The Welfare Effects of Brand Portfolio Strategies in the Soft Drink Industry: A Structural Bargaining Approach with Limited Data

Céline Bonnet,
TSE, INRA, Université de Toulouse 1, France, celine.bonnet@toulouse.inra.fr

Zohra Bouamra-Mechemache,
TSE, INRA, Université de Toulouse 1, France, zohra.bouamra@toulouse.inra.fr

Hugo Molina
INRA (ALISS) and École polytechnique, France, hugo.molina@polytechnique.edu

Paper prepared for presentation at the 149th EAAE Seminar 'Structural change in agri-food chains: new relations between farm sector, food industry and retail sector'
Rennes, France, October 27-28, 2016

Please contact authors before quoting

1 Introduction

How firms split the surplus in vertically related markets is of great interest for public authorities since it can either affect prices or have adverse effects on investment in innovation, which in both cases may undermine consumer welfare. This concern is particularly acute in agro-food industries where the annual negotiations between manufacturers and retailers often lead to fierce political debates. Over the course of these last decades, the food retail distribution sector has known a significant consolidation, leading to the rise of large food retailers owning important share of domestic retail sales. In particular, the use of joint purchasing agreements between retailers has become common practice over the past years.[1] For instance, the six largest retail groups in the French food retail sector in 2016 are Groupe Carrefour (21.1%), Groupe Leclerc (20.7%), ITM Entreprises (14.1%), Groupe Casino (11.4%), Groupe Auchan (11.4%), and Groupe Système U (10.1%).[2] In addition, the share of private labels introduced by food retailers have increased in almost all EU Member States, strengthening the bargaining power of retailers vis-à-vis producers.[3] Those changes have significantly affected the balance of power in favor of retailers in a number of agro-food industries. Nonetheless, in some markets retailers may face strong manufacturers with must-have brands, seeking to extract profits and being able to challenge their buyer countervailing power. As a result, the surplus division may become difficult to determine, which in turn prevents policy makers from a clearer understanding of the main driving forces in the vertical supply chain.

In this article we design a structural bargaining model to investigate the vertical interractions between up- and downstream firms in bilateral oligopolistic markets and identify the sharing of industry profits. We focus our analysis on the annual negotiations on the French soft drink market, which is of particular interest given the existence of large food companies operating in different segment of this sector.[4] We consider an empirical model of bilateral bargaining with secret offers and contracting externalities due to downstream competition. Our bargaining setting allows for multiproduct negotiations and incorporates the strategic behavior of each upstream firm to opt for either a separate or a joint

[1]More recently, these agreements raised concern in France (see Autorité de la concurrence, 2015).

[2]Kantar Worldpanel 2016: http://www.kantarworldpanel.com/fr/grocery-market-share/france.

[3]Private labels exceed 30% of market share in several Member States (e.g. UK, Germany, France) (see European Commission, 2011, p.78).

[4]In its recent study, the European Commission has pointed out that the French soft drinks market belongs to the most concentrated industries in the agro-food sector (see European Commission, 2014, p. 306). Additionally, "the top 50 global brands include 7 food products, mainly beverages." (European Commission, 2007, p.34).

negotiation over its products. We also consider downstream price competition between retailers which can affect the allocation of surplus within the vertical supply chain in several ways through the disagreement points of firms. In particular, we elaborate two informational structures specifying what retailers are able to learn about the bargaining outcome before they compete downstream.

Related literature and Contributions. This paper is in line with the empirical literature on vertical relationships and bilateral oligopoly. A first stream of articles have considered vertical relationships in noncooperative games with upstream take-it-or-leave-it offers. Downstream competition in the context of vertically separated markets was first introduced by Villas-Boas (2007) who analyzes the contractual forms used between manufacturers and retailers in the U.S. yogurt market. From the theoretical setting of interlocking relationships developed by Rey and Vergé (2010), Bonnet and Dubois (2010) structurally model two-part tariff contracts with (and without) resale price maintenance on the French bottled water market. Bonnet and Dubois (2015) extend these models to a setting where downstream firms enjoy some endogenous buyer power, i.e. retailers can reject offers if they benefit from higher disagreement points. An obvious weakness of these different approaches to model vertical relationships when firms are concentrated on both sides of the market is that they primarily rely on the assumption that downstream firms are price takers. In accordance with institutional details of the food retail sector and the growing bargaining power of retailers, our article contributes to an emerging literature on structural models of bargaining with externalities. In the U.S. multichannel television industry, Crawford and Yurukoglu (2012) develop a bargaining model between up- and downstream firms to investigate the impact of a ban on bundling offers in the downstream market where distributors compete in two dimensions, choosing both bundles and prices.[5] Following Crawford and Yurukoglu (2012), Grennan (2013) structurally models bilateral negotiations between medical devices manufacturers and hospitals to infer the effects of enforcing more uniform pricing in the coronary stent industry. Still in the health care sector, Gowrisankaran, Nevo and Town (2015) estimate an empirical model of bargaining between hospitals and insurers (MCOs) to analyze anticompetitive effects of hospital mergers. They simulate policy remedies imposed by the FTC to mitigate the post-merger price increase. Ho and Lee (2016) complement their structural framework by incorporating insurer price competition for enrollees. Focusing on the downstream

[5]More recently, Crawford et al. (2015) extend this framework to analyze the effects of vertical integration.

competition, they perform counterfactual experiments to analyze the welfare effects of changing insurer competition (e.g. the removal of one insurer). An important aspect of this recent empirical literature on multilateral bargaining models is the use of identification methods requiring data on negotiated prices. Built on Draganska, Klapper and Villas-Boas (2010) who analyze the division of surplus between manufacturers and retailers on the German coffee industry, our paper extends the methodology and contributes to the literature on several dimensions.

First, our method contrasts with most of previous empirical studies by identifying the division of surplus in the vertical chain without data on wholesale contracts or marginal costs, which are still rarely available to the econometrician for a large number of industries.

Second, we develop a game-theoretic framework of vertical interactions and retail price competition with *sequential-moves*, i.e. downstream firms decide retail prices subsequently to the bargaining stage.[6] In such context, the information about the bargaining stage available to retailers before they compete downstream plays a critical role in the division of surplus (Iozzi and Valletti, 2014). Our analysis explicitly considers different informational structures that are likely to fit with institutional details. In a first framework, we describe a downstream price competition with *interim unobservability* (Rey and Vergé, 2004), meaning that each retailer only observes contract terms it bargained with manufacturers. In a second framework, retailers get an additional information by competing downstream with *observable breakdowns* (Iozzi and Valletti, 2014) — i.e. retailers are able to observe any breakdown that occured during the bargaining stage before choosing final prices.

Third, in the light of industry practices (European Commission, 2005) and given the large brand portfolio of soft drink manufacturers, our structural model allows for multi-product bargaining. Since we believe that such practices are commonly used by firms in the negotiation stage so as to affect threat points and enjoy better trading terms, we model the strategic behavior of manufacturers, that is whether or not to opt for a joint negotiation over their own products — e.g. tie some products during the bargaining process — with downstream firms.

[6]Our framework differs from empirical models of bargaining in which wholesale contracts and retail prices are determined simultaneously. Either employed for tractability motives (Draganska, Klapper and Villas-Boas, 2010; Ho and Lee, 2016) or supported by institutional details (Crawford et al., 2015), we view this assumption as a limitation given that food retailers regularly adjust their prices.

Our estimation procedure to recover point identification of the market parameters can be summarized as follows. We first estimate a demand model in order to obtain the substitution patterns between products. Then, we specify a 3-stage game for each information structure considered in this paper — i.e. *interim unobservability* and *observable breakdowns* — in which equilibrium retail margins are derived using estimates of the demand model. From the demand parameters and retail margins, a bargaining game allowing for multiproduct negotiations is estimated. Looking for equilibrium bargaining strategies employed by manufacturers, we finally infer the outcome among the two informational structures that is closest to the data generating process.

This article is organized as follows. In Section 2, we describe the data used to estimate our empirical model. Section 3 presents the demand model that captures the consumers behavior on the French soft drink industry. In Section 4, we introduce the bargaining model devoted to the analysis of the balance of power between manufacturers and retailers in the vertical chain. Econometric methods to perform point identification of the market parameters are described in Section 5. Section 6 provides our preliminary empirical results. Finally, Section 7 discusses research perspectives and extensions for the current version of this paper.

2 Data

Homescan dataset. We use a household-level scanner data on soft drink purchases in France collected by Kantar WorldPanel from April 2005 to September 2005.[7] This dataset is composed of $265,998$ purchases of soft drink products for home consumption. As the dataset consists in homescan purchases, we observe prices of products that have been purchased, but we do not have any information about prices of competing products that the household decided not to buy. Hence, to infer prices of these other products, we compute an average monthly price for each alternative and assume that consumers faced the whole set of products at those average monthly prices when they made their purchases.[8]

[7]We decided to conduct our analysis over this sample period for two reasons. First, soft drink sales are sensitive to weather conditions, hence we select the most favorable time period for soft drink consumption in which we observe the largest number of purchases. Second, assuming that annual negotiations between firms having affected observed retail prices in our dataset took place before the summer season, we decided to analyse the French soft drink market before the Commission's decision (European Commission, 2005) which bound The Coca-Cola Company's behavior for the five subsequent years.

[8]We assume that consumers faced the same assortment of products in each retail store. Since we consider the major brands of soft drink in the choice set of consumers, we view this assumption as credible.

According to our sample, the upstream market is oligopolistic. Four majors beverage companies, namely The Coca-Cola Company, PepsiCo, Orangina-Schweppes, and Unilever compete with private labels.[9] We selected the first 21 biggest national brands according to their market shares, and four private labels aggregated with respect to their category (cola-flavoured, juice & nectar, ice-tea, and other soda). Private labels represent in average 41.61% of the total market shares over the six month period and national brands accounts for 32.97% of market share.[10] Therefore, because of the significant size of private labels, retailers are likely to play an important role in the allocation of margins within the distribution channel. In the downstream market, we consider five main retailers, an aggregate of remaining hypermarket and supermarket, and an aggregate of hard discounters.

Following the literature on vertical relationships, we assume that a product is a combination of one brand and one retailer — also called brand–service combination — meaning that a brand sold by different retailers is not considered as a same product. Therefore, we have 157 differentiated products competing in the market, plus an outside good that aggregates all the remaining products that a consumer might purchase.[11] The combined share of products that enter in our analysis account for 74.58% of the total sales of soft drink. Table 1 gives an overview of the data used to estimate the demand model.

Moreover, all the retailers are national chains and are present in all regions in France.

[9]We consider that private labels are either produced by retailers themselves or by a competitive fringe. In both cases, retailers purchase their private labels at marginal cost.

[10]The market share of product j is defined as the sum of the purchased quantities of product j divided by the total quantities purchased.

[11]The outside good is composed of all remaining national brands of carbonated soft drinks or juices and nectars, plus flavoured waters.

Table 1: Descriptive statistics of the brands

Brands	Manufacturer	# Retailers	Market shares	Price (€/liter)
Cola				
Brand 2 (PL)	Manuf. 5	7	6.19% (0.37)	€0.29 (0.05)
Brand 13	Manuf. 2	7	2.00% (0.20)	€0.68 (0.07)
Brand 22	Manuf. 1	6	0.08% (0.02)	€0.96 (0.06)
Brand 23	Manuf. 1	7	17.20% (1.00)	€0.88 (0.03)
Total			25.47% (1.16)	€0.71 (0.01)
Other soda				
Brand 4 (PL)	Manuf. 5	7	9.09% (0.81)	€0.37 (0.06)
Brand 5	Manuf. 2	6	0.08% (0.04)	€0.76 (0.05)
Brand 10	Manuf. 4	7	1.71% (0.16)	€0.84 (0.07)
Brand 11	Manuf. 4	7	1.97% (0.17)	€0.97 (0.06)
Brand 14	Manuf. 4	7	2.03% (0.39)	€1.05 (0.04)
Brand 15	Manuf. 2	7	0.37% (0.10)	€0.71 (0.05)
Brand 16	Manuf. 1	6	0.31% (0.05)	€0.74 (0.05)
Brand 17	Manuf. 4	6	0.54% (0.07)	€1.09 (0.06)
Brand 19	Manuf. 4	2	0.02% (0.01)	€0.71 (0.01)
Brand 20	Manuf. 4	6	0.09% (0.02)	€0.96 (0.03)
Brand 21	Manuf. 4	6	0.05% (0.01)	€3.31 (0.12)
Brand 24	Manuf. 1	7	1.05% (0.13)	€0.91 (0.08)
Total			17.31% (1.20)	€0.64 (0.01)
Juice & Nectar				
Brand 1 (PL)	Manuf. 5	7	23.67% (1.54)	€0.80 (0.09)
Brand 8	Manuf. 1	5	0.21% (0.04)	€1.70 (0.18)
Brand 12	Manuf. 4	6	0.57% (0.10)	€1.70 (0.10)
Brand 18	Manuf. 2	7	2.45% (0.19)	€2.08 (0.08)
Brand 25	Manuf. 1	6	0.18% (0.06)	€1.40 (0.10)
Total			27.08% (1.71)	€0.94 (0.01)
Ice-Tea				
Brand 3 (PL)	Manuf. 5	7	2.66% (0.31)	€0.49 (0.08)
Brand 6	Manuf. 3	7	1.73% (0.33)	€1.03 (0.06)
Brand 7	Manuf. 3	6	0.09% (0.03)	€1.24 (0.11)
Brand 9	Manuf. 1	5	0.24% (0.07)	€0.89 (0.06)
Total			4.72% (0.64)	€0.71 (0.02)
Outside Good		.	25.42%	.

Standard deviation in parenthesis refers to variation across retailers and periods. (PL) corresponds to *private label*. Prices in rows *Total* have been weighted by market shares of brands and their standard deviation in parenthesis refers to variation across periods. # Retailers: number of retailers who sell the brand.

Cost shifters data. We also employ additional data on cost shifters collected by the French National Institute of Statistics and Economic Studies (INSEE) over the six month period. These data contains the sugar price index, the water price index, and packaging costs such as the plastic price index and the aluminum price index. We also include the sugar content per 100g for each brand considered into our analysis.

3 The Demand Model

In order to deal with the dimensionality problem — given the large number of products that enter into our analysis — and considering heterogeneity in consumer preferences, we use a random coefficient logit model to estimate substitution patterns between products.

Utility. We consider a choice set $\mathcal{J} = \{0, 1, \ldots, J\}$ of differentiated products. We assume that consumers can only choose one unit of a product belonging to the choice set $\mathcal{J}$ in each period. Following the discrete-choice literature (Berry, Levinsohn and Pakes, 1995; Nevo, 2001), we assume that the utility derived by consumer i from purchasing product j at period t is specified as follows

$$U_{ijt} = \delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \delta_t + \xi_j + \Delta\xi_{jt} + e_{ijt}$$

where $\delta_{b(j)}$ and $\delta_{r(j)}$ are brand and retail fixed effects that capture respectively the mean utility in the population generated by unobserved time invariant brands characteristics and unobserved time invariant retailers characteristics, α_{ij} is the marginal disutility of the price according to consumer i, δ_t identifies time dummies controlling for monthly unobserved determinants of demand (e.g. weather or seasons variations), ξ_j and $\Delta\xi_{jt}$ respectively represent utility derived from unobserved time invariant and unobserved time variant (e.g. changes in shelf display) products characteristics, e_{ijt} captures the distribution of consumer preferences about the mean utility generated by product j (i.e. the unobserved consumer i's taste).

Taking into consideration heterogeneous consumer price disutilities, we assume that α_{ij} is lognormally distributed and varies across consumers such that

$$\alpha_{ij} = \alpha_{nb(j)} + \alpha_{pl(j)} + \sigma \nu_i$$

where $\alpha_{nb(j)}$ and $\alpha_{pl(j)}$ capture the mean consumer price disutility for national brands and private labels respectively, and ν_i is the individual deviation from these means.

Outside option. In order to give the possibility to consumers not to purchase any products among the J alternatives from our choice set, an outside good is introduced. The utility from purchasing this outside good is given by $U_{i0t} = \delta_t + \xi_0 + \Delta\xi_{0t} + e_{i0t}$.

Market share. Assuming that consumer i is an utility maximizer, and that ϵ_{ijt} is independently and identically distributed from the standard Gumbel distribution (also known as type I extreme value distribution), the individual market share of product j at period t can be written as follows

$$s_{ijt} = \int_0^{+\infty} \frac{e^{V_{ijt}}}{\sum_{k=0}^{J} e^{V_{ikt}}} f(\nu_i)\, \mathrm{d}\nu_i$$

where $f(.)$ corresponds to the density function of the standard lognormal distribution, i.e. $\nu_i \sim Log - \mathcal{N}(0,1)$, and $V_{ijt} \equiv \delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \delta_t$ denotes the deterministic portion of the utility obtained by consumer i from purchasing product j at period t.

Elasticity. The main advantage of the random coefficient logit is that it generates a flexible pattern of substitution between products by taking into account differences in consumer price disutilities. The random coefficient logit model is not subject to the IIA assumption unlike the multinomial logit model or the nested logit model. Own-price elasticities and cross-price elasticities generated by the random coefficient logit model can be written as follows

$$\epsilon_{jkt} = \begin{cases} -\frac{p_{jt}}{s_{jt}} \int_0^{+\infty} \alpha_{ij} s_{ijt} \left(1 - s_{ijt}\right) f(\nu_i)\, \mathrm{d}\nu_i & \text{if } \; j = k \\ \frac{p_{jt}}{s_{jt}} \int_0^{+\infty} \alpha_{ij} s_{ijt} s_{ikt} f(\nu_i)\, \mathrm{d}\nu_i & \text{if } \; j \neq k \end{cases}$$

Considering parameters of the demand model described above as known, we introduce the supply model in the subsequent section.

4 The Supply Model

We consider the French soft drink vertical channel composed of F manufacturers and R retailers. Each manufacturer, labelled by $f = 1,...,F$, produces a set of products $\mathcal{J}_f$ sold to retailers. Each retailer, labelled by $r = 1,...,R$, resells a set of products $\mathcal{J}_r$ to final consumers. Thus, we have

$$\bigcup_{f=1}^{F} \mathcal{J}_f = \bigcup_{r=1}^{R} \mathcal{J}_r = \mathcal{J}$$

Profit function. We denote the (per-period) profit function of manufacturer f as follows

$$\pi_f = \sum_{j \in \mathcal{J}_f} \left(w_j - \mu_j \right) M s_j$$

and the (per-period) profit function of retailer r as follows

$$\pi_r = \sum_{j \in \mathcal{J}_r} \left(p_j - w_j - c_j \right) M s_j$$

where w_j is the (negotiated) wholesale price of product j, p_j is the retail price of product j, μ_j and c_j are respectively the constant marginal cost of production and distribution for product j, M is the total number of quantity purchased in the market ("market size"), and s_j represents the predicted market share of product j. Throughout the analysis, we will omit the time dimension for readability reasons.

Timing of the game. We consider the following three-stage game:

- **Stage 1:** Each upstream firm determines its bargaining strategy, that is whether to negotiate jointly or separately wholesale prices of products for each category of soft drinks.

- **Stage 2:** Given the bargaining strategy employed by each manufacturer, up- and downstream firms negotiate bilaterally and simultaneously over linear wholesale price(s) of product(s).[12] We assume that wholesale contracts are secret, i.e. contract-

[12]Nonlinear contracts (e.g. two-part tariffs) are more efficient than linear tariffs since they allow to coordinate the distribution channel to avoid the double marginalization distortion and therefore maximize the industry profits. However, as pointed out by Dobson and Waterson (2007), there may be some reasons to lean toward linear tariffs, in particular when firms meet unfrequently (e.g. annual negotiations) and

ing parties bargain without being able to observe trading terms negotiated in other transactions which they do not participate.[13]

- **Stage 3:** Retail prices are determined simultaneously by retailers competing on the downstream market for consumers.

Since negotiations are modeled through Nash bargains, the specification of disagreement points plays a critical role into our analysis. We design two game-theoretic frameworks with different assumptions on the information known by retailers before the downstream price competition stage, namely:

- A game-theoretic framework with *interim unobservability*[14] (Rey and Vergé, 2004), i.e. when choosing retail prices downstream firms observe contract terms they bargained in the negotiation stage. However, they are not able to find out which transaction has been reached between manufacturers and other retailers, and therefore still form equilibrium beliefs about their outcome.

- A game-theoretic framework with *observable breakdowns* (Iozzi and Valletti, 2014), i.e. downstream firms observe both contract terms they bargained and any breakdowns that occurred in the bargaining stage before choosing retail prices. However, they still form conjectures about prices stipulated in each wholesale contract signed by their competitors.

In this draft, we describe the framework in which retailers engage in downstream competition with *observable breakdowns*.[15] Proceeding backwards, we first start from the last stage of the game.

4.1 Stage 3: Downstream Bertrand competition

Denote $\mathbf{p}_{\mathcal{J}_r}$ the retail price vector set by retailer r, and $\mathbf{p}^*_{\setminus\mathcal{J}_r}$ the (anticipated) equilibrium retail price vector set by its competitors. Boldface are used to distinguish between vectors

demand is uncertain. Although in reality transfers are often more complex (e.g. conditional rebates), such simple payment scheme have already been employed in theoretical setting to model vertical relationships (Dobson and Waterson, 1997; Inderst and Valletti, 2009; O'Brien, 2014), as well as in most empirical models of bargaining (Crawford and Yurukoglu, 2012; Grennan, 2013; Gowrisankaran, Nevo and Town, 2015; Ho and Lee, 2016).

[13] Although non-discriminatory laws were still in force over the time period examined in this paper (abolished by the LME act in 2008), secret backroom margins were commonly negotiated in practice (see Allain and Chambolle, 2011).

[14] This framework is also called *unobservable contracts* (O'Brien and Shaffer, 1992), or *unobservability game* (McAfee and Schwartz, 1994).

[15] The downstream price competition setting with *interim unobservability* is treated in our Web Appendix.

(or matrices) and scalars.

Bertrand-Nash equilibrium. We consider the downstream price competition between retailers and employ the Bertrand-Nash equilibrium concept to recover retail margins. In a setting with multi-product firms, retailer r's maximization problem — given its beliefs about wholesale contracts of its rivals[16] — can be written as follows

$$\max_{\{p_j\}_{j\in\mathcal{J}_r}} \sum_{j\in\mathcal{J}_r} \left(p_j - w_j - c_j\right) M\, s_j(\mathbf{p}_{\mathcal{J}_r}, \mathbf{p}^*_{\backslash\mathcal{J}_r})$$

The first-order condition of this maximization problem for product $k \in \mathcal{J}_r$ is given by

$$s_k + \sum_{j\in\mathcal{J}_r} \left(p_j - w_j - c_j\right) \frac{\partial s_j}{\partial p_k} = 0$$

From the system of first-order conditions of all product $k \in \mathcal{J}_r$, we can express in matrix form the equilibrium margins of retailer r

$$\boldsymbol{\gamma}^*_r \equiv \mathbf{p}^*_r - \mathbf{w}_r - \mathbf{c}_r = -\left(\mathbf{I}_r \mathbf{S}_{\mathbf{p}} \mathbf{I}_r\right)^+ \mathbf{I}_r \mathbf{s}(\mathbf{p}^*)$$

where $\mathbf{s}(\mathbf{p}^*)$ represents the J-dimensional vector of predicted market shares when retail prices are at the equilibrium level $\mathbf{p}^*$, $\mathbf{I}_r$ corresponds to the $J \times J$ ownership matrix of retailer r where the jth diagonal element is equal to 1 if retailer r sells product j and 0 otherwise (the off-diagonal elements being equal to 0). The mathematical symbol + corresponds to the unique Moore-Penrose pseudoinverse operator,[17] and $\mathbf{S}_{\mathbf{p}}$ is a $J \times J$ matrix consisting of the first derivatives of all market shares with respect to all retail prices

$$\mathbf{S}_{\mathbf{p}} = \begin{pmatrix} \frac{\partial s_1}{\partial p_1} & \cdots & \frac{\partial s_J}{\partial p_1} \\ \vdots & \ddots & \vdots \\ \frac{\partial s_1}{\partial p_J} & \cdots & \frac{\partial s_J}{\partial p_J} \end{pmatrix}$$

Anticipating the vector of equilibrium retail margins, i.e.

$$\boldsymbol{\gamma}^* = \sum_{r=1}^{R} \boldsymbol{\gamma}^*_r$$

[16] Marginal costs of production and distribution are assumed to be full information.

[17] $\mathbf{I}_r \mathbf{S}_{\mathbf{p}} \mathbf{I}_r$ is a rank deficient matrix.

we consider the stage 2 by solving the bargaining game between manufacturers and retailers in the supply chain.

4.2 Stage 2: Bargaining between up- and downstream firms

In stage 2, we model the bilateral negotiations between leading producers of soft drinks and retailers. In this stage, the bargaining strategies employed by each upstream firm in the first-stage game as well as the contractual form used between each manufacturer-retailer pair are assumed to be full information.

Equilibrium concept. Since negotiations are interdependent, we use the "Nash-in-Nash" bargaining solution (Horn and Wolinsky, 1988) to determine the division of surplus.[18] Based on the Nash's axiomatic theory of bilateral bargaining (Nash, 1950), this solution concept corresponds to a Nash equilibrium between bilateral Nash bargains: each pair of players determines the division of surplus — according to the *asymmetric* Nash bargaining solution — given its conjectures about all other pairs' surplus allocation.[19] Hence, the "Nash-in-Nash" bargaining solution is equivalent to a Perfect Bayesian Equilibrium with *passive beliefs* refinement (McAfee and Schwartz, 1994) — i.e. when an unexpected outcome arises from a bilateral negotiation, players do not revise their beliefs about outcomes determined in all other transactions — in which firms behave schizophrenically and contracts are binding. This equilibrium concept has been extensively employed in recent empirical models of bargaining (see Crawford and Yurukoglu, 2012; Grennan, 2013; Crawford et al., 2015; Gowrisankaran, Nevo and Town, 2015; Ho and Lee, 2016).[20]

In what follows, we solve the bargaining game and estimate the division of surplus

[18]The "Nash-in-Nash" bargaining solution is equivalent to the concept of *contract equilibrium* (Crémer and Riordan, 1987; O'Brien and Shaffer, 1992) in the particular case where trading terms are bargained.

[19]This corresponds to a delegated negotiator structure where manufacturers and retailers send separate representatives to each bilateral negotiation. During these negotiations, representatives — including those coming from the same firm — are unable to communicate with one another. As a result, each pair of representatives chooses the allocation of surplus given its conjectures about outcomes determined in all other bilateral negotiations.

[20]Collard-Wexler, Gowrisankaran and Lee (2015) offer a non-cooperative microfondation of this semi-cooperative approach for transferable utility games. In the spirit of Binmore, Rubinstein and Wolinsky (1986), they show that in settings where any bilateral transaction generates a positive surplus — given all other bilateral agreements being formed — the "Nash-in-Nash" solution concept coincides with the Perfect Bayesian Equilibrium with passive-beliefs of a Rubinstein alternating offers model. However, this result does not apply to more general settings with non-transferable utility, letting this issue beyond the current state of the art.

for all possible bargaining strategies that upstream firms can play in stage 1. In this section, we describe the structural bargaining model for two subgames, namely: (i) Each manufacturer opts for a joint negotiation over its products for each category of soft drinks (i.e. cola, other soda, juice & nectar, and ice-tea); (ii) Each manufacturer decides to bargain its products separately.

4.2.1 Joint negotiations of products within a category

In the light of industry practices and due to the diverse portfolios of some large upstream firms, it appears that the soft drink industry is conducive to tie-in sales within the supply chain. One reason for choosing to bargain over wholesale prices of a set of products — comprising several must-stock items which can be seen to some extent as substitute from the consumer's perspective — comes from the straightforward idea that it may reduce the bargaining position of retailers during the negotiation process. Taking account of such a practices, we describe the subgame in which each manufacturer opts for a joint negotiation over wholesale prices of products for each category of beverages.

Agreement payoffs. Let $\mathcal{B}_{frc}$ be the set of products belonging to the category of soft drinks c — e.g. cola, juice & nectar, ice-tea, other soda — that are jointly negotiated between manufacturer f and retailer r. $\mathbf{w}_{\mathcal{B}_{frc}}$ denotes the wholesale price vector determined in the following bilateral negotiation, and $\mathbf{w}^*_{\backslash\mathcal{B}_{frc}}$ is the (anticipated) equilibrium wholesale price vector determined in all other bilateral bargain. The agreement payoffs of manufacturer f and retailer r are written as follows

$$
\begin{aligned}
\pi_f &= \sum_{j\in\mathcal{B}_{frc}} \left(w_j - \mu_j\right) M\, s_j(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) \;+ \sum_{k\in\mathcal{J}_f\backslash\mathcal{B}_{frc}} \left(w^*_k - \mu_k\right) M\, s_k(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) \\
\pi_r &= \sum_{j\in\mathcal{B}_{frc}} \left(p_j[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}] - w_j - c_j\right) M\, s_j(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) \\
&\quad + \sum_{k\in\mathcal{J}_r\backslash\mathcal{B}_{frc}} \left(p_k[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}] - w^*_k - c_k\right) M\, s_k(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r})
\end{aligned}
$$

Disagreement payoffs. Denote $\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}$ the vector of out-of-equilibrium retail prices fixed by all the retailers if the set of products $\mathcal{B}_{frc}$ is no longer offered on the market. Since we use the "Nash-in-Nash" solution concept and retailers compete downstream with *observ-*

able breakdowns, the status quo payoffs of firms are given by[21]

$$d_f^{\mathcal{B}_{frc}} = \sum_{k \in \mathcal{J}_f \setminus \mathcal{B}_{frc}} \left(w_k^* - \mu_k\right) M \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}[\mathbf{w}^*_{\setminus \mathcal{B}_{frc}}])$$
$$d_r^{\mathcal{B}_{frc}} = \sum_{k \in \mathcal{J}_r \setminus \mathcal{B}_{frc}} \left(\tilde{p}_k^{-\mathcal{B}_{frc}}[w^*_{\setminus \mathcal{B}_{frc}}] - w_k^* - c_k\right) M \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}[\mathbf{w}^*_{\setminus \mathcal{B}_{frc}}])$$

where $\tilde{s}_k^{-\mathcal{B}_{frc}}$ represents the market share of product k when all products belonging to the set $\mathcal{B}_{frc}$ are no longer offered. This out-of-equilibrium market share can be written as follows

$$\tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}) = \int_0^{+\infty} \frac{e^{\tilde{V}_{ilt}^{-\mathcal{B}_{frc}}}}{\sum_{l \in \mathcal{J} \setminus \mathcal{B}_{frc}} e^{\tilde{V}_{ilt}^{-\mathcal{B}_{frc}}}} f(\nu_i)\ \mathrm{d}\nu_i$$

with $\quad \tilde{V}_{ikt}^{-\mathcal{B}_{frc}} = \delta_{B(k)} + \delta_{r(k)} - \alpha_{ik}\tilde{p}_{kt}^{-\mathcal{B}_{frc}} + \delta_t.$

Asymmetric Nash product. Following Horn and Wolinsky (1988), the *asymmetric* Nash product of the bilateral negotiation between manufacturer f and retailer r over the wholesale price vector $\mathbf{w}_{\mathcal{B}_{frc}}$ — taking $\mathbf{w}^*_{\setminus \mathcal{B}_{frc}}$ as given — is written as follows

$$\max_{\{w_j\}_{j \in \mathcal{B}_{frc}}} \left[\pi_f(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\setminus \mathcal{B}_{frc}}], \mathbf{p}^*_{\setminus \mathcal{J}_r}) - d_f^{\mathcal{B}_{frc}}\right]^{1-\lambda_{frc}} \left[\pi_r(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\setminus \mathcal{B}_{frc}}], \mathbf{p}^*_{\setminus \mathcal{J}_r}) - d_r^{\mathcal{B}_{frc}}\right]^{\lambda_{frc}}$$

where λ_{frc} (resp. $1 - \lambda_{frc}$) represents the Nash bargaining weight of retailer r (resp. manufacturer f) when it bargains with manufacturer f (resp. retailer r) over the category of soft drinks c.

Solving the bargaining game, we obtain the vector of manufacturer f's margins (see Appendix A for computational details)

$$\boldsymbol{\Gamma}_f^* \equiv \mathbf{w}_f^* - \boldsymbol{\mu}_f = -\left(\left[\mathbf{V}_f \boldsymbol{\iota}^\top\right] \circ \mathbf{M}_f^{\mathcal{B}} + \left[\left(\frac{\mathbf{1} - \boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}}\right) \boldsymbol{\iota}^\top\right] \circ \tilde{\mathbf{M}}_f\right)^+ \left(\frac{\mathbf{1} - \boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \mathbf{s}\right) \qquad (1)$$

[21] An alternative specification allowing for non-binding contracts and immediate renegotiation ("from scratch") may be employed (Stole and Zwiebel, 1996; de Fontenay and Gans, 2014). Hence, the bargaining game becomes a function of the buyer-seller network. However, its recursive structure is dramatically complex and computationally burdensome to solve (see Yurukoglu, 2008; Dranove, Satterthwaite and Sfekas, 2011).

$$\text{with}\quad \mathbf{V}_f \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \Big[(\mathbf{P_w} - \mathbf{I}) \mathbf{I}_r \mathbf{s} + \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_r \boldsymbol{\gamma}^* \Big]$$

$$\mathbf{M}_f^{\mathcal{B}} \equiv \mathbf{I}_f \tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} \mathbf{I}_f$$

$$\tilde{\mathbf{V}}_f^{\mathcal{B}} \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \Big[\boldsymbol{\iota} \mathbf{s}^\top \mathbf{I}_r \boldsymbol{\gamma}^* + \Big(\Big[\Big(\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} - \boldsymbol{\iota} \mathbf{s}^\top \Big) \mathbf{I}_r \Big] \circ \tilde{\boldsymbol{\gamma}}_{\mathcal{B}}^\top \Big) \boldsymbol{\iota} \Big]$$

$$\tilde{\mathbf{M}}_f \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_f$$

Notations employed in equation (1) are described below:

- The mathematical symbol $\circ$ represents the Hadamard product operator (also known as the element-by-element multiplication);
- $\boldsymbol{\iota} \equiv \mathbb{1}_J$ denotes the all-ones vector of dimension J, i.e. every element is equal to one;
- $\boldsymbol{\Gamma}_f^*$ is a J-dimensional vector where the jth element is equal to manufacturer f's equilibrium margins over product j if it belongs to $\mathcal{J}_f$, and 0 otherwise;
- $\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}}$ is a column vector of dimension J corresponding to the ratio of the Nash bargaining weights between channel members;
- $\boldsymbol{\gamma}^*$ corresponds to the J-dimensional vector of equilibrium retail margins;
- $\tilde{\boldsymbol{\gamma}}_{\mathcal{B}}$ is a $J \times J$ rank deficient matrix of equilibrium and out-of-equilibrium retail margins, i.e.

$$\tilde{\boldsymbol{\gamma}}_{\mathcal{B}}[k,j] = \begin{cases} \tilde{\gamma}_k^{-\mathcal{B}_{frc}} = \tilde{p}_k^{-\mathcal{B}_{frc}} + \gamma_k - p_k & \text{if } j \in \mathcal{B}_{frc} \text{ and } k \in \mathcal{J} \backslash \mathcal{B}_{frc} \\ \gamma_k^* & \text{if } j,k \in \mathcal{B}_{frc} \end{cases}$$

- $\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}}$ is a $J \times J$ rank deficient matrix of equilibrium market shares and changes in market shares following a bilateral disagreement over a set of products, i.e.

$$\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}}[j,k] = \begin{cases} s_k(\mathbf{p}^*) & \text{if } j,k \in \mathcal{B}_{frc} \\ s_k(\mathbf{p}^*) - \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}) & \text{otherwise} \end{cases}$$

- $\mathbf{P_w}$ corresponds to the $J \times J$ matrix of the first derivatives of retail prices with respect to wholesale prices. Since retailers are unable to observe wholesale contracts of their competitors, i.e.

$$\mathbf{P_w}[j,k] = \begin{cases} \frac{\partial p_k}{\partial w_j} & \text{if } j,k \in \mathcal{J}_r \\ 0 & \text{otherwise} \end{cases}$$

(see our Web Appendix for further details).

Since the system of equations (1) contains an unknown vector of parameters ($\boldsymbol{\lambda}$), we need an additional component to identify the equilibrium margins of manufacturer f ($\boldsymbol{\Gamma}^*_f$). Following Draganska, Klapper and Villas-Boas (2010), we rely on the relationship between industry margins and total marginal costs

$$\boldsymbol{\Gamma}^* + \boldsymbol{\gamma}^* = \mathbf{p}^* - (\mathbf{c} + \boldsymbol{\mu}) \tag{2}$$

where $\boldsymbol{\Gamma}^* = \sum_{f=1}^{F} \boldsymbol{\Gamma}^*_f$.

Since the total marginal cost of each product is not observed, we need to make assumptions about the cost structure of the soft drink sector. We specify the total marginal cost as a reduced-form function of cost characteristics separated into an observed and unobserved component, i.e.[22]

$$\mathbf{c} + \boldsymbol{\mu} = \boldsymbol{\omega\theta} + \boldsymbol{\eta} \tag{3}$$

where $\boldsymbol{\omega}$ is a $J \times K$ matrix of exogenous cost shifters, namely the price indices of aluminum and sugar (weighted by the sugar content in each brand), $\boldsymbol{\theta}$ corresponds to a K-dimensional vector of cost parameters, and $\boldsymbol{\eta}$ is a J-dimensional vector of unobserved marginal cost components.

Then, substituting (1) and (3) into (2), we obtain the following equation of retailers marginal costs

$$\mathbf{p}^* - \boldsymbol{\gamma}^* = -\sum_{f=1}^{F} \left(\left[\mathbf{V}_f \, \boldsymbol{\iota}^\top \right] \circ \mathbf{M}^{\mathcal{B}}_f + \left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}^{\mathcal{B}}_f \right) \boldsymbol{\iota}^\top \right] \circ \tilde{\mathbf{M}}_f \right)^+ \left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}^{\mathcal{B}}_f \circ \mathbf{s} \right) + \boldsymbol{\omega\theta} + \boldsymbol{\eta}$$

$$\Leftrightarrow \quad \mathbf{w}^* + \mathbf{c} = \underbrace{-\sum_{f=1}^{F} \left(\left[\mathbf{V}_f \, \boldsymbol{\iota}^\top \right] \circ \mathbf{M}^{\mathcal{B}}_f + \left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}^{\mathcal{B}}_f \right) \boldsymbol{\iota}^\top \right] \circ \tilde{\mathbf{M}}_f \right)^+ \left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}^{\mathcal{B}}_f \circ \mathbf{s} \right)}_{\text{Bargaining power effect}} + \underbrace{\boldsymbol{\omega\theta}}_{\text{Cost shifters effect}} + \boldsymbol{\eta} \tag{4}$$

[22]This approach is commonly used in empirical works (e.g. Petrin (2002); Gowrisankaran, Nevo and Town (2015)).

which then constitutes the basis for point identification of the supply-side parameters $\boldsymbol{\lambda}$ and $\boldsymbol{\theta}$ of this subgame.

4.2.2 Separate negotiations of products

We now describe the bargaining process in the subgame where each manufacturer chooses to negotiate its products separately.

Asymmetric Nash product. Let $\mathbf{w}^*_{\backslash j}$ be the (anticipated) equilibrium wholesale price vector of products — excluding product j. Taking $\mathbf{w}^*_{\backslash j}$ as given, the *asymmetric* Nash product of the bilateral negotiation between manufacturer f and retailer r over w_j can be written as follows (see our Web Appendix for computational details)

$$\max_{\{w_j\}}\left[\pi_f(\mathbf{p}_{\mathcal{J}_r}[w_j,\mathbf{w}^*_{\backslash j}],\mathbf{p}^*_{\backslash\mathcal{J}_r})-d_f^j\right]^{1-\lambda_{frc}}\left[\pi_r(\mathbf{p}_{\mathcal{J}_r}[w_j,\mathbf{w}^*_{\backslash j}],\mathbf{p}^*_{\backslash\mathcal{J}_r})-d_r^j\right]^{\lambda_{frc}}$$

As previously, solving the bargaining game and using (2) lead to the following equation of retailers marginal costs

$$\begin{aligned}
&\mathbf{p}^*-\boldsymbol{\gamma}^*=-\sum_{f=1}^{F}\left(\left[\mathbf{V}_f\,\boldsymbol{\iota}^\top\right]\circ\mathbf{M}_f+\left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}}\circ\tilde{\mathbf{V}}_f\right)\boldsymbol{\iota}^\top\right]\circ\tilde{\mathbf{M}}_f\right)^{+}\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}}\circ\tilde{\mathbf{V}}_f\circ\mathbf{s}\right)+\boldsymbol{\omega}\boldsymbol{\theta}+\boldsymbol{\eta}\\
\Leftrightarrow\quad&\mathbf{w}^*+\mathbf{c}=-\sum_{f=1}^{F}\left(\left[\mathbf{V}_f\,\boldsymbol{\iota}^\top\right]\circ\mathbf{M}_f+\left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}}\circ\tilde{\mathbf{V}}_f\right)\boldsymbol{\iota}^\top\right]\circ\tilde{\mathbf{M}}_f\right)^{+}\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}}\circ\tilde{\mathbf{V}}_f\circ\mathbf{s}\right)+\boldsymbol{\omega}\boldsymbol{\theta}+\boldsymbol{\eta}
\end{aligned}\tag{5}$$

$$\begin{aligned}
\text{with}\quad&\mathbf{M}_f\equiv\mathbf{I}_f\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}\mathbf{I}_f\\
&\tilde{\mathbf{V}}_f\equiv\sum_{r=1}^{R}\mathbf{I}_f\mathbf{I}_r\left[\iota\mathbf{s}^\top\mathbf{I}_r\boldsymbol{\gamma}^*+\left(\left[\left(\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}-\iota\mathbf{s}^\top\right)\mathbf{I}_r\right]\circ\tilde{\boldsymbol{\gamma}}^\top\right)\iota\right]
\end{aligned}$$

and where $\tilde{\boldsymbol{\gamma}}$ represents a $J\times J$ matrix of equilibrium and out-of-equilibrium retail margins, i.e.

$$\tilde{\boldsymbol{\gamma}}[j,k]=\begin{cases}\gamma_k^* & \text{if } j=k\\ \tilde{\gamma}_k^{-j}=\tilde{p}_k^{-j}+\gamma_k-p_k & \text{otherwise}\end{cases}$$

and $\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}$ corresponds to a $J\times J$ matrix of market shares and changes in market shares following a bilateral disagreement over a product, i.e.

$$\tilde{\mathbf{S}}_{\boldsymbol{\Delta}} = \begin{pmatrix} s_1(\mathbf{p}^*) & -\Delta\tilde{s}_2^{-1}(\tilde{\mathbf{p}}^{-1}) & \cdots & -\Delta\tilde{s}_J^{-1}(\tilde{\mathbf{p}}^{-1}) \\ -\Delta\tilde{s}_1^{-2}(\tilde{\mathbf{p}}^{-2}) & s_2(\mathbf{p}^*) & \cdots & -\Delta\tilde{s}_J^{-2}(\tilde{\mathbf{p}}^{-2}) \\ \vdots & \vdots & \ddots & \vdots \\ -\Delta\tilde{s}_1^{-J}(\tilde{\mathbf{p}}^{-J}) & -\Delta\tilde{s}_2^{-J}(\tilde{\mathbf{p}}^{-J}) & \cdots & s_J(\mathbf{p}^*) \end{pmatrix}$$

with $-\Delta\tilde{s}_k^{-j}(\tilde{\mathbf{p}}^{-j}) = s_k(\mathbf{p}^*) - \tilde{s}_k^{-j}(\tilde{\mathbf{p}}^{-j})$.

Similarly, equation (5) is the basis for the use of econometric methods to estimate the vector of parameters $\boldsymbol{\lambda}$ and $\boldsymbol{\theta}$ and then recover the vector of manufacturers' margins ($\boldsymbol{\Gamma}$) for the subgame in which each manufacturer bargains its products separately.

4.3 Stage 1: Choice of the bargaining strategy

In this preliminary stage, we allow the four national brand manufacturers to determine their bargaining strategy, i.e. whether to negotiate jointly or separately wholesale prices of products. Denote by $\mathcal{A}_f$ the strategy set of manufacturer f. If we allow manufacturer f to design a pool of products that will be bargained jointly with each retailer — its other products being bargained separately — the total number of actions it can play is given by

$$\text{card}(\mathcal{A}_f) = R\left(2^{\text{card}(\mathcal{G}_f)} - \text{card}(\mathcal{G}_f)\right)$$

where $\mathcal{G}_f$ indicates the set of brands produced by manufacturer f, and R the total number of retailers. Given the large number of possible actions, we impose restrictions on the strategy space in order to make the resolution of the game solvable.[23] First, we make the assumption that manufacturers have the same finite set of possible actions, denoted by $\mathcal{A}$. In addition, we limit our analysis to an environment in which each manufacturer makes a binary decision.[24] We define a vector of strategy profile $\mathbf{a} = (a_1, \ldots, a_F)$, where $a_f \in \mathcal{A}$ for $f = 1, \ldots, F$. Let $a_f = 1$ denote a decision by manufacturer f to "jointly negotiate wholesale prices of products for each category with each retailer", and $a_f = 0$ a decision by manufacturer f to "separately negotiate wholesale prices of products with each retailer".

[23]For example, given that $\text{card}(\mathcal{G}_1) = 7$, manufacturer 1 has to choose its best strategy among $7\left(2^7 - 7\right) = 847$ strategies.

[24]I.e. $\text{card}(\mathcal{A}) = 2$.

Finally, we assume that manufacturers choose simultaneously and deterministically their actions.

Equilibrium concept. To solve the first-stage game for each information structure we have specified — i.e. downstream competition with *interim unobservability* and with *observable breakdowns* — we employ an algorithm which identifies all pure-strategy Nash equilibria, i.e. every strategy profiles $\mathbf{a}^*$ such that

$$\forall f, a_f \in \mathcal{A}: \quad \pi_f(a^*_f, a^*_{-f}) \geq \pi_f(a_f, a^*_{-f})$$

where $\pi_f(.)$ corresponds to the payoffs of manufacturer f estimated in stage 2.

As shown in section 6.2, we may find multiple Nash equilibria in pure strategies. Whenever it is the case, we refine the Nash equilibrium set by selecting outcomes that are *coalition-proof* (Bernheim, Peleg and Whinston, 1987). The concept of Coalition-Proof Nash equilibrium consists of looking for equilibria of the game that are robust to any credible deviations by all possible coalitions of players — i.e. there is no incentives for any subcoalitions to deviate from the deviation.
[TO BE COMPLETED]

5 Econometrics

We use a two-step procedure to identify market parameters.[25] We first estimate the substitution patterns between products from our demand model. Then, using demand estimates we are able to achieve point identification of the supply parameters.

5.1 Identification of the demand parameters

Endogeneity problem. Prior to making their decisions, firms and consumers are likely to observe some product characteristics that are unavailable to the researcher. Being included in the error term of the demand model, these unobserved product characteristics

[25]Although a joint estimation of both demand and supply models has the advantage of increasing the accuracy of the estimation, demand estimates would be affected by the supply-side specification. Therefore, a two-step procedure which separately estimates demand and supply ensures to have consistent estimates of the substitution patterns between products, even in case of supply-side misspecifications (Bonnet and Dubois, 2010; Grennan, 2013).

influence the way firms set prices. Consequently, the error term and the price variable are correlated, generating the so-called endogeneity problem (Berry, 1994).[26] In order to mitigate the endogeneity problem and obtain consistent estimates, we use the two-stage residual inclusion method (2SRI).[27] The main idea behind this method is to generate a proxy variable that captures the part of the error term $\xi_j + \Delta\xi_{jt} + e_{ijt}$ correlated with the price variable p_{jt}. For this purpose, we regress the price on exogenous variables of the demand model ($\mathbf{X}_j^{\mathbf{D}}$) and instrumental variables of cost shifters ($\mathbf{Z}_{jt}$)

$$p_{jt} = \boldsymbol{\vartheta}\mathbf{X}_j^{\mathbf{D}} + \boldsymbol{\zeta}\mathbf{Z}_{jt} + \upsilon_{jt}$$

where $\boldsymbol{\vartheta}$ and $\boldsymbol{\zeta}$ are two vectors of parameters, and υ_{jt} represents the error term containing all unobserved variables that explain p_{jt}. Then, we add the residuals term of this regression ($\hat{\upsilon}_{jt}$) — which captures the part of the error term $\xi_j + \Delta\xi_{jt} + e_{ijt}$ correlated with the price p_{jt} — into V_{ijt}

$$U_{ijt} = \delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \delta_t + \varphi\hat{\upsilon}_{jt} + \epsilon_{ijt}$$

where $\epsilon_{ijt} = \xi_j + \Delta\xi_{jt} + e_{ijt} - \varphi\hat{\upsilon}_{jt}$ is now uncorrelated with prices.

Simulated Maximum Likelihood. To estimate parameters of the demand model, we use a subsample of $100,000$ observations. Based on Revelt and Train (1998), we estimate the random coefficient logit model by maximizing the simulated log-likelihood function written as follows

$$\text{SLL} = \sum_{i=1}^{I}\sum_{j=1}^{J}\sum_{t=1}^{T} \delta_{ijt} \ln\left(s_{ijt}^{h}\right)$$

where δ_{ijt} is a dummy variable equals to 1 if consumer i chooses product j at period t and 0 otherwise, and s_{ijt}^{h} represents the individual simulated market share of product j at period t.[28]

[26]The coefficient associated to the price will not only capture price effect on demand but also effect of other factors that are correlated with the price variable.

[27]Terza, Basu and Rathouz (2008) show that this method provides consistent estimates in a non-linear econometric model. Petrin and Train (2010) show that the 2SRI method gives similar results than the BLP approach. Additionally, they put forward that the 2SRI method is more general and easier to implement than the BLP approach.

[28]The individual simulated market share is written as follows:

$$s_{ijt}^{h} = \frac{1}{H}\sum_{h=1}^{H} \frac{e^{\delta_{b(j)}+\delta_{r(j)}+\delta_t-\left(\alpha_{nb(j)}+\alpha_{pl(j)}+\sigma\nu_i^h\right)p_{jt}+\varphi\hat{\upsilon}_{jt}}}{\sum_{k=0}^{J} e^{\delta_{b(k)}+\delta_{r(k)}+\delta_t-\left(\alpha_{nb(k)}+\alpha_{pl(k)}+\sigma\nu_i^h\right)p_{kt}+\varphi\hat{\upsilon}_{kt}}}$$

5.2 Identification of the supply parameters

For every subgames, we infer upstream equilibrium margins from a bargaining model and derive a statistical equation of the form

$$\mathbf{w}^* + \mathbf{c} = g(\mathbf{X^s}, \boldsymbol{\lambda}) + \boldsymbol{\omega}\boldsymbol{\theta} + \boldsymbol{\eta}$$

where $g(.)$ is the upstream margins derived from the "Nash-in-Nash" bargaining solution which corresponds to a nonlinear function of demand parameters, equilibrium and out-of-equilibrium retail prices and retail margins (denoted by $\mathbf{X^s}$), and Nash bargaining weights of firms.

Identification method. Identification of the supply-side parameters $\boldsymbol{\lambda}$ and $\boldsymbol{\theta}$ are then performed by nonlinear least squares, i.e.

$$\min_{\boldsymbol{\lambda},\boldsymbol{\theta}} \quad \boldsymbol{\eta}^\top \boldsymbol{\eta}$$

where $\mathbb{E}(\boldsymbol{\eta} \mid \mathbf{X^s}, \boldsymbol{\omega}) = 0$ should be satisfied to provide consistent point-estimates. While we can reasonably treat $\boldsymbol{\omega}$ as exogenous,[29] the component $\mathbf{X^s}$ raises more concerns. Indeed, as retail prices enter nonlinearly into $\mathbf{X^s}$ and are likely correlated with unobserved cost shifters, we have to be cautious when estimating supply-side parameters since the regression potentially suffers from endogeneity bias. We adress this issue by including into $\boldsymbol{\omega}$ — which already contains price indices of aluminium and sugar —– a constant term to capture the mean of unobserved marginal cost factors, and fixed effects so as to control for unobserved differences between marginal cost of products. More specifically, we use unobserved category fixed effects to capture the marginal cost heterogeneity across segments of products, namely: pure juice, juice & nectar, cola & other soda, and national brands. We also incorporate retail fixed effects and time fixed effects to capture any cost shocks over time. Controlling for these unobserved attributes, we further assume that the unobserved heterogeneity in marginal cost within categories of soft drinks are relatively small and do not affect our estimates.[30]

where H corresponds to the total number of Halton draws for each consumer i. In order to obtain each ν_i^h, we use Halton sequence. Based on Train (2000), we use 100 Halton draws for each individual in the subsample so as to obtain the smaller simulation variance in the estimation of the mixed logit parameters.

[29] Cost shifters are reasonably considered as uncorrelated with other unobserved input costs in our analysis.

[30] For instance, we believe that differences in producing a unit of Coca-Cola compared to a unit of Pepsi is likely to be very small. Thus, we do not control for these unobserved heterogeneity.

6 Empirical results

6.1 Demand Side

The estimated parameters of the random coefficient logit model are shown in Table 2.

Table 2: Results of the random coefficient logit model

Parameters			**Parameters**	
	Mean	Std. Dev.		Mean
Price (p_{jt})		0.62 (0.00)		
× PL	2.34 (0.00)			
× NB	1.46 (0.00)			
2SRI term ($\hat{v}_{jt}$)	4.41 (0.00)			
Retail fixed effect				
R_1	6.53 (0.00)		R_5	3.45 (0.00)
R_2	0.12 (0.00)		R_6	0.54 (0.00)
R_3	0.53 (0.00)		R_7	ref.
R_4	-1.08 (0.00)			
Brand fixed effect				
Cola				
B_2 (PL)	0.12 (0.00)		B_{22}	-2.02 (0.00)
B_{13}	-1.34 (0.00)		B_{23}	1.80 (0.00)
Other soda				
B_4 (PL)	-1.08 (0.00)		B_{16}	-2.06 (0.00)
B_5	-3.45 (0.00)		B_{17}	0.04 (0.00)
B_{10}	-0.30 (0.00)		B_{19}	-6.98 (0.00)
B_{11}	0.30 (0.00)		B_{20}	-2.51 (0.00)
B_{14}	1.01 (0.00)		B_{21}	4.03 (0.00)
B_{15}	-2.42 (0.00)		B_{24}	-0.21 (0.00)
Juice & Nectar				
B_1 (PL)	6.53 (0.00)		B_{18}	4.43 (0.00)
B_8	1.21 (0.00)		B_{25}	0.48 (0.00)
B_{12}	2.25 (0.00)			
Ice-Tea				
B_3 (PL)	1.53 (0.00)		B_7	-1.11 (0.00)
B_6	0.54 (0.00)		B_9	-1.72 (0.00)
Time fixed effect not shown.				
Log-likelihood				-345,275
Number of observations				100,000

Standard errors are in parenthesis. (PL) corresponds to *private label*.

First of all, we can observe from Table 2 that the average effect of the price on utility, which is allowed to differ between private labels and national brands, is negative and significant. Consumers are in average more sensitive to the price variations of private labels than those from national brands, which underlines the loyalty effect of consumers regarding national brands. Our estimates show that the standard deviation of the random coefficient is significant which indicates heterogeneity among consumers regarding the marginal price disutility. The coefficient associated to the control parameter $\hat{v}$ is significant and has a positive value, suggesting that the unobserved characteristics of products correlated with the price variable have a positive effect on the utility of consumers.[31] The retail fixed effects indicate that there exists a significant degree of heterogeneity in the preference of retail chain. This result is consistent with the study published by the European Commission (2007). Interestingly, the brand fixed effects reveal that private labels are perceived differently by consumers according to the categories of beverages. For instance, private labels for the juice & nectar segment are, in average, valued more than national brands, while private labels for the soda segment — excluding cola products — seem to be less valued than national brands.

Using the estimated parameters of the demand model in Table 2, we are able to compute the own and cross-price elasticites with respect to each product. Table 3 depicts the average estimated own-price elasticities of the brands.

[31] Ignoring the endogeneity problem would underestimate the negative effect of the price on consumers utility (Petrin and Train, 2010).

Table 3: Average own-price elasticities of the brands

Brands	Own-Price Elasticity	Brands	Own-Price Elasticity
Cola			
Brand 2 (PL)	-3.25 (0.56)	Brand 22	-4.14 (0.28)
Brand 13	-2.89 (0.31)	Brand 23	-3.64 (0.18)
Other Soda			
Brand 4 (PL)	-4.21 (0.58)	Brand 16	-3.09 (0.27)
Brand 5	-3.24 (0.26)	Brand 17	-4.74 (0.31)
Brand 10	-3.54 (0.36)	Brand 19	-2.98 (0.07)
Brand 11	-4.18 (0.43)	Brand 20	-4.15 (0.14)
Brand 14	-4.62 (0.27)	Brand 21	-17.65 (0.75)
Brand 15	-2.97 (0.29)	Brand 24	-4.05 (0.74)
Juice & Nectar			
Brand 1 (PL)	-8.24 (0.99)	Brand 18	-9.66 (0.90)
Brand 8	-7.62 (1.50)	Brand 25	-6.34 (0.65)
Brand 12	-7.92 (0.59)		
Ice-Tea			
Brand 3 (PL)	-5.42 (0.83)	Brand 7	-5.61 (0.68)
Brand 6	-4.37 (0.44)	Brand 9	-3.83 (0.31)

Standard deviation in parenthesis refers to variation across retailers and periods. (PL) corresponds to *private label*.

We can observe that own-price elasticities varies between -2.80 and -9.37 (with a peak up to -17.16 for brand 21 corresponding to an expensive specific brand as depicted in Table 1). These results are slightly higher than those found by Gasmi, Laffont and Vuong (1992), but are consistent with Dubé (2005) regarding cola's products, and Bonnet and Requillart (2013) who did not include the juice & nectar segment in their analysis.[32] Not surprisingly, given their cost of production and consequently their high price level relative to other beverages, own-price elasticities are higher for brands belonging to the juices & nectars category.

[32] Gasmi, Laffont and Vuong (1992) estimated a linear demand model and obtained own-price elasticities varying between -1.71 to -1.97 for cola's products in the U.S. soft drink market from 1968 to 1986. Using a multiple-discrete choice model, Dubé (2005) estimated own-price elasticities for cola's products between -3.10 to -5.76 in the Denver area in the 90's. Bonnet and Requillart (2013) found an average of -3.52 for their estimated own-price elasticities in the French soft drink market in 2005.

Table 4: Own and cross-price elasticities aggregated by category of beverages

Random Coefficients Logit				
Category	**Elasticities**			
	Cola	Other Soda	Juice	Ice-Tea
Cola	-2.58	0.89	0.59	0.87
Other Soda	0.54	-3.73	0.48	0.55
Juice & Nectar	2.46	2.94	-2.98	3.29
Ice-Tea	0.29	0.30	0.27	-4.36

Finally, Table 4 depicts the own and cross-price elasticities aggregated by categories of beverages.[33] We can see that the own-price elasticity of juice & nectar at the category level is lower compared to the own-price elasticities at the brand level (see Table 3). This suggests that there might exist an important substitutability between brands within this category. In addition, we can observe that cross-price elasticities of the juice & nectar segment indicate that all other categories are close substitute from the consumer's perspective. These results emphasize the strong presence of private labels within this category of products. Given that private labels are usually not highly differentiated — leading to an absence of brand loyalty — a price increase result in a large diversion within and outside the juice & nectar segment.

6.2 Supply Side

From the results of the demand model presented previously, we are able to recover retail margins and point identify the Nash bargaining weights of firms within the vertical chain as well as the total marginal costs of each product. Using these estimates, we can compute upstream profits for each subgame, determine the unique outcome of our first-stage game under each informational structure we consider, and infer the equilibrium outcome that best fits the data (Rivers and Vuong, 2002). We then investigate the sharing of industry profits and perform counterfactual experiments.

6.2.1 Best-fitting Equilibrium

Table 5 shows all pure-strategy Nash equilibria that are obtained for each information structure considered in this paper. When retailers compete downstream with *observable*

[33]This table can be interpreted as follows: if the prices of all cola's products increase by 1%, the demand of ice-tea products would increase by 0.87%.

breakdowns, a unique Nash equilibrium in pure strategies is found in our first-stage game: manufacturer 1 and 3 opt for a joint negotiation over wholesale prices of products for each category of soft drinks whereas manufacturer 2 and 4 decide to negotiate their products separately. In the *interim unobservability* setting, two pure-strategy Nash equilibria are obtained, namely: (i) manufacturer 1 and 2 adopt a joint negotiation over wholesale prices of products for each category of beverages whereas manufacturer 3 and 4 choose to negotiate their products separately; (ii) manufacturers 1 and 3 decide to jointly negotiate wholesale prices of products for each category of soft drinks whereas manufacturers 2 and 4 opt for a separate negotiation. Since in this framework we do not obtain a unique prediction of the game, we employ the communication-based refinement introduced by Bernheim, Peleg and Whinston (1987) and look for equilibria that are *coalition-proof*. First of all, we can see that manufacturer 1 and 4 do not change their actions between the two equilibria, therefore they do not play any additional role in the determination of the unique equilibrium outcome of the game. Furthermore, we can observe that manufacturer 2 and 3 are stricly better off in the second Nash equilibrium in pure strategies, i.e. $\mathbf{a}_2^* = (1,0,1,0)$. As a result, if we allow for nonbinding private communications between manufacturers, the second Nash equilibrium in pure strategies is the unique equilibrium of the game that is immune to any credible deviations by a coalition between manufacturer 2 and 3.

Table 5: Pure Strategies Nash Equilibria

	M1's payoffs	M2's payoffs	M3's payoffs	M4's payoffs	Coalition-Proof
Interim Unobservability					
Strategy profile: $\mathbf{a}_1^* = (1,1,0,0)$	€21,781,148	€5,013,083	€3,190,472	€13,087,139	No
Strategy profile: $\mathbf{a}_2^* = (1,0,1,0)$	€13,478,443	€5,073,375	€3,670,908	€8,921,877	Yes
Observable Breakdowns					
Strategy profile: $\mathbf{a}^* = (1,0,1,0)$	€17,980,816	€5,691,282	€3,717,219	€12,557,854	Yes

Payoffs correspond to the estimated profits of the manufacturers over the time-period considered in our analysis (i.e. from April to September 2005).

Model Selection. After identifying a unique equilibrium outcome for the first-stage game under each information structure, we infer the one that best fits the data, i.e. the equilibrium which is closest to the data generating process. To that end, we employ the test developed by Rivers and Vuong (2002) which offers a flexible selection procedure to compare nonnested econometric models. In particular, this approach does not require that one of the competing models is correctly specified and allows for various model selection criteria. In our setting, we use the mean squared errors of prediction criterion to determine the model that *significantly* outperforms the other (see Appendix D for details).

Our results suggest that the equilibrium under which retailers compete downstream with *observable breakdowns* best fits the data. In what follows, we therefore analyze the sharing of industry profits given by that equilibrium outcome.

6.2.2 Sharing of industry profits

To analyze the sharing of profits within the supply chain, we rely on *the split-the-difference rule* for nontransferable utility games which governs the division of surplus for each bilateral transaction. Derived from the first-order condition of the Nash product, this rule establishes that the slice captured by each player to a bilateral negotiation corresponds to its disagreement payoffs plus a fraction of the remaining bilateral surplus corresponding to the exogenous component of its bargaining power.[34] For instance, the sharing of profits between manufacturer f and retailer r when they bargain bilaterally over product j belonging to the category of soft drinks c — given that all other agreements are formed — is written as follows

$$\pi_f = d_f^j + \left(1-\lambda_{frc}\right)\left[-\left(\frac{\mathrm{d}\pi_f/\mathrm{d}w_j}{\mathrm{d}\pi_r/\mathrm{d}w_j}\right)\left(\pi_r - d_r^j\right) + \pi_f - d_f^j\right]$$
$$\pi_r = d_r^j + \lambda_{frc}\left[-\left(\frac{\mathrm{d}\pi_r/\mathrm{d}w_j}{\mathrm{d}\pi_f/\mathrm{d}w_j}\right)\left(\pi_f - d_f^j\right) + \pi_r - d_r^j\right]$$

The disagreement payoffs size of firms is depicted in Table 6 for each bilateral negotiation. These estimates show that status quo profits of manufacturer 1 and 4 are higher than retailers in almost all bilateral transactions. Moreover, manufacturers' disagreement points are homogeneous across retailers as well as those of the retailers across manufacturers putting forward that they are not sensitive to the trading partner.

[34]It is important to be clear on what we mean by *bargaining power*. The bargaining power corresponds to the ability of a player to affect negotiation's terms. In our Nash bargaining setting, the bargaining power has two components: (i) an endogenous part that corresponds to the differences between the agreement and disagreement payoffs of a player (also called bargaining position); (ii) an exogenous part represented by the Nash bargaining weight that reflects some imprecisely defined differences in players' bargaining power other than those already captured by the endogenous component (Binmore, Rubinstein and Wolinsky, 1986). It is thus completely independent from the players' bargaining positions.

Table 6: Size of the disagreement payoffs in the bilateral profit

(a) Manufacturers' disagreement payoffs

	Manuf.1	Manuf.2	Manuf.3	Manuf.4
Retailer 1	6.21%	2.16%	0.89%	4.45%
Retailer 2	9.08%	2.63%	1.11%	5.13%
Retailer 3	8.41%	2.75%	1.16%	4.92%
Retailer 4	8.26%	2.71%	1.16%	4.75%
Retailer 5	3.71%	1.69%	0.79%	3.43%
Retailer 6	6.12%	2.28%	0.97%	4.38%
Retailer 7	6.98%	2.86%	1.06%	4.77%

(b) Retailers' disagreement payoffs

	Manuf.1	Manuf.2	Manuf.3	Manuf.4
Retailer 1	5.31%	5.79%	5.71%	5.92%
Retailer 2	3.46%	3.53%	3.29%	3.73%
Retailer 3	2.82%	3.00%	2.91%	3.08%
Retailer 4	3.05%	3.03%	3.18%	3.17%
Retailer 5	3.87%	6.51%	5.55%	5.33%
Retailer 6	3.66%	4.88%	4.50%	4.50%
Retailer 7	1.67%	2.29%	1.81%	2.11%

Table 7 presents an average of the slice that each firm is able to capture from the surplus generated by the bilateral transactions. Overall, we can see that the retailers have a stronger clout than the manufacturers, and therefore capture a higher share of the surplus generated by the bilateral negotiations.

Table 7: Added Value generated by the bilateral transactions

(a) Ad.V. captured by the manufacturers

	Manuf.1	Manuf.2	Manuf.3	Manuf.4
Retailer 1	33.94%	39.28%	49.74%	44.90%
Retailer 2	16.57%	38.19%	49.76%	39.99%
Retailer 3	24.46%	39.01%	49.57%	43.90%
Retailer 4	26.04%	40.28%	49.59%	46.69%
Retailer 5	50.77%	37.09%	49.91%	50.44%
Retailer 6	30.88%	37.59%	49.66%	46.97%
Retailer 7	20.91%	37.88%	41.91%	46.49%

(b) Ad.V. captured by the retailers

	Manuf.1	Manuf.2	Manuf.3	Manuf.4
Retailer 1	66.06%	60.72%	50.26%	55.10%
Retailer 2	83.43%	61.81%	50.24%	60.01%
Retailer 3	75.54%	60.99%	50.43%	56.10%
Retailer 4	73.96%	59.72%	50.41%	53.31%
Retailer 5	48.44%	62.91%	50.09%	49.56%
Retailer 6	51.64%	62.41%	50.34%	53.03%
Retailer 7	49.53%	62.12%	42.75%	53.51%

The total sharing of industry profits between manufacturers and retailers in the French soft drink market is depicted in Table 8. We can observe that the slice captured by each firm is not highly sensitive to its trading partner. Overall, the bargaining power in the French soft drink market lies in the retailers' hands who capture the main share of the industry profits.
[TO BE COMPLETED]

Table 8: Slice of the manufacturers

	Manuf.1	Manuf.2	Manuf.3	Manuf.4
Retailer 1	36.24%	38.32%	47.35%	44.70%
Retailer 2	23.57%	38.46%	48.67%	41.57%
Retailer 3	30.12%	39.52%	48.71%	45.30%
Retailer 4	31.35%	40.68%	48.59%	47.74%
Retailer 5	51.01%	35.74%	47.54%	49.45%
Retailer 6	40.36%	37.17%	47.92%	47.18%
Retailer 7	36.09%	38.79%	49.19%	48.06%

7 Conclusion

In this paper, we analyze the vertical interactions between manufacturers and retailers in the French soft drink market. Paying particular attention to the strategy used by manufacturers in the negotiation process with downstream firms, we design an empirical framework of bargaining and apply game-theoretic concepts to recover the sharing of industry profits in the supply chain. Our framework explicitly considers multiproduct bargaining and downstream price competition between retailers under different information structures, which affect the allocation of surplus through disagreement points. Our very preliminary results suggest that joint negotiations of products are employed by two national brand manufacturers in the supply chain, retailers compete downstream with *observable breakdowns*, and that the bargaining power lies mainly with the latters. From the market parameter estimates, we plan to perform some counterfactual experiments to investigate the welfare effects of preventing the use of joint negotiations of products by multi-product upstream firms. Although our analysis focuses on the soft drink industry, the methodology used can be applied to other setting. Indeed, one of the main advantages of our empirical setting is that it does not require any extensive dataset with informations on the supply-side which are rarely available in practice, especially for all market participants (e.g. data on wholesale prices or data on firms' marginal costs).

Appendix

A Joint negotiations of products within a category

In the current section, we solve in further details the bilateral negotiation between manufacturer f and retailer r over wholesale prices of products belonging to the set $\mathcal{B}_{frc}$ (the subscript c denoting the category of products) in the setting where retailers compete downstream with *observable breakdowns*.

Agreement payoffs. Let $\mathcal{B}_{frc}$ be the set of products jointly negotiated between manufacturer f and retailer r, $\mathbf{w}_{\mathcal{B}_{frc}}$ denotes the wholesale price vector determined by manufacturer f and retailer r, and $\mathbf{w}^*_{\backslash\mathcal{B}_{frc}}$ is the (anticipated) equilibrium wholesale price vector determined in all other bilateral bargain. The agreement payoffs of manufacturer f (retailer r respectively) are written as follows

$$
\begin{aligned}
\pi_f &= \sum_{j\in\mathcal{B}_{frc}} \left(w_j - \mu_j\right) M\, s_j(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) + \sum_{k\in\mathcal{J}_f\backslash\mathcal{B}_{frc}} \left(w^*_k - \mu_k\right) M\, s_k(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) \\
\pi_r &= \sum_{j\in\mathcal{B}_{frc}} \left(p_j[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}] - w_j - c_j\right) M\, s_j(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) \\
&\quad + \sum_{k\in\mathcal{J}_r\backslash\mathcal{B}_{frc}} \left(p_k[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}] - w^*_k - c_k\right) M\, s_k(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r})
\end{aligned}
$$

Disagreement payoffs. Let $\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}$ and $\tilde{s}_k^{-\mathcal{B}_{frc}}$ be respectively the vector of out-of-equilibrium retail prices set by retailers and the market share of product k given that products belonging to the set $\mathcal{B}_{frc}$ are no longer offered. The disagreement payoffs of manufacturer f and retailer r are respectively derived as follows

$$
\begin{aligned}
d_f^{\mathcal{B}_{frc}} &= \sum_{k\in\mathcal{J}_f\backslash\mathcal{B}_{frc}} \left(w^*_k - \mu_k\right) M\, \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}[\mathbf{w}^*_{\backslash\mathcal{B}_{frc}}]) \\
d_r^{\mathcal{B}_{frc}} &= \sum_{k\in\mathcal{J}_r\backslash\mathcal{B}_{frc}} \left(\tilde{p}_k^{-\mathcal{B}_{frc}}[w^*_{\backslash\mathcal{B}_{frc}}] - w^*_k - c_k\right) M\, \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}[\mathbf{w}^*_{\backslash\mathcal{B}_{frc}}])
\end{aligned}
$$

Asymmetric Nash product. The *asymmetric* Nash product of the bilateral negotiation between manufacturer f and retailer r over the wholesale price vector $\mathbf{w}_{\mathcal{B}_{frc}}$ — taking $\mathbf{w}^*_{\backslash\mathcal{B}_{frc}}$ as given — is written as follows

$$
\max_{\{w_j\}_{j\in\mathcal{B}_{frc}}} \left[\pi_f(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) - d_f^{\mathcal{B}_{frc}}\right]^{1-\lambda_{frc}} \left[\pi_r(\mathbf{p}_{\mathcal{J}_r}[\mathbf{w}_{\mathcal{B}_{frc}}, \mathbf{w}^*_{\backslash\mathcal{B}_{frc}}], \mathbf{p}^*_{\backslash\mathcal{J}_r}) - d_r^{\mathcal{B}_{frc}}\right]^{\lambda_{frc}}
$$

The first-order condition of this maximization problem governs the division of surplus between players. With respect to $j \in \mathcal{B}_{frc}$, we can derive it as follows

$$
\lambda_{frc}\left[\pi_f - d_f^{\mathcal{B}_{frc}}\right]\left(\frac{\mathrm{d}\pi_r}{\mathrm{d}w_j}\right) + \left(1-\lambda_{frc}\right)\left[\pi_r - d_r^{\mathcal{B}_{frc}}\right]\left(\frac{\mathrm{d}\pi_f}{\mathrm{d}w_j}\right) = 0
$$

$$\Leftrightarrow \quad \left[\sum_{j\in\mathcal{B}_{frc}} \Gamma_j^* s_j(\mathbf{p}^*) + \sum_{k\in\mathcal{J}_f\setminus\mathcal{B}_{frc}} \Gamma_k^* \left(s_k(\mathbf{p}^*) - \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}})\right)\right]\left[\sum_{k\in\mathcal{J}_r} \frac{\partial p_k}{\partial w_j} s_k(\mathbf{p}^*) - s_j(\mathbf{p}^*) + \sum_{k\in\mathcal{J}_r} \gamma_k^* \sum_{l\in\mathcal{J}_r} \frac{\partial s_k}{\partial p_l}\frac{\partial p_l}{\partial w_j}\right]$$
$$+ \frac{1-\lambda_{frc}}{\lambda_{frc}}\left[\sum_{j\in\mathcal{B}_{frc}} \gamma_j^* s_j(\mathbf{p}^*) + \sum_{k\in\mathcal{J}_r\setminus\mathcal{B}_{frc}} \gamma_k^* s_k(\mathbf{p}^*) - \tilde{\gamma}_k(\tilde{\mathbf{p}}^{-\mathcal{B}_{fr}})\tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}})\right]\left[s_j(\mathbf{p}^*) + \sum_{k\in\mathcal{J}_f} \Gamma_k^* \sum_{l\in\mathcal{J}_r} \frac{\partial s_k}{\partial p_l}\frac{\partial p_l}{\partial w_j}\right] = 0$$

with $\Gamma_j^* \equiv w_j^* - \mu_j$; $\gamma_j^* \equiv p_j^* - w_j^* - c_j$; $\tilde{\gamma}_k \equiv \tilde{p}_j^{-\mathcal{B}_{frc}} - w_k^* - c_k$.

For all products owned by manufacturer f on the market, the system of first-order conditions can be written in matrix notation as follows

$$\left(\mathbf{I}_f \tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} \mathbf{I}_f \boldsymbol{\Gamma}_f^*\right) \circ \left(\sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \left[(\mathbf{P_w} - \mathbf{I})\mathbf{I}_r \mathbf{s} + \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_r \boldsymbol{\gamma}^*\right]\right)$$
$$+ \frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \left(\sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \left[\iota\mathbf{s}^\top \mathbf{I}_r \boldsymbol{\gamma}^* + \left(\left[\left(\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} - \iota\mathbf{s}^\top\right)\mathbf{I}_r\right] \circ \tilde{\boldsymbol{\gamma}}_{\mathcal{B}}^\top\right)\iota\right]\right) \circ \left(\mathbf{s} + \left[\sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_f\right] \boldsymbol{\Gamma}_f^*\right) = \mathbf{0} \tag{6}$$

where the $J \times J$ matrices $\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}}$, $\tilde{\gamma}_{\mathcal{B}}$, and $\mathbf{P_w}$ are build as follows

- $\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}}[j,k] = \begin{cases} s_k(\mathbf{p}^*) & \text{if } j,k \in \mathcal{B}_{frc} \\ s_k(\mathbf{p}^*) - \tilde{s}_k^{-\mathcal{B}_{frc}}(\tilde{\mathbf{p}}^{-\mathcal{B}_{frc}}) & \text{otherwise} \end{cases}$
- $\tilde{\gamma}_{\mathcal{B}}[k,j] = \begin{cases} \tilde{\gamma}_k^{-\mathcal{B}_{frc}} = \tilde{p}_k^{-\mathcal{B}_{frc}} + \gamma_k - p_k & \text{if } j \in \mathcal{B}_{frc} \text{ and } k \in \mathcal{J}\setminus\mathcal{B}_{frc} \\ \gamma_k^* & \text{if } j,k \in \mathcal{B}_{frc} \end{cases}$
  (see Appendix C for computational details of out-of-equilibrium prices)
- $\mathbf{P_w} = \sum_{r=1}^{R} \mathbf{I}_r^{\text{nb}} \mathbf{S_p}^\top \mathbf{I}_r \left(\mathbf{I}_r \mathbf{S_p} \mathbf{I}_r + \mathbf{I}_r \mathbf{S_p}^\top \mathbf{I}_r + \mathbf{I}_r \mathbf{S_p^p}\right)^+$ (see our Web Appendix for further details)

Let us define
$$\mathbf{V}_f \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \left[(\mathbf{P_w} - \mathbf{I})\mathbf{I}_r \mathbf{s} + \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_r \boldsymbol{\gamma}^*\right]$$
$$\mathbf{M}_f^{\mathcal{B}} \equiv \mathbf{I}_f \tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} \mathbf{I}_f$$
$$\tilde{\mathbf{V}}_f^{\mathcal{B}} \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \left[\iota\mathbf{s}^\top \mathbf{I}_r \boldsymbol{\gamma}^* + \left(\left[\left(\tilde{\mathbf{S}}_{\boldsymbol{\Delta}}^{\mathcal{B}} - \iota\mathbf{s}^\top\right)\mathbf{I}_r\right] \circ \tilde{\boldsymbol{\gamma}}_{\mathcal{B}}^\top\right)\iota\right]$$
$$\tilde{\mathbf{M}}_f \equiv \sum_{r=1}^{R} \mathbf{I}_f \mathbf{I}_r \mathbf{P_w} \mathbf{I}_r \mathbf{S_p} \mathbf{I}_f$$

and re-write the system of equations (6) as follows

$$\mathbf{V}_f \circ \left(\mathbf{M}_f^{\mathcal{B}} \boldsymbol{\Gamma}_f^*\right) + \frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \mathbf{s} + \frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \left(\tilde{\mathbf{M}}_f \boldsymbol{\Gamma}_f^*\right) = \mathbf{0} \tag{7}$$

To derive equilibrium margins of manufacturer f we introduce the following Lemma.

Lemma 1 (Associative property). *Let* $\mathbf{V}$, $\mathbf{\Gamma}$, *and* $\boldsymbol{\iota}$ *be three J-dimensional vectors where every element of* $\boldsymbol{\iota}$ *is equal to* 1. *Consider a* $J \times J$ *matrix denoted* $\mathbf{M}$. *If we define* $\mathbf{C} \equiv \mathbf{V} \circ (\mathbf{M}\mathbf{\Gamma})$ *and* $\mathbf{D} \equiv ((\mathbf{V}\boldsymbol{\iota}^\top) \circ \mathbf{M})\mathbf{\Gamma}$, *then*

$$\mathbf{C} \equiv \mathbf{D}.$$

Proof. See Appendix B.

From (7) and Lemma 1 we obtain

$$\begin{aligned}
&\left(\left[\mathbf{V}_f \boldsymbol{\iota}^\top\right] \circ \mathbf{M}_f^{\mathcal{B}}\right)\mathbf{\Gamma}_f^* + \frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \mathbf{s} + \left(\left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}}\right) \boldsymbol{\iota}^\top\right] \circ \tilde{\mathbf{M}}_f\right)\mathbf{\Gamma}_f^* = \mathbf{0} \\
\Leftrightarrow \quad & \mathbf{\Gamma}_f^* = -\left(\left[\mathbf{V}_f \boldsymbol{\iota}^\top\right] \circ \mathbf{M}_f^{\mathcal{B}} + \left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}}\right) \boldsymbol{\iota}^\top\right] \circ \tilde{\mathbf{M}}_f\right)^+ \left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \mathbf{s}\right)
\end{aligned} \tag{8}$$

We finally denote $\mathbf{\Gamma}^* \equiv \sum_{f=1}^{F} \mathbf{\Gamma}_f^*$ and derive the vector of equilibrium upstream margins as follows

$$\mathbf{\Gamma}^* = -\sum_{f=1}^{F}\left(\left[\mathbf{V}_f \boldsymbol{\iota}^\top\right] \circ \mathbf{M}_f^{\mathcal{B}} + \left[\left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}}\right) \boldsymbol{\iota}^\top\right] \circ \tilde{\mathbf{M}}_f\right)^+ \left(\frac{\mathbf{1}-\boldsymbol{\lambda}}{\boldsymbol{\lambda}} \circ \tilde{\mathbf{V}}_f^{\mathcal{B}} \circ \mathbf{s}\right)$$

B Proof of Lemma 1

Lemma 1 (Associative property). *Let* $\mathbf{V}$, $\mathbf{\Gamma}$, *and* $\boldsymbol{\iota}$ *be three J-dimensional vectors where every element of* $\boldsymbol{\iota}$ *is equal to* 1. *Consider a* $J \times J$ *matrix denoted* $\mathbf{M}$. *If we define* $\mathbf{C} \equiv \mathbf{V} \circ (\mathbf{M}\mathbf{\Gamma})$ *and* $\mathbf{D} \equiv ((\mathbf{V}\boldsymbol{\iota}^\top) \circ \mathbf{M})\mathbf{\Gamma}$, *then*

$$\mathbf{C} = \mathbf{D}.$$

Proof. The ith element of the vector $\mathbf{C}$ can be computed as follows

$$\begin{aligned}
&[\mathbf{C}]_i = [\mathbf{V} \circ (\mathbf{M}\mathbf{\Gamma})]_i \\
\Leftrightarrow \quad & [\mathbf{C}]_i = [\mathbf{V}]_i \sum_{j=1}^{J} [\mathbf{M}]_{ij} [\mathbf{\Gamma}]_j \quad \text{where } [\mathbf{M}]_{ij} \text{ denotes the element at the } i\text{th row and } j\text{th column of } \mathbf{M}.
\end{aligned}$$

Similarly, the ith element of the vector $\mathbf{D}$ is derived as follows

$$\begin{aligned}
&[\mathbf{D}]_i = \left[\left(\left[\mathbf{V}\boldsymbol{\iota}^\top\right] \circ \mathbf{M}\right)\mathbf{\Gamma}\right]_i \\
\Leftrightarrow \quad & [\mathbf{D}]_i = \sum_{j=1}^{J} [\mathbf{V}]_i [\mathbf{M}]_{ij} [\mathbf{\Gamma}]_j \\
\Leftrightarrow \quad & [\mathbf{D}]_i = [\mathbf{V}]_i \sum_{j=1}^{J} [\mathbf{M}]_{ij} [\mathbf{\Gamma}]_j
\end{aligned}$$

Then, we have shown that $\forall i,\ [\mathbf{D}]_i = [\mathbf{C}]_i \quad \Rightarrow \quad \mathbf{C} = \mathbf{D}$.

Illustration: Without loss of generality, let us define $\mathbf{V} = \begin{pmatrix} v_{11} \\ v_{21} \\ v_{31} \end{pmatrix}$, $\mathbf{M} = \begin{pmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{pmatrix}$, $\boldsymbol{\iota} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$, and $\boldsymbol{\Gamma} = \begin{pmatrix} \Gamma_{11} \\ \Gamma_{21} \\ \Gamma_{31} \end{pmatrix}$.
The second element of each vector $\mathbf{C}$ and $\mathbf{D}$ can be respectively derived as follows

$$[\mathbf{C}]_2 = v_2\left(m_{21}\Gamma_1 + m_{22}\Gamma_2 + m_{23}\Gamma_3\right) \quad \text{and} \quad [\mathbf{D}]_2 = v_2 m_{21}\Gamma_1 + v_2 m_{22}\Gamma_2 + v_2 m_{23}\Gamma_3$$

As a result, we have $[\mathbf{C}]_2 = [\mathbf{D}]_2$.

C Identification of out-of-equilibrium prices.

In this section, we derive the out-of-equilibrium retail prices following a disagreement over a product. The mechanism we employ is equivalent when a disagreement occur on a set of products.

Let's assume that product $j \in \mathcal{J}_r$ is no longer offered on the market. Under the assumption that wholesale prices and distribution costs of other products remain unchanged,[35] the equilibrium margins (γ_k^*) and out-of-equilibrium margins ($\tilde{\gamma}_k^{-j}$) of product $k \in \mathcal{J}_r$ are written as follows

$$\gamma_k^* = p_k^* - w_k^* - c_k \quad \text{and} \quad \tilde{\gamma}_k^{-j} = \tilde{p}_k^{-j} - w_k^* - c_k$$

We can see from these margins that the following equality holds

$$\tilde{p}_k^{-j} - \tilde{\gamma}_k^{-j} = p_k^* - \gamma_k^* = w_k^* + c_k \tag{9}$$

Thus, from equation (9), the out-of-equilibrium prices when product j is no longer offered are identified by solving the following minimization program

$$\min_{\tilde{\mathbf{p}}^{-j}} \quad ||\tilde{\mathbf{p}}^{-j} - \tilde{\boldsymbol{\gamma}}^{-j} - (\mathbf{p}^* - \boldsymbol{\gamma}^*)||$$

where in the *observable breakdowns* seeting the J-dimensional vectors $\tilde{\mathbf{p}}^{-j}$ and $\tilde{\boldsymbol{\gamma}}^{-j}$ are given by

$$\tilde{\mathbf{p}}^{-j}[k,1] = \begin{cases} 0 & \text{if } j = k \\ \tilde{p}_k^{-j} & \text{otherwise} \end{cases} \quad \text{and} \quad \tilde{\boldsymbol{\gamma}}^{-j}[k,1] = \begin{cases} 0 & \text{if } j = k \\ \tilde{\gamma}_k^{-j}(\tilde{p}_k^{-j}) & \text{otherwise} \end{cases}$$

[35] Thanks to the passive-beliefs specification implied by the "Nash-in-Nash" solution concept, wholesale prices of other products remain unchanged.

D Non-Nested Rivers and Vuong tests

Table 9: Rivers and Vuong test

	Observable Breakdowns
Interim Unobservability	-18.73005

[TO BE COMPLETED]

E Estimated marginal costs

Table 10: Average total marginal cost of the brands

Brands	Marginal cost (€/liter)	Brands	Marginal cost (€/liter)
Cola			
Brand 2 (PL)	0.20 (0.06)	Brand 22	0.53 (0.17)
Brand 13	0.41 (0.10)	Brand 23	0.46 (0.09)
Total	0.40 (0.16)		
Other soda			
Brand 4 (PL)	0.29 (0.06)	Brand 16	0.41 (0.05)
Brand 5	0.49 (0.10)	Brand 17	0.60 (0.08)
Brand 10	0.33 (0.09)	Brand 19	0.22 (0.03)
Brand 11	0.48 (0.10)	Brand 20	0.47 (0.04)
Brand 14	0.52 (0.18)	Brand 21	2.93 (0.12)
Brand 15	0.42 (0.09)	Brand 24	0.58 (0.16)
Total	0.65 (0.69)		
Juice & Nectar			
Brand 1 (PL)	0.71 (0.09)	Brand 18	1.56 (0.17)
Brand 8	0.96 (0.53)	Brand 25	0.85 (0.37)
Brand 12	1.43 (0.11)		
Total	1.13 (0.45)		
Ice-Tea			
Brand 3 (PL)	0.40 (0.08)	Brand 7	0.76 (0.19)
Brand 6	0.52 (0.10)	Brand 9	0.46 (0.07)
Total	0.53 (0.18)		

Standard deviation in parenthesis refers to variation across retailers and periods. (PL) refers to *private label*.

F Estimated bargaining weights

Table 11: Weighted average (by market shares) of the estimated Nash bargaining weights of the manufacturers ($1 - \lambda_{frc}$)

	Manuf.1	**Manuf.2**	**Manuf.3**	**Manuf.4**
Retailer 1	0.50	0.68	0.99	0.81
Retailer 2	0.20	0.65	0.99	0.66
Retailer 3	0.32	0.67	0.98	0.77
Retailer 4	0.35	0.70	0.99	0.87
Retailer 5	0.99	0.60	0.99	0.99
Retailer 6	0.60	0.64	0.99	0.88
Retailer 7	0.45	0.64	0.99	0.86

References

Allain, Marie-Laure, and Claire Chambolle. 2011. "Anti-competitive effects of resale-below-cost laws." *International Journal of Industrial Organization*, 29(4): 373–385.

Autorité de la concurrence. 2015. "Avis n°15-A-06 du 31 mars 2015 relatif au rapprochement des centrales d'achat et de référencement dans le secteur de la grande distribution."

Bernheim, Douglas B., Bezalel Peleg, and Michael D. Whinston. 1987. "Coalition-Proof Nash Equilibria I. Concepts." *Journal of Economic Theory*, 42(1): 1–12.

Berry, Steven T. 1994. "Estimating Discrete-Choice Models of Product Differentiation." *The RAND Journal of Economics*, 25(2): 242–262.

Berry, Steven T., James Levinsohn, and Ariel Pakes. 1995. "Automobile Prices in Market Equilibrium." *Econometrica*, 63(4): 841–890.

Binmore, Ken, Ariel Rubinstein, and Asher Wolinsky. 1986. "The Nash Bargaining Solution in Economic Modelling." *The RAND Journal of Economics*, 17(2): 176–188.

Bonnet, Céline, and Pierre Dubois. 2010. "Inference on vertical contracts between manufacturers and retailers allowing for nonlinear pricing and resale price maintenance." *The RAND Journal of Economics*, 41(1): 139–164.

Bonnet, Céline, and Pierre Dubois. 2015. "Non Linear Contracting and Endogenous Buyer Power between Manufacturers and Retailers: Empirical Evidence on Food Retailing in France." Unpublished.

Bonnet, Céline, and Vincent Requillart. 2013. "Impact of Cost Shocks on Consumer Prices in Vertically-Related Markets: The Case of The French Soft Drink Market." *American Journal of Agricultural Economics*, 95(5): 1088–1108.

Collard-Wexler, Allan, Gautam Gowrisankaran, and Robin S. Lee. 2015. "Bargaining in Bilateral Oligopoly: An Alternating Offers Representation of the "Nash-in-Nash" Solution." Unpublished.

Crawford, Gregory S., and Ali Yurukoglu. 2012. "The Welfare Effects of Bundling in Multichannel Television Markets." *American Economic Review*, 102: 643–685.

Crawford, Gregory S., Robin S. Lee, Michael D. Whinston, and Ali Yurukoglu. 2015. "The Welfare Effects of Vertical Integration in Multichannel Television Markets." Unpublished.

Crémer, Jacques, and Michael H. Riordan. 1987. "On Governing Multilateral Transactions with Bilateral Contracts." *The RAND Journal of Economics*, 18(3): 436–451.

de Fontenay, Catherine C., and Joshua S. Gans. 2014. "Bilateral Bargaining with Externalities." *The Journal of Industrial Economics*, 62(4): 756–788.

Dobson, Paul W., and Michael Waterson. 1997. "Countervalling Power and Consumer Prices." *The Economic Journal*, 107(441): 418–430.

Dobson, Paul W., and Michael Waterson. 2007. "The competition effects of industry-wide vertical price fixing in bilateral oligopoly." *International Journal of Industrial Organization*, 25(5): 935–962.

Draganska, Michaela, Daniel Klapper, and Sofia Villas-Boas. 2010. "A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel." *Marketing Science*, 29(1): 57–74.

Dranove, David, Mark Satterthwaite, and Andrew Sfekas. 2011. "Bargaining and Leverage in Option Demand Markets." Unpublished.

Dubé, Jean-Pierre. 2005. "Product Differentiation and Mergers in the Carbonated Soft Drink Industry." *Journal of Economics & Management Strategy*, 14(4): 879–904.

European Commission. 2005. "Case COMP/A.39.116/B2 - Coca-Cola."

European Commission. 2007. "Competitiveness of the European Food Industry - An economic and legal assessment."

European Commission. 2011. "The impact of private labels on the competitiveness of the European food supply chain."

European Commission. 2014. "The economic impact of modern retail on choice and innovation in the EU food sector."

Gasmi, Farid, Jean-Jacques Laffont, and Quang Vuong. 1992. "Econometric Analysis of Collusive Behavior in a Soft-Drink Market." *Journal of Economics & Management Strategy*, 12(1): 277–311.

Gowrisankaran, Gautam, Aviv Nevo, and Robert Town. 2015. "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry." *American Economic Review*, 105(1): 172–203.

Grennan, Matthew. 2013. "Price Discrimination and Bargaining: Empirical Evidence from Medical Devices." *American Economic Review*, 103(1): 145–177.

Ho, Katherine, and Robin S. Lee. 2016. "Insurer Competition in Health Care Markets." Unpublished.

Horn, Henrik, and Asher Wolinsky. 1988. "Bilateral Monopolies and Incentives for Merger." *The RAND Journal of Economics*, 19(3): 408–419.

Inderst, Roman, and Tommaso Valletti. 2009. "Price discrimination in input markets." *The RAND Journal of Economics*, 40(1): 1–19.

Iozzi, Alberto, and Tommaso Valletti. 2014. "Vertical Bargaining and Countervailing Power." *American Economic Journal: Microeconomics*, 6(3): 106–135.

McAfee, R. Preston, and Marius Schwartz. 1994. "Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformity." *American Economic Review*, 84(1): 210–230.

Nash, John F. 1950. "The Bargaining Problem." *Econometrica*, 18(2): 155–162.

Nevo, Aviv. 2001. "Measuring Market Power in the Ready-to-Eat Cereal Industry." *Econometrica*, 69(2): 307–342.

O'Brien, Daniel P. 2014. "The welfare effects of third-degree price discrimination in intermediate good markets: the case of bargaining." *The RAND Journal of Economics*, 45(1): 92–115.

O'Brien, Daniel P., and Greg Shaffer. 1992. "Vertical Control with Bilateral Contracts." *The RAND Journal of Economics*, 23(3): 299–308.

Petrin, Amil. 2002. "Quantifying the Benefits of New Products: The Case of the Minivan." *Journal of Political Economy*, 110(4): 705–729.

Petrin, Amil, and Kenneth Train. 2010. "A Control Function Approach to Endogeneity in Consumer Choice Models." *Journal of Marketing Research*, 47(1): 3–13.

Revelt, David, and Kenneth Train. 1998. "Mixed Logit with repeated choices: households' choices of appliance efficiency level." *The Review of Economics and Statistics*, 80(4): 647–657.

Rey, Patrick, and Thibaud Vergé. 2004. "Bilateral control with vertical contracts." *The RAND Journal of Economics*, 35(4): 728–746.

Rey, Patrick, and Thibaud Vergé. 2010. "Resale Price Maintenance and Interlocking Relationships." *The Journal of Industrial Economics*, 58(4): 928–961.

Rivers, Douglas, and Quang H. Vuong. 2002. "Model Selection Tests for Nonlinear Dynamic models." *The Econometrics Journal*, 5(1): 1–39.

Stole, Lars A., and Jeffrey Zwiebel. 1996. "Intra-firm Bargaining under Non-binding Contracts." *The Review of Economic Studies*, 63(3): 375–410.

Terza, Joseph V., Anirban Basu, and Paul J. Rathouz. 2008. "Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling." *Journal of Health Economics*, 27: 531–543.

Train, Kenneth. 2000. "Halton Sequences for Mixed Logit." *Department of Economics, UCB*.

Villas-Boas, Sofia. 2007. "Vertical Relationships between Manufacturers and Retailers: Inference with Limited Data." *The Review of Economic Studies*, 74(2): 625–652.

Yurukoglu, Ali. 2008. "Bundling and Vertical Relationships in Multichannel Television." Job Market Paper.