The Retail Services, The Market Power, and the Vertical Relationships in the Breakfast Cereals Industry

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Abstract

This article extends the Berry, Levinsohn, Pakes (1995) model to include retail services by Boston supermarkets in an equilibrium model of breakfast cereals and then tests alternative vertical pricing games between manufacturers and supermarkets to ascertain who's got the pricing power. Empirical results show that retail services play a significant role in market equilibrium. Consumers are willing to pay for additional retail services embedded in their cereal purchases, especially those with higher income and no kids. Markups and market shares increase with the level of retail services, although manufacturers dominate pricing decisions in the market channel for breakfast cereals. Significant downward biases in price elasticities and markup estimates result when services are ignored..

Key words: vertical relationships, discrete choice, supermarkets, market channel JEL codes: L11, L13, L66

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1. Introduction

The increasing importance of services in industrialized economies is reflected in the relative importance of service in product offerings at the retail level. Yet, typical industrial organization studies account only for physical product attributes of differentiated product demand system models. Although they employ retail level data, they ignore retail price and service conduct (Betancourt and Gantschi, 1993; Froeb et al., 2005). Since relatively few large supermarket chains dominate many local metropolitan retail food markets and have substantial purchasing power in wholesale food markets, ignoring this retail price and service conduct in brand level demand models may substantially bias any analysis of food manufacturing conducts. In this article, we examine the effects of supermarket pricing and services as well as the more standard measure of product characteristics on the distribution of consumer's preferences.

We focus on ready-to-eat cereals (RTECs) in Boston. Heterogeneity in the provision of supermarket retail services can take several forms, from upscale food operations –such as bakery, prepared foods and seafood departments, to non-food departments –such as pharmacies, banking and flower shops. By extending the scope of services, in fact, supermarkets facilitate one-stop shopping which results in convenience and time savings. The impact of the scope of retail services on market equilibrium depends on how service levels affect the primitives of market demand and costs, as well as market power.

Retail services affect demand for products because consumers value services beyond the physical attributes of the product in question. Consumers' willingness to pay for convenience, such as one-stop shopping, has been clearly documented in the business management literature. As such, RTEC brands are differentiated by the supermarket characteristics where they are sold as well as by their attributes. However, there is a cost associated with the scope of retail services. The conventional wisdom is that low-service retailers incur lower costs per unit and generally charge lower prices for otherwise identical products (Wolinsky, 1983). Indeed, this is a rationale behind big-box retailers, small limited assortment, such as Aldi, and small scale supermarkets, such as Food Leon. Nonetheless, the possibility of economies of scope makes it possible that average costs may actually drop with services in larger superstores and supercenters. Given that retail services affect the primitives of the market, i.e., demand and costs, they ultimately affect retail prices.

The market for RTECs are subject to multidimensional competition. Supermarkets with a greater scope of services will be able to capture a larger share of the market which increases horizontal market power. At the same time, it is unclear who's got the power in the vertical market channel and how the inclusion of retail services affect such results. The usual suspect has been the RTEC manufacturers, via muting price competition and engaging in non-price competition (Schmalensee, 1978; Scherer, 1982; Nevo, 2001) [1]. Previous studies have not modeled the retailing stage of the marketing channel to determine the relative contribution of retailers and manufacturers to channel price-cost margins and the role of retail services. Though Villas-Boas (2007) uses store level data to analyze the vertical relationships between retailers and manufacturers, the study ignores the retail service conduct. Moreover, it includes only few stores, hence sidestepping the chain level strategy.

This article contributes to the literature in two important ways. First, it extends the Berry, Levinsohn and Pakes (BLP, 1995) model of market equilibrium to ready-to-eat cereals (RTECs) in Boston by including consumer taste for the scope of retail services, applied to 37 brands of RTECs at the supermarket chain level in Boston. Second, it tests and compares alternative pricing games between RTEC manufactures and supermarkets in order to assess their relative market power and the consequences of including services, using a two-stage pricing model which is implemented assuming a Nash-Bertrand competition at each stage.

The scope of retail services are defined via principal components of retail configuration variables, including the square footage of the supermarkets, the presence of pharmacies, restaurants, and seafood and bakery departments. The approach here is to define a service quality index for each supermarket chain at a given time period and use it along with intrinsic brand characteristics in the indirect utility function. Empirical results confirm that services play a strong role in product differentiation and supermarket equilibrium. The findings are important and robust: On the demand side, higher-income consumers with few or no kids are willing to pay more for RTECs with added services, resulting in larger market shares for supermarkets with a greater scope of services. On the supply side, manufacturers dominate pricing decisions in the market channel for breakfast cereals.

2. RTEC Manufacturers and Supermarket Services

A prominent feature of the RTEC manufacturing industry is its high level of sales concentra-

[1] Bhuyan and Lopez(1997) and Gedjdenson and Schumer (1999) rank the RTEC industry as the most collusive and the one earning the highest price-cost margins among all U.S. food manufacturing industries. Nevo (2001) finds that high industry markups are not due to collusive, i.e. coordinated, behavior among breakfast cereals manufacturers but rather to product variety given consumer willingness to pay for their favorite brand and unilateral pricing power by firms supplying a portfolio of substitute brands.

tion, a measure of market structure traditionally used as a proxy for market power. The top four companies-Kellogg, General Mills, Post and Quaker Oats, account for approximately 82% of all RTEC sales. As noted by Nevo (2001) and Scherer (1982), the major RTEC manufacturers de-emphasize price competition and rather engage in non-price competition, i.e., product proliferation, advertising and couponing. Indeed, there are some 200 brands of RTECs today. Leading companies produce several brands to cover every possible niche in the market to deter market penetration by small firms and private label RTECs (Schmalensee, 1978). To strengthen brand loyalty, RTEC producers spend between 10 and 15 % of sales in mass-media advertising (Connor, 1999), among the highest in food advertising while coupons cover 17 to 20 % of sales.

Due to the lack of price competition, the price-cost margins in the industry are the highest across U.S. food manufacturers, ranging between 60 and 70% of sales (Bhuyan and Lopez, 1997; Connor, 1999). Currently, the industry is experiencing a moderate decline in revenues from its peak of $9.5 billion in 1995 due to a partial retreat from non-price marketing strategies (Cotterill and Franklin, 1999)and to competition from new breakfast alternatives, especially breakfast away from home. In addition, the industry is responding to parents' concern about the obesity epidemic by introducing products with reduced sugar and calorie content.

Supermarkets are the last players in the food distribution channel to consumers. Like other retailers, they rely on the concept of joint supply which gives them the possibility of carrying different manufacturing products and providing other services in a single location, hence reducing transaction costs (Blumenthal and Cohen, 1998). Supermarket appeared in the 1930s and they have evolved to many formats including the supermarket superstore, defined by the Progressive Grocer as any full-line, self-service grocery store with a sales volume of $8 million or more annually, with at least 30,000 square feet, offering an expanded selection of non-food items and specialty departments. Other large scale formats with extensive services include the combination food/drug store and supercenters (eg. Wal-mart, Target, K-Mart).

In Boston, the supermarket industry is dominated by four supermarket chains: Stop & Shop, Shaw's, DeMoulas and Star Market, who jointly control more than 71% of total food retail sales in Boston. As Table 1 shows, the Stop & Shop chain is clearly the dominant chain in the Boston area. Founded in 1914, it is now owned by Dutch retail giant Royal Ahold. It employs more than 58,000 workers and is the largest food retailer in New England. Shaw's Supermarkets is the second largest chain in terms of sales, operating approximately 200 stores and it is now owned by Albertson's. De Moulas is the largets privately owned retail chain in New England, operating about 60 stores. Star Market has a significance presence in the older, more densely populated urban areas, operating smaller stores than their suburban counterparts. All four chains offer various levels of retail services such as banking, bakery, a seafood department, restaurants and snack bars, salad bars, and non-food items. Stop & Shop offered more non-food services such as in-store banks and pharmacies in 1997 than the other supermarket chains. In contrast, Shaw's offered more food services such as bakery, salad and seafood departments. A similar pattern, with less intensity, was followed by Star Market while DeMoulas offered the most limited scope of services.

Service quality is a multidimensional and elusive concept. The approach we follow here is to define supermarket services using eight variables: grocery sales, square footage of the store, and the presence of in-store banking facilities, in-store pharmacy, bakery, seafood department, salad bar, and snack bar. Given the correlation across these variables and to reduce the dimension of the data while preserving their core variation across supermarkets, we use principal components analysis to construct an index of services offered[2]. All commodity sales volume is the key contributor to the index, followed by square footage, banking, pharmacy, bakery, salad bar, and snack bar services. Thus, this implies that size and non-food services are the primary contributors to an index of supermarket service levels.

In terms of RTEC pricing, these four supermarket chain charge significantly different prices for the same RTEC products (see Table 1). The price rankings by manufacturers, however, reflect national figures. For example, the price of Kellogg's Corn Flakes, arguably the most undifferentiated RTEC, varies as much as 15% across Boston supermarkets while Cheerios varies as much as 24%. On average, Star Market charges higher prices for RTECs and Shaw's the lowest. Although price differences may reflect differences in retail costs (as urban stores cost more to operate), we hypothesize that the scope of services play a significant role in explaining those price differences. Boston supermarkets also exercise oligopoly power in certain food items such as milk (Chidmi, Lopez and Cotterill, 2005; Lass, 2005), this may be due to the collection of side payments for allocation of shelf space, i.e., slotting allowances, and substantial bargaining power when negotiating trades promotions with manufacturers.

[2]In some situations, when the dimension of the data set is large and the variables are correlated, it is useful to reduce the dimension of the data. The principal component analysis (PCA) is an effective procedure for reducing the dimensionality of the data. The PCA has three effects. First, it orthogonalizes the components of the matrix of data so that the variables are uncorrelated with each other. Second, it orders the resulting orthogonal components (principal components) so that those with the largest variation come first. Finally, it eliminates the components that contribute the least to the variation of the data set. The PCA proceeds as follows. First, the variables are normalized so that they have zero mean and unity variance. Second, the PCA method generates a new set of variables (principal components) that are a linear combination of all the original variables. All the principal components are orthogonal to each other so that the information is not redundant.

In addition, there are some differences in terms of the mix of RTECs carried by the four chains. It is also clear that the ranking of manufacturer-specific retail prices varies by supermarkets. All manufacturers realize that they make a quarter of their sales at Stop & Shop. At Shaw's, the second largest supermarket chain, Kellogg has surprisingly minimum presence while the smaller manufacturers (Quaker and Ralston) are disproportionally represented. No previous study has investigated the vertical relationship between RTEC manufacturers and supermarkets. A model to provide the basis for such analysis is presented below.

3. The Model

Demand

We slightly modify the BLP model to include retail services in the indirect utility as well as the interaction between prices and services. The indirect utility of consumer i from buying one unit of brand j (U_{ij}) is given by [3]

$$U_{ijt} = \alpha_i p_{jt} + \beta_i x_{jt} + \gamma_i Sr_{jt} + \lambda_i p_{jt} Sr_{jt} + \epsilon_{ijt}, \quad i = 1, ...n; j = 1, ...J \tag{1}$$

where x_{jt} is a vector of the observed product characteristics of brand j at time t, p_{jt} is the price of brand j at time t ,Sr_{jt} is the service offered by supermarket stores, α_i, β_i, γ_i and λ_i are taste parameters unique to each consumer, and ϵ_{ijt} represents the distribution of consumer preferences around the unobserved product characteristics with a probability density function $f(\epsilon)$. For notational simplicity, the time subscript is dropped in what follows.

Following BLP, let $\alpha_i = \alpha_0 + \alpha_1 D_i + \alpha_2 v_i$, $\beta_i = \beta_0 + \beta_1 D_i + \beta_2 v_i$, $\gamma_i = \gamma_0 + \gamma_1 D_i + \gamma_2 v_i$ and $\lambda_i = \lambda_0 + \lambda_1 D_i + \lambda_2 v_i$, where D_i denotes observed consumer characteristics (e.g.., demographics) with a probability density function $h(D)$; v_i denotes the unobserved consumer characteristics with a probability density function $g(v)$, assumed to be normally distributed with mean zero and variance one; and $\theta_1 = (\alpha_0, \beta_0, \gamma_0, \lambda_0)$ and $\theta_2 = (\alpha_1, \alpha_2, \beta_1, \beta_2, \gamma_1, \gamma_2, \lambda_1, \lambda_2)$ denote fixed

[3]We will limit our analysis to the random coefficients model (referred here as BLP model). The superiority of the random coefficients model to the traditional logit model is well documented. Readers interested by the comparison of the two models are referred to Nevo (2000, 2001) and Villas-Boas (2007), for instance.

parameters. Substituting in (1) yields:

$$U_{ij} = \underbrace{\alpha_0 p_j + \beta_0 x_j + \gamma_0 Sr_j + \lambda_0 p_j Sr_j}_{\delta_j}$$
$$+ \underbrace{\alpha_1 D_i p_j + \alpha_2 v_i p_j + \beta_1 D_i x_j + \beta_2 v_i x_j + \gamma_1 D_i Sr_j + \gamma_2 v_i Sr_j + \lambda_1 D_i p_j Sr_j + \lambda_2 v_i p_j Sr_j + \epsilon_{ij}}_{\mu_{ij}} \tag{2}$$

The mean utility term, δ_j, is common to all consumers, and the deviation from that mean, μ_{ij}, accounts for interactions between consumer and product (including service) characteristics.

Let $k = 0$ denotes an outside good if the consumer decides not to buy any of the J brands (e.g., buys breakfast alternatives). Each consumer purchases a unit of the brand that yields the highest utility. Aggregating over consumers, the market share of the j^{th} brand corresponds to the probability that the j^{th} brand is chosen. That is,

$$s_j(p, x, \theta_2) = \int I\{(D_i, v_i, \epsilon_{ij}) : U_{ij} \geq U_{ik} \forall k = 0, ..., J\} dH(D)dG(v)dF(\epsilon) \tag{3}$$

where I is the indicator function, $H(D)$, $G(v)$ and $F(\epsilon)$ are cumulative density functions for the indicated variables, assumed to be independent from each other.

Using (3), the price elasticities of the market shares for individual brands are:

$$\eta_{jk} = \frac{\partial s_j}{\partial p_k}\frac{p_k}{s_j} = \left\{ \begin{array}{ll} \frac{p_j}{s_j}\int(\alpha_i + \lambda_i Sr_j)s_{ij}(1 - s_{ij})dH(D)dG(v), & for j = k, \\ -\frac{p_k}{s_j}\int(\alpha_i + \lambda_i Sr_j)s_{ij}s_{ik}dH(D)dG(v), & otherwise \end{array} \right. \tag{4}$$

To the extent that the market shares depend on the scope of services, then price elasticities will depend on the scope of services as well.

An important feature of the above model is that it allows to analyze how consumers trade-off between the services, Sr, offered by the supermarkets and the retail prices p. Higher services imply higher cost for the supermarkets and consequently higher retail prices.

Holding the level of utility and the product characteristics constant, the trade-off between the supermarkets services and the retail prices can be determined by totally differentiating (2)

$$dU_{ij} = \alpha_i dp_j + \gamma_i dSr_j + \lambda_i p_j dSr_j + \lambda_i Sr_j dp_j = 0 \tag{5}$$

Or

$$\frac{dp_j}{dSr_j} = -\frac{\gamma_i + \lambda_i p_j}{\alpha_i + \lambda_i Sr_j}, \tag{6}$$

Equation (6) is of a practical importance in at least two aspects. First, it gives the relationship between the retail prices and the supermarkets service level. Second, the estimation of equation (6) allows obtaining the distribution of the consumers's trade-off between retail prices and services. As the right hand-side of equation (6) varies across consumers' demographics (through α_i, γ_i, and λ_i), this trade-off will vary depending on how consumers value services and prices. Supermarkets could benefit by having an in depth knowledge of the characteristics (Income and the number of kids for example) of the consumers attracted by services.

Supply

This section examines the vertical relationship between RTEC manufacturers and retailers in the Boston market in the context of retail service. The model presented tests and compares alternative vertical pricing games between RTEC manufacturers and supermarkets in order to assess their relative market power. We specify a two-stage pricing model with a Nash-Bertrand horizontal competition among firms at each stage. Following Villas-Boas (2007), we specify and compare four different vertical competition scenarios to assess the bargaining power of RTEC manufacturers vs. supermarkets: (1) vertical Nash-Bertrand pricing or double marginalization; (2) non-linear pricing with a two-part tariff contract; (3) non-linear pricing with dominant retailers; and (4) non-linear pricing with dominant manufacturers.

Double Marginalization Scenario

Double marginalization occurs when the manufacturer and the retailer add a margin to their marginal costs, making the consumers face two margins. This is also described as vertical Nash-Bertrand or "arms length" pricing by manufacturers and retailers (Choi, 1991). Beginning with the retail problem, consider that there are N_r retailers in the retail market, and N_w manufacturers competing in the wholesale market. The retailer's problem is to maximize profit, given by

$$\pi_r = \sum_{j \in S_r} (p_j - w_j - c_j^r) s_j(p) M, \tag{7}$$

where S_r is the set of brands sold by the r^{th} retailer, w is the wholesale price the r^{th} retailer pays for brand j , c_j^r is the retailer's marginal cost for brand j, s_j is the market share of brand j , and M

is a measure of the market size. The first order conditions are given by

$$s_j + \sum_{k \in S_r} (p_k - w_k - c_k^r) \frac{\partial s_k(p)}{\partial p_j} = 0 \tag{8}$$

Repeating the same procedure for each retailer and each brand and stacking all the first order conditions together, one obtains the implied retailers' price-cost margins

$$p - w - c^r = -(T_r * \Delta_r)^{-1} s(p), \tag{9}$$

where T_r is the retailer's ownership matrix with the general element $T_r(i,j)$ equal to one when the brands i and j are sold by the same retailer and zero otherwise; Δ_r is a matrix of first derivatives of market shares with respect to all retail prices. The matrix $(T_r * \Delta_r)$ is the element by element multiplication of the two matrices.

Turning now to the upstream level, each manufacturer sets the wholesale price in order to maximize profit, given by

$$\pi_w = \sum_{j \in S_w} (w_j - c_j^w) s_j(p(w)), \tag{10}$$

where S_w represents the set of brands produced by manufacturer m , and c_j^w is the marginal cost of producing the brand j. The first order conditions are given by

$$s_j + \sum_{k \in S_w} (w_k - c_k^w) \frac{\partial s_k(p(w))}{\partial w_j} = 0. \tag{11}$$

Similarly, defining a matrix of manufacturers ownership, T_w, and a matrix of manufacturers' response, Δ_w, and stacking all the first order conditions together, we get

$$w - c^w = -(T_w * \Delta_w)^{-1} s(p). \tag{12}$$

In equation (10), the matrix Δ_w is more complicated to compute than the matrix Δ_r due to the composite effect of the wholesale prices on the market shares. The elements of this matrix are given by $\frac{\partial s_j(p(w))}{\partial w_j} = \frac{\partial s_j}{\partial p_j} \frac{\partial p_j}{\partial w_j}$.

In matrix notation, the manufacturers response matrix can be written as $\Delta_w = \Delta_p' \Delta_r$, where Δ_p' is a matrix of derivatives of all the retail prices with respect to all the wholesale prices [4].

[4] Following Villas-Boas (2000), the first derivatives of retail prices with respect to the wholesale prices can be

Finally,the implied price-cost margins for the whole channel are obtained by summing up (7) and (10).

$$p - c^r - c^w = -(T_r * \Delta_r)^{-1}s(p) - (T_w * \Delta_w)^{-1}s(p) \tag{13}$$

Non-Linear Pricing Scenario

Non-linear pricing behavior occurs when the manufacturer sets the price equal to marginal cost and lets the retailer be the residual claimant. The retailer pays the manufacturer part or the full surplus in the form of a fixed fee, depending on the power they have. In a one-manufacturer-one retailer case, this pricing model (known as a two-part tariff) is optimal under a demand certainty assumption (Tirole, 1988) when the retailers follow manufacturers in setting prices. In the case of multiple manufacturers and retailers, the non-linear pricing model can be analyzed under the framework proposed by Rey and Verg$\acute{e}$ (2004); where the manufacturer proposes a two-part tariff contract that consists of a wholesale price w_j, a franchise fee F, and the retail price p_j. The retailer then sets the retail price to maximize his profits given by

$$\pi_r = \sum_{j \in S_r} (p_j - w_j - c_j^r)s_j(p)M - F_j. \tag{14}$$

The first order conditions are similar to the ones given by equation (6) and the implied price-cost margins are given by equation (7).

For the manufacturer, the profit maximization problem consists of choosing the wholesale prices and the franchise fee, given that the retailer behaves according to equation (7). On the other hand, each manufacturer takes the franchise fees of other manufacturers as given. This implies the following constrained profit maximization:

$$\begin{array}{l} Max \;\; \pi_w = \sum_{j \in S_w} (w_j - c_j^w)s_j(p(w)) + F_j \\ s.t. \;\; \pi_r = \sum_{k \in S_r} (p_k - w_k - c_k^r)s_k(p(w)) - F_k \geq 0 \quad \forall r. \end{array} \tag{15}$$

Proceeding as in Rey and Verg$\acute{e}$ (2004) [5] the manufacturer's problem becomes

$$Max \; \pi_w = \sum_{j \in S_w} (w_j - c_j^w)s_j(p(w)) + \sum_{j \in S_r} (p_j - w_j - c_j^r)s_j(p(w)) - \sum_{j \notin S_w} F_j \tag{16}$$

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obtained by totally differentiating the retailer's first order conditions with respect to the wholesale prices for each brand.

[5]Rey and Verg$\acute{e}$ (2004) notice that the constraint in (13) is binding, so the expression of the franchise fee in the binding constraint can be plugged back into the manufacturers profit maximization expression.

The above set up allows us to distinguish three cases in the non-linear pricing scenario: (1) a two-part tariff contract, (2) a two-part tariff contract along with the resale price maintenance (manufacturers' price-cost margins are zero) and (3) a case where retailers' price-cost margins are zero.

In the first case, each manufacturer chooses the wholesale price, w, that maximizes the profit given by (14). The obtained price-cost margins are given by

$$w - c^w = -(T_w * \Delta_w)^{-1}[\Delta_r s(p) + \Delta_w(p - w - c^r)] \tag{17}$$

In the second case, the manufacturer offers the retailer a two-part tariff contract and a resale price maintenance clause. In this case the manufacturer's implied price-cost margins are zero and the wholesale price is equal to the manufacturer's marginal cost ($w = c^w$). The retailers' price cost margins are given by

$$p - c^r - c^w = -(T_r * \Delta_r)^{-1} s(p). \tag{18}$$

In the third case, the retailers' price-cost margins are zero and the final price consumers pay is the sum of the wholesale price and the retailers' marginal costs, i.e., $p_j = w_j + c_j^r$. The manufacturers get all the channel profits and their price-cost margins are given by

$$p - c^r - c^w = -(T_w * \Delta_w)^{-1} s(p). \tag{19}$$

Since the price-cost margins in the above alternative scenarios involve the first derivatives of market share with respect to the retail prices, these price-cost margins will depend on the level of retail services. This dependence results from two effects: The price elasticity effect and the marginal cost effect.[6] As showed in the demand section, the price elasticity depend on retail service level and how consumers value it.

4. Data and estimation

The data to implement the BLP model involve 35 four-weekly periods between April 1995 and December 1997. Given that product characteristics embed retail services, our working definition of a "brand" involve RTEC brand-supermarket chain combinations. Each time period is treated as a separate market consisting of two types of variables: (1) RTEC brand observations at the super-

[6] The price-cost margins are inversely proportional to the price elasticities. In addition, the price-cost margins increases when marginal cost increases, ceteris paribus.

market chain level on sales and product characteristics (including supermarket services) and (2) consumer characteristics which are superimposed on the sales data for each time period.

The sales data consist of scanner data for 37 RTEC brands at five supermarket chains in Boston obtained from Information Resources, Incorporated (IRI) via the Food Policy Marketing Center at the University of Connecticut, for 35 four-weekly periods between April 1995 and December 1997. This resulted in 185 brands (37 x 5) for each period or market. From here, dollar sales, percent sales under promotion, and retail prices were obtained for each brand. Following Nevo (2001), the potential market size for each period was defined as one serving of RTEC times the Boston population. Then, market shares for each brand were defined accordingly.

Brand characteristics included price, calories, fiber content, sugar, a kid dummy to designate kids' cereals and an index of supermarket services defined via principal components. Except for price and services, the product characteristics were obtained from the RTEC boxes. The service index for each chain was obtained from the first principal component applied to eight retail configuration variables described in a previous section, obtained from a custom tabulation by Trade Dimensions. The service index is included in the mean valuation utility as well as in the interaction with consumer characteristics. We control for promotion in the mean utility portion but do not consider it in the interaction terms as it is not regarded as a permanent characteristic of a brand.

Consumer characteristics for each period were obtained by randomly drawing 900 consumer observations on income and number of kids from the Current Population Survey[7] for the Boston area. Unobserved consumer characteristics were assumed to follow a random normal distribution with zero mean and unitary standard deviation. The observed demographics and the unobserved characteristics were matched and superimposed on each market of 185 brands. After stacking the data, one obtains 31,500 (35x900) consumer observations, 185 brands observed over 35 periods for a total of 6,475 brand observations. We then adapt the Nevo (2000) algorithm where the BLP procedure is modified for the estimation of the set of 31,500 taste parameters, one set for each consumer in the sample. Then, following Villas-Boas (2007), the results are used to simulate and compare four vertical scenarios between the six RTEC manufacturers and the five supermarket chains. Because the fifth chain in the sample includes all residual retailers, only the four biggest chains are discussed in the results presented in the following section.

The BLP model presented above implies the need to use instrumental variables to account for the potential endogeneity of prices. This endogeneity comes from the fact that the retail prices depend on the observed and unobserved product characteristics. Any variation in those charac-

[7]The data on consumer characteristics were retrieved from the March Supplement of the Current Population Survey.

teristics will induce a variation in retail prices. This implies that the prices are correlated with the change in brand characteristics and hence the error term and should be instrumented for. The issue of using instruments in this kind of setting has been widely discussed in the literature of the discrete choice model (for example BLP, 1995; Nevo, 2001; Villas-Boas 2007). The instrument used has to be uncorrelated with the error term and highly correlated with the endogenous variable under consideration. BLP(1995) note that if the producers know the values of the unobserved (to the econometricians) characteristics, then the prices are likely to be correlated with them. For the automobile industry they suggest using the cost and demand characteristics for all products in a given year. Nevo (2001) uses two alternative sets of instrumental variables: the prices of the brand in other cities and a set of instruments that attempt to proxy for regional marginal costs (material, labor, energy, transportation). Villas-Boas (2007) uses the interactions between the input prices and the brand dummy variables.

This study iteracts two sets of instrumental variables with error terms in the last step of the BLP estimation procedure[8]. As in Villas-Boas (2007), the first set consists of interactions between brand dummy variables and input prices. Input prices include Boston wages (U.S. Department of Labor), gas and electricity prices at the location of RTEC manufacturers (U.S. Department of Energy), the Federal Funds Effective, and three-month Commercial Paper interest rates (Federal Reserve Board). The second set of instruments consists of five supermarket dummy variables (one for each of the supermarket chains) to capture the differences among supermarket chains in terms of pricing and promoting the RTEC brands and chain-specific costs.

The menu approach given in the previous section requires a test to choose between alternative models. Given that all the supply models are non-nested, the non-nested tests of Vuong (1989) and Rivers and Vuong (2002) are used. The details are provided in appendix A.

5. Empirical results

5.1. Demand Results

Table 3 presents the distribution (mean and standard deviation) of the estimated taste parameters from the random coefficients logit model with and without supermarket service quality index as a characteristic of the brand. The mean parameter estimates of the variables price, promotion, calories, fiber, sugar content, and the kid dummy in the mean valuation utility preserve the same sign when service quality is included.

A key important result is that, at the mean, the inclusion of service variable reduces the esti-

[8]The two sets of instrumental variables are jointly used.

mated consumer responsiveness to price changes. This suggests that, on average, consumers are willing to pay higher prices provided that the quality of the services offered by the store is higher.

The parameter estimate for service in the mean valuation utility is positive and significant, suggesting that, on average, consumers value service. However, the distribution of this parameter, as shown in Figure 1, indicates that some consumers find stores with more services (larger supermarkets) annoying. A further analysis of this distribution (see figure 2) indicates that consumers who negatively value service are mainly consumers with a medium-to-high and high income.[9]Indeed, more than 97% of the consumers who negatively value service earn more than $50,000 a year (35% earn between $50,000 and $75,000 a year and 62% earn more than $75,000 a year).

The distribution of the trade-off between prices and service (equation 6) given in Figure 5 approximates a normal distribution. This implies that some consumers have a negative willingness to pay for higher service. Indeed, in spite of being attracted by higher service, low and low-to-medium income consumers have a negative willingness to pay higher prices for higher service as indicated by Figure 6. Figure 6 also indicates that medium-to-high and high income consumers are willing to pay higher prices for higher service offered by the supermarkets. So in essence, the service offered by the supermarkets attracts low and low-to-medium income consumers. However, these consumers are sensitive to the price changes induced by the improvement in the service quality. On the other hand, medium-to-high and high income consumers have higher willingness to pay for the service quality, but are not attracted by the improvement of that service.

A direct implication of these results for the supermarket chains is the difficulty to pass on the cost of the services to consumers without the concern to lose market share. This is similar to what Tirole (1988, p. 104) describes as an over-provision of services to consumers with low "intrinsic" willingness to pay for the extra service. This difficulty is worsened by the fact that wealthy people who can afford to pay for the extra service are not attracted by the services offered by the supermarket chains.

This raises the following question: Why do supermarket chains continue to large superstore with more services? A possible explanation is that supermarket chains engage in offering higher services in order to ensure their survival. If all competing supermarket chains have been able to improve their service, then failing to follow the wave may put a given supermarket chain in a competitive disadvantage. Here, we think that the purpose of the over-provision of service is not to

[9]Consumers were divided into four categories based on their income: low income consumers with a yearly income less than $25,000, low-to-medium income with a yearly income between $25,000 and $50,000, medium-to-high income with a yearly income between $50,000 and $75,000, and high income with a yearly income greater than $75,000.

gain competitive advantage, rather to gain competitive parity with respect to the service dimension.

Using equation 4, the own- and cross-price elasticities were computed for each brand and at each supermarket chain. Furthermore, these elasticities were computed with and without the service quality characteristic. Table 4 gives the own-price elasticities for each brand and supermarket when the service quality is not included and when it is in the utility specification. As mentioned earlier, the inclusion of the service quality as a characteristic reduces the consumer's price sensitivity, implying lower magnitudes for the own-price elasticities as shown in Table 4.

When the service quality is included, [10] the mean of own-price elasticities is -3.6923 with a standard deviation of 0.7284. At the supermarket level, on average, the own-price elasticities are generally lower in absolute value at Shaw's (a suburban supermarket chain) than other supermarket chains, while they are highest (most elastic) at Star Market (an urban supermarket).

At the brand level, the results show that Kellogg's Corn Flakes brand, the most undifferentiated brand, has the lowest own-price elasticity, regardless of the supermarket chain where it is sold. Also, the breakfast cereals from wheat (Kellogg's Frosted Mini Wheats and General Mills' Wheaties) and raisin bran (Kellogg's Raisin Bran, General Mills' Total raisin Bran and Post Raisin Bran) have the lowest own-price elasticity compared to the other brands produced by the same manufacturer.

5.2. Supply Results

Using the results from the random coefficients demand model, the price-cost margins described in section 3 were estimated for each scenario. A summary statistics of these price-cost margins as a percentage of the retail price is given in Table 6. First, note that the double marginalization model and the two-part tariff imply a Lerner index over 100% for the whole channel (Manufacturers and retailers), hence a negative marginal cost. This result could serve as an informal way to rule out these two scenarios in favor of the remaining two.

The Rivers and Vuong (2002) test to rank the scenarios shows that double marginalization model, for example, outperforms the two-part tariff model but is outperformed by the model where the manufacturer margins are zero and the model where the retailer margins are zero (See Table 7).[11] The pairwise comparison in Table 7 indicates that the model where retailer margins are zero

[10] In what follows and in the next subsection, we will discuss only the results implied by the demand parameters when the service quality is included in the utility specification

[11] To formally rank the models implied by the alternative scenarios, the Rivers and Vuong (2002) test developed in section 3 was conducted and the results are assigned in Table 7. The Rivers and Vuong non-nested test proceeds by pairwise comparison between alternative models. To rank the models, the test compares T_n, given by equation 25,

outperforms the three models and provides the best fit. This result implies that RTEC manufacturers have the pricing decisions and that the retailers do not intervene in setting the retail prices for breakfast cereal brands. This is consistent with the vertical restraints theory that helps the manufacturers eliminate the externality created by the double marginalization scenario and an excessive demand contraction (See Tirole, 1988, pp. 174-176).

However, one might ask why manufacturers do not let the retailers be the residual claimants and appropriate the channel profit by imposing a franchise fee; that is, the manufacturers would set their wholesale price equal to their marginal cost and let the retailers have the pricing decision. The answer to this question may be found in the specificity of the RTEC industry. This industry is characterized by a high concentration ratio, a high product proliferation and differentiation, a high advertising expenditure, and a non-price competition conduct (couponing). All these characteristics suggest that the RTEC manufacturers will circumvent the promotional efforts offered by the retailers and will use the latter as neutral pass-through intermediaries, despite their increasing bargaining power and concentration. However, the results do not imply any conclusion regarding the degree of power each player has in the absence of information on the contract between the manufacturers and the retailers.[12]

Compared to other studies of vertical relationships between manufacturers and retailers, the results contrast with the ones found by Villas-Boas (2007), where the retailers have the pricing decision in the case of yogurt; and Bonnet et al. (2004) who find that French bottled water manufacturers use two-part tariffs and resale price maintenance with retailers. These differences attest of the case-by-case character of the vertical relationship between the manufacturers and the retailers.

Having ranked the alternative models, in what follows, only the results of the scenario where the retail's margins are zero are discussed. Table 8 gives the estimated price-cost margins as a percentage of the retail prices by brand and supermarket chain. These price-cost margins or Lerner index range from 26.81% for Ralston Cookie Crisp in Stop & Shop to 82.92% for Kellogg Raisin Bran in Stop & Shop, with a mean of 50.11% and a standard deviation of 11.31%.

RTEC manufacturers extract more profit from selling their brands at Shaw's supermarket chain than at the remaining three main supermarket chains in Boston. This may be due to the fact that Shaw's supermarket chain by not providing services quality allows the RTEC manufacturers to

with critical values of a standard normal distribution. For instance, if α is the size of the test and $Z_{\frac{\alpha}{2}}$ the value of the inverse standard normal distribution, we will reject H_0 in favor of H_1 if $T_n < Z_{\frac{\alpha}{2}}$. If $T_n > Z_{\frac{\alpha}{2}}$, we will reject H_0 in favor of H_2. Otherwise, H_0 will not be rejected.

[12]Though the retailer margins are zero for this scenario, this does not mean the retailer's profit is zero as manufacturers can pay the retailers slotting allowances for their shelf space.

charge lower retail prices. The relatively lower Lerner index from Star Market chain is probably due to higher costs for operating urban stores. In addition, popular brands such as Kellogg's Corn Flakes, Kellogg's Raisin Bran, and Post Grape Nuts are very profitable since they yield high price-cost margins (around 80%).

At the manufacturer level, Kellogg, the leader of the RTEC manufacturers, appropriates the highest price-cost margins. For every dollar consumers spend buying Kellogg's brands, Kellogg appropriates around 60 cents as a margin (See Table 10). This attests of the bargaining power Kellogg has in setting the retail prices. Note also that in terms of the cost[13], Nabisco's brands (Frosted Wheat Bites and Spoon Size) are the cheapest to produce and sell, followed by Post's brands and Kellogg's brands. These marginal costs are lower for the two biggest suburban supermarket chains (Stop & Shop and Shaw's) than for the smallest urban supermarket chains (Demoulas and Star Market).

As it is expected, the estimated price-cost margins are inversely proportional to the own-price elasticities and therefore relies heavily on the demand specification. In the present case, the omission of the supermarket service offering as a characteristic that influences the consumer's choice will results in biased elasticity estimates. We reiterate here that the inclusion of services in the indirect utility function reduces the consumer's responsiveness to price changes.[14] At the supply side, the inclusion of services in the demand specification provides accurate measures of price-cost margins. In fact, Table 7 indicates that price-cost margins are underestimated when the demand specification does not take into account services offered by supermarket chains. This finding is in line with the conclusion of Ellickson (2006) that supermarket chains compete for consumers by offering a greater variety of products, requiring a fixed investment in distribution. The inclusion of services in the estimation takes these investments into account.

6. Conclusions

This paper estimated the brand-supermarket level demand for 37 brands of ready to eat cereals produced by six manufacturers and sold through four supermarket chains in Boston market area. The analysis uses the BLP discrete choice model where services offered by supermarket chains is

[13] The recovered marginal cost reported in Tables 9 and 10 is the sum of the production costs (manufacturers' costs) and the distribution costs (retailers' costs)

[14] The D statistic developed by Newey and West (1987) was used to test between the restricted (services not included) and the unrestricted (services included). The D test compares the restricted and ubrestricted objective functions in the context of GMM estimation (analogous to likelihood ratio test in the case of maximum likelihood estmation). The D test rejected the restricted model.

considered as a brand-supermarket characteristic and interacted with the consumers demographics. The demand results are used to estimate four alternative vertical relationships between RTEC manufacturers and supermarket chains.

The demand results indicate that the inclusion of the service quality variable reduces the estimated consumer responsiveness to price changes. This suggests that, in average, consumers are willing to pay higher prices provided that the quality of the services offered by the store is higher. However, this willingness to pay for higher service varies with consumer's income. Though high income consumers do not place a positive value on the service quality of the store they shop at, their willingness to pay for higher service is positive. In contrast, consumers with low income have a negative willingness to pay for higher service quality even though the value this service positively. This result suggests that supermarket chains are over-providing the service quality.

The analysis of the matrix of own- and cross-price elasticities indicate that the inclusion of the service quality in the utility expression reduces the own-price elasticities, implying a trade-off between the service quality and the price. These elasticities drop, on average, from -4.1823 to -3.7057 when the service quality is included. The cross-price elasticities across supermarket chains are quite low, implying some degree of spatial monopoly or supermarket loyalty as far as RTECs are concerned. In addition, the cross-price elasticities show that RTEC consumers are indifferent in their substitution pattern between supermarket chains if the price of their favorite brand increases in one chain, all else being equal.

The supply results indicate that the omission of service variable results in underestimating the price-cost margins by sidestepping the required investment to improve services.In addition, the results show that the model where the retailers margins are zero fits the data better than the alternative models. This result implies that RTEC manufacturers have the pricing decisions and that the retailers do not intervene in setting the retail prices. This is consistent with the vertical restraints theory that helps the manufacturers eliminate the externality created by the double marginalization scenario and an excessive demand contraction.

Finally, the estimates of the price-cost margins indicates that the RTEC manufacturers appropriate more than 50% of the retail prices. RTEC manufacturers extract more profit from selling their brands at Shaw's supermarket chain than at the remaining three main supermarket chains in Boston. This may be due to the fact that at Shaw's supermarkets, by not providing a higher service quality, allows the RTEC manufacturers to charge lower retail prices.

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Appendix: Testing Between Supply Models

The test of Vuong is used to choose between the competing models. The test applies when the competing models are non-nested, overlapping or nested. Moreover, the Vuong (1989) test does not require that either competing model be accurately specified under the null hypothesis. Rivers and Vuong (2002) is a generalization of Vuong (1989) to a broad class of estimation methods such as maximum likelihood estimator, minimum chi square estimator, GMM estimator, and some semi-parametric estimators.

Let H denote the different competing models described above. For each model, given implied price-cost margins, we can estimate the marginal cost representing the sum of the production cost and the distribution cost. This marginal cost is given by

$$MC_j^H = p_j - PCM_r^H - PCM_w^H, \tag{20}$$

where PCM_r^H and PCM_w^H are the price-cost margins , given model H, for the retailer and the manufacturer, respectively.

Assume that these marginal costs are affected by some exogenous cost shifters W_j according to the expression

$$\log MC_j^H = a^H + W_j' b^H + e^H, \tag{21}$$

where a^H and b^H are unknown parameters, W_j are exogenous cost shifters, and e^H are unobservable random shocks to the cost.

The test proceeds as follows. First, estimate the parameters a^H and b^H implied by each supply model. Then evaluate the lack of fit criterion, $Q_n^H(a^H, b^H)$, (see Rivers and Vuong, 2002) for each supply model. The null hypothesis is that the two competing models, H and H', are asymptotically equivalent when

$$H_0 : lim_{n\to\infty}\{Q_n^H(a^H, b^H) - Q_n^{H'}(a^{H'}, b^{H'})\} = 0. \tag{22}$$

The model H is asymptotically better than the model H' when

$$H_1 : lim_{n\to\infty}\{Q_n^H(a^H, b^H) - Q_n^{H'}(a^{H'}, b^{H'})\} < 0. \tag{23}$$

On the other hand, the model H' is asymptotically better than the model H when

$$H_2 : lim_{n\to\infty}\{Q_n^H(a^H, b^H) - Q_n^{H'}(a^{H'}, b^{H'})\} > 0. \tag{24}$$

Rivers and Vuong define the test statistic T_n as the variation that characterizes the sample values of the lack of fit criterion, and it is given by

$$T_n = \frac{\sqrt{n}}{\sigma_n^{HH'}} \{Q_n^H(a^H, b^H) - Q_n^{H'}(a^{H'}, b^{H'})\} \tag{25}$$

where $\sigma^{HH'}$ represents the estimated variance of the difference of the lack of fit criterion between the competing models H and H'. Rivers and Vuong (2002) show that T_n is asymptotically normally distributed with mean zero and variance one.

Table 1: Supermarket services and prices across Boston supermarkets

	Stop & Shop	Shaw's	Demoulas	Star Market	Average
Service					
		Percent of Supermarkets within a Chain			
Banking	55.07	40.43	6.06	36.59	37.93
Pharmacy	57.97	6.38	6.06	41.46	32.02
Bakery	85.51	100	57.58	95.12	86.21
Seafood Dept.	88.41	100	78.79	92.68	89.66
Restaurant	2.90	14.89	6.06	19.51	10.84
Salad Bar	68.12	87.23	9.09	70.73	62.07
Average	59.66	58.16	27.27	59.35	53.12
PCA Index Value	0.6382	0.5622	0.3892	0.6051	0.5487
Manufacturers/Selected Brands					
		1995-1997 Average Prices($/lb)			
Kellogg (11 Brands)	3.00	3.11	2.88	3.17	3.04
Corn Flakes	1.91	1.99	2.12	2.21	2.06
Raisin Bran	2.36	2.52	2.33	2.66	2.47
Special K	3.76	3.79	4.09	4.03	3.92
General Mills (12 Brands)	3.38	3.16	3.40	3.58	3.38
Cheerios	2.93	2.69	3.27	3.34	3.05
Kix	3.73	3.55	4.33	4.33	3.98
Total	3.81	3.44	3.95	4.14	3.83
Post (6 Brands)	2.96	2.71	2.86	3.03	2.89
Raisin Bran	2.42	2.22	2.28	2.61	2.38
Quaker (3 Brands)	3.19	2.78	2.89	3.47	3.08
Cap N' Crunch	3.14	2.95	3.09	3.68	3.21
Nabisco (2 brands)					
Frosted Wheat Bites	3.08	2.93	3.04	3.22	3.06
Ralston (3 Brands)	3.74	3.34	3.69	4.11	3.72
Cookie Crisp	5.24	4.63	4.41	5.71	5.00
Average (37 Brands)	3.87	3.64	3.53	4.06	3.77

Source: Information Resource Infoscan Inc., 1995-1997.

Table 2: Alternative manufacturers-retailers vertical relationships

Model	Manufacturers PCM	Retailers PCM
Double marginalization	$PCM_w = -(T_w * \Delta_w)^{-1} s(p)$	$PCM_r = -(T_r * \Delta_r)^{-1} s(p)$
Two part-tariff	$PCM_w = -(T_w * \Delta_w)^{-1} [\Delta_r s(p) + \Delta_w (p - w - c^r)]$	$PCM_r = -(T_r * \Delta_r)^{-1} s(p)$
$PCM_w = 0$	0	$PCM_r = -(T_r * \Delta_r)^{-1} s(p)$
$PCM_r = 0$	$PCM_w = -(T_w * \Delta_w)^{-1} s(p)$	0

Table 3: Demand parameter estimates with and without services

	With Services		Without Services	
Variable	Estimate	Std. Error	Estimate	Std. Error
Mean Utility Valuation				
Price	-19.8032	3.3363	-20.4911	1.9269
Calories	-2.8886	0.4243	-3.0832	0.3221
Fiber	-0.1706	0.0638	-0.2246	0.0532
Sugar	-0.1761	0.2698	-2.2768	0.2021
Kid dummy	-2.7233	1.0595	-1.4549	0.3212
Promotion	2.2970	0.1364	0.3608	0.1246
Service	0.0786	0.03268		
Service x price	8.1320	3.7651		
Interactions				
Income	0.6549	1.7822	0.8102	0.4656
Income x price	0.0854	4.8352	0.0870	2.3079
Income x calories	1.7447	0.5099	1.8301	0.3472
Income x fiber	0.2031	0.0924	0.1858	0.0607
Income x sugar	0.2243	0.3056	2.4873	0.1847
Income x kid dummy	1.4767	1.2759	1.6344	0.2968
Income x service	1.2368	0.5287		
Income x service x price	-0.0050	0.0005		
# of Kids	1.0619	2.6466	0.9844	1.2583
# of Kids x price	0.8830	9.1426	0.8956	3.0680
# of Kids x calories	1.0842	0.3542	-1.0577	0.8730
# of Kids x fiber	0.0828	0.0799	0.0540	0.0669
# of Kids x sugar	-0.3133	0.2229	-0.0100	0.3117
# of Kids x kid dummy	0.9774	1.4219	0.8875	0.4807
# of Kids x service	0.5038	4.4838		
# of Kids x service x price	0.2036	0.0219		
Unobserved.	0.1460	0.7950	0.1775	0.4637
Unobserved. x price	0.1852	4.2200	0.1171	1.5757
Unobserved. x calories	-0.8121	0.2269	-0.9276	0.2110
Unobserved. x fiber	0.0463	0.1024	0.0671	0.0744
Unobserved. x sugar	0.0742	0.4803	0.0872	0.3315
Unobserved. x kid dummy	0.7892	0.6218	1.0250	0.5013
Unobserved. x service	06279	1.2276		
Unobserved x service x price	0.1700	3.0757		

Table 4: Own price elasticity estimates for RTEC brands at Boston supermarkets with service quality

Manufacturer Brands	*Stop & Shop*	*Shaw's*	*Demoulas*	*Star Market*	*Average*	*Average without services*
Kellogg						
Apple Jacks	-3.6188	-3.5589	-3.7743	-3.8649	-3.7042	-5.0382
Complete Bran	-2.9646	-3.0201	-3.2948	-3.2192	-3.1247	-4.1418
Corn Flakes	-1.7968	-1.9763	-2.2907	-2.1286	-2.0481	-2.7789
Corn Pops	-3.1451	-3.1978	-3.9481	-3.5923	-3.4708	-4.6736
Krispix	-3.3732	-3.3779	-4.2110	-3.8657	-3.7070	-5.0436
Froot Loops	-3.2734	-3.7020	-3.5981	-3.4707	-3.5358	-4.8155
Frosted Flakes	-2.4923	-2.7116	-2.7973	-2.7182	-2.6774	-3.6411
Frosted Mini Wheats	-2.5253	-2.5927	-2.6443	-2.7576	-2.6298	-3.5889
Raisin Bran	-2.2396	-2.5345	-2.5455	-2.5982	-2.4795	-3.2340
Rice Krispies	-2.9985	-3.0702	-3.4782	-3.1791	-3.1815	-4.4406
Special K	-3.5504	-3.7459	-4.4261	-3.8825	-3.9012	-5.3017
General Mills						
Cheerios	-2.6258	-2.5573	-3.4073	-3.0763	-2.9167	-3.9917
Cinnamon Crunch	-3.3723	-3.2726	-4.0115	-3.6056	-3.5655	-4.9058
Cocoa Puffs	-3.2815	-3.3327	-3.9999	-3.5148	-3.5322	-4.8121
Golden Grahams	-3.6902	-3.5413	-4.2126	-4.1228	-3.8917	-5.2721
Honey Nut Cheerios	-2.9762	-3.0575	-3.3092	-3.1202	-3.1158	-4.2332
Kix	-3.3861	-3.3824	-4.5263	-4.0026	-3.8244	-5.3142
Lucky Charms	-3.3731	-3.2697	-4.0778	-3.5321	-3.5632	-4.8339
Multi Gain Cheerios	-3.7017	-3.8012	-4.0499	-4.1763	-3.9323	-5.3518
Total	-3.2663	-3.4172	-4.2952	-4.0094	-3.8370	-5.1737
Total Raisin Bran	-2.8977	-3.1556	-3.3180	-2.9468	-3.0795	-4.0756
Wheaties	-2.4978	-2.5546	-3.0670	-3.0321	-2.7879	-3.7610
Apple Cinnamon	-3.0507	-3.2878	-3.5334	-3.4041	-3.3190	-4.5261
Post						
Banana Nut Crunch	-2.9075	-2.6703	-3.5272	-3.2228	-3.0820	-4.2714
Cocoa Pebbles	-3.4842	-3.2294	-3.8675	-3.7990	-3.5950	-4.9216
Fruit Pebbles	-3.3790	-3.1025	-3.8107	-3.8155	-3.5269	-4.7967
Grape Nuts	-1.9754	-2.0766	-2.4108	-2.1079	-2.1427	-2.9013
Honey Comb	-3.1856	-3.0255	-3.6182	-3.5363	-3.3415	-4.5289
Raisin Bran	-2.3200	-2.2431	-2.5186	-2.5619	-2.2409	-3.1233
Quaker						
Cap N' Crunch	-3.0698	-2.9071	-2.7640	-3.4164	-3.0393	-4.2716
Oat Life	-3.2718	-3.1993	-3.6684	-3.8486	-3.4970	-4.1613
Toasted	-2.9443	-2.9187	-3.3162	-3.1401	-3.0798	-4.7754
Nabisco						
Frosted Wheat Bites	-2.6110	-2.5125	-3.0003	-2.7364	-2.7151	-4.1564
Spoon Size	-4.8640	-4.5057	-4.7045	-5.4032	-4.8694	-3.8589
Ralston						
Cookie Crisp	-3.5912	-3.3471	-4.2592	-4.1171	-3.8287	-6.7208
Corn Chex	-3.5830	-3.3607	-4.2773	-4.1002	-3.8308	-4.2579
Rice Chex	-4.4274	-3.9929	-4.6172	-4.9716	-4.5022	-4.8470
Average	-3.0973	-3.0819	-3.5618	-3.4336	-3.2937	-4.4845

Table 5: Price-cost margins and marginal cost by scenario

Model	Price-cost margins (in%)				Marginal cost ($)			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Double Marginalization								
Manufacturers PCM	95.08	20.78	50.27	155.79				
Retailers PCM	46.24	9.28	27.82	72.40				
Total PCM	141.32	34.79	49.54	382.32	-1.134	0.675	-2.776	1.252
Two-part tariff								
Manufacturers PCM	111.26	26.64	56.91	184.35				
Retailers PCM	54.27	12.54	32.26	103.97				
Total PCM	165.53	38.25	89.17	288.33	-1.127	0.673	-2.763	1.252
Zero manufacturers margin								
Retailers PCM	46.24	9.28	27.82	72.40				
Total PCM	46.24	19.28	27.82	72.40	1.746	0.645	0.362	4.275
Zero retail margin								
Manufacturers PCM	50.19	11.72	25.23	84.83				
Total PCM	50.19	11.72	25.23	84.83	1.867	0.602	0.553	4.127

Table 6: Rivers and Vuong Test

Model	Double marginalization	$PCM_r = 0$	$PCM_w = 0$	Two-part tariff
Double marginalization		6.443	6.579	-16.936
$PCM_r = 0$			-7.696	-6.008
$PCM_w = 0$				-4.562

Table 7: Price-cost margins (in %) estimates for the zero retailers margins scenario

Manufacturer Brands	*Stop & Shop*	*Shaw's*	*Demoulas*	*Star Market*	*Average*	*Average without services*
Kellogg						
Apple Jacks	43.97	44.27	46.90	39.25	52.07	51.01
Complete Bran	76.41	78.52	83.97	71.25	51.96	50.86
Corn Flakes	91.43	85.49	85.41	77.83	76.99	75.90
Corn Pops	49.91	49.20	44.44	42.56	53.08	52.12
Krispix	49.31	50.52	47.49	42.83	45.76	45.71
Froot Loops	50.19	47.77	56.44	48.00	48.45	47.04
Frosted Flakes	56.34	54.59	67.46	50.80	65.70	63.98
Frosted Mini Wheats	70.32	71.58	77.17	65.68	71.19	70.07
Raisin Bran	82.92	80.01	84.83	72.79	80.14	78.89
Rice Krispies	52.64	55.02	56.68	49.65	52.30	52.25
Special K	45.58	44.32	43.65	41.61	43.59	42.54
General Mills						
Cheerios	74.76	82.86	68.43	61.75	58.95	57.87
Cinnamon Crunch	53.84	58.57	53.85	50.95	44.89	43.86
Cocoa Puffs	34.72	35.96	37.19	31.85	50.91	48.29
Golden Grahams	37.98	41.81	41.00	34.46	40.59	38.79
Honey Nut Cheerios	54.10	57.21	64.83	52.64	56.43	55.33
Kix	50.34	53.08	44.78	42.13	46.84	44.97
Lucky Charms	40.31	43.93	43.34	37.77	50.84	48.93
Multi Gain Cheerios	48.69	50.41	57.05	42.02	45.63	45.04
Total	52.57	58.57	53.82	47.84	41.35	40.91
Total Raisin Bran	79.09	80.45	96.62	77.95	49.73	48.59
Wheaties	77.08	80.02	77.39	64.34	55.64	54.75
Apple Cinnamon	43.55	43.53	49.92	39.27	53.46	52.39
Post						
Banana Nut Crunch	52.47	60.61	50.45	48.90	53.11	52.84
Cocoa Pebbles	34.10	39.92	40.87	30.78	41.00	40.09
Fruit Pebbles	34.31	40.46	40.20	30.07	41.13	40.99
Grape Nuts		63.36	60.68	60.87	62.06	61.69
Honey Comb	42.92	46.23	43.69	39.53	43.09	41.95
Raisin Bran	62.14	67.61	66.73	57.20	63.42	62.39
Quaker						
Cap N' Crunch	41.84	44.06	42.77	35.62	41.07	40.43
Oat Life	40.78	44.71	51.28	37.12	43.47	42.45
Toasted	38.54	40.69	39.52	33.36	38.03	36.89
Nabisco						
Frosted Wheat Bites	42.62	45.42	43.41	40.62	43.02	42.59
Spoon Size	52.41	58.22	54.41	51.40	54.11	53.58
Ralston						
Cookie Crisp	26.81	30.51	31.69	25.23	28.56	28.03
Corn Chex	32.81	36.34	32.40	29.32	32.72	31.17
Rice Chex	32.86	36.19	32.25	29.40	32.67	31.36
Simple Average	50.41	52.60	50.75	46.66	50.11	49.09

Table 8: Distributions of the price-cost margins (Lerner index in %) and marginal cost (in $/lb) by manufacturer and supermarket chain

	Stop & Shop	Shaw's	Demoulas	Star Market	Average
Kellogg	59.28	59.35	59.77	54.77	58.29
	1.61	1.74	1.75	1.97	1.77
General Mills	50.20	52.45	49.01	46.77	49.61
	1.90	1.91	2.15	2.32	2.07
Post	50.35	54.67	50.76	46.76	50.63
	1.50	1.38	1.63	1.89	1.60
Quaker	40.39	43.15	44.52	35.37	40.86
	1.72	1.66	1.61	2.32	1.83
Nabisco	47.52	51.82	48.91	46.01	48.57
	1.40	1.36	1.48	1.65	1.47
Ralston	30.83	34.35	32.11	27.98	31.32
	2.73	2.43	2.70	3.32	2.79
Average	50.41	52.60	50.75	46.66	50.11
	1.77	1.77	1.91	2.19	1.91

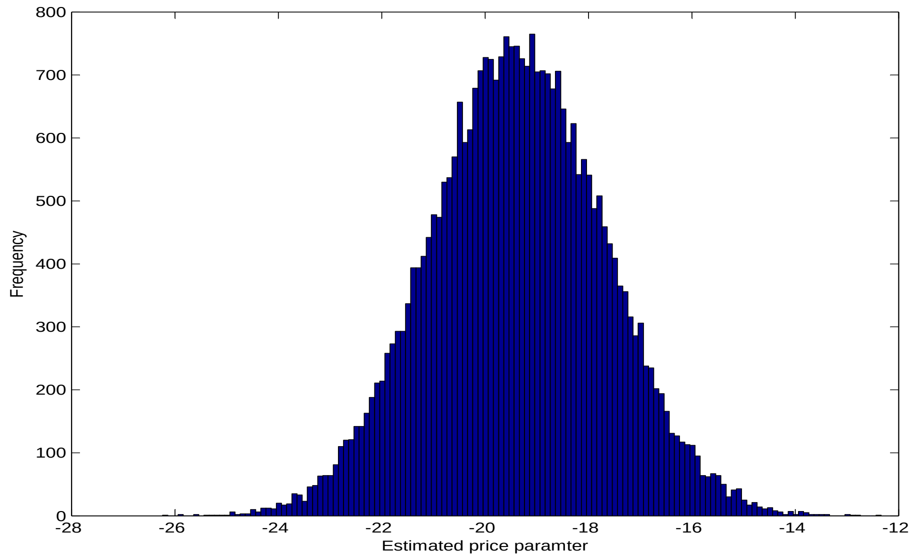

Fig. 1: Distribution of the estimated price parameter, service quality not included

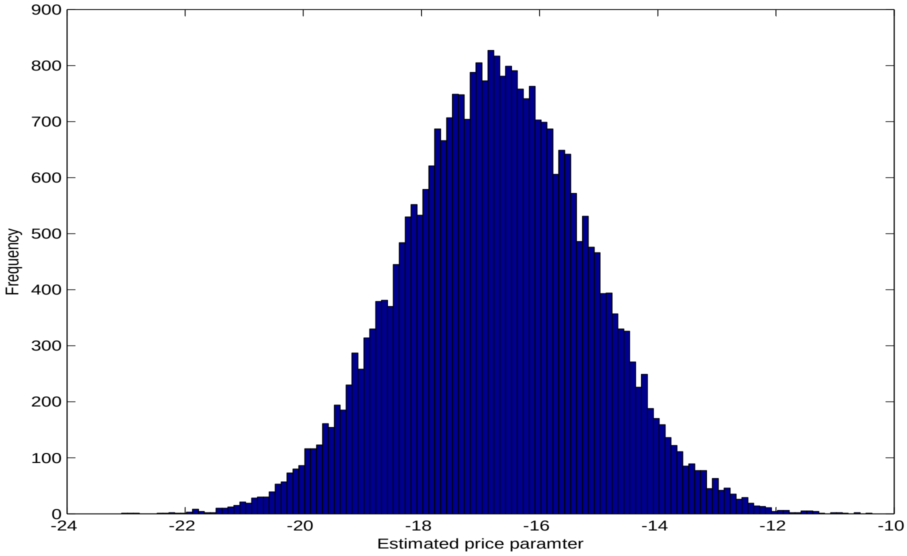

Fig. 2: Distribution of the estimated price parameter, service quality included

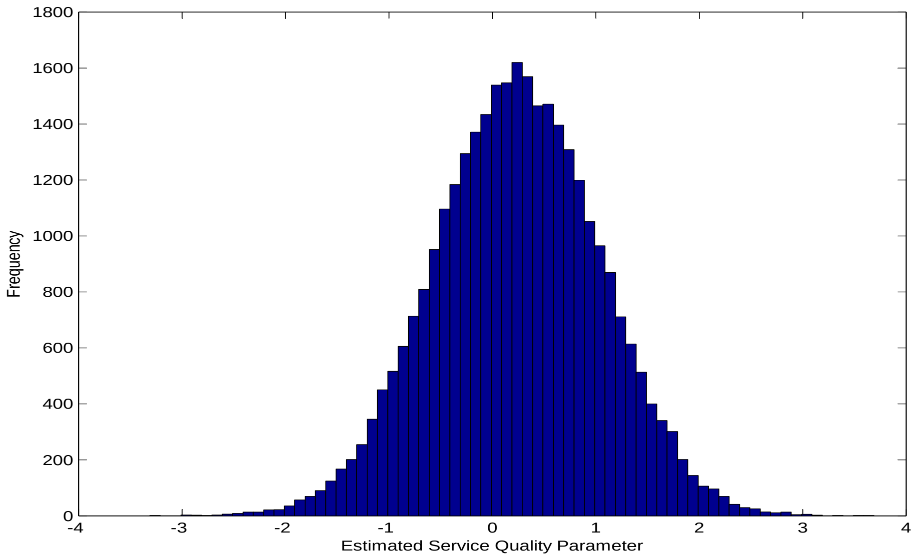

Fig. 3: Distribution of the estimated service quality parameter

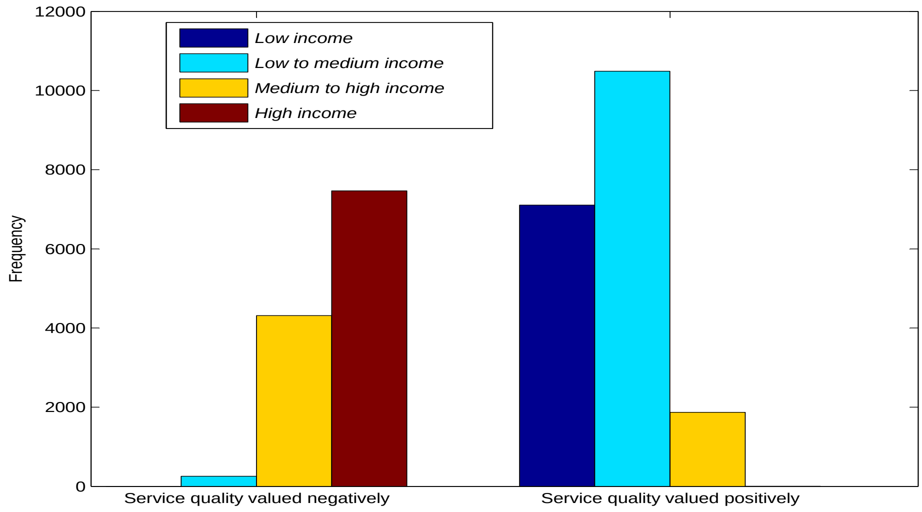

Fig. 4: Distribution of the estimated service quality parameter by income categories

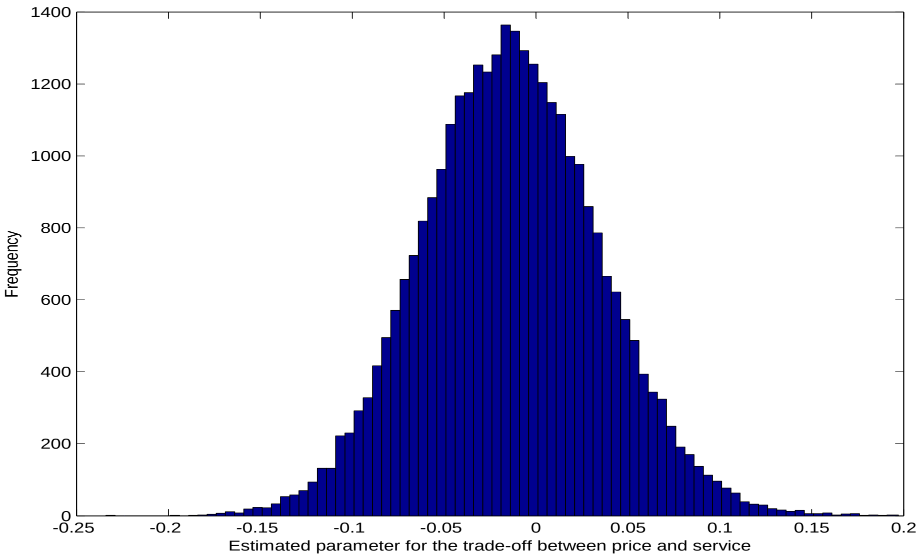

Fig. 5: Distribution of the consumers' willingness to pay for service quality

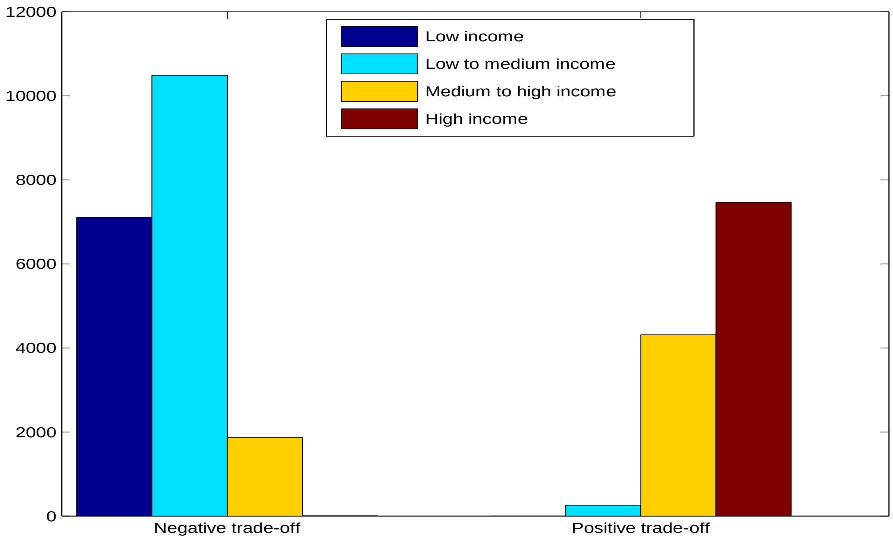

Fig. 6: Distribution of the consumers' willingness to pay for service quality by income categories