# ADVERTISING AND THE FOOD SYSTEM

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# ADVERTISING AND CONCENTRATION CHANGE IN U.S. FOOD AND TOBACCO PRODUCT CLASSES, 1958-1972

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The vigorous advertising wars that are taking place among many of the leading food processing companies pose a challenge not only to their competitors but also to our profession. Conventional economic tools are ill-equipped for today's economic setting. New economic tools must be forged and existing ones redesigned if economists are ever to gain an understanding of a food processing system whose primary forms of competition are advertising and other related forms of nonprice rivalry.

In this paper I analyze whether or not advertising activity has had any effect on industry structure. Recently, Mueller and Rogers (1980) have shown that consumer goods industries using advertising, particularly television advertising, to create and maintain product differentiation have either experienced increased industry concentration or have maintained already high levels of industry concentration despite natural eroding forces present in the economy.

Unlike previous analyses, I restrict my analysis to the food and tobacco industries and use data that more closely reflect an economist's notion of a market. That is, data at the Standard Industrial Classification Product Class level (five digit SIC) are used rather than the more common, broader four-digit industry level data. By restricting the focus to food and tobacco industries, a more homogenous group of industries that includes several of the heaviest users of advertising can be studied.

## OVERVIEW OF CONCENTRATION TRENDS

Mueller and Rogers (1980) calculated that average industry concentration for all manufacturing was remarkably stable over the 25-year period from 1947 to 1972. However, the overall stability concealed divergent trends that were occurring in different segments of manufacturing. In producer goods industries concentration had actually fallen, whereas in consumer goods industries it had risen. Further classification of consumer goods industries into product differentiation categories revealed that the largest increases in concentration occurred in the more highly differentiated industries.

A similar pattern emerges for the 86 food and tobacco product classes included in Table 1. Rather than classify product classes into product differentiation groups, this study groups product classes by their respective advertising-to-sales ratios. The advertising data used are measured media expenditures, and therefore they are consumer-oriented. The category of product classes that does not use measured media advertising is likely to include producer goods or virtually undifferentiated consumer goods. The other categories reflect increasing degrees of product differentiation as measured by the advertising-to-sales ratio.

While overall average four-firm concentration increased 2.4 percentage points, product classes that used no measured media advertising actually

experienced a decrease of 1.2 percentage points. As product differentiation becomes more pronounced, the changes in concentration become positive and larger. It should be noted that not only are the *trends* but also the *levels* of four-firm concentration positively associated with advertising-created product differentiation.

The contrasting patterns shown in Table 1 suggest that to look only at overall averages will mask interesting opposing trends. The purpose of the remainder of this paper is to use a multiple regression model to test hypotheses explaining the causes of concentration change, especially the influence of advertising.

## THE MODEL AND THE VARIABLES

The model is a linear equation estimated by ordinary least squares. Its basic form is as follows:

$$\Delta CR_4 = a + b_1ICR + b_2S + b_3G + b_4A/S + e$$

The dependent variable and the independent variables are defined and discussed below.

*Change in Concentration* ($\Delta CR_4$): The dependent variable measures the change in four-firm concentration ($CR_4$) between 1958 and 1972. The change is measured in percentage points, i.e., $CR_4$ 1972 minus $CR_4$ 1958.

*Initial Level of Concentration* (ICR): The initial level of concentration is measured by the beginning year's $CR_4$, i.e., $CR_4$ 1958. Economic theory suggests that ceteris paribus, leading firms in concentrated industries are likely to lose market share over time.[2] This implies a negative relationship between ICR and $\Delta CR_4$[3]

This reasoning ignores unconcentrated industries, as have most authors who have written about the relationship between ICR and $\Delta CR_4$. However, Bain (1970) noted, in a descriptive article, evidence for a centripetal tendency. Industries with low ICR tended to experience increases in concentration, whereas industries with high ICR experienced decreases in concentration. He offered no economic explanation although both tendencies are consistent with a negative relationship.

However, there are various reasons why industries with low ICR are more likely to experience increases than decreases in concentration. First, horizontal mergers may take place without challenge from the government antitrust authorities. Such mergers are often the result of acquiring firms seeking quick growth or searching for economies of scale and of acquired firms selling out a family business that lacks a successor.

Second, low ICR should be a proxy for low barriers to entry (e.g., low technical economies of scale, low product differentiation). When barriers are low, regional and local firms can survive and prosper even in markets where national firms operate. However, large firms that wish to diversify may find an industry with low ICR attractive since initially there are no well-entrenched, large dominant firms to resist their entry and government

**Table 1. Average Unweighted Four-Firm Concentration Ratios by Categories of Advertising Intensity for 86 U.S. Food and Tobacco Product Classes, 1958 to 1972**

| | | Product Classes' Advertising-to-Sales Ratio[2] (mean A/S for category) | | | |
|---|---|---|---|---|---|
| Year | All Product Classes[1] N=86 | 0% (0) N=30 | 0 to 1% (0.5) N=19 | 1 to 3% (1.7) N=13 | Greater than 3% (6.5) N=24 |
| 1972 | 48.5% | 42.6% | 37.4% | 54.0% | 61.5% |
| 1967 | 47.0 | 43.0 | 36.2 | 53.2 | 57.2 |
| 1963 | 46.1 | 42.1 | 36.5 | 50.9 | 56.0 |
| 1958 | 46.1 | 43.8 | 36.8 | 51.1 | 53.8 |
| Change 1958-1972 | +2.4 | -1.2 | +0.6 | +2.9 | +7.7 |

[1]All five-digit product classes in the two-digit Standard Industrial Classification (SIC) Major Groups 20 (food) and 21 (tobacco) where the data are comparable from 1958 to 1972; except for SIC 20164 (other poultry, small game), SIC 20210 (butter), and SICs 20513 to 20517 (sweet bread-type products). They were omitted due to data problems. In SIC 20820 (beer) data were used at the broader four-digit SIC level to reflect the close substitutibility of the five-digit product classes. In refined sugar SICs 20620 and 20630 were combined into one market because once refined, beet and cane sugar are indistinguishable to the consumer.

[2]The advertising-to-sales ratio (measured in percent) is constructed from each product class' advertising expenditures in eight measured media for 1967 and its 1967 value of shipments.

Source: Concentration ratios and value of shipments are from the U.S. Bureau of the Census, Census of Manufactures, 1972, Concentration Ratios in Manufacturing, MC72 (SR)-2. The basic advertising data were prepared by the late Robert Bailey of the Federal Trade Commission. Mr. Bailey essentially assigned a five-digit SIC code to the advertising data reported in Leading National Advertisers, Inc. 1967; Media Records, Part Two, Newspaper Advertisers, 1967; LNA Outdoor Advertising Expenditures, 1967; and Radio Expenditure Reports, 1967.

antitrust agencies have shown little disapproval of such diversification by merger strategies. Once a large firm enters a low ICR industry, it may trigger entry by other firms and a new form of competition may emerge, a struggle for market share fueled by massive advertising and new product campaigns. In this new environment, local and regional firms are no longer capable of prospering and the majority exit the industry, often by acquisition.

Many academic studies[4] and numerous business press articles[5] have stressed the profitability of being an industry leader. Relative firm market share (the firm's share relative to the leading firms' share) has proven to be positively correlated to profitability.[6] Obviously, it is easier to achieve a high relative market share if ICR is low than if it is high. Therefore, industries with low ICR may well experience increased concentration. Although the hypothesized negative relationship between ICR and change in concentration appear defensible, the reasoning furnishes little help as to the appropriate functional form.

*Industry Size* (S): Mueller and Hamm (1974, p. 514) hypothesized that "other things being the same, the larger the absolute size of an industry the lower its entry barriers." They add, "However, if industries were in long-

run equilibrium in the initial year of the period studied, industry size would not have any influence on concentration since an 'equilibrium' number of firms would already exist." Therefore, size should be either negatively related to $\triangle CR_4$ or insignificant. Size is measured as the natural logarithm of value of shipments in 1958.

*Industry Growth* (G): The vast majority of authors who have examined structural change have hypothesized that industry growth should have a deconcentrating influence (Nelson 1960, Shepherd 1964). Mueller and Hamm (1974, p. 514) state it this way, ". . . when an industry's demand is growing rapidly, new firms face a less difficult displacement problem, which has the effect of reducing entry barriers." Mueller and Rogers hypothesized the same negative influence for growth, yet their empirical work found growth to be insignificant.

In a recently completed review of the literature I found that growth is the only hypothesized variable that has statistically significant empirical findings pointing in both directions. Sawyer (1971) argued and empirically supported the view that growth would be positively related to concentration change, after controlling for the change in the number of firms in the industry. He reasoned that this was true because large firms, due to their multi-industry structure, are more likely to reap the benefits of industry growth and will grow faster than the smaller firms operating in the same industry.

Farris (1973) hypothesized that an industry's growth rate would affect concentration change differently depending on whether the industry is or is not highly concentrated. He hypothesized that the effect of growth would be positive in industries with low ICR and negative in industries with high ICR. Farris explains, "The rationale is that in industries of low concentration, rapid market growth could provide a very favorable environment for large firms to increase their sales without encountering strong resistance from other competitors" (p. 292). He also suggests that the firm's own expansion effort may encourage industry growth and the firm may capture a large part of that industry growth it has helped encourage. Finally, government antitrust agencies will not be concerned with a firm's expansion if concentration is low.

Farris argues that when ICR is high, competing firms would be more resistant to market expansion efforts, as would government antitrusters. This situation may provide greater opportunities for growth by intermediate-sized firms and the dominant firms may shift their attention to growth opportunities elsewhere. Farris found empirical support for his hypothesis for a sample of all manufacturing industries for the period 1963-1967.

In the food industries, I find such reasoning to be very compatible with my reading of the events shaping the structure of food processing. Large, multi-industry firms seeking to diversify have entered, almost always via acquisition, industries with growth potential and then used their marketing skills, managerial talent, capital, and other resources to foster a growth rate for the newly acquired units that exceeds the industry's rate of growth. Furthermore, industries that tend to be the fastest growing are usually those that produce more highly processed foods and therefore lend themselves to the use of product differentiation tactics. Such industries attract conglomerate entry and once conglomerates have entered they are able

to exploit the product differentiation opportunities and grow faster than less powerful firms in the industry and thus concentration increases. This also suggests that growth and advertising will be positively correlated.

For these reasons I would expect either a positive or an insignificant overall relationship between growth and concentration and a positive relationship if highly concentrated industries are removed. Growth is measured by the ratio of 1972 value of shipments (VOS) to 1958 VOS.

*Advertising Intensity* (A/S): Advertising-created product differentiation is a major source of market power for an individual firm and of industry entry barriers (Bain 1956; National Commission 1966; Comanor and Wilson 1974). For food and tobacco products, advertising and its related activities are clearly the leading barriers to entry because the other barriers to entry can be overcome by all viable potential entrants.[7]

If large scale advertising has substantial advantages, pecuniary or real, and especially if these advantages increased over the period studied, advertising would cause increased concentration in industries most susceptible to advertising. Brown (1978) finds that average advertising costs fall sharply with sales and that returns to advertising capital increase with sales over a wide range, "implying that barriers to entry due to advertising do exist and are substantial." Although Brown's analysis dealt with the cigarette industry, his findings should apply to most highly advertised consumer nondurable goods.

Not only were there likely large volume discounts in TV advertising in the past[8], but there are other advantages to the large advertiser. The use of national advertising seems to have a cost advantage over using local advertising. A firm or potential entrant will be at a cost disadvantage if it must use local advertising to compete with national advertising by national firms.

Large advertisers still appear to secure more favorable time slots than smaller advertisers (Scala 1973 and Levmore 1978). This is critical for many products because certain programs are much more valuable than others. For example, if access to major sports events is foreclosed by major brewers, small brewers are disadvantaged even when they have access to other "prime" time programs at the same cost per minute.[9] I hypothesize that advantages of large scale advertising do exist, especially in television advertising.

The impact of advertising goes beyond that associated with scale economies. There is case study evidence demonstrating that large conglomerate firms are able to use advertising in a cross-subsidizing manner, which might be legally viewed as predatory if it were reflected in deep price cutting. Instead, large conglomerates may subsidize advertising and promotion outlays to increase their market shares in particular markets (Mueller 1978 a, b). Unfortunately, this analysis cannot separate the structural changes associated with economies of scale in advertising from those due to cross-subsidization advertising by conglomerates.

Models that use only total advertising implicitly assume that all forms of advertising have the same impact on structure, which is very unlikely. Since television advertising generally is the most effective media and for large firms facing numerous buyers has the lowest cost per potential buyer, it is hypothesized that television will have a different impact on in-

dustrial structure than will other forms of advertising. This does not imply that advertising done by consumer goods firms in other media, magazines for example, has no influence on product differentiation. However, other media generally are less effective than television advertising as evidenced by the growing importance of the latter. Also, since virtually all TV advertising began after 1947, the unique impact of this medium on structure should be greatest and it is hypothesized that industries that lend themselves to TV advertising have moved toward a new equilibrium structure.

To test this hypothesis, advertising is entered into the model in two ways. First, the product class' total 1967 advertising-to-sales ratio (TA) is used. TA is expected to have a positive influence but mainly because television accounts for 65 percent of the advertising data used here. Next, TA is separated into a television-plus-radio (TVR) variable[10] and a printed media variable consisting of newspaper, outdoor, and magazine advertising (NOM). Here TVR is expected to be positively related to $\Delta CR_4$, whereas NOM is expected to be insignificant.

## EMPIRICAL RESULTS

The results of the multiple regression analysis are reported in Table 2.[11] Equation 2.1 is the basic model. Size is the only variable that is not significant in the model, suggesting that initial industry size had no subsequent effect on $\Delta CR_4$. ICR is negative and highly significant. No support for a nonlinear specification (using ICR and $ICR^2$) was found. Also, classifying observations by ICR categories (0 to 100 by 10s) and listing the corresponding mean $\Delta CR_4$ for each category supported the linear specification. Growth is positive and significant at 5 percent. This result differs considerably from the insignificant result found by Mueller and Rogers (1980), and even Farris' (1973) hypothesis predicted an insignificant result for growth in a combined high and low ICR sample. Evidently in food and tobacco product classes, rapidly growing industries are experiencing increased concentration. The total advertising-to-sales ratio is positive and highly significant. Product classes that are able to use advertising to encourage and enhance product differentiation are experiencing increased concentration. TA and G are significantly correlated ($r = .33$) and thus a product class that is characterized by intense advertising and that is growing rapidly is likely to post a positive change in concentration despite even high initial levels of concentration.

Equation 2.2 separates TA into its two components, TVR and NOM. As expected, television and radio are the more powerful media for restructuring markets; NOM is highly insignificant. The rest of the model performs as in equation 2.1.

Equations 2.3 and 2.4 are used to address the Farris hypothesis that growth would have a different effect depending on whether ICR is high or low. Farris separated his data into a group of observations where ICR was less than 50 and one with ICR of 50 or higher and estimated separate regressions for each group. A binary variable approach was used here that allows for different slope coefficients on growth depending on whether ICR is low or high. Two binary variables were constructed and interacted with

**Table 2. Results of Multiple Regressions Explaining Changes in Four-Firm Concentration Between 1958 and 1972, 84 U.S. Food and Tobacco Product Classes.**

| Equation | Dependent Variable | Constant | Initial $CR_4$ (ICR) | Initial Size (S) | Growth (G) | | Total A/S (TA) | TV and Radio A/S (TVR) | Newspaper, Outdoor, Magazine A/S (NOM) | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.1. | $\triangle CR_4$ 1958-72 | 6.72 | -.24** (-4.91) | -.21 (-0.28) | 2.75* (2.23) | | .96** (3.20) | | | .35 (10.65)** |
| 2.2. | $\triangle CR_4$ 1958-72 | 6.97 | -.24** (-5.18) | -.21 (-0.27) | 2.69* (2.24) | | | 1.47** (4.02) | -.20 (-0.34) | .39 (10.06)** |
| | | | | | GD1 | GD2 | TA | | | |
| 2.3. | $\triangle CR_4$ 1958-72 | 6.62 | -.23** (-3.46) | -.22 (-0.28) | 2.78* (2.16) | 2.67* (1.70) | .96** (3.18) | | | .35 (8.41)** |
| 2.4. | $\triangle CR_4$ 1958-72 | 0.89 | -.11 (1.39) | -.01 (-.01) | 3.02** (2.48) | -0.85 (-0.39) | 1.03** (3.48) | | | .38 (9.59)** |
| | | | | | | | | A/S for 1954 | | |
| | | | | | | | | NTV Only | Mag. Only | |
| 2.5. | $\triangle CR_4$ 1958-72 | 4.94 | -.24** (-4.63) | | 3.55** (2.92) | | | 4.76** (2.75) | 0.25 (0.18) | .34 (9.96)** |

Notes: 1. The dependent variable, change in four-firm concentration, was measured in percentage points.
2. The t-value for each regression coefficient appears below it and the regression's F-statistic appears below the $R^2$ value.
* The t-value is significantly different than zero at 5 percent using a one-tail test.
** The t-value is significantly different than zero at 1 percent using a one-tail test.

growth (G) as follows:

if ICR < X; D1 = 1 and D2 = 0
if ICR > X; D1 = 0 and D2 = 1
where X = a break value for ICR

and

GD1 = G * D1
GD2 = G * D2

The Farris hypothesis is that the coefficient from GD1 (low ICR) will be positive and the coefficient from GD2 (high ICR) will be negative. Break values for ICR were 30, 40, 50, 60, 70, and 80. The results from using a break value of 30 and 50 are similar to using one of 40.

Equation 2.3 uses the ICR break value of 40 and the effects of growth on $\Delta CR_4$ are statistically equivalent whether ICR is above or below 40. In fact, the regression looks like a copy of equation 2.1 with G listed twice, suggesting G had a similar effect on $\Delta CR$ irrespective of the ICR value.

Equation 2.4 uses an ICR break value of 60 and the effect of G on $\Delta CR_4$ differs depending on the level of ICR. This result is still consistent with the Farris idea that there would be a positive result from G if ICR was low. However, it stops short of providing support for the other half of the Farris hypothesis, that the effect of G on $\Delta CR_4$ would be negative if ICR was high. The coefficient on GD2 is not significant and, despite its negative sign, is best interpreted as G has no effect on $\Delta CR_4$ when ICR was equal to or exceeded 60. However, this result suggests the Farris hypothesis has merit and should be considered further.

Setting the break value at 70 results in the coefficient on GD2 becoming positive but still not significant. When the break value is increased to 80 (there are only 6 observations with ICR greater than 80) the coefficient on GD2 becomes positive and significant. The other coefficients remain as they were with a break value of 40. The conclusion reached is that growth has a positive effect on $\Delta CR_4$ when ICR is low. The relationship then seems to flatten out at higher values of ICR (60 to 80) and may then turn positive again. However, at no time does growth have a significant negative effect on $\Delta CR_4$ in food and tobacco product classes.

Equation 2.5 is a regression containing advertising variables based on 1954 data that I developed in response to criticisms made of using only the 1967 advertising data.[12] First, the year 1967 may be an atypical year and hence the results are spurious. Second, the question of causality is raised. If concentration is increasing and increased concentration results in increased nonprice competition, then the 1967 advertising will have increased, in part, by the $\Delta CR$ that it is trying to explain. Clearly, 1954 advertising is not influenced by $\Delta CR_4$ from 1958 to 1972. Regression 2.5 uses a 1954 network television advertising-to-sales ratio (NTV), a 1954 magazine advertising-to-sales ratio (M), and size is omitted because of its continual insignificance in the model. The results are very consistent with Equation 2.2 (1954 total advertising-to-sales ratio is also significant). This suggests that product classes that were able to use network television advertising in 1954 have been moving to a new higher equilibrium level of concentration.[13]

Overall, the results in Table 2 suggest that there is little likelihood that deconcentration will occur due to "natural causes" in the food and to-

bacco product classes. Concentrated product classes seem able to maintain high levels of concentration, primarily through the use of television advertising. Product classes that initially were not concentrated but displayed growth opportunities are moving toward higher levels of concentration and if the product class lends itself to advertising this concentrating effect is further enhanced. Such a conclusion is a sober one to economists who view less concentration as preferable to more, and to other social scientists who view the problems of concentration and nonprice competition in much broader terms than economists typically do.

## FOOTNOTES

[1] The views expressed in this paper are not necessarily those of his agency. The author would like to thank Julie Caswell, John Connor, Ed Jesse, and W.F. Mueller for helpful comments.

[2] See Mueller and Rogers (1980) for further explanation.

[3] Much discussion in the past has centered around the boundedness of both the dependent variable and ICR. It was argued that this boundedness would result in regression bias. However, subsequent work by Mueller and Hamm (1974) and Wright (1978) have shown that this is not a problem. In this data set ICR is close to being normally distributed around a mean of 45, with no observations less than 12 and only one observation over 90 (canned baby food at $CR_4 = 94$).

[4] For example, see R.D. Buzzel, et al., "Market Share a Key to Profitability," *Harvard Business Review,* January-February, 1975.

[5] R.E. Winter, "Corporate Strategists Giving New Emphasis to Market Share, Rank," *The Wall Street Journal,* February 3, 1978.

[6] For example, see Richard T. Rogers, "Structure-Profits Relationship for Food Manufacturing Firms," in W.F. Mueller, "The Celler-Kefauver Act, The First 27 Years," Committee of the Judiciary, House of Representatives, December 1978, pp. 184-188.

[7] See Horst (1974), Chapter 4.

[8] See Mueller and Rogers (1980) and Levmore (1978) for a discussion of volume discounts.

[9] For more information see Mueller (1979).

[10] Radio was combined with television because it was also an electronic media and was the only other media that had a positive simple correlation with $\Delta CR_4$. However, this addition has little real effect because radio expenditures are small, accounting for only 8 percent of the total advertising data used here.

[11] The regressions presented in Table 2 are estimated with two observations removed (SIC 20761, linseed oil; and SIC 20994, baking powder and yeast). They are both very small product classes, and it was originally thought that small product classes ought to be omitted for fear that they would tend to be erratic. However, in comparing regressions where all product classes with 1972 VOS less than $100 million were removed and regressions based on all the data, it was discovered that only these two product classes had large residuals. Thus, rather than present the models where all small product classes were omitted, I present those where only two small product classes are removed. The results are not that different but statistical significance is improved. For example, equation 2.2 is as follows when all 86 product classes are used:

$$\Delta CR_4 = 9.51 - .19ICR^{**} - .71S + 2.08G + 1.31TVR^{**} - .30NOM \qquad R^2 = .27$$
$$(-3.81) \quad (.85) \quad (1.56) \quad (3.21) \quad (-.47)$$

and as follows when product classes with 1972 VOS less than $100 million are removed (N = 77):

$$\Delta CR_4 = 6.9 + -.24ICR^{**} - .20S + 2.75G^{*} + 1.48TVR^{**} - 24\ NOM \qquad R^2 = .38$$
$$(-4.80) \quad (-.22) \quad (2.16) \quad (3.78) \quad (-.39)$$

[12] As can be seen, the above regression is virtually the same as equation 2.2 reported in Table 2.

[13] The 1954 advertising data are from *Leading National Advertisers,* LNA, 1954. The data were assigned a SIC five digit code in the same manner as Bailey constructed his 1967 advertising data. There were fewer data recorded in 1954 than in 1967. In 1954 only network television, magazines, network radio, and newspaper supplements were recorded.

[14] Another recently estimated model includes a change in advertising variable from 1954 to 1972 ($\Delta A/S$) for each product class as well as including the 1967 advertising-to-sale ratio (A/S). This is a very appealing model because both change in advertising intensity and intensity (from an intermediate year) are accounted for. The results of this model are as follows:

$$\Delta CR_4 = 3.63 - .20ICR^{**} + 3.11G^{**} + 1.86\ \Delta A/S^{*} + 1.43\ A/S^{**} \qquad R^2 = .36$$
$$(-4.13) \quad (2.61) \quad (1.68) \quad (2.57)$$

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