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Abstract

We develop a bilateral oligopoly framework with manufacturer-retailer bargaining to analyze the impact of retail mergers on market outcomes. We show that the surplus division between manufacturers and retailers depends on three bargaining forces and can be interpreted in terms of an "equilibrium of fear". We estimate our framework in the French soft drink industry and find that retailers have greater bargaining power than manufacturers. Using counterfactual simulations, we highlight that retail mergers increase retailers' fear of disagreement relative to that of manufacturers, which weakens their buyer power and leads to higher wholesale and retail prices.

Keywords: Bilateral oligopoly, Bargaining, Retail mergers, Soft drink industry.

JEL classification: C78, D43, L11, L13, L14, L41, L81.

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1 Introduction

Following successive waves of retail mergers in recent decades, the retail sector has undergone a substantial increase in concentration in most Western economies.[1] The analysis of such mergers typically involves the following trade-off. On the one hand, the reduction in the number of competitors is likely to increase market power, resulting in higher prices for consumers. On the other hand, even in the absence of cost synergies, efficiencies may arise in the form of greater buyer power. More specifically, the concept of countervailing buyer power (Galbraith, 1952) suggests that an increase in the buyer power of merging retailers should reduce the prices they pay to manufacturers which, in turn, provides them with incentives to charge lower prices to consumers.

Countervailing buyer power remains a subject of contention in retail merger analysis. Whereas it is explicitly recognized as an efficiency defense in the Horizontal Merger Guidelines of the European Commission (2004), the guidelines of the US Department of Justice and the Federal Trade Commission (2010) adopt a more ambiguous stance.[2] Furthermore, some antitrust scholars argue that such (potential) harm to manufacturers should instead raise anti-competitive concerns (Hemphill and Rose, 2018; Baker, 2019). The primary challenge in devising an appropriate merger policy in this context stems from the prevalence of intricate multilateral relationships in vertical markets, where terms of trade are frequently determined through bilateral negotiations. Given that the mechanisms underlying buyer power are complex and often lack empirical evidence, the proper treatment of buyer power in retail merger review remains unsettled (Carlton and Israel, 2011).

This article provides an empirical framework for analyzing competition and market

[1] For instance, the supermarket chain Albertsons acquired American Stores in 1999 for approximately \$13 billion and Kroger acquired Fred Meyer for \$15 billion. In 2014, Albertsons acquired Safeway for \$9.2 billion. In 2022, Kroger announced its intent to acquire Albertsons for \$24.6 billion. See Colen et al. (2020) for evidence of a similar trend in Europe.

[2] As Kirkwood (2012) highlights, Section 12 of the U.S. Guidelines ("Mergers of Competing Buyers") focuses instead on the notion of "monopsony power", which presumes that upstream manufacturers have no market power. Moreover, the U.S. antitrust agencies have adopted conflicting views on the treatment of buyer power in recent merger reviews (Sallet, 2017; Hemphill and Rose, 2018).

structure changes in bilateral oligopolies with multilateral bargaining. To align with the functioning of the supply chain in various industries (e.g., the grocery sector), our framework incorporates a model of manufacturer-retailer bargaining that takes into account the impact of negotiated wholesale prices on retail price competition.[3] Using the "Nash-in-Nash" bargaining solution (Horn and Wolinsky, 1988) as a surplus-sharing rule, we highlight that bargaining outcomes in our model depend on three distinct sources of bargaining power. First, a firm gets a better price when its gains from trade decrease relative to those of its trading partner (i.e., its losses from not reaching an agreement are lower). Second, a firm gets more favorable trading terms when its costs of making price concessions increase compared to those of its trading partner.[4] Third, a firm obtains better terms of trade when its bargaining ability increases relative to that of its trading partner. We further show that these bargaining outcomes can be interpreted in terms of "equilibrium of fear" (Aumann and Kurz, 1977; Svejnar, 1986), referring to a bargaining process in which each negotiation reaches a solution through mutual price concessions until both the manufacturer and the retailer have an identical fear of disagreement.

We leverage our framework to study manufacturer-retailer relationships and retail mergers in the French soft drink industry. Given its particular features, this industry offers an interesting laboratory for analyzing the potential countervailing buyer power effect of retail mergers in grocery markets. First, the upstream market is one of the most concentrated of the French agri-food sector (European Commission, 2014). Second, manufacturers supply brands that are often deemed as having "must-have" status for retailers due to consumer brand loyalty.[5] Soft drink manufacturers are thus likely to exert market power despite the presence of large downstream retailers.

[3] Recent empirical works provide suggestive evidence that retail prices in the supermarket industry immediately adjust to wholesale price changes (see, e.g., Nakamura and Zerom, 2010; Goldberg and Hellerstein, 2013; Anderson et al., 2017). As discussed in our literature review, most empirical models of bargaining rule out these retail price adjustments.

[4] A firm's concession costs in negotiations reflect how its profit decreases when it agrees to grant a better price to its trading partner.

[5] As pointed out by the European Commission (2007): "Just a small number of food products have a recognized brand value. Coca-Cola, the number 1 global brand, is a frequently mentioned and well-recognized example. The top 50 global brands include 7 food products, mainly beverages."

Using household-level scanner data on soft drink purchases, we develop a structural model of demand and supply to conduct our analysis. The demand-side consists of a random coefficient logit model which allows for unobserved heterogeneity in consumer preferences. The supply-side is directly based on our bilateral oligopoly framework. Absent data on wholesale contracts negotiated between manufacturers and retailers, our empirical strategy relies on demand estimates as well as on the set of first-order conditions characterizing the pricing behavior of retailers on the downstream market to back out retail marginal costs for soft drink products (e.g., Villas-Boas, 2007). Using these (inferred) marginal costs, we then specify the marginal cost function of retailers in terms of (i) production and distribution costs for soft drink products, and (ii) price-cost margins of manufacturers, which are determined through bilateral negotiations with retailers and derived from the "Nash-in-Nash" solution. Based on (plausibly) exogenous variation that shifts the price-cost margins of manufacturers but not marginal costs of products, we form moment conditions to estimate bargaining and cost parameters and recover the surplus division between manufacturers and retailers in the supply chain.

Our results indicate that more than 65 percent of the surplus generated by bilateral contracts in the supply chain is captured by retailers, suggesting that they have greater bargaining power than soft drink manufacturers. This is mainly due to the fact that retailers incur larger costs from making price concessions during negotiations than manufacturers. Using estimates of our structural model, we simulate (hypothetical) retail mergers that give rise to multi-store retailers. Based on the concept of "equilibrium of fear", we explore the countervailing buyer power hypothesis and find that retail mergers increase the merging retailers' fear of disagreement relative to that of manufacturers, suggesting that wholesale prices increase post-merger. We show that this stems from the effect of retail mergers on the concession costs of manufacturers and the merging retailers, which weakens buyer power. This result is supported by counterfactual simulations in which we recalculate a new bargaining and downstream price equilibrium following a retail merger. Despite retailers experiencing a decrease in bargaining power vis-à-vis manufacturers, our simulations further show that retail mergers remain profitable. This is due to a decrease in downstream competition which, in turn, comes at the expense of consumers and total welfare. As a result, our empirical analysis does not provide any support for the buyer power defense to retail mergers. Instead, we find that retail mergers raise substantial antitrust concerns due to the increase of market power at both the upstream and the downstream levels of the supply chain.

Contribution to the literature. Our article contributes to the extensive literature on buyer power in vertically related markets (see Snyder, 2008; Smith, 2016, for recent surveys). Since Galbraith (1952, 1954) who introduced the concept of countervailing buyer power, a large number of articles have analyzed circumstances under which mergers between competing retailers mitigate upstream market power and may generate pro-consumer effects.[6] Although theoretical work suggests that the emergence of countervailing buyer power is ambiguous and depends on particular market conditions, empirical research on this topic remains fairly limited.[7] Our approach relates to structural empirical models that use the "Nash-in-Nash" bargaining to study downstream market concentration.[8] In line with our findings, Grennan (2013) shows that mergers between hospitals may weaken their buyer power vis-à-vis coronary stent manufacturers. By considering an oligopoly model in which hospital buyers operate in different markets and where a merger creates a single buyer (no price discrimination between the merging hospitals), it is worth noting that the mechanisms underlying his results differ from ours in many aspects.[9] Instead, our empirical analysis is

[6] Mergers between retailers operating in separate markets have also been studied. Countervailing buyer power may arise in such cases when marginal production costs are convex (Chipty and Snyder, 1999; Inderst and Wey, 2003), or when the merging retailers adopt a single-sourcing policy, forcing manufacturers to compete for exclusivity (Inderst and Shaffer, 2007; Dana, 2012).

[7] E.g., it has been shown that countervailing buyer power depends on the degree of product differentiation (Dobson and Waterson, 1997), the nature of downstream competition and the observability of bargaining breakdowns (Iozzi and Valletti, 2014), or the pass-through rate of wholesale to retail prices (Gaudin, 2018).

[8] Alongside the structural approach, the impact of downstream concentration on market outcomes has also been studied using a reduced-form approach, offering mixed evidence on countervailing buyer power effects (see, e.g., Chorniy et al., 2020; Craig et al., 2021).

[9] The mechanisms in Grennan (2013) relate to the oligopoly price discrimination literature, especially Corts (1998). As hospitals differ in their preferences for manufacturers, a merger that prevents price discrimination tends to soften competition between manufacturers (i.e., uniform pricing implies that manufacturers focus on their "captive" hospitals instead of competing for other hospitals).

more closely related to two recent articles that examine the impact of downstream concentration in bilateral oligopolies. Ho and Lee (2017) simulate the effects of the removal of a downstream firm on market outcomes and show that countervailing buyer power effects depend on the competitiveness of the firm being removed. Focusing on the effects of horizontal and vertical mergers, Sheu and Taragin (2021) find that mergers between downstream firms improve their bargaining power vis-à-vis upstream firms by decreasing their relative gains from trade. We show that this result hinges on their assumption that wholesale and retail prices are determined simultaneously, which precludes the concession costs of firms from influencing the post-merger bargaining outcome.[10] By offering an empirical framework that explicitly accounts for this source of bargaining power in a tractable way, our article highlights that changes in the concession costs of firms can rule out the countervailing buyer power effect of downstream mergers identified in Sheu and Taragin (2021). Despite these differences, our analysis of consumer welfare aligns with Sheu and Taragin (2021), indicating that retail mergers harm consumers whether countervailing buyer power effects arise or not. We thus complement prior work in showing that buyer power is very unlikely to offset the standard upward pressure on retail prices caused by a reduction of competition, an argument that is often debated in merger litigation in Europe and more recently in the United States.[11]

Our article also provides a methodological contribution to the recent empirical literature on buyer-seller bargaining in bilateral oligopolies. Since Draganska et al. (2010), a large number of articles have adopted the timing assumption that wholesale and retail prices are determined simultaneously to simplify the estimation of the "Nash-in-Nash" bargaining model (see, e.g., Ho and Lee, 2017; Crawford et al., 2018; Noton and Elberg, 2018; Sheu and Taragin, 2021). Although reasonable in the presence of retail price stickiness, this assump-

[10]Note also that Sheu and Taragin (2021) use a calibration routine to estimate model parameters which requires the observation of one upstream and downstream margin. In contrast, our approach only requires data on market shares and retail prices as in Berry et al. (1995) and the ensuing literature.

[11]See, e.g., Kesko/Tuko (1996) – Case No IV/M.784; Rewe/Meinl (1999) – Case No IV/M.1221; Anthem/Cigna (2017) – United States v. Anthem, Inc., 236 F. Supp. 3d 171 (D.D.C. 2017); J Sainsbury Plc/Asda Group Ltd., CMA decision of 25 April 2019.

tion does not reflect well the functioning of vertical markets in which retail prices respond immediately to changes in wholesale prices (e.g., Nakamura and Zerom, 2010; Goldberg and Hellerstein, 2013). Our article highlights that this simultaneous timing assumption imposes strong restrictions on the concession costs of firms in bilateral negotiations which, in turn, have important consequences for merger analysis. A notable exception is the bilateral oligopoly framework of Crawford and Yurukoglu (2012) which, like ours, includes a sequential timing where retailers are able to observe wholesale prices and optimally adjust their pricing behavior accordingly.[12] We differ from Crawford and Yurukoglu (2012) in two important aspects. First, we allow for the presence of marginal costs of production and distribution. Second, we derive closed-form expressions for the price-cost margins of manufacturers, which considerably ease the estimation of our model as well as the computational burden of counterfactual simulations involving a new bargaining and downstream price equilibrium.

The remainder of this article is organized as follows. Section 2 introduces our bilateral oligopoly framework. Section 3 describes our empirical application to the French soft drink industry, discusses the identification and estimation of model parameters, and presents the empirical results. Section 4 is devoted to the analysis of retail mergers with a focus on the role of buyer power. Section 5 concludes.

2 A model of bilateral oligopoly

To analyze bilateral oligopolistic markets, we develop a framework involving "interlocking relationships" in which multi-product manufacturers engage in bilateral negotiations with multi-product retailers competing in retail prices for consumers. Our framework embeds three sources of bargaining power, accounts for the effects of negotiated wholesale prices on downstream competition, and allows for positive (constant) marginal costs of production

[12] Yang (2020) develops an empirical dynamic model of innovation that embeds a setting of vertical relations with sequential timing. We also differ from his approach in many dimensions. Among others, we allow for upstream competition and our estimation method does not require information on upstream price-cost margins and marginal costs.

and distribution. We further show that it admits a bargaining equilibrium outcome with an analytically tractable form and an intuitive interpretation.

Formally, we consider a market, indexed by t, in which F multi-product manufacturers, indexed by $f = 1, \ldots, F$, sell their brands to R multi-product retailers, indexed by $r = 1 \ldots, R$, which resell to consumers. Assuming that a product consists of a brand-retailer combination, each consumer on the market chooses among a set $\mathscr{J}_t \equiv \{0, 1, \ldots, J_t\}$ of differentiated products.[13] Let $\mathscr{J}_{ft}$ denotes the set of products owned by manufacturer f and $\mathscr{J}_{rt}$ the set of products distributed by retailer r such that $\bigcup_{f=1}^{F} \mathscr{J}_{ft} = \bigcup_{r=1}^{R} \mathscr{J}_{rt} = \mathscr{J}_t \backslash \{0\}$.

Profit functions. We define respectively the (per-market) profit function of manufacturer f and retailer r as follows:

$$\pi_{ft} \equiv \sum_{j \in \mathscr{J}_{ft}} \left(w_{jt} - \mu_{jt}\right) q_{jt}(\mathbf{p}_t) \tag{1a}$$

$$\pi_{rt} \equiv \sum_{j \in \mathscr{J}_{rt}} \left(p_{jt} - w_{jt} - c_{jt}\right) q_{jt}(\mathbf{p}_t) \tag{1b}$$

where w_{jt} and p_{jt} are respectively the wholesale and retail price of product j in market t, μ_{jt} and c_{jt} are respectively the (constant) marginal cost of production and distribution for product j in market t, and q_{jt} is the corresponding demand written as a function of retail prices denoted by the J_t-dimensional vector $\mathbf{p}_t$. For expositional purposes, we take demand as a primitive of our bilateral oligopoly model and defer to Section 3 for an application to the French soft drink industry.

Timing, information, and solution concept. Interactions between manufacturers and retailers are described by the following two-stage game:

- Stage 1: Manufacturers and retailers engage simultaneously and secretly in bilateral bargains to determine wholesale prices of products.

- Stage 2: Retailers compete in retail prices on the downstream market.

[13] We define product 0 as the outside option to the J_t products in the choice set of consumers.

To determine wholesale prices in stage 1, we leverage the “Nash-in-Nash” bargaining solution pioneered by Horn and Wolinsky (1988) which has been extensively used in applied work to deal with the presence of contracting externalities (see, e.g., Crawford and Yurukoglu, 2012; Grennan, 2013; Gowrisankaran et al., 2015; Ho and Lee, 2017). In stage 2, we consider that retail prices are determined by retailers competing on the downstream market with “interim unobservability”, meaning that bargaining outcomes between manufacturers and a given retailer remain unobserved to other retailers (Rey and Vergé, 2004, 2020; Gaudin, 2019).[14] Hence, any (unexpected) change in wholesale prices paid by one retailer does not affect the pricing behavior of other retailers. However, absent retail price inertia, we consider that each retailer sets retail prices conditional on the outcomes of its negotiations with manufacturers. We assume complete information about the (constant) marginal cost of production and distribution for each product and we solve our two-stage game by working backwards.

To gain insights into our equilibrium notion, we refer to Rey and Vergé (2020) who show that the equilibrium of our game coincides with the sequential equilibrium (Kreps and Wilson, 1982) of a two-stage noncooperative game comprising a model of delegated negotiations with a random-proposer protocol in the first stage, followed by a model of retail price competition similar to our second stage. As the notion of sequential equilibrium requires firms’ beliefs to be “consistent”, retailers competing in stage 2 always conjecture that their rivals have negotiated the equilibrium wholesale prices and therefore set the equilibrium retail prices.

Contractual form. We restrict the contractual form between manufacturers and retailers to linear wholesale prices. Even though such a simple payment scheme generates double marginalization, a body of empirical work has provided evidence of its use in numerous ver-

[14] It is worth noting that alternative information structures have been proposed in the literature, such as “observable breakdowns” in which bargaining breakdowns are observed before retail price competition takes place (Iozzi and Valletti, 2014), and “interim observability” where all bargaining outcomes are revealed (Rey and Vergé, 2004).

tical markets.[15] We however acknowledge that extending our empirical framework to non-linear wholesale contracts raises important identification issues that are beyond the scope of this article.

Stage 2: Downstream price competition

Each retailer sets retail prices for its products to maximize profit, holding the belief that its rivals pay the equilibrium wholesale prices to manufacturers. From the maximization problem of each retailer's profit function defined in (1b), we can derive the set of first-order conditions characterizing the equilibrium retail prices in market t as follows:

$$q_{jt}(\mathbf{p}_t) + \sum_{k \in \mathscr{J}_{r(j)t}} (p_{kt} - w_{kt} - c_{kt}) \frac{\partial q_{kt}}{\partial p_{jt}} = 0 \quad \forall j \in \mathscr{J}_t \backslash \{0\} \tag{2}$$

where *r(j)* indexes the retailer distributing product j. Following Berry and Haile (2014), price-cost margins and marginal costs of retailers can be directly recovered from (2) when demand is continuously differentiable with respect to retail prices and products are "connected substitutes".[16] Importantly, they stress that such conditions for invertibility of (2) do not place any restriction on the structure of retailers' marginal costs, which are fundamental ingredients for the determination of the surplus division in our empirical framework. Hence, using matrix algebra, we invert (2) and recover the J_t-dimensional vector of price-cost margins of retailers (computational details are deferred to Appendix S1.1 of the Supplemental Material). The retail price-cost margin of product $j \in \mathscr{J}_t \backslash \{0\}$ is given by $p_{jt} - w_{jt} - c_{jt} = \gamma_{jt}(\mathbf{q_t}, \mathbf{Q_{p_t}})$ where $\mathbf{Q_{p_t}}$ denotes the $J_t \times J_t$ matrix of partial derivatives $\frac{\partial q_{kt}}{\partial p_{jt}}$ and $\mathbf{q}_t$ is the J_t-dimensional vector of demand for products in market t. We then recover

[15] Luco and Marshall (2020) provide indirect evidence of linear wholesale prices in the U.S. carbonated-beverage industry. Linear tariffs have also been documented in the Chilean coffee market (Noton and Elberg, 2018), the UK liquid milk market (Smith and Thanassoulis, 2015), and various other sectors (e.g., Mortimer, 2008; Crawford and Yurukoglu, 2012; Grennan, 2013; Gowrisankaran et al., 2015; Ho and Lee, 2017).

[16] The notion of "connected substitutes" implies weak substitution between all products and some strict substitution as well. These conditions are shown to hold under a wide range of demand models, including the random coefficient logit considered in Section 3.

the marginal cost of retailers for each product $j \in \mathscr{J}_t \backslash \{0\}$ as follows:

$$w_{jt} + c_{jt} = p_{jt} - \gamma_{jt}. \tag{3}$$

Stage 1: Manufacturer-retailer bargaining

We determine the allocation of surplus in the supply chain according to the "Nash-in-Nash" bargaining solution. Conditioning on all other wholesale prices, the equilibrium wholesale price of product j owned by manufacturer f and distributed by retailer r solves the following Nash bargaining problem:

$$w_{jt}^{*} \equiv \underset{w_{jt}}{\text{argmax}} \left(\pi_{ft} - d_{ft}^{-j}\right)^{1-\lambda_{fr}} \left(\pi_{rt} - d_{rt}^{-j}\right)^{\lambda_{fr}} \tag{4}$$

where $\lambda_{fr} \in [0,1]$ denotes the bargaining weight of retailer r when negotiating with manufacturer f, π_{ft} and π_{rt} are profits of firms respectively defined in (1a) and (1b), and d_{ft}^{-j} and d_{rt}^{-j} correspond respectively to the status quo payoffs of manufacturer f and retailer r in the event of a bilateral disagreement over the wholesale price of product j. This specification thus implies that each manufacturer-retailer pair negotiates the wholesale prices of products separately.[17] Following our bargaining protocol and that retailers compete downstream with "interim unobservability", the status quo payoffs of firms are given by:

$$d_{ft}^{-j} = \sum_{k \in \mathscr{J}_{ft} \backslash \{j\}} \left(w_{kt}^{*} - \mu_{kt}\right) \tilde{q}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j}) \tag{5a}$$

$$d_{rt}^{-j} = \sum_{k \in \mathscr{J}_{rt} \backslash \{j\}} \left(\tilde{p}_{k,t}^{-j} - w_{kt}^{*} - c_{kt}\right) \tilde{q}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j}) \tag{5b}$$

where w_{kt}^{*} corresponds to the (anticipated) equilibrium wholesale price of product $k \neq j$, $\tilde{\mathbf{p}}_t^{-j}$ denotes the J_t-dimensional vector of out-of-equilibrium retail prices when product j is no longer offered on market t (see Appendix S3 of the Supplemental Material for compu-

[17] We have also considered an alternative specification with joint negotiations (see Appendix S6 of the Supplemental Material).

tational details), and $\tilde{q}_{kt}^{-j}$ is the demand for each product k remaining on the market. The status quo payoffs of firms are thus determined by removing product j from market t, holding fixed wholesale prices of other products as well as retail prices chosen by retailer r's rivals. Importantly, however, we allow retailer r to optimally adjust retail prices for its remaining products and, following these changes, consumers can purchase any other product remaining in their choice sets.

Surplus division and determinants of bargaining power. From (4), we can derive the set of first-order conditions that characterizes the division of surplus in every bilateral negotiation taking place in market t as follows:

$$\underbrace{\lambda_{f(j)r(j)}\left(\pi_{f(j)t}-d_{f(j)t}^{-j}\right)\frac{\partial\pi_{r(j)t}}{\partial w_{jt}}}_{\text{retailer } r(j)\text{'s bargaining power}}+\underbrace{\left(1-\lambda_{f(j)r(j)}\right)\left(\pi_{r(j)t}-d_{r(j)t}^{-j}\right)\frac{\partial\pi_{f(j)t}}{\partial w_{jt}}}_{\text{manufacturer } f(j)\text{'s bargaining power}}=0 \quad \forall j\in\mathscr{J}_t\backslash\{0\} \qquad (6)$$

where $f(j)$ indexes the manufacturer of product j. For a given bilateral negotiation, the first (resp. second) term on the left-hand side of (6) embeds every factor determining the retailer's (resp. manufacturer's) bargaining power. More precisely, we can identify three sources of bargaining power. The first comes from the bargaining weight λ_{fr}, which captures asymmetries in the bargaining ability of firms.[18] The second source of bargaining power is captured by the terms $\pi_{f(j)t}-d_{f(j)t}^{-j}$ and $\pi_{r(j)t}-d_{r(j)t}^{-j}$, which represent respectively the incremental gains from trade obtained by manufacturer *f(j)* and retailer *r(j)* given that all other bilateral contracts are formed. The higher a firm's incremental gains from trade the larger its losses from not reaching an agreement, which reinforces the bargaining power of

[18]These weights are often deemed to reflect some imprecisely defined asymmetries in the bargaining power of firms (Roth, 1979). Using strategic models of bargaining, Binmore et al. (1986) provide ground for the presence of such parameters in showing that they may capture differences in bargainers' beliefs or asymmetries in the bargaining procedure.

its trading partner. In our bilateral oligopoly framework, these terms are given by:

$$\pi_{f(j)t} - d_{f(j)t}^{-j} = (w_{jt} - \mu_{jt}) q_{jt}(\mathbf{p}_t) - \sum_{k \in \mathscr{I}_{f(j)t} \setminus \{j\}} (w_{kt}^{*} - \mu_{kt}) \left(\tilde{q}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j}) - q_{kt}(\mathbf{p}_t) \right) \tag{7a}$$

$$\begin{aligned} \pi_{r(j)t} - d_{r(j)t}^{-j} &= (p_{jt} - w_{jt} - c_{jt}) q_{jt}(\mathbf{p}_t) \\ &\quad - \sum_{k \in \mathscr{I}_{r(j)t} \setminus \{j\}} (\tilde{p}_{kt}^{-j} - w_{kt}^{*} - c_{kt}) \tilde{q}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j}) - (p_{kt} - w_{kt}^{*} - c_{kt}) q_{kt}(\mathbf{p}_t) \end{aligned} \tag{7b}$$

that is, for each trading partner, the incremental gains from trade correspond to the profit generated by the sale of product j minus the change in profit generated by its other products when removing product j. The last source of bargaining power, which has often been ignored in empirical work of bilateral oligopoly, relates to the concession costs of firms. It is embedded in $\frac{\partial \pi_{f(j)t}}{\partial w_{jt}}$ and $\frac{\partial \pi_{r(j)t}}{\partial w_{jt}}$, which respectively refer to the cost incurred by manufacturer *f(j)* and retailer *r(j)* from making a price concession to its trading partner during the course of negotiations. Hence, a bargainer with a high concession cost is less willing to provide more favorable terms of trade to his trading partner which, in turn, increases his bargaining power in the negotiation. The concession cost of manufacturer $f(j)$ when bargaining with retailer $r(j)$ over w_{jt} is given by:

$$\begin{aligned} \frac{\partial \pi_{f(j)t}}{\partial w_{jt}} &= q_{jt}(\mathbf{p}_t) + \underbrace{(w_{jt} - \mu_{jt}) \frac{\partial q_{jt}}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial w_{jt}}}_{\substack{\text{double-marginalization effect} \\ \text{on demand}}} + \underbrace{(w_{jt} - \mu_{jt}) \sum_{l \in \mathscr{I}_{r(j)t} \setminus \{j\}} \frac{\partial q_{jt}}{\partial p_{lt}} \frac{\partial p_{lt}}{\partial w_{jt}}}_{\text{direct steering effect}} \\ &\quad + \underbrace{\sum_{k \in \mathscr{I}_{f(j)t} \setminus \{j\}} (w_{kt} - \mu_{kt}) \frac{\partial q_{kt}}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial w_{jt}} + \sum_{k \in \mathscr{I}_{f(j)t} \cap \mathscr{I}_{r(j)t} \setminus \{j\}} (w_{kt} - \mu_{kt}) \frac{\partial q_{kt}}{\partial p_{kt}} \frac{\partial p_{kt}}{\partial w_{jt}}}_{\text{recapture effect}} \\ &\quad + \underbrace{\sum_{k \in \mathscr{I}_{f(j)t} \setminus \{j\}} (w_{kt} - \mu_{kt}) \sum_{l \in \mathscr{I}_{r(j)t} \setminus \{j,k\}} \frac{\partial q_{kt}}{\partial p_{lt}} \frac{\partial p_{lt}}{\partial w_{jt}}}_{\text{indirect steering effect}} \end{aligned} \tag{8a}$$

The first term in (8a) shows that an increase in w_{jt} raises manufacturer $f(j)$'s price-cost margins for product j which, in turn, increases its profit proportionally to product j's demand. This wholesale price increase of product j, however, generates two negative effects on its profit. First, it increases the double-marginalization which reduces demand for product j (second term). Second, whenever $\frac{\partial p_{lt}}{\partial w_{jt}} < 0 \ \forall l \in \mathscr{J}_{r(j)} \backslash \{j\}$, it decreases retail prices of other products sold by retailer $r(j)$ which, in turn, steers consumers of product j towards these other products ("direct steering effect").[19] Although these two negative effects reduce manufacturer $f(j)$'s profit over product j, they increase demand for other manufacturer $f(j)$'s products which, in turn, increases its profit over these products ("recapture effect"). Lastly, the retail price drop of retailer $r(j)$'s products (excluding product j) tends to mitigate the increase in demand from the "recapture effect" ("indirect steering effect"). Similarly, the concession cost of retailer $r(j)$ when bargaining with manufacturer $f(j)$ over w_{jt} is derived as follows:

$$\begin{aligned}
\frac{\partial \pi_{r(j)t}}{\partial w_{jt}} = & -q_{jt}(\mathbf{p}_t) + \underbrace{\frac{\partial p_{jt}}{\partial w_{jt}} q_{jt}(\mathbf{p}_t)}_{\text{double-marginalization effect}} + \underbrace{\sum_{k \in \mathscr{J}_{r(j)t} \backslash \{j\}} \frac{\partial p_{kt}}{\partial w_{jt}} q_{kt}(\mathbf{p}_t)}_{\text{cross double-marginalization effect}} \\
& + \underbrace{(p_{jt} - w_{jt} - c_{jt}) \frac{\partial q_{jt}}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial w_{jt}}}_{\substack{\text{double-marginalization effect} \\ \text{on demand}}} + \underbrace{(p_{jt} - w_{jt} - c_{jt}) \sum_{l \in \mathscr{J}_{r(j)t} \backslash \{j\}} \frac{\partial q_{jt}}{\partial p_{lt}} \frac{\partial p_{lt}}{\partial w_{jt}}}_{\text{direct steering effect}} \\
& + \underbrace{\sum_{k \in \mathscr{J}_{r(j)t} \backslash \{j\}} (p_{kt} - w_{kt} - c_{kt}) \frac{\partial q_{kt}}{\partial p_{jt}} \frac{\partial p_{jt}}{\partial w_{jt}} + \sum_{k \in \mathscr{J}_{r(j)t} \backslash \{j\}} (p_{kt} - w_{kt} - c_{kt}) \frac{\partial q_{kt}}{\partial p_{kt}} \frac{\partial p_{kt}}{\partial w_{jt}}}_{\text{recapture effect}} \\
& + \underbrace{\sum_{k \in \mathscr{J}_{r(j)t} \backslash \{j\}} (p_{kt} - w_{kt} - c_{kt}) \sum_{l \in \mathscr{J}_{r(j)t} \backslash \{j,k\}} \frac{\partial q_{kt}}{\partial p_{lt}} \frac{\partial p_{lt}}{\partial w_{jt}}}_{\text{indirect steering effect}}
\end{aligned} \tag{8b}$$

In addition to the aforementioned effects, three additional effects come into play in (8b). First, an increase in w_{jt} reduces retailer $r(j)$'s price-cost margins over product j which, in turn, decreases its profit proportionally to product j's demand (first term). Second, this wholesale price increase raises retailer $r(j)$'s price-cost margin over product j which, in turn, increases its profit ("double-marginalization effect"). Third, whenever $\frac{\partial p_{lt}}{\partial w_{jt}} < 0 \ \forall l \in$

[19] As the profitability of product j decreases following an increase in w_{jt}, negative cross retail pass-through rates may arise due to retailer $r(j)$'s incentive to redirect consumer demand towards its other products. This aligns with the estimates from our structural model of demand and supply described in Section 3.

$\mathscr{J}_{r(j)} \backslash \{j\}$, the increase in w_{jt} reduces the retail price of other products sold by retailer $r(j)$ which, in turn, decreases its profit ("cross double-marginalization effect").

"Equilibrium of fear". To gain further insights into the bargaining outcome obtained in our framework, we can rearrange (6) as follows:

$$\frac{1}{\lambda_{f(j)r(j)}} \frac{\pi_{r(j)t} - d_{r(j)t}^{-j}}{-\partial \pi_{r(j)t}/\partial w_{jt}} = \frac{1}{\left(1-\lambda_{f(j)r(j)}\right)} \frac{\pi_{f(j)t} - d_{f(j)t}^{-j}}{\partial \pi_{f(j)t}/\partial w_{jt}} \quad \forall j \in \mathscr{J}_t \backslash \{0\} \tag{9}$$

where the ratios $\frac{\pi_{r(j)t} - d_{r(j)t}^{-j}}{-\partial \pi_{r(j)t}/\partial w_{jt}}$ and $\frac{\pi_{f(j)t} - d_{f(j)t}^{-j}}{\partial \pi_{f(j)t}/\partial w_{jt}}$ relate to the concept of "fear of ruin" introduced in Aumann and Kurz (1977). More specifically, firms' gains from trade in the numerator of each ratio can be interpreted as the cost incurred by retailer *r(j)* (reps. manufacturer *f(j)*) in the event of a bargaining breakdown. Therefore, each ratio provides a measure of a firm's fear of risking a bargaining breakdown compared to accepting a price concession to its trading partner. Based on this appealing concept, Svejnar (1986) develops a bargaining model in which, at any given stage, the firm with a greater fear of bargaining breakdown relative to its bargaining ability must make a price concession to its trading partner.[20] The unique solution to this bargaining process is obtained when firms perceive the same fear of bargaining breakdown relative to their bargaining ability, which is precisely what (9) describes. Hence, our bargaining outcome has intuitive appeal in that it can be interpreted in terms of an "equilibrium of fear" (i.e., all firms equally fear the possibility of disagreement). In Section 4, we further show that the left- and right-hand sides of (9) provide insightful measures to predict the directional wholesale price effects of changes in market conditions.

Price-cost margins of manufacturers. As for the vector of retail price-cost margins derived from (2), we show in Appendix S1.2 of the Supplemental Material that a closed-form expression for the J_t-dimensional vector of price-cost margins of manufacturers can be obtained

[20] That is, retailer *r(j)* makes a price concession to manufacturer *f(j)* whenever $\frac{1}{\lambda_{f(j)r(j)}} \frac{\pi_{r(j)t} - d_{r(j)t}^{-j}}{-\partial \pi_{r(j)t}/\partial w_{jt}} > \frac{1}{\left(1-\lambda_{f(j)r(j)}\right)} \frac{\pi_{f(j)t} - d_{f(j)t}^{-j}}{\partial \pi_{f(j)t}/\partial w_{jt}}$, and conversely.

by inverting the system (6). More specifically, the price-cost margins of manufacturer *f(j)* for product j is given by:

$$w_{jt} - \mu_{jt} = \Gamma_{jt}(\mathbf{q}_t, \mathbf{Q}_{\mathbf{p}_t}, \mathbf{Q}_{\mathbf{p}_t\mathbf{p}_t}, \tilde{\mathbf{Q}}_{\Delta t}; \boldsymbol{\lambda}) \tag{10}$$

where $\boldsymbol{\lambda}$ denotes the J_t-dimensional vector of bargaining weights, $\mathbf{Q}_{\mathbf{p}_t\mathbf{p}_t}$ is an array of J_t matrices of second partial derivatives $\frac{\partial^2 q_{jt}}{\partial p_{kt}\partial p_{lt}}$ denoted by $\mathbf{Q}_{\mathbf{p}_{kt}\mathbf{p}_t}$ (each matrix $\mathbf{Q}_{\mathbf{p}_{kt}\mathbf{p}_t}$ being of $J_t \times J_t$ dimension), and $\tilde{\mathbf{Q}}_{\Delta t}$ is the $J_t \times J_t$ matrix of differences in quantities upon a bargaining breakdown (that is, $q_{kt}(\mathbf{p}_t) - \tilde{q}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j})$).[21] This result makes our model of bilateral oligopoly particularly attractive for empirical works. In what follows, we show how to take the model to data and estimate the surplus division between manufacturers and retailers in the French soft drink industry.

3 Application to the French soft drink industry

The French soft drink industry corresponds to a classic example of a bilateral oligopoly in which large firms operate at both levels of the supply chain. Six retail groups dominate the downstream level: Groupe Carrefour, Groupe Leclerc, ITM Entreprises, Groupe Casino, Groupe Auchan, and Groupe Système U. These retailers deal with four large soft drink manufacturers operating upstream: The Coca-Cola Company, PepsiCo, Orangina-Schweppes, and Unilever. Our empirical analysis of this industry proceeds as follows. First, we present our dataset. Second, we introduce our econometric methodology including the specification of consumer demand and firms' marginal cost functions. We also describe our strategy to identify and estimate model parameters. Third, we discuss the empirical results by paying particular attention to the determinants of bargaining power in the supply chain.

[21] The closed-form expression also includes vectors and matrices of out-of-equilibrium quantities and first partial derivatives of demand upon removing product $k \in \mathscr{J}_t$ from market t: that is, $(\tilde{\mathbf{q}}_t^{-1}, \ldots, \tilde{\mathbf{q}}_t^{-J_t})$ and $(\tilde{\mathbf{Q}}_{\tilde{\mathbf{p}}_t^{-1}}, \ldots, \tilde{\mathbf{Q}}_{\tilde{\mathbf{p}}_t^{-J_t}})$. For the sake of conciseness, we omit to express this dependence in our notations.

Data

We use data from a panel of households, representative of the French population, who scanned the bar code of their grocery purchases for home consumption from April 2005 to September 2005. The data are collected by Kantar WorldPanel and include a total of 265,998 soft drink purchases. For each purchase, we observe the date of the shopping trip, the quantity bought in liters, the retail price in euros, the brand name of the purchased item (e.g., Coca-Cola) and its packaged type (e.g., can, plastic bottle). The data also provide information on the store at which each purchase was made including its name, its size area, and its type (e.g., supermarket, hypermarket).

Following Bonnet and Réquillart (2013b), we consider purchases of soft drinks at all retailers. Among the five largest retailers, three are characterized by large stores whereas the two others have intermediate-sized stores. We also define two aggregates: an aggregate of discounters which are stores of small to intermediate size offering basic services, and an aggregate of the remaining retailers. In addition to the purchases of private labels (store brands), we focus on the purchases of the 21 top-selling national brands according to our sample. All remaining soft drink purchases are aggregated under the label "outside good" which also includes purchases of flavored water. To analyze the interaction between manufacturers and retailers, we define a product as a brand-retailer combination.[22] Consequently, we have a total of 157 differentiated products representing 72.51% of all soft drink and flavored water purchases (the remaining 27.49% being the outside good).

Although we observe the retail price of each purchased product, our data do not provide information on the other products available to consumers during their shopping trips. To reconstitute the choice set of each consumer, we proceed as follows. First, we define each market t as all soft drink purchases for home consumption in France within a month (implying that $t = 1, \dots, 6$). Second, we assume that each consumer has access to the seven retailers. This is a plausible assumption given that we consider soft drink purchases at na-

[22] Hence, a national brand (e.g., Coca-Cola) sold by two retailers corresponds to two different products.

tional retail chains with stores located in every region in France.[23] Third, we assume that a retailer's assortment for a specific month includes any brand of soft drink for which we observe a purchase from that retailer during that same month. We believe this assumption to be realistic as we focus on the top-selling national brands of soft drinks. These modeling choices imply that the choice set of each consumer consists of the 157 differentiated products plus the outside good. Finally, we compute a monthly average (deflated) retail price for each product in the choice set to infer the retail prices of products available to consumers during their shopping trips.[24]

Table 1 reports summary statistics of market shares and retail prices across manufacturers and soft drink categories. There is substantial heterogeneity in the market shares of national brand manufacturers, ranging from 2.07% to 14.37%. We observe, however, that each national brand manufacturer has a market share advantage over its rivals in each soft drink category. The greatest dominance is in the cola category where the leading national brand manufacturer has a market share of 12% (representing 70% of total cola product sales). Despite the presence of large national brand manufacturers, private labels have a total market share of 43.63%. Ranging from 2.32% of market share in the iced tea category to 29.83% in the fruit juice category, we find that private labels constitute a substantial part of total sales in each soft drink category. This descriptive evidence suggests that retailers are likely to play an important role in the soft drink industry. For a given national brand manufacturer, we find little variation in retail prices across soft drink categories, except for fruit juices which are substantially more expensive than other products. The variation in retail prices is more important across manufacturers. For instance, the average retail price of manufacturer 1's products in the cola category equals 0.92 euro per liter whereas that of manufacturer 2's products is 0.71 euro per liter. This retail price gap is even higher between

[23]We examined the sensitivity of our estimates to this assumption by excluding retailers from the choice set of consumers if they did not have stores in their respective "département" of residence (the finest geographic area available in our data). The results are available upon request.

[24]More precisely, we construct the retail price of product j in month t as follows: $p_{j,t} = \frac{\sum_i \mathbb{1}_{i,j,t} p_{i,j,t} q_{i,j,t}}{\sum_i \mathbb{1}_{i,j,t} q_{i,j,t}}$, where $\mathbb{1}_{i,j,t}$ is an indicator equals to 1 if consumer i has purchased product j in month t, $p_{i,j,t}$ is the observed retail price paid by the consumer, and $q_{i,j,t}$ is the observed quantity purchased (in liter).

national brands and private labels. For instance, the average retail price of national brands is three times higher than that of private labels in the cola category.

Table 2 displays the same summary statistics across retailers. We also find large heterogeneity in the market shares of retailers, ranging from 5.88% to 14.51%. National brands do not always constitute the largest portion of retailers' market shares, especially in the case of retailer 5 where private labels account for more than 90% of its sales. We also observe variations in the retail prices across retailers. In particular, the retail prices of national brands and private labels distributed by retailer 5 are considerably lower than the retail prices charged by other retailers. Table 10 in Appendix A reports additional summary statistics for each brand of soft drink considered in our analysis (including also the brand ownership of each manufacturer).

Empirical framework

We first specify and estimate a model of consumer demand for soft drinks. Based on our demand estimates, we then discuss the identification and estimation of our empirical bilateral oligopoly framework.

Consumer demand for soft drinks

Demand specification. We consider a discrete choice model of consumer behavior in which each consumer chooses one unit of the product that maximizes his utility (McFadden, 1973). Following the discrete-choice literature (e.g., Berry et al., 1995; Nevo, 2001; Train, 2009), the indirect utility is a function of the product characteristics for which we determine consumer preferences. More precisely, we specify the utility that consumer i derives from purchasing product j in month t as follows:

$$U_{ijt} = \delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \xi_{jt} + \epsilon_{ijt} \tag{11}$$

where $\delta_{b(j)}$ and $\delta_{r(j)}$ are brand and retail fixed effects which capture respectively the mean utility in the population generated by unobserved time-invariant brand and retailer characteristics, ξ_{jt} is a scalar that represents unobserved (to the econometrician) characteristics of product j in month t, and ϵ_{ijt} is an error term capturing unobserved consumer-specific preferences. The parameter α_{ij} represents the sensitivity (or disutility) of consumer i to the retail price of product j. Allowing for heterogeneous consumer price sensitivity, we assume that α_{ij} varies across consumers as follows:

$$\alpha_{ij} = \exp(\alpha_{nb(j)} + \alpha_{pl(j)} + \sigma \nu_i) \quad \text{where } \nu_i \sim \mathcal{N}(0,1)$$

where $\alpha_{nb(j)}$, $\alpha_{pl(j)}$ and σ are parameters of the log-normal distribution. We allow for a different price sensitivity for national brand and private label products, $\alpha_{nb(j)}$ and $\alpha_{pl(j)}$ respectively, to obtain a more flexible pattern of substitution across products. We normalize the utility from purchasing the outside good to $U_{i0t} = \epsilon_{i0t}$. Assuming that ϵ_{ijt} is independently and identically distributed from the standard Gumbel distribution, the individual market share of product $j \in \mathcal{J}_t \backslash \{0\}$ in month t can be written as follows:

$$s_{ijt} = \int_{0}^{+\infty} \frac{\exp(\delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \xi_{jt})}{1 + \sum_{k=1}^{J_t} \exp(\delta_{b(k)} + \delta_{r(k)} - \alpha_{ik} p_{kt} + \xi_{kt})} f(\alpha_{ij}) \, \mathrm{d}\alpha_{ij} \tag{12}$$

where $f(\cdot)$ corresponds to the density function of the log-normal distribution.

Identification. We identify consumer substitution patterns from the variation in retail prices and changes in the number of products offered to consumers over time. However, the retail price variation may not be exogenous because the pricing behavior of retailers depends on all product characteristics, including ξ_{jt}.[25] As stressed by Berry (1994), the correlation between retail prices and unobserved demand factors introduces an endogeneity problem

[25] For instance, we do not observe changes in advertising expenditure for soft drink products or changes in shelf display which are likely to affect consumer behavior and are included in our model through ξ_{jt}.

that threatens the identification of demand parameters. To address this issue and obtain consistent estimates, we use a control function approach (Petrin and Train, 2010).[26] First, we regress the retail price variable on a set of instruments:

$$p_{jt} = \delta_{b(j)} + \delta_{r(j)} + \boldsymbol{\beta}\mathbf{Z}^d_{jt} + u_{jt} \tag{13}$$

where $\delta_{b(j)}$ and $\delta_{r(j)}$ are the exogenous brand and retail fixed effects (included instruments), $\mathbf{Z}^d_{jt}$ is a vector of excluded instruments, $\boldsymbol{\beta}$ is a vector of parameters, and u_{jt} is an error term capturing all unobserved factors explaining p_{jt}. Instrumental variables in $\mathbf{Z}^d_{jt}$ should affect retail prices by shifting supply (costs or markups of firms) but not consumer preferences for unobserved product attributes. In practice, we use the number of competing products in each month. Exogeneity of this BLP-type instrument rests on the common assumption that product characteristics are uncorrelated with ξ_{jt} (Berry et al., 1995). We also use two cost shifters consisting of the input price index of sugar multiplied by the quantity of added sugar for each brand of soft drink and the input price index of aluminum multiplied by the average canned rate sold for each product in other months.[27] Exogeneity of these variables relies on the assumption that the soft drink industry represents only a small share of the demand for sugar and aluminum.[28] The second step of the control function approach uses the OLS residuals of the regression model (13), denoted by $\hat{u}_{jt}$, as a proxy for the unobserved product characteristics that affect both retail prices and consumer behavior (e.g., advertising, shelf display). More specifically, we include $\hat{u}_{jt}$ into (11) to control for the correlation between p_{jt} and ξ_{jt} as follows:

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

[26] See, e.g., Hausman and Newey (2016); Crawford et al. (2018); Dubois et al. (2018); Beck and Lein (2020) for recent use of the control function approach in demand estimation. We acknowledge however that the control function approach is valid under restrictive functional form restrictions (Blundell and Matzkin, 2014).

[27] These input price indexes are from the French National Institute for Statistics and Economic Studies.

[28] In a spirit similar to the Hausman-type instruments (Hausman, 1996), our second cost shifter also relies on the identification assumption that demand for soft drinks is independent across months.

where ρ is a parameter capturing the mean utility generated by unobserved product attributes that are correlated with retail prices.

Estimation procedure. We estimate the vector of demand parameters, denoted by $\theta^d \equiv (\alpha_{nb(j)}, \alpha_{pl(j)}, \sigma, \delta_{b(j)}, \delta_{r(j)}, \rho)^\top$, by maximizing the following simulated log-likelihood function:[29]

$$\text{SLL}(\theta^d) = \sum_i \sum_t \sum_j \mathbb{1}_{\{y_{ijt}=1\}} \ln(\check{s}_{ijt}(\theta^d))$$

where $\check{s}_{ijt}(\theta^d)$ represents the simulated counterpart of (12). In practice, we compute this simulated market share using Monte Carlo integration as follows:

$$\check{s}_{ijt} = \frac{1}{ns} \sum_{h=1}^{ns} \frac{\exp(\delta_{b(j)} + \delta_{r(j)} - \exp(\alpha_{nb(j)} + \alpha_{pl(j)} + \sigma \nu_{ih})\, p_{jt} + \rho \hat{u}_{jt})}{\sum_{k \in \mathcal{J}_t} \exp(\delta_{b(k)} + \delta_{r(k)} - \exp(\alpha_{nb(k)} + \alpha_{pl(k)} + \sigma \nu_{ih})\, p_{kt} + \rho \hat{u}_{kt})}$$

where ns denotes the total number of random draws for each consumer i. It is worth noting that the use of simulated market shares in the log-likelihood function may generate both noise and bias (Train, 2009). With a large sample size, the simulation noise has the desirable property to vanish without even increasing the number of simulation draws. However, the simulation bias may be magnified which renders the maximum simulated likelihood estimator inconsistent. Fortunately, this bias decreases with the number of draws used in the simulation. In our application, we use 100 Halton draws.[30]

Identification and estimation of bargaining stage

Econometric model. As shown in (3), we can recover the marginal cost of retailers for each soft drink product $j \in \mathcal{J}_t \backslash \{0\}$ from demand estimates and by inverting (2). We have further shown in (10) that one can recover the price-cost margins of manufacturers up to an unknown vector of bargaining weights λ to be estimated. To this end, we rely on the varia-

[29] The mathematical symbol "⊤" denotes the transpose operator.

[30] For one-dimensional integration, Bhat (2001) has shown that the simulation error is smaller with 75 Halton draws than with 2000 pseudo-random draws (see also Train, 2000).

tion in marginal costs of retailers across products and markets, which can be explained by (i) asymmetries in the bargaining power of firms in the supply chain, and (ii) differences in marginal costs of production and distribution. We thus proceed by partitioning the marginal cost of retailers for each product $j \in \mathscr{J}_t \backslash \{0\}$ as follows:

$$w_{jt} + c_{jt} = \underbrace{(w_{jt} - \mu_{jt})}_{\text{price-cost margins of manufacturers}} + \underbrace{(c_{jt} + \mu_{jt})}_{\text{operational costs}} \tag{14}$$

Then, we leverage our bilateral oligopoly model and make use of the closed-form expression in (10) for the price-cost margins of manufacturers in (14). This markup term is derived from consumer demand for each product $j \in \mathscr{J}_t \backslash \{0\}$ which is given by $q_{jt} = M_t s_{jt}$, where M_t denotes the market size and s_{jt} is the aggregate market share of product j in market t.[31] As further detailed in Appendix S1.2 of the Supplemental Material, this markup term also depends on the out-of-equilibrium demand of each product $k \in \mathscr{J}_t \backslash \{0, j\}$ following the removal of product $j \in \mathscr{J}_t \backslash \{0\}$, which is given by $\tilde{q}_{kt}^{-j} = M_t \tilde{s}_{kt}^{-j}$. We derive the out-of-equilibrium market share $\tilde{s}_{kt}^{-j}$ as follows:

$$\tilde{s}_{kt}^{-j}(\tilde{\mathbf{p}}_t^{-j}; \theta^d) = \begin{cases} \int_0^{+\infty} \frac{\exp(\tilde{\upsilon}_{ikt}^{-j})}{\sum\limits_{l \in \mathscr{J}_{rt} \backslash \{j\}} \exp(\tilde{\upsilon}_{ilt}^{-j}) + \sum\limits_{m \in \mathscr{J}_t \backslash \mathscr{J}_{rt}} \exp(\upsilon_{imt})} f(\alpha_{ij})\, \mathrm{d}\alpha_{ij} & \text{if } k \in \mathscr{J}_{rt} \backslash \{j\} \\ \int_0^{+\infty} \frac{\exp(\upsilon_{ikt})}{\sum\limits_{l \in \mathscr{J}_{rt} \backslash \{j\}} \exp(\tilde{\upsilon}_{ilt}^{-j}) + \sum\limits_{m \in \mathscr{J}_t \backslash \mathscr{J}_{rt}} \exp(\upsilon_{imt})} f(\alpha_{ij})\, \mathrm{d}\alpha_{ij} & \text{otherwise} \end{cases}$$

where $\upsilon_{ikt} \equiv \delta_{b(k)} + \delta_{r(k)} - \alpha_{ij} p_{kt} + \rho \hat{u}_{kt}$ and $\tilde{\upsilon}_{ikt}^{-j} \equiv \delta_{b(k)} + \delta_{r(k)} - \alpha_{ij} \tilde{p}_{kt}^{-j} + \rho \hat{u}_{kt}$. Absent additional information, we impose some structure on the "operational costs" term in (14). Following Gowrisankaran et al. (2015), we assume that the constant marginal cost of product $j \in \mathscr{J}_t \backslash \{0\}$ is given by: $c_{jt} + \mu_{jt} = \mathbf{v}_{jt} \boldsymbol{\kappa} + \omega_{jt}$, where $\mathbf{v}_{jt}$ is a $1 \times K$ vector of cost shifters, $\boldsymbol{\kappa}$ is a $K \times 1$ vector of cost parameters, and ω_{jt} denotes an additive error term which captures unobserved cost factors (e.g., the productivity of firms). In our application, $\mathbf{v}_{jt}$ includes cat-

[31] The aggregate market share of product $j \in \mathscr{J}_t \backslash \{0\}$ predicted by our demand model is given by: $s_{jt} = \int_0^{+\infty} \frac{\exp(\delta_{b(j)} + \delta_{r(j)} - \alpha_{ij} p_{jt} + \xi_{jt})}{\sum_{k \in \mathscr{J}_t} \exp(\delta_{b(k)} + \delta_{r(k)} - \alpha_{ik} p_{kt} + \xi_{kt})} f(\alpha_{ij})\, \mathrm{d}\alpha_{ij}$ (see, e.g., Nevo, 2001).

egory and retailer fixed effects, the (monthly) input price of sugar multiplied by the sugar content of each brand of soft drink, and the (monthly) input price of aluminum multiplied by the average percentage of cans sold for each product. We thus specify the marginal cost function of retailers in the soft drink industry as follows:

$$w_{jt} + c_{jt} = \Gamma_{jt}(\mathbf{q}_t, \mathbf{Q}_{\mathbf{p}_t}, \mathbf{Q}_{\mathbf{p}_t\mathbf{p}_t}, \tilde{\mathbf{Q}}_{\Delta t}; \boldsymbol{\lambda}) + \mathbf{v}_{jt}\boldsymbol{\kappa} + \omega_{jt} \tag{15}$$

where the vector of supply parameters to be estimated is $\theta^s \equiv (\boldsymbol{\lambda}^\top, \boldsymbol{\kappa}^\top)^\top$.

Identification. Intuitively, identification of the bargaining weights amounts to identifying the slope of the marginal cost function of retailers. For instance, when $\lambda_{fr} = 0\ \forall f, r$, retailers make take-it-or-leave-it offers to manufacturers and the price-cost margins of manufacturers equal zero. In this case, (15) is flat with respect to quantity as in Berry et al. (1995). In contrast, when manufacturers exert market power, (15) also depends on the price-cost margins of manufacturers and, in turn, on quantity. In this case, the pricing behavior of retailers differs from the standard oligopoly setting due to the double marginalization, thereby revealing the presence of manufacturers' bargaining power.

Identification of θ^s can be jeopardized by the fact that the quantity vector $\mathbf{q}_t$, which enters non-linearly into (15) through the markup term Γ_{jt}, is likely to be correlated with unobserved cost factors ω_{jt}. Indeed, under complete information about marginal costs, firms observe the realization of ω_{jt} before setting wholesale and retail prices which, in turn, affects $\mathbf{q}_t$. Moreover, the variation in quantities depends on the unobserved product characteristics ξ_{jt} which is likely to be correlated with ω_{jt}. To address this endogeneity issue, one needs instrumental variables that shift either demand or the price-cost margins of manufacturers but not the marginal costs of products. In our application, we rely on the amount of competition that each product faces in characteristics space.[32] Intuitively, after controlling for differences in marginal costs, products with distant substitutes in characteristics space

[32]This markup shifter relates to the so-called BLP instruments and directly builds on the "Differentiation IVs" suggested by Gandhi and Houde (2023, 2020) to identify consumer substitution patterns as well as firms' conduct in oligopoly markets.

should systematically have higher wholesale prices (and thus greater retail marginal costs) than products with close substitutes if manufacturers are able to exert market power (bargaining weights are close to 0). If, however, the location of products in characteristics space does not explain differences in retail marginal costs across products, this may reveal that retailers are able to mitigate the market power of manufacturers such that wholesale prices only reflect production costs (bargaining weights are close to 1).

In practice, we use two sets of instrumental variables: (i) the number of rival products in the same soft drink category, and (ii) the number of rival products sold by the same retailer interacted with manufacturer-category fixed effects. The validity of these instruments hinges on the conditions that they are correlated with quantities and exogenous to the structural error term ω_{jt}. For the first condition, our instruments aim at measuring the competitive pressure exerted on each product which is very likely to explain differences in quantity sold across products and markets. For the exogeneity condition, we rely on the common assumption that observed product characteristics are exogenous.

As the order condition requires at least one instrument for each bargaining weight that interacts with quantities (which grows with the number of manufacturer-retailer pairs), we consider only manufacturer-specific bargaining weights in estimation ($\lambda_{fr} = \lambda_f$).[33] For manufacturers 1 and 2 which have the most diverse brand portfolio (see Table 10 in Appendix A), we allow bargaining weights to differ between the "cola and other soda" and "fruit juice and iced tea" products. Hence, there are six bargaining weights to be estimated.

Estimation procedure. We estimate the vector of supply parameters by continuous-updating GMM (Hansen et al., 1996). Note that we concentrate the cost parameters $\boldsymbol{\kappa}$ out of the GMM objective function and search nonlinearly over the vector of bargaining weights $\boldsymbol{\lambda}$. Formally,

[33] We have 28 manufacturer-retailer pairs, requiring the use of at least 28 instruments. We thus employ parameter restrictions for tractability motives as commonly applied in the literature (see e.g. Gowrisankaran et al., 2015; Ho and Lee, 2017; Crawford et al., 2018). Moreover, we make the simplifying assumption that private label manufacturers are vertically integrated with retailers (no bargaining).

our GMM estimator is defined as follows:

$$\hat{\lambda} \equiv \underset{\lambda}{\operatorname{argmin}} \, (\mathbf{Z}^s \omega(\lambda, \kappa(\lambda)))^\top \mathbf{A}^{-1} \mathbf{Z}^s \omega(\lambda, \kappa(\lambda)) \tag{16}$$

where $\omega(\lambda, \kappa(\lambda))$ is the $\sum_t J_t$-dimensional vector of unobserved cost factors, $\mathbf{Z}^s$ is a $L \times \sum_t J_t$ matrix of instrumental variables (including the K exogenous cost shifters), and $\mathbf{A}$ is a $L \times L$ weighting matrix (see Appendix S5 of the Supplemental Material for further details on our estimation procedure).

Estimation results

We first estimate the random coefficient logit model using our household-level data on soft drink purchases. Given demand estimates, we compute the price-cost margins and marginal costs of retailers by inverting the system of first-order conditions described in (2). Finally, using demand and retailers' marginal cost estimates, we estimate the marginal cost function of retailers described in (15). In what follows, we present our estimation results.

Demand estimates

Table 3 reports parameter estimates of our random coefficient logit model. The estimated coefficient of the first-step residuals of the control function approach is positive and significant at the 5% level. This suggests that unobserved product attributes are positively correlated with the retail price variable, justifying the need to account for the retail price endogeneity issue.[34] The retail price has a significant and negative impact on consumer utility. On average, we find that consumers are more sensitive to price variation of private labels than national brands, which may stem from greater consumer brand loyalty with respect to national brands. Our estimates also reveal heterogeneity in price sensitivity across consumers (see Figure 2 in Appendix B).

[34] Table 11 in Appendix B displays estimates of the first step of the control function approach. We find an F-stat equal to 22.62, indicating that our excluded instruments are not weakly correlated with the endogenous retail price variable.

We use demand estimates to compute the own and cross-price elasticity of demand for each product. Our results are in line with recent empirical work on the soft drink industry. For instance, we find an aggregate own-price elasticity of −1.49 for soft drinks (excluding fruit juices) as in Dubois et al. (2020).[35] In line with Dubé (2004) and Ershov et al. (2021), we also obtain that the own-price elasticities for brands in the cola category range from −2.76 to −3.28 on average. To gain additional insights into our estimates of substitution patterns among products, we have also computed the average recapture ratios (also known as the aggregate diversion ratios) for each soft drink category. This provides a measure of the average fraction of sales lost by a product due to a retail price increase that is recaptured by all products belonging to another category. Results reported in Table 4 reveal intuitive patterns. For instance, 25.00% of the demand lost by a product in the cola category due to a retail price increase diverts to other sodas. This demand diversion is lower for other soft drink categories (21.85% for fruit juices and 6.42% for iced tea). It is worth noting that diagonal elements in the table are not equal to −100% due to intra-category substitution.

Supply estimates

Table 5 reports estimates of the retail marginal cost function described in (15). The value of the GMM objective function at estimated parameters is 1.90 and the overidentification test of Hansen (1982) cannot reject our model at the 95% confidence level. Cost parameters are precisely estimated and have the expected signs. For instance, fruit juice fixed effects contribute positively to the marginal costs of products due to their fruit content. In contrast, the average marginal cost of private labels is lower than that of national brands. Although bargaining weight parameters should theoretically lie in the interval $[0, 1]$, we do not impose any parameter constraints in our estimation. Results indicate that there is substantial heterogeneity in the bargaining weights of retailers across manufacturers and soft drink categories. Whereas retailers have a lower bargaining ability than manufacturers 3 and 4,

[35] Consistent with Bonnet and Réquillart (2013a), we also obtain an average own-price elasticity of −3.27 for soft drinks (excluding fruit juices).

results vis-à-vis manufacturer 1 are more balanced. We do not report standard errors for the bargaining weights of retailers vis-à-vis manufacturer 2 because they lie on the boundary of the parameter space. Instead, we use a grid search method and select values of the bargaining weights of retailers vis-à-vis manufacturer 2 that minimize our GMM objective function (we refer to Appendix S5 of the Supplemental Material for further details). We find that retailers make take-it-or-leave-it offers to manufacturer 2 for products belonging to the cola and other soda categories. This result is particularly consistent with anecdotal evidence suggesting that the market penetration of manufacturer 2 over these soft drink categories in France is very limited.[36] In contrast, when negotiating wholesale prices of fruit juice products, we find that retailers receive take-it-or-leave-it offers from manufacturer 2 which owns the leading brand in this category.

Using bargaining weight and cost parameter estimates, we compute the price-cost margins of manufacturers, the marginal cost of production and distribution of products, and the surplus division in the supply chain of the French soft drink industry. Table 6 displays the results. Consistent with our cost parameter estimates, we find that the marginal cost of fruit juice products is twice higher than that of cola, other soda, and iced tea products. For each soft drink category, we also find that private labels have much smaller marginal costs than national brands. These results explain part of the (observed) retail price variation which is also driven by differences in price-cost margins. In each category, we find greater total price-cost margins for national brands than for private labels, which is mainly due to the double-marginalization effects. These margins, however, are not evenly split between manufacturers and retailers. In particular, we find that the price-cost margins of manufacturers are systematically lower than the price-cost margins of retailers. This suggests that the estimated bargaining weights partially explain the surplus division in the soft drink industry, especially for manufacturers 3 and 4 which have a higher bargaining ability than retailers.

In addition to the relative bargaining ability of firms, Section 2 highlights that two other

[36] At the end of the 1990s, the European Commission received several complaints from manufacturer 2 alleging abuse of a dominant position by manufacturer 1, which raised entry barriers in the cola and other soda product categories (Case COMP/A.39.116/B2).

sources of bargaining power influence the determination of trading terms between manufacturers and retailers. Table 7 displays estimates of these two bargaining forces as well as the share of the surplus generated by bilateral agreements that is captured by each retailer. We find that the ratio of the gains from trade of manufacturers to retailers ranges from 0.43 to 0.50, suggesting that the losses from not reaching an agreement are twice higher for retailers than for manufacturers. Although this bargaining force tends to tilt the distribution of bargaining power towards manufacturers, we also find that the ratio of the concession costs of manufacturers to retailers is close to half. This highlights that the costs of making price concessions in negotiations decrease substantially more retailers' profits than manufacturers' profits. As a result, retailers are less willing to grant wholesale price concessions, which reinforces their bargaining power vis-à-vis manufacturers. Overall, we obtain that each retailer captures more than 65% of the surplus generated by its bilateral agreements with manufacturers, indicating that retailers have a higher bargaining power than soft drink manufacturers. This result shows that firms' relative concession costs play a critical role in the distribution of bargaining power in the supply chain of the French soft drink industry.

4 The equilibrium effects of retail mergers

By affecting both downstream consumers and upstream manufacturers, the analysis of retail mergers raises thorny questions for competition authorities. In particular, the effect on buyer power and its appropriate treatment remains a challenging issue in merger enforcement. As stated by Carlton and Israel (2011): "The difficulties arise from the fact that answers to these questions turn on specific details of underlying bargaining games, which are hard to observe in practice. Hence, answers to these questions will depend on empirical tests that have been applied to the specific industries and firms in question". Leveraging estimates of our structural model of bilateral oligopoly, we aim at shedding new light on the effect of retail mergers on the buyer power of retailers vis-à-vis manufacturers and retail prices paid by consumers.

Preliminary insights. Consider a hypothetical merger between two retailers, indexed by r and r', which gives rise to a multi-store retailer, indexed by rr', distributing the set of products $\mathscr{J}_{rt} \cup \mathscr{J}_{r't}$ (e.g., Rey and Vergé, 2020; Sheu and Taragin, 2021).[37] Based on (1b), we define the (per-market) profit function of the merged entity by:

$$\pi^{post}_{rr't} \equiv \sum_{j \in \mathscr{J}_{rt} \cup \mathscr{J}_{r't}} \left(p_{jt} - w_{jt} - c_{jt}\right) q_{jt}(\mathbf{p}_t) \tag{17}$$

In what follows, we examine the (pure) bargaining effect of the merger using insights drawn from Section 2. More specifically, we compare the pre-merger bilateral negotiation between manufacturer *f(j)* and retailer r over the wholesale price of product $j \in \mathscr{J}_{rt}$ with the post-merger bilateral negotiation between manufacturer *f(j)* and the merged retailer rr' over the same wholesale price.

As (17) shows, the merged retailer rr' distributes both sets of products $\mathscr{J}_{rt}$ and $\mathscr{J}_{r't}$. When these products are substitutes, the gains from trade of the merged retailer rr' in its negotiation for product $j \in \mathscr{J}_{rt}$ are lower than what retailer r obtains in the pre-merger situation. The intuition is that the marginal contribution of product j to retailer r's profit reduces when it distributes a larger number of substitute products. Based on (6), we obtain that a decrease in the gains from trade of the merged retailer strengthens its bargaining power vis-à-vis manufacturer *f(j)*. This mechanism is in line with the conventional wisdom suggesting that larger retailers are able to secure better trading terms. However, the effect of the merger on the relative concession costs of firms may nuance this view.

Using estimates of our structural model, Table 8 shows how firms' concession costs and their determinants described in (8a) and (8b) are affected by retail mergers in the French soft drink industry (holding retail prices fixed at the pre-merger level). The first row of the table shows that retail mergers increase on average the concession costs of manufacturers by 16.24% and decrease those of the merging retailers by −8.49%. As described in

[37]The merger is similar to a collusion between retailers r and r' which seek to maximize their joint profits $(\pi_{rt} + \pi_{r't})$. This differs from the case where a merger reduces product variety (e.g., Iozzi and Valletti, 2014; Ho and Lee, 2017; Gaudin, 2018) or induces uniform pricing (Grennan, 2013).

(6), these effects weaken the bargaining power of the merging retailers vis-à-vis soft drink manufacturers. Subsequent rows of the table provide further insights into the mechanisms at play by reporting the impact of retail mergers on firms' concession costs when holding one of their determinants fixed at the pre-merger level. The results show that, on average, the concession costs of manufacturers (resp. the merging retailers) would have decreased (resp. increased) by -1.06% (resp. 4.51%) if retail mergers had not impacted the effect of double-marginalization (DM) on demand. This suggests that the change in the effect of DM on demand is a key driver of the increase (resp. decrease) in manufacturers' (resp. retailers') concession costs caused by retail mergers. The intuition underlying this result is as follows. By decreasing the own retail pass-through (-9.68%), retail mergers reduce the negative effect of DM on demand which, in turn, raises the profitability of a wholesale price increase for manufacturers ($\partial \pi_{f(j)t}/\partial w_{jt}$ goes up). In contrast, this effect reduces the merging retailers' losses from a wholesale price increase, which decreases their concession costs ($-\partial \pi_{r(j)}/\partial w_j$ goes down). Although the table shows that the impact of retail mergers on the "recapture effect" also explains part of the decrease in retailers' concession costs, we find that changes in other determinants of firms' concession costs play a less important role in our results (especially for the increase in manufacturers' concession costs).

To summarize, we find that the ultimate impact of retail mergers on the bargaining power of retailers vis-à-vis manufacturers depends on two opposite bargaining forces. Based on these preliminary insights, we analyze the bargaining effect of retail mergers using the notion of "equilibrium of fear" outlined in Section 2 before conducting merger simulations.

Retail mergers and "equilibrium of fear". As described in (9), the outcome of our bargaining game can be interpreted in terms of an "equilibrium of fear". Hence, the directional impact of retail mergers on wholesale prices can be understood by analyzing their effects on firms' fear of disagreement. Using estimates of our structural model, we compute the ratio of firms' fear of disagreement for any (hypothetical) merger of two retailers. Figure 1 displays the results. The first violin plot shows the distribution of the ratios of firms' fear of disagreement following retail mergers given that retail prices are held fixed at the pre-merger level. For any merger of two retailers, we find that the fear of disagreement of the merging retailers is systematically higher than that of manufacturers in every bilateral negotiation (that is, $\frac{1}{\lambda}\frac{\pi_{rr'(j)t}-d_{rr'(j)t}^{-j}}{-\partial\pi_{rr'(j)t}/\partial w_{jt}} > \frac{1}{(1-\lambda)}\frac{\pi_{f(j)t}-d_{f(j)t}^{-j}}{\partial\pi_{f(j)t}/\partial w_{jt}}$). Following Svejnar (1986), this suggests that the merging retailers have to make price concessions to manufacturers, implying that retail mergers in the French soft drink industry tend to weaken buyer power.

To shed light on the bargaining forces at play, the second violin plot in the figure displays the distribution of the ratios of firms' fear of disagreement following retail mergers when both retail prices and firms' concession costs are held fixed at the pre-merger level. The results indicate that the fear of disagreement of the merging retailers is systematically lower than that of manufacturers, suggesting that retail mergers strengthen buyer power. Combined with the previous result, this demonstrates that the negative effect of retail mergers on buyer power stems from their impact on firms' concession costs. By holding retail prices fixed at the pre-merger level, it is worth noting that our analysis omits the effect of retail mergers on the downstream market. To evaluate the robustness of our results to changes in downstream market concentration, we simulate post-merger retail prices (holding wholesale prices fixed at the pre-merger level) and recompute the ratios of firms' fear of disagreement. The third violin plot in the figure displays the results.[38] For most bilateral bargains, we find that the fear of disagreement of the merging retailers remains higher than that of manufacturers, suggesting that our results are fairly robust to changes in retail prices due to greater downstream concentration. Interestingly, however, we find that some ratios of firms' fear of disagreement are above 1. This indicates that the negative effect of retail mergers on buyer power applies to most but not all bilateral negotiations.

These results offer preliminary evidence that the impact of retail mergers on firms' concession costs dominates that on firms' gains from trade, which weakens the bargaining power of the merging retailers vis-à-vis soft drink manufacturers. To further examine the

[38] By accounting for the effect on the downstream market, these ratios provide a more accurate measure of the directional impact of retail mergers on wholesale prices.

equilibrium effect of retail mergers in bilateral oligopolies, we simulate three different mergers: (i) a merger involving two large retailers (retailers 1 and 4), (ii) a merger involving a small and a large retailer (retailers 2 and 6), and (iii) a merger involving two small retailers (retailers 3 and 7).

Merger simulations. Using estimates of our bilateral oligopoly model, we simulate the impact of retail mergers on equilibrium outcomes. Based on our algorithm described in Appendix S4 of the Supplemental Material, we recompute a new bargaining and downstream price equilibrium. In particular, we perform our merger simulations holding fixed: (i) consumer preferences, (ii) the marginal cost of production and distribution of each product, (iii) the buyer-seller network structure, and (iv) the bargaining weights of firms.[39]

Simulation results are reported in Table 9. For each merger, we find that the (quantity-weighted) average price-cost margins of manufacturers for products distributed by the merging retailers increase. Retail mergers thus weaken the bargaining power of the merging retailers vis-à-vis manufacturers, which is consistent with the insight drawn from Figure 1. More specifically, the effect of retail mergers on the concession costs dominates the benefit that the merging retailers get from a reduction in their gains from trade. Interestingly, this wholesale price increase is higher (resp. smaller) when the merger involves two large (resp. small) retailers. Despite the retailers' loss of bargaining power vis-à-vis manufacturers, our simulation results highlight that each merger remains profitable due to a substantial increase in retail prices.[40] This upward pricing pressure causes a fall in consumer surplus and total welfare, with larger impacts estimated for retail mergers involving large retailers.[41]

This analysis illustrates well the different bargaining forces at work in our model. In

[39] We perform a series of robustness checks, including changes in demand curvature, bargaining weights, and merger-specific efficiency gains (see Appendix S8 of the Supplemental Material). We show that our merger simulation results hold, provided that mergers involve at least one large retailer and marginal cost savings are not too high.

[40] Note that this increase in profits is higher for the non-merging retailers than the merging retailers, which is consistent with the free-riding effect highlighted in Deneckere and Davidson (1985).

[41] As shown in Appendix S8 of the Supplemental Material, retail mergers remain detrimental to consumers and total welfare even when taking into account merger-specific bargaining weight efficiencies. Instead, we find that significant marginal cost savings are required for retail mergers to benefit consumers.

particular, we highlight that the concession costs of firms during negotiations may have important implications for retail merger reviews. Interestingly, our results regarding the effect of retail mergers on buyer power stand in contrast with Sheu and Taragin (2021) who consider a framework of bilateral oligopoly with a simultaneous timing assumption that rules out the role of firms' concession costs in the bargaining outcome. By accounting for this additional bargaining force, we find no support for the emergence of a countervailing buyer power effect as envisioned by Galbraith (1952) and outlined in the European Commission's guidelines. Instead, we obtain that the main motive for retail mergers is to increase market power, implying that antitrust practitioners should be particularly concerned about these operations.

5 Concluding remarks

The concept of buyer power and its implications for market outcomes have become increasingly topical in political and antitrust debates. In this article, we offer an empirical framework for analyzing buyer power in bilateral oligopolies in which retail prices adjust to wholesale price changes, which is typically the case in industries such as food retailing. Using this framework and data on soft drink purchases in France, we empirically investigate the buyer power defense in retail merger analysis. In contrast to the conventional wisdom, we find that the merging retailers pay higher wholesale prices following the merger. The mechanism underlying this result stems from the impact of retail mergers on the concession costs of firms in bilateral bargains. Our findings thus suggest that such bargaining effects, which have largely been ignored in previous work, have critical implications for merger analysis in bilateral oligopolies.

From a competition policy perspective, we shed new light on the buyer power defense in retail merger analysis. In particular, our empirical findings cast serious doubt on the claim that retail mergers create countervailing buyer power effects that reduce wholesale prices and ultimately benefit consumers. Instead, we find that retail mergers generally harm consumers and total welfare.

Finally, although we focus on retail mergers in the French soft drink industry, we would like to highlight two key features that make our empirical framework of bilateral oligopoly particularly attractive for applied work. First, despite the complexity of our bargaining model, we demonstrate that the price-cost margins of both retailers and manufacturers have closed-form expressions. Second, we show that one can estimate our framework without data on wholesale contracts, margins, or marginal costs of firms, which are rarely available in practice. Hence, we believe that our empirical framework can be readily extended to analyze a number of other bilaterally oligopolistic industries or address different policy questions. These may include topics such as buyer alliances (Molina, 2021) or upstream horizontal mergers.

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Tables

Table 1: Descriptive statistics for manufacturers and product categories

	Market share					Retail price				
	colas	sodas	juices	iced tea	total	colas	sodas	juices	iced tea	total
M1	12.00	1.58	0.57	0.22	14.37	0.92	0.91	1.61	0.93	0.95
	(0.53)	(0.11)	(0.14)	(0.06)	(0.42)	(0.02)	(0.03)	(0.08)	(0.03)	(0.02)
M2	1.12	0.45	3.36	–	4.93	0.71	0.76	2.19	–	1.72
	(0.09)	(0.10)	(0.21)		(0.17)	(0.02)	(0.02)	(0.04)		(0.05)
M3	–	–	–	2.07	2.07	–	–	–	1.09	1.09
				(0.39)	(0.39)				(0.02)	(0.02)
M4	–	6.66	0.84	–	7.50	–	1.08	1.79	–	1.16
		(0.61)	(0.10)		(0.57)		(0.02)	(0.03)		(0.02)
PL	4.12	7.36	29.83	2.32	43.63	0.30	0.39	0.84	0.52	0.70
	(0.15)	(0.46)	(1.92)	(0.37)	(1.32)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Notes: $N = 265,998$. "M1", "M2", "M3" and "M4" refer respectively to manufacturers 1, 2, 3, and 4, "PL" corresponds to private label, and "sodas" and "juices" refer respectively to other sodas and fruit juices. Market shares are measured in the number of household purchases. Retail prices in euros per liter are calculated using quantity weights. Standard deviations in parenthesis refer to variation across months. Remark that we are not permitted to reveal names of manufacturers due to confidentiality regarding Kantar WorldPanel data.

Table 2: Descriptive statistics for retailers

	Market share			Retail price		
	national brand	private label	total	national brand	private label	total
Retailer 1	7.82	6.69	14.51	1.20	0.82	1.02
	(0.25)	(0.34)	(0.53)	(0.02)	(0.02)	(0.02)
Retailer 2	3.92	5.01	8.93	1.14	0.72	0.90
	(0.21)	(0.13)	(0.16)	(0.02)	(0.02)	(0.02)
Retailer 3	4.56	3.14	7.71	1.13	0.76	0.98
	(0.26)	(0.27)	(0.18)	(0.03)	(0.01)	(0.02)
Retailer 4	4.29	7.91	12.21	1.21	0.79	0.94
	(0.18)	(0.40)	(0.44)	(0.02)	(0.02)	(0.01)
Retailer 5	1.05	10.31	11.36	0.82	0.55	0.57
	(0.08)	(0.41)	(0.44)	(0.03)	(0.01)	(0.01)
Retailer 6	4.94	6.98	11.91	1.10	0.68	0.85
	(0.32)	(0.27)	(0.29)	(0.03)	(0.02)	(0.01)
Retailer 7	2.29	3.59	5.88	1.12	0.69	0.86
	(0.20)	(0.25)	(0.25)	(0.03)	(0.03)	(0.02)

Notes: $N = 265,998$. Market shares are measured in the number of household purchases. Retail prices in euros per liter are calculated using quantity weights. Standard deviations in parenthesis refer to variation across months. Remark that we are not permitted to reveal names of retailers due to confidentiality regarding Kantar WorldPanel data.

Table 3: Results of the random coefficient logit model

	Estimate	S.E.		Estimate	S.E.
Retail price sensitivity (log-normal):					
Private label (α_{pl})	2.24*	0.65			
National brand (α_{nb})	1.05*	0.21			
σ	0.81*	0.28			
Control function (ρ)	3.77*	0.96			
Retailer fixed effects (δ_r)					
Retailer 1	0.99	0.58	Retailer 5	0.25	0.59
Retailer 2	0.49	0.58	Retailer 6	0.65	0.58
Retailer 3	0.32	0.58	Retailer 7	ref.	
Retailer 4	0.87	0.58			
Brand fixed effects (δ_b)					
Colas					
Brand 23 *(PL)*	0.49	0.92	Brand 9	−1.89	1.57
Brand 5	1.13	1.86	Brand 4	−2.83	1.99
Other sodas					
Brand 25 *(PL)*	1.94*	0.95	Brand 14	−0.95	1.79
Brand 3	−2.71	1.64	Brand 15	−0.46	1.98
Brand 6	−0.93	1.92	Brand 17	0.15	2.09
Brand 7	−0.60	2.45	Brand 19	−3.36	1.96
Brand 8	−4.13*	1.68	Brand 20	1.82	3.31
Brand 10	−2.96	1.60	Brand 21	−4.84*	1.57
Fruit juices					
Brand 22 *(PL)*	6.25*	1.05	Brand 1	−0.08	2.63
Brand 11	2.90	2.86	Brand 18	−0.82	2.12
Brand 16	0.95	2.67			
Iced tea					
Brand 24 *(PL)*	1.70	0.97	Brand 12	−0.21	2.03
Brand 2	−2.59	1.84	Brand 13	−2.13	2.27
Simulated Log-likelihood: −922,237					
Number of observations: 265,998					

Notes: Maximum simulated likelihood estimates. Standard errors are computed using the asymptotic formula of Karaca-Mandic and Train (2003) which takes into account the sampling variance in the first-step estimates of the control function approach. * indicates significance at the 5% level. "*PL*" stands for private label.

Table 4: Recapture ratios at the soft drink category level

Category	Recapture ratios				
	Colas	Other sodas	Fruit juices	Iced tea	Outside good
Colas	−76.86	25.00	21.85	6.42	3.98
	(8.11)	(3.13)	(9.31)	(0.90)	(1.63)
Other sodas	25.44	−77.68	27.97	6.58	3.03
	(7.96)	(2.68)	(9.55)	(0.73)	(1.29)
Fruit juices	17.36	20.10	−46.91	6.24	0.53
	(7.98)	(3.27)	(11.29)	(0.68)	(0.35)
Iced tea	24.56	24.19	32.19	−94.32	2.27
	(9.16)	(2.71)	(11.17)	(0.67)	(0.95)

Notes: The (quantity-weighted) average recapture ratios (also known as "aggregate diversion ratios") measure the average fraction of sales lost by a product in the category of row j following a small retail price increase that is recaptured by all products in the category of column k. Standard errors in parenthesis are computed using a parametric bootstrap where 500 draws are taken from the estimated asymptotic normal distribution of our demand parameters.

Table 5: Bargaining and marginal cost parameter estimates

	Estimate	S.E.
Marginal cost of production and distribution:		
Sugar content × Sugar price	0.01	0.03
Canned rate × Aluminium price	0.31*	0.04
Cola	0.43*	0.03
Sola	0.45*	0.03
Fruit juice	0.88*	0.03
Pure fruit juice	1.11*	0.01
Iced tea	0.53*	0.02
Private label	−0.21*	0.01
Brand 20	1.73*	0.02
Retailer fixed effects (not shown)		
Bargaining weights:		
Manufacturer 1 (colas, other sodas)	0.68⋆	0.03
Manufacturer 1 (fruit juices, iced tea)	0.57	0.06
Manufacturer 3	0.26⋆	0.07
Manufacturer 4	0.39⋆	0.03
Manufacturer 2 (colas, other sodas)	1.00	–
Manufacturer 2 (fruit juices)	0.00	–
GMM objective function value (J-statistic)	1.92	
χ^2 critical values (5%)	5.99	
Number of observations	920	

Notes: Continuously-updating GMM estimates (see Appendix S5 of the Supplemental Material for technical details). Heteroskedasticity-robust standard errors. * indicates significance at the 5% level. ⋆ indicates bargaining weight estimates that differ significantly from 0.5 at the 5% level.

Table 6: Price-cost margins and marginal costs estimates

	Retail price	Own-price elasticities	Marginal Cost	Price-cost margins		
				Manufacturers	Retailers	Total
Manufacturer 1:						
Colas	0.92	−3.05	0.49	12.09	35.13	47.22
	(0.02)	(0.02)	(0.01)	(0.08)	(0.19)	(0.25)
Other sodas	0.94	−3.13	0.50	12.32	35.30	47.62
	(0.03)	(0.04)	(0.03)	(0.19)	(0.40)	(0.57)
Fruit juices	1.61	−3.86	0.99	11.41	28.35	39.76
	(0.08)	(0.06)	(0.07)	(0.26)	(0.45)	(0.70)
Iced tea	0.93	−3.17	0.47	15.06	35.01	50.07
	(0.03)	(0.04)	(0.02)	(0.17)	(0.41)	(0.57)
Manufacturer 2:						
Colas	0.71	−2.76	0.43	1.29	39.89	41.18
	(0.02)	(0.05)	(0.02)	(0.06)	(0.59)	(0.60)
Other sodas	0.76	−2.82	0.45	1.32	39.21	40.53
	(0.02)	(0.05)	(0.02)	(0.06)	(0.89)	(0.86)
Fruit juices	2.19	−4.07	1.15	20.52	26.28	46.80
	(0.04)	(0.01)	(0.02)	(0.05)	(0.07)	(0.08)
Manufacturer 3:						
Iced tea	1.09	−3.35	0.52	19.45	32.81	52.26
	(0.02)	(0.02)	(0.01)	(0.10)	(0.19)	(0.29)
Manufacturer 4:						
Other sodas	1.08	−3.29	0.53	18.49	33.41	51.90
	(0.02)	(0.01)	(0.01)	(0.09)	(0.14)	(0.20)
Fruit juices	1.79	−3.96	1.04	14.57	27.38	41.95
	(0.03)	(0.02)	(0.01)	(0.11)	(0.12)	(0.23)
Private labels:						
Colas	0.30	−3.20	0.18	–	41.89	41.89
	(0.01)	(0.08)	(0.01)		(1.12)	(1.12)
Other sodas	0.39	−3.53	0.25	–	36.53	36.53
	(0.01)	(0.04)	(0.01)		(0.36)	(0.36)
Fruit juices	0.84	−3.83	0.60	–	28.83	28.83
	(0.01)	(0.01)	(0.01)		(0.12)	(0.12)
Iced tea	0.52	−3.83	0.33	–	33.64	33.64
	(0.01)	(0.04)	(0.01)		(0.38)	(0.38)

Notes: Retail prices and total marginal costs are in euros per liter. Price-cost margins are in percentage of the retail prices. All values are calculated using quantity weights and standard deviations in parenthesis refer to variation across months.

Table 7: Surplus division estimates

	Ratio of gains from trade	Ratio of concession costs	Share of retailers
Retailer 1	0.49	−0.48	67.60
	(0.01)	(0.00)	(0.18)
Retailer 2	0.48	−0.49	67.01
	(0.01)	(0.01)	(0.51)
Retailer 3	0.48	−0.48	66.48
	(0.01)	(0.01)	(0.25)
Retailer 4	0.50	−0.48	67.11
	(0.01)	(0.01)	(0.26)
Retailer 5	0.43	−0.55	69.51
	(0.01)	(0.02)	(0.67)
Retailer 6	0.48	−0.49	67.61
	(0.01)	(0.01)	(0.50)
Retailer 7	0.47	−0.49	66.60
	(0.01)	(0.00)	(0.23)

Notes: The first column displays the average ratio of gains from trade of manufacturers to retailers: $(\pi_{ft} - d_{ft}^{-j})/(\pi_{rt} - d_{rt}^{-j})$. The second column shows the quantity weighted average ratio of concession costs of manufacturers to retailers: $\frac{\partial \pi_{ft}}{\partial w_{jt}} / \frac{\partial \pi_{rt}}{\partial w_{jt}}$. The third column shows the average share of the surplus from bilateral agreements captured by each retailer. Standard deviations in parenthesis refer to variation across months.

Table 8: Changes in firms' concession costs following retail mergers

	$\Delta\partial\pi_{f(j)}/\partial w_j$	$\Delta(-\partial\pi_{r(j)}/\partial w_j)$
Changes in firms' concession costs	16.24	−8.49
Decomposition:		
No change in the DM effect on demand	−1.06	4.51
No change in the direct steering effect	16.27	−8.51
No change in the recapture effect	16.52	5.15
No change in the indirect steering effect	17.00	−10.13
No change in the DM effect	–	−20.46
No change in the cross DM effect	–	−12.99

Notes: Average percentage changes in firms' concession costs following a retail merger (holding retail prices fixed at the pre-merger level) are reported across the 21 mergers involving two retailers. The first row labeled "changes in all concession costs' effects" reports the average percentage change in firms' concession costs when accounting for the impact of retail mergers on all concession costs' effects described in (8a) and (8b). Subsequent rows show the average percentage changes in firms' concession costs when holding one of their determinants fixed at the pre-merger level. DM stands for "double-marginalization".

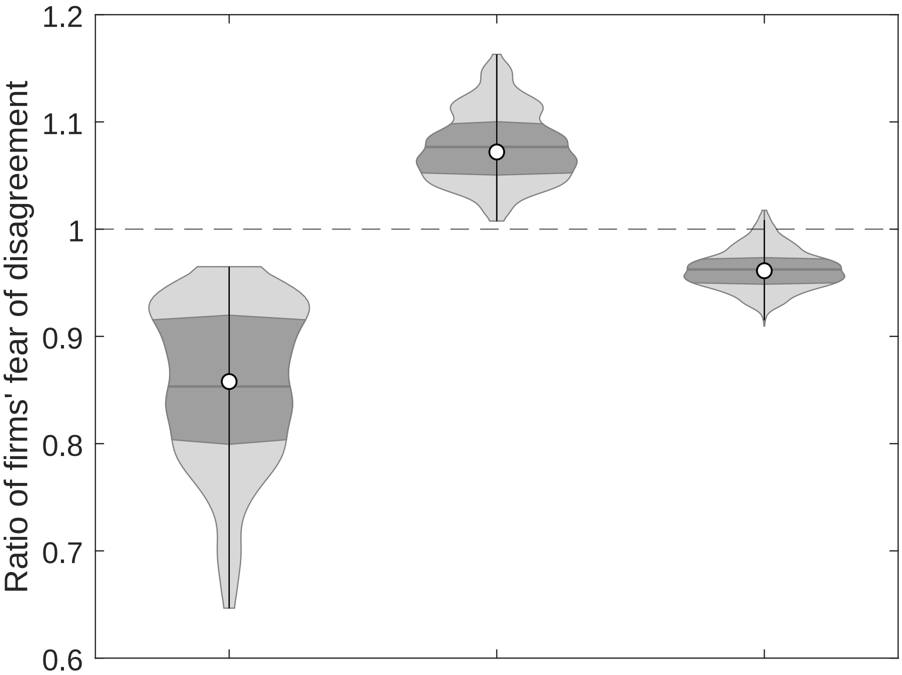
Table 9: Results of the merger simulations

	△ Retail price	△ Price-cost margins		△ Profit		△ Welfare	
		Manufacturers	Retailers	Manufacturers	Retailers	Consumers	Total
Merger between retailers 1 and 4:							
Retailer 1	8.07	3.97	22.62	−2.29	2.89	–	–
	(0.26)	(0.12)	(0.50)	(0.21)	(0.11)		
Retailer 4	9.24	3.59	27.16	−4.63	2.44	–	–
	(0.17)	(0.18)	(0.44)	(0.25)	(0.11)		
Other retailers	0.65	1.31	1.76	9.64	9.94	–	–
	(0.01)	(0.05)	(0.02)	(0.21)	(0.15)		
Total	3.58	2.30	10.22	4.15	6.98	−1.87	−0.77
	(0.08)	(0.07)	(0.17)	(0.14)	(0.08)	(0.03)	(0.01)
Merger between retailers 2 and 6:							
Retailer 2	6.49	1.84	20.58	−5.41	1.49	–	–
	(0.20)	(0.07)	(0.57)	(0.32)	(0.07)		
Retailer 6	5.35	2.84	16.26	−2.61	1.63	–	–
	(0.08)	(0.20)	(0.22)	(0.22)	(0.08)		
Other retailers	0.42	0.91	1.06	5.62	5.59	–	–
	(0.01)	(0.03)	(0.01)	(0.16)	(0.13)		
Total	1.98	1.35	5.97	2.83	4.44	−1.04	−0.35
	(0.05)	(0.04)	(0.13)	(0.10)	(0.08)	(0.02)	(0.01)
Merger between retailers 3 and 7:							
Retailer 3	2.97	1.00	9.68	−2.68	0.84	–	–
	(0.06)	(0.08)	(0.19)	(0.06)	(0.03)		
Retailer 7	4.31	1.50	14.61	−4.61	0.30	–	–
	(0.05)	(0.13)	(0.20)	(0.09)	(0.04)		
Other retailers	0.19	0.38	0.48	2.35	2.36	–	–
	(0.01)	(0.01)	(0.02)	(0.05)	(0.05)		
Total	0.82	0.55	2.61	1.18	2.04	−0.45	−0.14
	(0.02)	(0.02)	(0.05)	(0.05)	(0.04)	(0.01)	(0.00)

Notes: Percentage changes in retail prices and price-cost margins are calculated using quantity weights. Standard deviations in parenthesis refer to variation across markets.

Figures

Figure 1: The effects of retail mergers on the ratio of firms' fear of disagreement



Notes: Violin plots (combination of box plots with kernel density plots) depict the distribution of the effect of mergers between two retailers on the ratio of firms' fear of disagreement: $\frac{1}{1-\lambda}\frac{\pi_{ft}-d_{ft}^{-j}}{\partial\pi_{ft}/\partial w_{jt}} \times \left(\frac{1}{\lambda}\frac{\pi_{rr't}-d_{rr't}^{-j}}{-\partial\pi_{rr't}/\partial w_{jt}}\right)^{-1}$. The dark grey area in each violin plot represents the interval between the 25th and the 75th percentile, the white circle shows the median and the horizontal grey line represents the average ratio of firms' fear of disagreement.

Appendix A Descriptive statistics

Table 10: Descriptive statistics for brands

	Brand ownership					Market share		Retail price	
	M1	M2	M3	M4	PL	mean	s.d.	mean	s.d.
Colas									
Brand 4	•	○	○	○	○	0.14	0.03	1.02	0.11
Brand 5	•	○	○	○	○	11.86	0.55	0.92	0.02
Brand 9	○	•	○	○	○	1.12	0.09	0.72	0.02
PL	○	○	○	○	•	4.12	0.15	0.30	0.01
Total						17.25	0.64	0.76	0.01
Other sodas									
Brand 3	•	○	○	○	○	0.39	0.02	0.78	0.01
Brand 6	•	○	○	○	○	1.20	0.10	0.95	0.05
Brand 8	○	•	○	○	○	0.08	0.03	0.80	0.03
Brand 10	○	•	○	○	○	0.37	0.08	0.75	0.02
Brand 14	○	○	○	•	○	1.71	0.11	0.89	0.05
Brand 15	○	○	○	•	○	1.75	0.20	1.03	0.02
Brand 17	○	○	○	•	○	2.21	0.41	1.11	0.02
Brand 18	○	○	○	•	○	0.77	0.07	1.14	0.02
Brand 19	○	○	○	•	○	0.09	0.01	1.00	0.02
Brand 20	○	○	○	•	○	0.13	0.02	3.50	0.03
Brand 21	○	○	○	•	○	0.02	0.01	0.75	0.01
PL	○	○	○	○	•	7.36	0.46	0.39	0.01
Total						16.05	1.17	0.74	0.01
Fruit juices									
Brand 1	•	○	○	○	○	0.26	0.07	1.78	0.11
Brand 7	•	○	○	○	○	0.31	0.16	1.48	0.07
Brand 11	○	•	○	○	○	3.36	0.21	2.19	0.04
Brand 16	○	○	○	•	○	0.84	0.10	1.79	0.03
PL	○	○	○	○	•	29.83	1.92	0.84	0.01
Total						34.60	2.10	1.01	0.02
Iced tea									
Brand 2	•	○	○	○	○	0.22	0.06	0.93	0.03
Brand 12	○	○	•	○	○	1.95	0.35	1.08	0.02
Brand 13	○	○	•	○	○	0.12	0.05	1.32	0.08
PL	○	○	○	○	•	2.32	0.37	0.52	0.01
Total						4.61	0.79	0.79	0.02
Outside good						27.49	0.81		

Notes: $N = 265,998$. "M1", "M2", "M3" and "M4" refer respectively to manufacturers 1, 2, 3, and 4 and "PL" stands for private label. Filled circles represent the brand ownership of each manufacturer. Market shares are measured in the number of household purchases and standard deviations refer to variation across months. Retail prices in euro per liter are calculated using quantity weights and standard deviations refer to variation across months. Remark that we are not permitted to reveal names of the brands, manufacturers and retailers due to confidentiality regarding Kantar WorldPanel data.

Appendix B Demand results

Table 11: First-stage of the control function approach

	Estimate	S.E.
Sugar content × Sugar price	0.0005	0.0012
Canned rate × Aluminium price	0.0037*	0.0004
Number of competing products	−0.0034*	0.0016
Retailer fixed effects (not shown)		
Brand fixed effects (not shown)		
F-statistic		
Excluded instruments	22.62	
R^2 adjusted	0.99	
Number of observations	919	

* indicates significance at the 5% level. Heteroskedasticity-robust standard errors.

Figure 2: Distribution of the retail price sensitivity across consumers