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Sugar Policy Reform, Tax Policy and Price Transmission in the Soft Drink Industry.

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Abstract

There is growing interest in evaluating the impact of price variations in agricultural commodities on food prices and consumption. Food industries typically consist of large firms that benefit from market power and price transmission along the chain is affected by this imperfectly competitive environment. In this paper, we propose an empirical analysis of the impact of a reform of the EU sugar policy on the soft drink industry. The reform produces a significant decrease in the price of sugar. We consider how the manufacturers and the retailers both strategically react to this change in the production cost of soft drinks. Using a structural econometric model, we first estimate the consumer substitution patterns and the models for the vertical relationships between the soft drink industry and the retail industry. After selecting the 'best' model for vertical relationships, we simulate the impact of the sugar policy reform. We show that the retail prices decrease more than the marginal production costs. Our results thus suggest that the assumption of passive pricing by the industry leads to a poor estimate of the impact of an upstream cost shock. We also simulate the impact of a recently enacted excise tax on soft drinks. Because of strategic pricing, this tax is likely to lead to an increase of approximately 10% in prices thereby decreasing the soft drink consumption by more than 3 liters per person per year.

JEL codes:H32, L13, Q18, I18

Key words: vertical contracts, two-part tariffs, competition, manufacturers, private labels, retailers, differentiated products, soft drinks, non-nested tests, sugar policy, pass-through.

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1 Introduction

Even in developed countries a significant portion of the population is extremely concerned about food price inflation. On average, in the EU27, food expenditure accounts for 22.2% of the total expenditures of the consumers in the first quintile of income. There is an even larger proportion of 30% seen in eight EU27 countries. Consumers in the third quintile of income devotes 14%, 19.1% and 25.2% of their total expenditures to food in France, Spain and Hungary, respectively (Eurostat data).

Following the peak of agricultural commodity prices in 2007-2008, the food price inflation in the EU has shown considerable discrepancy across countries (Bukeviciute et al., 2009). For example, from July 2007 to August 2008, the consumer food price index increased by less than 4% in France while simultaneously rising by over 6% in Austria, Denmark, Ireland and the UK and over in Hungary. According to these authors, the elasticity of consumer food prices to producer food prices was approximately 25% in the UK, which was larger than the 30% observed in Sweden, and lower than the 15% observed in Romania or the 15 - 20% observed in the Eurozone on average. The speed of adjustment in the consumer price to a change in the producer price is also quite variable. Although the price transmission of food prices along the food chain is relatively well documented through time-series analysis (e.g. Vavra and Goodwin, 2005), the main determinants of food price transmission remain unclear. Few structural analyses have addressed the functioning of the food chain and its implications in term of price transmission. OECD (2011) expects that over the coming decade the real prices for many agricultural products could increase by 20% to 30% higher compared with the prices in 2001-2010. Furthermore, increased volatility in the prices is forecasted. Therefore, the explanations of the transmission of price variations is of increasing interest.

Food chains typically consist of large firms with market power. Many food categories are highly concentrated: the concentration ratio for the top four industries is above 50%. For instance, the concentration ratio for the top four ice cream producers was over 58%, that in the soft drinks category was 64% and that in the savory biscuits category was 68% in Europe in 2001 (Bukeviciute et al., 2009). At the retail level, because of the concentration process of recent decades, the top five supermarket retailers now account for over 50% of the groceries market in many EU countries. This consolidation process could impact the balance of power between food producers and retailers. We are then faced with an imperfectly competitive environment in food chains. The theoretical literature that explores price transmission in this context is limited. Carbonnier (2006) shows that under a Cournot competition, the cost pass-through might be less than or greater than 100% and particularly depends on the curvature of the demand curve.[1] Anderson et al. (2001) investigated price transmission in a Bertrand competition with differentiated products. The empirical literature has more examples. Note that in this literature, the pass-through rates are frequently reported in the elasticity form rather than as a level. As soon as there is a wedge between the price and the marginal cost in the market the pass-through in the elasticity form becomes lower than the pass-through as a level. For example, Nakamura and Zerom (2010) studied the US coffee industry and reported a long-run pass-through of coffee commodity prices to retail prices of 0.252 in elasticity form and 0.916 in level form. Interestingly, they showed that the markup adjustment explained a significant part of the incomplete pass-through in this market. Bettendorf and Verboven (2000) reached a similar conclusion in their analysis of the coffee market in Europe. Hellerstein (2008) showed that the markup adjustment at the manufacturer and the retailer levels plays an important role in explaining the incomplete pass-through of cost changes (arising from changes in the exchange rate) in the beer industry. In this case, the markup adjustment accounts for approximately half of the explanation for the incomplete pass-through. Overall, these papers suggest that firms should strategically adjust their markups when facing a change in their input costs. Kim and Cotterill (2008) suggested that the pass-through rate is lower under collusive behavior than under more competitive behavior in the US processed cheese industry. Bonnet et al. (2009) showed that the pass-through rate for upstream cost shocks in the ground coffee category to the downstream retail prices depends on the form of the contracts between the manufacturers and the retailers. For example, the pass-through rate is 10 percentage points higher with resale price maintenance than with standard non-linear pricing.

[1] Following Kim and Cotterill (2008), we assume that the 'cost pass-through rate is defined as the proportion of a change in input cost that is passed through to the final price of the product'.

In this paper, we investigate the potential impact on consumer prices of a recent reform of the EU sugar policy taking into account the markup adjustment of the manufacturers and the retailers. Over the last 20 years, the sugar price in the European Union (EU) was well above the world market price. A combination of a price floor, import duties, export subsidies and quotas was used to sustain the domestic price (European Commission, 2004). Moreover because of a restrictive quota, high fructose corn syrup (HFCS) did not substitute for sugar in the EU as it did in the US.[2] Thus, in the EU, the price of caloric sweeteners was higher than that in other countries. In February 2006, a reform of the EU sugar policy was agreed upon (Union Européenne, 2006). The reference price, which roughly acts as a floor price, was reduced by 36% over a 4-year period starting in 2006.

Sugar is used as an input in many food industries. In particular, it is an important input for the soft drink (SD) industry because the sugar content of SDs ranges from 6% to 11%. Moreover, the sugar costs range from 7 to 24% of the final price of SDs. The anticipated 36% decrease in the price of sugar could have a significant impact on consumer prices. Our approach is original because it addresses with a vertical chain that is composed of oligopolies. The SD industry is highly concentrated, as is the retail industry. It is thus necessary to explicitly address imperfect competition in the chain to analyze how any changes in input costs are transmitted to the final consumers. This paper uses structural econometric models that accounts for the structure of the industry: in particular the horizontal and vertical interactions between the manufacturers and the retailers, unlike the pass-through analysis of Kim and Cotterill (2008), which assumes that manufacturers and retailers are vertically integrated. Using estimates for the consumers' demand in the French SD market, we recover price cost margins from several supply models as in Berto Villas-Boas (2007) and Bonnet and Dubois (2010). We then select the model that best fits the data. Using this selected model, we quantify the impact of the alternative scenarios on prices, on the market's share of the different SDs and on consumption. We first analyze the effects of the EU sugar policy reform and then address the impact of an excise tax on SDs that was recently voted for by the French representatives. Our results suggest that the manufacturers and the retailers use two-part tariff contracts

[2] For an analysis of competition between sugar and HFCS in the EU, see Cooper et al. (1995). For an analysis of the US market, see Beghin et al. (2003).

and transmit an amount greater than the cost change to their consumers. The pass-through rate of a cost change is approximately 1.1. Ignoring the strategic effect then leads to biased estimates of the impact of the sugar policy reform. As a consequence, the decrease in sugar prices will lead to a decrease in the consumer price of over 4% for regular SDs, thereby generating a consumption increase greater than 9% for the regular products, to the detriment of the diet products. The 0.0716 €/liter tax on SDs has a large impact on both consumer prices and on consumption. In particular, because of strategic pricing, the tax is over-transmitted to consumers with a pass-through rate of 1.14. When the tax is applied to all products, the aggregate consumption of soft drinks decreases by approximately 3.4 liters per person per year which represents roughly 15% of the initial consumption.

This paper is organized as follows. Section 2 presents the main characteristics of the SD industry. Section 3 presents the data and the descriptive statistics regarding soft drink consumption. Section 4 describes the model and the methods that are used to analyze the demand and to infer the more likely vertical relationships between manufacturers and retailers. In Section 5, we discuss demand and supply results and cost estimates. In Section 6, we present the results of the policy simulations and we conclude this paper in Section 7.

2 The soft drink market

In 2004, the turnover of the French soft drink industry reached 2.2 billion euros, which is 1.6% of the total turnover of the French food industry. SDs represent approximately 11% of the consumption of beverages in France which includes mineral water, alcohol, coffee, tea, drinking-milk and fruit juices.[3] On average, SD consumption increased by 32% from 1994 to 2004.[4] Nevertheless, the per capita consumption in France (42.5 liters per year) remains lower than that in the EU (71.2 liters on average). Market analysts frequently distinguish between carbonated soft drinks, or sodas (e.g. colas, tonics, carbonated fruit drinks, lemonade) and non-carbonated soft drinks (e.g. iced tea, fruits drinks). In France in 2004, carbonated

[3] Canadean 2004, website http://www.canadean.com/.

[4] Note that the consumption of diet drinks increased by 224% from 1994 to 2004. Nevertheless, the market share is still below 20%.

and non-carbonated SDs represented 78.5% and 21.5% of the market, respectively. The three main categories of SD are colas (54% of all SDs), fruit drinks (25% for both carbonated and non-carbonated products) and iced tea (8%). Soft drinks do not include fruit juices and nectars, which represent a significant portion of beverage consumption. These products do not contain a significant proportion of added sugar and they are thus not directly affected by the change in sugar price.[5] In our analysis, they are included in the 'outside' option for consumers because they are substitutes for SDs.

In general, there are two versions of each SD: a regular version which is sweetened using caloric sweeteners, mainly sugar in France, and a diet version which is sweetened using non-caloric sweeteners such as aspartame or acesulfame. The two primary ingredients of regular SDs are water (approximately 90%) and sweetener (approximately 10%). The primary ingredient of a diet soft drink is water (99.7%). Obviously, soft drinks also contain food additives such as food coloring, artificial flavoring, emulsifiers and preservatives.

The industry is highly concentrated with the top two manufacturers (the alliance of Coca Cola Enterprises and Cadbury Schweppes and, the alliance of Unilever and Pepsico) sharing 88.6% of the total production in 2004. Each of the manufacturers owns a brand portfolio even if Coca Cola and Pepsico are mainly involved in colas products and Unilever in iced tea. This situation is the result of two mergers: Coca-Cola Enterprises and Cadbury Schweppes merged their European drink industries in 1999, and Unilever and Pepsico together created Pepsi Lipton International in 2003.

3 Data

We use consumer panel data collected by TNS WordPanel which is a French representative survey of 19,000 households over a three-year period (2003-2005). This survey provides information on the purchases of food products (quantity, price, brand, characteristics of goods, store). According to our sample, the average consumption of regular soft drinks is 34 liters per person per year, whereas the average consumption of diet products is 8 liters per person per year.

[5] Fruit juices do not contain added sugar whereas nectar contains less than 6% of added sugar.

From the panel data, we selected the eleven primary national brands (NB) from the soft drink industry as well as three private labels (PL), one for each of the three categories of products (colas, iced tea, fruit drinks). We selected the nine largest retailers in France, which are grocery store chains and differ by the size of their outlets as well as by the services that they provide to consumers. Three of the selected retailers primarily have large outlets (larger than 2,500 m^2) located in suburbs and two primarily have intermediate-sized outlets (from 400 to 2,500 m^2) that are generally located near small cities. Two retailers have both large and intermediate size outlets. Finally, the last two retailers are discounters with outlets of small to intermediate size. Taking into account the set of products carried by each retailer we obtain 105 (or 104, depending on the period) differentiated products that compete on the market.[6]

Market shares are defined as follows. We first consider the total market for non-alcoholic beverages including soft drinks, fruit juice and nectar. This market is considered to be the relevant market. The market shares of a given brand at a given retailer is defined as the ratio of the sum of the quantities of the brand purchased at the selected retailer during a period of four weeks and the sum of quantities of all brands purchased at all of the retailers in the relevant market during the same period. The outside option (which represents 66% of the entire market) is composed of two elements: purchases of fruit juice and nectar (40% of the market) and purchases of other SDs (77 brands with a very low market share for a total of 11% of the market) or purchases of the considered SDs at non-considered retailers (66 other retailers as well as other distribution channels for a total of 16% of the market).

As shown in Table 1, the products selected for our analysis represent 33.8% of the entire market. The average price over all products and all periods is 0.76 euros per liter. Regular products dominate, as they represent approximately 80% of the SD purchases; their prices is 15% lower than the price for the diet products. PLs hold approximately 27% of the SD market and are sold at approximately half of the price of NBs.

We provide additional information on the SD market (excluding the 'outside goods') in the Annexes (Tables 6 and 7). Brands 1 to 11 are NBs whereas brands 12 to 14 are PLs. The main NB has a market

[6] From the consumer perspective, a product is the combination of a brand and a retailer.

Table 1: **General Descriptive Statistics for Prices and Market Shares.**

		Prices (in euros per liter) Mean (std)	Market Shares Mean in %
Outside Good			66.2
Soft Drinks		0.76 (0.02)	33.8
	Regular products	0.73 (0.02)	80.8
	Diet products	0.88 (0.03)	19.2
	National brands	0.89 (0.02)	73.1
	Private labels	0.40 (0.01)	26.9

share of over 30% (of the soft drink market), whereas the least popular one has less than 1% of the market. The market share for the private label products varies between 6 and 12%. The average NB prices vary from 0.74 to 1.12 €/l, whereas PL prices range from 0.38 to 0.54 €/l. The market shares of the retailers are also heterogenous and vary from 2% to 20%. On average, the prices at the different retailers are similar except at retailers 8 and 9, which sell at significantly lower prices because a large share of their sales is derived from private labels.

4 Models and methods

To analyze strategic pricing in the food chain, we follow a general methodology that was recently developed to analyze vertical relationships between manufacturers and retailers (e.g. Berto Villas-Boas, 2007; Bonnet and Dubois, 2010). We consider a demand model to obtain the price elasticities of demand for every product. The model needs to be as flexible as possible, and we therefore opt for a random coefficients logit model (Berry et al., 1995; McFadden and Train, 2000). Strategic pricing in the channel can be modified by the nature of the contracts between the firms in the sector or by the vertical restraints considered. We design, as suggested by Bonnet et al. (2009), alternative models for the vertical relationships between the processors and the retailers. From the first-order conditions and estimates of demand, we are able to calculate the price cost margins for manufacturers and retailers, from which we deduce the cost estimates. To choose the vertical relationship model that best fits the data, we first estimate a cost model where the calculated cost for each vertical relationship model is the endogenous variable, and we then use a non-nested Rivers and Vuong (2002) test to select the best model. Finally, using the selected model, we simulate the impact of the alternative price policies (the reform of the sugar policy and the excise tax on SDs) on consumers' prices and consumption. In the following, we provide a brief summary regarding the main assumptions and methods. The reader will find more extensive explanations regarding the details of the method in Bonnet and Dubois (2010).

4.1 The Demand Model: a random coefficients logit model

We use a random coefficients logit model to estimate the demand and the related elasticities. The indirect utility funtion V_{ijt} for consumer i buying product j in period t is given by

$$V_{ijt} = \beta_j + \gamma_t - \alpha_i p_{jt} + \rho_i l_j + \sum_{k=1}^{2} \tau_{ik} c_{k(j)} + \xi_{jt} + \varepsilon_{ijt}$$

where β_j are product fixed effects that capture the (time invariant) unobserved product characteristics, γ_t are the time fixed effects that capture time demand shocks, p_{jt} is the price of product j in period t, α_i is the marginal disutility of the price for consumer i, l_j is a dummy related to an observed product characteristic (which takes the value of 1 if product j is a diet product and 0 otherwise), ρ_i captures consumer i's taste for the diet characteristic, $c_{k(j)}$ is a dummy that takes the value of 1 if product j belongs to product category k, τ_{ik} represents the consumer i's taste for category k, ξ_{jt} captures the unobserved variation in the product characteristics and ε_{ijt} is an unobserved individual-specific error term. We assume that α_i, ρ_i and τ_{ik} vary across consumers. Indeed, consumers can have a different price disutility or different tastes for the diet characteristic or for categories of products considered. We assume that distributions of α_i, ρ_i and τ_{ik} are independent and that the parameters have the following specification:

$$\begin{pmatrix} \alpha_i \\ \rho_i \\ \tau_{i1} \\ \tau_{i2} \end{pmatrix} = \begin{pmatrix} \alpha \\ \rho \\ \tau_1 \\ \tau_2 \end{pmatrix} + \Sigma v_i$$

where $v_i = (v_i^{\alpha}, v_i^{\rho}, v_i^{\tau_1}, v_i^{\tau_2})'$ a 4x1 vector that captures the unobserved consumers characteristics. Σ is a 4×4 diagonal matrix of parameters $(\sigma_\alpha, \sigma_\rho, \sigma_{\tau_1}, \sigma_{\tau_2})$ that measures the unobserved heterogeneity of the consumers. We suppose that $P_v(.)$ is a parametric distribution of v_i. We can then break down the indirect utility into a mean utility $\delta_{jt} = \beta_j + \gamma_t + \alpha p_{jt} + \rho l_j + \sum_{k=1}^{2} \tau_k c_{k(j)} + \xi_{jt}$ and a deviation from this mean utility $\mu_{ijt} = \left[p_{jt}, l_j, c_{1(j)}, c_{2(j)}\right] \left(\sigma_\alpha v_i^\alpha, \sigma_\rho v_i^\rho, \sigma_{\tau_1} v_i^{\tau_1}, \sigma_{\tau_2} v_i^{\tau_2}\right)'$. The indirect utility is given by $V_{ijt} = \delta_{jt} + \mu_{ijt} + \varepsilon_{ijt}$. The consumer can decide not to choose one of the considered products. Thus, we introduce an outside option that allows for substitutions between the considered products and a substitute. The utility of the outside good is normalized to zero. The indirect utility of choosing the outside good is $V_{i0t} = \varepsilon_{i0t}$.

Assuming that ε_{ijt} is independently and identically distributed like an extreme value type I distribution, we are able to write the market share of product j at period t in the following way (Nevo, 2001):

$$s_{jt} = \int_{A_{jt}} \left(\frac{\exp(\delta_{jt} + \mu_{ijt})}{1 + \sum_{k=1}^{J_t} \exp(\delta_{kt} + \mu_{ikt})} \right) dP_\nu(\nu) \tag{1}$$

where A_{jt} is the set of consumers who have the highest utility for product j in period t, a consumer is defined by the vector $(\nu_i, \varepsilon_{i0t}, ..., \varepsilon_{iJt})$. We assume that P_ν is independently and normally distributed with means of α, ρ, τ_1, τ_2, and standard deviations of σ_α, σ_ρ, σ_{τ_1}, σ_{τ_2}.

The random coefficients logit model generates a flexible pattern of substitutions between products that is driven by the different consumer price disutilities α_i. Thus, the own and cross-price elasticities of the market share s_{jt} can be written as:

$$\frac{\partial s_{jt}}{\partial p_{kt}} \frac{p_{kt}}{s_{jt}} = \begin{cases} -\frac{p_{jt}}{s_{jt}} \int \alpha_i s_{ijt}(1 - s_{ijt})\, \phi(v_i) dv_i & \text{if } j = k \\ \frac{p_{kt}}{s_{jt}} \int \alpha_i s_{ijt} s_{ikt}\, \phi(v_i) dv_i & \text{otherwise.} \end{cases} \tag{2}$$

4.2 Supply models: vertical relationships between processors and retailers

The economics literature has extensively explored the vertical relationships between manufacturers and retailers (e.g. Rey and Vergé, 2004). In food retailing, the upstream and downstream industries are highly concentrated and it is well known that linear contracts are not efficient in a chain of oligopolies because the profit of the chain is not maximized. Indeed, this situation provides incentives to agents to design more sophisticated contracts such as non-linear contracts and particularly two-part tariff contracts. In the empirical literature, two-part tariff contracts were only recently integrated into the analysis (Berto Villas-Boas, 2007; Bonnet and Dubois, 2010). In this paper, we consider linear pricing, characterized by Bertrand-Nash competition at the downstream and upstream levels, and a set of two part-tariff contracts where the processors have all of the bargaining power.[7] The general framework of the vertical relationships is described by the following game:

- Stage 1: Manufacturers simultaneously propose take-it or leave-it contracts to retailers. Depending on the supply model, we define only the wholesale price if we assume a linear contract, or we define both a fixed fee and a wholesale price if we assume a two part tariff contract. Finally, we specify consumer price in addition to the fixed fee and the wholesale price for the contracts that include resale price maintenance;

- Stage 2: Retailers simultaneously accept or reject the offers that are public information. If a retailer rejects one offer, he obtains his outside option which has a positive fixed value if the private labels are not acknowledged or otherwise is the profit coming from private labels;

- Stage 3: Retailers set consumer prices.

In the following, we briefly present the general methodology. The profit of retailer r is given by:

$$\Pi^r = \sum_{j \in S_r} [M(p_j - w_j - c_j)s_j(p) - F_j]$$

where M is the size of the market, S_r is the set of products that retailer r sells, w_j and p_j are the wholesale and retail prices of product j, $s_j(p)$ is the market share of product j and c_j is the constant marginal cost to distribute product j. In the specific case of private labels, we assume that they are sold to retailers at the marginal cost by the producing firms.[8]

[7] This primarily affects how profits are shared (through the fixed fees) rather than the choices of prices that we are studying here. According to Rey and Vergé (2004), equilibrium prices would be the same if retailers have all of the bargaining power. We will also justify this assumption when analyzing the results of the demand analysis.

[8] A retailer defines the characteristics of its own private label. It then delegates the production of this product to a manufacturer. In this process the retailer organizes competition among producers for a given product. This competition is interpreted to be a price competition with a homogenous product that leads to a selling price that is equal to the marginal costs. For additional information on private labels, refer to Bergès-Sennou et al. (2004).

Assuming price competition among retailers and assuming the existence of the equilibrium, the first-order conditions are given by:

$$s_j + \sum_{k \in S_r} [(p_k - w_k - c_k)] \frac{\partial s_k}{\partial p_j} = 0 \quad \forall j \in S_r, \quad \text{for } r = 1, ..., R \tag{3}$$

These are standard conditions that define the Bertrand-Nash equilibrium at the third stage of the game. These conditions are valid regardless of whether manufacturers propose linear prices or two-part tariffs. These conditions do not hold with resale price maintenance because in that case, the retailers do not have any strategic role in determining the prices of the national brands; rather the manufacturers determine the consumer prices of the national brands.

In the following we focus more on two-part tariff contracts, as the linear case (double marginalization) is now well known (refer to Sudhir, 2001; Berto Villas-Boas, 2007; Bonnet and Dubois, 2010). Let us define μ_j as the constant marginal cost to produce product j and G_f as the set of products that are sold by manufacturer f. The manufacturer maximizes its profit

$$\Pi^f = \sum_{j \in G_f} [M(w_j - \mu_j) s_j(p) + F_j]$$

subject to the participation constraints of each retailer, i.e. for all $r = 1, .., R$, $\Pi^r \geq \sum_{j \in \widetilde{S}_r} M(\widetilde{p}_j^r - w_j - c_j) s_j(\widetilde{p}^r)$ where $\widetilde{S}_r$ is the set of private labels belonging to retailer r and $\widetilde{p}^r = (\widetilde{p}_1^r, ..., \widetilde{p}_J^r)$ is the vector of prices when retailer r sells only its private labels. By convention, we have $\widetilde{p}_j^r = +\infty$ for all brands sold by retailer r except for private labels. The vector of the market shares $s(\widetilde{p}^r)$ thus corresponds to the market shares when retailer r sells only its private labels.

Manufacturers can adjust franchise fees such that all constraints are binding. The use of the participation constraint of retailer r allows us to re-write the profit of manufacturer f as (see details in Appendix):

$$\Pi^f = \sum_{j \in G_f} M(w_j - \mu_j) s_j(p) + \sum_{j=1}^{J} M(p_j - w_j - c_j) s_j(p) - \sum_{r=1}^{R} \sum_{j \in \widetilde{S}_r} M(\widetilde{p}_j^r - w_j - c_j) s_j(\widetilde{p}^r) - \sum_{j \notin G_f} F_j$$

Thus, the profit of a manufacturer is no longer a function of the fixed fees attached to its products. Rather the profit depends on the fixed fees set by the other manufacturers. Thus, the maximization problem becomes simple to solve and everything occurs as if the manufacturer chooses wholesale prices, i.e. when there is no resale price maintenance, or consumer prices, i.e. when there is resale price maintenance.

We first consider the case where the manufacturers can use resale price maintenance in their contracts with the retailers. In this case, the manufacturers propose the franchise fees F as well as the retail prices p to the retailers. Note that the wholesale prices have no direct effect on the profits[9]. Therefore, the program of manufacturer f is given by

$$\max_{\{p_k\}_{k\in G_f}} \sum_{j\in G_f} M(w_j-\mu_j)s_j(p)+\sum_{j=1}^{J} M(p_j-w_j-c_j)s_j(p)-\sum_{r=1}^{R}\sum_{j\in\widetilde{S}_r} M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r).$$

We deduce the first order conditions for this manufacturer's program as

$$\sum_{j\in G_f}(w_j-\mu_j)\frac{\partial s_j(p)}{\partial p_k}+s_k(p)+\sum_{j=1}^{J}(p_j-w_j-c_j)\frac{\partial s_j(p)}{\partial p_k}-\sum_{r=1}^{R}\sum_{j\in\widetilde{S}_r}(\widetilde{p}_j^r-w_j-c_j)\frac{\partial s_j(\widetilde{p}^r)}{\partial p_k}=0\quad\forall j\in G_f,\qquad\text{for } f=1,...,N_f \tag{4}$$

The above conditions only apply for NBs. For PLs, the retailers maximize their profit with respect to the retail prices of PLs:

$$\max_{\{p_k\}_{k\in\widetilde{S}_r}}\sum_{j\in\widetilde{S}_r}(p_j-\mu_j-c_j)s_j(p)+\sum_{j\in S_r\backslash\widetilde{S}_r}(p_j^*-w_j-c_j)s_j(p^*)$$

where p_j^* represents the equilibrium price of NBs chosen by the manufacturers. Thus, for PLs, additional equations are obtained from the first-order conditions of the profit maximization of retailers which both produce and retail these products:

$$\sum_{j\in\widetilde{S}_r}(p_j-\mu_j-c_j)\frac{\partial s_j(p)}{\partial p_k}+s_k(p)+\sum_{j\in S_r\backslash\widetilde{S}_r}(p_j^*-w_j-c_j)\frac{\partial s_j(p^*)}{\partial p_k}=0\qquad\forall j\in\widetilde{S}_r,\qquad\text{for } r=1,...,R \tag{5}$$

Basically, the system of the equations 4 and 5 characterizes the equilibrium, which depends on the structure of the industry at the manufacturer and retailer levels and also on the shape of the demand curve. It should be noted that, because wholesale and retail margins cannot be identified in this system, it is necessary to include additional assumptions about the margins. As in Bonnet and Dubois (2010),

[9] The wholesale prices of the manufacturer f have no direct effect on profits but they have a strategic role in the retail price choices because they affect the profits of the other manufacturers.

we assume zero wholesale margins for national brands ($w_j - \mu_j = 0$) or, alternatively, zero retail margins for national brands ($p_j - w_j - c_j = 0$).

When resale price maintenance is not allowed, manufacturer f maximizes its profit with respect to wholesale prices:

$$\max_{\{w_k\}_{k\in G_f}} \sum_{j\in G_f} M(w_j - \mu_j)s_j(p) + \sum_{j=1}^{J} M(p_j - w_j - c_j)s_j(p) - \sum_{r=1}^{R}\sum_{j\in \widetilde{S}_r} M(\widetilde{p}_j^r - w_j - c_j)s_j(\widetilde{p}^r).$$

from which we deduce the first order conditions $\forall j \in G_f, \quad \text{for } f = 1, ..., N_f$:

$$\sum_{j\in G_f}(w_j - \mu_j)\frac{\partial s_j(p)}{\partial w_k} + \sum_{j=1}^{J}\frac{\partial p_j}{\partial w_k}s_j(p) + \sum_{j=1}^{J}(p_j - w_j - c_j)\frac{\partial s_j(p)}{\partial w_k} - \sum_{r=1}^{R}\sum_{j\in \widetilde{S}_r} M(\widetilde{p}_j^r - w_j - c_j)\frac{\partial s_k(\widetilde{p}^r)}{\partial w_k} = 0 \quad (6)$$

The equilibrium is then characterized by the system of equations 6 where the retail price response matrix to the wholesale prices that contains the first derivative of the retail prices with respect to the wholesale prices is obtained by totally differentiating 3, and the retail margins are deduced from 3.

In summary, we consider seven different models: double marginalization, two part tariffs with or without resale price maintenance and without the role of PLs; and two-part tariffs with or without resale price maintenance and with the role of PLs.[10]

4.3 Cost specification and testing between the alternative models

Once the demand model is estimated and given the assumptions regarding the structure of the industry and the vertical interactions between the manufacturers and the retailers, price-cost margins are estimated. We thus obtain estimated costs $C_{jt}^h = p_{jt} - \Gamma_{jt}^h - \gamma_{jt}^h$ for each product j in period t for any supply model h, where $\Gamma_{jt}^h = w_{jt}^h - \mu_{jt}^h$ is the manufacturer's margin for product j and $\gamma_{jt}^h = p_{jt}^h - w_{jt}^h - c_{jt}^h$ is the retailer's margin for product j.

We specify a fixed effects model for the estimated marginal costs and assume that it takes the following specification:

$$C_{jt}^h = \sum_{k=1}^{K}\lambda_k^h W_{jt}^k + w_j^h + w_{jy(t)}^h + \tau_t^h + \eta_{jt}^h$$

[10] Note that we consider two versions of contracts with resale price maintenance: zero wholesale margins for national brands ($w_j - \mu_j = 0$) or, alternatively, zero retail margins for national brands ($p_j - w_j - c_j = 0$).

where W_{jt} is a vector of inputs, w_j^h represents the product fixed effects for model h, $w_{jy(t)}^h$ allows us to differentiate the product fixed effect for product j across the years and τ_t^h is the monthly fixed effect for model h. We suppose that $E(\eta_{jt}^h | W'_{jt}, w_j^h, w_{jy(t)}^h, \tau_t^h) = 0$ to consistently identify and estimate $\lambda_k^h, w_j^h, w_{jy(t)}^h$ and τ_t^h. To be consistent with the economic theory Gasmi et al. (1992), we impose the positivity of parameters λ_k^h and use a non-linear least square method to estimate them. We use this cost function specification to test any pair of supply models C_{jt}^h and $C_{jt}^{h'}$ and we infer which model is statistically the best using a non nested Rivers and Vuong (2002) test.

4.4 Simulations

Using the estimated marginal costs from the preferred model for contracts in the vertical chain as well as the other estimated structural parameters from the demand estimation, we can simulate the policy experiments of interest (a decrease in sugar price and an excise tax). We denote $C_t = (C_{1t}, .., C_{jt}, .., C_{Jt})$ as the vector of marginal costs for all products present in period t, where C_{jt} is given by $C_{jt} = p_{jt} - \Gamma_{jt} - \gamma_{jt}$. For example, to model the impact of a change in the sugar price, we have to solve the following program:

$$\min_{\left\{p_{jt}^*\right\}_{j=1,..,J}} \left\| p_t^* - \Gamma_t\left(p_t^*\right) - \gamma_t\left(p_t^*\right) - \widetilde{C}_t \right\|$$

where $\|.\|$ is the Euclidean norm in $\mathbb{R}^J$, γ_t and Γ_t correspond respectively to the retail and wholesale margins for the best supply model and $\widetilde{C}_t$ is the vector of marginal cost estimated using the new sugar price. The taxation of SDs is modeled by adding a constant to the marginal cost of production. Then, modeling the impact of a tax in addition to a change in sugar price is obtained by adding the amount of the tax to $\widetilde{C}_t$.

5 Results for demand and vertical relationships

5.1 Demand results

We estimated the random coefficients logit model using the well-known GMM method proposed by Berry et al. (1995), Nevo (2000) and Nevo (2001). This method requires the use of a set of instruments to solve an omitted variables problem. Indeed, prices can be correlated with the error term of the demand equations because any unobserved characteristics that are included in the error term could be correlated with prices (e.g., advertising, promotions). To obtain unbiased price effects, we choose instruments that affect the marginal cost curve. Then, if the unobserved factors such as advertising or promotion change, thereby affecting the demand, the estimated price is not affected. In practice, we use input price indices for wages, plastic, aluminium, sugar and gasoline as it is unlikely that these input prices are correlated with any unobserved demand determinants.[11] These variables are interacted with the manufacturers' dummies because we expect that manufacturers obtain different prices from suppliers for raw materials and that the quality of plastic and aluminium can change depending on the manufacturers.

Table 2 shows the results of the demand model estimates by GMM that account for consumer heterogeneity regarding price sensitivity and the taste for observed product characteristics.[12] First, note that the over-identifying restriction test is not rejected which indicates that the instruments are valid. On average, the price has a significant and negative impact on utility. Given the value of the price standard deviation, only 0.1% of the distribution of the price coefficient is positive. The coefficient of the dummy that identifies diet products is positive on average, which means that consumers like this characteristic. The soda category is preferred to the fruit drink category, but consumers prefer fruit drinks to iced teas. However, the standard deviations for both categories are large, which means that some consumers prefer these categories and others do not.

Using the structural demand estimates, we are able to compute own and cross-price elasticities for each

[11] These indices are from the French National Institute for Statistics and Economic Studies.

[12] This estimation was achieved using 500 draws for the parametric distribution that represents the unobserved consumer characteristics and for the non-parametric distribution of the consumer demographics.

Table 2: **Results of the random-coefficients logit model.**

Coefficients (Std. error)	Mean	Standard Deviation
Price	-7.04(0.41)	2.35 (0.43)
Diet	0.52 (0.02)	0.26 (0.23)
Soda category	1.90 (0.02)	2.96 (0.45)
Ice tea category	-0.71 (0.02)	2.89 (0.59)
Coefficients δ_j, γ_t not shown		
Overidentifying Restriction Test (df)	19.43 (15)	

differentiated products (Table 3).[13] The own-price elasticities of demand for a brand vary between -2.37 and -4.90 with an average value of -4.06. The own price elatisticities of the NBs (average value of -4.6) are larger, in absolute value, than the own price elasticities of the PLs (average value of approximately -2.6). Other studies of the soft drink market report own price elasticities of a similar magnitude. For example, Gasmi et al. (1992) estimate own price elasticities of -2 for Coca-Cola and Pepsi-Cola. For the carbonated soft drink US market, Dhar et al. (2005) distinguished 4 brands and found own-price elasticities between -2 and -4. Dube (2005) found elasticities ranging from -3 to -6 in the Denver area. It is interesting to note that the substitutions primarily occur between products in the same categories.

To investigate whether consumers have a strong brand preference we compare the following alternatives for a consumer. If the price of a brand increases, does a consumer switch to an other brand that is sold by the same retailer, or does the customer prefer to switch between retailers in order to buy the same brand? As shown by Steiner (1993), if the customer prefers to switch the brand, then the bargaining power is in favor of the retailers; otherwise it is in favor of the manufacturers. We report in Table 3 the average of the cross-price elasticities of each brand computed within a retailer (switch of brand) and within the same brand (switch of retailers). The results depend on the products. It is interesting to note that for the leading products (product 3 is the leading regular product and product 4 is the leading diet product) consumers prefer to switch their retailer to buy the prefered brand rather than switching to an

[13] The own price elasticity of a brand reported in the table 3 is the average of the own-price elasticity of this brand for the different retailers. We also calculate two average cross-price elasticities for each brand. The first elasticity (within a retailer) is the average over all retailers of the average of cross-price elasticities of a brand with respect to any other brand sold at a retailer. The second elasticity (between the same brands) is the average of cross price elasticities of a brand with respect to the same brand sold at any other retailer. All averages are weighted averages, and we use market shares as to weight them.

Table 3: **Cross Price Elasticities between products**

Brands		Within a retailer	Between same brands
B1	-4.20 (0.17)	0.003 (0.001)	0.001 (0.0004)
B2	-4.36 (0.17)	0.004 (0.001)	0.002 (0.0006)
B3	-4.60 (0.13)	0.039 (0.006)	0.182 (0.025)
B4	-4.84 (0.12)	0.021 (0.005)	0.031 (0.009)
B5	-4.78 (0.20)	0.005 (0.002)	0.012 (0.007)
B6	-4.90 (0.20)	0.001 (0.001)	0.0005 (0.0004)
B7	-4.31 (0.21)	0.004 (0.002)	0.003 (0.001)
B8	-4.42 (0.19)	0.005 (0.002)	0.004 (0.002)
B9	-4.35 (0.19)	0.003 (0.001)	0.001 (0.0007)
B10	-4.08 (0.20)	0.003 (0.001)	0.002 (0.001)
B11	-4.17 (0.14)	0.002 (0.001)	0.001 (0.0003)
B12	-2.37 (0.13)	0.005 (0.001)	0.012 (0.003)
B13	-2.76 (0.23)	0.002 (0.001)	0.012 (0.004)
B14	-2.69 (0.10)	0.003 (0.001)	0.006 (0.001)

other brand sold by the same retailer. This preference is also the case for the PLs. PLs are significantly cheaper than NBs. If the price of a PL increases at a retailer, a consumer could prefer to buy another PL (from another retailer) rather than buying a NB from the same retailer. This result suggests that some manufacturers have market power in this market ,which is consistent with our assumption regarding the game that gives all bargaining power to the manufacturers.

5.2 Preferred model, price-cost margins and cost estimates

Using the demand estimates, we are able to compute the price cost margins for each supply model. On the basis of the Rivers and Vuong tests (see the results in Table 10 in the appendix) the best supply model is the model where the manufacturers and the retailers use two-part tariff contracts with resale price maintenance[14], the wholesale margin is equal to zero, and where the private labels have no strategic role in the manufacturer-retailer relationships. This result is consistent with the idea that in this industry, brands are strong and thus provide market power to the upstream producers. According to these results, the price cost margins are 45.25% of the consumer price, on average. The margins are

[14]Resale price maintenance (RPM) is prohibited by the competition authorities. However, in France, specific laws for the retail industry have led to a situation where it is, in practice, possible to implement RPM (Biscourp et al., 2008).

relatively heterogeneous across brands (see Table 8 in the appendix). The average price-cost margins for the PLs (38.65%) are significantly lower than those for the NBs (47.43%). The price-cost margins do not differ across retailers except for retailer 8 which has lower margins because it only sells PLs, and retailer 9, which has a higher average margin because it sells brands 1 and 2 with high margins as well as PLs. The estimated marginal cost calculated from the best supply model is 0.45€/liter on average. The average marginal cost of the PLs (0.30€/liter) is lower than that of the NBs (0.50€/liter).

6 Simulations

We define three policy scenarios. Scenario 1 simulates the impact of a significant decrease in the EU sugar price. As explained above, the reference price of sugar, which roughly acts as a floor price, was reduced by 36% over a 4-year period starting in 2006.[15] The actual decrease from 2006 to 2010 was approximately 25% from 636 €/t in 2006 to 477 €/t in April 2010.[16] Scenarios 2 and 3 simulate the excise tax of €0.0716 per liter for soft drinks voted on December 28, 2011 by the French representatives. Because there was a debate about the scope of the tax, we simulate both the initial proposal, which taxes only regular, or sweetened, products (scenario 2), and the selected proposal, which taxes both regular and diet products (scenario 3).

6.1 The impact of the sugar policy reform

Consistent with the anticipated impact of EU sugar policy reform, we simulate a 36% decrease in the sugar price.[17] Using the estimated marginal cost specification for the best supply model, we find a decrease of 2.61 € cents/liter (or 8.34%) in the total marginal cost of regular soft drinks, which is very close to the estimate obtained with an accounting calculation (approximately 2 € cents/liter). Cost decreases vary

[15] The reference price for white sugar was 631.9€/t from July 1, 2006 to September 30, 2008. It was 541.5€/t from October 1, 2008 to September 30, 2009 and 404.4€/t after October 1, 2009.

[16] http://ec.europa.eu/agriculture/minco/manco/cmo/index.htm

[17] The impacts on price and consumption are roughly linear in terms of the percentage change of sugar price. The impact of a 25% decrease in sugar price (as observed from 2006 to 2010) will then be roughly equal to 25/36 of the reported results.

across brands (Table 4) because the sugar content and the marginal cost differ across brands. Thus, the marginal cost of a PL is lower than the marginal cost of a NB, which partly explains the larger percent decrease in the marginal cost of the PLs.

Table 4: **Impact of a decrease in the sugar price**

			Change in cost in % Mean (std)	Change in price in % Mean (std)	Pass-through $\triangle p/\triangle c$ Mean (std)	Change in MS in % Mean (std)
Brand 1	NB	R	-12.84 (1.60)	-4.87 (0.19)	1.09 (0.03)	11.79 (1.27)
Brand 2	NB	D	–	0.85 (0.11)	-	-12.12 (0.90)
Brand 3	NB	R	-7.14 (0.39)	-3.57 (0.10)	1.09 (0.03)	9.18 (1.06)
Brand 4	NB	D	–	0.75 (0.08)	-	-11.48 (0.81)
Brand 5	NB	R	-3.35 (0.21)	-2.05 (0.13)	1.07 (0.03)	3.63 (0.76)
Brand 6	NB	D	–	0.57 (0.06)	-	-8.94 (0.73)
Brand 7	NB	R	-4.13 (0.22)	-2.82 (0.16)	1.16 (0.03)	7.74 (0.70)
Brand 8	NB	R	-4.26 (0.15)	-3.14 (0.11)	1.23 (0.04)	9.77 (0.55)
Brand 9	NB	D	–	0.66 (0.06)	-	-7.47 (0.86)
Brand 10	NB	R	-5.09 (0.37)	-3.28 (0.19)	1.13 (0.03)	9.19 (0.63)
Brand 11	NB	R	-5.31 (0.28)	-3.57 (0.13)	1.17 (0.03)	10.82 (0.59)
Brand 12	PL	R	-18.22 (1.79)	-8.96 (0.42)	1.03 (0.01)	12.16 (0.89)
Brand 13	PL	R	-9.58 (1.34)	-5.25 (0.26)	1.06 (0.02)	7.60 (0.72)
Brand 14	PL	R	-9.65 (0.49)	-6.13 (0.20)	1.11 (0.01)	12.86 (0.43)

On average, in response to the price cut, consumer prices decrease by 4.48% for the regular products. Note that the percent price decrease for the PLs is larger than that for the NBs because the PLs are cheaper than the NBs. For regular products, the pass-through, which is measured by the ratio of the difference in retail prices to the difference in marginal costs, has an average value of 1.10. Therefore, if the marginal cost decreases by 1 € cent/liter the retail price decreases by an average of 1.10 € cents/liter. The industry thus overshifts the cost decrease. This result is consistent with the supply model. Indeed, the contract that best fits the data (two part-tariff contracts with resale price maintenance and zero manufacturer gross margins; in the following, we denote this contract as the 'selected' contract) allows the industry to behave non-competitively. This contract maximizes the total profit of the entire chain in the absence of private labels (Bonnet and Dubois, 2010). Moreover, Rey and Tirole (2007) showed that a monopoly producer facing several retailers can use this type of contract to implement a monopoly situation. Carbonnier (2006) showed that under imperfect competition the cost pass-through could be less than or greater than 100% depending on the curvature of the demand. This result is also consistent with the reduced form analysis of Campa and Goldberg (2006) who found that the pass-through rates in the food industry in France are larger than one (1.41). Besley and Rosen (1999) also found, in the case of the US, that the SD industry overshifts tax changes. According to them, this overshifting is a consequence of the imperfect competition in this industry.

The pass-through varies by brand from 1.03 to 1.23; therefore it is important to consider the strategic behavior of the producers of differentiated products. It should be acknowledged that the model integrates the brand portfolio of the manufacturers. Thus manufacturers choose a pricing policy for the entire set of products, thereby internalizing the substitution among their own set of products. The price of diet products does not change significantly; it increases by less than 1%. As a result of these strategic reactions, the aggregate market share of the regular products increases by 9.56% by replacing diet products, whose market share decreases by 10.85%, and the outside option, whose market share decreases by 5.6%.[18]

6.2 The impact of a tax on soft drinks

As mentioned above, the appropriate scope of SDs taxation was debated by the French parliament. For some representatives the proposed tax (7.16 € cents/liter) should apply only to the sweetened (regular) SDs. In this case, the tax would increase public revenues (the main objective) but it could also reduce the consumption of sweetened SDs. The tax was presented as an 'obesity tax' because a high consumption of sweetened SDs is frequently associated with obesity; this idea is opposed by the representatives of the French Food Industry (ANIA) who are strongly against the idea of a health policy based on taxation. In the end, the scope of the tax was enlarged to include all SDs, regardless of whether they incorporate added sugar, and is no longer presented as an obesity tax. We simulate both options and evaluate the changes created by the tax (Table 5).

The proposed tax is approximately 10% of the price of the SDs. When the tax only applies to regular products, the price of the regular products increases by over 13%, on average. Strategic pricing increases

[18] Note that the price of the outside option is assumed to be unchanged, which is a limit in the analysis. However, a significant part of the goods in the outside option will not be affected by the decrease in the sugar price as those goods do not contain any added sugar.

Table 5: **Impact of a decrease in sugar price and a sugar content based taxation**

		Change in Price %	ΔConsumption liter/pers/year
	Regular products	13.62 (0.53)	-4.11 (0.08)
Tax on	NBs	9.48 (0.32)	-2.48 (0.07)
regular SDs	PLs	21.95 (0.94)	-1.63 (0,08)
	Diet products	-1.69 (0.24)	1.15 (0.02)
	Regular products	12.90 (0.52)	-3.02 (0.09)
Tax on	NBs	8.42 (0.28)	-1.54 (0.05)
all SDs	PLs	21.93 (0.94)	-1.48 (0.08)
	Diet products	7.91 (0.30)	-0.37 (0.02)

In (), standard deviation

the tax by approximately 10%. The increase is much larger for PLs than for NBs. This difference mainly occurs because the initial price of the PLs is approximately half of the price for the NBs. As a consequence the market share of the PLs decreases to a larger extent than that of the NBs. The price of the diet products is slightly adjusted. The consumption of regular products decreases by over 4 liters/person/year, which represents 22% of the initial consumption. The consumption of diet products increases by over 1 liter, which is approximately 33% greater than the initial consumption. Thus, there is a significant shift from regular to diet products. When the tax applies to all SDs, the prices for the diet products significantly increases (by approximately 8% because their initial price is higher than the price of the regular products). The prices of the regular products are adjusted. The impact on the consumption of SDs is greater than that in the first case because the tax is extended to all products. However, the consumption of regular SDs decreases by 3 liters/person/year, i;e. it is 25% lower than in the previous case.

7 Conclusion

This paper provides a general methodology to evaluate price transmission in vertically related markets. This method allows us to assess the effects of changes in input prices as well as tax policies on consumer prices and food consumption while taking into account the pricing strategies of manufacturers and retailers in the food chain. As an example, we analyze the impact on the soft drink industry of a change in the sugar price or the introduction of an excise tax. Using the recent development of empirical industrial organization, we have estimated a very flexible demand model, a random coefficients logit model, and several models for the vertical relationships within the industry. We have shown that the most likely supply model is the model where the manufacturers and the retailers use two-part tariff contracts with resale price maintenance and where the private labels play no role in the manufacturer/retailer relationships. In this case, the manufacturers have a significant market power which is a consequence of the strength of their brands. This result is consistent with anecdotal evidence regarding this specific industry, such as the advertising investments of firms to build a strong reputation. Using this model, we have simulated the impact on prices for alternative policy scenarios that take into account the strategic choices of agents. We have shown that, on average, the pass-through is greater than 1; the industry would then transmit more than the change in cost (when analyzing a change in input cost) or more than the excise tax to the consumers. Our results then suggest that the assumption of passive pricing by the industry would result in an under-estimation of the change in retail prices and thus in consumption.

According to these results, any analysis of the impact of food price policies requires that the strategic pricing of the firms be addressed. One difficulty is that we cannot easily extrapolate our results to other industries. Neither the type of contracts used by a specific industry nor the qualitative results (e.g., the overshift of cost changes) can be generalized. First, the structure of the upstream industry plays a role in the choice of contracts between the processors and the retailers. In the specific case of food markets, the structure of the upstream industry varies significantly from a low level of concentration (e.g., the meat industry or the wine industry) to a high level of concentration (e.g., the processed cheese industry or the water industry). Second, the strategic response depends on the curvature of the demand, which is also market-specific. As a consequence, the empirical analysis of price transmission in a given industry requires that the vertical relationships of this specific industry be evaluated first.

Our analysis of the impact of the tax is related to the market conditions in 2003-2005. To extrapolate the results to the present situation, at least two elements must be integrated. First, the size of the market has certainly changed between 2005 and 2011. Second, SD prices have changed, and thus the shock created by the tax as a percentage is different.

One limitation of our analysis is the implicit assumption that the price of the outside option does not changed, regardless of the policy. With this assumption the products included in the outside option are supposed not to be directly affected by the policy scenarios. In our case, many goods in the outside option will not be affected by a decrease in the sugar price because these goods do not contain any added sugar and they will also not be affected by the proposed excise tax. However, this assumption also means that the producers and the retailers of the outside good do not strategically react to any changes in the prices of the market under scrutinity. This option is acceptable if the market of the outside option is sufficiently competitive.

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8 Appendices

8.1 Descriptive statistics on data

Table 6: **Descriptive Statistics for Prices and Market Shares by Brands.**

	Prices (in euros per liter) Mean (std)	Market Shares Mean in % (std)
Brand 1	0.67 (0.03)	2.52 (0.43)
Brand 2	0.70 (0.03)	3.13 (0.64)
Brand 3	0.87 (0.02)	33.06 (2.72)
Brand 4	0.90 (0.02)	13.08 (0.96)
Brand 5	1.03 (0.04)	3.85 (1.21)
Brand 6	1.03 (0.05)	0.71 (0.22)
Brand 7	1.00 (0.04)	3.80 (0.52)
Brand 8	1.11 (0.03)	3.74 (0.81)
Brand 9	1.00 (0.05)	2.41 (0.60)
Brand 10	0.86 (0.05)	4.40 (0.69)
Brand 11	0.90 (0.02)	2.50 (0.36)
Brand 12	0.33 (0.01)	9.04 (0.66)
Brand 13	0.43 (0.03)	5.80 (1.14)
Brand 14	0.44 (0.01)	11.90 (1.13)

Table 7: **Descriptive Statistics for Prices and Market Shares by Retailers.**

	Prices (in euros per liter) Mean (std)	Market Shares Mean in % (std)
Retailer 1	0.86 (0.03)	13.32 (0.95)
Retailer 2	0.85 (0.03)	16.54 (1.12)
Retailer 3	0.87 (0.03)	8.14 (0.58)
Retailer 4	0.84 (0.03)	12.42 (0.97)
Retailer 5	0.77 (0.02)	20.49 (1.13)
Retailer 6	0.80 (0.04)	8.85 (0.80)
Retailer 7	0.89 (0.03)	5.21 (0.37)
Retailer 8	0.48 (0.02)	1.96 (0.30)
Retailer 9	0.35 (0.1)	13.02 (1.30)

8.2 Detailed proof of the manufacturers profit expression

Manufacturers can adjust franchise fees such that all constraints are binding. So the participation constraint for the retailer r becomes:

$$\sum_{j\in S_r}[M(p_j-w_j-c_j)s_j(p)-F_j]=\sum_{j\in\widetilde{S}_r}M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r)$$

$$\sum_{j\in S_r}F_j=\sum_{j\in S_r}M(p_j-w_j-c_j)s_j(p)-\sum_{j\in\widetilde{S}_r}M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r)$$

$$\sum_{j\in G_f}F_j+\sum_{j\notin G_f}F_j=\sum_{r=1}^{R}\sum_{j\in S_r}F_j=\sum_{j=1}^{J}M(p_j-w_j-c_j)s_j(p)-\sum_{r=1}^{R}\sum_{j\in\widetilde{S}_r}M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r)$$

$$\sum_{j\in G_f}F_j=\sum_{j=1}^{J}M(p_j-w_j-c_j)s_j(p)-\sum_{r=1}^{R}\sum_{j\in\widetilde{S}_r}M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r)-\sum_{j\notin G_f}F_j$$

Therefore, we can re-write the profit of the manufacturer as:

$$\Pi^f=\sum_{j\in G_f}M(w_j-\mu_j)s_j(p)+\sum_{j=1}^{J}M(p_j-w_j-c_j)s_j(p)-\sum_{r=1}^{R}\sum_{j\in\widetilde{S}_r}M(\widetilde{p}_j^r-w_j-c_j)s_j(\widetilde{p}^r)-\sum_{j\notin G_f}F_j \quad (7)$$

8.3 Price-cost margins

Table 8: **Margins for the prefered model.**

Brands	Total margins in %	Retailers	Total margins in %
B1	63.7 (3.5)	R1	49.4 (2.2)
B2	61.7 (3.6)	R2	49.7 (2.2)
B3	53.9 (2.1)	R3	47.5 (1.9)
B4	53.0 (2.4)	R4	47.9 (2.1)
B5	42.6 (1.4)	R5	49.1 (1.4)
B6	42.6 (2.1)	R6	46.5 (1.8)
B7	40.9 (0.7)	R7	47.9 (2.1)
B8	40.0 (0.6)	R8	33.0 (1.5)
B9	41.0 (0.8)	R9	54.4 (2.4)
B10	42.8 (1.0)		
B11	42.1 (0.8)		
B12	49.8 (2.6)		
B13	42.2 (3.6)		
B14	40.7 (1.3)		

8.4 Cost function

Table 9: **Estimation of the marginal cost function.**

Coefficients (Std. error)	$\mathbf{C}_{jt}$
Wages	8.81 (0.24)
Plastic	7.64 (0.23)
Aluminium	10.15 (0.34)
Water	10.53 (0.26)
Gazole	8.72 (0.26)
Sugar	0.08 (0.00)
Coefficients $w_j^h, w_{jy(t)}^h$and w_t^h not shown	
F test for w_j^h (p value)	99.91 (0.00)
F test for w_t^h (p value)	12.19 (0.00)

Results are provided at 10^{-4}.F tests for $w_{jy(t)}^h$ show that the year fixed effects by product are always significant.

8.5 Non-nested tests

Table 10: **Non-nested Rivers and Vuong tests.**

Rivers and Vuong Test Statistic T_n						
$\diagdown$	H_2					
H_1	**2**	3	4	5	6	7
1	**-4.64**	-3.92	2.23	-4.15	-2.62	2.46
2		**11.90**	**2.27**	**4.75**	**7.07**	**2.51**
3			2.26	-2.20	4.18	2.50
4				-2.27	-2.25	0.68
5					8.19	2.50
6						2.49

Model 1 is double marginalisation, Model 2 is two part tariffs with resale price maintenance and $w = \mu$, Model 3 is two part tariffs with resale price maintenance and $p - w - c = 0$, Model 4 is two part tariffs without resale price maintenance, Model 5 is two part tariffs with resale price maintenance and $w = \mu$ and private labels buyer power, Model 6 is two part tariffs with resale price maintenance, $p - w - c = 0$ and private labels buyer power, Model 7 is two part tariffs without resale price maintenance and private labels buyer power