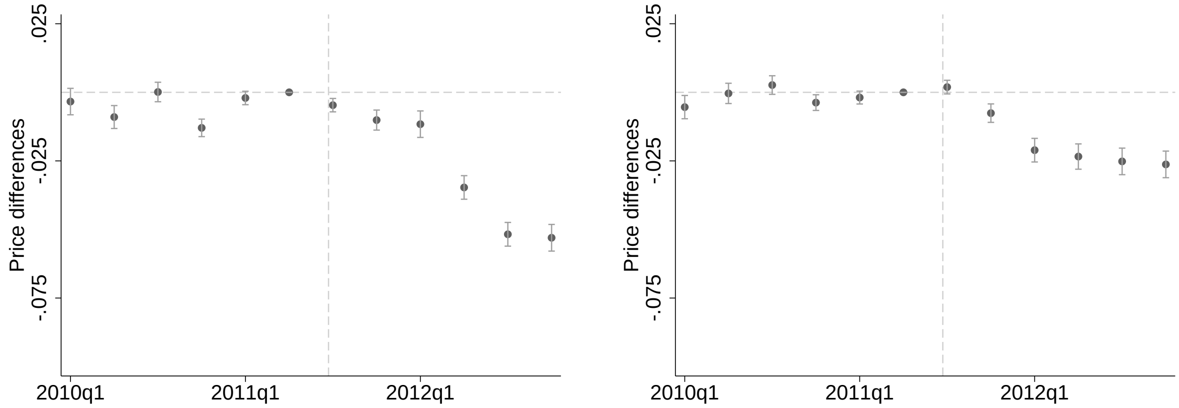
We model consumers' preferences following Berry et al. (1995); Nevo (2001), and the literature that followed. We consider a market to be a store–week combination, and we model consumers' preferences in the product characteristics space and specify the indirect utility function as

$$u_{ijst} = -\alpha_i p_{jst} + \beta_i + \gamma_{js} + \gamma_t + \xi_{jst} + \varepsilon_{ijst}, \tag{2}$$

where p_{jst} and ξ_{jst} are the price and unobserved characteristics of product j at store s in week t, respectively, and γ_{js} and γ_t are product–store and time fixed effects. The consumer-specific parameter α_i is consumer i's price coefficient, whereas β_i is consumer i's taste for the inside goods (i.e., a random coefficient on the constant). Finally, we assume that ε_{ijst} is an i.i.d. extreme value type 1 idiosyncratic taste shock.

[17] The price promotion flag is a variable included in the IRI dataset and takes the value one when a temporary price discount of five percent or greater is in effect for a given product–store–week combination.

Figure 1: The Impact of Revenue Sharing on Prices (in Logs)



Panel A: Full sample *Panel B*: No price promotions

Notes: Standard error clustered at the store level in parentheses. An observation is a store–week–product combination. All columns include product–store and store–week fixed effects.

We model α_i and β_i as

$$\alpha_i = \exp\{\alpha + \sigma_p \cdot v_i^{\alpha} + \pi_p \cdot \text{income}_i\} \quad \text{and} \quad \beta_i = \beta + \sigma_0 \cdot v_i^{\beta} + \pi_0 \cdot \text{income}_i,$$

where income_i is consumer i's income (normalized to be in the unit interval) and both v_i^{α} and v_i^{β} are drawn from a standard normal distribution.[18]

5.2 Supply

To model the supply side of the market, we assume that firms compete à la Bertrand-Nash and choose the prices of their portfolio of products to maximize their profits at the market level. Specifically, we assume that firm f, selling product portfolio $\mathcal{J}_{fst}$ at store s in week t, solves

$$\max_{p_{jst} \forall j \in \mathcal{J}_{fst}} \sum_{j \in \mathcal{J}_{fst}} (p_{jst}\mu_{jst} - c_{jst}) M_{st} s_{jst}(\mathbf{p}), \tag{3}$$

where μ_{jst} corresponds to the share of revenues that firm f keeps (and $1-\mu_{jst}$ corresponds to the share of revenues that f pays to the upstream firm), c_{jst} is the marginal cost of product j at store s in week t, and M_{st} represents the size of the market.

[18] We specify the random coefficient on price to be log-normally distributed to lessen ex-ante restrictions on the model's cost pass-through (Miravete et al., 2023). In the case of the draws v_i^{α} and v_i^{β}, we use 500 scrambled Halton draws per market.

The first-order conditions for firm f are given by

$$s_{jst}(\mathbf{p}) + \sum_{k \in \mathcal{J}_{fst}} (p_{kst} - c_{kst}/\mu_{jst}) \frac{\partial s_{kst}(\mathbf{p})}{\partial p_{jst}} = 0.$$

We can also write the first-order conditions of market t in matrix form

$$\mathbf{s}_{st}(\mathbf{p}) - \Omega(\mathbf{p})(\mathbf{p}_{st} - \mathbf{c}_{st}/\mu_{st}) = 0,$$

where $\Omega(p)$ is a $J_t \times J_t$ matrix with the element-by-element product of the ownership matrix and the partial derivatives of demand with respect to prices (Nevo, 2001) and $\mathbf{c}_{st}/\mu_{st}$ is the element-wise division of $\mathbf{c}_{st}$ and μ_{st}.

6 Estimation

6.1 Demand

We estimate demand using `pyBLP` (Conlon and Gortmaker, 2020). In the estimation, we follow Nevo (2001) and include product–store fixed effects ξ_{js}, which absorb time-invariant product characteristics and time-invariant product-specific demand shifters at the store level. Further, we also include week fixed effects ξ_t. Our specification includes a random coefficient on price and on the intercept, which allows us to rationalize substitution to the outside option more flexibly.

We estimate our demand model using a 2-step GMM approach. In the first step, we use cost shifters and local differentiation instruments to address price endogeneity and to identify the random coefficients. In the first set of instruments, we include the interaction between diesel prices and the distance from production facilities to stores (Hristakeva, 2022), an indicator that equals one for General Mills' products after the transaction between General Mills and Sodiaal and zero before it, and the mean weekly temperature in the zip code of each store. We also include store–week counts of products featured and displayed. We construct the second set of instruments following Gandhi and Houde (2023) and include one based on the number of products with a Euclidean distance on price that is less than one standard deviation of the price distribution, and one that interacts a product's price with this distance, which helps in identifying the random coefficient on the intercept. Finally, in the second step of our GMM estimator, we construct approximated optimal instruments following Conlon and Gortmaker (2020).

We report our estimates in Table 2. In the first column, we report the estimates of

Table 2: Demand estimates: specifications with product-store and week fixed effects

	(1)	(2)	(3)
Price RC (Log Normal)			
Constant (α)	1.578	1.522	2.100
	(0.033)	(0.004)	(0.013)
Normal draw (σ_p)		0.034	0.015
		(0.002)	(0.009)
Household income (π_p)			-17.160
			(0.532)
RC on Constant (Normal)			
Normal draw (σ_0)		3.942E-05	0.039
		(0.085)	(0.025)
Household income (π_0)			-26.520
			(1.949)
Observations	3,199,520	3,199,520	3,199,520
Median own-price elasticity	-3.66	-3.45	-3.60

Notes: Standard error clustered at the store level in parentheses. An observation is a store–week–product combination. All specifications include product-store and week fixed effects.

the version of the model without customer heterogeneity (i.e., $\alpha_i = \alpha$ and $\beta_i = \beta$ for all consumers i). We report the estimates of the full model in columns 2 and 3. Column 3 incorporates consumer demographics (namely, household income) into the random coefficients, whereas column 2 does not. The estimates in column 2 reveal the existence of unobserved consumer heterogeneity in price sensitivity (σ_p) and near null heterogeneity on the intercept (σ_0). These patterns remain unchanged in column 3, but column 3 also shows that higher-income households are less price-sensitive and are more willing to substitute toward the outside option (both effects are statistically significant). In the rest of the paper, except where noted, we report results for these two specifications.

Figure A.1 in the Online Appendix reports the cumulative distribution function (CDF) of the implied own-price elasticities across all the observations in our data, using the estimates in Table 2 (column 3). Table A.2 in the Online Appendix reports various percentiles of the distribution of own-price elasticities by the firm for the same specification. Overall, we find that own-price elasticities vary between -2 and -6. The median own-price elasticity is -3.6, while the mean is -3.65. These elasticities are in line with those reported in previous work but are smaller in absolute value (e.g., Hristakeva, 2022 and Villas-Boas, 2007 report mean own-price elasticity equal to -4.05 and -5.64, respectively), which may be explained by our decision to estimate demand with products of the three most popular brands in this product category.

Finally, in Table A.3 and Table A.4 in the Online Appendix we report the full matrices of median own- and cross-price elasticities for all the products in our data.

6.2 Revenue Sharing Agreement and Marginal Costs

Given the demand estimates, we can recover marginal costs up to the revenue-sharing agreement parameter μ using

$$\frac{\mathbf{c}_{st}}{\mu_{st}} = \mathbf{p}_{st} - \Omega(\mathbf{p}_{st})^{-1}\mathbf{s}_{st}(\mathbf{p}_{st}), \tag{4}$$

where $\mu_{jst} = \mu$ for Yoplait products prior to July 2011 and $\mu_{jst} = 1$ otherwise.

The empirical challenge is separating $\mathbf{c}_{st}$ from μ_{st}. We propose two complementary approaches for doing so.

Marginal Cost Approach

Using Equation 4, we recover $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jst}$ using our demand estimates. We model c_{jst} and we separate it from μ_{jst} leveraging the termination of the revenue-sharing agreement, which was specific to Yoplait products.

Specifically, we assume $c_{jst} = \exp\{\gamma_t + \kappa_j + \varepsilon_{jst}\}$, where γ_t and κ_j are week and product fixed effects, respectively, and ε_{jst} is an error term clustered at the store level. Taking the logarithm of $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jst}$, and using that $\mu_{jst} = \mu$ for Yoplait products prior to July 2011 and $\mu_{jst} = 1$ otherwise, we obtain

$$\log \tilde{c}_{jst} = \gamma_t + \gamma_j - \log \mu \cdot 1\{\text{Yoplait, pre-July 2011}\} + \varepsilon_{jst}.$$

We assume that there is no systematic change in marginal costs except for a common trend. That is, the termination of the revenue-sharing agreement is the only systematic change in $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jst}$ affecting Yoplait products.

We estimate this equation using the full sample and excluding quarters 3 and 4 of 2011. Table 3 reports the estimates for the revenue sharing coefficient. We find that when we exclude quarters 3 and 4 of 2011, the coefficient is about 0.97, and does not vary across specifications, suggesting that General Mills was paying Sodima about 3 percent of its revenues while the revenue-sharing agreement was in place.

Table 3: Estimating the Revenue Sharing Parameter: Marginal Cost Approach

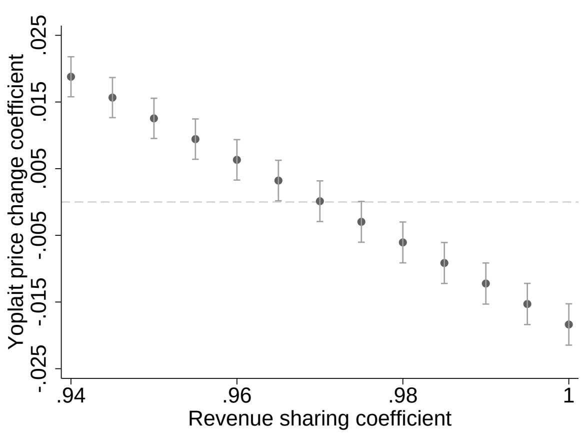
	(1)	(2)	(3)	(4)
	No demographics		Demographics	
		Excluding		Excluding
	Full sample	Q3/Q4 2011	Full sample	Q3/Q4 2011
Yoplait * Pre July 2011	0.016	0.029	0.018	0.029
	(0.003)	(0.004)	(0.003)	(0.003)
N	3,197,702	2,658,172	3,198,599	2,659,056
Implied Rev. Sharing Coef.	0.984	0.972	0.983	0.972

Notes: Standard errors clustered at the store level in parentheses. An observation is a product–store–week combination. The 'no demographics' and 'demographic' specifications make use of the estimates in columns (2) and (3) of Table 2. In all specifications we reject the hypothesis that $\hat{\mu}$ is equal to 1.

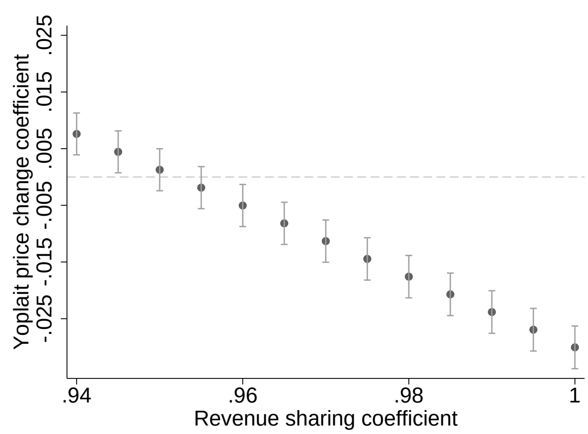
Indirect Inference Approach

In our second approach, we start by computing $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jst}$ using our demand estimates. As before, we assume $\mu_{jst} = \mu$ for Yoplait products prior to July 2011 and $\mu_{jst} = 1$ otherwise. We then take an arbitrary value of μ (call it μ^{guess}) and compute the implied marginal costs: $c_{jst}^{\mu^{\text{guess}}} = \mu^{\text{guess}}\tilde{c}_{jst}$ for Yoplait products prior to July 2011 and $c_{jst}^{\mu^{\text{guess}}} = \tilde{c}_{jst}$ otherwise.

Figure 2: Estimating the Revenue Sharing Parameter: Indirect Inference Approach



A) Full sample



B) Excluding Q3/Q4 2011

Notes: The specifications make use of the estimates in Column (3) of Table 2. Panel B excludes the third and fourth quarter of 2011, as in columns (3) and (4) of Table 1.

Next, we compute the equilibrium prices for every market using $\mathbf{c}^{\mu^{\text{guess}}}$ and our demand estimates. We denote these prices $\mathbf{p}^{\mu^{\text{guess}}}$. Lastly, we estimate equation (1) using $\mathbf{p}^{\mu^{\text{guess}}}$. That is, we make within-product price comparisons of Yoplait products and products not directly affected by the revenue-sharing agreement before and after July 2011, using prices $\mathbf{p}^{\mu^{\text{guess}}}$.

What is the idea? Under the assumption that the revenue-sharing agreement termination was the only systematic factor affecting Yoplait products through July 2011, the estimates of equation (1) using $\mathbf{p}^{\mu^{\text{guess}}}$ should reveal a null effect (i.e., $\hat{\beta} = 0$ in equation 1) if the value μ^{guess} equals the true value of μ governing the revenue-sharing agreement. Using this logic, we repeat the steps above, searching for the value of μ^{guess} such that $\hat{\beta} = 0$.

Figure 2 presents the estimates of β in equation (1) using the prices $\mathbf{p}^{\mu^{\text{guess}}}$ that correspond to different values of μ^{guess}. We do this exercise using the demand estimates in Table 2 (column 3), and we repeat the analysis excluding quarters 3 and 4 of 2011.[19] In Figure 2.A and Figure 2.B, we find that the value of μ that leads to $\hat{\beta} = 0$ is $\hat{\mu} = 0.97$, whereas we find that this value is $\hat{\mu} = 0.95$ when excluding quarters 3 and 4 of 2011. These results suggest that General Mills paid Sodima between 3 and 5 percent of its revenues while the revenue-sharing agreement was in place.

We conclude this section by noting that both methods for estimating the RSA exploit the termination of the RSA and rely on the price variation caused by the RSA. In both cases, we rely on the assumption that the termination of the RSA was the one systematic factor that changed pricing incentives during the sample period. The key difference among both methods is that the marginal cost approach uses a transformation of the equilibrium vector of prices (see equation 4) whereas the indirect inference approach uses prices directly. Confounders that impact prices (e.g., a product-specific demand shock) may have a differential effect on the estimates of the RSA depending on the method used. We find similar estimates across methods ($\hat{\mu} = 0.95$ and $\hat{\mu} = 0.97$), which suggests that confounders that violate our identification assumption (if any) play a minor role.

7 The Cost of an Inefficient Vertical Contract

How does the revenue-sharing agreement (RSA) impact General Mills' profits and supply chain? We answer this question by comparing the baseline equilibrium (i.e., that with the RSA in place) with the counterfactual equilibrium in which Yoplait's supply chain is vertically integrated (i.e., the revenue-sharing agreement parameter is set to $\mu = 1$). This comparison allows us to learn about the impact of the distortion on pricing incentives caused by the

[19]See Figure A.2 in the Online Appendix for the same analysis using the estimates in Table 2 (column 2).

RSA on market outcomes. We restrict attention to the period before July 2011, which is the period before General Mills acquired Yoplait.

General Mills's Outcomes

We first measure the impact of the RSA on endogenous outcomes set by General Mills. We compute and compare these endogenous variables under three scenarios: i) baseline equilibrium with RSA; ii) no RSA, but General Mills is the only firm allowed to reoptimize; and iii) equilibrium without RSA. The difference between scenarios ii) and iii) allows us to separate the direct effect of eliminating the RSA from the equilibrium feedback effects that come into play once all firms best respond and a new equilibrium without RSA is reached.

Table 4 presents the results of this comparison for the model estimates based on Table 2 (Column 3).[20] We consider RSAs with values of $\hat{\mu} = 0.97$ (estimate using the marginal cost approach) and $\hat{\mu} = 0.95$ (estimate using the indirect inference approach). Each column of the table presents estimates for the following equation

$$\log(X_{jswt}) = \delta_0 + 1\{\text{no RSA, best-response}\}_{jswt}\delta_1 + 1\{\text{no RSA, equilibrium}\}_{jswt}\delta_2 + \varepsilon_{jswt},$$

where X_{jswt} is an outcome variable (price, market share, or profit) for product j at store s in week w under scenario $t \in \{\text{baseline equilibrium, no RSA, best-response, no RSA, equilibrium}\}$. The omitted category in the equation is the baseline equilibrium scenario.

The table shows that removing the revenue-sharing agreement leads to an average equilibrium price decrease in Yoplait (General Mills) products of 1.95 to 3.3 percent, depending on the value of μ. As discussed in Section 2, from the perspective of pricing incentives, an RSA is equivalent to having an inflated marginal cost. When the RSA is eliminated, the upward pressure on prices introduced by the RSA is eliminated. The effects of eliminating the RSA on Chobani and Groupe Danone products are of second order, making the effects on prices nearly identical between the cases in which the RSA is eliminated and only General Mills is allowed to reoptimize (row labeled 'Best-response wo/RSA') and the equilibrium without the RSA (row labeled 'Equilibrium wo/RSA').

We find that eliminating the RSA causes an average increase in the equilibrium market share of General Mills products of between 6.3 to 10.5 percent. This suggests that eliminating the RSA helps General Mills increase the market share of its products by stealing market share away from rivals and the outside option. Lastly, we compute the change in a product's profit in a store when eliminating the RSA. We find that the equilibrium profits of Yoplait

[20] See Table A.5 in the Online Appendix for more details, with a breakdown of changes in market outcomes by firm.

Table 4: The Impact of a Revenue Sharing Agreement on Market Outcomes: General Mills

	(1)	(2)	(3)	(4)	(5)	(6)
		$\mu = 0.97$			$\mu = 0.95$	
	Price	Share	Profit	Price	Share	Profit
Best-response	-0.0195	0.0632	0.0935	-0.0325	0.1051	0.1565
wo/RSA	(0.0005)	(0.0021)	(0.0021)	(0.0004)	(0.0021)	(0.0021)
Equilibrium	-0.0195	0.0631	0.0933	-0.0325	0.1049	0.1563
wo/RSA	(0.0005)	(0.0021)	(0.0021)	(0.0004)	(0.0021)	(0.0021)
N	2,402,718	2,402,718	2,402,718	2,402,718	2,402,718	2,402,718

Notes: The estimates are based on demand estimates in Table 2 (column 3). Standard errors in parentheses. An observation is a product–store–week combination. We restrict attention to weeks before July 2011 (i.e., the time when the transaction was completed) and General Mills products. Each column displays regression coefficients of $\log(X)$, for $X \in \{\text{price}, \text{market share}, \text{profit}\}$, on an indicator for when General Mills best responds to the removal of the RSA (but all other firms are not allowed to respond) and an indicator for the equilibrium without RSA (an indicator for the baseline equilibrium is the omitted category).

products, captured by General Mills, increased by between 9.3 and 15.7 percent on average.

Did downstream competition limit the extent to which the RSA introduced inefficiencies in this market? The model we discussed in Section 2 shows that the main effect of the RSA is to distort the pricing incentives of the firm that is subject to it. However, the presence of downstream rivals, which are not subject to the RSA, limits the extent of the inefficiency caused by this contract, as these firms may respond by increasing their prices too. Table 4 shows that the competitive effects are of second order in this setting, and the direct effect of eliminating the RSA dominates the comparison.

How large are these effects? We find that eliminating the RSA would have increased the profit earned by General Mills in a store–year by between \$1,594 ($\mu = 0.97$) and \$2,689 ($\mu = 0.95$) on average. Assuming that the sample of stores in the IRI Marketing Data Set is representative of the universe of supermarket/grocery stores in the U.S. at the time of General Mills's acquisition of Yoplait, the nation-wide change in General Mills' annual profits from eliminating the RSA is between \$103 million and \$173 million.[21] Note that we exclude licensing fees from this calculation (i.e., lump sum payments between General Mills and Sodima).

[21] Here, we scale up the store–year average profit change (between \$1,594 and \$2,689) by 64,366, which is the number of supermarket/grocery stores in the U.S. in 2011 according to the County Business Patterns.

Table 5: The Impact of a Revenue Sharing Agreement on General Mills' Supply Chain Profit

	(1)	(2)
	$\mu = 0.97$	$\mu = 0.95$
	General Mills's Supply Chain Profit	
Best-response wo/RSA	0.0038	0.0087
	(0.0021)	(0.0021)
Equilibrium wo/RSA	0.0037	0.0084
	(0.0021)	(0.0021)
N	2402718	2402718

Notes: The estimates are based on demand estimates in Table 2 (column 3). Standard errors in parentheses. An observation is a product–store–week combination. We restrict attention to weeks before July 2011 (i.e., the time when the transaction was completed) and General Mills products. Each column displays regression coefficients of log(Profit of supply chain) on an indicator for when General Mills best responds to the removal of the RSA (but all other firms are not allowed to respond) and an indicator for the equilibrium without RSA (an indicator for the baseline equilibrium is the omitted category).

General Mills's Supply Chain Outcomes

Our findings suggest a significant distortion in prices and the profits of General Mills caused by the revenue-sharing agreement (RSA). What is the impact of the RSA on Yoplait's supply chain profits? In the scenario with the RSA, the profits of the supply chain equal the sum of the profits of General Mills (product market profits minus the revenue shared with Sodiaal) and Sodiaal (revenue collected from General Mills), whereas in the scenario without the RSA the profits of the supply chain equal the profits of General Mills.

As argued in Section 2, the RSA has two effects on the profits of the supply chain. On the one hand, it inflates prices, which increases the price–cost margin of the supply chain. On the other hand, the greater prices cause a decrease in the market shares of the supply chain's products. Depending of the relative magnitude of these effects, the RSA may increase or decrease supply chain profits.

Table 5 presents the results of comparing supply chain profits across the same scenarios as in Table 4. The table shows that eliminating the RSA increases the profits of General Mills' supply chain by 0.37 and 0.84 percentage points when $\mu = 0.97$ and $\mu = 0.95$, respectively. These findings suggest that while the RSA has an economically significant impact on General Mills's profits, it has a modest impact on the profits of the supply chain. This result may explain why RSAs are common in practice.

8 Concluding Remarks

Revenue-sharing agreements (RSA) are commonly used along the vertical supply chain. We argue that RSAs introduce a distortion in the supply chain that leads to inefficiency. We quantify the magnitude of this inefficiency in the context of a specific RSA that was in place in the U.S. yogurt industry until 2011. Specifically, between 1976 and 2011, Sodiaal (a French firm originally named Sodima and renamed in 1989) owned the Yoplait brand. In the U.S., General Mills sold Yoplait under a licensing contract that involved an RSA. This agreement was terminated in 2011 when General Mills acquired the Yoplait brand. After this transaction, the supply chain became vertically integrated.

Though the terms of the RSA remain confidential, we exploit our knowledge of the contract structure and its termination date to identify the contract terms. We do this by first estimating demand for the U.S. yogurt industry. With estimates of demand in hand, we recover the ratio of marginal costs and the revenue sharing parameter (μ for Yoplait products before the transaction and one after it, and one for all other products over the entire sample period). We then use two complementary approaches to identify and estimate the revenue-sharing parameter μ. We find that General Mills paid between 3 and 5 percent of its annual category revenues to Sodiaal between 2010 and 2011.

With the estimates of the revenue-sharing parameters in hand, we turn to quantifying the RSA's impact on equilibrium outcomes. We find that vertical integration (eliminating the RSA) decreased equilibrium prices by between 1.95 and 3.3 percent and increased General Mills' equilibrium profits by between 9.3 and 15.7 percent. These findings speak to the distortionary effects of revenue-sharing agreements.

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Online Appendix: Not For Publication

The Cost of an Inefficient Vertical Contract

Fernando Luco and Guillermo Marshall

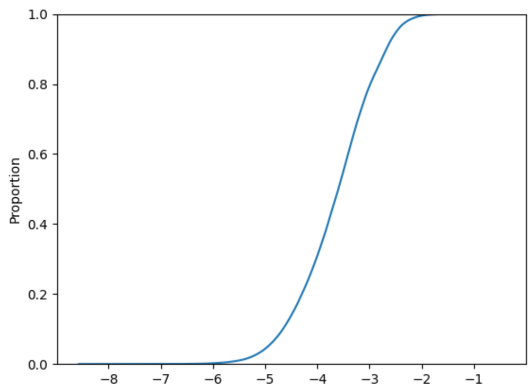
A Additional Tables and Figures

Table A.1: Summary Statistics

		0.375 lbs			1 lbs			1.5 lbs		
Brand	Firm	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
Brown Cow	Groupe Danone	35,273	1.06	0.24	9,132	3.72	0.56			
Chobani	Chobani	166,203	1.33	0.20	78,602	3.40	0.52			
Dannon	Groupe Danone	115,589	0.67	0.18						
Dannon Activia	Groupe Danone				199,994	2.48	0.42	62,085	3.00	0.48
Dannon Activia Dessert	Groupe Danone				40,468	2.33	0.44			
Dannon Activia Fiber	Groupe Danone				123,824	2.45	0.43			
Dannon Activia Light	Groupe Danone				188,986	2.47	0.42	51,413	2.90	0.51
Dannon All Natural	Groupe Danone	131,621	0.66	0.15						
Dannon Danimals Crushcups	Groupe Danone				127,910	2.36	0.34			
Dannon Lght N Ft Crb & Sugr C	Groupe Danone				67,062	3.05	0.37			
Dannon Light N Fit	Groupe Danone	132,490	0.66	0.16				177,785	2.21	0.35
Dannon Nutriday	Groupe Danone				4,976	1.01	0.08			
Stonyfield Farm	Groupe Danone	85,092	0.96	0.20				20,811	4.08	0.60
Yoplait	General Mills	138,101	1.04	0.21	42,329	2.85	0.44			
Yoplait Delights	General Mills				119,754	2.87	0.46			
Yoplait Fiber One	General Mills				87,553	2.52	0.42			
Yoplait Light	General Mills	203,545	0.67	0.13				0		
Yoplait Light Thick & Creamy	General Mills	141,848	0.66	0.12						
Yoplait Original	General Mills	212,541	0.69	0.15				96,226	2.47	0.42
Yoplait Thick & Creamy	General Mills	150,554	0.66	0.12						
Yoplait Trix	General Mills							130,972	2.69	0.46
Yoplait Yo Plus	General Mills				70,452	2.36	0.45			

Notes: An observation is a store–week–product combination. The columns labeled "Mean" and "S.D." report the mean and standard deviation of prices for each product.

Figure A.1: Estimated own-price elasticities



Notes: The figure reports the cumulative distribution function (CDF) of the estimated own-price elasticities according to specification 3 in Table 2.

Table A.2: Estimated own-price elasticities by firm

		Percentile								
Firm	Mean	1%	5%	10%	25%	50%	75%	90%	95%	99%
Chobani	-4.37	-6.17	-5.62	-5.32	-4.83	-4.32	-3.86	-3.46	-3.27	-2.9
General Mills	-3.52	-5.36	-4.85	-4.55	-3.97	-3.42	-3.01	-2.66	-2.48	-2.17
Danone	-3.64	-5.31	-4.85	-4.59	-4.14	-3.65	-3.15	-2.64	-2.45	-2.07

Notes: The table reports percentiles of the firm-specific distribution of own-price elasticities. An observation is a product-store-week combination. The table is based on the estimates of specification 3 in Table 2

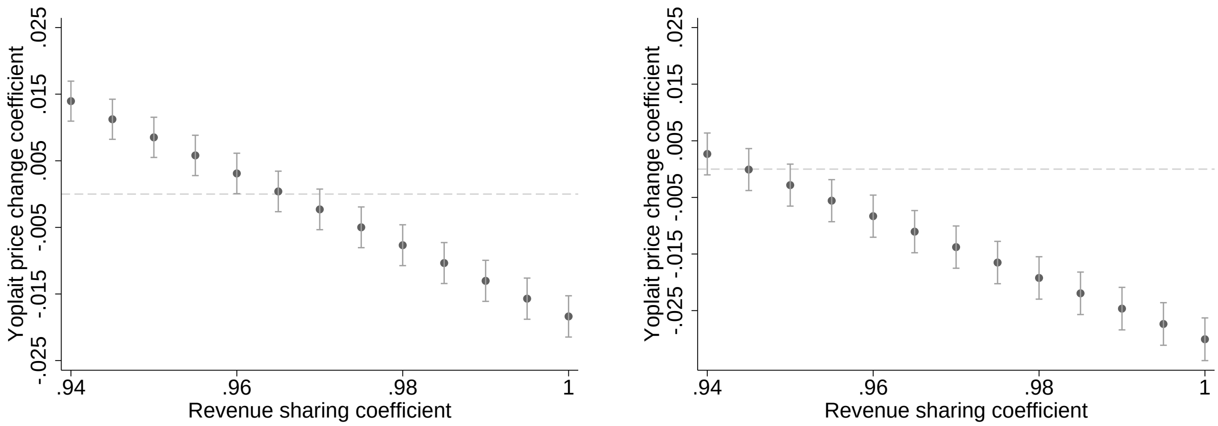
Table A.3: Estimated median own- and cross-price elasticities (Log Normal specification)

ID	Brand	ID 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Brown Cow 0.375	-4.143	0.011	0.240	0.028	0.036	0.075	0.006	0.004	0.015	0.049	0.006	0.009	0.009	0.011	0.061
2	Brown Cow 1.0	0.007	-4.356	0.270	0.024	0.027	0.053	0.004	0.003	0.012	0.035	0.004	0.009	0.011	0.010	0.082
3	Chobani 0.375	0.012	0.009	-4.244	0.028	0.028	0.074	0.005	0.004	0.014	0.042	0.005	0.008	0.009	0.010	0.052
4	Chobani 1.0	0.010	0.008	0.344	-4.508	0.028	0.066	0.005	0.004	0.013	0.037	0.004	0.010	0.008	0.010	0.057
5	Dannon 0.375	0.006	0.006	0.202	0.019	-3.190	0.063	0.006	0.004	0.012	0.036	0.005	0.011	0.009	0.008	0.064
6	Dannon Activia 1.0	0.013	0.007	0.214	0.023	0.030	-3.935	0.006	0.005	0.016	0.044	0.006	0.009	0.010	0.009	0.055
7	Dannon Activia 1.5	0.011	0.007	0.165	0.018	0.034	0.063	-3.603	0.004	0.012	0.036	0.005	0.011	0.009	0.008	0.065
8	Dannon Activia Dessert 1.0	0.008	0.006	0.164	0.021	0.032	0.083	0.005	-3.844	0.015	0.045	0.005	0.010	0.009	0.009	0.068
9	Dannon Activia Fiber 1.0	0.012	0.008	0.198	0.022	0.032	0.079	0.006	0.005	-3.942	0.045	0.006	0.010	0.011	0.009	0.062
10	Dannon Activia Light 1.0	0.013	0.007	0.214	0.023	0.029	0.078	0.006	0.005	0.016	-3.970	0.006	0.009	0.010	0.009	0.055
11	Dannon Activia Light 1.5	0.008	0.008	0.148	0.018	0.033	0.069	0.005	0.004	0.014	0.040	-3.520	0.011	0.009	0.008	0.065
12	Dannon All Natural 0.375	0.011	0.006	0.195	0.018	0.033	0.067	0.006	0.004	0.013	0.039	0.006	-3.205	0.009	0.008	0.065
13	Dannon Danimals Crushcups 1.0	0.011	0.007	0.186	0.021	0.033	0.075	0.006	0.005	0.016	0.043	0.006	0.010	-3.929	0.009	0.062
14	Dannon Light N FT CRB & Sugar 1.0	0.010	0.009	0.311	0.025	0.031	0.065	0.005	0.004	0.013	0.036	0.004	0.011	0.008	-4.378	0.062
15	Dannon Light N Fit 0.375	0.008	0.006	0.180	0.019	0.032	0.064	0.006	0.004	0.013	0.036	0.005	0.011	0.009	0.008	-3.146
16	Dannon Light N Fit 1.5	0.010	0.005	0.151	0.017	0.031	0.069	0.006	0.004	0.014	0.039	0.005	0.009	0.009	0.007	0.058
17	Dannon Nutriday 1.0	0.006	0.002	0.057	0.013	0.021	0.083	0.009	0.009	0.023	0.051	0.012	0.009	0.018	0.008	0.041
18	Stonyfield Farm 0.375	0.009	0.008	0.232	0.021	0.034	0.070	0.006	0.004	0.014	0.044	0.006	0.011	0.010	0.009	0.072
19	Stonyfield Farm 1.5	0.010	0.007	0.329	0.021	0.035	0.062	0.005	0.003	0.013	0.040	0.005	0.013	0.009	0.010	0.078
20	Yoplait 0.375	0.011	0.008	0.229	0.023	0.027	0.073	0.006	0.005	0.014	0.042	0.005	0.008	0.009	0.009	0.050
21	Yoplait 1.0	0.013	0.011	0.265	0.021	0.024	0.071	0.005	0.004	0.011	0.041	0.005	0.007	0.005	0.009	0.039
22	Yoplait Delights 1.0	0.012	0.009	0.212	0.023	0.030	0.075	0.006	0.005	0.015	0.045	0.006	0.009	0.010	0.010	0.058
23	Yoplait Fiber One 1.0	0.010	0.008	0.184	0.021	0.031	0.075	0.006	0.005	0.015	0.046	0.006	0.010	0.011	0.009	0.063
24	Yoplait Light 0.375	0.011	0.006	0.171	0.019	0.031	0.073	0.006	0.005	0.015	0.040	0.006	0.009	0.009	0.008	0.057
25	Yoplait Light Thick & Creamy 0.375	0.011	0.006	0.152	0.018	0.031	0.071	0.006	0.005	0.015	0.041	0.006	0.010	0.010	0.008	0.058
26	Yoplait Original 0.375	0.011	0.006	0.174	0.019	0.031	0.073	0.006	0.005	0.015	0.040	0.006	0.009	0.009	0.008	0.057
27	Yoplait Original 1.5	0.010	0.005	0.166	0.016	0.029	0.071	0.005	0.005	0.013	0.038	0.005	0.008	0.007	0.007	0.050
28	Yoplait Thick & Creamy 0.375	0.011	0.006	0.170	0.019	0.032	0.070	0.006	0.005	0.014	0.041	0.006	0.010	0.009	0.008	0.059
29	Yoplait Trix 1.5	0.011	0.006	0.141	0.018	0.034	0.074	0.006	0.005	0.015	0.043	0.006	0.010	0.011	0.008	0.065
30	Yoplait Yo Plus 1.0	0.011	0.008	0.144	0.022	0.030	0.073	0.006	0.005	0.016	0.044	0.006	0.010	0.012	0.009	0.064

Table A.4: Estimated median own- and cross-price elasticities (Log Normal specification)

		ID														
ID	Brand	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Brown Cow 0.375	0.044	0.005	0.021	0.025	0.021	0.012	0.018	0.011	0.168	0.014	0.125	0.012	0.012	0.018	0.011
2	Brown Cow 1.0	0.027	0.001	0.041	0.022	0.018	0.008	0.019	0.013	0.107	0.015	0.074	0.007	0.015	0.023	0.011
3	Chobani 0.375	0.043	0.007	0.020	0.012	0.018	0.010	0.017	0.011	0.121	0.013	0.093	0.011	0.011	0.025	0.010
4	Chobani 1.0	0.047	0.003	0.026	0.012	0.015	0.007	0.016	0.011	0.100	0.012	0.076	0.009	0.014	0.028	0.009
5	Dannon 0.375	0.055	0.012	0.020	0.011	0.014	0.007	0.014	0.011	0.127	0.018	0.094	0.012	0.015	0.032	0.010
6	Dannon Activia 1.0	0.049	0.013	0.019	0.012	0.018	0.009	0.017	0.012	0.146	0.016	0.115	0.012	0.013	0.030	0.012
7	Dannon Activia 1.5	0.043	0.008	0.021	0.011	0.017	0.008	0.014	0.011	0.135	0.020	0.101	0.010	0.015	0.030	0.011
8	Dannon Activia Dessert 1.0	0.049	0.005	0.022	0.012	0.022	0.011	0.017	0.011	0.158	0.018	0.115	0.012	0.015	0.029	0.010
9	Dannon Activia Fiber 1.0	0.047	0.012	0.020	0.012	0.019	0.009	0.018	0.012	0.142	0.018	0.114	0.013	0.015	0.031	0.012
10	Dannon Activia Light 1.0	0.049	0.012	0.019	0.012	0.018	0.009	0.017	0.012	0.146	0.016	0.113	0.012	0.013	0.029	0.012
11	Dannon Activia Light 1.5	0.041	0.013	0.020	0.009	0.018	0.008	0.015	0.012	0.157	0.019	0.112	0.012	0.015	0.029	0.013
12	Dannon All Natural 0.375	0.053	0.012	0.019	0.011	0.015	0.008	0.014	0.010	0.144	0.017	0.107	0.012	0.014	0.029	0.011
13	Dannon Danimals Crushcups 1.0	0.048	0.013	0.021	0.012	0.020	0.009	0.017	0.012	0.145	0.017	0.114	0.012	0.015	0.030	0.012
14	Dannon Light N FT CRB & Sugar 1.0	0.045	0.003	0.029	0.012	0.017	0.008	0.016	0.011	0.118	0.013	0.082	0.010	0.014	0.026	0.011
15	Dannon Light N Fit 0.375	0.049	0.012	0.020	0.011	0.015	0.007	0.014	0.011	0.136	0.018	0.105	0.011	0.015	0.030	0.011
16	Dannon Light N Fit 1.5	-2.715	0.014	0.016	0.010	0.015	0.007	0.014	0.010	0.152	0.017	0.116	0.013	0.014	0.030	0.011
17	Dannon Nutriday 1.0	0.040	-2.093	0.007	0.010	0.021	0.002	0.025	0.016	0.186	0.027	0.150	0.011	0.018	0.050	0.017
18	Stonyfield Farm 0.375	0.048	0.009	-4.069	0.012	0.021	0.010	0.018	0.012	0.137	0.018	0.100	0.013	0.015	0.029	0.012
19	Stonyfield Farm 1.5	0.053	0.003	0.044	-4.134	0.016	0.006	0.015	0.012	0.100	0.016	0.071	0.009	0.017	0.028	0.010
20	Yoplait 0.375	0.048	0.011	0.017	0.013	-4.286	0.009	0.017	0.012	0.141	0.015	0.104	0.012	0.012	0.028	0.011
21	Yoplait 1.0	0.051	0.000	0.010	0.006	0.016	-4.402	0.013	0.010	0.149	0.013	0.101	0.012	0.009	0.024	0.006
22	Yoplait Delights 1.0	0.042	0.012	0.020	0.014	0.023	0.011	-4.317	0.013	0.152	0.017	0.113	0.012	0.014	0.027	0.013
23	Yoplait Fiber One 1.0	0.043	0.010	0.022	0.013	0.022	0.010	0.019	-4.113	0.156	0.020	0.113	0.013	0.015	0.030	0.012
24	Yoplait Light 0.375	0.053	0.014	0.017	0.011	0.016	0.008	0.015	0.011	-3.112	0.017	0.121	0.013	0.014	0.031	0.011
25	Yoplait Light Thick & Creamy 0.375	0.052	0.014	0.018	0.010	0.017	0.008	0.015	0.011	0.154	-3.237	0.119	0.013	0.015	0.031	0.011
26	Yoplait Original 0.375	0.053	0.014	0.017	0.011	0.016	0.008	0.015	0.011	0.154	0.017	-3.156	0.013	0.014	0.031	0.011
27	Yoplait Original 1.5	0.059	0.006	0.014	0.009	0.016	0.008	0.012	0.009	0.157	0.014	0.116	-3.099	0.013	0.027	0.008
28	Yoplait Thick & Creamy 0.375	0.056	0.014	0.017	0.010	0.016	0.008	0.015	0.011	0.155	0.018	0.114	0.013	-3.237	0.031	0.011
29	Yoplait Trix 1.5	0.049	0.015	0.020	0.012	0.020	0.011	0.016	0.011	0.159	0.019	0.126	0.014	0.015	-3.287	0.012
30	Yoplait Yo Plus 1.0	0.036	0.010	0.022	0.012	0.021	0.009	0.020	0.013	0.166	0.021	0.131	0.011	0.016	0.029	-3.905

Figure A.2: Estimating the Revenue Sharing Parameter: Indirect Inference Approach, remaining specifications (no demographics)



A) Full sample

B) Excluding Q3/Q4 2011

Notes: The specifications make use of the estimates in Column (2) of Table 2. Panel B excludes the third and fourth quarter of 2011, as in columns (3) and (4) of Table 1.

Table A.5: The Impact of an Efficient Vertical Contract on Market Outcomes: The Role of Competition

	(1)	(2)	(3)	(4)	(5)	(6)
	Price change (in log points)		Market share change (in log points)		Profit change (in log points)	
	BR	Equilibrium	BR	Equilibrium	BR	Equilibrium
Panel A: Revenue sharing parameter 0.97						
Chobani	-	0.00014	-0.00694	-0.00755	0.13061	0.13044
		(0.00001)	(0.00007)	(0.00007)	(0.00080)	(0.00080)
General Mills	-0.01940	-0.01941	0.06322	0.06307	0.09367	0.09350
	(0.00006)	(0.00006)	(0.00033)	(0.00033)	(0.00030)	(0.00030)
Groupe Danone	-	-0.00031	-0.00809	-0.00698	0.09351	0.09351
		(0.00000)	(0.00006)	(0.00005)	(0.00031)	(0.00031)
Panel B: Revenue sharing parameter 0.95						
Chobani	-	0.00025	-0.01162	-0.01274	0.22981	0.22954
		(0.00001)	(0.00012)	(0.00012)	(0.00149)	(0.00148)
General Mills	-0.03244	-0.03245	0.10511	0.10488	0.15673	0.15646
	(0.00009)	(0.00009)	(0.00055)	(0.00055)	(0.00050)	(0.00050)
Groupe Danone	-	-0.00052	-0.01352	-0.01180	0.16226	0.16225
		(0.00001)	(0.00010)	(0.00009)	(0.00055)	(0.00055)
Observations	1,811,560	1,811,560	1,811,560	1,811,560	1,811,560	1,811,560

Notes: The estimates are based on demand estimates in Table 2 (column 3). Standard errors in parentheses. An observation is a product–store–week combination. We restrict attention to weeks prior to July 2011 (i.e., the time when the transaction was completed). Each column displays regression coefficients of $\log(X^{\text{counterfactual}}) - \log(X^{\text{observed}})$ on firm-level indicators, for $X \in \{\text{price}, \text{market share}, \text{profit}\}$. $X^{\text{counterfactual}}$ are the equilibrium outcomes with an efficient vertical contract in columns labeled 'Equilibrium'; whereas in columns labeled 'BR', $X^{\text{counterfactual}}$ is the best response of General Mills to rivals' prices when an efficient vertical contract is implemented and rivals are not allowed to respond. X^{observed} is the equilibrium outcome in the observed equilibrium.