THE ROLE OF ADVERTISING IN CHANGING CONCENTRATION OF MANUFACTURING INDUSTRIES

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Willard F. Mueller and Richard T. Rogers*

All economists probably agree that the near $40 billion spent annually on advertising constitutes a powerful force for good or ill in a capitalistic economy. But there remains much about advertising that is not well understood. Among the most important unsettled questions is the impact of advertising on industrial structure.

Although views still differ, there is increasing evidence that advertising plays an especially prominent role in structural change. Weiss[1/] found some evidence of a general tendency for concentration to increase between 1947 and 1954 in consumer durable goods manufacturing industries. Blair[2/] conducted an informal test of the hypothesis and he concluded that concentration generally increased between 1947 and 1963 in industries that were heavy users of network television advertising. Mueller[3/] reported that between 1947 and 1963 concentration appeared to be increasing most rapidly in industries with high advertising intensities. A subsequent study by Mueller and Hamm confirmed this finding for the period 1947-1970.[4/]

The Mueller-Hamm study has been criticized on several grounds. Ornstein[5/] alleges that it is flawed by errors in its advertising intensity variable, which uses Parker's[6/] classification system that divides consumer goods into three discrete classes of product differentiation. Ornstein also contends that the study is invalid because its sample consists of largely mature, slow growing industries. Finally, the study has been criticized because the use of one of the independent variables, the beginning level of concentration, results in regression bias.[7/]

Here we report the results of a more comprehensive analysis for the period 1947-1972 that: (1) uses a continuous measure of advertising intensity; (2) differentiates between TV and other types of advertising; (3) includes a proxy for changes in economies of scale; and (4) uses a more appropriate specification of one of the independent variables. We also respond to the criticisms mentioned above.

Overview of Concentration Trends

Viewed in the aggregate, the average level of concentration in manufacturing industries displays remarkable stability over the 25 year period, 1947-1972. In a 167 industry sample, the average market share of the leading four firms (CR_4) was 40.9 percent in 1947 and 42.4 percent in 1972 (Table 1, Column 1). This apparent stability results from averaging the partially offsetting changes occurring in different segments of manufacturing. Most important is the differing behavior in producer and consumer goods industries.[8/] Whereas average concentration in producer goods changed little over the period, consumer goods experienced a persistent and substantial upward trend. The contrasting trends are especially evident when consumer goods are subdivided by degree of product differentiation. For this purpose, we have grouped the industries according to Parker's classification system wherein he identified industries by the degree of product differentiation (Table 1, Columns 4, 5, and 6). Parker's classification is based mainly on the advertising intensities of leading firms in an industry.[9/] We have included in the table the average total industry

Table 1. Average Unweighted Four-Firm Concentration Ratios by Degree of Product Differentiation for 167 U.S. Manufacturing Industries, 1947-1972

	Total Industries[a/] (167)	Producer Goods (97) A/S = 0.1%[b/]	Consumer Goods: Degree of Differentiation			
			All (70) A/S = 2.2%[b/]	Low (21) A/S = 0.3%[b/]	Moderate (33) A/S = 1.6%[b/]	High (16) A/S = 6.3%[b/]
	(1)	(2)	(3)	(4)	(5)	(6)
1972	42.4	42.8	41.8	28.3	41.4	60.6
1967	41.4	42.6	39.7	25.2	39.2	59.9
1963	41.1	42.5	39.2	24.6	39.6	57.8
1958	39.9	42.5	36.3	22.4	36.7	53.4
1954	40.3	43.4	36.0	23.7	35.9	52.3
1947	40.9	44.7	35.7	25.9	36.2	47.7
Change 1947-1972	+1.6	-1.9	+6.1	+2.4	+5.2	+12.9

a/ These industries are all those manufacturing industries that had comparable data for the period 1947 to 1972. See footnote 11.

b/ This is the average advertising-to-sales ratio for all industries in this group. This includes advertising expenditures for eight measured media in 1967. See text.

advertising-to-shipments ratios for the industries in each of Parker's product differentiation classes. This comparison shows that average advertising intensity differs substantially among Parker's three product differentiation classes.[10/]

The average CR_4s shown for various groupings of industries also obscure considerable variation within each group. The extent of this variation is shown in Table 2. Even in producer goods industries, 11 industries experienced increases in CR_4 of over 10 percentage points. The extent of variation was even greater among consumer goods.

The contrasting pattern displayed in Tables 1 and 2 illustrate that the apparent stability in concentration over a 25-year period is deceptive, hiding more than it tells. The purpose of the following analysis is to test hypotheses explaining the causes for changes in concentration, especially the unique role played by advertising.

The Sample

The analysis uses 167 four-digit SIC manufacturing industries for which comparable four-firm concentration ratios (CR_4) and other necessary data are available for the period 1947-1972.[11/] These industries are quite closely representative of all manufacturing industries. The chief criticism of this data set is that by restricting the sample to industries whose SIC definitions have not changed over a 25-year period, it allegedly consists of "only the slowest growing and least technologically dynamic industries."[12/] Unfortunately, this criticism cannot be tested rigorously. Since all the data that could be used have been used, a Chow test or other similar statistical procedures cannot be performed. However, careful examination of changes in SIC

Table 2. Change in Four-Firm Concentration Between 1947 and 1972 for 167 Selected U.S. Industries[a/]

Percentage Points Change in Four-Firm Concentration 1947 to 1972	Number of Industries					
	Total Industries	Producer Goods	Consumer Goods			
			All	Low Differentiation	Moderate Differentiation	High Differentiation
Increased Concentration:						
21 or More	10	1	9	2	3	4
16 to 20	10	4	6	1	3	2
11 to 15	19	6	13	2	6	5
6 to 10	23	9	14	4	9	1
1 to 5	27	19	8	4	4	1
Number of Industries with Increased Concentration	89	39	50	13	24	13
No Change	4	4	0	0	0	0
Decreased Concentration:						
-1 to -5	26	20	6	2	3	1
-6 to -10	17	12	5	3	1	1
-11 to -15	18	16	2	1	1	0
-16 to -20	5	2	3	1	2	0
-21 or Less	8	4	4	1	2	1
Number of Industries with Decreased Concentration	74	54	20	8	9	3
Totals	167	97	70	21	33	16

a/ Same as in Table 1.

Source: Same as Table 1.

classifications and comparisons of our sample with other SIC industries for later periods does not support the criticism that the sample differs markedly from the universe.

The Bureau of the Census changes industry definitions for various reasons and in different ways. Most changes in industry definitions have nothing to do with whether or not industries are dynamic. Many definitions have been changed because products were added or deleted, and in some cases industries have had some products added and others deleted. In other cases, two or more industries were combined to form a new industry, and sometimes (relatively few) new SIC industries have been created.

Mueller-Hamm[13/] found that their 1947-1970 sample exhibited the same overall trend and level of concentration between 1958 and 1970 as did a much larger sample. (The latter sample represented 74 percent of all manufacturing value added.) Additionally, Weiss has argued that using only industries with essentially the same definition does not create any major bias.[14/]

We have further examined the hypothesis that industries with consistent SIC classifications for the entire 1947-1972 period constitute a slower, less dynamic group of industries than does the entire population of manufacturing industries. We separated the entire population of 1967 SIC industries (N = 413) into a group consisting of our sample (Group A, N = 167) and a group that was not in our sample (Group B, N = 169) but had comparable data back to 1963 (the year of the last major revision). This left a residual group (N = 48) whose data were not comparable over this 9 year period and hence were excluded from the analysis. The total value added attributed to Group A was 83 percent of that of Group B. Mean percentage growth rates were computed for each group and a difference in means test was performed between Group A and Group B for the time periods 1963-1967, 1967-1972, and 1963-1972. The differences between the two groups were not statistically different at the 5 percent level for the two shorter periods.15/ However, for the 1963-1972 period, the means of the two groups were statistically different at the 5 percent level. Examining the entire range of percentage growth rates for Groups A and B over the 1963-1972 period reveals that the entire distribution is very similar. The statistically significant difference in the means of the two groups is entirely attributable to one extreme observation, household furniture, n.e.c. (SIC 2519), which grew by 533 percent. Removing this industry, there is no statistically significant difference in the means of the two groups at the 10 percent level for the 1963-1972 period. This evidence yields no support for the criticism that our sample is seriously biased against rapidly growing industries.

Our analysis also makes use of a subsample of the N = 167 sample that excluded 38 industries that had value of shipments under $100 million in years 1947 or 1972. This subsample was used to see if the inclusion of small industries was causing any bias in the results. A similar comparison of mean percentage growth rates of this subsample (Group A', N = 128) and those industries from Group B with 1963 value added exceeding the minimum 1963 value added observed in Group A' (Group B', N = 165) revealed no statistical differences for any of the time periods involved. In fact, for the 1967-1972 period the mean percentage growth rate of Group A' exceeded that of Group B'. The results based on the exclusion of small industries substantiates our findings for the entire sample, and allows us to infer with considerable confidence that there exists no statistical differences in growth rates between included and excluded industries. We therefore conclude that our sample is quite representative of all U.S. manufacturing and that analyses based on it provide inferences applicable to concentration changes in all manufacturing industries.

The Variables

Change in Concentration (ΔCR)

The dependent variable measures the change in four-firm concentration (CR_4) between 1947 and 1972 for our main model. The change is measured in percentage points, i.e., CR_4 1972 minus CR_4 1947.[16/]

Initial Level of Concentration (ICR)

Initial level of concentration is measured by the beginning year's CR_4. Economic theory suggests that, ceteris paribus, leading firms in concentrated industries are likely to lose market share over time or to increase less rapidly than less concentrated industries.[17/] We therefore expect this variable to have a negative sign.

A referee for the Mueller-Hamm study, Richard Caves, suggested that the expected negative relationship between initial level of concentration and change in concentration may be a statistical artifact because industries with very high CR_4 in 1947 could thereafter experience decreases but not increases in concentration, thus violating the assumption of homoskedasticity. Subsequent tests by Mueller and Hamm, including one suggested by Caves, provided no evidence of regression bias.[18/] Wright concludes that the negative impact of initial level of concentration is not a statistical artifact because he finds the same result after he removes any possible regression bias.[19/] The upper bound is rarely constraining in our data set as it includes only two observations where CR_4 exceeds 90 in 1947. Furthermore, whereas regression bias will result in nonnormally distributed residuals, plots of residuals did not indicate nonnormality.

Industry Growth Rate (G)

Growth in industry demand affects the opportunity for entry by new firms and expansion of fringe firms already in the market. Slow growing industries create a more difficult "displacement problem" than rapidly growing ones.[20/] We therefore expect this variable to be negatively related to change in concentration. Percentage change in value added in current dollars was used to measure industry growth.

Industry Size (S)

Other things being the same, the larger the absolute size of an industry the lower its entry barriers.[21/] 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 trends since an "equilibrium" number and size distribution of firms would already exist. But we cannot make such an equilibrium assumption. First, the original structure of an industry may have been the product of a patent monopoly and therefore was more concentrated than warranted by scale requirements. Second, prior to the 1950 amendment of Section 7 of the Clayton Act, horizontal mergers were essentially immune from antitrust challenge, therefore resulting in higher levels of concentration than dictated by scale requirements alone. Industry size is measured by the natural logarithm of the industry's total value added (VA) in 1972 (hundreds of thousands of dollars). This measure, which differs from the specification used in the Mueller-Hamm study, was used to account for the nonlinear negative relationship between size and ΔCR_4 because the distribution of VA is badly skewed. To find the impact on ΔCR_4 from VA rather than ℓn VA, which is the variable used in the regression models, the regression coefficient from the ℓn VA variable must be divided by VA. Hence, as VA gets larger its eroding effect on concentration diminishes.

Change in Economies of Scale (ΔE)

A major determinant of industrial concentration is economies of scale. Therefore, a model which is used to explain charges in concentration should include a change in economies of scale variable. Despite its deficiencies, we used the proxy variable developed by Weiss,[22/] an industry's midpoint plant's share of industry value added in a specific year. The change in scale economies variable (ΔE) used in this study is the 1972 value minus the 1947 value.

Bain, in his often cited study, found that plant size was the most important source of firm economies.[23/] Scherer's analysis of multiplant economies of several industries has cast some doubt on this finding.[24/] Additionally, Weiss' proxy variable suffers because plant size tends to increase with firm size for reasons unrelated to efficiency considerations alone.[25/]

In support of ΔE, Weiss,[26/] in comparing two proxy economies of scale variables with actual estimates of minimum efficient size made by himself, Scherer, and Pratten, found that the proxy based on midpoint plant size relative to industry size had a stronger association with the direct estimates than the proxy constructed as the average value of shipments of plants accounting for the top half of industry shipments. For example, in Scherer's sample, the corrected R^2 for the association was 0.9.

Given the shortcomings of our proxy variable, ΔE, models were estimated with ΔE included and excluded. We hypothesize that ΔE will be positively associated with changes in concentration, although we believe that this association is only partially due to economies of scale.

Advertising Intensity (A)

Advertising-created product differentiation is a major source of market power for an individual firm and of industry entry barriers.[27/] Because the payoff from successful product differentiation is large, firms have a strong incentive to engage in the level of advertising necessary to achieve the optimal degree of differentiation.

If there are substantial advantages (pecuniary or real) of large-scale advertising, and especially if these advantages increased over the period studied, advertising would cause increasing concentration in industries most susceptible to advertising. Until at least the mid-1960s, there were substantial volume discounts in TV advertising (Blake and Blum, 1965). Although Peterman[28/] dismissed the benefits of TV discounts as an illusion, businessmen themselves had no doubts as to the value of such discounts.[29/] Even with the discontinuance of the flagrantly discriminatory discount structure for TV advertising, other forms of price discrimination continued until at least the early 1970s.[30/] But most importantly, large advertisers still appear to secure more favorable time slots than smaller advertisers.[31/] This is critical for many products because certain programs are much more valuable than others. For example, to not be disadvantaged a brewer must have equal access to certain types of programs, especially major sports events. If access to such programs is foreclosed by major brewers, other brewers are disadvantaged even when they have access to other "prime" time programs at the same cost per minute. Although economists still disagree over these matters, we 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 as a competitive strategy that would be legally viewed as predatory if the massive cross-subsidization were reflected in deep price cutting. Instead, large conglomerates may subsidize advertising and promotion outlays to increase their market shares in particular markets. Prominent current examples are P&G's expansion in coffee and Philip Morris' expansion in beer.[32/] Unfortunately, we cannot here separate the structural changes associated with economies of scale in advertising from those due to cross-subsidized advertising by conglomerates.

Television advertising grew from near zero in 1947 to 69 percent of all measured media advertising in 1972.[33/] We believe this growing importance of television advertising has been a major source of structural change in consumer goods industries. Models that use only total advertising implicitly assume that all forms of advertising have the same impact on structure, which is very unlikely. Advertisements that contain a high proportion of informational content (e.g., price advertising in newspapers by local retail outlets) may encourage competitive market structures. On the other hand, advertising to achieve product differentiation through subjective image-building may increase entry barriers and concentration. Firms select those advertising media most effective in achieving particular objectives. Since television advertising generally is the most effective media (and for large firms facing numerous buyers has the lowest cost per potential buyer) for the creation of product differentiation in consumer goods industries, it is hypothesized that television will have a different impact on industrial structure than will other forms of advertising. This does not imply that advertising done by consumer good 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. We hypothesize that industries that lend themselves to TV advertising moved toward a new equilibrium structure between 1947 and 1972.

The separate treatment of consumer and producer goods industries has a long established tradition in the advertising and concentration literature. This separation has been justified because not only are the advertising expenditures allocated differently but the knowledge possessed by potential buyers of the product involved is also different. However, the decision criteria used to classify industries is always somewhat arbitrary. Furthermore, it fails to capture consumer-oriented advertising efforts by an industry that is classified as a producer goods industry. These efforts include attempts to presell products by establishing final consumer demand for products that were manufactured as inputs for consumer products (e.g., synthetic fibers). Also, firms use consumer media advertising for that portion of their total output that goes to final consumers (this amount is less than the arbitrary cutoff but it is not necessarily zero, e.g., sugar and flour industries). To overcome this problem, our analysis places firms on a producer goods to consumer goods industry continuum. Since our advertising expenditures data are almost exclusively final consumer oriented, firms will have selected those amounts believed to be most effective in achieving their objectives. Since heavy users of television advertising will be predominantly consumer-oriented (there is some public relations advertising done on television, but this occurs more today than in 1967), we believe the data themselves capture differences between consumer and producer goods industries.[34/]

The authors are indebted to the late Robert Bailey of the staff of the Bureau of Economics, Federal Trade Commission, for most of the advertising data used herein. Working with the 1967 National Advertising Investments (NAI) compiled and published by Leading National Advertisers, Inc. (LNA),[35/] Bailey meticulously assigned firms' advertising expenditures on individual products to categories based on the Standard Industrial Classification (SIC). The media totals in NAI are based on advertising investments in 98 magazines; five newspaper supplements; net time and program expenditures on the three television networks; and spot television expenditures on 400 stations. Bailey supplemented this source with Media Records[36/] data for newspaper advertising expenditures and Radio Expenditure Reports[37/] for radio advertising expenditures.[38/]

An alternative total advertising data source is available from the Department of Commerce which has computed advertising expenditures for industries in its input-output (I-0) tables.[39/] These tables classify industries according to their Business Economic Activity (BEA). Although BEA industries are cross-referenced to SIC industries, there is not always a one-to-one correspondence between a BEA industry and a four-digit industry. This presents a major problem to the researcher wishing to use the I-0 advertising data in examining four-digit SIC industries. Sometimes the combined four-digit SIC industries that comprise one BEA industry are quite similar, and hence no problem exists in assigning each of these SICs the BEA A/S ratio. However, in some cases the combined SICs which comprise the BEA are not similar industries (e.g., SIC 2083, malt, is combined with 2082, malt liquors; 2084, wines and brandy; and 2085, distilled liquor).

We identified 19 SICs (out of the 167 industries in our sample) that appeared to be badly misrepresented by the I-0 figures. In all 19 cases we substituted Bailey's total A/S ratio for the I-0 value (e.g., SIC 2083, malt was given a zero value). The simple correlation between Bailey's total A/S ratios and those from the I-0 tables (after the changes) is .9.[40/] Thus, Bailey's data are quite similar to the I-0 data (especially if corrected) that other researchers have relied on. The great advantage of Bailey's data set is that it reports advertising by type of media, which is essential in testing our hypothesis that TV advertising intensity has a unique impact on concentration. However, the I-0 data are more broadly defined than Bailey's and hence, when corrected, are perhaps the better source of total advertising expenditures.

We introduce advertising into our models in two general ways. First, we focus on total advertising, employing three measures of the total advertising-to-sales ratio. The first is one based on Bailey's data (TA-B). The second uses the adjusted I-O data (TA-IO). The third is a hybrid of the two data sources (TA-IO-B).[41/] Our second general method of introducing advertising focuses on the importance of television advertising. It separates TA-B into a television A/S ratio (TV-B) and an A/S based on all other forms of advertising (OA-B). Additionally, we separate Bailey's TA-B into a television-plus-radio (TVR-B) and an all other category consisting of newspaper, outdoor, and magazine advertising (NOM-B). Similarly, we subtract TVR-B from the broader total advertising ratio, TA-IO-B, to form a more inclusive all other advertising variable (OA-IO-B).[42/] The virtue of this more inclusive "all other" advertising variable is that it provides more complete data for testing the difference between TVR and "all other" advertising.

We hypothesize that TA is positively associated with change in CR_4 mainly because television advertising accounts for 63 percent of total advertising in Bailey's FTC data used here. We hypothesize that TV (and TVR) will be positively associated with changes in CR_4, and that OA (and NOM) will not be significantly associated, or at best, weakly positively associated.

The Model and Predicted Relationships

The above variables are incorporated in a multiple least squares regression model expressed by the following general equation:

$$\Delta CR = a + b_1 ICR + b_2 G + b_3 S + b_4 \Delta E + b_5 TA + \varepsilon$$

where: ΔCR = percentage point change in four-firm concentration

ICR = initial level of concentration

G = industry growth

S = industry size

ΔE = change in economies of scale

TA = total measured media advertising-to-sales ratio

ε = error term

We hypothesize that ICR, G, and S will be negatively and ΔE and TA positively related to ΔCR.

Alternative models introduce various types of advertising as separate independent variables. These are:

TV = television advertising-to-sales ratio

OA = all other advertising excluding television advertising-to-sales ratio (OA-IO-B excludes both television and radio advertising)

TVR = television and radio advertising-to-sales ratio

NOM = newspapers, outdoor and magazine advertising-to-sales ratio

Finally, our general model will be tested by replacing our advertising intensity variables with the binary variables using Parker's discrete classification system which identifies consumer goods industries by the degree of product differentiation. These variables are:

H = high product differentiation

M = moderate product differentiation

L = low product differentiation

In the alternative models we hypothesize that TV and TVR will be positively related to ΔCR and that OA and NOM will not have a significant effect or, at best, be weakly positively related. When Parker's measures are introduced as dummy variables, we predict that both the moderate and high differentiation variables will be positively related to ΔCR, with the regression coefficient greater for the latter than the former. Based on Mueller-Hamm's findings we predict an insignificant relationship for the low differentiation variable.

The Results

The estimated coefficients of the models that use total A/S ratios and Parker's discrete classification scheme are displayed in Table 3. The first four equations are estimated excluding ΔE while the next four equations are replications of the first four but including ΔE. This procedure was done because of concern over ΔE as explained above.

All variables in Equation 1 have the predicted sign, and all but G are statistically significant at levels of at least 5 percent. TA in Equation 1 is Bailey's eight-media total A/S ratio, has a coefficient slightly larger than unity and is significant at 1 percent.

Equation 2 is identical to Equation 1 except that the total A/S ratio, TA-IO, is constructed from I-O data. All coefficients are remarkably close to those in Equation 1. TA-IO has a higher t-value than TA-B in Equation 1.

Equation 3 is again identical to Equations 1 and 2 except that the TA variable is a mix of IO and FTC data depending on the correspondence between BEAs and SICs as explained above. Again, the results are virtually identical.

Table 3. Results of Multiple Regressions for Changes in Four-Firm Concentration Between 1947 and 1972, 167 U.S. Manufacturing Industries

Independent Variables	Equation							
	1	2	3	4	5	6	7	8
Constant	23.48**	23.41**	23.45**	29.03**	19.41**	19.67**	19.58**	25.06**
Initial CR (ICR)	-.23** (-6.25)	-.23** (-6.29)	-.23** (-6.31)	-.23** (-6.62)	-.21** (-5.77)	-.21** (-5.86)	-.21** (-5.85)	-.21** (-6.14)
Industry Growth (G)	-.003 (-.75)	-.003 (-.81)	-.003 (-.79)	-.002 (-.77)	.001 (.16)	.001 (.18)	.001 (.21)	.000 (.06)
Industry Size (S)	-1.55* (-1.78)	-1.64* (-1.92)	-1.60* (-1.85)	-2.43** (-2.98)	-1.28 (-1.55)	-1.38* (-1.70)	-1.33 (-1.63)	(-2.11)** (-2.67)
Change MES (ΔE)					.96** (4.61)	.93** (4.52)	.94** (4.53)	.76** (3.76)
Total A/S (TA-B)	1.06** (2.87)				.75* (2.13)			
Total A/S (TA-IO)		1.16** (3.68)				.90** (2.98)		
Total A/S (TA-IO-B)			1.04** (3.36)				.78** (2.60)	
High Product Differentiation (H)				18.32** (6.28)				15.81** (5.49)
Moderate Product Differentiation (M)				5.01** (2.36)				3.76* (1.82)
Low Product Differentiation (L)				-.99 (-.38)				.04 (.02)
R^2	.23	.25	.24	.36	.32	.34	.33	.42
F	12.15**	13.79**	13.08**	15.22**	15.19**	16.43**	15.83**	16.14**

Notes: 1. The dependent variable, change in four-firm industry concentration, was measured in percentage points.

2. The t-value for each regression coefficient appears below it.

* 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.

Equation 4 substitutes Parker's discrete product differentiation variables for the continuous advertising intensity variables used in Equations 1-3. This is included to permit comparisons with Mueller and Hamm's[43/] earlier findings that used these variables for the period 1947-1970. Equation 4 replicates their model for 1947 to 1972, except that it uses a different specification of S, as discussed in the text above. This more appropriate specification of S improves the statistical significance of the size variable. G is insignificant here, perhaps reflecting the increased collinearity with S. The high and moderate differentiation variables perform as predicted. The low differentiation variable is negative but is statistically insignificant. Thus, ceteris paribus, low differentiation consumer goods industries perform no differently than producer good industries. Both the R^2 and F-statistic are improved. The discrete classification performs better than the single continuous TA variables, which is not surprising because data errors are more likely to appear in a continuous, single dimension variable than in a discrete classification scheme that incorporates several dimensions of product differentiation when placing consumer goods industries into a product differentiation class. Parker used both the absolute level of advertising expenditures as well as the A/S ratio. This allows an industry that has massive advertising outlays and large sales to be properly classified as a highly differentiated industry despite its relatively low A/S ratio, e.g., autos. The inability to make such adjustments in our continuous TA variable makes the highly significant findings in Equations 1-3 even more impressive.

Equations 5-8 replicate Equations 1-4 except that they include the change in economies of scale variable, ΔE. The variable performs as predicted, while lowering somewhat the level of significance of all other variables. The latter result also was predictable because of the deficiencies mentioned earlier in the economies of scale variable, which tends both to reflect the changes in concentration as well as the causes of the change. The variable is highly significant and enhances the model as reflected in higher R^2 and F values. Advertising remains a highly significant explanatory variable in this expanded model.

Results of the models where the total A/S ratio was separated into a television A/S ratio and an all other media A/S ratio are displayed in Tables 4a and 4b. Table 4a reports the findings for the full sample (N = 167) and Table 4b the results for the subsample (N = 128), which excludes small industries. Equations 1-3, for both the sample and the subsample, are estimated without ΔE, and Equations 4-6 replicate 1-3 but include ΔE.

Equation 1 introduces TV-B and OA-B as the advertising variables. The other independent variables behave as they did when TA was used. TV-B is highly significant, more so than TA-B in Table 3, and has a larger coefficient. OA-B has an unpredicted negative sign but is not statistically significant.[44/]

Equation 2 is the same as Equation 1 except radio advertising is removed from OA and combined with TV for reasons explained above. Although radio represents only 8 percent of our sample's total advertising expenditures, its inclusion with television increases the significance of the TV variable,[45/] TVR-B. On the other hand, the

Table 4a. Results of Multiple Regressions for Changes in Four-Firm Concentration Between 1947 and 1972, 167 U.S. Manufacturing Industries

Independent Variables	Sample: All Comparable Industries, N = 167					
	1	2	3	4	5	6
Constant	22.96**	22.93**	23.66**	18.97**	18.98**	19.80**
Initial CR (ICR)	-.23** (-6.14)	-.23** (-6.10)	-.23** (-6.30)	-.20** (-5.66)	-.20** (-5.64)	-.21** (-5.84)
Industry Growth (G)	-.003 (-.87)	-.003 (-.90)	-.003 (-.86)	.000 (.14)	.000 (.11)	.000 (.14)
Industry Size (S)	-1.48* (-1.71)	-1.48* (-1.73)	-1.58* (-1.84)	-1.21 (-1.48)	-1.22 (-1.50)	-1.32 (-1.62)
Change MES (ΔE)				.95* (4.60)	.95** (4.61)	.94** (4.51)
Television A/S (TV-B)	1.82** (3.49)			1.47** (2.95)		
Non-TV A/S (OA-B)	-.52 (-.60)			-.72 (-.90)		
TV and Radio A/S (TVR-B)		1.82** (3.83)	1.64** (3.29)		1.47** (3.24)	1.33** (2.81)
Newspapers, Magazines, Outdoor A/S (NOM-B)		-.97 (-1.11)			-1.15 (-1.39)	
Non-TV and Radio A/S (OA-IO-B)			.15 (.23)			-.06 (-.10)
R^2	.25	.26	.25	.34	.35	.34
F	10.74**	11.27**	10.95**	13.59**	14.11**	13.62**

Notes: 1. The dependent variable, change in four-firm industry concentration, was measured in percentage points.

2. The t-value for each regression coefficient appears below it.

* 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.

removal of radio from the OA category increases the negative significance of the OA variable, NOM-B, although it remains insignificant.[46/]

Equation 3 is identical to Equation 2 except that the OA variable is changed to the more broadly defined OA-IO-B. Here the results are similar but the coefficient of OA-IO-B moves to a small, positive, insignificant value.[47/] Equations 2 and 3 indicate that radio advertising, although small in dollar volume, is best treated along with television advertising rather than in the "other" advertising category.

Equations 4-6 reproduce Equations 1-3 but with the inclusion of ΔE. The results are similar to those in Table 3. Including ΔE lowers somewhat the estimated coefficients of the other variables and their significance and changes the sign of G, which remains insignificant. ΔE performs well, as expected, but its interpretation again is not certain.

Analyses of the subsample, where small industries are removed, are shown in Table 4b. The results are generally consistent with those of the full sample. The main difference is in the TV variable. In Equations 1-3, TV and TVR have coefficients exceeding 2 and are very significant. Also, in all six equations using the subsample the spread between the opposing effects of TV and OA (and NOM) increases when compared to the same equations for the full sample (Table 4a). In Equations 2 and 5 the negative coefficients for NOM-B are weakly significant.[48/] G moves closer to positive significance in all six equations. S retains approximately the same estimated coefficient but its significance falls to slightly below the 5 percent level (this reflects an increase in the standard error of S probably due to the increased collinearity with G in the subsample).

Table 4b. Results of Multiple Regressions Changes in Four-Firm Concentration Between 1947 and 1972, 128 U.S. Manufacturing Industries

Independent Variables	Subsample: Excludes Small Industries, N = 128					
	1	2	3	4	5	6
Constant	23.64**	23.46**	25.11**	17.58*	17.52*	18.98*
Initial CR (ICR)	-.24** (-5.53)	-.24** (-5.50)	-.25** (-5.77)	-.21** (-4.98)	-.20** (-4.96)	-.21** (-5.21)
Industry Growth (G)	.002 (.53)	.002 (.53)	.003 (.69)	.005 (1.03)	.005 (1.03)	.005 (1.17)
Industry Size (S)	-1.70 (-1.46)	-1.70 (-1.47)	-1.87 (-1.61)	-1.18 (-1.07)	-1.18 (-1.08)	-1.34 (-1.22)
Change MES (ΔE)				1.16** (4.17)	1.14** (4.14)	1.15** (4.13)
Television A/S (TV-B)	2.33** (4.23)			1.86** (3.51)		
Non-TV A/S (OA-B)	-1.18 (-1.42)			-1.10 (-1.33)		
TV and Radio A/S (TVR-B)		2.22** (4.48)	2.19** (4.15)		1.78** (3.72)	1.73** (3.40)
Newspapers, Magazines, Outdoor A/S (NOM-B)		-1.58 (-1.76)			-1.45 (-1.72)	
Non-TV and Radio A/S (OA-IO-B)			-.64 (-.93)			-.54 (-.83)
R^2	.28	.29	.28	.37	.38	.37
F	9.55**	10.17**	9.55**	11.93**	12.44**	11.85**

Notes: 1. The dependent variable, change in four-firm industry concentration, was measured in percentage points.

2. The t-value for each regression coefficient appears below it.

* 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.

To test if the relationships between structure and changing concentration were stable over the entire 1947 to 1972 period we separated the data into two subperiods, 1947 to 1958 and 1958 to 1972. All of the variables (independent as well as the dependent) except the advertising variables were recalculated according to the appropriate year(s). For example, growth was measured from 1947 to 1958 for the first period and from 1958 to 1972 for the second period. Since we did not have advertising data for the earlier period we assigned the 1967 figures to both periods. This procedure is less than ideal; however, the 1967 A/S ratios should be reliable proxies for the earlier period insofar as the 1967 advertising data capture the relative opportunities for product differentiation in an industry. Although this should hold for total advertising, it may be less applicable to television advertising. Television advertising was a relatively new advertising medium before 1958, and therefore had less time in which to exert its influence. We hypothesize that TV advertising will be positive for both periods, though we expect a weaker relationship in the earlier period.

Equation 1 of Table 5 uses TA-B as its advertising variable. The results for the earlier period differs from those of the latter period but only the constant term and the size variable are statistically different at 5 percent. Perhaps the most apparent difference is the generally weaker results of the earlier period as compared to the latter period. Except for ΔE the estimated coefficients are all nearer to zero and are less significant in the earlier period. This reflects the concentration pattern portrayed in Table 1, where the average concentration for the 167 sample industries declined between

Table 5. Results of Seemingly Unrelated Regressions for Changes in Four-Firm Concentration for Two Subperiods, 1947 to 1958 and 1958 to 1972, 166 U.S. Manufacturing Industries

Independent Variables	Sample: All Comparable Industries							
	Equation 1		Equation 2		Equation 3		Equation 4	
	1947-1958	1958-1972	1947-1958	1958-1972	1947-1958	1958-1972	1947-1958	1958-1972
Constant	1.03	21.92**	1.98	21.86**	1.15	22.29**	4.74	23.94**
Initial CR (ICR)	-.07** (-2.84)	-.15** (-5.19)	-.07** (-2.72)	-.14** (-5.07)	-.08** (-2.91)	-.15** (-5.22)	-.09** (-3.33)	-.14** (-5.14)
Industry Growth (G)	-.002 (-.25)	.004 (.50)	-.003 (-.38)	.006 (.81)	-.002 (-.25)	.005 (.72)	-.003 (-.37)	.40 (.57)
Industry Size (S)	.14 (.23)	-1.81** (-2.89)	.15 (.25)	-1.85** (-3.00)	.10 (.16)	-1.87** (-3.02)	-.29 (-.46)	-2.27** (-3.76)
Change MES (ΔE)	.70** (4.05)	.46* (2.21)	.69** (4.02)	.48** (2.36)	.69** (4.00)	.47* (2.31)	.58** (3.35)	.49** (2.46)
Total A/S (TA-B)	.38 (1.53)	.54* (1.99)						
TV and Radio A/S (TVR-B)			.60* (1.84)	1.10** (3.17)	.44 (1.29)	1.09** (2.99)		
Newspapers, Magazines, Outdoor A/S (NOM-B)			-.21 (-.35)	-1.00 (-1.55)				
Non-TV and Radio A/S (OA-IO-B)					.44 (1.03)	-.40 (-.86)		
High Product Differentiation (H)							6.24** (2.89)	11.32** (5.15)
Moderate Product Differentiation (M)							1.18 (.78)	3.10* (1.93)
Low Product Differentiation (L)							-3.36* (-1.81)	2.56 (1.31)
R^2	.17	.21	.18	.24	.18	.23	.23	.31

Notes:

1. Seemingly Unrelated Regression, or Stacked Regression, is a multivariate model that utilizes any correlation that may exist between the residuals of regression equations. The technique involves stacking one equation (the 1947-1958 equation) on top of the other (the 1958-1972 equation) and then estimating the parameters using the two-stage Zellner procedure. The estimated parameters from the stacked estimation should be more efficient than had the parameters of each equation been estimated individually by an OLS package. The gain in efficiency is a decreasing function of the correlation of the two X matrices involved and an increasing function of the correlation of the residuals of the two equations involved. In theory, there will never be a loss of efficiency, for if the error terms of the two equations have zero correlation or if the X matrices are identical the multivariate model reduces to an OLS model for each equation (see Kmenta, 1971, pp. 517-528).

2. One industry was lost from the N = 167 sample due to census disclosure rules concerning the industry's 1958 CR_4.

3. The dependent variable, change in four-firm industry concentration, was measured in percentage points.

4. The t-value for each regression coefficient appears below it.

* 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.

1947 and 1958. The only category to experience significantly increased concentration during this period was the highly differentiated consumer goods group.

For the later period when greater structural change occurred, all independent variables except growth were significant at least at the 5 percent level. S is the only independent variable that differs statistically from its counterpart in the earlier period. Advertising is statistically significant and carries a larger coefficient in the second period than in the first but this difference, although predicted, is not statistically significant.

Equation 2 is the same as Equation 1 except that TA-B is separated into TVR-B and NOM-B. The first four independent variables behave as they did in Equation 1. TVR-B is larger in the latter period than in the earlier one, and the difference is significant at the 10 percent level. NOM-B has a stronger negative result for the latter period but it is not statistically significant at the 10 percent level.

Equation 3 is identical to Equation 2 except that NOM-B is replaced by OA-IO-B as the other advertising variable. The results are very similar to those of Equation 2. TVR is significantly larger in the 1958-1972 period at the 10 percent level. OA-IO-B becomes negative in the latter period and is significantly different from its 1947-1958 value at the 10 percent level.

Equation 4 replaces the continuous advertising data with the discrete variables constructed by Parker. Again the first four independent variables behave as before. The discrete variables yield added insight and support to the findings of Equations 1-3, which use continuous advertising-to-sales ratios. Between 1947 and 1958, in highly differentiated consumer goods industries, CR_4 increases by 6.24 points, ceteris paribus. M is positive but not statistically significant. L is negative and significant at 5 percent for the period. Between 1958 and 1972, product differentiation is even more significant in restructuring industries, with highly differentiated consumer goods industries experiencing increases in CR_4 of 11.32 points, ceteris paribus. M becomes significant at the 5 percent level and L now has a positive coefficient but is not significant. Compared to the 1947-1958 period, the coefficients of H and L are significantly larger at the 5 percent level. Although the coefficient for M increased, the amount is not significant.

Conclusions

The analysis indicates once again the presence of countervailing forces shaping concentration in manufacturing industries. The net result has been a modest, though persistent, upward trend in the average level of market concentration between 1958 and 1972. Growing economies of scale may be playing a part in this process, though we reemphasize our earlier caution (and that of others) that our measure of scale economies is deficient because it captures the results of increasing concentration as well as its causes.

The most important finding of the study is that television advertising has played an especially potent role in increasing concentration of consumer goods industries. Studies that combine television advertising with all other forms of advertising have obscured this unique role of television advertising. In every equation estimated for the period 1947 to 1972 the television advertising variable was statistically significant at the 1 percent level. The data values for TVR-B ranged from zero to 12.6 (see Appendix, Table 1), hence the estimated impact of television-plus-radio advertising on ΔCR_4 ranged from no impact in industries with little such advertising to increasing the industry four-firm concentration ratio by about 25 percentage points (ignoring confidence bands and using an estimated beta coefficient of 2 for TVR-B).

While the study indicates TV advertising increased concentration in those consumer good industries most susceptible to product differentiation via TV advertising, the enormous expenditures for TV advertising raise public policy questions beyond their impact on industrial structure. Because TV is such a powerful medium in shaping consumer preferences, it holds the potential for distorting the sovereign role consumers as decision-makers are presumed to play in a free market economy. Traditional antitrust policies aimed at anticompetitive conduct and structural reform are not adequate to deal with these aspects of advertising.

Footnotes

* Willard F. Mueller, Vilas Research Professor of Agricultural Economics, Professor of Economics, and Professor in the Law School, University of Wisconsin-Madison. Richard T. Rogers is an agricultural economist with Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, and is located at the University of Wisconsin-Madison. The views expressed here are those of the authors and not necessarily of the U.S. Department of Agriculture. This research was supported by the College of Agricultural and Life Sciences, University of Wisconsin and the United States Department of Agriculture.

1. Weiss, 1963 (RESTAT).
2. Blair, 1972, pp. 321-331.
3. Mueller, 1967, pp. 476-84.
4. Mueller and Hamm, 1974.
5. Ornstein, 1977, p. 22.
6. Parker, 1967. Also, see Mueller and Hamm, 1974.
7. Ornstein, 1977, p. 22, and Wright (forthcoming).
8. Consumer goods are distributed primarily for use by households whereas producer goods are used mainly by other manufacturers or service industries.
9. Parker, 1967. See also footnote 8 of Mueller and Hamm, 1974.
10. These data are from the measured media advertising expenditures used in this paper. See below and footnote 38 for details. The simple correlation coefficient between Parker's classification and total industry A/S is .64. Parker's estimates were for 1963, whereas the advertising intensities are for 1967.

11. These industries were taken from the Census of Manufactures, 1967, and 1972. They were recorded with their 1967 SIC code. Three-digit "n.e.c." (not elsewhere classified) industries were excluded (e.g., 2099). All other industries with comparable data over the 1947-1972 period were retained. In four instances FTC estimates from Parker (1967) were used to establish comparable data back to 1947. In two additional cases the FTC estimates for CR_4 were used to obtain CR_4s for industries where the Census withheld the CR_4 for disclosure reasons.

12. Ornstein, 1977, p. 22.

13. Mueller and Hamm, 1974.

14. Weiss, 1963 (JIE, pp. 237-54).

15. We also used a group of industries that had comparable data back to 1967 only, rather than 1963, but this added only one industry to Group B and had no effect on any of the results.

16. Neil R. Wright, in his Ph.D. dissertation, "Four Essays in Industrial Economics," Massachusetts Institute of Technology, 1977, argued that to use the dependent variable specified here would cause specification bias because CR_4 is bounded from above and below. He uses a dependent variable of the form:

$$SC = \Delta CR_4/(50 - |50 - CR_4 1947|)^{1/2} * (50 - |50 - CR_4 1972|)^{1/2}.$$

This geometric mean functional form, Wright argues, is a superior symmetric functional specification without bounds. We have calculated all our models using Wright's functional form of the dependent variable; the results were essentially the same as those reported here. (One industry, primary aluminum, was removed from the sample because the CR_4 in 1947 was 100, hence Wright's dependent variable would have been undefined for that industry.) Also, the simple correlation between Wright's dependent variable and ours is .92. We choose the percentage points change in CR_4 variable due to its simplicity. Also, see Wright, forthcoming.

17. Stigler, 1952, p. 232. For a fuller discussion of this hypothesis, see Mueller and Hamm, 1974, p. 514.
18. Mueller and Hamm, 1974, footnote 24.
19. Wright, forthcoming.
20. Bain, 1968, p. 213; Nelson, 1964, pp. 265-268; Shepherd, 1963, pp. 204-206; and Farris, 1973.
21. Bain, 1956.
22. Weiss, 1963 (RESTAT).
23. Bain, 1968, pp. 166-167. Bain, 1956.
24. Scherer, 1975.
25. Consider the case of constant returns to scale. In this situation, once minimum optimum scale has been achieved, perhaps at a modest level, the optimum size of plant is indeterminant. Scherer (1970, p. 77) suggests that much of manufacturing displays constant returns to scale over a broad size range.
26. Weiss, 1976.
27. Bain, 1956, Commanor and Wilson, 1974.
28. Peterman, 1968, pp. 321-322.
29. FTC, 1969, pp. 444-448; Hearing, 1966.
30. Scala, 1973, p. 254, note 99.
31. Scala, 1973, pp. 254-255.
32. See Mueller, May 1978 and Mueller, July 1978.
33. Based on data from Leading National Advertisers, Inc. (LNA), 1972.

34. Using a continuous variable, CD, that measures the percent of an industry's sales that are consumer goods derived from the 1967 U.S. Input-Output Tables, Vol. 1, we found a positive significant relationship between advertising and CD. Furthermore, in the regression analysis which follows we tested the hypothesis that consumer goods industries differed significantly from producer goods industries and found that no statistical difference was evident in models that excluded the change in economies of scale variable, ΔE. Inclusion of ΔE caused a significant difference to appear; however, this is due to the inadequacies of ΔE rather than the inappropriateness of combining consumer and producer industries. ΔE reflects changing concentration as well as the causes for changing concentration, and because concentration changed more in consumer goods industries than in producer goods industries, we are not surprised that ΔE is significantly different in the former than the latter. It is not because plant economies of scale have a significantly greater impact in consumer goods industries.

35. Leading National Advertisers, Inc., 1967. National Advertising Investments, Vol. 19, No. 2.

36. Media Records, Part Two (Blue Book), Newspaper Advertisers, 1967. Bailey also supplemented his basic data set with outdoor advertising from LNA Rorabaugh Services, LNA Outdoor Advertising Expenditures, January-December, 1967 (compiled and published in cooperation with the Institute of Outdoor Advertising).

37. Radio Expenditure Reports, Network and Spot Advertisers estimated expenditures--National and Regional Advertisers, 1967.

38. We used Bailey's exact data set except for three changes that we felt were necessary. For SICs 2086, bottled and canned soft drinks, and 2087, flavoring extracts and sirups, we combined their advertising expenditures and used the value of shipments from SIC 2086 to form the A/S ratio. This was done because the largest soft drink companies (e.g., Coca-Cola, Pepsico) that are classified in SIC 2087 grant franchises to bottlers, that are classified in 2086. Since product differentiation for soft drinks is created by the combined advertising of the extract manufacturers and bottlers, we combined the measured media advertising expenditures of the two SICs and dismissed the value of shipments from 2087 to prevent double counting. The resulting A/S ratio was assigned to both SIC 2086 and SIC 2087 on the assumption that both industries would be structurally affected by the same A/S ratio. The second change involved SIC 3942, dolls. Bailey's data reported no television advertising expenditures for the doll industry, but we knew that dolls were heavily advertised on children's television programs. Upon investigation we found that in 1967 companies reported to LNA their advertising expenditures on dolls in the more general category, games and toys. However, in 1972 companies reported separately advertising expenditures on dolls. Therefore, the A/S ratios for dolls were computed based on 1972 value of shipments and 1972 LNA six-media totals. (Although no data on newspaper and spot radio advertising are included, neither involve significant expenditures.) The third change was for SIC 3996, hard surface floor coverings. Again Bailey's data reported zero advertising expenditures for this industry, which was an error given that the

Armstrong Company operates in the industry. Fortunately, for SIC 3996 an alternative data source to the LNA data is the 1967 Input-Output tables (see text). For the total advertising-to-sales ratio we used the 1967 Input-Output figure of 3.5 percent (LNA six-media total yielded a value of 3.1 percent using 1972 data for advertising and value of shipments). For the television and other media A/S ratios we used 1972 LNA data and value of shipments.

39. Input-Output Structure of the U.S. Economy: 1967. Vol. 1, U.S. Department of Commerce, 1974.

40. Before the changes were made the simple correlation coefficient was .74.

41. TA-IO-B was computed as follows. When an SIC is identical to a BEA, the A/S ratio from the I-O tables was used, otherwise Bailey's total A/S was used. This measure attempts to gain the advantage of the broader I-O advertising data.

42. The reasons for combining TV and radio advertising were the high degree of correlation (.65) between the two and the finding that both had positive, simple correlations with changing concentration, unlike the remaining other advertising media.

43. Mueller and Hamm, 1974, p. 516, Table 5, Equation 1a.

44. This result is heavily influenced by two observations, distilled liquor and phonograph records. Both industries have experienced large decreases in concentration and are among the heaviest users of nontelevision advertising. Distilled liquor is denied television advertising but its product lends itself to the same type of image-building product differentiation that highly differentiable consumer goods industries successfully employ (e.g., malt liquors).

There is no statistical reason why this observation should be removed for it is not an outlier (in the sense of having a large residual or that its A/S ratio is extreme) and its value is not the result of measurement error. The phonograph records industry, SIC 3652, is more suspect of measurement error, for even though its SIC and BEA are identical, there may be a large error in our measure of its A/S. TA-IO, the supposedly broader measure, has a value of 4.5 whereas TA-B is 8.2. When Equation 1 was estimated with the distilled liquor industry omitted, OA-B was positive but not significant (t-statistic = .86). TV-B remained positive and significant at the 1 percent level. The simple correlation between TV-B and OA-B increased from .4 to .5, causing some sharing of the explanatory power of advertising. Equation 1 was also reestimated with both distilled liquor and phonograph records removed. This resulted in OA-B being positive and significant at the 1 percent level whereas TV-B became highly insignificant. The simple correlation between OA-B and TV-B now had increased to .7, hence to find separate independent effects becomes difficult without more data. Thus, a researcher may justifiably combine TV-B with OA-B and use only TA-B as the advertising variable, while noting that TV advertising now accounts for 67 percent of all advertising in the sample data, and thus TA-B becomes a proxy for TV advertising. Alternatively, the researcher may elect to drop OA (i.e., constrain OA to have a zero impact) and use only TV. When this is done TV is highly significant with an estimated coefficient equal to 1.66 and a t-statistic equal to 3.44.

45. The improvement in the TV variable is due to a high correlation between radio and television advertising and that they are both positively related to ΔCR_4.

46. Again, this result is heavily influenced by distilled liquor and phonograph records (see footnote 44). Removing only distilled liquor does not alter the findings, but when both distilled liquor and phonograph records are removed OA-B becomes positive and significant at the 1 percent level whereas TVR-B becomes insignificant. The simple correlation between OA-B and TVR-B increases from .4 to .7 suggesting that OA-B and TVR-B should be combined as TA-B because of multicollinearity or that the OA variable, NOM-B, should be dropped from the regression. When NOM-B is removed TVR-B has an estimated coefficient equal to 1.63 with a t-statistic of 3.63. When Equation 2 is estimated using the subsample and omitting distilled liquor and phonograph records, both TVR-B and NOM-B are significant at the 5 percent level and have equal standardized beta coefficients. When NOM-B is excluded from Equation 2 and estimation is based on the subsample, TVR-B has an estimated coefficient equal to 1.94 with a t-statistic of 4.11.

47. Footnotes 44 and 46 are relevant here also. When Equation 3 was estimated excluding distilled liquor and phonograph records, OA-IO-B became positive and significant at the 5 percent level whereas TVR-B remains significant at the 1 percent level. Also, the standardized beta coefficient for TVR-B exceeds that of OA-IO-B. Furthermore, when using the subsample the removal of the two industries leaves OA-IO-B very insignificant (t-statistic = .47) and TVR-B highly significant. This finding reflects the advantage

of using the I-O data, which include a larger non-TV and nonconsumer advertising component. (The correlation between TVR-B and OA-IO-B increases from .47 to .54 after removing the two industries from the full sample.) By reducing the multicollinearity problems, these data provide a better opportunity to identify the independent effects of TVR and OA. In conclusion, the finding that distilled liquor and phonograph records are responsible for the unpredicted negative relationship found between ΔCR_4 and the OA variables does not detract from our finding that TV advertising has played the major role in increasing concentration in consumer goods industries. Even in those cases where the removal of two industries resulted in high degrees of multicollinearity which prevented regression analysis from identifying the independent effects of TV and OA it must be recalled that TV advertising accounts for nearly 70 percent of total measured media advertising outlays. In these cases the researcher has two options: (1) combine TV and OA to form TA; or (2) drop OA from the model. Both procedures were used here and both rendered the same conclusion: television advertising has had the major impact in increasing concentration in consumer goods industries.

48. See footnotes 44, 46, and 47.

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Table 1. Descriptive Statistics of Variables Used in Regression Analysis, U.S. Manufacturing Industries, 1947 to 1972

Variable	Sample: All Comparable Industries, N = 167					Subsample: Excludes Small Industries, N = 128				
	Mean	Standard Deviation	Minimum	Maximum	Sum	Mean	Standard Deviation	Minimum	Maximum	Sum
in CR (ΔCR_4)	1.46	12.8	-31.0	43.00	243.0	1.17	13.0	-31.0	43.00	150.0
Concen- ion (ICR)	40.94	24.2	3.0	100.00	6,837.0	40.88	24.0	3.0	100.00	5,232.0
y Growth (G)	324.64	283.0	-67.1	1,637.50	54,215.0	313.80	256.0	-59.5	1,365.70	40,167.0
y Size (VA72)	6,759.10	11,215.0	156.0	103,050.00	1,128,800.0	8,359.90	12,369.0	559.0	103,050.00	1,070,100.0
y Size VA72)	8.14	1.1	5.1	11.54	1,360.0	8.47	1.0	6.3	11.50	1,084.4
MES (ΔE)	-.14	4.3	-26.8	15.90	-23.5	-.13	3.6	-19.4	13.20	-16.9
/S (TA-B)	1.00	2.5	0.0	15.94	167.1	1.14	2.7	0.0	15.94	145.4
/S (TA-IO)	1.53	2.8	0.0	23.57	255.5	1.68	3.1	0.0	23.57	215.6
/S (TA-IO-B)	1.43	2.9	0.0	23.57	238.5	1.59	3.2	0.0	23.57	203.3
ion A/S (TV-B)	.59	1.8	0.0	12.34	98.7	.66	2.0	0.0	12.34	85.0
A/S (OA-B)	.41	1.1	0.0	9.56	68.4	.47	1.2	0.0	9.56	60.4
Radio A/S	.65	1.9	0.0	12.61	108.3	.73	2.1	0.0	12.61	93.8
ers, Magazines, A/S (NOM-B)	.34	1.0	0.0	9.56	57.1	.39	1.2	0.0	9.56	49.8
and Radio A/S B)	.79	1.5	0.0	11.62	131.6	.86	1.6	0.0	11.62	109.6