Food Marketing Policy Center

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On incumbents' profits and consumer welfare:
The U.S. Processed Cheese Market Case**

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Research Report No. 79
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Research Report Series
http://www.fmpc.uconn.edu

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Preface

We estimate the effects of new brands on market competition and consumer welfare in the U.S. processed cheese market. We find that an observed increase in consumer welfare was attributable mainly to an increase in the number of brands in the sample market, while the price effect, which measures welfare change caused by adding new brands to existing brands, decreased welfare as the prices of the existing brands increased in a large portion of sample markets. The price increase was most pronounced among the introducer's existing brands.

Key words: Consumer Welfare, Incumbent's Profits, New Brands, Random Coefficient Model

I. Introduction

New brands have been an important source of consumer welfare change and firms' market strategy. In this paper we evaluate how new brands have affected the U.S. processed cheese market in terms of consumers' welfare and firms' profits. During the sample period, from the first quarter of 1988 to the fourth quarter of 1992, three processed cheese brands entered the markets.

The introduction of new brands can happen when there is open entry or when incumbents choose to preempt a threat of entry by brand proliferation. Incumbents may seek to pack the product characteristics space with a sufficient diversity of product variants so that no room for profitable new entry remains.[1] According to Smiley (1988), the introduction of new product was one of the most prevalent strategies for deterring entry. Schmalensee (1979) and Scherer (1982) also claim that brand proliferation served as an entry deterrent in the RTE cereal industry.[2] Considering that knowledge of the relationship between dietary fat and heart disease has been spreading rapidly since the mid 1980's,[3] the introduction of low-fat segment brands in the U.S. processed cheese market could have been an attempt to fill the related product niches.

The entry of new brands could affect consumers' welfare in either of two ways, by increasing the variety of brands or by changing the market equilibrium prices. The variety effect would be positive for consumer welfare. Since the entrants were low-fat segment brands, consumers whose preferences are in the neighborhood of the product characteristics of the entrants in the product space might have benefited more than average consumers. The price effect, however, could be positive or negative for consumer welfare depending on the strategy of the introducer and other firms' reactions. The market could have become more competitive following the entry. However, the new brands might have given the introducer, Phillip Morris, some control over prices and increased the market prices of existing brands. New brands could take producer's surplus of incumbents. This is called "cannibalization."[4] When new brands are close substitutes for incumbents, new brands cannibalize considerable surplus from the other brands. Since the new brands are low-fat segments, low-fat brands might have lost more than other segments' brands among incumbents.[5]

We proceed as follows.[6] We estimate the processed cheese demand and pricing relationship using a random coefficient model at post-entry equilibrium under the assumption of Nash price competition.[7] This is therefore an unbalanced panel model that accommodates the entry of new brands. To evaluate the entry effects, we implement a counterfactual simulation. Our counterfactual is that new brands are removed from the market. We then estimate a new equilibrium price, given consumers' preferences without the new brands. We evaluate the changes in consumer welfare and firms' margins and profits in 210 markets since the fourth quarter of 1991, the point after which all brands were available.

Our results suggest that the total social welfare increased by 63.5 million dollars in the 2l0 sample markets. The consumer surplus was estimated as 43.2 million dollars while total profit change was 20.3 million dollars. The consumer welfare increase was attributable mostly to the increase in the number of brands available to consumers. The price effect, which measures welfare change from the market with existing brands to the market with the new brands added, eroded welfare as the prices of existing brands actually increased facing the new brands in a large portion of sample markets. In particular, the increase was most prominent among Phillip Morris's brands. This

[1] Scherer and Ross (1990), p.404.

[2] Scherer and Ross (1990) also describe General Motor's 1921 decision to offer a complete spectrum of automobiles. And they illustrate how the Swedish Tobacco Company reacted by offering twice as many brands upon losing its legal monopoly.

[3] See Pauline M. Ippolito and Alan D. Mathios (1996)

[4] See Scherer and Ross (1990), p.605.

[5] The shares of other low-fat segment cheeses, Lite line, Weight Watchers, and Light N Lively, decreased from 0.79 % to 0.37%, from 1.01% to 0.21%, and 0.98% to 0.43%, respectively, during the sample period.

[6] Studies on consumer benefits from new products include Feenstra (1988), Berry, Levinsohn and Pakes (1993), Fershtman and Gandal (1998), Petrin (2001), Bresnahan (1986), Greenstein (1994),
Trajtenberg (1989), Hausman (1997a, 1997b, 1999). These studies include the automobile, computer, health care, breakfast cereal, and cellular phone industries.

[7] Refer to BLP(1995), Nevo (2001) and Petrin (2002) for model specification.

verifies that new brands provide a price control for the existing brands of the introducer.

In Part II, we look into the change in the structure of the U.S processed cheese market and examine data taken during the sample period. We then explain the estimation of demand and pricing relationships in Part III. We summarize the estimation results in Part IV. And we conclude in Part V.

2. The U.S. Processed Cheese Market and Data

Processed cheese is the largest-selling among all types of cheese and is primarily sold pre-sliced in packages or in individually wrapped slices in packages. Table 1 shows the trend in market shares for leading processed cheese brands. Phillip Morris has a dominant position in the market and Borden is a distant second to Phillip Morris.

During the sample period, from the first quarter of 1988 to the fourth quarter of 1992, Phillip Morris introduced new brands to protect its dominant position. Kraft Free and Velveeta Light were introduced in the first quarter in 1990 and the first quarter in 1991, respectively. Kraft Light had existed since the first quarter of 1988, but it had been available in only a few markets and did not become fully available until the fourth quarter of 1991. These new brands helped to recapture market share when their two main brands, Kraft and Velveeta, were losing their market shares. The market shares of Kraft and Velveeta were 32.43 % and 25.49 % in the first quarter of 1988, but they shrank to 23.49 % and 19.40 % by the fourth quarter of 1992, respectively. The combined share of the three low-fat brands was 8.45% for the fourth quarter of 1992, almost the same as the market share of Borden, which was the second strongest firm.

The data consists of market share, price, product characteristics, and demographic variables. The data for price and quantity was collected from supermarkets in the most populous metropolitan areas of the U.S by Information Resources Inc. Market share and price are quarterly, covering the period from the first quarter of 1988 to the fourth quarter of 1992. Each city and quarter combination is defined as a market. The total number of markets in the data is 680. For the analysis, 10 brands are selected, while other brands and private labels are treated as outside goods. Due to the entry of new brands, the number of brands varies from seven to 10 in different markets.

The price is the net of any merchandising activity. Thus, a price reduction for a promotion is reflected in the price. And price is deflated using the regional city CPI and then converted to real price per serving (28g). Market share is volume share. Product characteristics, calories, fat, sodium, and cholesterol were obtained from nutrient fact books that were published during the sample period. Demographic variables are sampled from the Current Population Survey (CPS). These include income, age, child, and race. We define the child variable as 1 if the age is less than 17 years old, 0 otherwise. The nonwhite variable's value is 1 if an individual is nonwhite and 0 if an individual is white. Income is household income divided by the number of household members.

3. Model

3.1. Demand Specification

We estimate demand for processed cheese using a random coefficient model.[8] The model represents consumer preferences for products as a function of individual consumer characteristics and characteristics of the products.[9] The indirect utility of consumer i from brand j at market m depends on product characteristics and consumer: $U_{ijm}(x_{jm}, \xi_{jm}, p_{jm}, D_i, v_i : \theta)$, where x_{jm}, p_{jm} are observed cheese characteristics and prices and D_i, v_i, ξ_{jm} are observed individual characteristics, unobserved individual consumer characteristics, and unobserved cheese characteristics,[10] respectively. And θ is an unknown parameter vector to be estimated. We specify the indirect utility function as quasi-linear, following Berry (1994).

[8] Refer to BLP (1995) and Nevo (2001).

[9] An alternative approach to solving the dimensionality problem in the differentiated product markets is to use a multi-level demand system for differentiated products (Hausman, Leonard, and Zona, 1994, Cotterill, 1994), which is an application of multi-stage budgeting.

[10] They are observed by consumers but not observed by econometricians.

$$u_{ijm} = x_{jm}\beta_i - \alpha_i p_{jm} + \xi_{jm} + \varepsilon_{ijm} \tag{1}$$

In the utility function, α_i represents consumer i 's marginal income utility, β_i represents individual-specific parameters on product characteristics, and ε_{ijm} is a mean zero stochastic term, respectively.[11]

The indirect utility can be divided into two parts. The first part is the mean utility level of brand *j* in the market m, δ_{jm}, and the second part is the deviation from the mean level utility, which captures the effects of the random coefficients.

$$u_{ijm} = \delta_{jm}(x_j, p_{jm}, \xi_{jm} : \theta_1) + \mu_{ijm}(x_j, p_{jm}, v_i, D_i; \theta_2) + \varepsilon_{ijm} \tag{2}$$

$$\delta_{jm} = x_{jm}\beta - \alpha p_{jm} + \xi_{jm} \tag{3}$$

$$\mu_{ijm} = \sum_{l=1}^{L} \eta_l D_{il} p_{jm} + \sigma_{K+1} v_{i(K+1)} p_{jm} + \sum_{l=1}^{L} \sum_{k=1}^{K} \phi_{lk} D_{il} x_{jkm} + \sum_{k=1}^{K} \sigma_k v_{ik} x_{jkm} \tag{4}$$

$$u_{i0m} = \xi_{0m} + \phi_0 D_i + \sigma_0 v_{i0m} + \varepsilon_{iom} \tag{5}$$

μ_{ijm} represents the interaction of price and product characteristics with the observed demographic variables D_i and unobservable individual characteristics v_i. The D_i is an $L \times 1$ vector for each individual. The unobserved individual characteristics, or v_i's, are random draws from the multivariate normal distribution, $N(0, I_{K+1})$, where $K+1$ draws for each individual corresponds to the price and product characteristics of which the dimension is $K \times 1$. The contribution of x_{jkm} units of the product characteristic to consumer i's utility is

$$(\beta_k + \sum_{l=1}^{L} \phi_{lk} D_{il} + \sigma_k v_{ik}) x_{jkm}.$$

Additionally, $u_{i0m} = \xi_{0m} + \phi_0 D_i + \sigma_0 v_{i0m} + \varepsilon_{iom}$ is the indirect utility of the outside goods option.[12]

We assume that consumers choose one unit of the processed cheese brand that offers the highest utility and that they choose only one brand during each shopping trip. Let us assume that F is the joint distribution function of D, v and ε. In that case A_{jm} represents the set of the values for D, v and ε that induces the choice of brand j in market m.

$$A_{jm} = \{D, v, \varepsilon \mid \quad u_{ijm} > u_{ihm} \ \ h = 0,1,..., J\} \tag{6}$$

[11] For the logit model, consumers have the same parameters in the utility function and the individual heterogeneity is modeled in the error term only.

[12] We define the total volume of processed cheese sold as market size and we treat the private labels and other small-share brands that are not included in the analysis as outside goods. Considering that a cheeseburger costs very little more than a hamburger, an increase in the processed cheese price would not make people shift away from consumption of cheeseburgers and consume hamburgers instead. Rather, people would substitute private labels or relatively cheaper brands that are not included as inside goods. Nevo (2001) assumed the size of the market to be one serving of cereal per capita per day and BLP (1995) use the number of automobiles sold as market size.

If we assume that D, v and ε are independent, then the market share of brand j in market m is as follows.

$$s_{jm}(x,\ p,\delta;\theta_2) = \int_{A_{jm}} dF(D,v,\varepsilon) = \int_{A_{jm}} dF(\varepsilon \mid D,v)dF(v \mid D)dF(D) \tag{7}$$
$$= \int_{A_{jm}} dF(\varepsilon)dF(v)dF(D)$$

Since the integral is increasingly difficult to calculate as the dimensions of the consumer characteristics increase, a simulation estimator of the integral that uses the empirical distribution instead of population density F is used in this paper.

3.2 Pricing Relationship

Let us assume that each manufacturer f produces goods j=1,…., J_f and that a firm's marginal cost is constant for each product and varies across markets; mc_{jm}, then a firm's profit in market m can be represented as follows[13]

$$\Pi_f^m = \sum_{j=1}^{J_f}(p_{jm} - mc_{jm})Ms_{jm}(p) \tag{8}$$

M is market size and s_{jm}(p) is the market share of j in market m. With this we can solve the multi-product firm's profit maximization problem under the assumption of Nash-Bertrand competition.

$$\frac{\partial \Pi_f^m}{\partial p_{jm}} = s_{jm} + \sum_{k=1}^{J_f}(p_{km} - mc_{km})\frac{\partial s_{km}}{\partial p_{jm}} = 0,\ \ j = 1,\ldots\ldots,J_f \tag{9}$$

When a firm produces many brands, it maximizes the sum of brands' profits in the firm. The second term therefore includes the impact of p_{jm} on the other brands' revenues inside the firm as well as the own price effect on its revenue. Hence, the first order conditions, (9), can be summarized in vector notation as (10):

$$(p\ - mc)\Delta(p) + s(p) = 0 \tag{10}$$

where p, mc, and s(p) are a price vector for all brands, a vector of marginal costs of all brands and a vector of market shares, and Δ is a $J * J$ matrix with elements:

$$\begin{cases} \dfrac{\partial s_k(p)}{\partial p_j}, & \text{if brand k and j are produced by the same firm} \\ 0, & \text{Otherwise} \end{cases} \tag{11}$$

3.3 Estimation

We estimate the demand function and then recover the pricing relationship given the estimated demand surface. The demand function is estimated by the GMM. An estimation issue in the model is the correlation between prices

[13] In this paper we assume that firms solve profit maximization problems in each market separately rather than coordinating pricing across markets.

and the error term in the mean utility function. The error term has the interpretation of unobserved product quality.[14] Hence the estimation requires instrumental variables that are correlated with prices but uncorrelated with the error term. To construct the instrumental variables, we followed an approach similar to that of Hausman (1996), Cotterill (1994), and Nevo (2001). The identifying assumption is that, controlling for brand-specific means and demographics, city-specific demand shocks are independent across cities. Given this assumption, a demand shock for a particular brand will be independent of prices of the same brand in other cities. Due to the common marginal cost, prices of a brand in different cities within a region will be correlated, and therefore can be used as valid instrument variables.[15] We include also time dummy fixed effects in the regression model and use them as instruments because the independence assumption will be violated if there is a national or regional demand shock or nationwide advertising campaign.[16]

Let Z be n by L matrix with its row z_k and $\xi(\theta)$ be n by 1 error term in mean utility with its row ξ_k. Then the moment condition, where the instrumental variables are orthogonal to the structural error, or error terms in the mean utility, is used to form the GMM objective function, $E[z_k \xi_k(\theta)] = 0$. Then the sample moment will be

$$\bar{m}(\theta) = \frac{1}{n}\sum_{k=1}^{n} z_k \xi_k(\theta) = \frac{1}{n} Z'\xi(\theta)$$

Now we search for θ, which minimizes the GMM objective function. The GMM estimate is:

$$\hat{\theta} = \arg\min_{\theta}[\bar{m}' W \bar{m}] \tag{12}$$

Where W is a consistent estimate of the inverse of asymptotic variance of $\sqrt{n}\,\bar{m}(\theta)$.

3.4. Estimation of changes in consumer welfare and firms' profit

Suppose that the new brands that entered the market during the sample period were removed. There would then be only seven processed cheese brands in each market and market prices would converge to new counterfactual equilibrium prices, which can be captured by the pricing relationship. As the number of brands changes, the structure of $\Delta(p)$ will change and market share, $s(p)$, will also be different as the probability that consumers will choose any particular brand changes. Given the estimated demand side parameters and the technology of brands, we can solve for new equilibrium prices using (13) and calculate firms' new margins and profits.

$$\hat{p} = mc + \Delta(p)^{-1} s(p) \tag{13}$$

[14] The correlation between price and unobserved characteristics is positive because higher quality could lead suppliers to set higher prices. Trajtenberg (1989, 1990) found that demand for CT scanners was estimated to be positively sloped with price because of the omission of unobserved quality, which was positively correlated with price.

[15] One of the instruments typically used is the variable that represents closeness in product space in the particular markets. The examples are BLP (1995) and Bresnahan, Stern, and Trajsenberg (1997). The counts of brands with similar characteristics that are sold by competing firms and the same firm provide one example of these instruments. These instruments are, however, appropriate for dynamically changing markets in which product characteristics evolve continuously. If a market is mature and product characteristics do not change much, then this instrumental variable will not change across markets and it will have little identifying power.

[16] Refer to Bresnahan's comment on Hausman (1996).

The total change in producer profits in the sample markets can be calculated as follows.

$$\sum_{m=1}^{M=210}\sum_{f=1}^{F}[\Pi_f^m(p_1, mc:\theta) - \Pi_f^m(p_0, mc:\theta)] \tag{14}$$

$\Pi_f^m(p_1, mc:\theta)$ is a firm's profit at the post entry equilibrium price and $\Pi_f^m(p_0, mc:\theta)$ is a firm's profit at the conterfactual equilibrium price. As the prices and the number of brands available to consumers change, consumers' welfare also will change. The consumer welfare change is estimated by the compensating variation, which is defined as follows:

$$CV_i = \frac{\ln[\sum_{j=0}^{J=10}\exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7}\exp((V_{ij}(p_0))]}{\alpha_i} \tag{15}$$

Here, $V_{ij}(p_1)$ represents $V_{ij} = x_j\beta_i + \alpha_i p_j + \xi_j$ at equilibrium prices p_1 with new brands. $V_{ij}(p_0)$ is the utility level of consumer i who consumes brand j at the counterfactual price p_0 without new brands. And α_i is the marginal income utility of consumer i.[17] The compensating variation can be divided into two parts, a variety effect and a price effect.[18]

$$\begin{aligned} CV_i = &\frac{\ln[\sum_{j=0}^{J=10}\exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7}\exp(V_{ij}(p_1))]}{\alpha_i} \\ &+ \frac{\ln[\sum_{j=0}^{J=7}\exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7}\exp(V_{ij}(p_0))]}{\alpha_i} \end{aligned} \tag{16}$$

The first part of the compensating variation captures the consumer benefit derived from the increase in variety while the second part measures the welfare change caused by the price change in the existing market brands.

4. Results

Tables 4 and 5 show the estimated demand side parameters.[19] For the parameters of mean utility, the coefficient on price is negative and significant and fat is positive and significant. This is possibly because butterfat increases the taste of processed cheese. However, the sensitivity to fat increases as income rises. The interaction term between fat and income is negative and significant. The estimates of own and cross price elasticities indicate that cross price elasticities between regular segment and low fat segment were asymmetric. Cross price elasticities of low fat segment corresponding to price changes of regular segment brands are higher than those of regular segment with respect to the price changes in low fat segment. This might have provided an incentive for Phillip Morris to introduce 3 low fat segment cheeses to capture consumers who were sensitive to fat and less sensitive to prices. In Table 6 we estimate new equilibrium prices without the new brands in each market under the assumption of Nash price competition and compare the estimates with current prices. We assume a maximum of seven brands in each market for the

[17] We assume that marginal income utility did not change at the pre and post-entry equilibrium.
[18] Hausman and Leonard (2002) also separated the two effects in the different model for the bath tissue market.
[19] The coefficients in the mean utility are recovered from the brand fixed effects using the minimum distance technique. See Nevo (2000).

counterfactual prices. Table 6 indicates that market equilibrium prices did not necessarily decrease the following entries. For substantial markets, the prices increased for all brands. The increases were more pronounced for the introducer of new brands, Phillip Morris. The prices of Kraft, Velveeta, and Light N Lively increased in 141, 125, and 157 out of 210 markets following the entries. Meanwhile, prices of other firms' existing brands for the most part decreased. Hence the margins of the introducer increased while those of other firms' brands dropped at the median level. This result may suggest that the introducer of new brands, Phillip Morris, responded to market competition by packing the market with new brands, thereby reinforcing their market power.

We can calculate the change in variable profits for each firm by computing implied profits without new brands and comparing them to estimated profits with new brands. Producer surplus is computed as the total sum of the profit changes as in (14) and it leads to 20.3 million dollars in the 210 sample markets.

In the counterfactual, the removal of the new brands leads consumer welfare, which is measured by the compensating variation, to decrease, on average,[20] by 0.86 cents per serving for each individual consumer since the fourth quarter of 1991.[21]

$$\int \frac{\ln[\sum_{j=0}^{J=10} \exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7} \exp(V_{ij}(p_0))]}{\alpha_i} F(D)F(\nu) = 0.86 \tag{17}$$

where $F(D)$ and $F(\nu)$ are the distribution functions of demographic variables and unobserved individual characteristics. And total consumer surplus is calculated as average compensating variation per serving times total servings. The sum of volume sales of total U.S. Processed cheese brands in the 210 markets is converted to total servings with the assumption that each serving is 28g.

$$Total\,Consumer\,Surplus = Average\,CV_i \times Total\,Servings \tag{18}$$

The estimated total consumer surplus was 43.2 million dollars in the 210 sample markets. We found that the increase in consumer welfare was attributable mainly to an increase in the number of brands available in the market. The variety effect is estimated as 1.12 cents per serving for an average consumer.

$$\int \frac{\ln[\sum_{j=0}^{J=10} \exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7} \exp(V_{ij}(p_1))]}{\alpha_i} F(D)F(\nu) = 1.12 \tag{19}$$

Meanwhile, the price effect, the welfare change from the seven existing brands, decreased by 0.24 cents per serving for an average consumer.[22]

$$\int \frac{\ln[\sum_{j=0}^{J=7} \exp(V_{ij}(p_1))] - \ln[\sum_{j=0}^{J=7} \exp(V_{ij}(p_0))]}{\alpha_i} F(D)F(\nu) = -0.24 \tag{20}$$

The welfare loss produced by consuming the existing brands of the introducer contributed principally to the result. This is because the introducer raised its prices in a substantial portion of the markets while other firms lowered their prices on corresponding brands in the face of competition against the new brands.[23]

[20] The average was measured by the median.
[21] When we estimate consumer welfare change, we assume that consumers' welfare from outside goods did not change.
[22] The estimated variety effect and price effect correspond to approximately 8.13 % and –2.03% of retail price per serving, respectively.
[23] This indicates an overall trend. Prices of other firms' brands did not necessarily decrease in all markets.

Meanwhile, the entry of low-fat segment cheese might have affected consumers' welfare differently, depending on consumers' income levels. The effect of the fat level on a consumer's utility can be represented as follows, using estimated demand side parameters:

$$\frac{\partial V_i}{\partial FAT} = 0.5990 + 2.6675 * \nu_{i3} - 0.1490 * INCOME_i \tag{21}$$

If we assume that ν_3 is zero on average because ν_3 is a random draw from a mean zero normal distribution,[24] the FAT effect is negative for high-income consumers, positive for low-income consumers.[25] The entry of low-fat brands, therefore, might benefit high-income consumers more than low-income consumers.

5. Conclusion.

In this paper we have estimated the effects of new brands in the processed cheese market on consumers' utility and firms' margins and profits. We find that new brands have increased consumers' welfare overall, but the price increase of existing brands has eroded that welfare gain somewhat. We also show that the additional brands in the U.S. processed cheese market reinforced the price control of the new brands introducer.

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[24] $\nu_i's$ are random draws from the multivariate normal distribution. Here, we assume that $\nu_i's$ are independent of each other.

[25] Here, INCOME is the log of individual income, which is calculated by dividing the household income by the number of households.

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Table1. Market Share Trend (Volume share)

Manufacturer /Brand	1st Quarter 1988	4th Quarter 1990	4th Quarter 1992
Kraft(P)	32.43	30.14	23.49
Light N Lively(P)	0.98	0.89	0.43
Velveeta(P)	25.49	25.03	19.40
Kraft Light(P)	0.07	1.23	1.63
Kraft Free(P)	-	0.20	3.44
Velveeta Light(P)	-	-	3.38
Borden(B)	8.78	8.32	8.75
Lite Line(B)	0.79	0.72	0.37
Land O'Lakes(L)	0.84	0.73	1.18
Weight Watchers(H)	1.01	0.48	0.21

Note: P:Phillip Morris, B: Borden Inc, L: Land O'Lakes, H: HJ Heinz Co

Table 2. Market share, Prices, and Product Characteristics

	Market Share	Price	Calories	Fat (g)	Choles-terol (mg)	Sodium (mg)
Kraft(P)	0.2909	14.197	90	7	25	380
Velveeta(P)	0.1987	12.230	90	6	25	400
Light N Lively(P)	0.0088	17.334	70	4	15	406
Kraft Free(P)	0.0310	16.541	42	0.3	5	273
Kraft Light (P)	0.0169	15.348	70	4	20	160
Velveeta Light(P)	0.0224	12.186	60	3	15	430
Borden(B)	0.0662	12.931	80	6	20	360
Lite Line(B)	0.0061	19.456	50	2	15	171
Land O'lakes(L)	0.0064	11.990	110	9	26	430
Weight Watchers(H)	0.0059	15.376	50	2	7.5	400

Note: Market share and price are the medians for all city-quarter markets. The unit of price is cents per serving (28g). P: Phillip Morris, B: Borden Inc, L: Land O'Lakes, H: HJ Heinz Co.

Table 3. Demographic Variables

	Median	Mean	Std	Min	Max
Log (Income)	7.835	7.838	0.905	0.405	10.742
Log (Age)	3.465	3.241	0.940	0	4.564
Child	0	0.255	0.436	0	1
Nonwhite	0	0.155	0.362	0	1

Table 4. Demand Parameter Estimates: Random Coefficient Model

Parameter Estimates			Standard Errors
CONTANT	-6.4305	**	0.8255
PRICE	-6.9269	**	0.9207
FAT	0.5990	**	0.0825
SODIUM	-2.1397	**	0.1674
INCOME	20.6871	**	9.8835
NONWHITE	-5.9528	**	1.6391
PRICE*INCOME	-20.0635	**	6.8385
PRICE*INCOME^2	9.1480	**	3.2117
PRICE*AGE	-2.1751	*	1.4795
PRICE*CHILD	2.5205	*	1.3550
FAT*INCOME	-0.1490	**	0.0419
CONSTANT* v_1	0.9280		1.0675
PRICE* v_2	1.9152	**	0.6817
FAT* v_3	2.6675	*	1.3746
SODIUM* v_4	3.0215	*	1.5379

Note: * t-value > 1, **: t-value >2

Table 5. Price Elasticities Table

		Regular Segment				Low fat segment					
		Kraft(P)	Velveeta(P)	Borden(B)	Land O'Lakes(L)	Light N Lively(P)	Kraft free(P)	Kraft Light(P)	Velveeta light(P)	Lite Line(B)	Weight Watchers (H)
Regular Segment	Kraft(P)	-4.705	1.645	0.844	0.236	0.027	0.156	0.198	0.251	0.007	0.034
	Velveeta(P)	1.276	-5.853	0.961	0.197	0.033	0.207	0.201	0.482	0.010	0.048
	Borden(B)	1.515	1.060	-7.864	0.242	0.030	0.221	0.226	0.350	0.010	0.054
	Land O'Lakes(L)	1.214	1.023	2.217	-8.531	0.049	0.180	0.601	0.434	0.011	0.057
Low fat segment	Light N Lively(P)	0.660	0.521	0.232	0.034	-3.894	0.092	0.067	0.114	0.021	0.020
	Kraft free(P)	0.115	0.838	0.410	0.032	0.025	-5.803	0.201	0.303	0.010	0.060
	Kraft light(P)	0.604	0.579	0.780	0.190	0.025	0.351	-7.550	0.308	0.012	0.051
	Velveeta light(P)	0.872	0.914	1.002	0.133	0.046	0.426	0.261	-8.321	0.016	0.084
	Lite Line(B)	0.148	0.192	0.099	0.010	0.026	0.049	0.028	0.049	-4.994	0.009
	Weight Watchers(H)	0.246	0.666	0.857	0.087	0.043	0.512	0.266	0.464	0.020	-7.216

Note: Elasticities are median values for all markets; P: Phillip Morris, B: Borden Inc, L: Land O'Lakes, H: HJ Heinz Co. Row is *i* and column is *j*. Each cell (*i*, *j*) gives the percent change in market share of brand *i* corresponding to a 1 percent change in price of brand *j*.

Table 6. New equilibrium Prices

Brand	Current Prices (CP)	Counter-Factual Prices (CFP)	ΔP	% Change	# of markets where $CP - CFP > 0$ out of 210 markets
Kraft(P)	14.293	13.505	0.791	5.858	141(67%)
Light N Lively(P)	18.285	18.154	0.231	1.272	125(60%)
Velveeta(P)	12.850	12.293	0.557	4.531	157(75%)
Borden(B)	12.696	13.121	-0.425	-3.239	33(16%)
Lite Line(B)	20.047	20.305	-0.258	-1.271	91(43%)
Land O'Lakes(L)	10.756	11.364	-0.608	-5.350	52(25%)
Weight Watchers(H)	14.023	14.430	-0.408	-2.821	34(16%)

Note: Prices are cents per serving, Medians of 210 markets, $\Delta P = CP - CFP$, P: Phillip Morris, B: Borden Inc, L: Land O'Lakes, H: HJ Heinz Co.

Table 7. Margins

Brand	Current Margins (CM)	Counter-Factual Margins (CFM)	Δ Margin ($CM - CFM$)
Kraft(P)	36.562	34.427	1.548
Light N Lively(P)	29.718	29.231	0.487
Velveeta(P)	35.923	34.648	1.275
Borden(B)	12.853	13.841	-0.988
Lite Line(B)	13.625	14.412	-0.787
Land O'Lakes(L)	11.624	12.587	-0.963
Weight Watchers(H)	11.269	12.534	-1.265

Note: Medians of 210 markets, P: Phillip Morris, B: Borden Inc, L: Land O'Lakes, H: HJ Heinz Co.

Table 8. Total Social Welfare Change ($ Millions)

Total Welfare Change	Total Consumer Surplus	Total Profit change
63.5	43.2	20.3

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