The Cost of an Inefficient Vertical Contract

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Big picture

- What vertical contracts are observed in practice?
- How do they distort incentives?
- What is their impact on efficiency?

Big picture

- Empirical challenge: contracts are confidential
- Researchers rarely gain access to upstream data
  - Some exceptions: pay TV (Crawford and Yurukoglu 2013, Crawford et al. 2018), food distribution (Marshall 2020), alcoholic beverages distribution (Miravete, Seim, Thurk 2018 and others)
- Some work uses variation in vertical structure
  - Indirect test for linear prices: e.g., Luco and Marshall (2020), Bajo-Buenestado and Borrella-Mas (2022)
  - Experimental variation in vertical rebates: Conlon and Mortimer (2021)
- Other work attempts to learn about vertical contracts without variation in vertical structure
  - E.g., Villas-Boas (2007), Bonnet and Dubois (2010), Hristakeva (2021)
  - Leans heavily on model specification

What we do

- Leverage knowledge of a vertical contract in a given industry
  - An inefficient contract: a revenue sharing agreement
- Exploit variation in vertical structure to estimate the details of the contract
- Use an equilibrium model to quantify the cost of the inefficient vertical contract.

Context

- Between 1977 and 2011, General Mills produced Yoplait in the US under a licensing agreement with Sodiaal.
  - Sodiaal supplied an intangible input: Yoplait image and brand rights
  - Production and marketing were GM's responsability
  - The agreement was for an unknown (to us) percentage of Yoplait-GM's gross revenues.
- May 2011: GM reached an agreement with Sodiaal to purchase the Yoplait brand.
- July 2011: The transaction was completed.

Source: "Grab a spoon. It's time to make sense of the yogurt aisle." *The Washington Post*, September 16, 2019. Accessed on September 19, 2023.

Why are revenue sharing agreements (RSA) inefficient?

- Consider a monopolist single-product downstream firm.
- It keeps a fraction $\mu \in [0, 1]$ of its revenue due to a RSA.
- The firm solves

$$\max_{p} \quad \mu \cdot p \cdot q(p) - c \cdot q(p)$$

- Or, equivalently,

$$\max_{p} \quad p \cdot q(p) - \frac{c}{\mu} q(p)$$

- The RSA is as though the firm produces with a scaled-up marginal cost
- Relative to when $\mu = 1$, the firm chooses a higher price, distorting quantity produced and profits.

Data

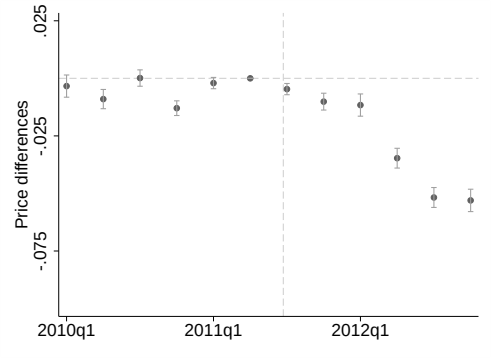
Data: IRI Marketing Data Set

- Weekly scanner data for the years 2010 to 2012 across 50 MSAs
- An observation is a store–week–product combination, where a product is a brand–size combination
- We focus on the top three firms: Groupe Danone, Chobani, and General Mills
  - 22 brands, 30 products
  - Example of product: 0.375 lbs package of Yoplait Original
- Top three firms: 75.6% of category revenue during sample period.

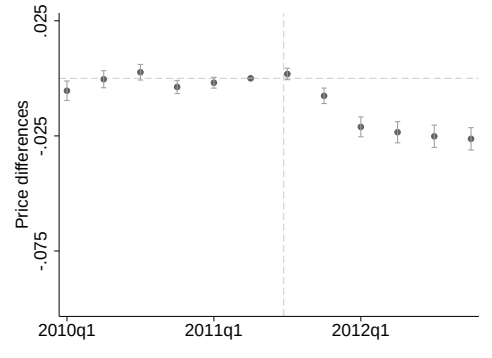
Descriptive evidence

The Impact of Revenue Sharing on Prices

- Yoplait prices drop by 1.8% on average after July 2011.



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.

Empirical Model

Empirical Model

We use an empirical model to:

1. Estimate the revenue sharing agreement
2. Compute the counterfactual equilibrium under an efficient vertical contract

Key features of the model:

- Demand follows BLP (1995), Nevo (2001)
  - Random coefficients on price and constant.
- Supply: We assume firms compete à la Bertrand-Nash
  - A market is a store–week.

Identification and estimation of demand system

- Instruments:
  - Cost shifters
  - Local differentiation IVs (Gandhi and Houde 2023)

- Estimation:
  - We estimate demand using `pyBLP` (Conlon and Gortmaker 2020).
  - 2-Step GMM, with approximated optimal instruments in the second step.
  - We include product, store, and week fixed effects.

Elasticities

Table 1: Estimated own- and cross-price elasticities for the most popular product of each firm

	Chobani	General Mills	Danone
Chobani	-3.56	0.13	0.04
General Mills	0.25	-2.73	0.03
Danone	0.32	0.14	-3.46

Notes: The table reports the median own- and cross-price elasticities for the top product of each firm. The sample used to compute these statistics consists of store–weeks in which the three products were available. Store–week combinations in which at least one of these products was not available are omitted. Overall, own-price elasticities range between -4.83 and -1.93 (considering the 1st and 99th percentiles of the distribution).

The cost of inefficient vertical contracts

Estimating the revenue sharing agreement

Under a revenue-sharing agreement, we can use our demand estimates to recover

$$\frac{\mathbf{c}_{st}}{\mu_t} = \underbrace{\left[\mathbf{p}_{st} - \Omega(\mathbf{p}_{st})^{-1}\mathbf{s}_{st}(\mathbf{p}_{st})\right]}_{\text{data + demand estimates}},$$

where

- $$\mu_{jt} = \begin{cases} \mu & \text{if Yoplait AND } t < \text{July 2011} \\ 1 & \text{otherwise.} \end{cases}$$
- $\Omega(p)$ is the matrix with the element-by-element product of the ownership matrix and the partial derivatives of demand with respect to prices (Nevo 2001).

$\Rightarrow$ The challenge is to separate c_{st} from μ_t

Estimating the revenue sharing parameter I: marginal costs approach

- We can recover $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jt}$
- Assume $c_{jst} = \exp\{\gamma_t + \gamma_j + \varepsilon_{jst}\}$
- Recall $\mu_{jt} = \mu$ if Yoplait and $t <$ July 2011; $\mu_{jt} = 1$ otherwise.
- Taking logs and combining these equations:

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

- Key assumption:
  - No systematic change in costs except for a common trend

Estimating the revenue sharing parameter I: marginal costs approach

	(1)	(2)
	12-week window	24-week window
General Mills * Pre July 2011 $(-\log \mu)$	0.009	0.005
	(0.003)	(0.003)
N	549,869	1,068,574
Implied Rev. Sharing Coef.	0.991	0.995
	(0.003)	(0.003)

Notes: Standard errors clustered at the store level in parentheses. An observation is a product–store–week combination.

Estimating the revenue sharing parameter II: indirect inference approach

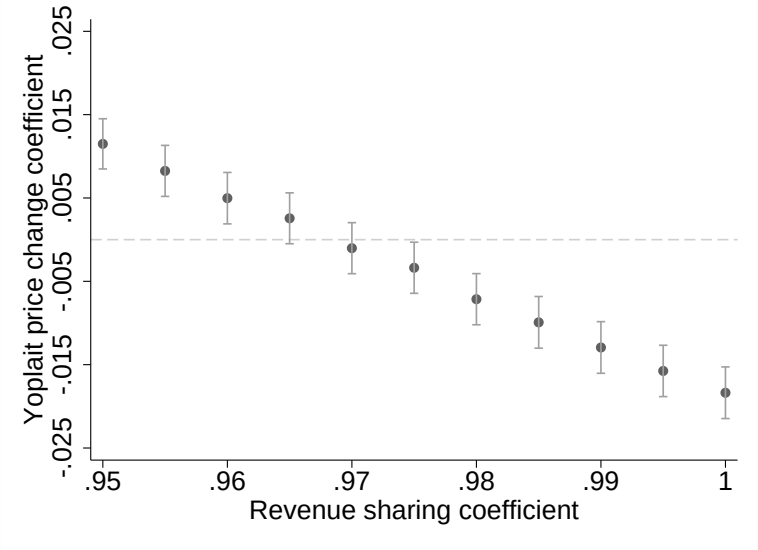
- In our descriptive section, we ran

$$\log p_{jst} = \beta \cdot 1\{\text{Yoplait AND post-July 2011}\} + \text{FEs} + \varepsilon_{jst} \quad (1)$$

.

- Recall $\tilde{c}_{jst} \equiv c_{jst}/\mu_{jt}$.
- We implement the following routine:
  1. Fix μ, compute $c_{jst} = \mu \cdot \tilde{c}_{jst}$.
  2. Use c_{jst} to solve for the price equilibrium assuming no revenue sharing.
  3. Use these counterfactual prices to run regression (1). Record β.
  4. Back to step 1 and repeat for another value of μ.
- Find the value of μ such that $\hat{\beta} = 0$.
- Key assumption: Elimination of the revenue sharing agreement was the only change affecting Yoplait through July 2011.

Estimating the revenue sharing parameter II: indirect inference approach



The Impact of an Efficient Vertical Contract on Market Outcomes

Efficient vertical contracts

- Estimated $\hat{\mu} \in [0.97, 0.99]$.
- One efficient contract has a fixed transfer $F(\hat{\mu})$ that leaves Sodiaal indifferent between the revenue sharing contract $\hat{\mu}$ and $F(\hat{\mu})$.
- With the efficient contract, GM's profits are not distorted: $\mu = 1$.

The impact of efficient vertical contracts

Table 2: Changes in market outcomes (in log points) when switching to an efficient contract

	(1)	(2)	(3)	(4)	(5)	(6)
	Revenue sharing parameter: 0.97			Revenue sharing parameter: 0.99		
	Price	Market share	Profit	Price	Market share	Profit
Chobani	0.000	-0.006	-0.006	0.000	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
General Mills	-0.019	0.044	0.041	-0.006	0.018	0.017
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Groupe Danone	0.000	-0.006	-0.007	0.000	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	2,384,559	2,384,559	2,384,559	2,384,559	2,384,559	2,384,559

Note: An observation is a product–store–week combination. We restrict attention to weeks prior to March 2011 (i.e., the time when the transaction was announced).

The impact of efficient vertical contracts

- GM's profits would increase by between $245 y $653, on average, by store–year, holding Sodiaal's profits constant.
- County Business Patterns: In 2011, there were 64,366 supermarkets/grocery stores in the U.S.
- Combining these figures: GM's profits would have increased by between 16 and 42 million (USD).
- In 2010, Yoplait sales in the US were about 1.5 billion.
  - Profit increase ranges between 1 and 2.9 percent of sales

Summary

- We leverage information about a vertical contract and variation in vertical structure to estimate the details of the contract
- We use an equilibrium model to quantify the impact of the inefficient vertical contract
- We show that an inefficient vertical contract can have a significant impact on efficiency and profits
- New evidence on vertical contracts that are used in practice

Thank you!