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Abstract

The online distribution channel expands in many sectors, and the food industry is not left out. This paper analyzes the impact of e-commerce on French grocery shopping. Using purchase data, we develop a structural econometric model of demand and supply to estimate the effect of the emergence of online distribution channels on retail competition, consumer welfare, and profit sharing between retailers and manufacturers in the French soft drink sector. We find that e-commerce leads to an increase in consumer surplus, and the effect on the retailers' profits correlates with their online strategy. The retailers which developed independent and remote warehouses for the online distribution channel would get higher market shares, retail margins, and profits. Most retailers that develop online services in existing stores or with warehouses attached to a traditional store would get lower downstream margins, market shares, and profits with e-commerce than counterfactual without e-commerce. Our results also suggest that the introduction of the online grocery channel is profitable to the manufacturers due to an increase in wholesale margins. This increase with the introduction of e-commerce comes from the higher retailers' fear of risking a bargaining breakdown compared to accepting a concession to its trading partner.

Key words: E-commerce, grocery, online shopping, bargaining, profit sharing
JEL classification: L13, L63, L81

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1 Introduction

Although traditional shopping is not about to disappear, e-commerce has expanded significantly in recent years, particularly with the covid-19 crisis. In many sectors, there is already massive use of e-commerce as a distribution channel. A recent report of Nielsen (2017) indicates that online sales of consumer products worldwide will exceed store sales within five years.

Online Grocery Shopping is in expansion. In 2012, grocery e-commerce represented 1.2% in Europe, but it is increasing over time (European Commission et al. 2014). There are mainly two types of online distribution channels in the food market: the online distribution channels with delivery and a new e-commerce concept called click and drive. In the click and drive channel, the consumers buy online and then pick up their order by car in a dedicated warehouse or on the specially arranged parking of a supermarket. Traditional e-commerce with delivery in the food market has not convinced many consumers in Europe except for the United Kingdom. Consumers generally pay the delivery costs, and only a few consumers are willing to pay for delivery. The click and drive, which allows firms or consumers to avoid delivery costs, has been developed in Europe, particularly France. In 2015, 80% of French households had access to a click and drive store within 15 minutes of home. It is therefore not surprising that 24% of French households used the click and drive. The Nielsen study also reveals that the click and drive convince 9% of French households by making at least 40% of their purchases in 2015. There are two types of click and drive stores. Solo click and drive stores have an autonomous and remote warehouse and a pick-up point. Attached click and drive stores have a warehouse that is attached to a classical store, or they share the warehouse with a brick-and-mortar store (Colla and Lapoule 2012). In addition, attached click and drive stores may have a dedicated picking facility shared with a traditional store, or they may do a store-based fulfillment.

The first objective of this paper is to analyze the impact of the introduction of e-commerce on retail competition and consumer welfare. As the firms' strategies may also be influenced by e-commerce, the second objective is to analyze the impact of the emergence of e-commerce on vertical relationships and particularly on profit sharing. Indeed, online, the different retail groups develop different online strategies at different intensity levels. Using home-scan data on soft drink purchases in France, we use a structural econometric model to represent consumers and firms (retailers and manufacturers) behavior. Our framework aligns with the literature on structural bargaining models that allow retail competition and profit sharing between manufacturers and retailers. The developed methodology is based on Draganska et al. (2010)[1]. In order to study the impact of e-commerce, we use a counterfactual experiment method removing the online products to analyze the effect of the introduction of the online distribution channel on wholesale and retail prices, manufacturer and retailer profits, and consumer surplus. Our results show that e-commerce leads to increased consumer welfare due to the variety effect. There is an increase in NB retail prices, and then the NB market share globally decreases. Inversely, a decrease in PL retail prices for most retailers leads to the rise of the PL market shares. Thanks to their bargaining ability, the manufacturers obtain higher offline wholesale prices with the retailers which have opened an online distribution channel with e-commerce. This

[1]Draganska et al. (2010) develop a supply model in order to study the surplus division between manufacturers and retailers in the German coffee market. They estimate the bargaining power of firms assuming that retail and wholesale prices are determined simultaneously, which simplifies the model's computation. From this empirical framework, a growing literature use models of vertical negotiations: Crawford and Yurukoglu (2012), Grennan (2013), Gowrisankaran et al. (2015), Ho and Lee (2017), and Bonnet et al. (2021) among others.

increase in offline upstream margins allows manufacturers to obtain greater profits with e-commerce despite decreasing market shares. With the hard discounters, which have not opened online stores, the manufacturers obtain lower wholesale prices with e-commerce. The existence of e-commerce permits manufacturers to obtain a higher share of total margins as the increase of the offline upstream margins is higher than the increase in NB retail price. For retailers, our results show heterogeneous effects. The impact of e-commerce is correlated with the online strategy of retailers. Two retail groups have mainly built solo click and drive stores and obtain higher market shares, offline retail margins, and higher profits thanks to the online distribution channel's existence. The solo strategy allows the retailers that adopt this strategy to set up the warehouse within the catchment area of their competitors and thus may allow the retailers to cannibalize their competitors. Five other retailers have mainly opened attached click and drive stores. Except for one, the retailers that follow an attached strategy get lower market shares, offline downstream margins, and lower profits with e-commerce. Despite the loss of profits with e-commerce, they decided to still open click and drive stores due to a strategic reaction to the introduction of click and drive stores of the two retailers that have been the first to set up click and drive stores and which follow a solo strategy. Indeed, the retailers with an attached click and drive strategy obtain fewer market shares and profits if they do not open an online distribution channel when competitors which follow a solo strategy introduce click and drive stores than if they open an online store.

Our paper contributes to the literature on the effect of e-commerce on retail competition in the agro-food industry. Duch-Brown et al. (2017) focus on the impact of the online distribution channel on the total sales, on the potential benefit for the consumers, and the prices levels for electronic products in the European market. They compare the consumer surplus and the profit between the observed situation and after removing the online channel products. The total sales, the consumer surplus, and the profits decreased without the online channel products. As in Duch-Brown et al. (2017), this paper shows that e-commerce may positively impact consumer surplus. The above study focuses on non-grocery markets. However, grocery shopping differs from non-grocery shopping. From a firm point of view, the goods' perishability nature does not allow to centralize operation over large areas. Therefore, the potential cost gain is limited. Additionally, the competition in this market tends to be local. In addition, unlike other markets, there are fewer alternatives online than offline in the food industry. Thus, conclusions about non-grocery products might not apply to grocery items. Pozzi (2013) examines the impact of e-commerce on brick-and-mortar sales of an American grocery retailer which has both online and offline distribution channels. He first estimates whether the online channel leads to an increase in sales. He finds that for 1 dollar spent online, less than 50 cents crowded out in-store expenditure. The retailer's revenues go up by 13 percent after online shopping becomes available in the zip code. It confirms that the internet channel does not simply displace the retailer's traditional sales but generates new business. In this paper, we find that opening an online distribution channel leads to an increase in profits for a minority of retailers. Our paper is the first paper that studies the impact of e-commerce on vertical relationships in the food industry using a structural model. Several papers examine the effect on the price level and price dispersion (Brynjolfsson and Smith (2000), Clay et al. 2002, Pan et al. 2004). However, there are no empirical studies about the impact of e-commerce on vertical relationships.

This paper is organized as follows. We first describe the data in section 2. We then present the demand and supply model in section 3. In section 4, we discuss the model results, and we use our framework to simulate the impact of the e-commerce introduction for both manufacturers and retailers. Finally, section 5 gives the main conclusions of the paper.

2 Market and Data

2.1 Click and Drive and Soft Drink Market in France

The first click and drive store in France was set up in 2000. Since the last decade, click and drive stores have flourished throughout this country. Rarely a new mode of distribution will have had a progression as fast as the click and drive. According to Nielsen (2016), in 2012 and 2013, 1.9 click and drive stores opened daily. This pace has slowed down in recent years. In the first quarter of 2016, 0.8 click and drive stores opened daily due to potential market saturation.

Retailers are grocery store groups differing by the size of their outlets and the services provided to consumers. Six leading retail groups (Auchan, Carrefour, Casino, Les Mousquetaires, Système U, and Leclerc) and two german hard discounters (Aldi and Lidl) operate in the French food retail sector. The most traditional distribution channel is the offline option, where the consumers directly buy in-store. Additionally, it is possible to buy online. The leading retailers have opened an online distribution channel. They can adopt either build solo or attached click and drive stores. In Appendix, Table 12 provides the details of the kind of click and drive chosen by the main retailers. Only retailers 2 and 6 mostly made solo click and drive stores. The retailers 3, 4, 5, and 8 mainly built attached click and drive stores.

To analyze vertical relationships, we focus on a specific market: the French soft drink market. Large companies produce the main brands in this market. Furthermore, 21.5%[2] of the households that consume non-alcoholic beverages are online consumers (i.e., consumers who did at least once a year their purchases online). It is the sector with one of the highest expenditures. Thus, it seems to be one of the most interesting markets to study the impact of online grocery shopping.

2.2 Data

We use a dataset on soft drink purchases in 2014 collected by the society Kantar WorldPanel. Those purchases are made by a French representative household panel. There is information about the product characteristics, the date of the purchase, the retail price, and the retail chain where the panelist made their purchases for each purchase. The dataset also provides information on whether the purchase has been made online or offline and the brand names of purchased items. There are 734,506 purchases where 7.51% (6.51% excluding the outside option) were done online. The online market share represents 9.25% in volume and 7.30% in value. We do not distinguish the click and drive stores and the online service with delivery for the online alternatives. About 87.4 % of the online purchases are done through the click and drive and only 12.6% through delivery which is not sufficient in order to have enough purchases for each product in each period. Moreover, we are not able to distinguish the attached click and

[2] Our own computation, source: Kantar dataset

drive and the solo click and drive for the online distribution channel because we do not have the exact store where the purchases have been made, only the retail chain and the online-offline information. However, as explained in the section above, we know the main kind of click and drive chosen for each retailer. Consumers face a choice set composed of different soft drink products, and each product is defined as the combination of a brand, a retailer, and a distribution channel. The set of brands includes private labels (PLs) and national brands (NBs). The private labels denote products manufactured or packaged for sale for a unique retailer. We assume that private labels are either produced by a competitive fringe or by retailers in the French soft drink market and that manufacturers sell their PLs at marginal cost. National brands are nationally distributed brands. Five leading manufacturers operating in the French soft drink market produced the NBs: the Coca-Cola Company, PepsiCo, Orangina-Schweppes, Eckes Granini, and Folliet. Soft drinks include several categories: colas, other sodas, ice tea, and fruit juices. Each manufacturer produces one or several brands, and each brand provides only one type of soft drink. We consider one PL per category of soft drinks and per retailer. Consumers can substitute the considered products with an alternative product, the outside option which includes other secondary brands with a market share lower than 0.15% and the small retailers (regional retailers, stores specialized in frozen food, butchers, bakeries, gas stations, regional markets, small grocery stores). The outside good represents 24.07% of the market of which 0.01% are sold online.

As we only observe the purchases of households and not the set of products that they may face, we compute retail prices of a product in period t as the ratio between the total expenditure and the total quantity over households who buy this product at period t. The computed retail price of a product, that is of a brand, a retailer, and a distribution channel is then composed of several UPCs of the brand sold in the retailer and the distribution channel. For instance, the Brand Coca-Cola is composed of several UPCs: Coca-Cola, Coca-Cola Zero, Coca-Cola Light, Coca-Cola Life, Coca-Cola Cherry, and Coca-Cola Zero Cherry. Retail prices of a brand across retailers and distribution channels could be different for two reasons: either prices of UPCs are different or the set of UPCs that allows computing average retail prices is different. In the dataset, there are a smaller number of UPCs sold online than offline but the online and offline prices for the same UPCs are generally not significantly different. Table 1 depicts some descriptive statistics about prices per liter and market shares per brand. We find that the average retail prices of the purchased goods are globally slightly lower online. Then, the difference in online and offline retail prices of the different brands comes from less expensive UPCs are sold online. Retail prices of NBs are about twice more expensive than PLs.The online market share of the brands is more than ten times lower than their offline market shares.

The eight retailers sold about 95% of soft drink products. In the Kantar WorldPanel dataset, we do not know the type of click and drive store where the households buy the grocery products. We only know the click and drive strategy mainly chosen for each retail group, thanks to the TradeDimension dataset (Table 12). Retailers 2 and 6 mostly follow a solo strategy and retailers 3, 4, 5, and 8 mainly follow an attached strategy. Only the hard discounters, retailers 1 and 7, do not offer online services[3].

[3]It would be interesting to study the causal effect of the choice of the click and drive strategy for the retailers on their profits. We would have to endogenize this choice in the supply model. However, it would also require differentiating for each retailer, the purchases from independent warehouses (solo strategy) to the attached or shared warehouse (attached strategy) and the data at hand does not allow to make this distinction.

Table 1: Descriptive statistics for prices and market share per Brand

	Manufacturer	Market Share Offline %	Market Share Online %	Retail Price Offline €	Retail Price Online €
Cola					
NB 1	Manufacturer 1	14.14	1.22	1.00	0.96
		(0.65)	(0.10)	(0.29)	(0.28)
NB 2	Manufacturer 2	1.04	0.12	0.73	0.75
		(0.08)	(0.03)	(0.21)	(0.23)
PL	PL	1.94	0.19	0.46	0.41
		(0.09)	(0.03)	(0.13)	(0.12)
Total		17.13	1.53	0.92	0.87
		(0.62)	(0.13)	(0.27)	(0.26)
Soda					
NB 3	Manufacturer 1	0.35	0.06	1.39	1.32
		(0.13)	(0.04)	(0.41)	(0.43)
NB 4	Manufacturer 1	0.93	0.07	0.96	0.91
		(0.09)	(0.02)	(0.27)	(0.29)
NB 5	Manufacturer 3	2.51	0.22	0.99	0.93
		(0.26)	(0.03)	(0.29)	(0.28)
NB 6	Manufacturer 3	1.57	0.14	1.14	1.11
		(0.23)	(0.03)	(0.33)	(0.33)
NB 7	Manufacturer 3	0.23	0.02	1.20	1.24
		(0.12)	(0.01)	(0.37)	(0.28)
NB 8	Manufacturer 3	0.43	0.02	1.26	0.78
		(0.10)	(0.01)	(0.38)	(0.47)
NB 9	Manufacturer 3	2.51	0.17	1.19	1.16
		(0.33)	(0.03)	(0.34)	(0.32)
NB 10	Manufacturer 2	0.50	0.04	0.80	0.78
		(0.11)	(0.01)	(0.23)	(0.25)
NB 11	Manufacturer 1	0.32	0.04	0.74	0.67
		(0.04)	(0.01)	(0.21)	(0.17)
NB 12	Manufacturer 3	0.30	0.02	1.34	1.31
		(0.06)	(0.01)	(0.38)	(0.32)
NB 13	Manufacturer 2	0.14	0.01	1.20	1.25
		(0.03)	(0.01)	(0.31)	(0.32)
PL	PL	5.40	0.49	0.63	0.62
		(0.55)	(0.06)	(0.18)	(0.18)
Total		15.16	1.31	0.93	0.88
		(1.45)	(0.13)	(0.26)	(0.25)
Ice Tea					
NB 14	Manufacturer 2	1.65	0.11	0.98	0.93
		(0.17)	(0.02)	(0.28)	(0.28)
NB 15	Manufacturer 1	0.24	0.02	0.87	0.84
		(0.09)	(0.00)	(0.25)	(0.18)
PL	PL	1.32	0.11	0.71	0.69
		(0.19)	(0.02)	(0.19)	(0.19)
Total		3.21	0.24	0.86	0.81
		(0.39)	(0.04)	(0.24)	(0.22)
Juice					
NB 16	Manufacturer 4	2.85	0.30	1.40	1.33
		(0.30)	(0.05)	(0.43)	(0.39)
NB 17	Manufacturer 3	0.28	0.03	2.36	2.06
		(0.07)	(0.01)	(0.71)	(0.67)
NB 18	Manufacturer 5	3.95	0.29	1.93	1.82
		(0.19)	(0.03)	(0.52)	(0.53)
PL	PL	26.86	2.80	1.13	1.12
		(1.23)	(0.28)	(0.33)	(0.33)
Total		33.94	3.43	1.26	1.20
		(1.27)	(0.34)	(0.36)	(0.35)
Outside Option		24.07 (0.34)			

Source: Kantar Worldpanel, 2014. Market shares are in frequency of purchases, and their standard deviations in parenthesis refer to variation across periods. PL means private label. We weight retail prices by market shares of brands, and their standard deviations in parenthesis refer to variation across retailers and periods.

We assume that the retailers are national chains and are present in all regions in France. We suppose that consumers in different regions face the same assortment of products when shopping at a given retailer.

Table 2 shows heterogeneous market shares across retailers ranging from 0.69% to 19.25%. Retailers 2 and 6, the only retailers that have mainly adopted a solo strategy, have an online market share of respectively 1.83% and 3.01%, while the other retailers obtain an online market share lower than 1%. The solo strategy would make it possible to determine the right location and capture the flow of cars and then would lead to more market expansion effect. The ranking for the market share is different online and offline and the online distribution channel changes the global ranking of the two first retailers. We then expect that the introduction of e-commerce affects their bargaining power.

3 Methodology

In this section, we do a structural demand and supply model to represent consumers' and firms' behavior in the French soft drink market. We first model the consumers' preferences using a random coefficient logit model to estimate flexible substitution patterns. Then, we model the retail competition and show how to compute retail margins. Afterward, we will estimate the profit sharing between retailers and manufacturers using a Nash Bargaining game model. Finally, to estimate the effect of the emergence of online distribution channels for consumers and firms, we remove the online alternatives and simulate new price equilibrium and market shares.

Table 2: Descriptive statistics for prices and market share per retailer

Retailer	**Retailer's strategy**	Market Share			Retail Price	
		Offline %	**Online** %	**Total** %	**Offline** €	**Online** €
Retailer 1						
NBs		0.43		0.43	1.02	
		(0.05)		(0.05)	(0.26)	
PLs		0.27		0.27	0.89	
		(0.05)		(0.05)	(0.23)	
Total		0.69		0.69	0.97	
		(0.04)		(0.04)	(0.25)	
Retailer 2	Solo					
NBs		4.53	0.91	5.44	1.16	1.10
		(0.21)	(0.07)	(0.23)	(0.36)	(0.31)
PLs		3.86	0.92	4.78	1.07	1.00
		(0.16)	(0.11)	(0.20)	(0.31)	(0.30)
Total		8.38	1.83	10.21	1.12	1.05
		(0.27)	(0.15)	(0.27)	(0.32)	(0.30)
Retailer 3	Attached					
NBs		9.26	0.24	1.19	1.20	
		(0.33)	(0.05)	(0.35)	(0.34)	
PLs		7.88	0.20	8.06	1.07	1.04
		(0.46)	(0.05)	(0.45)	(0.31)	(0.32)
Total		17.14	0.44	17.56	1.13	1.13
		(0.49)	(0.09)	(0.48)	(0.33)	(0.32)
Retailer 4	Attached					
NBs		3.35	0.10	3.45	1.27	1.23
		(0.16)	(0.02)	(0.17)	(0.36)	(0.38)
PLs		4.52	0.10	4.62	1.06	1.10
		(0.17)	(0.03)	(0.19)	(0.31)	(0.37)
Total		7.87	0.19	8.07	1.15	1.18
		(0.26)	(0.03)	(0.28)	(0.33)	(0.37)
Retailer 5	Attached					
NBs		4.82	0.21	1.12	1.20	
		(0.59)	(0.06)	(0.33)	(0.37)	
PLs		5.29	0.23	5.52	0.92	0.98
		(0.16)	(0.05)	(0.13)	(0.27)	(0.29)
Total		10.10	0.45	10.55	1.05	1.14
		(0.59)	(0.10)	(0.61)	(0.30)	(0.34)
Retailer 6	Solo					
NBs		7.30	1.23	8.43	1.16	1.07
		(0.29)	(0.09)	(0.31)	(0.34)	(0.31)
PLs		8.94	1.79	10.72	0.92	0.98
		(0.38)	(0.13)	(0.38)	(0.27)	(0.29)
Total		16.24	3.01	19.25	1.02	1.02
		(0.53)	(0.15)	(0.47)	(0.30)	(0.30)
Retailer 7						
NBs		1.36		1.36	1.16	
		(0.19)		(0.19)	(0.34)	
PLs		0.74		0.74	0.67	
		(0.12)		(0.12)	(0.18)	
Total		2.09		2.09	0.98	
		(0.18)		(0.18)	(0.28)	
Retailer 8	Attached					
NBs		2.88	0.21	3.09	1.14	1.11
		(0.20)	(0.03)	(0.20)	(0.33)	(0.31)
PLs		4.05	0.36	4.42	1.00	0.98
		(0.20)	(0.06)	(0.20)	(0.29)	(0.29)
Total		6.93	0.58	7.51	1.06	1.03
		(0.37)	(0.09)	(0.36)	(0.30)	(0.28)
Outside Option		24.07 (0.34)				

Source: Kantar TNS Worldpanel, 2014 Market shares are in frequency of purchases and their standard deviations in parenthesis refer to variation across periods. The retailer strategy is the strategy that is mainly chosen by the retailers.

3.1 The demand model: a random coefficient logit model

We use a random coefficient logit model to estimate the demand and the price elasticities, as in McFadden and Train (2000). We assume that the whole set of soft drink products the consumer faces can be defined by the distribution channel c, which is offline or online, the retailer r among R retailers, and the brand b. A product j is then indexed by the triple subscript (c,r,b)[4]. There are J_t goods where:

$$J_t = \sum_{c=1}^{C} \sum_{r=1}^{R} J_{crt} \tag{1}$$

where J_{crt} is the set of soft drink brands sold by the retailer r in the distribution channel c in period t.

A household h=1, ..., H, is assumed to maximize an indirect utility function U_{jt}^h of buying the good j at period t:

$$U_{jt}^h = \delta_{cr(j)} + \delta_{b(j)} + \alpha^h p_{jt} + \varepsilon_{jt}^h \tag{2}$$

where $\delta_{cr(j)}$ and $\delta_{b(j)}$ are time-invariant retailers distinguished by the distribution channel and brand fixed effects, respectively. p_{jt} is the retail price per liter of product j in period t. α^h is the price disutility of the household. ε_{jt}^h is the unobserved error term. We assume that $\varepsilon_{jt}^h = \xi_{jt} + e_{jt}^h$ where ξ_{jt} is a product-specific error term varying across periods and e_{jt}^h is an individual specific error term.

[4]For example, the brand Coca-Cola sold by Carrefour online and Coca-Cola sold by Carrefour offline are two different products as we consider that services and prices could be different

We assume that α^h could vary across households.

$$\alpha^h = \alpha + \sigma v_h^{\alpha} \tag{3}$$

where α is the average price sensitivity, v_i^{α} follows a normal distribution and represents the deviation to the average price sensitivity, and σ measures the degree of heterogeneity.

We can divide the indirect utility into a mean utility $V_{jt} = \delta_{cr(j)} + \delta_{b(j)} + \alpha p_{jt} + \xi_{jt}$ and a deviation from this mean utility $\varphi_{jt}^h = p_{jt}[\sigma_\alpha v_h^\alpha]$. The indirect utility is given by $U_{jt}^h = V_{jt} + \varphi_{jt}^h + e_{jt}^h$.

The households can decide not to choose one of the considered products but a substitute, the outside option. The utility of the outside good is normalized to zero. The indirect utility of choosing the outside good is $U_{0t}^h = e_{0t}^h$.

We assume that ε_{jt}^h is independently and identically distributed like an extreme value type I distribution. We are then able to write the individual probability for household h to buy product j at time t in the following way:

$$s_{hjt} = \frac{\exp(V_{jt} + \varphi_{jt}^h)}{1 + \sum_{k=1}^{J_t} \exp(V_{kt} + \varphi_{kt}^h)} \tag{4}$$

The market share of product j in period t in the following way:

$$s_{jt} = \int_{A_{jt}} \left(\frac{\exp(V_{jt} + \varphi_{jt}^h)}{1 + \sum_{k=1}^{J_t} \exp(V_{kt} + \varphi_{kt}^h)} \right) \phi(\nu_h)\, d\nu_h \tag{5}$$

where A_{jt} is the set of households buying the product j at time t and ϕ is the density of the normal distribution.

The own-price elasticities and cross-price elasticities can be written as:

$$\frac{\partial s_{jt}}{\partial p_{kt}} \frac{p_{kt}}{s_{jt}} = \begin{cases} \frac{p_{jt}}{s_{jt}} \int \alpha^h s_{hjt}(1 - s_{hjt}) \; \phi(v_h) dv_h & \text{if } j = k \\ -\frac{p_{kt}}{s_{jt}} \int \alpha^h s_{hjt} s_{hkt} \; \phi(v_h) dv_h & \text{otherwise.} \end{cases} \tag{6}$$

Identification and Estimation

We estimate the demand model using the simulated maximum likelihood method as in Revelt and Train (1998). This method relies on the assumption that all product characteristics are independent of the error term ε_{jt}^h. However, if unobserved factors such as advertising, promotions, displays are included in ξ_{jt}^h and are correlated with observed characteristics like the price, the independence assumption cannot hold. To solve the problem that omitted product characteristics might be correlated with prices and obtain consistent estimates of demand parameters, we use a two-stage residual inclusion approach as in Petrin and Train (2010), and Terza et al. (2008). We regress prices on instrumental variables, as well as exogenous variables of the demand equation:

$$p_{jt} = W_{jt}\psi + \iota_{cr(j)} + \iota_{b(j)} + \eta_{jt} \tag{7}$$

where W_{jt} is a vector of instrumental variables, ψ is the vector of associated parameters, η_{jt} is an error term that captures the remaining unobserved variation in prices, and $\iota_{cr(j)}$ and $\iota_{b(j)}$ are exogenous demand variables (distribution channel and retailer fixed effects, and brand fixed effects). The estimated error term $\widehat{\eta}_{jt}$ of the price equation includes some omitted variables such as promotions, advertising variations, and shelf displays that are not captured by the other exogenous variables of the demand equation and by the instrumental variables that represent the cost of producing soft drinks or firms markup. Introducing $\widehat{\eta}_{jt}$ in the mean utility of households V_{jt} allows us to capture unobserved product characteristics varying across time. Consequently, prices are now uncorrelated with the new product-specific error term varying across periods the new error term $\zeta_{jt} = \xi_{jt} - \pi\widehat{\eta}_{jt}$.

We then write:

$$V_{jt} = \delta_{cr(j)} + \delta_{b(j)} + \alpha p_{jt} + \zeta_{jt} + \pi\widehat{\eta}_{jt} \tag{8}$$

where π is the parameter associated with the estimated error term of the first stage.

We use the price indexes for the main inputs (sugar, aluminum, and glass) used in the production of soft drinks to explain prices. The soft drink market only represents a tiny share of the demand for those inputs, which justifies the absence of a correlation between input prices and unobserved determinants of the demand for soft drinks. We use the input price of sugar interacted by the quantity of added sugar content of each brand, taking into the proportion of regular soft drinks for each product in the other periods[5]. As packaging materials (can or glass bottles) affect soft drink prices, we also use the input price of aluminum interacted by the average percentage of cans sold for each product in the other periods. Similarly, we use the input price of glass interacted by the average percentage of glass bottles sold for each product in the other periods. These price indexes are provided by the French National Institute for Statistics and

[5]The proportion of regular soft drinks for each product in the other periods is independent of the demand in the current period as we assume that the demand is independent across periods (Hausman 1996), but it is a good proxy of the proportion of products with sugar as a cost shifter.

Economic Studies (INSEE). We also use BLP instruments as the number of competing products in the same soft drink category within the retailer (Berry et al. 1995). The estimation results of the price equation are reported in Table 13 in Appendix. The instruments are not weak since the F-test is superior to 10.

3.2 Supply

The French soft drink industry is modeled considering the vertical relationships between the M manufacturers and R retailers. S_{mt} is the set of products sold by the manufacturer m at period t and S_{rt}^{c} the set of products sold by the retailer r in distribution channel c at time t.

The profit of the manufacturer m in period t can be written as:

$$\pi_t^m = \sum_{b \in S_{mt}} \sum_{r=1}^{R} \sum_{c=1}^{C} Q_t \left(w_{rbt} - \mu_{bt} \right) s_{crbt}(p) \tag{9}$$

and the profit of the retailer r in period t is the following:

$$\pi_t^r = \sum_{c=1}^{C} \sum_{b \in S_{rt}^c} Q_t \left(p_{crbt} - w_{rbt} - \kappa_{crbt} \right) s_{crbt}(p) \tag{10}$$

where Q_t is the market size, that is the total amount of quantity bought on the market in period t, μ_{bt} is the marginal cost of production of brand b in period t, s_{crbt} is the market share for a brand b sold by a retailer r in a distribution channel c in period t, w_{rbt} is the wholesale price for brand b sold to a retailer r in period t[6]. The distribution

[6] We assume they negotiate the same wholesale price for the brand b whatever the channel distribution where the product will be sold.

channel are denoted as $c = 1, 2$ where $c = 1$ is the offline distribution channel and $c = 2$ is the online distribution channel. p_{crbt} and κ_{crbt} are respectively the retail price and the marginal cost of distribution for brand b sold by a retailer r in the distribution channel c in period t.

In many markets, as in the soft drink market, both the retailers and the manufacturers have market power. Thus, we develop a bargaining game model as in Draganska et al. (2010). First, we derive the retail margins. The retail prices are determined simultaneously by retailers that compete on the downstream market for final consumers. Secondly, we turn to the wholesale price equilibrium, which results from the negotiation between each pair of retailers and manufacturers. Manufacturers and retailers bargain simultaneously and bilaterally over linear wholesale prices for each good. The wholesale contracts are secret for those which do not participate in the contract. We assume that negotiation on wholesale prices is modeled as a Nash bargaining game, and wholesale and retail prices are determined simultaneously as in Draganska et al. (2010).

Resolution of retail price competition

We assume that there is Bertrand-Nash Competition between retailers, and they set prices for each product. The retailer then maximizes its profit π_t^r. The first order condition of the retailer's maximization program is:

$$\sum_{c=1}^{C} s_{crkt}(p) + \sum_{c=1}^{C} \sum_{b \in S_{rt}^c} (p_{crbt} - w_{rbt} - \kappa_{crbt}) \frac{\partial s_{crbt}(p)}{\partial p_{crkt}} = 0 \quad \forall k \in \ S_{rt}^c \tag{11}$$

Using and solving this equation, the vector γ_{rt} of margins $p_{crbt} - w_{rbt} - \kappa_{crbt}$ for the retailer r can be written in the matrix form :

$$\gamma_{rt}(p_t, \hat{\theta}, I^R_{rt}) = -(I^R_{rt} S_{pt} I^R_{rt})^{-1} I^R_{rt} s_t(p_t) \tag{12}$$

where I^R_{rt} is the JxJ ownership diagonal matrix with element 1 if product j is sold by the retailer r and 0 otherwise, S_{pt} is the JxJ matrix of the market shares derivatives with respect to all retail prices with general element $\frac{\partial s_{crbt}(p)}{\partial p_{c'r'b't}}$ in period t. $s_t(p_t)$ is the vector of market shares. Then, the whole vector of retail margins γ_t is equal to:

$$\gamma_t(p_t, \hat{\theta}, I^R_t) = -\sum_{r=1}^{R} (I^R_{rt} S_{pt} I^R_{rt})^{-1} I^R_{rtt}(p_t) \tag{13}$$

where $I^R_t = (I^R_{1t}, ..., I^R_{Rt})$.

Resolution of the bargaining model between retailers and manufacturers We assume that retailers and manufacturers have rational expectations and that the wholesale price is determined independently of possible changes to the retail price. Like in Draganska et al. (2010), the manufacturer bargain with a given retailer for each of its brands, and each brand is negotiated independently with the manufacturer. Retail prices are assumed to be fixed and not observable when manufacturers and retailers negotiate[7].

The equilibrium wholesale price for brand b sold to retailer r is derived from the bilateral bargaining problem between a manufacturer m that sold brand b and a retailer r. The manufacturer and retailer pair maximize the Nash product over the brand b:

[7] We follow the literature (Draganska et al. 2010; Yonezawa et al. 2019; Bonnet and Bouamra-Mechemache 2020).

$$(\pi_t^r - d_t^r)^{\lambda_{rm}}(\pi_t^m - d_t^m)^{1-\lambda_{rm}} \tag{14}$$

λ_{rm} is the exogenous bargaining weight of retailer r, and $1 - \lambda_{rm}$ is the exogenous bargaining weight of manufacturer m. In other words, λ_{rm} represents the share of the gain from trade going to the retailer for brand b produced by the manufacturer m. π_t^r and π_t^m are respectively the profit of the retailer r and the manufacturer m in period t. d_t^r and d_t^m are respectively the disagreement payoffs of the manufacturer m and the retailer r in period t. The manufacturer could obtain profit d_t^m from the sale of the other alternatives than brand b to retailer r. The retailer can get d_t^r if it drops the manufacturer's brand b from its stores but contracts with other brands. As the retail prices are fixed during the negotiation, the disagreement payoffs are the following equations:

$$d_t^r = \sum_{c=1}^{C} \sum_{k \in S_{rt}^c - \{b\}} (p_{crbt}^* - w_{rbt}^* - \kappa_{crbt}) Q_t \widetilde{s}_{crkt}^{-rb}(p) \tag{15}$$

$$d_t^m = \sum_{k \in S_{mt} - \{rb\}} \sum_{n=1}^{R} \sum_{c=1}^{C} (w_{nkt}^* - \mu_{kt}) \;\; Q_t \widetilde{s}_{cnkt}^{-rb}(p) \tag{16}$$

where $\widetilde{s}_{cr'b't}^{-rb}(p)$ is the market share of brand b' sold by retailer r' in the distribution channel c if brand b sold by retailer r is not offered in period t.

Solving the bargaining power in equation (14) and after rearranging them, the first order condition are equivalent to:

$$\lambda_{rm}(\pi_t^m - d_t^m)\frac{\partial \pi_t^r}{\partial w_{rbt}} + (\pi_t^r - d_t^r)(\,1 - \lambda_{rm})\frac{\partial \pi_t^m}{\partial w_{rbt}} = 0 \tag{17}$$

Replacing the profits and the disagreement payoffs by their expression in equations

(17), we get:

$$(\sum_{c=1}^{C}\Gamma_{rbt}s_{crbt}+\sum_{k\in S_{mt}-rb}\sum_{c=1}^{C}\sum_{n=1}^{R}\Gamma_{nkt}\left(s_{cnkt}-\widetilde{s}_{cnkt}^{-rb}(p)\right))(-s_{crbt})+$$
$$\frac{1-\lambda_{rm}}{\lambda_{rm}}(\sum_{c=1}^{C}\gamma_{crbt}s_{crbt}+\sum_{c=1}^{C}\sum_{k\in S_{rt}^{c}-\{b\}}\gamma_{crkt}\left(s_{crkt}-\widetilde{s}_{crkt}^{-rb}(p)\right))(s_{crbt})=0 \tag{18}$$

In matrix form, it is equal to:

$$-(\sum_{m=1}^{M}I_{mt}^{M}\widetilde{S}_{\Delta t}I_{mt}^{M}\Gamma_{ft})+(\sum_{r=1}^{R}\frac{1-\lambda_{rm}}{\lambda_{rm}}I_{rt}^{R}\widetilde{S}_{\Delta t}I_{rt}^{R}\gamma_t(p_t,\hat{\theta},I_t^R))=0 \tag{19}$$

$I_t^M=(I_{1t}^M,...,I_{Mt}^M)$, where I_{mt}^M is the (JxJ) ownership matrix of the manufacturer m with element 1 if the product j (=crb) is sold by the manufacturer m and 0 otherwise at time t. The vector of retail margins of general element $\gamma_t(p_t,\hat{\theta},I_t^R)$ is derived from equation (13). $\widetilde{S}_{\Delta t}$ is a JxJ ownership matrix which is built as follows:

$$\widetilde{S}_{\Delta t}=\begin{cases} s_{cr'b't} & \text{if r'b'=rb} \\ s_{cr'b't}-\widetilde{s}_{cr'b't}^{-rb} & \text{otherwise}\end{cases} \tag{20}$$

Using the equation (19) for all brands sold by all retailers in all distribution channels in period t, we obtain the matrix of the manufacturer margins:

$$\Gamma_t(p_t,I_t^R,I_t^M,\hat{\theta}/\lambda)=\sum_{m=1}^{M}(I_{mt}^M\widetilde{S}_{\Delta t}I_{mt}^M)^{-1}\left[\sum_{r=1}^{R}\frac{1-\lambda}{\lambda}*(I_{rt}^R\widetilde{S}_{\Delta t}I_{rt}^R)\gamma(p_t,\hat{\theta},I_t^R)\right] \tag{21}$$

where λ is the vector of all bargaining parameters.

Identification

As in Draganska et al. (2010), we are not able to identify $\Gamma_t(p_t,I_t^R,I_t^M,\theta/\lambda)$ because we do not observe the bargaining power, λ_{rm}. As the total marginal cost for a brand b sold by retailer r in distribution channel c in period t is $C_{crbt} = \kappa_{crbt} + \mu_{bt} = p_{crbt} - \gamma_{crbt} - \Gamma_{crbt}$, we use additional restrictions on the marginal cost function to identify λ_{rm}. We assume that C_{crbt} has the following specification:

$$C_{crbt} = \Lambda \omega_{crbt} + \eta_{crbt} \tag{22}$$

where ω_{crbt} is a vector of cost shifters for brand b sold by retailer r in distribution channel c in period t, Λ is the vector of parameters associated, and η_{crbt} an error term. We use several cost shifters. In practice, we use brand fixed effect and retailer fixed effect to take into account specific brand and retailer cost. We also use the price indexes for the main inputs used in the production of soft drinks, such as the input price of sugar interacted by the quantity of added sugar content of each brand, taking into the proportion of regular soft drinks for each product in each period. Besides, we use the input price of aluminum interacted by the average percentage of can sold for each product in each period, and the input price of glass interacted by the average percentage of glass bottles sold for each product in each period. To be consistent with economic theory, as in Gasmi et al. (1992), we impose the positivity of these three above instrumental variables as they should impact positively the cost.

The final equation to be estimated is given by:

$$p_t - \gamma_t(p_t, \hat{\theta}, I_t^R) = \Gamma_t(p_t, I_{rt}^R, I_t^M, \hat{\theta}/\lambda) + \Lambda \omega_t + \eta_t \tag{23}$$

Using non-linear least squared, we can estimate both vector of parameters Λ and

λ and thus deduce the margin of the manufacturers from the equation (21)[8]. All the coefficients of the cost function Λ are significant at 1% (Table 13 in Appendix).

3.3 Counterfactual

To analyze the impact of the online distribution channel, we use the structural demand and supply model and the related parameters ($\hat{\theta}$,$\hat{\lambda}$). To conduct a counterfactual, we remove the alternatives from the online distribution channel from markets and develop an algorithm to compute new equilibrium prices.

The goal of the algorithm is to find for each period t independently J_t^{post} dimensional vector of retail price p_t^{post} that solves the following system of J_t^{post} equations:

$$\left(p_t^{post} - \gamma_t(p_t^{post}, \hat{\theta}, I_t^{R,post}) + \Gamma_t(p_t^{post}, I_t^{R,post}, I_t^{M,post}, \hat{\theta}/\hat{\lambda}_{rm}\right) - \hat{C}_{crbt} = 0 \tag{24}$$

$I_t^{M,post} = (I_{1t}^{M,post}, ..., I_{Mt}^{M,post})$, where $I_{mt}^{M,post}$ is the (J_t^{post}xJ_t^{post}) ownership matrix of the manufacturer m with element 1 if the product j(=crb) is produced by the manufacturer m and 0 otherwise at time t. $I_t^{R,post} = (I_{1t}^{R,post}, ..., I_{Rt}^{R,post}$, where $I_{rt}^{R,post}$ is the (J_t^{post}xJ_t^{post}) ownership matrix of the retailer r with element 1 if the product j is sold by the retailer r and 0 otherwise at time t. p_t is the vector of equilibrium retail prices in period t from the baseline model. We estimate that

[8] The identification of parameters ($\hat{\theta}$,$\hat{\lambda}_{rm}$) can be jeopardized by the variables like the retail prices or the predicted market shares of products in equation (23) because they are likely to be correlated with the unobserved cost factors η. To solve this problem, we could use a GMM estimator of the negotiation like in Gowrisankaran et al. (2015). However, we would need as many instruments as parameters, so we should impose very strong restrictions on the exogenous bargaining parameters (for example, $\lambda_{rm} = \lambda_m$ totally ignores the heterogeneity of the different retailers). We decide to follow Draganska et al. (2010) to consider the heterogeneity of the bargaining parameters both across retailers and manufacturers.

$\hat{C}_{crbt} = p_t - \gamma_t(p_t, \hat{\theta}, I_t^{R,post}) - \Gamma_t(p_t, I_t^{R,post}, I_t^{M,post}, \hat{\theta}/\hat{\lambda}_{rm})$ from the demand and supply models in sections 3.1 and 3.2 respectively.

Given new price equilibrium, p_t^{post} we are then able to compute new downstream and upstream margins and new profits.

In order to know if e-commerce is beneficial for the consumer, we compute the variation of consumer surplus. In logit models, the consumer surplus is calculated as the compensating variation necessary to restore consumers to the original level of utility. The change in consumer welfare brought about by removing the online alternatives and by changing prices from p_t to p_t^{post} is given by

$$\begin{aligned}\Delta CS_t = \frac{1}{\alpha^h}(ln \sum_{j=1}^{J_t} exp(\delta_{cr(j)} + \delta_{b(j)} + \alpha^h p_{jt} + \pi\widehat{\eta}_{jt}) \\ -ln \sum_{j=1}^{J_t^{post}} exp(\delta_{cr(j)} + \delta_{b(j)} + \alpha^h p_{jt}^{post} + \pi\widehat{\eta}_{jt}))\end{aligned} \tag{25}$$

We assume that $\widehat{\eta}_{jt}$ the error term of the price equation which includes all unobserved variables that explain the prices as the discount or the advertising variations do not change without online alternatives. The offline discount and advertisement should not change if we remove the online products.

4 Results

In this section, we first present the results of the random coefficient logit model and thus the price elasticities in the French soft drink market. Second, we discuss retail and manufacturer margins, and profit sharing from the supply model. Finally, to assess the effect of introducing the online distribution channel, we remove the online alternatives and analyze this effect on prices, profits, and consumer surplus.

4.1 Demand Results

We estimate a random coefficient logit model on the whole sample of 684,010 observations using a simulated maximum likelihood method and a control function approach to solve the endogeneity issue. We consider our purchase sample as a cross-sectional dataset, each purchase is then independent of the other. The results are reported in Table 3. Households have heterogeneous price sensitivity as 95% of the households have a price sensitivity that ranges from -6.03 to -6.93. For each retailer, the preference for the brick-and-mortar stores is stronger than the online stores as the offline coefficients are higher than the online coefficients for each retailer. Consumers have heterogeneous preferences for NB and PL products.

Table 4 exposes the own and cross-price elasticities aggregated by distribution channel (see in Appendix for computation details). If the prices of all offline products increase by 1%, the demand for the offline products decreases by 2.29% (i.e. 1.59 percentage points), and the demand for online products increases by 5.28% (i.e. 0.34 percentage points). If the prices of all online products increase by 1%, the demand for offline products increases by 0.48% (i.e. 0.33 percentage points), and the demand for online products decreases by 6.87% (i.e. 0.45 percentage points). The demand for online products is then more elastic but cross-effects are similar.

According to Table 5, the own-price elasticities at the product level are similar for online and offline distribution channels and across retailers. Table 6 presents the

Table 3: Random Coefficient Logit Demand Estimates

	Mean	**Standard deviation**		**Mean**	**Standard deviation**
Price (α)	-6.48 (1.16e-04)	0.23 (3.91e-05)	**Brand fixed effects**		
Control function (η)	6.65 (1.16e-04)		NB 1	-	
			NB 2	-4.35 (3.47e-05)	
Retailer fixed effects			NB 3	-0.96 (5.22e-05)	
Brick and mortar stores			NB 4	-3.14 (1.70e-05)	
Retailer 1	1.68 (1.18e-04)		NB 5	-1.61 (9.78e-06)	
Retailer 2	4.52 (1.30e-04)		NB 6	-1.12 (2.18e-05)	
Retailer 3	5.42 (1.33e-04)		NB 7	-2.64 (3.90e-05)	
Retailer 4	4.93 (1.38e-04)		NB 8	-2.12 (3.17e-05)	
Retailer 5	4.54 (1.27e-04)		NB 9	-0.47 (2.39e-05)	
Retailer 6	4.90 (1.25e-04)		NB 10	-4.86 (3.44e-05)	
Retailer 7	2.95 (1.24e-04)		NB 11	-5.77 (4.43e-05)	
Retailer 8	4.10 (1.26e-04)		NB 12	-1.54 (4.90e-05)	
			NB 13	-3.24 (4.43e-05)	
Online stores			NB 14	-2.46 (1.28e-05)	
Retailer 2	2.66 (1.24e-04)		NB 15	-4.95 (3.38e-05)	
Retailer 3	1.43 (1.28e-04)		NB 16	1.16 (5.00e-05)	
Retailer 4	1.23 (1.39e-04)		NB 17	5.40 (1.67e-04)	
Retailer 5	1.75 (1.34e-04)		NB 18	5.25 (1.17e-04)	
Retailer 6	2.80 (1.17e-04)		PL Colas	-5.80 (6.97e-05)	
Retailer 8	1.39 (1.24e-04)		PL Sodas	-3.74 (5.02e-05)	
			PL Tea	-4.39 (1.35e-05)	
			PL Ice Juices	1.36 (3.86e-05)	
Number of Observations	684,010		LL	-2,559,730	

NB and PL respectively correspond to national brand and private label. Standard errors are in parenthesis.

Table 4: Aggregated Elasticities

	Elasticities* Offline	Online
Offline	-2.29 (0.06)	5.28* (0.10)
Online	0.48 (0.03)	-6.87 (0.10)

*The table should be read as follows: if the prices of all offline products increase by 1%, the demand for online products would increase by 5.28%. Standard deviations are in parenthesis.

own-price elasticities per distribution channel and brand and shows that the average own-price elasticities range between -2.97 and -6.83 for cola's products, -4.12 and -9.76 for other sodas, -4.91 and -6.93 for ice tea products -7.87 and -16.52 for juices. Own-price elasticities are then mainly heterogeneous across brands. These results do not follow the current literature on e-commerce in the food industry. Pozzi (2012) finds that offline own-price elasticities for the American cereal market are about fifty percent higher than online own-price elasticities. Chu et al. (2008) and Chu et al. (2010) also find that consumers are less price-sensitive in the online channel than in the offline channel in the Spanish grocery market. The difference between our results and the literature could come from heterogeneous price sensitivity to the distribution channel. We also specify demand with two distinct average price sensitivities, one for online purchases and one for offline purchases. The two estimates were similar. Differences are certainly due to our analysis on a specific market: the French soft drink industry.

4.2 Bargaining power and price-cost margins

First, we compute the retail margins using equation (13) and the demand estimates. We then estimate the exogenous bargaining power parameters of each pair manufacturer/retailer and the cost shifters, using equation (23). Consequently, we can compute the manufacturer margins.

According to Table 5 and Table 6, retail price-cost margins are presented as a percentage of the retail price and range from 7.13% to 41.75%. As for price elasticities, heterogeneity is more important across brands than across retailers or distribution channels. Retail margins are higher for PL than for NB in each product category. As in Bonnet et al. (2021), the manufacturer margins also presented as a percentage of the retail price are often lower than the retailer margins. Globally, online and offline margins are similar for the different retailers (Table 5). The offline and online downstream margins are similar for the different NBs except for the PL colas, PL other sodas, NB 8, NB 10, and NB 11, which get lower downstream margins offline than online. The offline upstream margin is generally higher than the online upstream margin except for NB 5, NB 6, NB 7, NB 9, NB 12, and NB 17. Table 7 provides the bargaining power estimates λ. λ could vary from 0.43 and 0.68 and are often in favor of retailers (higher than 0.5). The bargaining power varies for each manufacturer across retailers and each retailer across manufacturer, justifying our choice about estimation strategy.

Table 5: Own-price elasticities and price-cost margins per retailer

		Own-price elasticities		**Manufacturer margins (%)**		**Retailer margins (%)**		**Total Margins (%)**	
		Offline	**Online**	**Offline**	**Online**	**Offline**	**Online**	**Offline**	**Online**
Retailer 1	NB	-8.58	-	15.49	-	13.84	-	29.33	-
		(1.71)	-	(1.09)	-	(0.99)	-	(2.08)	-
	PL	-4.42	-	-	-	19.24	-	19.24	-
		(0.75)	-	-	-	(2.15)	-	(2.15)	-
Retailer 2	NB	-8.27	-8.15	15.98	16.52	14.67	15.07	30.66	31.60
		(0.24)	(0.27)	(0.30)	(0.34)	(0.25)	(0.27)	(0.43)	(0.50)
	PL	-5.37	-4.76	-	-	16.07	18.23	16.07	18.23
		(0.13)	(0.20)	-	-	(0.16)	(0.80)	(0.16)	(0.80)
Retailer 3	NB	-8.54	-8.50	13.71	14.39	15.55	16.35	29.25	30.74
		(0.18)	(0.56)	(0.22)	(0.64)	(0.26)	(0.73)	(0.48)	(1.36)
	PL	-5.16	-5.10	-	-	18.14	18.97	18.14	18.97
		(0.18)	(0.31)	-	-	(0.46)	(0.83)	(0.46)	(0.83)
Retailer 4	NB	-9.11	-8.92	13.32	13.24	13.34	13.68	26.66	26.93
		(0.50)	(0.80)	(0.32)	(0.55)	(0.33)	(0.67)	(0.64)	(1.21)
	PL	-4.97	-5.82	-	-	16.48	16.40	16.48	16.40
		(0.10)	(0.78)	-	-	(0.28)	(2.28)	(0.28)	(2.28)
Retailer 5	NB	-8.24	-8.56	14.83	14.38	15.02	14.54	29.84	28.92
		(0.17)	(0.59)	(0.36)	(0.38)	(0.34)	(0.38)	(0.70)	(0.75)
	PL	-4.96	-5.36	-	-	17.52	17.08	17.52	17.08
		(0.19)	(0.50)	-	-	(0.43)	(1.40)	(0.43)	(1.40)
Retailer 6	NB	-8.02	-7.53	15.38	16.51	16.45	17.59	31.82	34.09
		(0.14)	(0.17)	(0.34)	(0.40)	(0.32)	(0.39)	(0.61)	(0.71)
	PL	-4.73	-4.95	-	-	20.37	19.63	20.37	19.63
		(0.10)	(0.17)	-	-	(0.44)	(0.77)	(0.44)	(0.77)
Retailer 7	NB	-8.53	-	13.90	-	12.78	-	26.68	-
		(0.55)	-	(1.09)	-	(0.93)	-	(2.02)	-
	PL	-4.64	-	-	-	22.00	-	22.00	-
		(0.52)	-	-	-	(1.19)	-	(1.19)	-
Retailer 8	NB	-8.21	-8.11	15.56	15.75	14.25	14.32	29.81	30.07
		(0.19)	(0.30)	(0.39)	(0.67)	(0.39)	(0.60)	(0.77)	(1.25)
	PL	-5.09	-5.03	-	-	16.59	17.31	16.59	17.31
		(0.11)	(0.33)	-	-	(0.35)	(0.98)	(0.35)	(0.98)

Average price-cost margins as a percentage of retail prices and average marginal costs have been weighted by market shares. Standard deviations in parenthesis refer to variation across periods and products. We impose that the manufacturer margins are the same online and offline for the same brand sold by the same retailer. However, the retail prices can be different online and offline and the online and offline brands available for the retailers are not necessarily the same, so the price-cost margins are different online and offline.

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Table 6: Own-price elasticities and price-cost margins per brand

	Manufacturer	**Own-price elasticities**		**Manufacturer margins (%)**		**Retailer margins (%)**		**Total Margins (%)**	
		Offline	**Online**	**Offline**	**Online**	**Offline**	**Online**	**Offline**	**Online**
Colas									
NB 1	Manufacturer 1	-6.83	-6.83	17.58	20.07	16.70	17.61	34.27	37.68
		(0.15)	(0.21)	(0.40)	(0.67)	(0.38)	(0.59)	(0.78)	(1.26)
NB 2	Manufacturer 2	-5.37	-5.32	20.90	23.34	21.88	22.45	42.78	45.80
		(0.19)	(0.33)	(0.66)	(1.14)	(0.70)	(1.13)	(1.36)	(2.25)
PL colas	-	-3.09	-2.97	-	-	37.93	41.75	37.93	41.75
		(0.09)	(0.27)	-	-	(1.19)	(2.37)	(1.19)	(2.37)
Other sodas									
NB 3	Manufacturer 1	-9.76	-9.47	12.70	14.56	12.02	12.59	24.73	27.15
		(0.31)	(0.27)	(0.35)	(0.38)	(0.37)	(0.46)	(0.71)	(0.82)
NB 4	Manufacturer 1	-6.86	-6.65	18.11	21.06	17.18	18.52	33.29	39.58
		(0.17)	(0.62)	(0.40)	(1.19)	(0.33)	(1.09)	(0.70)	(2.27)
NB 5	Manufacturer 3	-6.95	-6.98	13.64	11.52	17.07	18.26	30.71	29.78
		(0.29)	(0.52)	(0.73)	(0.61)	(0.82)	(0.75)	(1.50)	(1.33)
NB 6	Manufacturer 3	-8.05	-8.31	11.71	9.68	14.74	15.66	26.45	25.34
		(0.24)	(0.81)	(0.46)	(0.64)	(0.43)	(0.96)	(0.84)	(1.57)
NB 7	Manufacturer 3	-8.50	-8.55	10.96	9.39	13.95	14.43	24.92	23.82
		(0.34)	(0.53)	(0.58)	(1.54)	(0.57)	(1.31)	(1.10)	(0.87)
NB 8	Manufacturer 3	-8.96	-9.08	10.23	12.43	13.58	19.99	23.81	32.42
		(0.76)	(2.23)	(0.88)	(1.45)	(1.05)	(1.77)	(1.89)	(1.11)
NB 9	Manufacturer 3	-8.34	-8.35	11.25	9.28	14.17	15.10	25.42	24.39
		(0.19)	(0.44)	(0.37)	(0.22)	(0.31)	(0.55)	(0.62)	(0.71)
NB 10	Manufacturer 2	-5.62	-5.46	19.90	23.74	20.93	22.92	40.83	46.66
		(0.15)	(0.33)	(0.55)	(1.56)	(0.53)	(1.69)	(1.07)	(3.22)
NB 11	Manufacturer 1	-5.17	-4.68	23.94	30.42	22.64	26.30	46.59	56.71
		(0.23)	(0.29)	(0.93)	(1.74)	(0.93)	(1.56)	(1.84)	(3.28)
NB 12	Manufacturer 3	-9.43	-9.12	9.83	7.65	12.53	13.37	22.36	23.03
		(0.22)	(0.40)	(0.36)	(0.57)	(0.30)	(0.64)	(0.61)	(1.06)
NB 13	Manufacturer 2	-8.58	-8.26	12.42	13.21	14.10	14.04	26.53	27.25
		(0.47)	(0.72)	(0.62)	(1.93)	(0.55)	(2.08)	(1.15)	(4.00)
PL other sodas	-	-4.51	-4.12	-	-	25.87	27.88	25.87	27.88
		(0.22)	(0.18)	-	-	(1.10)	(0.84)	(1.10)	(0.84)
Ice Tea									
NB 14	Manufacturer 2	-6.93	-6.72	16.11	18.90	16.83	18.23	32.94	37.13
		(0.24)	(0.43)	(0.45)	(0.87)	(0.52)	(0.85)	(0.97)	(1.72)
NB 15	Manufacturer 2	-6.22	-5.59	19.93	24.84	19.35	21.47	39.28	45.31
		(0.41)	(0.53)	(0.89)	(2.02)	(0.91)	(1.89)	(1.78)	(3.90)
PL Ice Tea	-	-4.91	-5.16	-	-	23.60	24.60	23.60	24.60
		(0.07)	(0.60)	-	-	(0.32)	(1.06)	(0.32)	(1.06)
Juices									
NB 16	Manufacturer 4	-9.67	-9.52	11.40	12.60	11.94	12.71	23.34	25.32
		(0.40)	(0.58)	(0.43)	(0.63)	(0.49)	(0.68)	(0.93)	(1.31)
NB 17	Manufacturer 3	-16.52	-15.64	5.71	4.95	7.13	7.97	12.84	12.92
		(0.87)	(1.28)	(0.34)	(0.31)	(0.37)	(0.60)	(0.70)	(0.84)
NB 18	Manufacturer 5	-13.23	-13.28	8.46	9.77	8.83	9.33	17.29	19.10
		(0.35)	(0.46)	(0.20)	(0.32)	(0.23)	(0.34)	(0.43)	(0.66)
PL Juices	-	-7.87	-7.96	-	-	14.64	15.00	14.64	15.00
		(0.07)	(0.21)	-	-	(0.14)	(0.45)	(0.14)	(0.45)

Average price-cost margins as a percentage of retail prices and average marginal costs have been weighted by market shares. To compare the online and offline margins, I did not take into account the hard discounters, which do not have an online distribution channel. Standard deviations in parenthesis refer to variation across periods and retailers. We impose that the manufacturer margins are the same online and offline for the same brand sold by the same retailer. However, the retail prices can be different online and offline, so the price-cost margins are different online and offline.

Table 7: Retailer-Manufacturer Estimates of Bargaining power λ_{rm} of the retailer

	Manufacturer 1	**Manufacturer 2**	**Manufacturer 3**	**Manufacturer 4**	**Manufacturer 5**
Retailer 1	0.52	0.49	0.45	0.49	-
Retailer 2	0.53	0.46	0.66	0.52	0.52
Retailer 3	0.54	0.53	0.49	0.50	0.49
Retailer 4	0.57	0.50	0.43	0.50	0.49
Retailer 5	0.53	0.55	0.49	0.49	0.49
Retailer 6	0.50	0.53	0.68	0.49	0.51
Retailer 7	0.51	0.53	0.44	0.47	0.53
Retailer 8	0.47	0.51	0.61	0.54	-

4.3 Counterfactual experiments

To evaluate the effect of e-commerce on retail competition, profit sharing between manufacturers and retailers, and consumer surplus, we simulate the absence of online products. We then compute new equilibrium prices, market shares, and profits for each actor.

4.3.1 Impact of online distribution channel

Tables 8 and 9 depict the difference in prices, margins, market shares, and profits with the introduction of e-commerce. The changes in offline retail prices and margins for each row have been weighted by market shares. It is the variation between the counterfactual prices or margins and the offline simulated prices or margins. The change in offline profit is the variation in percent between the offline simulated profit and counterfactual profit. The change in profit is the variation in percent between the simulated profit and the counterfactual profit. In Appendix, Table 16 provides the difference in market shares, profits, and profit-sharing when we do not consider strategic price reaction, Table 17 presents the change in prices across retailers and PL and NB products, and Table 18 provides the market shares for each retailer.

Global effect on consumers

To know if e-commerce is beneficial for the consumer, we compute the consumer surplus. With e-commerce, consumer surplus increases by 2.27% with a standard deviation of 0.06 across periods. The price reaction limits it. When we compute the variation of consumer surplus without estimating new prices strategies, we find an increase of consumer surplus of 4.93% and a standard deviation of 0.11 with e-commerce. It shows that the global rise in offline retail prices in brick-and-mortar stores due to e-commerce limits the increase in consumer surplus. It is in line with the literature that find also a greater consumer surplus with an online distribution channel (Duch-Brown and Martens 2014; Duch-Brown et al. 2017).

Effect on retail prices and market shares

According to Table 8, we see that PL and NB prices decrease for retailers 1 and 7, the hard discounters, that have not opened an online distribution channel. This price decrease allows them to limit the decrease in market share due to the introduction of drive service by retail competitors. Indeed, Table 16 in Appendix shows that, when we do not consider strategic price reaction, the market shares of the hard discounters (i.e. the retailer 1 and 7) decrease, respectively, by 0.05 and 0.15 percentage points with e-commerce, whereas in Table 8, considering price adjustments, the decrease in market shares are only 0.02 and 0.06 percentage points, respectively.

Only retailers 2 and 6, which have opened an online distribution channel mainly following a solo click and drive strategy, increase their PL and NB prices with e-commerce (Table 17 in Appendix). The increase in NB prices is to a larger extent than for other retailers. The solo strategy would enable them to increase more their prices, for two reasons. First, price comparison is more difficult with this strategy between online and offline prices because the pick-up points are separate from the traditional stores and it is not always easy to know which traditional store to compare the online store to. Second, this click and drive strategy may allow retailers to attract more consumers from new catchment areas without price adjustment. Their market shares then largely increase compared to other retailers (see Table 16 in Appendix with 1.25 and 1.88 percentage points increase with e-commerce and without strategic price reaction). With e-commerce and considering the price reaction, retailers 2 and 6 obtain a market share increase of 0.49 and 0.71 percentage points.

The retailers which follow an attached strategy have different reactions. For retailers 3, 4, and 5, we see a slight price increase of NB products and a very small price decrease of PL products. We can also note that their market shares slightly decrease despite the introduction of click and drive service in their shares. For retailer 8, we observe a price increase of NB products and a very small price increase for PL products.

The increase in offline retail prices with e-commerce for the retailers that opened an online distribution channel could be a consequence of a differentiation effect. The differentiation effect is an observed phenomenon allowing a product, service, or company to gain a competitive and decisive advantage over the competition's offer. Opening online stores could be seen as a competitive advantage.

The offline retail prices of NB products increase, whereas the offline retail prices of PL products are globally stable with e-commerce. Consequently, the NB share decreases, and the PL share increases with e-commerce (Table 9).

Effect on wholesale prices and manufacturer profits

The effect of the introduction of e-commerce on offline wholesale prices depends on whether the retailers have opened an online distribution channel. For the hard discounters that have not developed any online distribution channel, the wholesale prices and the upstream margins are lower with e-commerce. For the retailers which have opened an online distribution channel, the offline wholesale prices, and consequently, the offline upstream margins are higher with e-commerce. The total manufacturer profits globally increase with e-commerce. The loss in market shares due to the higher share of PLs online is compensated by increased margins when the online distribution channel is introduced. Moreover, e-commerce permits manufacturers to get a higher share of total margin thanks to the important increase of upstream margins.

Effect on downstream margins and retailer profits

For the hard discounters, the decrease in wholesale prices is smaller than the decline in retail prices, reducing downstream margins. Hard discounters lose market shares, downstream margins, and consequently profits with the introduction of online services in traditional retailers as they do not offer them. However, hard discounters gain from the profit sharing with the manufacturers because of a larger decrease in upstream margins than in downstream margins with e-commerce.

The offline downstream margins increase for the retailers with a solo strategy thanks to a substantial increase in offline retail prices superior to the rise in offline wholesale prices. The increase in market shares and offline downstream margins leads to greater total profits with e-commerce for retailers 2 and 6 that follow a solo strategy.

The retailers which have mainly opened attached click and drive stores have different reactions. For retailers 3, 4, and 5 with an attached strategy, the increase in offline retail prices is insufficient to compensate for the rise in offline wholesale prices, so they get lower offline downstream margins with e-commerce. They obtain fewer profits with e-commerce, due to the lower market shares and offline downstream margins. Retailer 8's offline downstream margins increase because the increases in offline retail prices are superior to the increases in offline wholesale prices. This retailer obtains more profits with e-commerce thanks to the rise in market shares and offline downstream margins. However, the increase in market shares, offline downstream margins, and total profits for retailer 8 is lower than the increase for the retailers with a solo strategy.

A regression in Table 10 confirms that there is a correlation between the change in profit with e-commerce and the online strategy.

To summarize, hard discounters and most retailers, which have mainly adopted an attached strategy, obtain lower market shares and profits with e-commerce. The retailers which have adopted a solo approach obtain higher market shares, offline downstream margins, and higher profits with an online distribution channel. However, the solo click and drive stores have independent and remote warehouses whose substantial fixed starting costs may make the opening of online stores less beneficial.

Effect on offline distribution channel

All the manufacturers and retailers obtain a lower market share and profit through the offline distribution channel with e-commerce. It shows that online sales have

Table 8: Results per retailer with e-commerce

	For offline products			
	Change in retail prices (%)	**Change in downstream margins (%)**	**Change in upstream margins (%)**	**Change in retailer profits (k€)**
Retailer 1	-0.06 (0.00)	-0.03 (0.00)	-0.32 (0.03)	-7.41 (0.63)
Retailer 2	1.50 (0.03)	0.55 (0.01)	10.31 (0.27)	-530.43 (43.91)
Retailer 3	0.07 (0.01)	-0.29 (0.02)	0.92 (0.06)	-322.47 (26.94)
Retailer 4	0.08 (0.01)	-0.13 (0.01)	0.81 (0.06)	-131.00 (9.23)
Retailer 5	0.23 (0.02)	-0.09 (0.01)	1.72 (0.10)	-214.93 (18.66)
Retailer 6	1.35 (0.03)	0.88 (0.01)	8.81 (0.22)	-977.55 (73.92)
Retailer 7	-0.06 (0.00)	-0.07 (0.00)	-0.31 (0.01)	-22.88 (2.09)
Retailer 8	0.50 (0.02)	0.05 (0.01)	3.37 (0.09)	-198.34 (14.28)
	For all products			
	Change in market shares (% point)	**Change in retailer profits (k€)**	**Change in retailer profit sharing (% point)**	
Retailer 1	-0.02 (0.00)	-7.41 (0.63)	0.27 (0.38)	
Retailer 2	0.49 (0.01)	223.22 (17.52)	-6.81 (3.68)	
Retailer 3	-0.23 (0.02)	-123.62 (11.03)	-0.76 (0.53)	
Retailer 4	-0.11 (0.01)	-47.21 (4.68)	-0.81 (0.55)	
Retailer 5	-0.07 (0.01)	-33.09 (4.60)	-1.34 (0.84)	
Retailer 6	0.71 (0.01)	395.3 (33.49)	-4.57 (3.38)	
Retailer 7	-0.06 (0.00)	-22.88 (2.09)	0.15 (0.21)	
Retailer 8	0.05 (0.00)	20.94 (2.54)	-2.64 (1.52)	

The changes in offline retail prices and margins for each row have been weighted by market shares. It is the variation between the counterfactual prices or margins and the offline simulated prices or margins. It must be read as follow: with e-commerce, the offline retail prices of retailer 1 decrease on average by 0.06%. The change in offline profit is the variation in percent between the offline simulated profit and counterfactual profit. The change in profit is the variation in percent between the simulated profit and the counterfactual profit. The standard deviations in parenthesis refer to variation across periods and products.

cannibalized a part of traditional retail sales.

4.3.2 Variation of wholesale prices and bargaining ability

To understand the variation of the wholesale prices, we study the bargaining outcome between the retailers and the manufacturers. Solving the bargaining power in equation

Table 9: Results per manufacturers with e-commerce

For offline products				
	Change in retail prices (%)	**Change in downstream margins (%)**	**Change in upstream margins (%)**	**Change in manufacturer profits (k€)**
Manufacturer 1	1.45 (0.04)	0.18 (0.01)	8.18 (0.09)	-425.25 (26.46)
Manufacturer 2	1.11 (0.02)	0.18 (0.01)	8.80 (0.15)	-152.79 (9.96)
Manufacturer 3	0.58 (0.06)	0.22 (0.04)	9.31 (0.57)	-43.54 (8.42)
Manufacturer 4	0.99 (0.02)	0.17 (0.01)	9.21 (0.12)	-51.22 (3.00)
Manufacturer 5	0.35 (0.01)	0.23 (0.03)	3.73 (2.27)	-1.91 (0.29)
PL	0.03 (0.00)	0.16 (0.01)	-	-

For all products			
	Change in market shares (% point)	**Change in manufacturer profits (k€)**	**Change in manufacturer profit sharing (% point)**
Manufacturer 1	-0.82 (0.03)	307.87 (25.50)	2.80 (3.69)
Manufacturer 2	-0.35 (0.01)	143.55 (11.96)	3.63 (3.59)
Manufacturer 3	-0.04 (0.02)	157.23 (28.56)	4.37 (5.04)
Manufacturer 4	-0.13 (0.00)	63.99 (4.61)	4.11 (4.00)
Manufacturer 5	-0.01 (0.00)	0.23 (1.33)	2.39 (3.50)
PL	2.11 (0.02)	-	-

The changes in offline retail prices and margins for each row have been weighted by market shares. It is the variation between the offline simulated prices or margins and counterfactual prices or margins. It must be read as: with e-commerce, the offline retail prices of manufacturer 1 increase on average by 1.45%. The change in offline profit is the variation in percent between the offline simulated profit and the counterfactual profit. The change in profit is the variation in percent between the simulated profit and the counterfactual profit. The standard deviations in parenthesis refer to variation across periods and products.

(14) leads to the following first-order condition:

$$(1 - \lambda_{rm})(\pi_t^r - d_t^r) - \lambda_{rm}(\pi_t^m - d_t^m) = 0 \tag{26}$$

As in our framework, the retail and wholesale prices are determined simultaneously, we distinguish two sources of bargaining power. The first source of bargaining power is the bargaining weight λ_{rm}. The second source of bargaining power is captured by the terms $\pi^m_{crbt} - d^m_{crbt}$ and $\pi^r_{crbt} - d^r_{crbt}$ which represents the additional gain of respectively manufacturer m and retailer r, from trade between these two trading partners, given

Table 10: Regression of the change in profits (in %) with e-commerce

	(1)	(2)
Online Strategy Fixed Effect		
No e-commerce	-2.71*** (0.04)	-
Attached Strategy	-1.46*** (0.04)	-
Solo Strategy	5.71*** (0.04)	-
Click and Drive proportion Fixed Effect		
No e-commerce	-	-2.71***(0.04)
Attached click and drive (in proportion, between 0 and 1)	-	-2.59***(0.04)
Solo click and drive (in proportion, between 0 and 1)	-	11.82***(0.04)
Retailer Fixed Effect	Yes	Yes
Period Fixed Effect	Yes	Yes
R^2 adjusted	0.9995	0.9995
Number of observations	104	104

***significant at 1%. The change in profit is the variation in percent between the simulated profit and the counterfactual profit. The standard errors are in parenthesis. It is a pooled OLS regression where I cluster the standard errors.

that all other bilateral contracts are made. The more a firm's additional gains from trade, the greater its losses from failure to achieve a deal. It would lead to an increase in the bargaining power of its trading partner.

We rearrange the equation (27) and we find:

$$\frac{\pi^r_{crbt} - d^r_{crbt}}{\lambda_{rm}} = \frac{\pi^m_{crbt} - d^m_{crbt}}{1 - \lambda_{rm}} \tag{27}$$

As in Bonnet et al. (2021), we compute these ratios that measure a firm's fear of risking a negotiation breakdown. Retailer r makes a price concession to manufacturer m for the brand b, sold by retailer r in the distribution channel c in period t if $\frac{\pi^r_{crbt} - d^r_{crbt}}{\lambda_{rm}} > \frac{\pi^m_{crbt} - d^m_{crbt}}{1 - \lambda_{rm}}$ and conversely. We compute these two ratios removing the online alternatives without estimating a new price equilibrium. Table 19 in Appendix shows that only the hard discounters, retailers 1 and 7, generally make a price concession when we delete the online distribution channel without estimating new prices. The manufacturers make a price concession to the other retailers with e-commerce and without a price adjustment. It may explain that, with e-commerce, wholesale prices decrease for the hard discounters and increase for the retailers which have opened an online distribution channel with e-commerce[9].

4.3.3 Variation of retailer profits and choice of strategy

From 2000 to 2008, only click and drive stores of retailers 2 and 6 were present in France and they mainly choose a solo strategy. The other retailers progressively opened click and drive distribution channels in France from 2009 and they mostly chose an attached strategy. Most retailers that have chosen an attached strategy obtain fewer profits with e-commerce than without e-commerce. We want to understand why they open and keep an online distribution channel if they do not get more profits with e-commerce. We simulated another counterfactual where we removed the online alternative only for the retailers which chose an attached strategy. We find that the retailers which have chosen a solo strategy obtain larger market shares and profits when they are the only ones to have an online distribution channel. On average, most retailers that have chosen an attached strategy get lower market shares and profits when only the retailers that have chosen a solo strategy have an online distribution channel than when they also open

[9] The ratio is equal to $\frac{\pi^m_{crbt} - d^m_{crbt}}{\partial \pi^m_{crbt} / \partial w_{rbt}} \frac{1}{1-\lambda_{rm}} \left(\frac{\pi^r_{crbt} - d^r_{crbt}}{-\partial \pi^r_{crbt} / \partial w_{rbt}} \frac{1}{\lambda_{rm}} \right)^{-1}$. However, in our framework, the retail and wholesale prices are determined simultaneously and the ratio of concession costs $\frac{\partial \pi^m_{crbt}}{\partial w_{rbt}} / \frac{\partial \pi^r_{crbt}}{\partial w_{rbt}} = -1$. In Bonnet et al. (2021), they also focus on the French soft drink market, and they develop a sequential model allowing for wholesale prices to affect retailers' final price decisions. In this paper, the ratio of concession cost is about -0.5. Consequently, changing our framework would not change the sign of the ratio for the retailers that have opened an online distribution channel but maybe for the hard discounters because they have a ratio on average lower than 1. It could lead to an increase in wholesale prices for the hard discounters which would result in a higher loss in their profits with e-commerce. Thus, a sequential model should not change the direction of profit variation for retailers.

an online distribution channel (Table 11). This result then explains that they would lose more without opening an online distribution channel and explain their strategic decision.

Table 11: Market shares and profits in the three scenarios

Market shares			
	With e-commerce	**Only e-commerce for retailers with solo strategy**	**Without e-commerce**
Retailer 1	0.70	0.71	0.72
	(0.04)	(0.04)	(0.04)
Retailer 2	10.22	10.62	9.73
	(0.28)	(0.29)	(0.28)
Retailer 3	17.62	17.42	17.85
	(0.57)	(0.56)	(0.59)
Retailer 4	8.08	7.95	8.18
	(0.15)	(0.14)	(0.15)
Retailer 5	10.56	10.24	10.63
	(0.29)	(0.27)	(0.30)
Retailer 6	19.26	20.79	18.56
	(0.44)	(0.51)	(0.44)
Retailer 7	2.11	2.15	2.17
	(0.06)	(0.06)	(0.06)
Retailer 8	7.47	7.01	7.42
	(0.14)	(0.12)	(0.14)
Total profits in million €			
	With e-commerce	**Only e-commerce for retailers with a solo strategy**	**Without e-commerce**
Retailer 1	3.36	3.42	3.45
Retailer 2	54.49	56.87	51.58
Retailer 3	102.41	101.02	104.02
Retailer 4	42.07	41.34	42.68
Retailer 5	56.49	54.56	56.92
Retailer 6	114.12	125.55	108.98
Retailer 7	10.33	10.51	10.62
Retailer 8	38.61	36.07	38.33

The standard deviations in parenthesis refer to variation across periods.

5 Conclusion

In this paper, we assess the impact of online grocery shopping on the French soft drink markets. We develop a structural demand and supply model that allows us to consider the heterogeneity in consumer preferences and the division of surplus in the vertical chain. A simulation method allows us to see the impact of online grocery shopping on consumers' and firms' surplus and the profit sharing between retailers and manufacturers. We find that, despite a price increase of NBs, the consumer surplus increases with e-commerce. The online distribution channel reduces sales from the offline distribution channel. The effect of e-commerce on retailers' profits and margins is correlated with their strategy. The retailers which have chosen a solo strategy get higher market shares, offline downstream margins, and consequently higher profits thanks to the existence of the online distribution channel. However, this strategy requires high initial fixed costs to be implemented to add the independent and remote warehouses, so it is difficult to know if e-commerce is really beneficial for these retailers. The retailers which follow an attached strategy generally obtain lower market shares, offline downstream margins, and total profits with e-commerce. However, they would lose more if they do not introduce click and drive services as their market shares and profit would lower with e-commerce for only the retailers which follow a solo strategy.

We contribute to the literature by analyzing the impact of the emergence of e-commerce on vertical relationships. Several papers study the effect on the price level and price dispersion. However, there is no empirical study about the impact of e-commerce on vertical relationships. We show that e-commerce leads to higher upstream margins and profits for the majority of manufacturers. The variation of the wholesale prices is explained by the firms' fear of making a negotiation breakdown instead of accepting a price concession. Indeed, we find that the fear of risking a breakdown is lower for the hard discounters than for the manufacturers, explaining the decline in offline wholesale prices. On the contrary, this fear is higher for the other retailers, explaining the increase in offline wholesale prices.

This paper has some limits. It would be interesting to analyze the causal effect of the choice of the click and drive strategy for the retailers. First, this requires endogenizing this choice in the supply model. Second, it would also require differentiating for each retailer, the purchases from independent warehouses (solo strategy) to the attached or shared warehouse (attached strategy). Unfortunately, our data do not allow us to make this distinction.

References

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

Celine Bonnet, Zohra Bouamra-Mechemache, and Hugo Molina. An empirical model of bargaining with equilibrium of fear: Application to retail mergers in the french soft drink industry. *working paper*, 2021.

Céline Bonnet and Zohra Bouamra-Mechemache. Empirical methodology for the evaluation of collusive behaviour in vertically-related markets: An application to the "yogurt cartel" in france. *International Review of Law and Economics*, 61(105872), 2020.

Céline Bonnet, Zohra Bouamra-Mechemache, and Tifenn Corre. An environmental tax towards more sustainable food: Empirical evidence of the consumption of animal products in france. *Ecological Economics*, 147:48–61, 2018.

Erik Brynjolfsson and Michael D. Smith. Frictionless commerce? a comparison of internet and conventional retailers. *Management Science*, 46(4):563–585, 2000.

Junhong Chu, Pradeep Chintagunta, and Javier Cebollada. A comparison of within-household price sensitivity across online and offline channels. *Marketing Science*, 27: 283–299, 2008.

Junhong Chu, Marta Arce-Urriza, José-Javier Cebollada-Calvo, and Pradeep K. Chintagunta. An empirical analysis of shopping behavior across online and offline channels for grocery products: The moderating effects of household and product characteristics. *Journal of Interactive Marketing*, 24(4):251–268, 2010.

Karen Clay, Ramayya Krishnan, Eric Wolff, and Danny Fernandes. Retail strategies on the web: Price and non-price competition in the online book industry. *Journal of Industrial Economics*, 50(3):351–367, 2002.

Enrico Colla and Paul Lapoule. E-commerce: Exploring the critical success factors. *International Journal of Retail Distribution Management*, 40(11):842–864, 2012.

European Commission, Directorate-General for Competition, Arcadia International, and Ernst&Young. The economic impact of modern retail on choice and innovation in the eu food sector final report. 2014.

Gregory S. Crawford and Ali Yurukoglu. The welfare effects of bundling in multichannel television markets. *The American Economic Review*, 102(2):643–685, 2012.

Michaela Draganska, Daniel Klapper, and Sofia B. Villas-Boas. A larger slice or a larger pie? an empirical investigation of bargaining power in the distribution channel. *Marketing Science*, 29(1):57–74, 2010.

Néstor Duch-Brown and Bertin Martens. Consumer benefits from the eu digital single market: Evidence from household appliances markets. *Digital Economy Working Paper*, 2014.

Néstor Duch-Brown, Lukasz Grzybowski, André Romahn, and Frank Verboven. The impact of online sales on consumers and firms: evidence from consumer electronics. *International Journal of Industrial Organization*, 52:30–62, 2017.

Farid Gasmi, Jean-Jacques Laffont, and Quang Vuong. Econometric analysis of collusive behavior in a soft-drink market. *Journal of Economics & Management Strategy*, 1 (2):277–311, 1992.

Gautam Gowrisankaran, Aviv Nevo, and Robert Town. Mergers when prices are negotiated: Evidence from the hospital industry. *American Economic Review*, 105 (1):172–203, 2015.

Matthew Grennan. Price discrimination and bargaining: Empirical evidence from medical devices. *American Economic Review*, 103(1):45–177, 2013.

Jerry A. Hausman. *The Economics of New Goods*, chapter Valuation of new goods under perfect and imperfect competition, pages 207–248. ed. Timothy F. Bresnahan and Robert J. Gordon, 1996.

Kate Ho and Robin S. Lee. Insurer Competition in Health Care Markets. *Econometrica*, 85(2):379–417, 2017.

Daniel McFadden and Kenneth Train. Mixed MNL models for discrete response. *Journal of Applied Econometrics*, 15(5):447–470, 2000.

Nielsen. Avec plus de 4000 points de retrait et un chiffre d'affaires en hausse de 14%, le drive confirme son succès! 2016.

Nielsen. What's next in commerce? 2017.

Xing Pan, Brian T. Ratchford, and Venkatesh Shankar. Price dispersion on the internet: A review and directions for future research. *Journal of Interactive Marketing*, 18:116 – 135, 2004. doi: 10.1002/dir.20019.

Amil Petrin and Kenneth Train. A control function approach to endogeneity in consumer choice models. *Journal of Marketing Research*, 47(1):3–13, 2010.

Andre Pozzi. The effect of internet distribution on brick and mortar sales. *The RAND Journal of Economics*, 44(3):569–583, 2013.

Andrea Pozzi. Shopping cost and brand exploration in online grocery. *American Economic Journal: Microeconomics*, 4(3):96–120, 2012.

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

Joseph V. Terza, Anirban Basu, and Paul J. Rathouz. Two-stage residual inclusion estimation addressing endogeneity in health econometric modeling. *Journal of Health Economics*, 27(3):531–543, 2008.

Koichi Yonezawa, Miguel I. Gomez, and Timothy J. Richards. The robinson-patman act and vertical relationships. *American Journal of Agricultural Economics*, 102(1): 329–352, 2019.

6 Appendix

6.1 Types of E-commerce and Choices of Retailers

There are two main types of e-commerce in the French food industry: the orders with delivery and click and drive, where the consumers buy online and then pick up the order by car.

There are two kinds of click and drive stores: the solo click and drive with an autonomous and remote warehouse and the attached click and drive with a dedicated warehouse but attached to a classic store or with a warehouse that is shared with the traditional store.

Table 12 shows the kind of click and drive store chosen by the leading retailers. The retail groups do not have the same strategy. Retailers 2 and 6 mostly built solo click and drive stores, unlike other groups.

Table 12: Types of click and drives Strategy and Retailers' Choices

Group	Attached	Solo	Total
Retailer 2	78 (42.4%)	106 (57.6%)	184 (100%)
Retailer 3	400 (92.2%)	34 (7.8%)	434 (100%)
Retailer 4	284 (95,6%)	13 (4.4%)	297 (100%)
Retailer 5	610 (99.5%)	3 (0.5%)	613 (100%)
Retailer 6	239 (43.3%)	312 (56.6%)	551 (100%)
Retailer 8	335 (98.5%)	5 (1.5%)	340 (100%)

Source: Nielsen TradeDimensions, 2014

6.2 Aggregated Elasticities

As in Bonnet et al. (2018), we also compute the variation of the market share of the distribution channel g_c when the prices of all products belonging to the distribution channel $g_{c'}$ increase by 1% at the period t is given by the elasticity $\eta_{g_c g_c' jt}$ such that:

$$\eta_{g_c g_c' jt} = \frac{\partial s_{g_c t}}{\partial p_{g_{c'} t}} \frac{p_{g_{c'} t}}{s_{g_c t}} = \sum_{j \in g_c'} \eta_{g_c jt} \tag{28}$$

with

$$\eta_{g_c jt} = \frac{\partial s_{g_c t}}{\partial p_{jt}} \frac{p_{jt}}{s_{g_c t}} = \sum_{j' \in g_c} \frac{ds_j'}{dp_{jt}} \frac{p_{jt}}{s_j'} \frac{s_j' t}{s_{g_c t}} = \sum_{j' \in g_c} \eta_{j' jt} \frac{s_j' t}{s_{g_c t}}$$

where $\eta_{g_c jt}$ represents the variation of the market share for the distribution channel g_c, when the price of the product j increases by 1% at the period t.

6.3 Control Function

Table 13: Control Function

Price (Euro/Liter)	Value	Standard error
Sugar Cost 100ml Month	0.0001***	0.0000
Product number per category and period	-0.0318***	0.0034
Cost Aluminium Month	0.0062***	0.0007
Cost Glass Month	0.0227***	0.0010
Retailer fixed effect (Offline and Online)	Yes	
Brand fixed effect	Yes	
F-statistic	4272.91	
Probability > F	0.000	
R^2 adjusted	0.9804	
Number of observations	3,331	

***indicates significance at the 1% level.

Table 14: Correlation between the BLP instruments

	Sugar Cost 100ml	Product number per category and period	Aluminium Cost	Glass Cost
Sugar Cost 100ml	1.0000			
Product number per category and period	0.0065	1.0000		
Aluminium Cost	-0.0451	0.0009	1.0000	
Glass Cost	0.1374	0.1187	-0.0232	1.0000

6.4 Cost estimates

Table 15: Cost Estimates

	Coefficient (standard error)
Sugar	0.0586*** (0.0015)
Glass	0.1322*** (0.0004)
Aluminium	0.0436*** (0.0002)
Retailer Fixed Effect (Offline and Online)	Yes
Brand fixed effects	Yes
Parameters $\frac{1-\lambda}{\lambda}$	see Table 7
Number of Observations	3,406

***significant at 1%.

6.5 Changes with e-commerce

Table 16: Results with e-commerce without adjustment of prices

For all products			
	Change in market shares (%)	**Change in manufacturer profits (k euros)**	**Change in manufacturer profit sharing (% point)**
Manufacturer 1	0.374 (0.023)	942.266 (67.664)	3.529 (3.406)
Manufacturer 2	0.158 (0.013)	371.904 (29.367)	3.878 (3.219)
Manufacturer 3	0.194 (0.042)	198.45 (37.870)	4.288 (2.631)
Manufacturer 4	0.067 (0.006)	139.611 (9.677)	4.130 (3.653)
Manufacturer 5	-0.004 (0.003)	0.386 (2.719)	2.183 (3.306)
PL	0.857 (0.046)	-	-

	Change in market shares (% point)	**Change in retailer profits (k euros)**	**Change in retailer profit sharing (% point)**
Retailer 1	-0.049 (0.003)	-18.128 (1.431)	-0.145 (0.205)
Retailer 2	1.253 (0.026)	563.715 (46.290)	-6.701 (3.694)
Retailer 3	-0.755 (0.050)	-415.393 (34.239)	-1.207 (0.759)
Retailer 4	-0.340 (0.013)	-149.500 (11.299)	-1.168 (0.730)
Retailer 5	-0.265 (0.018)	-122.508 (8.952)	-1.632 (1.015)
Retailer 6	1.879(0.029)	1035.192 (81.850)	-4.259 (3.397)
Retailer 7	-0.147 (0.005)	-56.673 (5.290)	-0.141 (0.128)
Retailer 8	0.069 (0.011)	29.127 (5.541)	-2.863 (1.698)

The standard deviations in parenthesis refer to variation across periods. The change in offline profit is the variation in percent between the offline simulated profit and the counterfactual profit without adjustment of prices. *It must be read as follow: with e-commerce and without adjustment of prices strategy, the market share of manufacturer 1 increases on average by 0.374%.

Table 17: Changes in offline retail prices with e-commerce

	Change in retail price (%)	
	NB	PL
Retailer 1	-0.15 (0.02)	-0.01 (0.00)
Retailer 2	2.97 (0.06)	0.09 (0.00)
Retailer 3	0.20 (0.02)	-0.05 (0.00)
Retailer 4	0.20 (0.02)	-0.02 (0.00)
Retailer 5	0.49 (0.03)	-0.02 (0.00)
Retailer 6	2.50 (0.05)	0.18 (0.00)
Retailer 7	-0.12 (0.01)	-0.02 (0.00)
Retailer 8	1.04 (0.03)	0.01 (0.00)

The standard deviations in parenthesis refer to variation across periods.

Table 18: Market shares

	Estimated market shares (in %)		Counterfactual market shares (in %)
	Offline	Online	Offline
Retailer 1	0.70	-	0.72
	(0.04)	-	(0.04)
Retailer 2	8.38	1.84	9.73
	(0.23)	(0.05)	(0.28)
Retailer 3	17.18	0.44	17.85
	(0.56)	(0.02)	(0.59)
Retailer 4	7.87	0.21	8.18
	(0.14)	(0.01)	(0.15)
Retailer 5	10.12	0.44	10.63
	(0.27)	(0.02)	(0.30)
Retailer 6	16.25	3.01	18.56
	(0.37)	(0.07)	(0.44)
Retailer 7	2.11	-	2.17
	(0.06)	-	(0.06)
Retailer 8	6.92	0.55	7.42
	(0.13)	(0.01)	(0.14)

The change in offline profit is the variation in percent between the offline simulated profit and counterfactual profit without adjustment of prices. The change in profit is the variation in percent between the simulated profit and the counterfactual profit without adjustment of prices. Standard deviations in parenthesis refer to variation across periods.

Table 19: Ratio between the retailers and the manufacturers ratios

	Manufacturer 1	Manufacturer 2	Manufacturer 3	Manufacturer 4	Manufacturer 5
Retailer 1	0.967	0.988	0.995	0.996	-
	(0.001)	(0.000)	(0.001)	(0.000)	-
Retailer 2	1.233	1.216	1.214	1.218	1.148
	(0.002)	(0.005)	(0.007)	(0.002)	(0.013)
Retailer 3	0.999	1.018	1.020	1.026	1.005
	(0.001)	(0.001)	(0.002)	(0.001)	(0.008)
Retailer 4	0.994	1.018	1.009	1.027	1.001
	(0.001)	(0.004)	(0.003)	(0.002)	(0.000)
Retailer 5	1.019	1.034	1.035	1.044	1.014
	(0.001)	(0.003)	(0.005)	(0.001)	(0.024)
Retailer 6	1.180	1.172	1.183	1.177	1.020
	(0.001)	(0.002)	(0.007)	(0.004)	(0.069)
Retailer 7	0.968	0.986	0.995	0.996	1.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Retailer 8	1.064	1.069	1.068	1.081	-
	(0.003)	(0.005)	(0.002)	(0.004)	-

The ratio between the two ratios is $\frac{\pi_t^m - d_t^m}{1-\lambda_{rm}} / \frac{\pi_t^r - d_t^r}{\lambda_{rm}}$.
The standard deviations in parenthesis refer to variation across periods. We compute these two ratios removing the online alternatives without estimating a new price equilibrium.