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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 prices, profit, consumer surplus, and profit-sharing between retailers and manufacturers in the soft drink sector. We find that e-commerce leads to market expansion, increase in consumer surplus and the effect on the retailers' profits depends on their online strategy. The retailers which developed independent warehouses for the online distribution channel get higher market shares, retail margins, and profits. The retailers which develop the online services in the existing stores or adjoined warehouses get lower downstream margins, market shares, and profits with e-commerce. Our results also suggest that the introduction of the online grocery channel is profitable to most 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 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. The customers want to save time and money while benefiting from a wide choice of goods, and firms are interested in wider market penetration. 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. E-commerce has many different advantages. For customers, e-commerce makes it possible to make purchases from anywhere and at any time. They are therefore not limited by the opening hours of a traditional store.

E-commerce has rapidly become a significant component of sales. The offline and online distribution channels do not seem to be separate markets but are substitutes (Goolsbee 2001; Prince 2007). Intuitively, one of the main expected benefits of e-commerce is a price decline (Brown and Goolsbee 2002; Cooper 2006). However, the introduction of online commerce did not necessarily have a dramatic price decrease (Brynjolfsson et al. 2000; Clay et al. 2012). The online distribution channel can allow the consumers to access more varieties thanks to a larger storage capacity. The access to more varieties thanks to e-commerce has a positive impact on welfare, according to the literature (Brynjolfsson et al. 2003; Quan and Kevin 2017). Empirical evidence shows that e-commerce may have a positive impact on the market expansion (Duch et al. 2017; Biyalogorsky and Naik 2003; Gallino and Moreno 2014). For example, Duch et al. (2017) find that the online distribution channel's sales compensated the little reduction of traditional distribution channel activity. The above studies all focused 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. 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. Consumers' behavior can be different across online and offline consumers. The marketing literature shows that, on the online grocery shopping market, online consumers are less price-sensitive than offline consumers (Chu and Cebollada-Calvo 2008; Degeratu et al. 2000; Andrews and Currim 2004; Chu et al. 2010). Furthermore, the brand loyalty is higher online than offline (Degeratu et al. 2000; Danaher et al. 2003; Andrews and Currim 2004; Pozzi 2012). When the households consume, they have to support some transaction costs as, for instance, the transportation cost, the costs of inability to verify product quality before buying, or the physical costs of picking items. Chintagunta et al. (2012) find that transaction costs can be sizable and played a significant role in the choice between online and offline channels. However, they find an important household heterogeneity in these costs. Consuming through the online distribution channel, the consumer avoids storage costs, picking items, and transportation costs. The share of bulky and promotional items in the average household's basket increases once it was possible to shop online (Pozzi 2013b). E-commerce also positively impacts the market expansion for the food industry (Pozzi 2013a).

The traditional e-commerce with delivery in the food market did not convince 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. Nowadays, a new e-commerce concept, click & drive, has been developed in Europe, particularly in

France. 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. It allows firms or consumers to avoid delivery costs. The first click & drive store in France was set up in 2000. Since the last decade, click & drive structures have flourished throughout this country. In the online distribution channel, the drive represents 81% of the online sales against 19% for the delivery (Nielsen 2018). Rarely a new mode of distribution will have had a progression as fast as the drive. According to Nielsen (2016), in 2012 and 2013, 1.9 click & drive opened daily. This pace has slowed down in recent years. In the first quarter of 2016, 0.8 click & drive opened daily due to potential market saturation. In 2015, 80% of French households now had access to a click & drive within 15 minutes of home. It is therefore not surprising that 24% of French households used the drive. The Nielsen study also reveals that 9% of French households are even convinced by the drive-by making at least 40% of their purchases in 2015. Among them are mainly families, in search of practicality and time-saving.

The retailers click & drive services with two distinct strategies in the French grocery market. An isolated drive is a place with an autonomous and remote warehouse, and the adjoined drive is attached to a classic store. This work's first objective is to identify the effect of both strategies on prices, profits, and consumer surplus. The second objective of this work is to analyze the impact of e-commerce on the vertical relationship. We will identify the effects on manufacturer and retailer profits and profit-sharing. Using scanner data on the French soft drink market, we develop a demand and supply model to better understand retailers' and manufacturers' consumer preferences and pricing strategies. We focus on the French soft drink industry, which is of particular interest, given large food companies operating in a different market segment. Furthermore, 21.5%

of the households that consume non-alcoholic beverages market are "online consumers" (i.e., consumers who did at least one time their purchases online). In this market, the average share of expenditures for online consumers is high: nearly 30%. It is the sector with one of the highest expenditure. Our paper contributes to the literature on the effect of e-commerce on retail competition in the agro-food industry. It is the first paper that studies the impact of the different strategies of click & drive on retail competition and market expansion. Several papers examine the effect on the price level, price dispersion, and market expansion. However, there are no empirical studies about the impact of e-commerce on vertical relationships. Our framework is in line with the literature on structural models of vertical relationships that allow profit sharing between manufacturers and retailers. The methodology developed 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 alternatives to analyze the effect of the introduction of the online distribution channel on wholesale and retail prices, manufacturer and retailer profits, and consumer surplus. E-commerce leads to market expansion and an increase in consumer welfare. There is an increase in NB retail prices. Consequently, 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 obtained higher wholesale prices with the retailers who opened an online distribution channel, and then higher manufacturer margins are higher with e-commerce. This increase of upstream margins allows most manufacturers to obtain greater profits with e-commerce despite their market shares

[1]Draganska et al. (2010) develop a supply model 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), Bonnet et al. (2020), and Ho and Lee among others.

decrease. With the hard discounter, which did not open online stores, the manufacturers obtain lower wholesale prices and lower offline profits with e-commerce. The existence of e-commerce permits manufacturers to obtain a higher share of total margins thanks to the significant increase of the upstream margin. Moreover, the effect of e-commerce on the retailer profits and the downstream margins depends on their strategy. The retailers that have chosen an isolated strategy have higher margins, market shares, and profits thanks to the online distribution channel's existence. The isolated strategy allows retailers to determine the right location and capture the flow of cars. Installing the warehouse within the catchment area of the competitors permits cannibalizing them. It can explain the increase of market shares of the retailers which choose the isolated strategy. The retailers which followed an adjoined strategy get lower downstream margins, market shares, and profits with e-commerce. Despite the loss of profits with e-commerce, they decided to still open click & drive stores due to a strategic reaction to the introduction of isolated click & drive stores. Indeed, the retailers with an adjoined drive strategy obtain on average fewer market shares and profits if they do not open an online distribution channel when competitors who follow an isolated strategy introduce click & drive infrastructures than if they open online store. However, these differences are not significant.

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 Data

We use a dataset of soft drink purchases in 2014 collected by the society KANTAR. Those purchases are made by a French representative household panel. There is information about the product characteristics, the date of the purchase, the price, the retail chain where the panelist made their purchases, and household characteristics for each purchase. The dataset also provides information on whether the purchase has been made online or in-store and brand names of purchased items. There are 734,506 purchases where 7.51% were done online. The online market share represents 9.25% in volume and 7.30% in value. About 87.40 % of the online purchases are done through the click & drive. The set of brands includes private labels (PLs) and national brands (NBs). The private labels denote products manufactured or packaged for sale under the name of the retailer. In the French soft drink market, we assume that private labels are either produced by a competitive fringe or by retailers themselves. Retailers sell their PLs at marginal cost. 21.5% of the households who buy soft drinks are online consumers. Moreover, the average share of expenditures for online consumers is high: nearly 30%. It is one of the largest values of the average share of spending compared to other food sectors. Consequently, it seems to be one of the most interesting markets to study the impact of online grocery shopping. 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 colas, other sodas, ice tea, and fruit juices. Each manufacturer produces several brands, and each brand provides only one type of soft drink. We consider one PL per variety 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[2]. The outside good represents 24.07 percent of the market.

Table 1 depicts some descriptive statistics about prices and market shares per brand. Retail prices of NBs are about twice more expensive than PLs. The average retail prices of the purchased goods are globally lower online. An intensification of the competition can explain it due to the possibility for the consumer to compare the online prices. (Brown and Goolsbee 2002; Zettelmeyer et al. 2006). However, the computed prices are the prices of the purchased goods and not of all the available goods. Moreover, we computed a price for aggregation of several products that are marketed by this brand. The number of alternatives is different online and offline: all the products are not all available online and are not sold by all retailers. Consequently, lower prices can also be the result of a different offer. The difference in online and offline prices does not mean that the price is different for the same product online and offline. The prices are generally the same online as in the store to which it is attached when there is an attached store.

The PL represents a larger proportion of online sales than offline sales. 48.46 % of the offline sales are PLs products, while 53.36 % of the online sales are PLs products. It may be a consequence of the smallest choice variety over the representation of PLs with an online distribution channel in the food industry. Furthermore, they are very often favored there for visibility. For leading brands, the reality is different from a physical store. Indeed, in hypermarkets, the strength of leading brands is to build a vast range around their main format. In the click & drive concept, the notion of facing

[2]regional retailers, stores specialized in frozen food, butchers, bakeries, gas stations, regional markets, small grocery stores

disappears, and all the references have the same number of pixels on the screen: an essential reference has as much space as the product of a local speaker. The small brands' challenge of the click & drive is first to be present (Nielsen 2013).

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

	Manufacturer	Market Share **Offline** **%**	**Online** **%**	Retail Price **Offline** **€**	**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 TNS Worldpanel, 2014. Market shares are in frequency of purchases and their standard deviations in parenthesis refer to variation across periods. "PL" corresponds to private label. Retail prices for each row have been weighted by market shares of brands, and their standard deviations in parenthesis refer to variation across retailers and periods.

Retailers are grocery store chains that differ by the size of their outlets and the services they provide 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 retail sector, which sold about 95 percent of soft drink products. 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 opened an online distribution channel. They can adopt either an isolated strategy or an adjoined strategy. Only retailers 2 and 6 globally adopt an isolated strategy.[3] Only the hard discounters, retailers 1 and 7, do not offer online services. We assume that all the retailers are national chains and are present in all regions in France. We suppose that consumers based 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 adopt an isolated strategy, have an online market share of respectively 1.83% and 3.01%, while the other retailers obtain an online market share lower than 10%. There is also a potential explanation. The isolated strategy makes it possible to determine the right location and capture the flow of cars. For all the retailers except for the fourth one, the proportion of purchased PL is higher online than offline.

[3]In Appendix, Tables 11 provide the details of the kind of drive chosen by the main retailers.

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

Retailer	Retailer's strategy	Market Share		Retail Price	
		Offline %	**Online %**	**Offline €**	**Online €**
Retailer 1					
NBs		0.43		1.02	
		(0.05)		(0.26)	
PLs		0.27		0.89	
		(0.05)		(0.23)	
Total		0.69		0.97	
		(0.04)		(0.25)	
Retailer 2	Isolated strategy				
NBs		4.53	0.91	1.16	1.10
		(0.21)	(0.07)	(0.36)	(0.31)
PLs		3.86	0.92	1.07	1.00
		(0.16)	(0.11)	(0.31)	(0.30)
Total		8.38	1.83	1.12	1.05
		(0.27)	(0.15)	(0.32)	(0.30)
Retailer 3	Adjoined strategy				
NBs		9.26	0.24	1.19	1.20
		(0.33)	(0.05)	(0.35)	(0.34)
PLs		7.88	0.20	1.07	1.04
		(0.46)	(0.05)	(0.31)	(0.32)
Total		17.14	0.44	1.13	1.13
		(0.49)	(0.09)	(0.33)	(0.32)
Retailer 4	Adjoined strategy				
NBs		3.35	0.10	1.27	1.23
		(0.16)	(0.02)	(0.36)	(0.38)
PLs		4.52	0.10	1.06	1.10
		(0.17)	(0.03)	(0.31)	(0.37)
Total		7.87	0.19	1.15	1.18
		(0.26)	(0.03)	(0.33)	(0.37)
Retailer 5	Adjoined strategy				
NBs		4.82	0.21	1.12	1.20
		(0.59)	(0.06)	(0.33)	(0.37)
PLs		5.29	0.23	0.92	0.98
		(0.16)	(0.05)	(0.27)	(0.29)
Total		10.10	0.45	1.05	1.14
		(0.59)	(0.10)	(0.30)	(0.34)
Retailer 6	Isolated strategy				
NBs		7.30	1.23	1.16	1.07
		(0.29)	(0.09)	(0.34)	(0.31)
PLs		8.94	1.79	0.92	0.98
		(0.38)	(0.13)	(0.27)	(0.29)
Total		16.24	3.01	1.02	1.02
		(0.53)	(0.15)	(0.30)	(0.30)
Retailer 7					
NBs		1.36		1.16	
		(0.19)		(0.34)	
PLs		0.74		0.67	
		(0.12)		(0.18)	
Total		2.08		0.98	
		(0.18)		(0.28)	
Retailer 8	Adjoined strategy				
NBs		2.88	0.21	1.14	1.11
		(0.20)	(0.03)	(0.33)	(0.31)
PLs		4.05	0.36	1.00	0.98
		(0.20)	(0.06)	(0.29)	(0.29)
Total		6.93	0.58	1.06	1.03
		(0.37)	(0.09)	(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.

3 Methodology

In this section, we model the French soft drink market using a structural model of demand and supply. We first estimate the consumers' preferences using a random coefficients logit model. 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. Then, we model the retail competition that allows us to compute retail margins. Afterward, we will estimate the profit sharing between retailers and manufacturers using a Nash Bargaining game model. In order to estimate the effect of the emergence of online distribution channels on prices, and manufacturer and retailer profits, we remove the online stores and simulate new price equilibrium and market shares.

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 Berry et al. (1995), McFadden and Train (2000), and Nevo (2001). This model gives flexible substitution patterns for consumers. We assume that the whole set of soft drink products the consumer faces can be defined by the distribution channel d, 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 (d,r,b). There are J goods where:

$$J = \sum_{d=1}^{D} \sum_{r=1}^{R} J_{dr} \tag{1}$$

where J_{dr} is the set of soft drink brands sold by the retailer r in the distribution channel d.

Households h=1, ..., H are assumed to maximize an indirect utility function U_{jt}^h of buying the good j at the purchase occasion trip t:

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

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

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[4], 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 $V_{jt} = \delta_{dr(j)} + \delta_{b(j)}\alpha p_{jt} + \xi_{jt}$ and a deviation from this mean utility $\mu_{jt}^h = p_{jt}(\sigma_\alpha v_h^\alpha)$. The indirect utility is given by $U_{jt}^h = V_{jt} + \mu_{jt}^h + e_{jt}^h$.

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

[4]We also estimated demand with two distinct average price sensitivities, one for the online purchases and one for offline purchase. The two coefficients and the elasticities are not significantly different.

h to buy product j at time t in the following way:

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

The market share of alternative j which at period t in the following way:

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

where A_{jt} is the set of consumers 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:

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

We also compute the variation of the market share of the distribution channel g_d when the prices of all products belonging to the distribution channel $g_{d'}$ increase by 1% at the period t is given by the elasticity $\eta_{g_d g'_d jt}$ such that:

$$\eta_{g_d g'_d jt} = \frac{\partial s_{g_d t}}{\partial p_{g_{d'} t}} \frac{p_{g_{d'} t}}{s_{g_d t}} = \sum_{j \epsilon g'_d} \eta_{g_d jt} \tag{7}$$

With

$$\eta_{g_d jt} = \frac{\partial s_{g_d t}}{\partial p_{jt}} \frac{p_{jt}}{s_{g_d t}} = \sum_{j' \epsilon g_d} \frac{ds'_j}{dp_{jt}} \frac{p_{jt}}{s'_j} \frac{s'_j t}{s_{g_d t}} = \sum_{j' \epsilon g_d} \eta_{j' jt} \frac{s'_j t}{s_{g_d t}}$$

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

Identification and Estimation

We estimate the demand model using the simulated maximum likelihood method as in Revelt and Train (1997). This method relies on the assumption that all product characteristics are independent of the error term ε_{jt}^h. However, the independence assumption cannot hold if unobserved factors included in ξ_{jt}^h such as promotions, displays, and advertising are correlated with observed characteristics like the price. In order 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 then regress prices on instrumental variables, as well as exogenous variables of the demand equation:

$$p_{jt} = W_{jt}\psi + \kappa_{b(j)} + \kappa_{dr(j)} + \eta_{jt} \tag{8}$$

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 $\kappa_{b(j)}$and $\kappa_{dr(j)}$ are exogenous demand variables (distribution channel and retailer 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. Introducing $\widehat{\eta}_{jt}$ in the mean utility of consumers 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:

$$V_{jt} = \delta_{dr(j)} + \delta_{b(j)} + \alpha p_{jt} + \zeta_{jt} + \pi \widehat{\eta}_{jt} \tag{9}$$

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

We use the price indexes for the main inputs used in the production of soft drinks. Input prices are valid instruments since they explain prices. Moreover, the soft drink industry only represents a very small 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 we think that packaging material (can or glass bottle) could affect both prices and demand of soft drinks, we use the input price of aluminum interacted by the average percentage of can 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 indexes are provided by the French National Institute for Statistics and 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). Estimation results of the price equation are presented in Table 12 in Appendix. We can see that the instruments are not weak since the F-test is superior to 10.

[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. The demand is independent across periods(Hausman 1996), but it is a good proxy of the proportion of products for the sugar as a cost shifter.

3.2 Supply

The French soft drink industry is modeled, considering the vertical relationship between the M manufacturers and R retailers. Let's define S_{mt} the set of products sold by the manufacturer m at period t and S_{rt}^{d} the set of products sold by the retailer r in distribution channel d at time t.

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

$$\pi_t^m = \sum_{b\epsilon S_{mt}} \sum_{r=1}^{R} \sum_{d=1}^{D} Q_t \left(w_{rbt} - \mu_{bt}\right) s_{drbt}(p) \tag{10}$$

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

$$\pi_t^r = \sum_{d=1}^{D} \sum_{b\epsilon S_{rt}^{d}} Q_t \left(p_{drbt} - w_{rbt} - c_{drbt}\right) s_{drbt}(p) \tag{11}$$

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_{drbt} is the market share for a brand b sold by a retailer r in a distribution channel d in period t, w_{rbt} is the wholesale price for brand b sold to a retailer r in period t. The distribution channel are denoted as $d = 1, 2$ where $d = 1$ is the offline distribution channel and $d = 2$ is the online distribution channel. p_{drbt} and c_{drbt} are respectively the retail price and the constant marginal cost of distribution for brand b sold by a retailer r in the distribution channel d 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 follows.

Stage 1: manufacturers and retailers bargain simultaneously and bilaterally over linear wholesale prices for each good. Wholesale contracts are secret for those who don't participate in the contract. We assume that negotiation on wholesale prices is modeled as a Nash bargaining game.

Stage 2: retail prices are determined simultaneously by retailers competing on the downstream market for final consumers.

We follow the method used in Draganska et al. (2010), and we assume that wholesale and retail prices are determined simultaneously. We then turn to wholesale price equilibrium, which results from the negotiation between manufacturers and retailers.

Stage 2: J 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:

$$\sum_{d=1}^{D} s_{drkt}(p) + \sum_{d=1}^{D} \sum_{b \epsilon S_{rt}^d} (p_{drbt} - w_{rbt} - c_{drbt}) \frac{\partial s_{drbt}(p)}{\partial p_{drkt}} = 0 \quad \forall k \epsilon \ S_{rt}^d \tag{12}$$

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

$$\gamma_{rt}(p_t, \hat{\theta}, I_{rt}) = -(I_{rt} S_{pt} I_{rt})^{-1} I_{rt} \ s_t(p_t) \tag{13}$$

I_{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 $\frac{\partial s_{drbt}(p)}{\partial p_{d'r'b't}}$ in period t. $s_t(p_t)$ is the vector of market shares.

Stage 1: J resolution bargaining between retailers and manufacturers

We assume that retailers and manufacturers have rational expectations. The wholesale is determined independently of possible changes to retail price because the effect of the outcome on the retail price is anticipated by both parties. Like in Draganska et al. (2010), the manufacturers bargain with a given retailer for each of its goods, and each good is negotiated independently with the manufacturer. Retail prices are assumed to be fixed when manufacturers and retailers negotiate and are not observable at this moment[6].

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 maximizes the Nash product over the brand b:

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

λ_{rm} is the exogenous bargaining weight of the retailer, and $1 - \lambda_{rm}$ is the exogenous bargaining weight of the manufacturer. 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.

$$\pi_t^r = \sum_{d=1}^{D} Q_t \left(p_{drbt}^* - w_{rbt} - c_{drbt}\right) s_{drbt} \ + \sum_{d=1}^{D} \sum_{k \epsilon S_{rt}^d - \{b\}} Q_t \left(p_{drkt}^* - w_{rkt}^* - c_{drkt}\right) s_{drkt} \tag{15}$$

[6] This is a strong assumption. We follow the literature (Draganska et al. 2010; Bonnet and Bouamra-Mechemache 2020).

$$\pi_t^m = \sum_{d=1}^{D} Q_t \ (w_{rbt} - \mu_{rbt})\, s_{drbt} + \sum_{k\epsilon S_{mt}-\{rb\}} \sum_{n=1}^{R} \sum_{d=1}^{D} Q_t \ (w^*_{nkt} - \mu_{nkt})\, s_{dnkt} \tag{16}$$

d_t^r and d_t^m are respectively the disagreement payoffs of the manufacturer m and of 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 we said before, the retail prices are fixed during the negotiation. The disagreement payoffs are given by:

$$d_t^r = \sum_{d=1}^{D} \sum_{k\epsilon S_{rt}^d-\{b\}} (p^*_{drbt} - w^*_{rbt} - c_{drbt}) Q_t \widetilde{s}_{drkt}^{-rb}\,(p) \tag{17}$$

$$d_t^m = \sum_{k\epsilon S_{mt}-\{rb\}} \sum_{n=1}^{R} \sum_{d=1}^{D} (w^*_{nkt} - \mu_{nkt}) \ \ Q_t \widetilde{s}_{dnkt}^{-rb}\,(p) \tag{18}$$

where $\widetilde{s}_{d'r'b'}^{-rb}(p)$ is the market shares of product k that occurs if brand b sold by retailer r in both distribution channels is not offered.

Solving the bargaining power in equation (14) leads to the following first order condition:

$$\begin{aligned} \lambda_{rm}\,(\pi_t^r - d_t^r)^{\lambda_{rm}-1}\,\frac{\partial \pi_t^r}{\partial w_{rbt}}(\pi_t^m - d_t^m)^{1-\lambda_{rm}} + \\ (\pi_t^r - d_t^r)^{\lambda_{rm}}\,(1-\lambda_{rm})\,(\pi_t^m - d_t^m)^{-\lambda_{rm}}\,\frac{\partial \pi_t^m}{\partial w_{rbt}} = 0 \end{aligned} \tag{19}$$

After rearranging term, it is equivalent to:

$$\lambda_{rm}(\pi_t^m - d_t^m)\frac{\partial \pi_t^r}{\partial w_{rbt}} + (\pi_t^r - d_t^r)(\ 1 - \lambda_{rm})\frac{\partial \pi_t^m}{\partial w_{rbt}} = 0 \tag{20}$$

Replacing the profits and the disagreement payoffs by their value in the equations (15), (16), (17) and (18), we get:

$$(\sum_{d=1}^{D}\Gamma_{rbt}s_{drbt}+\sum_{k\in S_{mt}-rb}\sum_{d=1}^{D}\sum_{n=1}^{R}\Gamma_{nkt}\left(s_{dnkt}-\widetilde{s}_{dnkt}^{-rb}(p)\right))(-s_{drbt})+ \tag{21}$$

$$\frac{1-\lambda_{rm}}{\lambda_{rm}}(\sum_{d=1}^{D}\gamma_{drbt}s_{drbt}+\sum_{d=1}^{D}\sum_{k\epsilon S_{rt}^{d}-\{b\}}\gamma_{drkt}\left(s_{drkt}-\widetilde{s}_{drkt}^{-rb}(p)\right))(s_{drbt})=0$$

In matrix form, it is equal to:

$$-(\sum_{m=1}^{M}I_{mt}\widetilde{S}_{\Delta t}I_{mt}\Gamma_{ft})+(\sum_{r=1}^{R}\frac{1-\lambda}{\lambda}I_{rt}\widetilde{S}_{\Delta t}I_{rt}\gamma(p_t,\hat{\theta},I_{rt}))=0 \tag{22}$$

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

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

where $\widetilde{s}_{dr'b't}^{-rb}$ is the market share of the brand b' sold by retailer r' in the distribution channel d if brand b sold by retailer r is not offered. $s_{dr'b't}$ is the market share for the brand b' sold by retailer r' in the distribution channel d in period t when all products are available.

Using the equation (22) for all brand b sold by a retailer r in distribution channel d in period t, we obtain the matrix of the manufacturer margins:

$$\Gamma_t(p_t, I_{rt}, I_{mt}, \hat{\theta}/\hat{\lambda}) = \sum_{m=1}^{M} (I_{mt}\widetilde{S}_{\Delta t}I_{mt})^{-1}[\sum_{r=1}^{R} \frac{1-\lambda}{\lambda} * (I_{rt}\widetilde{S}_{\Delta t}I_{rt})\gamma(p_t, \hat{\theta}, I_{rt})] \tag{23}$$

The vector of total margins is equal to

$$\Gamma(p_t, I_{rt}, I_{mt}, \hat{\theta}/\hat{\lambda}) + \gamma(p_t, \hat{\theta}, I_{rt}) = \tag{24}$$

$$\left[\sum_{m=1}^{M} (I_{mt}\widetilde{S}_{\Delta}I_{mt})^{-1} \left(\sum_{r=1}^{R} \frac{1-\lambda}{\lambda} * (I_{rt}\widetilde{S}_{\Delta t}I_{rt}) + I\right)\right] (I_{rt}S_pI_{rt})^{-1}I_{rt}s_t(p_t)$$

where I is the (JxJ) identity matrix.

Identification

As in Draganska et al. (2010), we are not able to identify $\Gamma_t(p_t, I_{rt}, I_{mt}, \theta/\lambda)$ because we do not observe the bargaining power, λ_{rm}. As $C_{drbt} = p_{drbt} - \gamma_{drbt} - \Gamma_{drbt}$, we use restriction on the marginal cost function to identify λ_{rm}. We assume that C_{drbt} has the following specification:

$$C_{drbt} = c_{drbt} + \mu_{bt} = \Lambda\omega_{drbt} + \eta_{drbt} \tag{25}$$

where ω_{drbt} is a vector of cost shifters of the brand b in a distribution channel d and a retailer r in period t, Λ is the vector of parameters associated, and η_{drbt} the error term. We use several cost sifters. In practice, we 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 light 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. These indexes are provided by the French National Institute for Statistics and Economic Studies. To be consistent with economic theory, as in Gasmi et al. (1992), we impose the positivity of the parameters sugar, glass, and aluminum coefficients. Indeed, we assume that they all increase the overall marginal cost. We use a non-linear least-squares method to estimate them. All the coefficients are significant at 1%.

The final equation to be estimated is given by:

$$p_t - \gamma_t(p_t, \hat{\theta}, I_{rt}) = \Gamma_t(p_t, I_{rt}, I_{mt}, \hat{\theta}/\hat{\lambda}) + \Lambda\omega_t + \eta_t \tag{26}$$

Using non-linear least squared, we can estimate both Λ and λ_{rm} for each retailer/manufacturer (rm) pair and thus to deduce the margin of the manufacturers from the equation (23) [7].

3.3 Counterfactual

We use the estimated parameters of the structural model ($\hat{\theta}$,$\hat{\lambda}_{rm}$) to analyze the impact of the online distribution channel. To conduct such an experiment, we remove the online distribution channel from markets and develop an algorithm that allows us to compute

[7] The identification of parameters ($\hat{\theta}$,$\hat{\lambda}_{rm}$) can be jeopardized by the presence of variables like the retail prices or the predicted market shares of products in equation 24 that 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 instruments as we have parameters so we should impose the following restriction $\lambda_{rm} = \lambda_r + \lambda_m$ or $\lambda_{rm} = \lambda_m$. We decide to follow Draganska et al. (2010) in order to take into account the heterogeneity of λ_{mr}.

new equilibrium prices. Then, we compute new price-cost margins, new market shares, and the new firms' profits. Finally, we compare two situations: the observed and the counterfactual one.

Our algorithm consists in finding the J_{post} dimensional vector of retail price p_t^{post} that solves the following system of J_{post} equations

$$(p_t^{post} - (\gamma_t(p_t^{post}, \hat{\theta}, I_{rt}^{post}) + \Gamma_t(p_t^{post}, I_{rt}^{post}, I_{mt}^{post}, \hat{\theta}/\hat{\lambda}_{rm})) \tag{27}$$

$$-(p_t^* - (\gamma_t(p_t^*, \hat{\theta}, I_{rt}^{post}) + \Gamma_t(p_t^*, I_{rt}^{post}, I_{mt}^{post}, \hat{\theta}/\hat{\lambda}_{rm}))) = 0$$

where p_t^* is the vector of equilibrium retail prices in period t from the baseline model.

Removing the online distribution channel alternatives, consumers have access to fewer goods. The supply side of our model does not change, but the property matrices change. I_{mt}^{post} is the (J_{post}xJ_{post}) ownership matrix of the manufacturer m with element 1 if the product j(=drb) is produced by the manufacturer m and 0 otherwise at time t and I_{rt}^{post} is the (J_{post}xJ_{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.

The equilibrium margins change because they depend on p_t^{post} I_{rt}^{post}, and I_{mt}^{post}. We cannot re-estimate λ_{rm} because there is the same number of unknown variables p_t^{post} and equation (27).

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

$$\Delta CS_t = \frac{1}{\alpha^h}(ln \sum_{j=1}^{J} exp(\delta_{dr(j)}+\delta_{b(j)}+\alpha^h p_{jt}^*+\pi\widehat{\eta}_{jt})-ln \sum_{j=1}^{J_{post}} exp(\delta_{dr(j)}+\delta_{b(j)}+\alpha^h p_{jt}^{post}+\pi\widehat{\eta}_{jt}) \tag{28}$$

4 Results

In this section, we first present the results of the random coefficient logit model and thus the consumer substitution patterns in the French soft drink market. Given the results on price elasticity, we compute retail margins. Using exogenous cost variables, we then estimate the exogenous bargaining power of retailers relative to manufacturers, which allows us to compute manufacturer margins. Second, we discuss retail, manufacturer and total margins, and bargaining power estimates. Finally, to assess the effect of introducing the online distribution channel, we remove the online alternatives, and we analyze the effect on prices, profits, and consumer surplus.

4.1 Demand Results

We estimated a random coefficient logit model on the whole sample of 684,010 observations using a simulated maximum likelihood method, and these results are reported in Table 3. Households have heterogeneous price sensitivity with a standard deviation of 0.23. For each retailer, the preference for the brick-and-mortar stores is stronger than the online store as the offline coefficients are higher than the online coefficients. Consumers have heterogeneous preferences for NB products and PL categories.

Table 3: Random Coefficient Logit Demand Estimates

	Mean	Standard deviation		Mean	Standard deviation
Alpha	-6.48 (0.00)	0.23 (0.00)	**Brand fixed effects**		
Error of the price equation	6.65 (0.00)		NB 1	-	
			NB 2	-4.35 (0.00)	
Retailer fixed effects			NB 3	-0.96 (0.00)	
Brick and mortar stores			NB 4	-3.14 (0.00)	
Retailer 1	1.68 (0.00)		NB 5	-1.61 (0.00)	
Retailer 2	4.52 (0.00)		NB 6	-1.12 (0.00)	
Retailer 3	5.42 (0.00)		NB 7	-2.64 (0.00)	
Retailer 4	4.93 (0.00)		NB 8	-2.12 (0.00)	
Retailer 5	4.54 (0.00)		NB 9	-0.47 (0.00)	
Retailer 6	4.90 (0.00)		NB 10	-4.86 (0.00)	
Retailer 7	2.95 (0.00)		NB 11	-5.77 (0.00)	
Retailer 8	4.10 (0.00)		NB 12	-1.54 (0.00)	
			NB 13	-3.24 (0.00)	
Online stores			NB 14	-2.46 (0.00)	
Retailer 2	2.66 (0.00)		NB 15	-4.95 (0.00)	
Retailer 3	1.43 (0.00)		NB 16	1.16 (0.00)	
Retailer 4	1.23 (0.00)		NB 17	5.40 (0.00)	
Retailer 5	1.75 (0.00)		NB 18	5.25 (0.00)	
Retailer 6	2.80 (0.00)		PL Colas	-5.80 (0.00)	
Retailer 8	1.39 (0.00)		PL Sodas	-3.74 (0.00)	
			PL Tea	-4.39 (0.00)	
			PL Ice Juices	1.36 (0.00)	
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 depicts the own and cross-price elasticities aggregated by distribution channel. If the prices of all offline products increase by 1%, the demand for the outside option increase by 5.21% (i.e. 1.25% point), the demand for the offline products decreases by 2.29% (i.e. 1.59% point) and the demand for online products increases by 5.28% (i.e. 0.34% point). If the prices of all online products increase by 1%, the demand of the outside option increase by 0.47% (i.e. 0.11% point on average), the demand of the offline products increases by 0.48% (i.e. 0.33% point), and the demand for online products decrease by 6.87% (i.e. 0.45% point). There is important substitutability from the online to the offline distribution channel. However, from the offline distribution channel to the online one, there is smaller substitutability.

Table 4: Aggregated Elasticities

	Elasticities*		
	Outside Option	Offline	Online
Offline	5.21 (0.10)	-2.29 (0.06)	5.28* (0.10)
Online	0.47 (0.03)	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.

Table 8 shows the own-price elasticities per distribution channel and brand. 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. They are globally similar online and offline. These results do not follow the current literature on e-commerce in the American food industry. Pozzi (2012) finds that in-store own-price elasticities for the cereal market are about fifty percent higher than online own-price elasticities and in-store cross-price elasticities are nearly three times as large as online cross-price elasticities. In the same vein, Harris (2018) finds that the own-price elasticities and cross-price elasticities are, on average, two and three times larger offline than online. However, Pozzi (2012) focuses on mixed-channel households and Harris (2018) estimates the demand with a sample of households. The own-price elasticities and estimated margins per retailer are given in Table 7. The own-price elasticities are similar across the online and offline distribution channels and the different retailers.

4.2 Bargaining power and price-cost margins

We compute the retail margins using equation (13) and the demand estimates. We then estimate the parameters of equation (25) to obtain the exogenous bargaining power parameters of each pair manufacturer/retailer and the cost shifters. Consequently, we can compute the manufacturer margins.

The reported estimates of Table 5 are obtained through the estimation of the bargaining model in equation (26). In this table, we only report the estimated cost.

Table 5: Cost Estimates

	Coefficient (standard error)
Sugar	0.23*** (0.00)
Glass	0.12*** (0.00)
Aluminium	0.03*** (0.00)
Type of soft drink fixed effects	Yes
Manufacturer fixed effects	Yes
Parameters $\frac{1-\lambda}{\lambda}$	not shown
Number of Observations	3,406

***significant at 1%.

We provide in Table 6 the bargaining power estimates. The retailers 2 and 6 which follow an isolated strategy, are generally the ones with the greater bargaining power as they have a greater λ_{rm}.

Table 7 depicts the estimated margins per retail group. Total price-cost margins are generally not evenly split between upstream and downstream. As in Bonnet et al. (2020), the manufacturer margins are often lower than the retailer margins. Globally, offline and online margins are similar for the different retailers. Table 8 depicts the estimated margins per brand. Most of the NBs obtain slightly lower manufacturer margins online

Table 6: Retailer-Manufacturer Estimates of Bargaining power λ_{rm} of the retailer

	Manufacturer 1	**Manufacturer 2**	**Manufacturer 3**	**Manufacturer 4**	**Manufacturer 5**
Retailer 1	0.49	0.48	0.45	0.49	-
Retailer 2	0.58	0.48	0.67	0.54	0.53
Retailer 3	0.50	0.50	0.44	0.50	0.48
Retailer 4	0.43	0.40	0.33	0.47	0.47
Retailer 5	0.49	0.51	0.47	0.49	0.48
Retailer 6	0.75	0.73	0.85	0.54	0.52
Retailer 7	0.46	0.53	0.46	0.47	0.53
Retailer 8	0.46	0.52	0.67	0.55	-

than in-sore except for the NBs 13 and 16. The offline and online downstream margins are similar for the different NBs except for the PL colas, NB 8, and NB 11 which gets lower downstream margins in-store than online.

Table 7: 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	-6.88	-	5.90	-	17.37	-	23.26	-
	(1.23)	-	(0.51)	-	(1.58)	-	(1.23)	-
Retailer 2	-7.74	-7.50	6.76	6.92	15.39	16.69	22.15	23.61
	(0.19)	(0.21)	(0.14)	(0.16)	(0.14)	(0.45)	(0.26)	(0.58)
Retailer 3	-7.93	-7.78	7.68	7.89	16.87	17.71	24.55	25.60
	(0.15)	(0.49)	(0.33)	(0.51)	(0.27)	(0.57)	(0.50)	(0.93)
Retailer 4	-8.35	-8.12	9.44	8.64	15.00	15.23	24.44	23.87
	(0.41)	(0.70)	(0.27)	(0.42)	(0.29)	(1.35)	(0.43)	(1.18)
Retailer 5	-7.64	-7.83	7.91	7.44	16.31	15.90	24.22	23.35
	(0.15)	(0.48)	(0.26)	(0.34)	(0.30)	(0.80)	(0.47)	(0.75)
Retailer 6	-7.42	-7.03	3.60	3.77	18.39	18.62	21.99	22.39
	(0.12)	(0.13)	(0.07)	(0.09)	(0.30)	(0.47)	(0.35)	(0.54)
Retailer 7	-7.53	-	6.69	-	17.99	-	24.68	-
	(0.47)	-	(0.41)	-	(0.88)	-	(1.17)	-
Retailer 8	-7.60	-7.38	7.35	7.17	15.47	15.93	22.83	23.11
	(0.16)	(0.19)	(0.17)	(0.33)	(0.13)	(0.57)	(0.26)	(0.81)

Average price-cost margins as a percentage of retail prices and average marginal costs are calculated using quantity weights.

Standard deviations in parenthesis refer to variation across periods.

Table 8: 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	16.20	13.98	16.70	17.61	32.89	31.59
		(0.15)	(0.21)	(0.32)	(0.40)	(0.38)	(0.59)	(0.70)	(0.99)
NB 2	Manufacturer 2	-5.37	-5.32	19.68	17.75	21.88	22.45	41.56	40.20
		(0.19)	(0.33)	(0.67)	(0.91)	(0.70)	(1.13)	(1.36)	(1.96)
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	11.17	9.37	12.02	12.59	23.19	21.96
		(0.31)	(0.27)	(0.43)	(0.42)	(0.37)	(0.46)	(0.77)	(0.80)
NB 4	Manufacturer 1	-6.86	-6.65	16.00	13.79	17.18	18.52	33.18	32.31
		(0.17)	(0.62)	(0.49)	(0.87)	(0.33)	(1.09)	(0.77)	(1.86)
NB 5	Manufacturer 3	-6.95	-6.98	13.77	8.87	17.07	18.26	30.84	27.13
		(0.29)	(0.52)	(0.91)	(0.70)	(0.82)	(0.75)	(1.59)	(1.33)
NB 6	Manufacturer 3	-8.05	-8.31	11.80	7.35	14.74	15.66	26.55	23.02
		(0.24)	(0.81)	(0.63)	(0.63)	(0.43)	(0.96)	(0.95)	(1.47)
NB 7	Manufacturer 3	-8.50	-8.55	11.12	7.59	13.95	14.43	25.08	22.02
		(0.34)	(0.53)	(0.65)	(4.27)	(0.57)	(1.31)	(1.09)	(3.12)
NB 8	Manufacturer 3	-8.96	-9.08	10.18	8.27	13.58	19.99	23.76	28.25
		(0.76)	(2.23)	(1.00)	(3.33)	(1.05)	(1.77)	(1.97)	(1.89)
NB 9	Manufacturer 3	-8.34	-8.35	11.35	6.93	14.17	15.10	25.52	22.04
		(0.19)	(0.44)	(0.57)	(0.31)	(0.31)	(0.55)	(0.76)	(0.51)
NB 10	Manufacturer 2	-5.62	-5.46	18.53	16.74	20.93	22.92	39.47	39.66
		(0.15)	(0.33)	(0.56)	(1.23)	(0.53)	(1.69)	(1.05)	(2.83)
NB 11	Manufacturer 1	-5.17	-4.68	21.23	19.61	22.64	26.30	43.87	45.90
		(0.23)	(0.29)	(0.94)	(0.87)	(0.93)	(1.56)	(1.81)	(2.31)
NB 12	Manufacturer 3	-9.43	-9.12	9.96	5.04	12.53	13.37	22.50	18.41
		(0.22)	(0.40)	(0.53)	(1.09)	(0.30)	(0.64)	(0.72)	(1.25)
NB 13	Manufacturer 2	-8.58	-8.26	12.29	13.05	14.10	14.04	26.40	27.10
		(0.47)	(0.72)	(0.58)	(1.67)	(0.55)	(2.08)	(1.12)	(3.74)
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	15.31	14.10	16.83	18.23	32.15	32.33
		(0.24)	(0.43)	(0.45)	(0.72)	(0.52)	(0.85)	(0.96)	(1.55)
NB 15	Manufacturer 2	-6.22	-5.59	17.47	14.25	19.35	21.47	36.82	35.72
		(0.41)	(0.53)	(0.74)	(1.45)	(0.91)	(1.89)	(1.55)	(2.91)
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	10.89	11.34	11.94	12.71	22.82	24.05
		(0.40)	(0.58)	(0.41)	(0.56)	(0.49)	(0.68)	(0.91)	(1.24)
NB 17	Manufacturer 3	-16.52	-15.64	5.89	3.87	7.13	7.97	13.02	11.84
		(0.87)	(1.28)	(0.34)	(0.53)	(0.37)	(0.60)	(0.70)	(0.78)
NB 18	Manufacturer 5	-13.23	-13.28	8.06	7.42	8.83	9.33	16.89	16.75
		(0.35)	(0.46)	(0.20)	(0.24)	(0.23)	(0.34)	(0.42)	(0.58)
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 are calculated using quantity weights. 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

4.3 Counterfactual experiments

Finally, we remove the online products, compute a new bargaining equilibrium, and a downstream price equilibrium for each product at each period. We estimate the effect of the introduction of the online distribution channel on prices, profits, and consumer surplus to first identify if e-commerce would lead to market expansion for retailers. As the firms' strategies may also be influenced by e-commerce and its potential market expansion effect, we also analyze the impact of the emergence of e-commerce on vertical relationships and particularly on profit sharing.

4.3.1 Impact of online distribution channel

Global effect on consumers and market

In order to know if e-commerce is beneficial for the consumer, we computed the consumer surplus. With e-commerce, consumer surplus increases by 2.87% with a standard deviation of 0.07 across periods. It is mainly due to the variety effect because 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 retail prices in brick-and-mortar stores due to e-commerce limits the increase in consumer surplus. Duch and Martens (2014) and Duch et al. (2017) also find a greater consumer surplus with an online distribution channel. We find a market expansion effect: the total share of the J alternatives is, on average, 0.96 percentage points greater with e-commerce with a standard deviation across periods of 0.04. It is in line with the literature that also finds a positive impact of e-commerce on the market expansion (Duch et al. 2017; Biyalogorsky and Naik 2003; Gallino and Moreno 2014). The price reaction restricts this expansion. Without taking into account the new price strategy, the market expansion would be one average 1.65 percentage point with a standard deviation across periods of 0.06. Tables 9 and 10 depicts the difference in prices, margins, market shares, and profit with the introduction of e-commerce. All the manufacturers and retailers obtain a lower profit through the offline distribution channel with e-commerce. It shows that online sales have cannibalized a part of traditional retail sales.

Effect on retail prices

When we do not estimate a new price strategy without e-commerce, the market shares of most of the manufacturers and the PLs increase with e-commerce (Table 14 in Appendix). Considering strategic price reaction, the offline retail prices of NB products increase for the retailer. The offline retail prices of PL products are globally stable with e-commerce. More precisely, the PL retail prices decrease with e-commerce except for the retailers 2 and 6, which open an online distribution channel following mainly an isolated strategy, and the retail prices of the NBs products increase except for the retailers 1 and 7 that do not open an online distribution channel(Table 15in Appendix). Consequently, the NB share decreases and the PL share increases with e-commerce (Tables 9).

Effect on wholesale prices

The effect of the introduction of e-commerce on offline wholesale prices depends if the retailers open or not an online distribution channel. For the hard discounters that did not develop any online distribution channel, the offline wholesale price and the offline upstream margins and profits are lower with e-commerce. For the retailer which opened an online distribution channel, the wholesale price, and consequently, the offline upstream margins are higher with e-commerce. The total manufacturer profits globally increased 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. Only manufacturer 5 obtained a lower profit with the presence of an online distribution channel. Moreover, e-commerce permitted manufacturers to get a higher share of total margin thanks to the important increase of upstream margin.

Heterogeneous effect on retail prices across click & drive stategies

The impact of e-commerce on offline retail prices and market shares depends on retailers' click drive strategy. First, Table 14 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 point with e-commerce. Table 10 shows that taking into account the price reaction, the new retail price equilibrium, the retail prices decrease with e-commerce by about 0.04% and 0.05%, limiting the previous decrease of market share. Consequently, with e-commerce, the hard discounters obtain a market share decrease of only 0.03 and 0.08 percentage points. For the retailers that followed an isolated strategy (i.e. retailers 2 and 6), the market shares increase by, respectively, 1.25 and 1.88 percentage points with e-commerce and without strategic price reaction. However, an increase in retail prices by about 1% limits the increase of market shares with e-commerce. With e-commerce, retailers 2 and 6 obtain a market share increase of 0.55 and 1.30 percentage points. The retailers which followed an adjoined strategy have different reactions. Without the strategic price reaction, one of them, retailer 8, obtain a market share increase of 0.07 percentage point with e-commerce. An increase in their retail prices by 0.50% leads to a decrease in market shares of 0.01 percentage point. For the other retailers that followed an adjoined strategy, the retailers 3, 4, and 5, the market shares decrease by respectively 0.76, 0.34, and 0.27 percentage points without considering the price reaction. When we simulate the new prices without e-commerce, retail prices increase with e-commerce, limiting the decrease in market share. Finally, with e-commerce, the market shares of the retailers 3, 4, and 5 decrease by, respectively, 0.38, 0.22, and 0.18 percentage points.

Heterogeneous effect on retail margins and profits across click & drive strategies

The effect of the online distribution channel on downstream margins also depends on the click & drive strategy of the retail groups. Table 10 shows that, for the retailers which do not open an online distribution channel, the hard discounters, the retail prices, and the wholesale prices decrease with e-commerce. For the hard discounters, the decrease in wholesale prices is smaller than the decline in the retail price, so it leads to a decrease in downstream margins. Hard discounters lose market shares and downstream margins from 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 decrease in upstream margins larger than the decrease in downstream margins with e-commerce. The downstream margins increase for the retailer with an isolated strategy thanks to an important increase in the retail price superior to the rise in wholesale prices. The increase in downstream margins and market shares leads to greater total profits with e-commerce for retailers 2 and 6 that followed an isolated strategy. The downstream margins decrease for the retailers with an adjoined strategy. The increase in retail price is not sufficient to compensate for the rise in wholesale price. The retailers with an adjoined strategy obtained fewer profits with e-commerce, thanks to the lower market shares and downstream margins.

To summarize, the hard discounters and the retailers who mainly adopt an adjoined strategy obtained lower market shares with e-commerce. The retailers which adopt an isolated approach obtained higher market shares.

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	1.06 (0.03)	0.27 (0.01)	8.39 (0.08)	-276.13 (16.99)
Manufacturer 2	0.86 (0.01)	0.27 (0.01)	8.78 (0.15)	-129.05 (7.78)
Manufacturer 3	0.46 (0.05)	0.35 (0.06)	9.00 (0.56)	-81.75 (14.41)
Manufacturer 4	0.90 (0.01)	0.26 (0.01)	9.21 (0.12)	-47.94 (2.94)
Manufacturer 5	0.37 (0.01)	0.36 (0.05)	3.73 (2.27)	-2.36 (0.27)
PL	0.05 (0.00)	0.25 (0.01)	-	-

For all products			
	Change in market shares (% point)	**Change in manufacturer profits (k€)**	**Change in manufacturer profit sharing (% point)**
Manufacturer 1	-0.44 (0.03)	236.07 (19.83)	3.40 (4.36)
Manufacturer 2	-0.24 (0.01)	98.80 (9.05)	4.02 (4.21)
Manufacturer 3	0.01 (0.03)	70.81 (17.47)	4.55 (5.34)
Manufacturer 4	-0.13 (0.00)	55.82 (4.17)	4.25 (4.13)
Manufacturer 5	-0.01 (0.00)	-0.27 (1.28)	2.32 (3.52)
PL	1.77 (0.02)	-	-

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 1.06% point. The change in offline profit is the variation in percent between the offline simulated profit and the counterfactual profit. The standard deviations in parenthesis refer to variation across periods.

4.3.2 Variation of wholesale prices and bargaining ability

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

Table 10: 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	-0.04 (0.00)	-0.04 (0.00)	-0.20 (0.02)	-9.88 (0.80)
Retailer 2	1.32 (0.03)	0.62 (0.01)	10.34 (0.26)	-503.00 (42.12)
Retailer 3	0.08 (0.01)	-0.47 (0.03)	1.03 (0.05)	-405.80 (33.69)
Retailer 4	0.15 (0.01)	-0.25 (0.01)	1.00 (0.05)	-179.91 (12.59)
Retailer 5	0.25 (0.02)	-0.21 (0.02)	1.83 (0.10)	-263.97 (22.59)
Retailer 6	0.82 (0.02)	1.61 (0.02)	8.52 (0.20)	-651.40 (48.79)
Retailer 7	-0.05 (0.00)	-0.09 (0.00)	-0.19 (0.01)	-30.35 (2.77)
Retailer 8	0.50 (0.02)	-0.02 (0.01)	3.44 (0.09)	-223.80 (16.01)

For all products			
	Change in market shares (% point)	**Change in retailer profits (k€)**	**Change in retailer profit sharing (% point)**
Retailer 1	-0.03 (0.00)	-9.88 (0.80)	0.16 (0.23)
Retailer 2	0.55 (0.01)	250.64 (19.57)	-6.50 (3.48)
Retailer 3	-0.38 (0.02)	-206.95 (17.49)	-0.92 (0.60)
Retailer 4	-0.22 (0.01)	-96.11 (7.88)	-1.09 (0.67)
Retailer 5	-0.18 (0.01)	-82.13 (7.59)	-1.48 (0.91)
Retailer 6	1.30 (0.01)	721.45 (58.20)	-2.93 (2.46)
Retailer 7	-0.08 (0.00)	-30.35 (2.77)	0.10 (0.11)
Retailer 8	-0.01 (0.01)	-4.52 (2.63)	-2.61 (1.58)

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 0.04 % point. The change in offline profit is the variation in percent between the counterfactual profit and the offline simulated profit. The standard deviations in parenthesis refer to variation across periods.

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

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

As in Bonnet et al. (2020), we distinguish three 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 $\pi_{drbt}^m - d_{drbt}^m$ and $\pi_{drbt}^r - d_{drbt}^r$ which represents the additional gain of respectively manufacturer m and retailer r, from trade between these two trading partners, given 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. The third source of bargaining power refers to the concession costs. The concession cost of manufacturer m, $\frac{\partial \pi_{drbt}^m}{\partial w_{rbt}}$ or the concession cost of retailer r $\frac{\partial \pi_{drbt}^r}{\partial w_{rbt}}$ are the cost for the manufacturer m or the retailer r respectively from making a price concession to its trading partner during negotiations. A firm with a weak concession cost is more likely to offer its trading partner more advantageous trading conditions. However, with our framework, the ratio is simplified because $-\frac{\partial \pi_{drbt}^r}{\partial w_{rbt}} = \frac{\partial \pi_{drbt}^m}{\partial w_{rbt}}$[8].

We rearrange, the equation (29) and we find:

$$\frac{\pi_{drbt}^r - d_{drbt}^r}{\lambda_{rm}} = \frac{\pi_{drbt}^m - d_{drbt}^m}{1 - \lambda_{rm}} \tag{29}$$

[8]In our framework, the retail and wholesale prices are determined simultaneously and the ratio of concession costs $\frac{\partial \pi_{drbt}^m}{\partial w_{rbt}} / \frac{\partial \pi_{drbt}^r}{\partial w_{rbt}} = -1$. In Bonnet et al. (2020), 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 of concession cost.

As in Bonnet et al. (2020), we compute these rations that measure a firm's fear of risking a negotiation breakdown versus accepting a concession from a trade partner. Retailer r makes a price concession to manufacturer m for the brand b, sold by retailer r in the distribution channel d in period t if $\frac{\pi^r_{drbt}-d^r_{drbt}}{\lambda_{rm}} > \frac{\pi^m_{drbt}-d^m_{drbt}}{1-\lambda_{rm}}$ and conversely. We compute these two ratios removing the online alternatives without estimating a new price equilibrium. Table 16 in Appendix shows that only the hard discounters, the 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 who opened an online distribution channel with e-commerce.

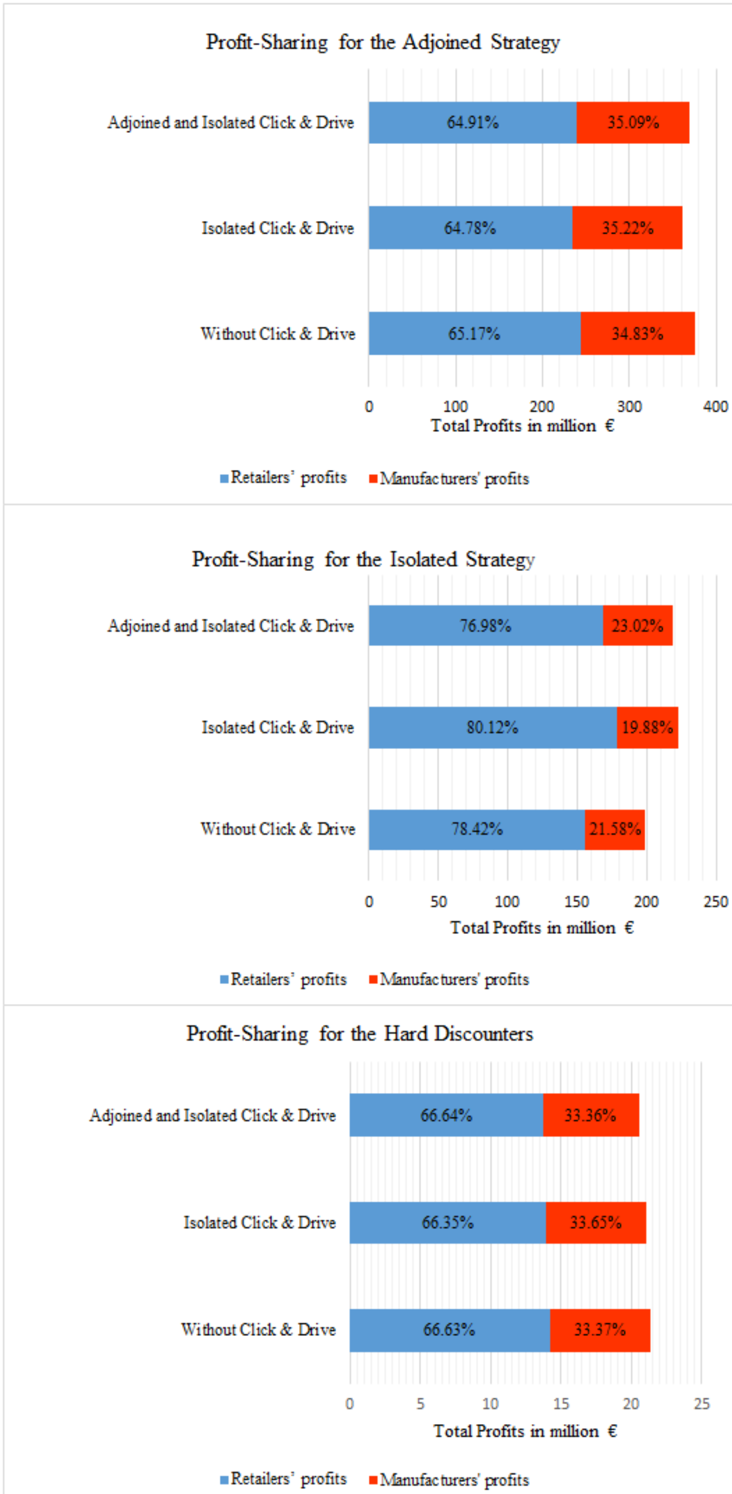
4.3.3 Variation of retailer profit and choice of strategy

From 2000 to 2008, only isolated Click & Drives of the Retailers 2 and 6 were present in France. The other retailers progressively opened Click & Drive distribution channels in France from 2009. The retailers which choose an adjoined 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 profit with e-commerce. We simulated another counterfactual where we remove the online alternative only for the retailers which choose an adjoined strategy. Figure 1 shows that profit-sharing between the manufacturers and the retailers is relatively stable across the different scenarios. We find that the retailers which choose an isolated strategy obtain larger market shares and profits when they are the only ones to have an online distribution channel. The retailers which choose an adjoined strategy get on average lower market shares and profits when only the retailers which choose an isolated strategy have an online distribution channel than when they also open an online distribution channel. However, this difference is not significant.

5 Conclusion

In this paper, we assess the impact of online grocery shopping on the French soft drink markets. We developed a structural demand and supply model that allows us to take into consideration the heterogeneity in consumer preferences and the division of surplus in the vertical chain. A simulation method allowed us to see the impact of online grocery shopping on consumers' and firms' surplus and the profit-sharing between retailers and manufacturers. The first objective of this work is to identify the effect of the adjoined and isolated strategies on prices, profits, and consumer surplus. 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, but at the same time, e-commerce creates a market expansion effect. The effect of e-commerce on retailers' profits and margins depends on their strategy. The retailers which have chosen an isolated strategy get higher market shares, downstream margins, and profits thanks to the existence of the online distribution channel. The retailers which followed an adjoined strategy obtain lower downstream margins, market shares, and profits with e-commerce. From 2000 to 2008, only the retail groups 2 and 6 that follow in the majority the isolated strategy open Click & Drive stores in France. The other retailers progressively opened Click & Drive distribution channels in France from 2009. We find that the retailers which choose an adjoined strategy obtain lower market shares

Figure 1: Profits Sharing



and profits if only the retailers that mainly open isolated click & drive stores open an online distribution channel than with e-commerce. However, these differences are not significant.

The second objective of this work is to analyze the impact of the emergence of e-commerce on the vertical relationship. Several papers study the effect on the price level, price dispersion, and market expansion. However, there are no empirical studies 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 price is explained by the firms' fear of making a negotiation breakdown versus accepting a to its trading partner. Indeed, we found that the fear of risking a breakdown is lower for the hard discounters than for the manufacturers, explaining the decline in wholesale prices. On the contrary, this fear is higher for the other retailers, explaining the increase in wholesale prices.

With the emergence of the internet, online grocery shopping expands in Europe, especially in the UK and France. This project is of great contemporary academic significance to understand how the growing distribution channel affects the agro-food chain.

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6 Appendix

6.1 Types of E-commerce and Choices of Retailers

There are three types of e-commerce in the food industry: the orders with delivery, the Click & Collect, where the consumers buy online and then pick up their order prepared in the store. Finally, the most used strategy in France is Click & drive, where the consumers buy online and then pick up the order by car.

There are two kind of Click & drive: the isolated drive with an autonomous and remote warehouse and the adjoined drive with a dedicated warehouse but attached to a classic store. It exists two types of adjoined click & drive stores. The location is adjacent to a store for the adjoined parking drive but supplies itself and operates autonomously. The employee does not shop in-store itself but in the warehouse. For the adjoined picking drive, the employee shops in the same store to satisfy the order. The customer will pick up his/her order in a space dedicated to the click & drive store.

Table 11 shows the kind of click & drive store chosen by the leading retailers. The groups do not have the same strategy. Retailers 2 and 6 resorted to drives mostly isolated, unlike other groups.

Table 11: Types of Click & Drives Strategy and Retailers' Choices

Group	Adjoined picking	Adjoined parking	Isolated	Total
Retailer 2	5 (2.7%)	73 (39.7%)	106 (57.6%)	184 (100%)
Retailer 3	390 (89 ,9%)	10 (2.3%)	34 (7.8%)	434 (100%)
Retailer 4	284 (95,6%)	0 (0%)	13 (4.4%)	297 (100%)
Retailer 5	609 (99.3%)	1 (0.2%)	3 (0.5%)	613 (100%)
Retailer 6	58 (10.5%)	181 (32.8%)	312 (56.6%)	551 (100%)
Retailer 8	331 (97.3%)	4 (1.2%)	5 (1.5%)	340 (100%)

Source: Nielsen TradeDimensions, 2014

6.2 Control Function

Table 12: 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	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 13: 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

6.3 Changes with e-commerce

Table 14: 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)	527.465 (39.845)	3.741 (4.371)
Manufacturer 2	0.158 (0.013)	247.064 (20.092)	4.192 (4.088)
Manufacturer 3	0.194 (0.042)	99.290 (25.134)	4.494 (5.093)
Manufacturer 4	0.067 (0.006)	121.125 (8.552)	4.277 (3.897)
Manufacturer 5	-0.004 (0.003)	0.330 (2.537)	2.186 (3.311)
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)	-0.022 (0.031)
Retailer 2	1.253 (0.026)	563.715 (46.290)	-6.344 (3.434)
Retailer 3	-0.755 (0.050)	-415.393 (34.239)	-1.210 (0.751)
Retailer 4	-0.340 (0.013)	-149.500 (11.399)	-1.263 (0.782)
Retailer 5	-0.265 (0.018)	-122.508 (8.952)	-1.628 (1.007)
Retailer 6	1.879 (0.029)	1035.192 (81.850)	-2.886 (2.506)
Retailer 7	-0.147 (0.005)	-56.673 (5.290)	-0.063 (0.050)
Retailer 8	0.069 (0.011)	29.127 (5.541)	-2.706 (1.657)

The standard deviations in parenthesis refer to variation across periods. The change in offline profit is the variation in percent between the counterfactual profit without adjustment of prices and the offline simulated profit. *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 15: Changes in offline retail prices with e-commerce

	Change in retail price (%)	
	NB	PL
Retailer 1	-0,104 (0.010)	-0,007 (0.001)
Retailer 2	2,580 (0.049)	0,097 (0.001)
Retailer 3	0,249 (0.017)	-0,086 (0.005)
Retailer 4	0,366 (0.024)	-0,041 (0.002)
Retailer 5	0,565 (0.030)	-0,037 (0.002)
Retailer 6	1,313 (0.023)	0,322 (0.009)
Retailer 7	-0,085 (0.010)	-0,020 (0.001)
Retailer 8	1,047 (0.033)	-0,003 (0.001)

The standard deviations in parenthesis refer to variation across periods.

Table 16: Difference between the retailers and the manufacturers ratios

	Manufacturer 1	Manufacturer 2	Manufacturer 3	Manufacturer 4	Manufacturer 5
Retailer 1	0.0061 (0.0002)	0.0029 (0.0002)	0.0017 (0.0002)	0.0012 (0.0000)	-
Retailer 2	-0.0667 (0.0005)	-0.0710 (0.0018)	-0.0498 (0.0018)	-0.0628 (0.007)	-0.0437 (0.0039)
Retailer 3	-0.0050 (0.0003)	-0.0077 (0.0003)	-0.0080 (0.0006)	-0.0089 (0.0003)	-0.0022 (0.0026)
Retailer 4	-0.0064 (0.0003)	-0.0097 (0.0015)	-0.0057 (0.0015)	-0.0096 (0.0006)	-0.0008 (0.0000)
Retailer 5	-0.0106 (0.0004)	-0.0121 (0.0010)	-0.0122 (0.0016)	-0.0145 (0.0004)	-0.0047 (0.0078)
Retailer 6	-0.0443 (0.0003)	-0.0373 (0.0005)	-0.0375 (0.0019)	-0.0496 (0.0012)	-0.0037 (0.0206)
Retailer 7	0.0057 (0.0002)	0.0030 (0.0001)	0.0015 (0.0002)	0.0010 (0.0000)	-0.0002 (0.0000)
Retailer 8	-0.0252 (0.0008)	-0.0217 (0.0015)	-0.0162 (0.0006)	-0.0229 (0.0011)	-

The difference between the two ratios is $\frac{1}{\lambda_{rm}} \frac{\pi_t^r - d_t^r}{-\partial \pi_t^r / \partial w_{rbt}} - \frac{1}{1-\lambda_{rm}} \frac{\pi_t^m - d_t^m}{\partial \pi_t^m / \partial w_{rbt}}$.

The standard deviations in parenthesis refer to variation across periods.