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Abstract

Store brands are thought to improve a retailer's position relative to leading brand manufacturers and to reduce retail prices. Steiner (2004) offers a characterization of typical industry structures by considering the relationship between interbrand and intrabrand elasticities. We estimate a model of demand and use elasticity estimates to characterize Boston's fluid milk market as falling into one of Steiner's "typical industry structures". In addition to investigating the relationship between interbrand and intrabrand elasticities we derive and test structural models of supply channel conduct that explicitly identify the pricing conduct that is implicit in Steiner's "typical industry structures". Using scanner data for brand level milk sales milk sales at leading retail chains in Boston we show that store brands do in fact improve the profit position of retailer vis á vis the manufacturer, reduce retail prices, and improve total welfare in the market.

1 Introduction

Both theoretical and empirical research has generally found that the marketing of store brands strengthens the position of the retailer in the market channel relative to the upstream brand manufacturers allowing the retailer to capture more profit on leading manufacturer brands (Mills, 1995; Scott-Morton & Zettelmeyer, 2001; Chintagunta & Bonfrer, 2002). Sale of store brands is also thought to place downward pressure on all retail prices in the category, hence improving consumer welfare (Steiner, 2004). This paper employs a structural approach to analyze manufacturer and store brand pricing relationships in an equilibrium framework. This framework assumes a two stage pricing game wherein one can test for alternative price conduct.

Mills (1995) presents a rigorous model that demonstrates store brands are instruments for a retailer to overcome the well-known double marginalization problem present in distribution channels. Steiner (2004) similarly argues that the unique position of store brands constrain the market power of national brands in ways that their horizontal competitors cannot. Moreover, he postulates that the vertical competition between store and national brands has a consumer welfare improving effect via a decrease in retail prices and stimulation of innovation. Steiner (1993) coins the term "mixed regimen" to describe the vertical structure where store brands generate countervailing power and improvement in welfare. Empirical support for this model, however, is sparse. Raju, Sethuraman, and Dhar (1995) find that store brands indeed do increase category profits for retailers. Furthermore, they conclude that this is particularly the case when a category has several national brands.

This paper will test, from a structural and econometric standpoint the empirical validity of the Steiner (2004) hypotheses about store brand presence. These hypotheses can be broken down into two themes. The first are determinants of margins and prices and the second is industry structure. Testing of the former will involve analysis of horizontal and vertical competition by econometrically testing for the pricing model that best characterizes the market we analyze. Following Steiner's theory we will estimate substitution effects among brands within a store and switching to another store to purchase a well known brand. These are respectively defined as interbrand and intrabrand cross price elasticities. We will use these cross price elasticities to determine relative retail/manufacturer margins and retail prices. Specifically, we will analyze whether decreased store brand presence increases the retail prices of leading brands and analyze where the lost retail profits go, *i.e.* whether they go to leading or secondary manufacturers, retail competitors or some combination thereof. Steiner (2004) suggests four different industry outcomes are possible: retailer domination, manufacturer's brand domination, mixed regimen and mutual dependence.[1] The first two depend on different inter- and intra-brand elasticities. The second two require similar values for these elasticities. For example if the inter-brand elasticity (in store) is high and the intra-brand elasticity (across stores) is low retailers dominate via the ability the raise prices of all brands without loss of business to other stores and an individual brand manufacturer cannot raise price because of in store substitution to other brands (high interbrand elasticity).

The empirical venue for this research is fluid milk sold at major supermarkets in the Boston market, monthly from March 1996 to July 2000. Testing the Steiner model requires analysis of the horizontal and vertical conduct in the market channel. We begin by specifying a nested logit model of retail demand for brands of milk at the supermarket chain level. Wojcik (2000) points out that one of the virtues of the nested logit is its superior ability to predict market shares compared to the theoretically desirable heterogeneous-agent random coefficients logit of Berry, Levinsohn, and Pakes (1995) and Nevo (2001), this is particularly true when aggregate data such as the chain level data used in this research is used to estimate the demand model. The nest in our model has two levels, first the consumer decides which supermarket to shop, then once they are in the supermarket they decide which brand (including the store brand offering) of milk to buy. This model recognizes that consumers prefer one-stop shopping and that their choice is essentially restricted to in store products once they have committed to a store.[2] Since the nested logit relies on the mapping of products from characteristic space into market share, we include store-product specific search attributes directly in the demand specification. This approach works hand in hand with the decision structure story

[1] Also mentioned is a structure called private label domination. This structure has been documented to occur in European supermarkets however is not relevant to our empirical study.

[2] This modeling prior does not prevent consumers switching to products in other stores.

as well as the notion that a chain can brand itself by developing a unique array of services and products including a broad high quality line of store brands.[3]

Steiner's model depends on measurement of retail level inter- and intra-brand cross price elasticities. To estimate intrabrand elasticities one must have chain level not market level data. This is the first study to employ chain level data from an entire cross section of major retailers in a market, so it is the first direct test of Steiner. Recent advances in vertical channel modeling, moreover, allow us to determine the nature of the vertical pricing game manufacturers and retailers are playing. Much of the work on store brand pricing including Steiner's employ retail price elasticities without explicitly modeling how brand manufacturers wholesale pricing moves are linked by some form of retailer pricing conduct to retail prices.

Sudhir (2001) working on the yogurt and peanut butter markets, highlights the need to accurately model vertical strategic interaction as well as horizontal strategic interaction when using retail level data. Villas-Boas (2007) outlines conditions that allow data on retail price, retail quantities and input prices at the two stages in the market channel to identify retailers' and manufacturers' vertical pricing conduct. This method allows one to investigate interactions in the market channel pricing using retail level prices without observing wholesale prices. Villas-Boas however analyzes retail conduct for two chain stores and a small retailer, a total of 3 locations, and a set of manufacturers. Legitimate modeling of horizontal strategic interaction requires studying a robust cross section of firms at each level of the channel. Here we analyze vertical conduct in a market that has four retail chains, a total of 187 locations, each chain with a store brand, and two brand manufactures that sell in all four retailers. To the best of our knowledge this is the first paper to conduct a chain level study that includes the entire cross section of major supermarket chains and brand manufacturers in a given metropolitan area.

Once demand parameters are estimated we use them to compute inter- and intra- brand cross price elasticities. Estimates of these elasticities shed light upon the possible industry structure at

[3]Bonnano and Lopez (2009) report that the consumer demand for fluid milk is influenced by one stop shopping attributes of supermarkets specifically breadth and depth of services offered as well as price. Services include: pharmacy, bank, fresh seafood counter, salad bar, and prepared foods

play in Boston's fluid milk market. Next we compute retailer and manufacturer price cost margins under different vertical and horizontal pricing games. Alternative measures of channel marginal cost are derived by calculating, price less implied retailer and manufacturer margins under different forms of strategic channel behavior. Then we estimate the relationship between the channel marginal cost associated with each behavioral scenario and the input prices at the two stages of the market channel. As in Villas-Boas (2007) alternative games of strategic behavior are tested by implementing a series of non-nested tests of alternative hypothesized models (Smith, 1992). Pairwise tests of each model determine the best model of channel marginal cost and consequently the best model of strategic channel pricing.

The preferred model is used to test Steiner's hypotheses. We perturb the price of the leading retailers store brand both up and down from equilibrium. This is consistent with the reduction and expansion of the quantity of store brand sold, *ceteris paribus*. These perturbations shed light on intrabrand (across retailers) and interbrand (within retailer) competition. When the profits of two firms are negatively related they compete, otherwise they are cooperative (Steiner, 2004, p. 120). This exercise also provides us with reliable measures of the degree to which strategic presence of the chain's store brand determines the retail price and allows one to make conclusions about relative consumer welfare.[4]

The remainder of this paper is organized as follows. Next we specify the demand model, outline Steiner's hypotheses about industry structure and propose a structural model of the supply channel. Within this section we develop a framework for pairwise testing between the non-nested models. The third section discusses the data, estimation techniques, and estimation results. The fourth section discusses results of the tests of Steiner's hypotheses. This section includes analysis of

[4]This is a new empirical approach to the analysis of store brand pricing and its impacts on the channel. Chintagunta and Bonfrer (2002) examine the introduction of a store brand into a category by estimating demand conditions before and after introduction for oats and frozen pasta categories at a single retailer. They observe wholesale prices paid by the retailer and use them to gain intuition on vertical conduct in the market. For demand they investigate the changes in preferences under the two market regimes, before and after the introduction of the store brand. On the supply side they measure the effects of the new entrant store brand on the actions between retailer and manufacturer. However they use a conduct parameter approach and do not explicitly formulate and test pricing games. See Corts (1998) for critiques of conduct parameter approaches.

inter- and intra- brand elasticities and it also reports the results of the tests between the structural models and determines the most statistically valid one. In the fifth section the most statistically valid model is used to determine equilibrium prices and quantities. From this equilibrium the price of the leading store brand milk is perturbed to demonstrate the affect of a decrease or increase in the presence of the leading store brand milk, which consequently reveals the winners and losers that result from less or more of Stop & Shop's store brand milk in Boston's fluid milk market. Finally, concluding remarks and suggestions for extending the research are made.

2 Models and Hypotheses of Industry Structure

2.1 Model of Demand

We specify the following linear version of the random utility model(RUM)

$$u_{ijk} = \delta_{jk} + \zeta_{ik} + (1 - \sigma)\epsilon_{ij}$$

$i, j \& k$ subscript individuals, retailers and brands respectively, δ_j is mean utility and $\zeta_{ik} + (1-\sigma)\epsilon_{ij}$ is the residual error of the RUM with the Weibull (extreme value) distribution. Note, $\sigma \in (0, 1]$. As the parameter $\sigma \to 1$, the with-in retailer correlation of utility level goes to one, and as $\sigma \to 0$, the with-in retailer correlation goes to zero. Mean utility is more explicitly defined as

$$\delta_{jk} = x_{jk}\beta - \alpha p_{jk} + \xi_{jk}$$

x_{jk} is a vector of characteristics for product j in retailer k and p_{jk} is the price of product j in retailer k. Since it is assumed $\zeta_{ik} + (1 - \sigma)\epsilon_{ij}$ has the Weibull distribution, the probabilities, or in the context of demand predicted market share for the retailer specific product, have a closed form. Under weak regularity conditions on the density of consumer unobservables, the existence of a unique mean utility that satisfies the observed market shares has been established by Berry

(1994). Next we follow Berry (1994) and Cardell (1997) to derive the empirical variance components nested logit model of demand we estimate.

If product j is in retailer k, the formula for the market share of product j as a function of the total group share is

$$s_{j/k}(\delta,\sigma) = \frac{[e^{\delta_j/(1-\sigma)}]}{D_k},$$

where

$$D_k \equiv \sum_{j \in \mathfrak{J}_k} e^{\delta_j/(1-\sigma)},$$

$\mathfrak{J}_k$ denotes the set of products owed by retailer k. The probability of choosing one of the retailer's products is

$$s_k(\delta,\sigma) = \frac{D_k^{(1-\sigma)}}{[\sum_k D_k^{(1-\sigma)}]}$$

The market share of product j in retailer k is the product of the two conditional shares defined above

$$s_{jk}(\delta,\sigma) = s_{j/k}(\delta,\sigma)s_k(\delta,\sigma) = \frac{e^{\delta_j/(1-\sigma)}}{D_k^{\sigma}[\sum_k D_k^{(1-\sigma)}]}$$

Additionally, normalizing the mean utility of the outside good to zero where the outside good is the only member of it's respective group gives us the share of the outside good

$$s_0(\delta,\sigma) = \frac{1}{[\sum_k D_k^{(1-\sigma)}]}$$

so,

$$s_{jk}(\delta,\sigma) = \frac{e^{\delta_j/(1-\sigma)}}{D_k^{\sigma}} s_0(\delta,\sigma).$$

Finally, take the log of group share

$$ln(D_k) = \delta_j/(1-\sigma) - ln(s_{j/k}),$$

Take the log of the market share and substitute in the expression immediately above for $ln(D_k)$;

the estimable expression for demand is,

$$ln(s_{jk}) - ln(s_0) = x_{jk}\beta - \alpha p_{jk} + \sigma ln(s_{j/k}) + \xi_{jk}. \tag{1}$$

2.2 Steiner's Hypotheses

Steiner (2004, p.120) succinctly states "The structure of a consumer goods industry and the relative and absolute margins of manufacturers are largely determined by the magnitudes of two cross elasticities that define the willingness of consumers to switch brand within store (interbrand) and to switch stores within a brand (intrabrand). When the magnitudes are different, margins at the two stages will be negatively related." Furthermore Lynch (1986) and Steiner (1993, 2004) assert that "when the magnitudes are relatively similar, margins at the two stages in the channel are likely to be positively related" (Steiner, 2004, p.120).

To test for these particular Steiner regimens in the market we compute average inter- and intrabrand cross price elasticities for each brand at each retailer. If interbrand elasticity is smaller than intrabrand elasticity manufacturers "dominate" because they can raise price of their brand with out losing market share due to consumer switching to other brands within the retailer. Furthermore competition on that brand's price occurs among retailers and keeps retail margins slim. Steiner calls this the manufacturer domination case. On the other hand according to Steiner, if the interbrand elasticity is larger than the intrabrand elasticity retailers "dominate" manufacturers. That is a retailer has the ability to raise the price of all products in the category with out losing market share to horizontal competitors. Steiner calls this the retailer domination case.

If the elasticities are effectively equal Steiner follows Bowman (1952) who sees mutual dependance as the outcome. This Steiner regimen is characterized by relatively low inter- and intrabrand cross price elasticities of the same magnitude. In this regimen both retailers and manufacturers earn high margins because they tacitly collude effectively sharing in the monopolization of the market. Coordination by a category manager or channel captain may facilitate this outcome helping to mitigate the tendency of double marginalization with its loss of channel profits and higher retailer prices.

A fourth possibility is what Steiner refers to as the “mixed regimen”. Here manufacturers and retailer compete horizontally and vertically to the benefit of consumers. Manufacturer margins on their brands are kept in check by the store brand offering. Steiner’s “mixed regimen” result goes beyond elimination of double marginalization to inject vertical competition into the pricing game. The net result is lower retail prices and greater output, thereby producing a higher level of consumer welfare than his other three possible scenarios.

2.3 The Retail Market

Assume there are N Nash Bertrand multi-product oligopolists competing in a retail market and each retailer maximizes category profit for sale of all branded and own-labeled fluid milk products. each retailers milk profit function in time period t takes the form

$$\pi_{rt} = \max_{p_{jt} \forall j \in \mathfrak{S}_{rt}} \sum_{j \in \mathfrak{S}_{rt}} [p_{jt} - p^w_{jt} - c^r_{jt}] s_{jt}(p)$$

$\mathfrak{S}_{rt}$ is the set of products sold by retailer r during week t. The first order conditions, assuming a pure strategy Nash equilibrium in prices, are

$$s_{jt} + \sum_{m \in \mathfrak{S}_{rt}} [p_{mt} - p^w_{mt} - c^r_{mt}] \frac{\partial s_{mt}}{\partial p_{jt}} = 0 \qquad (2)$$

Defining the retailers ownership matrix T_r and response matrix $\triangle_{rt}$, $\triangle_{rt}$ contains the first derivative off all the shares with respect to all the retail prices thus having the common element $\frac{\partial s_j}{\partial P_i}$.[5] Stacking up the first order conditions for each product and each retailer and rearranging terms one has

$$p_t - p^w_t - c^r_t = -(T_r. * \triangle_{rt})^{-1} s_t(p) \qquad (3)$$

[5]The ownership matrix is a matrix of zeros and ones. Element $T(i,j) = 1$ if a retailer has ownership of both i and j, $T(i,j) = 0$ otherwise.

2.4 Manufacturers

The manufacturer's profit maximization problem is similarly written as

$$\pi_{wt} = \max_{p_{wt} \forall j \in \mathfrak{S}_{wt}} \sum_{j \in \mathfrak{S}_{wt}} [p^w_{jt} - c^w_{jt}] s_{jt}(p(p^w)),$$

Here $\mathfrak{S}_{wt}$ is the set of products sold by manufacturer w during week t. The resulting first order condition is

$$s_{jt} + \sum_{m \in \mathfrak{S}_{wt}} [p^w_{mt} - c^w_{mt}] \frac{\partial s_{mt}}{\partial p^w_{jt}} = 0$$

Let us define the manufacturer ownership matrix T_w and manufacturer response matrix $\triangle_{wt}$ whose elements are the first derivatives of market shares with respect to each wholesale price, i.e. $\frac{\partial s_j}{\partial p^w_i}$.[6] The matrix $\triangle_{wt}$ contains the cross price elasticities of demand and the effects of cost pass through. The question then becomes how one finds such a matrix, Define the matrix $\triangle_{pt}$ whose elements are the derivatives of all retail prices with respect to all wholesale prices. A simple application of the chain rule leads us to see

$$\triangle_{wt} = \triangle'_{pt} \triangle_{rt}$$

$\triangle_{pt}$ has the general element $(i, j) = \frac{\partial p_j}{\partial p^w_i}$. It is then a question of finding the matrix $\triangle_{pt}$. To answer this we begin by totally differentiating for a given product j the retailer first order condition in equation 2.

$$\sum_{k=1}^{N} \underbrace{[\frac{\partial s_j}{\partial p_k} + \sum_{i=1}^{N} (T_r(i,j) \frac{\partial^2 s_i}{\partial p_j \partial p_k} (p_i - p^w_i - c^r_i)) + T_r(k,j) \frac{\partial s_k}{\partial p_j}]}_{g(j,k)} \, dp_k - \underbrace{T_r(f,i) \frac{\partial s_f}{\partial p_j}}_{h(j,f)} \, dp^w_f = 0$$

Concatenating all $j = 1, 2, ..., N$ products together, one has the matrix G with general element $g(j,k)$ and and H_f be the N-dimensional vector with general element $h(j,f)$ then

[6] The ownership matrix and the response matrix here are defined in a manner analogous to that of the retailer.

$$Gdp - H_f dp_f^w = 0$$

implying the vector

$$\frac{dp}{dp_f^w} = G^{-1} H_f$$

Horizontally concatenating all N (equal to the number of brand-store specific products) columns of H_f together one has the desired matrix.

$$\triangle_p = G^{-1} H$$

Collecting terms and solving for the manufacturers' implied price-cost margins leaves us with

$$p_t^w - c_t^w = -(T_w. * \triangle_{wt})^{-1} s_t(p). \tag{4}$$

2.5 Pricing Games of Steiner Industrial Structure

We offer three different structural models of channel pricing conduct that capture the essence of Steiner's four industry structures. In the first industry structure retailers and manufacturers play a linear pricing game, manufacturers know the retailer's price response function when determining their optimal wholesale price and consequently their margin. This is a Manufacturer Stackelberg pricing game that is characterized in our structural model by the ownership matrix described in footnote 5. This pricing game is consistent with Steiner manufacturer domination since all manufacturers including the store brand manufacturer capture larger margins than the retailers do on the milk sold in their store.

In the second game only manufacturers of the branded products, Hood and Garelick, are channel Stackelberg leaders. The store brand milk is procured at processor cost. This means that either the retailer is vertically integrated into the manufacturing process and produces its own private label, as Stop & Shop was doing during the period we study, or simply the retailer is able to buy the milk at or very close to cost from a processor. The latter scenario arises when a processing plant wants to ensure that it is running at capacity and increase their margins on the branded products they are producing by decreasing average cost of production. Steiner (2004, p.113) cites research on private milk bargaining where this has been the case. Steiner also mentions that a strong store brand line lends retailers channel bargaining power. This allows them to procure their store brands for competitive prices from store brand suppliers. This pricing game is Steiner's mixed regimen pricing model. We call this game Manufacturer Brand Stackelberg with Integrated Store Brand, hereafter MBS-ISB.

The two other pricing models, retailer domination and mutual dependance industry structures are modeled as equation 3 except $p_t^w = c_t^w$ and the ownership matrix is equal to that described in footnote 5 and the manufacturer's ownership matrix would equal zero for each element. If tests point to this structural model as the most statistically valid, one could examine the relationship between inter- and intra- brand elasticities to identify which Steiner pricing model is actually present. The identifying assumption rests on Steiner's assertion that under retailer domination interbrand elasticity exceeds intrabrand elasticity and for mutual dependance the two elasticities are similar. This fact allows one to conclude which industry structure prevails in the event that this empirical structural model is the statistically valid one.[7]

2.6 Formally Ranking the Models of Industry Structure

To formally rank the different models of the supply side conduct we follow the lead of Villas-Boas (2007). First we compute the implied price-cost margins under each pricing game outlined in the previous subsection. Next we define retail price as the sum of retailer and manufacturer margins, and channel marginal cost, which is a function of input prices, c, and parameterized by γ. The specification is completed with a product, store and market specific structural error term, ϵ.

[7]Data on wholesale price, if it were available, would also allow separate identification of retailer domination or mutual dependance as distinctly different empirical structural models of Nash-Bertrand channel markup. In a similar spirit identification of these two models could also be accomplished if data on separate retailer or manufacturer costs were available. Unfortunately our data are limited to retial transactions.

$$p_{jkt} = \overbrace{(p_{jkt} - p^w_{jkt} - c^r_{jkt})}^{retailer\ margin} + \overbrace{(p^w_{jkt} - c^w_{jkt})}^{manufacturer\ margin} + \overbrace{f(c\gamma)}^{channelMC} + \epsilon_{jkt} \tag{5}$$

subtracting the margins from both sides of the equation

$$\widehat{channel\ MC_l} = f(c\gamma) + \epsilon_{jkt}. \tag{6}$$

For different retailer manufacturer pricing games the estimated marginal cost (left hand side of equation 6) will differ. The function $f(c\gamma)$ specifies that channel marginal costs are a function of input prices.[8] We explored the following alternative functional forms: linear, generalized Leontief, exponential ($e^{c\gamma}$) and logarithmic ($ln(c\gamma)$). To formally rank our supply side models Smith (1992) provides a test in the generalized moment framework. For the five different models considered in this paper twenty pairwise tests identify the best pricing game in the sense that it explains the data generation process better then the competing games. Alternative functional forms of channel marginal cost did not change the results of the hypotheses tested, therefore only results for the linear functional form are reported.

To estimate channel marginal costs we once again employ a GMM estimator by simply exploiting unconditional mean independence between explanatory variables and the model error. Estimated channel marginal costs calculated from each supply side game are regressed on the set of retailer and manufacturer input prices. Because our set of explanatory variables do not change for different supply side games, our non-nested tests need not concern themselves with differing instrument validity assumptions. Selecting a preferred supply side model will be done using pairwise tests for non nested models estimated by GMM (Smith, 1992).

[8]equation 6 highlights that instrument validity is assumed to be the same for all supply side specifications. *i.e.* every specification of channel marginal cost has the same explanatory variables.

3 Data and Demand Specification

The Information Resources Inc.(IRI) chain level market data for Boston used in this study has many chain level variables including prices and quantity, and it covers 58 quad week periods beginning March 1996 and ending July 2000. Raw milk input prices are from the USDA. Data on supermarket characteristics for each chain come from Spectra Marketing and spans the same time period as the scanner data in quarterly observations, this data set also reports a figure for sales per square foot. Per capita income and population data have been collected from annual editions of Market Scope. Data on electricity and diesel fuel cost are from the Energy Information Administration.[9] Summary Statistics for the variables used in the demand specification is available in the data appendix.

The dependant variable in the demand equation is the difference in the log of shares of the observed product and the outside good. Shares were computed under the assumption that each member of Boston's population consumes 6 ounces of fluid milk each day.[10] The Independent variables specified in the nested logit demand equations are: price, log of within store brand share, and product characteristics. The variables for product characteristics are: weighted price reduction, share of skim to whole, income, and variables that account for food and non-food services that the supermarkets offered. The motivation for including the food and non-food service variables comes from our nesting structure. Since we assume that the customer first decides which supermarket to patronize and then which milk to buy, one can account for the decision to buy a brand of milk in a supermarket chain by interacting brand dummies with these food and non-food service variables. This gives utility due to services, as measured by our service index, when purchasing a specific brand.

The service index is a measure that falls between 0 and 1 and reveals the propensity for a

[9]Spectra Marketing is a sister company of A. C. Nielsen. All marketing data is available from the University of Connecticut, Food Marketing Policy Center.

[10]Demand was estimated under alternative definitions of market size where consumer had a smaller or larger serving of fresh milk each day. Estimation for each potential market helps to verify the robustness of parameter estimates under different exogenously determined market sizes. Given actual consumption and total potential consumption one can compute the market share of the outside good as well as the shares for different brands of milk sold in the different chains. Most importantly elasticity estimates were robust to the alternative market size specifications.

particular chain to offer a service. In the Spectra data we know whether a specific store in the Boston IRI market has the service or not. Using this information one can calculate the proportion of stores in the chain offering the service in each time period. Due to collinearity in the service data we use principal component analysis to identify two orthogonal services. Service variables in the underlying Spectra data are: propensity to offer bakery, restaurant, seafood counter, pharmacy and bank services. A principle components analysis indicates that component one includes pharmacy and bank and component two includes bakery, restaurant and seafood counter.[11] The two components are food and non food services. To generate the non-food service variable we take the product of the propensity measures for those services, the same procedure is executed to generate the variable for food service. To top off our specification we include quarterly dummies that capture unobserved seasonal determinants of demand.

One must use an IV estimator to obtain estimates of α, β and σ in the demand model (equation 1). Price and the log of conditional market share terms are inherently endogenous. To identify α, the price coefficient, we use changes in channel input prices, specifically the price of raw milk multiplied by the brand indicator variables, price of electric and diesel as well as sales per square foot.[12] Berry (1994) suggests appropriate instruments for the identification of σ could be variables that include characteristics of other brands the chain offers. Raw milk price interacted with brand dummies meet this criteria because these instruments capture differences in the production characteristics of other brands within a supermarket. Generalized method of moments (GMM) is used to estimate the demand equation. Newey and McFadden (1994) show in addition to being a consistent unbiased asymptotically normal estimator GMM is robust to heteroscedastic errors. The moment condition used for parametric identification is the unconditionally expected orthogonality between the set of instruments and the model error.

[11] These results are available in the data appendix

[12] Interacting raw milk prices with brand dummies allows us to separate brand variation in prices (Villas-Boas, 2007, p.637-38).

3.1 Demand Parameter Estimates

The following analysis assumes that each memeber of Boston's population consumes six fluid ounces of fresh milk each day during our analysis period. The six ounce serving assumption is presented for no other reason than it was the middle specification for market size. Results under other definitions of market size do not greatly effect the sign of the coefficients or their relative magnitude. For example, differences in inter- and intra-brand elasticities have the same sign and relative magnitude. Furthermore, the estimates maintain the same ordering. Since margins are proportional to elasticities and since we use margins to tests supply side conduct to choose the most appropriate supply side pricing game, evaluation of Steiner pricing conduct is unaffected by the choice of the outside option.[13]

Table 1 presents demand parameter estimates. The marginal utility of price, α in equation 1, is negative as the law of demand predicts and significant at the 1% level. σ, the with-in retailer correlation component, is an element of (0,1] and significant at the 5% level. All but one of the coefficients that measure the marginal utilities of the product characteristics are highly significant. As hypothesized an increase in weighted price reduction positively influences mean utility. The positive coefficient on units per volume indicates people prefer smaller packaging, which isn't surprising because, all else equal, smaller packages mean milk is fresher every time the individual consumes it. The positive coefficient on skim to whole reveals that people on average prefer low fat milk. Income positively contributes to mean utility and demand for milk. The service variables, which are interacted with brand dummies are expected to increase demand. In the case of store brands demand is decreasing in food service. Perhaps people purchasing store brand believe that stores with more services have higher priced milk. The marginal utility of food service for those

[13] Huang, Rojas, and Bass (2008) show in simulations using a logit specification of demand that a larger market will not effect own price elasticity but biases cross prices elasticities toward zero and when a smaller market is assumed both own and cross price elasticities are biased away from zero. They add the caveat that this may not hold for more complex specifications. We attempted to use these criterion to determine market size, however our estimates did not behave in this way. Their technique may not be appropriate for the nested logit demand model. This is likely due to the less restrictive nature of the substitution patterns of the nested logit demand model, as compared to the simple logit demand model Huang et al. (2008) use.

purchasing Garelick brand is not statistically significant. The J-statistics reveal that we fail to reject the specification, suggesting we have instruments orthogonal to the structural error. The F-tests affirm that the instruments used are collectively relevant. A second specification leaves out the promotion variable (weighted price reduction), this biases α away from zero indicating that controlling for promotional activity, consumers are less price sensitive. The bias is small indicating that intertemporal substitution is not likely which is not surprising for a product with very limited shelf life. Moreover, this gives us reason to believe a static framework for analysis is reasonable.

4 Testing Steiner's Hypotheses

4.1 Results on Interbrand and Intrabrand Elasticities

Table 2 reports elasticities. Interbrand elasticities for manufacturer brands are smaller than their respective intrabrand elasticities at each retailer. This result implies that consumers are more likely to switch stores within a leading brand, like Hood or Garelick, rather than switch to other brands or a store brand in a retailer. Additionally interbrand elasticities for store brands are higher than intrabrand elasticities. This implies that consumers are more likely to switch from the store brand to one of the manufacturer brands within the retailer than to switch to another retailer's store brand. The results imply that manufacturers dominate on their brands and retailers dominate on the store brands.This is a mixed result that does not fall squarely into manufacturer or retailer domination or the mutual dependence structure. However we will demonstrate that it is a mixed regimen result.

4.2 Testing for the Supply Side Pricing Game

Table 3 presents the results of 6 pairwise non-nested hypothesis tests for the three structural models evaluated. For each test of the null model in a row being true against the specified alternative model in a column we report a p-value. As an alternative choice the Manufacturer Brand Stackelberg

Integrated Store Brand (MBS-ISB) model rejects the other models. Further, we fail to reject MBS-ISB against the two other models. These results indicate that MBS-ISB is the best empirical model of channel marginal costs and therefore the best empirical model of supply side conduct. The MBS-ISB model is a Steiner "mixed regimen" industry structure. We will employ the MBS-ISB model to test Steiner's other hypotheses about, division of profits in the channel, and the resulting impact on the retail price consumers pay. This test result is consistent with Steiner's prediction based on interbrand elasticities that are slightly smaller that intrabrand elasticities for the leading brand and interbrand elasticities are slightly larger than intrabrand elasticities for store brand milks.

The results in Table 4 report the vertical share of profits in the channel for each milk product. The vertical share of channel profits under the MBS-ISB model suggests that manufacturers have higher margins and larger profit share on their leading brands than do the retailers selling their milk, specifically more so for Garelick than Hood. In the MBS-ISB model retailers capture the entire store brand margin and since store brand sales make up the lions share of fresh milk sales in Boston retailers capture a larger share of the channel profits than do Garelick and Hood. Steiner (2004, p.123) explains that strong private label lines at these retailers are improving their vertical bargaining clout in two ways. The retailers obtain reductions in the wholesale price of the leading brands vis á vis the manufacturer as well as from the store brand suppliers. The latter result is particularly important for the justification of our structural model as it applies to the retailers other than Stop & Shop who do not own the processors of their milk. In the next section we use equilibrium price simulations to demonstrate the wholesale price reducing effect of store brand provision on the leading brands and store brand retail prices. Moreover these simulations reveal the effect private label provision has on retail prices and flow of profits in the channel.

5 Simulation of a Decrease and Increase in the Presence of Store Brand Milk

5.1 Model of Equilibrium in Prices and Quantities

We perturb the price of Stop&Shop's, the leading retailer, store brand milk to simulate a reduction and expansion of store brand sold, *ceteris paribus*. This technique allows us to analyze horizontal and vertical profit states under the counterfactual that Stop&Shop's store brand is not strategically priced for profit maximization, given pricing game is MBS-ISB. These perturbations are carried out in an equilibrium framework defined by the following condition.

$$p = \hat{mc} + \overbrace{\Omega^{retail}(p)^{-1}s(p)}^{RetailMargin} + \overbrace{\Omega^{manufacturer}(p)^{-1}s(p)}^{ManufacturerMargin}. \tag{7}$$

here $\Omega^{retail}(p)^{-1}$ and $\Omega^{manufacturer}(p)^{-1}$ are respectively the matrices the $-(T_r.*\triangle_{rt})^{-1}$ and $-(T_w.*\triangle_{wt})^{-1}$ from equations 3 and 4. $\hat{mc}$ denotes the channel marginal costs derived using the MBS-ISB supply side structure. Channel marginal costs are assumed constant when the market reacts to the change in Stop&Shop's store brand price. Here we find it reasonable to assume no major changes in costs structure brought about by a small perturbation of price. In this simulation the price of Stop&Shop store brand is perturbed in equation 7 to obtain new optimal prices for the competing products. This simulation simultaneously determines the new equilibrium retail prices, as well as retailer and manufacturer margins and profits.

5.2 Simulation Strategy and Results

In simulations where Stop&Shop's store brand price is perturbed from equilibrium an increase in the price of Stop&Shop's store brand decreases store brand presence while a price decrease has the opposite effect. Before proceeding it should be mentioned that we could augment the store brand milk sales at any retailer and general results would not vary. Precisely, this is due to firm response symmetry inherent in the structural model among retailers and manufacturers. This fact ensures that our results can be generalized to provision of store brand milk by any of the major retailers incorporated in our study. We will proceed by first analyzing the vertical effects at play and then move onto the horizontal effects. Finally we will consider the net effects of the simulation.

Simulation results appearing in Table 4 show that a decrease in the presence of Stop & Shop's store brand milk increases manufacturer profit share on their branded milk sold through Stop & Shop. In fact we find in that Stop & Shop uses the lower wholesale price, store brand bargaining power affords them, to increase their channel profit share. Stop & Shop accomplishes this by reducing retail margins on leading brands of milk, consequently the dual margin crunch leads to lower retail prices on milk at Stop & Shop. Table 5 Documents that the decrease in Stop & Shop store brand increases retail prices of all milks in Stop & Shop and decreases the retail price of manufacturer brands at other retailers. Furthermore it increases the retail price of store brand milk at Shaws and Demoulas but not at Star Market.

A decrease in the presence of Stop & Shop's store brand milk also has important horizontal effects. It should not be surprising that a decreased presence in the leading retailer's store brand helps horizontal competitors capture some of their market share. Shaws, Demoulas, and Star Market are not only emboldened horizontally they also enjoy more vertical bargaining clout. Table 4 shows that a decrease in the presence of Stop & Shop's store brand actually reduces manufacturer channel profit share on their milks sold through Stop & Shop's competitors. Consumer switching to competitor store brands improves the vertical position of these competitors. This new vertical bargaining power affords them lower wholesale prices on the leading brands. Table 5 documents that the paired reduction in channel margins is passed on to the consumer in the form of lower retail prices on manufacturer brands at Stop $ Shop's competition.

Taking the vertical effects together with the horizontal effects we find that the net reduction in the presence of store brand milk in the channel leads to a net increase in retail prices. Table 5 reports a share weighted price index that testifies to a 5 cent increase in price for fluid in Boston brought about by a decrease in the presence of Stop & Shop store brand milk. This results is consistent with Steiner's hypothesis that the mixed regimen serves society best. In Steiner's terms, leading brands have been challenged by the store brands of four major retailers. In general the rivalry in Boston's fluid milk market produces lower average prices and larger output that it other wise would without the all important provision of store brand milk.

6 Conclusion

This paper empirically explored horizontal and vertical competition amongst retailers and manufacturers and the role of store brand marketing within. We tested the Steiner (2004) hypotheses in the context of the Boston fluid milk market where store brand milks capture a large share of fresh milk sales. Specifically we estimate a nested logit model of market demand. Structural parameter estimates allowed us to calculate inter- and intra- brand cross price elasticities which where used to test Steiner's hypotheses about the relationship between these two elasticities and industry structure. Additional the demand parameter estimates enabled us to conduct supply side analysis under three alternative structural specifications of market conduct. From these we found a statistically and empirically favorite supply channel game in MBS-ISB, consistent with Steiner's "mixed regimen" industry structure. This model has the retailer vertically integrated into the manufacturing process of its private label milk and manufacturers determining wholesale price given the retail price on branded products. In simulations we find that store brand provision improves the position of the retailer vis a vis the manufacturer allowing them to capture more channel profits and reduces prices for fluid milk improving the welfare of consumers.

Research in the future could consider more complex specifications of supply side behavior including non-linear pricing games. This however, would make formal ranking of a statistically preferred set of models difficult and possibly infeasible. Additionally, one may consider adapting the Smith (1992) test of non-nested hypotheses to consider multiple alternative hypotheses, leaving one with a more manageable set to rank from. Ultimately, availability of wholesale prices would enable formal testing of the identification strategy used for the non-nested hypothesis tests. Such verification would provide further validity to the results.

Table 1: Results from Nested Logit Model of Demand with Market Defined as One Six Ounce Serving per Person per Day

		With Price Reduction				Without Price Reduction		
Variable		Coefficient	s.e.	p-Value		Coefficient	s.e	p-Value
Constant		-2.6191	0.9444	0.006		-3.6529	1.0316	0
price		-34.4902	7.7647	0.000		-35.1064	8.0416	0.000
log of group share		0.2900	0.1435	0.040		0.2543	0.1540	0.099
weighted price reduction		0.0086	0.0035	0.014				
units per volume		3.3779	1.2938	0.009		3.4027	1.3719	0.013
skim to whole ratio		0.0897	0.0173	0.000		0.1022	0.0186	0.000
income		0.0002	0.00004	0.000		0.0002	0.00004	0.000
Food service								
Hood		3.0284	1.2257	0.013		3.5063	1.2877	0.006
Garelick		1.0185	1.0143	0.315		1.3175	1.0561	0.212
Store Brand		-4.6810	0.5859	0.000		-4.8551	0.6409	0.000
Non-Food Service								
Hood		2.2149	0.3182	0.000		2.1879	0.3310	0.000
Garelick		0.4601	0.2593	0.076		0.3080	0.2786	0.269
Store Brand		3.0411	0.5571	0.000		3.1375	0.5837	0.000
Centered R^2		0.8759				0.8635		
Hasen J		0.5520		0.968		0.4610		0.977
F-Statistic	d.f. (17,678)	372.45		0.000	d.f. (16,679)	362.87		0.000
Serving-capita-day	Sensitivity of Estimated Price Coefficient to Market Definition							
6 oz.		-34.4902	7.7647	0.000		-35.1064	8.0416	0.000
8 oz.		-29.6610	7.1700	0.000		-30.24	7.4562	0.000
	Sensitivity of Estimated log of group share ($\ln(s_{i/j})$)Coefficient to Market Definition							
6 oz.		0.2900	0.1435	0.040		0.2543	1.0316	0.099
8 oz.		0.3378	0.1337	0.012		0.2988	0.1443	0.038

Note: The dependant variable in each regression is $\ln(s_{ijt})$-$\ln(s_{0t})$. Regressions include brand dummies and quarterly dummies
Source: Authors Calculations

Table 2: Estimated Mean Interbrand and Mean Intrabrand Price Elasticities

		Market defined by 6oz serving					Market defined by 8oz serving				
Retailer	Manufacturer	own-price	cross mean	within store	other stores	difference	own-price	cross mean	within store	other stores	difference
Stop&Shop	Hood	-7.993	0.183	0.181	0.196	0.015	-7.376	0.238	0.236	0.255	0.018
	Garelick	-7.684	0.271	0.270	0.281	0.011	-7.091	0.354	0.353	0.366	0.013
	Store Brand	-5.354	0.926	0.966	0.823	-0.143	-4.834	1.271	1.335	1.129	-0.206
Shaws	Hood	-8.668	0.090	0.091	0.095	0.005	-7.837	0.111	0.112	0.119	0.007
	Garelick	-8.126	0.347	0.352	0.355	0.004	-7.274	0.441	0.444	0.453	0.009
	Store Brand	-5.308	1.396	1.517	1.246	-0.271	-4.772	1.581	1.701	1.409	-0.291
Demoulas	Hood	-8.197	0.039	0.036	0.042	0.006	-7.545	0.047	0.043	0.050	0.007
	Garelick	-7.745	0.076	0.072	0.080	0.008	-7.139	0.090	0.085	0.095	0.010
	Store Brand	-4.298	1.419	1.414	1.289	-0.125	-3.822	1.829	1.831	1.661	-0.170
Star	Hood	-8.101	0.233	0.228	0.249	0.021	-7.395	0.280	0.274	0.300	0.026
	Garelick	-7.144	0.590	0.588	0.615	0.027	-6.486	0.706	0.705	0.736	0.031
	Store Brand	-5.981	0.937	0.968	0.832	-0.136	-5.412	1.121	1.159	0.994	-0.165
Avergae	Hood	-8.240	0.136	0.134	0.146	0.012	-7.538	0.169	0.166	0.181	0.014
	Garelick	-7.675	0.321	0.320	0.333	0.012	-6.998	0.398	0.397	0.412	0.016
	Store Brand	-5.235	1.170	1.216	1.047	-0.169	-4.710	1.451	1.506	1.298	-0.208
Average		-7.050	0.542	0.557	0.539	-0.018	-6.415	0.673	0.690	0.630	-0.059

Source: Authors Calculations

Table 3: p-Values for Tests of Non-Nested Supply Side Scenarios

	Alternative Model		
Null Model	1	2	3
1: Manufacturer Stakkelberg	-	0.0003	0.4851
2: MS with integrated store brand	0.4652	-	0.4915
3: Joint Colusion	0.0439	0.0237	-

Source: Authors Calculations

Note: p-values for the (Smith, 1992) pairwise test of non-nested hypotheses of the null model in a row being true against the alternative in a column.

Table 4: Vertical Share of Channel Profits

		Equilibrium		10% Price increase on Stop&Shop store brand	
Manufacturer	Retailer	Retailer	Manufacturer	Retailer	Manufacturer
Hood	Stop&Shop	43.90%	56.10%	42.35%	57.65%
	Shaws	38.31%	61.69%	39.28%	60.72%
	Demoulas	41.75%	58.25%	42.23%	57.77%
	Star	39.90%	60.10%	40.82%	59.18%
	total	41.77%	58.23%	41.58%	58.42%
Garelick	Stop&Shop	40.94%	59.06%	38.74%	61.26%
	Shaws	34.59%	65.41%	35.29%	64.71%
	Demoulas	39.17%	60.83%	39.57%	60.43%
	Star	36.00%	64.00%	36.62%	63.38%
	total	37.53%	62.47%	37.36%	62.64%

Source: Authors Calculations

Table 5: Retail Prices per Gallon to Changes in Stop&Shop Store Brand Price

		Equilibrium	10% Price increase on Stop&Shop store brand		10% Price decrease on Stop&Shop store brand	
Retailer	Brand	price	price	difference	price	difference
Stop&Shop	Hood	$2.775	$2.839	$0.065	$2.722	-$0.053
	Garelick	$2.745	$2.841	$0.096	$2.664	-$0.081
	Store Brand	$2.429	$2.672	$0.243	$2.186	-$0.243
Shaws	Hood	$2.894	$2.863	-$0.031	$2.970	$0.177
	Garelick	$2.861	$2.833	-$0.028	$2.932	$0.259
	Store Brand	$2.391	$2.392	$0.001	$2.389	-$0.045
Demoulas	Hood	$2.716	$2.700	-$0.016	$2.754	$0.038
	Garelick	$2.591	$2.575	-$0.016	$2.629	$0.038
	Store Brand	$2.226	$2.230	$0.004	$2.221	-$0.006
Star	Hood	$2.793	$2.765	-$0.028	$2.861	-$0.033
	Garelick	$2.673	$2.650	-$0.023	$2.732	-$0.129
	Store Brand	$2.435	$2.435	$0.000	$2.435	$0.044
Price Index		$2.449	$2.498	$0.049	$2.361	-$0.087

Source: Authors Calculations

A Data Appendix

Table 6: Market Shares, Within Retailer Share, Prices: Summary Statistics

Retailer		Manufacturer	Mean	S.D.	Minimum	Maximum
Market Share	*Chain Share*					
Stop&Shop	0.180	Hood	0.022	0.005	0.013	0.029
		Garelick	0.032	0.003	0.026	0.038
		Store Brand	0.126	0.006	0.112	0.140
Shaws	0.137	Hood	0.009	0.007	0.000	0.017
		Garelick	0.030	0.006	0.017	0.040
		Store Brand	0.097	0.011	0.073	0.117
Demoulas	0.123	Hood	0.006	0.002	0.003	0.011
		Garelick	0.007	0.003	0.003	0.011
		Store Brand	0.111	0.010	0.090	0.131
Star	0.082	Hood	0.013	0.003	0.008	0.018
		Garelick	0.026	0.003	0.017	0.032
		Store Brand	0.043	0.007	0.029	0.053
Group Share						
Stop&Shop	0.180	Hood	0.121	0.023	0.076	0.159
		Garelick	0.180	0.017	0.147	0.227
		Store Brand	0.699	0.017	0.661	0.746
Shaws	0.137	Hood	0.070	0.052	0.000	0.134
		Garelick	0.221	0.030	0.164	0.274
		Store Brand	0.709	0.037	0.633	0.764
Demoulas	0.123	Hood	0.048	0.022	0.024	0.094
		Garelick	0.053	0.025	0.025	0.093
		Store Brand	0.898	0.045	0.832	0.949
Star	0.082	Hood	0.162	0.043	0.099	0.236
		Garelick	0.316	0.018	0.279	0.356
		Store Brand	0.523	0.044	0.448	0.604
Price per gallon						
Stop&Shop	0.180	Hood	$2.772	$0.113	$2.460	$2.961
		Garelick	$2.731	$0.207	$2.363	$3.072
		Store Brand	$2.436	$0.117	$2.251	$2.685
Shaws	0.137	Hood	$2.765	$0.151	$2.408	$3.087
		Garelick	$2.708	$0.181	$2.426	$3.058
		Store Brand	$2.395	$0.126	$2.207	$2.651
Demoulas	0.123	Hood	$2.776	$0.077	$2.597	$2.924
		Garelick	$2.646	$0.135	$2.380	$2.935
		Store Brand	$2.211	$0.101	$2.054	$2.411
Star	0.082	Hood	$2.925	$0.091	$2.761	$3.143
		Garelick	$2.786	$0.156	$2.567	$3.168
		Store Brand	$2.434	$0.134	$2.236	$2.723

Source: IRI

Table 7: Advertising, Package Size, Skim to Whole Ratio: Summary Statistics

Retailer	Manufacturer	Mean	Median	S.D.	Minimum	Maximum
Weighted Price Reduction						
Stop&Shop	Hood	8.33	7.78	5.30	0	22.89
	Garelick	8.99	7.48	6.59	0	27.37
	Store Brand	8.29	8.30	3.19	0	16.68
Shaws	Hood	7.42	8.29	7.17	0	26.83
	Garelick	11.48	12.18	5.54	0	24.89
	Store Brand	8.04	8.50	4.34	0	19.22
Demoulas	Hood	1.86	0.00	3.00	0	7.00
	Garelick	2.08	0.00	3.16	0	11.16
	Store Brand	4.17	4.94	3.74	0	11.95
Star	Hood	7.65	7.32	4.16	0	17.03
	Garelick	9.41	9.47	4.51	0	21.05
	Store Brand	5.50	5.93	3.23	0	12.75
Units per Volume						
Stop&Shop	Hood	0.187	0.186	0.009	0.175	0.227
	Garelick	0.187	0.186	0.006	0.175	0.213
	Store Brand	0.171	0.172	0.004	0.157	0.178
Shaws	Hood	0.199	0.199	0.005	0.185	0.209
	Garelick	0.158	0.158	0.002	0.154	0.163
	Store Brand	0.277	0.264	0.026	0.239	0.318
Demoulas	Hood	0.236	0.239	0.018	0.192	0.278
	Garelick	0.154	0.157	0.005	0.147	0.162
	Store Brand	0.288	0.292	0.013	0.265	0.306
Star	Hood	0.201	0.201	0.006	0.185	0.214
	Garelick	0.165	0.166	0.002	0.160	0.172
	Store Brand	0.270	0.265	0.015	0.247	0.295
Skim to Whole Ratio						
Stop&Shop	Hood	12.52	12.16	1.85	7.69	17.92
	Garelick	16.53	16.31	2.13	11.11	22.08
	Store Brand	10.73	10.75	0.33	9.99	11.61
Shaws	Hood	7.17	8.66	3.22	1.06	10.69
	Garelick	14.32	14.23	2.04	11.35	18.45
	Store Brand	11.57	11.47	0.70	10.25	12.73
Demoulas	Hood	4.20	4.20	1.29	2.10	6.28
	Garelick	4.19	4.07	0.83	2.96	7.46
	Store Brand	12.47	12.43	0.38	11.80	13.54
Star	Hood	8.53	8.93	2.39	4.94	14.41
	Garelick	14.13	13.77	2.16	10.45	20.73
	Store Brand	11.56	11.73	0.81	9.16	14.23

Source: IRI

Table 8: Income, Services, Cost Proxies and Input Costs: Summary Statistics

Retailer	Variable	Mean	Median	S.D.	Minimum	Maximum
	Income	$18,003	$17,894	$1,398	$16,240	$19,787
Stop&Shop	Number of stores	69.65	70.5	4.40	61	74
	Bakery	0.861	0.888	0.056	0.730	0.904
	Bank	0.578	0.605	0.053	0.453	0.622
	Restaurant	0.043	0.054	0.017	0.015	0.057
	Pharmacy	0.567	0.599	0.075	0.423	0.649
	Seafood Counter	0.947	0.957	0.032	0.880	0.990
	Volume Sales	491559	509857	41520	426689	553425
	Retial Sq Footage	41178	42234	3293	33932	44730
Shaws	Number of stores	46.45	46	1.61	43	49
	Bakery	0.924	1	0.123	0.708	1
	Bank	0.391	0.391	0.059	0.313	0.486
	Restaurant	0.064	0.066	0.048	0	0.136
	Pharmacy	0.055	0.043	0.026	0.019	0.093
	Seafood Counter	1	1	0	1	1
	Volume Sales	35388	36149	2528	30125	38111
	Retial Sq Footage	24991	24903	355	24465	25558
Demoulas	Number of stores	32.1	32	0.31	32	33
	Bakery	0.544	0.588	0.093	0.352	0.633
	Bank	0.046	0.000	0.064	0.000	0.156
	Restaurant	0.055	0.062	0.013	0.031	0.063
	Pharmacy	0.017	0.000	0.028	0.000	0.063
	Seafood Counter	0.829	0.882	0.102	0.641	0.917
	Volume Sales	555204	566927	32652	497656	598438
	Retial Sq Footage	38641	40026	5496	27087	44781
Star	Number of stores	39.25	39.5	2.75	33	42
	Bakery	0.978	1	0.032	0.920	1
	Bank	0.365	0.383	0.059	0.244	0.429
	Restaurant	0.180	0.173	0.078	0.095	0.360
	Pharmacy	0.370	0.382	0.047	0.273	0.424
	Seafood Counter	0.971	0.970	0.019	0.945	1
	Volume Sales	405614	419367	35431	327000	435888
	Retial Sq Footage	35260	34617	2756	32196	41819
	Costs					
	Price of raw Milk	$1.40	$1.39	$0.10	$1.23	$1.66
	Electric	$7.67	$7.86	$0.93	$5.19	$9.27
	Diesel	$112.42	$113.21	$12.23	$89.33	$131.72

Sources: Income: Market Scope, Retailer Characteristics: Spectra Marketing, Costs: Federal Milk Market Order and Energy Information Association

Table 9: Results of Principal Component Analysis of Services Across all Retailers

	Correlation		
	Non-Food Service	Food Service	
Bakery	0.565637	0.772051	
Bank	0.953579	0.123939	
Pharmacy	0.853078	0.109090	
Seafood	0.481116	0.682857	
Restaurant	-0.115646	0.856386	
% of total variance account for by the two components			80.4972
Initial Eigenvalues			1.11477

Source: Authors Calculations

Table 10: Retailer Margins per Gallon

		Equilibrium	10% Price increase on Stop&Shop store brand	
Retailer	Brand	margin	margin	difference
Stop&Shop	Hood	\$0.422	\$0.434	\$0.012
	Garelick	\$0.429	\$0.443	\$0.014
	Store Brand	\$0.487	\$0.731	\$0.244
Shaws	Hood	\$0.439	\$0.438	-\$0.001
	Garelick	\$0.447	\$0.446	-\$0.001
	Store Brand	\$0.484	\$0.485	\$0.001
Demoulas	Hood	\$0.429	\$0.427	-\$0.002
	Garelick	\$0.431	\$0.429	-\$0.002
	Store Brand	\$0.528	\$0.531	\$0.004
Star	Hood	\$0.436	\$0.435	-\$0.001
	Garelick	\$0.450	\$0.450	-\$0.001
	Store Brand	\$0.464	\$0.464	\$0.000

Source: Authors Calculations

Table 11: Manufacturer Margins per Gallon

		Equilibrium	10% Price increase on Stop&Shop store brand	
Manufacturer	Retailer	margin	margin	difference
Hood	Stop&Shop	\$0.539	\$0.591	\$0.052
	Shaws	\$0.707	\$0.677	-\$0.030
	Demoulas	\$0.598	\$0.584	-\$0.014
	Star	\$0.657	\$0.631	-\$0.027
Garelick	Stop&Shop	\$0.618	\$0.700	\$0.082
	Shaws	\$0.846	\$0.819	-\$0.027
	Demoulas	\$0.669	\$0.655	-\$0.014
	Star	\$0.800	\$0.778	-\$0.022

Source: Authors Calculations

Table 12: Retail Profits

Retailer	Manufacturer	Equilibrium profit	10% Price increase on Stop&Shop store brand profit	difference
Stop&Shop	Hood	$64,496	$78,892	$14,396
	Garelick	$97,124	$119,186	$22,062
	Store Brand	$372,898	$316,930	-$55,968
	total	$534,519	$515,008	-$19,511
Shaws	Hood	$13,443	$14,039	$596
	Garelick	$52,759	$55,148	$2,389
	Store Brand	$226,218	$237,408	$11,190
	total	$292,420	$306,594	$14,174
Demoulas	Hood	$10,880	$11,343	$464
	Garelick	$21,274	$22,186	$912
	Store Brand	$477,988	$503,891	$25,903
	total	$510,142	$537,421	$27,279
Star	Hood	$40,621	$42,413	$1,792
	Garelick	$105,729	$110,563	$4,834
	Store Brand	$171,599	$179,722	$8,123
	total	$317,948	$332,698	$14,750
All Retailers		$1,655,029	$1,574,123	-$80,906

Source: Authors Calculations

Table 13: Manufacturer Profits

Manufacturer	Retailer	Equilibrium profit	10% Price increase on Stop&Shop store brand profit	difference
Hood	Stop&Shop	$82,433	$107,410	$24,977
	Shaws	$21,643	$21,701	$58
	Demoulas	$15,181	$15,519	$338
	Star	$61,188	$61,486	$298
	total	$180,445	$206,115	$25,670
Garelick	Stop&Shop	$140,096	$188,487	$48,391
	Shaws	$99,753	$101,142	$1,388
	Demoulas	$33,042	$33,879	$837
	Star	$187,971	$191,364	$3,393
	total	$460,862	$514,872	$54,010

Source: Authors Calculations

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