MARKET CONDUCT IN THE U.S. READY-TO-EAT CEREAL INDUSTRY

PRELIMINARY DRAFT

Jeffrey J. Reimer  
Food System Research Group, Dept. of Agricultural and Applied Economics,  
University of Wisconsin, Madison, WI

John M. Connor  
Dept. of Agricultural Economics, Purdue University, West Lafayette, IN

Abstract

The “Big Three” case against top breakfast cereal makers was the focus of U.S. antitrust activity during the 1970s, but scrutiny of the industry ended abruptly after the case was dismissed in 1981. About this time the prices of breakfast cereals began a steep rise relative to other food products. Using a differentiated-products Bertrand oligopoly framework and data from Selling Area Markets, Inc. (SAMI), the extent and type of market power exercised during the case, and then after the case, is investigated. Between these periods average price-cost margins rose from 38.0% to 41.5%. In both periods the exercise of market power was primarily related to product differentiation (unilateral market power) and the fact that firms manage multiple brands (the portfolio effect). The rise in margins between the two periods, however, was driven by an increase in coordinated market power, which lends support to the original FTC case.
I. Introduction

Three characteristics distinguish the U.S. ready-to-eat (RTE) cereal industry. First, the industry is highly concentrated. Although there are approximately 40 companies producing more than 400 brands, more than 90% of output since 1980 has been produced by just five companies.\(^1\) Another characteristic is extensive advertising. Average selling expenses are 30% of sales value, with smaller firms tending to advertise more than large firms. Additionally, most of this expense is for mass-media advertising. The third distinguishing characteristic of the RTE cereal industry is product proliferation. New product launches have increased from one or two products per year in 1950, to more than 100 per year since 1989. If one accounts for all of the variations in sizes and flavors of the 400 brands, there are approximately 1000 RTE cereal products for sale in the U.S!

Private label products (on which the supermarket affixes its own company imprint) are an important source of competition in other industries, but have limited effect in the RTE cereal industry. Although branded cereals are priced about 40% above private label cereals, branded products continuously capture more than 90% of the market (Connor, 1999).

These attributes tend to facilitate the exercise of unilateral or cooperative market power, and in the past have led U.S. antitrust authorities to closely scrutinize the RTE cereal industry. The Federal Trade Commission (FTC), in fact, devoted up to two-thirds of its resources to investigate the industry during the Ford and Carter administrations. The FTC sued the top three manufacturers – Kelloggs, General Mills, and Post – for effectively operating as a “shared monopoly.”\(^2\) By the late 1970s events turned against the prosecutors, however. The 1970s period of relative activism by the FTC was poorly received on Main Street and in corporate offices, and Congress directed some of this negative pressure onto the FTC (Bittlingmayer, 2002). The political climate in 1979-1980 was

---

\(^1\) These numbers are valid for the RTE cereal industry as a whole. If the classification is made by individual product (corn flakes, for example) the concentration is still higher.

\(^2\) Another RTE cereal company, Quaker, was a respondent to the 1972 FTC case, although was dropped in 1978 (Scherer and Ross, p. 465). Two other cereal-makers, Ralston and Nabisco, were also mentioned in the original 1972 FTC complaint, but not listed as respondents.
particularly unfavorable: during the U.S. presidential campaign, incumbent Jimmy Carter and challenger Ronald Reagan both came out in support of the RTE cereal industry.\textsuperscript{3} Perhaps not surprisingly, the case was later dismissed in 1981, and appeals by FTC enforcement staff went nowhere.\textsuperscript{4}

This paper provides an economic analysis of the RTE cereal industry in the years surrounding these events. Our analysis begins with Figure 1, which displays cereal prices during the FTC case and in the years following its dismissal. Prices are in logged dollars per pound for seven “kids” cereals, and for an aggregate Private Label category (these are unit values deflated with the U.S. Bureau of Labor Statistics Food and Beverage Consumer Price Index based on 1982-84). Quite interestingly, between 1979 and 1980 there is an abrupt shift in price levels. A slight downward trend before this point turns into a strong upward trend, for branded cereals in particular. Although not shown here, this trend continues well into the late 1980s, and occurs for branded cereals beyond the “kids” segment as well. This leads to the question: Why did cereal prices rise rapidly in the early 1980s relative to U.S. food prices as a whole? While there are a number of plausible explanations (e.g., changes in the prices of raw materials, increases in product quality), most are not very convincing, and it is remarkable how the pricing shift coincides with the demise of the FTC case against the cereal industry.

In this paper we hypothesize that once the industry no longer found itself under the spotlight

\textsuperscript{3} According to Scherer and Ross (p. 466), “during the week before he was elected President of the United States, Ronald Reagan released a letter to the president of Kellogg, observing, ‘It is clear to me that the [cereal] case under consideration has very little basis in fact and that a favorable ruling on behalf of the FTC would have a chilling effect on American industry.’ A similar statement was made by then-President Carter while he was campaigning in Michigan.”

\textsuperscript{4} There was some drama surrounding the demise of the case. According to Scherer and Ross (1990, p. 466), “As the trial neared completion, the administrative law judge who had presided over it for four years was disqualified on procedural grounds. A replacement judge heard the final defense witnesses, drew the threads, and ordered that the case be dismissed. Except for rejecting the cereal makers’ ‘all breakfast foods’ proposal and accepting RTE cereals as a relevant market, which he found to be highly concentrated, he resolved virtually every contested issue of fact or theory in favor of the companies. What followed was even more unprecedented. As is common in important FTC proceedings, the … FTC enforcement staff sought to appeal to the commission as a whole. But their superiors … refused to transmit the appeal … Under a cloud of continuing congressional criticism … the commission elected to receive the appeal but dismissed it without addressing its factual merits.”
of an on-going anti-trust investigation, it increased its exercise of market power. We further hypothesize that this increase came through coordinated as opposed to unilateral or other forms of market conduct. Testing these hypotheses requires data over the relevant time period, and the development of a model that nests the various types of industry conduct. The analysis will depend heavily on reliable price elasticities of consumer demand, and an appropriate model of supply.

Our characterization of the demand side draws from Nevo (2001), who uses the Berry, Levinsohn, and Pakes (1995) discrete choice approach to estimate an aggregate model of demand for 25 RTE cereals. Substitutability among brands is modeled in terms of the underlying characteristics of cereals, including calories, sugar, and sogginess. While Nevo’s mixed logit model is fairly restrictive (e.g., prices of different brands have a common coefficient in the indirect utility function), the results are state-of-the-art concerning our knowledge of cereal demand, and perhaps even differentiated products in general.

It is important to emphasize why Nevo’s study, which also assesses market power in the cereal industry, cannot address the issues identified above, however. First of all, Nevo’s paper emphasizes the demand side of the cereal market, and employs somewhat simple characterizations of the supply side of the industry. Instead of trying to measure industry conduct, price-cost margins (PCMs) associated with three extreme forms of conduct are calculated. These cases are “extreme” because they either assume no pricing interdependence among firms (scenarios 1 and 2), or assume joint profit maximization of all brands, which is meant to mimic perfect collusion or “shared monopoly” (scenario 3). These scenarios’ respective PCMs are then evaluated in light of a single, accounting-based measure of price-cost margins (PCMs). The accounting-based PCM is 46%, and based upon a First Boston Bank report on the Kelloggs company.\(^5\) The three extreme cases of market conduct effectively serve as benchmarks by which one can decompose the exercise of market power.

\(^5\) As indicated in Nevo (2001), this figure came from 1996 Congressional testimony by Ronald W. Cotterill.
power.

To use this approach in answering the questions posed earlier, one would need observations on actual PCMs specific to particular periods of time (1976 - 1979 and 1981 - 1985), and ideally, PCMs specific to individual brands (instead of one particular firm such as Kelloggs). This is a particularly tall order, however, and not necessarily ideal anyway, so we opt for a somewhat different approach to obtaining actual, “observed” PCMs for the periods of interest. The key is to develop a more realistic specification of industry conduct. We begin by noting that one of the defining characteristics of oligopoly is that firms recognize their mutual interdependence. A number of studies have found that firms selling differentiated products do not set prices in isolation, but have some sort of average reaction to others’ changes in prices (Liang, 1989; Cotterill, Putsis, and Dhar, 2000; Cotterill and Samson, 2002).\textsuperscript{6} These studies estimate \textit{price reaction elasticities} that represent the tendency of one firm’s prices to change in response to other firms’ price changes. Here, price responses are not interpreted as “conjectures” so much as the “observed reactions” of other firms (Cotterill and Samson, 2002). While Sexton (2000, p. 1093) points out such measures are an attempt to model dynamic phenomena within a static framework, they nevertheless provide a useful empirical measure of the departure of a given market from competitive outcomes. Moreover, estimation of price reaction elasticities allow us to consider the spectrum of oligopoly outcomes, including such games such as Stackelberg leadership, and nest the extreme cases investigated by Nevo. Estimation of observed price reactions also eliminates the need to rely solely on a company-specific, brand-independent accounting measure of the price-cost margin to assess market conduct.

A key component of our analysis is data from Selling-Area Markets, Inc. (SAMI), which

\textsuperscript{6} Theoretical and empirical support for such approaches is offered by Dixit (1986) and Genesove and Mullin (1998). Dixit (1986) offers a theoretical analysis of the comparative statics of a quantity-setting, conjectural variations oligopoly, and shows that most pure strategy games can be nested in a conjectural variations model. A comparable study dealing with price-setting differentiated-product oligopolies is not known to exist. In an historical study of the sugar industry for which good information on marginal costs was available, Genesove and Mullin (1998) provide empirical evidence in favor of the use of oligopoly conduct parameters.
encompass the period January 1976 to June 1985. These data represent approximately 95% of the U.S. market over the period of interest. With these data we calculate “observed” price-cost margins for the period during the FTC case (Jan. 1976 - Dec. 1979), and then the period by which the industry could have adjusted to a new (lenient) regulatory environment (Dec. 1981 - June 1985). Our analysis is able to explain a fair amount of the pattern exhibited in Figure 1. In particular, we find that coordinated market power increased after the FTC case ended, leading to even higher price-cost margins than already in place from product differentiation and the portfolio effect (i.e., managing several brands simultaneously).

The remainder of the paper is organized as follows. In the next section we lay out our conceptual model for addressing the issue at hand. In the third section the data used to implement the conceptual model are described. The subsequent section presents the results, and the final section summarizes and concludes.

II. Empirical Framework

Modeling the cereal industry

The cereal industry is characterized by a small number of firms each selling differentiated brands. In this context it is appropriate to consider the profit-max problem of a multi-brand firm. The set-up is similar to Nevo (1998). Let $\Theta$ represent the set of brands associated with a certain segment of the cereal industry (at present we focus on kids cereals). There are $F$ firms, each producing some subset, $\Theta_f$, of this segment’s brands. Let $\Theta_{-f}$ be the subset of this segment’s brands not associated with firm $f$. Therefore, $\Theta = \Theta_f \cup \Theta_{-f}$. There are $J$ brands in $\Theta$, indexed $j = 1, \ldots, J$, $r = 1, \ldots, J$, or $k = 1, \ldots, J$. Marginal costs are constant. The profits of firm $f$ are:

$$\Pi_f = \sum_{j \in \Theta_f} \left( p_j - mc_j \right) q_j - C_f$$  \hspace{1cm} (1)$$

where $p_j$ is the price of brand $j$, $mc_j$ is the (constant) marginal cost of brand $j$, and $C_f$ is the firm’s
fixed cost of production. The demand for brand \( j \) depends on its own price and that of all competitors in the segment: \( q_j = q_j(p_1, \ldots, p_J) \). In other words, the demand for a brand depends on own- and cross-price elasticities of demand. Firms tend to react to price changes of brands not part of their portfolio: \( p_{j \in \Theta_f} = h(p_{k \in \Theta_f}) \). We assume Bertrand price competition, meaning that a firm maximizes profit by choosing the prices of brands within its portfolio. The first order condition of brand \( j \) associated with firm \( f \) is:

\[
q_j + \sum_{r \in \Theta_f} (p_r - mc_r) \left[ \frac{\partial q_r}{\partial p_j} + \sum_{k \in \Theta_f} \frac{\partial q_r}{\partial p_k} \frac{\partial p_k}{\partial p_j} \right] = 0. 
\]

(2)

Multiplying through by \( p_j / \sum p_rq_r \) as well as by \( (p_j / p_r), (p_k / p_k), \) and \( (q_r / q_r) \) in certain terms, yields the following modified first order condition:

\[
s_j + \sum_{r \in \Theta_f} s_r \, \text{PCM}_r \left[ \epsilon_{rj} + \sum_{k \in \Theta_f} \epsilon_{rk} \eta_{kj} \right] = 0 .
\]

(3)

The term \( s_j \) is the expenditure share on brand \( j \), \( \text{PCM}_r = (p_r - mc_r) / p_r \) is the price-cost margin (i.e., Lerner index), and \( \epsilon_{rj} = (\partial q_r / \partial p_j)(p_j / q_r) \) is the price elasticity of demand for brand \( r \) with respect to brand \( j \). The term \( \eta_{kj} = (\partial p_k / \partial p_j)(p_j / p_k) \) is a “price reaction elasticity,” and measures the degree to which brand \( k \) is observed to respond to a change in brand \( j \)’s price. This might also be labeled a “conduct parameter” but the term “price reaction elasticity” is maintained in the remainder of the paper. We now solve (3) for brand \( r \)’s price-cost margin (\( \text{PCM}_r \)).

It is useful to rewrite (3) in matrix form. Define the term \( \Psi_{rj} \):

\[
\Psi_{rj} = s_r \left[ \epsilon_{rj} + \sum_{k \in \Theta_f} \epsilon_{rk} \eta_{kj} \right].
\]

(4)

Following Nevo (1998), let \( \Omega' \) be a \((J \times J)\) matrix, with element \( \Omega'_{rj} \) in row \( j \) and column \( r \) be:

\[
\Omega'_{rj} = \begin{cases} 
1, & \text{if } \exists f : \{r, j\} \subset \Theta_f \\
0, & \text{otherwise}
\end{cases}
\]

In turn, \( \Omega \) is a \((J \times J)\) matrix with typical element \( \Omega_{rj} = \Omega'_{rj} \Psi_{jr} \). \( \text{PCM} \) is a \((J \times 1)\) vector of price-cost margins, and \( s \) is a \((J \times 1)\) vector of expenditure shares. Then (3) can be re-written in
matrix form:

\[ \text{s + } \Omega^* \text{PCM } = 0. \]  

Solving for the price-cost margins yields:

\[ \text{PCM } = -\Omega^{-1} \text{s}. \]  

To help in understanding (6), consider the following scenario. (This also is the one that we examine empirically in a later section.) Suppose that there are three firms (Kelloggs, Quaker, and General Mills) which altogether produce seven kids cereals. Kelloggs manages brands 1 and 2; Quaker manages brands 3 and 4; and General Mills manages brands 5, 6, and 7. In this case (6) takes the form:

\[
\begin{pmatrix}
\text{PCM}_1 \\
\text{PCM}_2 \\
\text{PCM}_3 \\
\text{PCM}_4 \\
\text{PCM}_5 \\
\text{PCM}_6 \\
\text{PCM}_7 \\
\end{pmatrix}
= -
\begin{bmatrix}
\psi_{11} & \psi_{12} & 0 & 0 & 0 & 0 & 0 \\
\psi_{21} & \psi_{22} & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \psi_{33} & \psi_{34} & 0 & 0 & 0 \\
0 & 0 & \psi_{43} & \psi_{44} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \psi_{55} & \psi_{56} & \psi_{57} \\
0 & 0 & 0 & 0 & \psi_{65} & \psi_{66} & \psi_{67} \\
0 & 0 & 0 & 0 & \psi_{75} & \psi_{76} & \psi_{77} \\
\end{bmatrix}
\begin{bmatrix}
s_1 \\
s_2 \\
s_3 \\
s_4 \\
s_5 \\
s_6 \\
s_7 \\
\end{bmatrix}.
\]  

Equation (7) implies that without observing actual costs, brand-level PCMs can be estimated based on inter-firm price reaction elasticities, and on own- and cross- price elasticities of demand.

The remainder of this paper is concerned with obtaining estimates of these PCMs for the two periods of interest: during the FTC case (1976-1979), and after its termination (1981-1985). We assume that demand behavior was constant during this period, and make use of Nevo’s estimates concerning seven kid cereals. We hypothesize, however, that inter-firm behavior changed between these two periods, and focus on obtaining consistent estimates of the price reaction elasticities. These are used to calculate observed PCMs, which we effectively treat as “truth,” although of course they are conditional on our data, modeling, and estimation work.

Not only are we interested in the extent of market power exhibited in each time period, we are interested in the form that it took. It is thus necessary to decompose the observed PCMs along
such lines, or at least have some benchmark associated with each form of market power. We obtain benchmarks by considering various hypothetical industry conduct models, as in Nevo (2001). Those considered allow us to distinguish three forms of potential market power. Scenario (i) assumes the cereal industry is comprised of single-brand firms which derive market power solely from product differentiation. Firms are assumed to operate in isolation from each other, so price reaction elasticities are set equal to zero (i.e., $\eta_{ij} = 0 \ \forall \ k, j \in \Theta$). This structure represents the potential for unilateral market power. Scenario (ii) allows several brands to be managed by each firm, thereby incorporating unilateral market power plus that associated with the portfolio effect. This concept implies that a firm managing a portfolio of brands internalizes the cross-price effects of demand associated with these brands. Consequently, a firm producing two imperfectly substitutable brands will charge a higher price for them than if they are produced by two rival, single-brand firms. As with scenario (i), we assume firms operate in isolation from each other. We now turn to the final scenario (iii), which adds coordinated market power. It assumes a single agent jointly maximizes the profit of all the brands. Thus we have a situation of perfect collusion or “shared monopoly” (the term employed by FTC prosecutors to describe the alleged behavior of the cereal firms). The difference in PCMs between this scenario and the prior represent the potential for price collusion.

These three hypothetical industry conduct models are specific cases of the general framework developed earlier to calculate observed PCMs. Since the first two scenarios assume (and the third scenario implies) zero price reaction elasticities ($\eta_{ij} = 0 \ \forall \ k, j \in \Theta$), the following holds in all three scenarios: $\Psi_p = s_r \varepsilon_r$. Other implications concern the $\Omega'$ matrix. In scenario (i) each brand is managed by a single-product firm, so $\Omega'$ is an identity matrix, and $\text{PCM}_r = -1/\varepsilon_r$. In scenario (ii) multi-brand firms jointly set the prices for their subset of brands, and $\Omega'$ contains blocks of ones centered on the diagonal. In contrast, scenario (iii) implies that $\Omega'$ is comprised entirely of ones. The PCMs associated with these three scenarios provide bounds on the PCMs associated with hypothetical forms of market conduct, and help us decompose our observed, brand-
specific PCMs.

Demand elasticities

Estimating brand-level elasticities in an industry is challenging, especially for an industry in which there are hundreds of brands, depending on how they are defined. Among the econometric problems are that prices are endogenous, and there are a very large number of own- and cross-price elasticities to estimate. To address this problem Nevo (2001) uses a generalized, random-coefficients version of the logit framework to estimate brand-level elasticities. This approach negates the need to make assumptions about the way in which the cereal industry is segmented (although this information is incorporated into the estimation scheme), and 25 brands are considered simultaneously. Although in theory we could employ all 25 of Nevo’s elasticity estimates in our analysis, there are several reasons for not doing so. First, four of these brands were not available during the period in which we are interested. Second, the estimation of price reaction elasticities is itself a difficult procedure, hampered by consideration of numerous brands at a time (whose prices are correlated over time), and price endogeneity. Third and most importantly, it seems more natural to divided the cereal industry into segments. This is also widely accepted. For example, Schmalensee (1978) argues that cereals are “spatially” differentiated products grouped into different segments, which he characterizes as “clusters of more directly competitive brands” (p. 309). For some parts of his analysis Nevo also classifies the 25 cereals into four segments: All family/basic, Simple health/nutrition, Taste enhanced wholesome, and Kids. This classification is based directly on Cotterill and Haller (1997), who in turn cite these same categories as used by industry experts at A.C. Nielsen, a leading marketing information company.7 Given this evidence concerning the RTE

---

7 As an illustration of the widespread acceptance of the fact that the RTE cereal industry is segmented, Cotterill and Haller (p. 2) provide the following quote from Nielsen Marketing Research executives. It describes one segment of the industry, but is applicable to any of them: “The [Taste Enhanced Wholesome] segment consists of brands that possess strong interactions with each other. Including other category segments into the evaluation may ‘dilute’ the switching patterns observed in the data.”
cereal market, we focus on one segment at a time. In the present paper we analyze the “kids” segment.

Price reaction elasticities

As in Cotterill, Putsis, and Dhar (2000) and Cotterill and Samson (2002), a first order Taylor series approximation concerning the price reaction elasticities is estimated. Our estimation scheme is guided by the following characteristics. First, these are a system of linear equations whose disturbances are likely to be contemporaneously correlated. Additionally, there are endogenous variables on both the left and right hand sides of the equations, as well as lagged endogenous and exogenous variables on the right hand sides, meaning that regressors are not orthogonal to the disturbance terms. For these reasons, three-stage least squares is likely the most efficient estimation process, at least in an asymptotic sense (Judge et al., 1988, p. 668), and we follow that here. Cost shift variables are included as explanatory variables in each equation. The first two concern raw cereal ingredients, including the wholesale price refined sugar in the Midwest (SUGAR), and the U.S. price of wheat (WHEAT). The price of Private Label cereals is also included, which in the SAMI data is an aggregate combining all segments. Private label price ($p_{pl}$) is assumed to embody a small or non-existent markup over costs, thereby providing an additional proxy for costs. A one-period lag of the dependent variable ($\ln p_{j,\tau-1}$, where $\tau$ indexes time) is included on the right hand side of each equation. The final empirical form is:

$$\ln p_j = \beta_{1j} + \sum_{k \in \Theta_j} \eta_{jk} \ln p_{ki} + \beta_{2j} \ln p_{j,\tau-1} + \beta_{3j} SUGAR + \beta_{4j} WHEAT + \beta_{5j} \ln p_{pl} + u_{it}, \quad (8)$$

where $u_{it}$ is a disturbance term assumed to be identically, independently, and normally distributed. Checking of the order and rank conditions indicate the equations are over-identified. It may have

---

8 There are six predetermined variables excluded from each equation. The number of endogenous variables (minus one) is
been desirable to incorporate additional exogenous variables that capture potential variation in marketing strategies, demographic patterns, consumer preferences, and the number of competing products (new cereal introductions, as well as out-of-segment such as toaster pastries and cereal bars), but such information was not found for the sample period.

III. Data

Data from Selling-Area Markets, Inc. (SAMI) covering the period January 1976 to June 1985 is used to estimate (8). SAMI observations are at the brand-level, and in dollars and pounds for the U.S. market as a whole. They correspond to four-week intervals, such that there are 13 observations per year. According to their documentation, SAMI data account for approximately 95% of cereal sales in the U.S. The average price, or more correctly, “unit value,” of a brand is obtained by dividing sales in dollars by sales in pounds. To account for general inflation over time unit values are deflated with the Bureau of Labor Statistics’ U.S. City Average Food and Beverage Price Index. As indicated earlier, the series are split into two periods: Jan. 1976 to Dec. 1979, and Dec. 1981 to June 1985. This inner period covers the time in which the FTC case lost favor in political circles, as well as its dismissal.

In the present draft of this paper we restrict ourselves to the Kids segment of the cereal market. Kids cereals are distinguished by a combination of high sugar content and marketing targeted at kids, in which the image of a colorful cartoon character is typically emphasized as opposed to family imagery or health/nutritive properties. Twenty-one kids cereals are tracked by the SAMI data over the duration of the sample period. In terms of pounds of cereal, we examine seven of these, which account for an average 41% share of the kids segment. The cereals are Kelloggs Froot Loops, Kellogg Corn Pops, Quaker Cap N Crunch, Quaker Life, General Mills Lucky Charms, five in the Kelloggs and Quaker equations, and four in the General Mills equations.
General Mills Trix, and General Mills Kix.\footnote{Kelloggs, General Mills, and Post were the principal companies involved in the case. None of Post’s kids cereals was examined by Nevo (2001), however, so they are excluded from the present paper, although in future versions we will consider other segments for which Post elasticities are available. Although Quaker is not among these three companies, it was an initial respondent to the 1972 FTC case, and was dropped only after the case was completed 1978 (Scherer and Ross, p. 465).}

*Price elasticities of demand*

Table 1 reports median price elasticities of demand from Nevo (2001). Entry \((i,j)\) represents the percentage by which the price in row \(i\) changes as the price in column \(j\) changes 1%. For example, the second entry in the leftmost data column indicates that when the price of Kelloggs Froot Loops increases 1%, consumption of Kelloggs Corn Pops rises 0.113%, indicating these brands are imperfect substitutes. The reverse case indicates even more inelasticity: as the price of Corn Pops increases by 1%, the demand for Froot Loops increases by just 0.066%. Note that in every case the cross-price elasticity of demand is positive. This indicates that brands are substitutes as opposed to complements, which seems realistic given that consumption of one does not generally coincide with consumption of another (in contrast to complementary foods such as milk and cereal, for example). Note that the largest cross-price elasticities are associated with Quaker Cap N Crunch, and to a lesser extent, Kelloggs Froot Loops. In this sense, consumers are less loyal to these brands; they switch more readily to another brand when price rises. One notes, however, that in terms of own-price elasticities these brands are among the most inelastic. Looking down the diagonal of Table 1, own-price elasticities range from \(-2.277\%\) for Cap N Crunch to \(-3.422\%\) for General Mills Kix.

**IV. Results**

*Price reaction elasticities*

In regression equation (8) there is a specific price reaction elasticity \((\eta_{jk})\) associated with
each brand \( j \in \Theta_f \) of firm \( f \), and each outside brand \( k \in \Theta_{-f} \). Thus two brands of the same firm are not restricted to have identical price reaction elasticities with all outside brands. Evidence suggests, however, that price reaction elasticities of any two brands of the same firm are likely to be similar, such that these restrictions should be imposed. In other words, strategic price decisions may be occurring at the firm level as opposed to the individual brand level. One clue is that price changes often occur across-the-board in the RTE cereal industry. For example, in describing the FTC case, Scherer and Ross (1990, p. 257) state that “Kelloggs was recognized by all as the leader. It normally led [price] increases in rounds covering many but not all products in its line.” Similarly, Cotterill, Putsis, and Dhar (2000) indicate that it is routine for Post, Nabisco, and Kelloggs to make price cuts for \textit{all} their cereal brands at the same time (p. 110-111). The implication is that price reaction elasticities are likely to be identical for same-firm brands. This possibility concerning \( \eta_{jk} \) was tested as joint hypothesis when estimating equation (8). Using critical values from \( F \) and Wald Chi-square tests, a hypothesis that price reaction elasticities are common across brands of the same firm is not rejected for five out of the six cases, in each of the two time periods. Given this finding, in the remainder of the analysis brands of the same firm are restricted to have common price reaction elasticities with respect to the brands of other firms. A side benefit is that potential multicollinearity problems may be lessened.

Tables 2 and 3 display 3SLS estimates of mean price-reaction elasticities for 1976-1979 and 1981-1985, respectively. The nature of the restrictions discussed just above should be readily visible in these tables. A given entry \((i, j)\) indicates the percent by which row \( i \)'s price is estimated to change when column \( j \)'s price increases by 1%. Note that any two brands of the same firm have no

---

10 There are several possibilities why price changes often occur across-the-board. For example, activities that affect costs, such as dealing with input suppliers and a distribution network, often take place at the firm level as opposed to the level of individual brands. Acquisition of shelf space in a supermarket also occurs at the firm level. Furthermore, advertising may be cheaper when done at the firm level instead of for each brand individually.

11 The two exceptions among the 12 cases are: Kelloggs with respect to General Mills in the first period, and Kelloggs with respect to Quaker in the second period.
price reaction elasticities, since they are part of the same joint profit-max problem. Standard errors are in parenthesis. One, two, and three asterisks indicate statistical significance at the 10%, 5%, and 1% level, respectively. In five out of six cases the coefficients are statistically different from zero at one of these levels. In Table 3 the same is true for four out of six cases. An immediate interpretation of these results is that an assumption that firms operate in complete isolation from each other is inappropriate.

Table 2 represents industry conduct during the FTC proceedings. Interestingly, coefficients that are statistically non-zero are all negative. This suggests that rivalry was the dominant form of inter-firm conduct during this time period. For example, when Quaker increased its prices by 1%, Kelloggs is estimated to have reduced its brands’ prices by 0.198%, presumably to gain market share at the expense of Quaker. This type of competitive behavior appears to be strongest at General Mills. When Kelloggs and Quaker raised their prices by 1%, General Mills tended to reduce its own by 0.325% and 0.262%, respectively.

A very different form of inter-firm conduct is exhibited in Table 3, which quantifies pricing behavior after the emergence of a more lenient regulatory environment. Those price reaction elasticities which are statistically significant (four out of six) are all positive. The implication is that when one firm raised its prices, others followed suit. This is indicative of coordinated market power, and was a primary concern of the original 1970s FTC investigation. Once again we see that General Mills exhibits the most clear-cut behavior. It reacted positively to the other firms’ price increases, with an elasticity of 0.146 and 0.114 for Kelloggs and Quaker, respectively. Kelloggs’ price reaction elasticity associated with General Mills was also statistically significant and positive, having an estimated value of 0.100. One notes little connection between Kelloggs and Quaker during this period, as the two corresponding price reaction elasticities are both close to zero, and not statistically significant. It appears that Kelloggs’ behavior towards General Mills and Quaker (in particular) changed from rivalry during the FTC case, to a collusive arrangement in the period after dismissal.
Analogous statements apply to the other two firms: Quaker and General Mills. It appears that some form of tacit collusion took place in the years after the case was dismissed.12 (Note that an alternative, visual presentation of PCMs is displayed in Figure 2.)

**Price-cost margins**

Given that price reaction elasticities were statistically non-zero in the periods surrounding the FTC case, representing firms as operating in isolation from each other (even when allowing for product differentiation and portfolio effects) should at best be only a benchmark for measuring market power. Additionally, the previous discussion makes clear that notable changes occurred in pricing behavior. We now use our estimates of the price reaction elasticities to assess more carefully the extent and type of market power exhibited in the cereal industry during and after the FTC case, as well as the role this played with respect to the striking change in prices exhibited in Figure 1. The calculated observed price-cost margins are presented in Table 4. As discussed earlier, we associate these with “truth,” although in reality they are conditional, as always, on model and data. The average PCM during the case was 38.0%. Comparing this to that associated with our hypothetical scenarios, it appears that brands had just about the level of market power associated with product differentiation alone (its average was 38.1%). The average 1976 - 1979 observed PCM is about two percentage points less than the market power associated with the unilateral plus portfolio effect (40.1%). Interestingly, once the industry was no longer under scrutiny, the average PCM rose by 3.5 percentage points. This made the average 1981 - 1985 PCM higher than that associated with unilateral and portfolio effect put together (41.5% versus 40.1%). However, it is not close to the average PCM associated with perfect collusion (48.5%), the extreme scenario in which a single agent

---

12 In a future version of this paper it might be worthwhile to test for evidence of Stackelberg leadership, since Kelloggs plays a dominant role within the RTE cereal industry (Scherer and Ross, 1990, p. 257). Although such a theory is not well developed for our framework, based loosely on Dixit (1986) we might expect Kellogg’s price reaction elasticities to be particularly large relative to those of other firms. A cursory look at the results in Tables 2 and 3 suggest this is not the case, but this topic may warrant additional theoretical and empirical consideration.
manages all brands, taking all cross price effects into account. On the basis of these findings we tentatively rule out the FTC’s “shared monopoly” theory, at least in the extreme form of scenario three. We find that the high cereal industry PCMs are due primarily to product differentiation and the portfolio effect (i.e., the management of a range of brands by individual firms).

At the same time, it is clear that RTE cereal companies did engage in some form of cooperative pricing during the newly relaxed regulatory environment of the early- to mid-1980s. The increase in PCMs relative to the hypothetical benchmarks suggests some degree of coordinated market power was exercised. Not surprisingly, the rise in margins coincides with the rise in cereal prices during this period (Figure 1).

V. Summary and Conclusions

The U.S. RTE cereal industry is highly concentrated, engages in extensive advertising, and continually introduces new varieties of cereal. These attributes are consistent with the exercise of either unilateral or cooperative market power, and in the 1970s incited the FTC to prosecute the three largest U.S. cereal makers. This “Big Three” case was dismissed in 1981, however, leaving open the question of what conduct was leading to the cereal industry’s consistently high profits. Moreover, in the years following the case’s dismissal, RTE cereal prices experienced a dramatic increase relative to most other U.S. food products. With these observations, this study examines the degree and type of market power that was exercised prior to and following the termination of the case. We employ a differentiated-products Bertrand oligopoly framework in conjunction with time-series data on kids cereals during (part of) the FTC trial (1976-1979), and then in the years following dismissal of the case (1981-1985).

While our estimates of brand-specific price-cost margins (PCMs) were high during both periods (30.3% - 46.5%), comparison with hypothetical conduct scenarios suggests this arose primarily from product differentiation and the ability of firms to manage a portfolio of brands. There
was nonetheless a clear change in industry behavior after the industry was no longer under the spotlight. Once the FTC case was dismissed, price reaction elasticities went from being significantly negative in general (indicating some form of rivalry) to significantly positive in general (suggestive of collusion). In turn, price-cost margins rose an average of 3.5 percentage points. Comparison to the PCMs associated with several hypothetical modes of industry conduct suggests that most of the increase was due to a rise in coordinated market power, thus lending support to the FTC’s original case against the cereal industry.
References


SAMI (Selling Area Markets, Inc.), Microfiche Archive, Purdue University.


Figure 1. Ready-to-eat cereal prices over time

Notes: These are unit values from Selling Area Markets, Inc. (SAMI), normalized on the Bureau of Labor Statistics U.S. average Food and Beverage Consumer Price Index (base period 1982-1984).
Figure 2. *Price-cost margins*

![Price-cost margins diagram](image)

Notes: The information conveyed in this figure is based on Tables 2 and 3. Diamonds are the 1976-1979 observed PCMs. Circles are the 1981-1985 observed PCMs. The solid squares represent the PCMs associated with three hypothetical modes of conduct: from left to right these are single-brand firms, multi-brand firms, and perfectly collusive firms. As such they represent potential unilateral market power; unilateral plus portfolio market power, and collusive market power, respectively.
Table 1. Median own- and cross-price elasticities of demand

<table>
<thead>
<tr>
<th></th>
<th>Kelloggs Froot Loops</th>
<th>Kelloggs Corn Pops</th>
<th>Quaker Cap N Crunch</th>
<th>Quaker Life</th>
<th>GM Lucky Charms</th>
<th>GM Trix</th>
<th>GM Kix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelloggs Froot Loops</td>
<td>-2.340</td>
<td>0.066</td>
<td>0.149</td>
<td>0.060</td>
<td>0.107</td>
<td>0.074</td>
<td>0.052</td>
</tr>
<tr>
<td>Kelloggs Corn Pops</td>
<td>0.113</td>
<td>-2.449</td>
<td>0.127</td>
<td>0.049</td>
<td>0.098</td>
<td>0.071</td>
<td>0.046</td>
</tr>
<tr>
<td>Quaker Cap N Crunch</td>
<td>0.124</td>
<td>0.061</td>
<td>-2.277</td>
<td>0.080</td>
<td>0.106</td>
<td>0.069</td>
<td>0.064</td>
</tr>
<tr>
<td>Quaker Life</td>
<td>0.114</td>
<td>0.053</td>
<td>0.182</td>
<td>-3.157</td>
<td>0.096</td>
<td>0.058</td>
<td>0.077</td>
</tr>
<tr>
<td>GM Lucky Charms</td>
<td>0.124</td>
<td>0.066</td>
<td>0.147</td>
<td>0.059</td>
<td>-2.536</td>
<td>0.074</td>
<td>0.052</td>
</tr>
<tr>
<td>GM Trix</td>
<td>0.109</td>
<td>0.061</td>
<td>0.123</td>
<td>0.046</td>
<td>0.096</td>
<td>-2.557</td>
<td>0.045</td>
</tr>
<tr>
<td>GM Kix</td>
<td>0.101</td>
<td>0.052</td>
<td>0.149</td>
<td>0.079</td>
<td>0.088</td>
<td>0.058</td>
<td>-3.422</td>
</tr>
</tbody>
</table>


Table 2. Mean price reaction elasticities, Jan. 1976 – Dec. 1979

<table>
<thead>
<tr>
<th></th>
<th>Kelloggs Froot Loops</th>
<th>Kelloggs Corn Pops</th>
<th>Quaker Cap N Crunch</th>
<th>Quaker Life</th>
<th>GM Lucky Charms</th>
<th>GM Trix</th>
<th>GM Kix</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelloggs Froot Loops</td>
<td>--</td>
<td>--</td>
<td>-0.198***</td>
<td>-0.198***</td>
<td>-0.058*</td>
<td>-0.058*</td>
<td>-0.058*</td>
<td>0.403</td>
</tr>
<tr>
<td>(0.072)</td>
<td></td>
<td></td>
<td>(0.072)</td>
<td>(0.046)</td>
<td>(0.046)</td>
<td>(0.046)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kelloggs Corn Pops</td>
<td>--</td>
<td>--</td>
<td>-0.198***</td>
<td>-0.198***</td>
<td>-0.058*</td>
<td>-0.058*</td>
<td>-0.058*</td>
<td>0.517</td>
</tr>
<tr>
<td>(0.068)</td>
<td></td>
<td></td>
<td>(0.072)</td>
<td>(0.046)</td>
<td>(0.046)</td>
<td>(0.046)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quaker Cap N Crunch</td>
<td>0.077</td>
<td>0.077</td>
<td>--</td>
<td>--</td>
<td>-0.090**</td>
<td>-0.090**</td>
<td>-0.090**</td>
<td>0.841</td>
</tr>
<tr>
<td>(0.068)</td>
<td>(0.068)</td>
<td></td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.043)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quaker Life</td>
<td>0.077</td>
<td>0.077</td>
<td>--</td>
<td>--</td>
<td>-0.090**</td>
<td>-0.090**</td>
<td>-0.090**</td>
<td>0.819</td>
</tr>
<tr>
<td>(0.068)</td>
<td>(0.068)</td>
<td></td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.043)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GM Lucky Charms</td>
<td>-0.325***</td>
<td>-0.325***</td>
<td>-0.262***</td>
<td>-0.262***</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.307</td>
</tr>
<tr>
<td>(0.074)</td>
<td>(0.074)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GM Trix</td>
<td>-0.325***</td>
<td>-0.325***</td>
<td>-0.262***</td>
<td>-0.262***</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.027</td>
</tr>
<tr>
<td>(0.074)</td>
<td>(0.074)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GM Kix</td>
<td>-0.325***</td>
<td>-0.325***</td>
<td>-0.262***</td>
<td>-0.262***</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.250</td>
</tr>
<tr>
<td>(0.074)</td>
<td>(0.074)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td>(0.086)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Standard error in parenthesis. Coefficients concerning same company are restricted to be equal. One, two, and three asterisks signify statistical significance at the 10%, 5%, and 1% level, respectively, in a one-sided test.

<table>
<thead>
<tr>
<th></th>
<th>Kelloggs Froot Loops</th>
<th>Kelloggs Corn Pops</th>
<th>Quaker Cap N Crunch</th>
<th>Quaker Life</th>
<th>GM Lucky Charms</th>
<th>GM Trix</th>
<th>GM Kix</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelloggs Froot Loops</td>
<td>--</td>
<td>--</td>
<td>-0.072 (0.078)</td>
<td>-0.072 (0.078)</td>
<td>0.100*** (0.028)</td>
<td>0.100*** (0.028)</td>
<td>0.100*** (0.028)</td>
<td>0.855</td>
</tr>
<tr>
<td>Kelloggs Corn Pops</td>
<td>--</td>
<td>--</td>
<td>-0.072 (0.078)</td>
<td>-0.072 (0.078)</td>
<td>0.100*** (0.028)</td>
<td>0.100*** (0.028)</td>
<td>0.100*** (0.028)</td>
<td>0.888</td>
</tr>
<tr>
<td>Quaker Cap N Crunch</td>
<td>-0.067 (0.067)</td>
<td>-0.067 (0.067)</td>
<td>--</td>
<td>--</td>
<td>0.114*** (0.030)</td>
<td>0.114*** (0.030)</td>
<td>0.114*** (0.030)</td>
<td>0.926</td>
</tr>
<tr>
<td>Quaker Life</td>
<td>-0.067 (0.067)</td>
<td>-0.067 (0.067)</td>
<td>--</td>
<td>--</td>
<td>0.114*** (0.030)</td>
<td>0.114*** (0.030)</td>
<td>0.114*** (0.030)</td>
<td>0.926</td>
</tr>
<tr>
<td>GM Lucky Charms</td>
<td>0.146*** (0.055)</td>
<td>0.146*** (0.055)</td>
<td>0.114* (0.082)</td>
<td>0.114* (0.082)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.978</td>
</tr>
<tr>
<td>GM Trix</td>
<td>0.146*** (0.055)</td>
<td>0.146*** (0.055)</td>
<td>0.114* (0.082)</td>
<td>0.114* (0.082)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.977</td>
</tr>
<tr>
<td>GM Kix</td>
<td>0.146*** (0.055)</td>
<td>0.146*** (0.055)</td>
<td>0.114* (0.082)</td>
<td>0.114* (0.082)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0.890</td>
</tr>
</tbody>
</table>

Note: Standard error in parenthesis. Coefficients concerning same company are restricted to be equal. One, two, and three asterisks signify statistical significance at the 10%, 5%, and 1% level, respectively, in a one-sided test.

Table 4. Price-cost margins (%)

<table>
<thead>
<tr>
<th></th>
<th>Observed PCMs</th>
<th>Hypothetical benchmarks</th>
<th>Single-brand Firms(^a)</th>
<th>Multi-brand Firms(^b)</th>
<th>Colluding Firms(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelloggs Froot Loops</td>
<td>42.2</td>
<td>44.4</td>
<td>+ 2.2</td>
<td>42.7</td>
<td>43.8</td>
</tr>
<tr>
<td>Kellogg Corn Pops</td>
<td>40.1</td>
<td>44.3</td>
<td>+ 4.1</td>
<td>40.8</td>
<td>43.1</td>
</tr>
<tr>
<td>Quaker Cap N Crunch</td>
<td>43.0</td>
<td>46.5</td>
<td>+ 3.5</td>
<td>43.9</td>
<td>46.0</td>
</tr>
<tr>
<td>Quaker Life</td>
<td>30.4</td>
<td>33.6</td>
<td>+ 3.1</td>
<td>31.7</td>
<td>33.1</td>
</tr>
<tr>
<td>GM Lucky Charms</td>
<td>40.2</td>
<td>42.8</td>
<td>+ 2.6</td>
<td>39.4</td>
<td>41.2</td>
</tr>
<tr>
<td>GM Trix</td>
<td>39.8</td>
<td>43.3</td>
<td>+ 3.4</td>
<td>39.1</td>
<td>41.2</td>
</tr>
<tr>
<td>GM Kix</td>
<td>30.3</td>
<td>35.6</td>
<td>+ 5.3</td>
<td>29.2</td>
<td>32.4</td>
</tr>
<tr>
<td>Average</td>
<td>38.0</td>
<td>41.5</td>
<td>+ 3.5</td>
<td>38.1</td>
<td>40.1</td>
</tr>
</tbody>
</table>

\(^a\) Represents the potential for unilateral market power through product differentiation.
\(^b\) Represents unilateral market power plus the portfolio effect.
\(^c\) Represents a pure “shared monopoly” achieved through joint-profit maximization by a single agent.