Department of Social Sciences

Economics Working Papers

AN OPEC IN FANTASYLAND?
The NAB Television Code as Cartel
(revised)

Carroll B. Foster
and
Brooks B. Hull

Economics Working Paper #41

The University of Michigan-Dearborn

Dearborn, Michigan 48128-1491 (313) 593-5096

29 September 1986
Submission draft. Not to be quoted.

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Abstract

The U.S. Justice Department filed suit against the National Association of Broadcasters in 1979, charging that its Television Code restricted the supply of advertising. Had the case, which was settled by consent decree in 1982, gone to trial under a "rule of reason," the cartel effects of the code would have been examined.

This paper employs a number of statistical techniques to see if the code provided cartel benefits. The results suggest that the decision to become a code member cannot be ascribed to cartel effects of the code.

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Introduction[1]

In June, 1979, the Antitrust Division of the U.S. Justice Department filed suit against the National Association of Broadcasters (NAB), charging that certain provisions of its Television Code constituted unreasonable restraint of trade and commerce in violation of the Sherman Act. The questionable provisions regulated quantity, length, placement, and format of "non-program material" (commercials and promotional announcements) that code subscribers could broadcast. These advertising restrictions were eliminated from the code when the case was settled by consent decree in November, 1982.

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[1]The authors are grateful to William Greene, William Mason, and Albert Anderson for programming assistance, and to Kenneth Boyer and Rick Bold for reading a preliminary draft. Special thanks to Stanley M. Besen and referees for comments. The usual *nostra culpa* applies.

Economic theory and antitrust case law have established that a trade association like the NAB may facilitate collusion by firms in the industry. If the association's efforts are successful, joint firm profit increases. Was the NAB's Television Code an instrument of collusion? Clearly the Justice Department thought so, and it can be argued that NAB and code practices fell into the category of proscribed behavior established by legal precedent in trade association cases. If it was such an instrument, and if the suit had been tried in court under a *per se* rule, the NAB would have lost. Thus, the consent decree may have protected the NAB from subsequent treble-damage suits.

On the other hand, many observers of the commercial broadcasting industry considered the code ineffective, unenforceable, and honored as often as not in the breach. Under a "rule of reason," applied in most court decisions involving trade association conspiracy, the question of the actual anticompetitive effect of the code arises.

The effect of the code is analyzed in this paper. The next part discusses the history of the NAB and the Television Code, summarizes the course of the government antitrust suit, and makes some conjectures regarding legal interpretation of NAB code practices. Part Two uses a model of television station behavior to show how a television station cartel can raise station profit by restricting number of commercials broadcast. The model also shows how colluding stations may dissipate profit by competing over program quality. Parts Three and Four employ single-equation and simultaneous-equation estimation techniques, respectively, to determine if cartel-like activities of the code had any discernible influence on station asset values or station behavior. Part Five summarizes the findings and concludes that no anticompetitive effects of the code can be inferred from the evidence analyzed herein.

I. Background

The National Association of Broadcasters was formed in 1923 during a time of confusion and conflict in the fledgling radio broadcast industry. RCA and AT&T were trying to extend their patent monopolies on crucial components of radio transmitters, the second Washington Radio Conference was allocating frequency bands on the radio spectrum, and the American Society of Composers, Authors and Publishers was demanding royalty fees for use of copyrighted music played on the air (Barnouw, 1966, pp. 114-21). By banding together in what must have been perceived as self-defense, commercial radio stations felt they could better protect their interests. The NAB lobbied before Congress for favorable allocation of frequencies and provided legal support for stations being sued for royalty payments.

In the years after its formation, the NAB's role in the industry expanded to include provision of various technical services to members and promotion of industry self-regulation. The principal instrument of self-regulation has been voluntary codes of station behavior whose provisions are divided between programming ethics and advertising standards. The first NAB radio code was ratified in 1929. The first television code was adopted in 1952, shortly after television stations were admitted to the NAB.

Self-regulation can serve three purposes. Publishing ethical standards builds good public relations, important for an industry so dependent on the whim of congress and about which consumers are so sensitive. Also, by giving the appearance of policing themselves, commercial broadcasters may forestall more inflexible or undesirable regulation by the Federal Communications Commission and other government agencies. Finally, by providing focal point output levels for advertising and by monitoring station compliance with code recommendations, the NAB may organize the industry in an anti-competitive way. It was the ability of the NAB to accomplish this last task which concerned the Justice Department's antitrust division.

The Antitrust Suit Against the Television Code

The Justice Department filed suit against the Television Code of the NAB in 1979, alleging:

> . . . that the NAB had violated Section 1 of the Sherman Act by combining and conspiring to restrain trade. Specifically . . . the NAB had promulgated and enforced a television code, certain provisions of which restricted the quantity, placement, and format of television advertisements (47 Fed. Reg. 32813, 29 July 1982).

Four sets of television code advertising rules were challenged:[2] commercial time limitations, program

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[2]The Radio Code and provisions of the Television Code not related to advertising were unaffected by the suit. The challenged paragraphs of the code are reprinted in Appendix A of *U.S. v. NAB* (1982). The complete code is printed in NAB (1981).

interruptions, consecutive announcements, and multiple product advertisements. The code set maximum limits on the number of minutes of commercials and promotional announcements during program periods. For example, network affiliates were limited to nine and one-half minutes of non-program material per hour during prime time. Separate standards applied during non-prime hours and for independent stations.

Additional standards limited the number of interruptions per program period and the number of commercials per interruption. Provisions of the code also prohibited advertising two or more separate products in an announcement of less than sixty seconds. Exceptions and additions to these limits applied to children's programs, news programs, sports programs, and short features.

The government's suit claimed that, as a result of the above code provisions, "purchasers of television advertising time have been deprived of the benefits of free and open competition among television broadcasters" (*Broadcasting*, 18 June 1979, p. 27). The NAB countered the government's claim using four arguments. (1) The association's attempts to avoid over-commercialization were valued by the public.[3] (2) Subscription to the code was voluntary. (3) The government needed to show an anti-competitive purpose to the

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[3]Theoretical support for this argument is developed in Koford (1984).

code. (4) The code was endorsed by the FCC and other government agencies.

The Justice Department responded to each NAB argument. (1) Fear of losing viewers would prompt individual stations to avoid over-commercialization without NAB help.[4] (2) The code was "not a mere set of advisory standards which subscribers may choose to ignore, but a contractual arrangement to which they are obligated to adhere." (3) The intent of the code was open to debate, but "anticompetitive effect would be enough to prove a violation of the law." (4) Endorsement of the code by government bodies other than Congress does not confer antitrust immunity.[5]

In March 1982, the District Court issued a summary judgment requiring the NAB to suspend enforcement of the rule prohibiting multiple product commercials (paragraph IX). The NAB immediately suspended enforcement of all the challenged code rules. In July of that year the Justice Department filed a proposed consent decree and the NAB accepted, reasoning that continued litigation would be costly, that they were losing the case, and that loss after trial would expose the association to subsequent private

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[4]After the code advertising provisions were suspended in 1982, the only restrictions on commercials were those adopted by the FCC in 1973: sixteen minutes per hour for all stations (twenty minutes during political campaigns). Recent FCC staff studies find that most stations are below these limits (Smyntek and Peterson, 1984; Donovan, 1984).

[5]The charges and countercharges are quoted or paraphrased in *Broadcasting*, 8 March 1982, pp. 37-38.

suits and treble-damage claims (*Broadcasting*, 19 July 1982, p. 39).

The decree was officially entered on November 23, 1982. By its provisions, the NAB immediately canceled the challenged portions of paragraphs IX, XIV, and XV of the code, and agreed not to reinstate them for ten years[4] (*U.S. v. NAB*, 1982). In accepting the consent degree, the NAB leaves undetermined the ultimate court ruling on the case, a decision resting largely on whether NAB restrictions on commercials were *per se* illegal or should be decided by a rule of reason.

The Rule of Reason and Trade Association Cases

As of a decade ago, the Justice Department routinely filed about ten cases a year against trade associations, the majority of which ended in consent decrees (Wilcox and Shepherd, 1975, p. 162). Trade associations are most commonly charged with some form of price-fixing violation of the Sherman Act, Section One.

Price-fixing conspiracy is usually subject to a *per se* prohibition, but trade association pricing activities are treated differently, and naturally so. Trade associations often use price reporting systems. These systems are said to improve market functioning under some conditions and to

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[4]An interesting question not considered here is the effect of such a limited injunction. How does a ten year limit alter behavior of firms if the code did indeed enforce collusive behavior?

facilitate collusion under others. Price reporting is not *per se* illegal; the court examines the circumstances surrounding a plan and its consequences.[7] Even in *United States v. Container Corp. of America, et al.* (393 U.S. 333, 1969), where the courts came close to applying a *per se* rule to a trade association case, the structure of the market, elasticity of demand, and stabilizing effects of the sharing of price information were all taken into account before a verdict was reached.[8]

The NAB's Television Code was not a price reporting scheme. However, it may have served as a focal point for present and planned restrictions of <u>output</u> (number and length of commercials), and there were penalties (exposure, expulsion) on sellers who did not adhere to the code's provisions. Had the case gone to trial, a rule of reason may well have been applied.[9] If so, the question of the actual anticompetitive effects of the code's advertising restrictions would have arisen. It is this question which the remainder of this paper addresses.

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[7]According to Wilcox and Shepherd, for these systems to avert antitrust challenge they need to (1) be fully available to all sellers and buyers, (2) not identify traders, (3) cover only past sales, not present or planned ones, (4) avoid circulating average prices (focal points for new price agreements), and (5) be free of any controls or penalties on sellers (1975, p. 160).

[8]The evolution of trade association price-fixing case law is briefly traced in Asch (1983), pp. 214-17.

[9]In preliminary arguments the NAB specifically asked for a rule of reason interpretation of the case, while the Justice Department requested application of *per se* (Broadcasting, 10 December 1979, p. 93).

II. Television Station Behavior

In typical industries, joint profit increases if firms collectively restrict output of their product. The potential gains to television stations from collusive behavior are less obvious. The output of television stations is not television commercials, and measuring the product is not as easy a task as in, say, manufacturing industries. Because the product is difficult to measure, substantial opportunity is present for cheating on non-measured dimensions of the product. This section describes television stations' product and shows how some or all potential monopoly profit may be dissipated by competition on program quality.

A commercial television station broadcasts programs and non-program material, including paid advertisements, free of charge to a viewing audience. The station's programs come from a network (if the station is a network affiliate), from syndicators who sell individual programs to stations, and from the station's own production facilities. Station revenue comes from sale of commercial time on programs and payments from networks for showing network programs and commercials.

Advertisers in turn purchase commercial air time in order to produce customer advertising response--increased sales. Advertisers buy commercial time from the national networks, from agents representing a number of stations in a region, or directly from individual stations. Some commercial time on syndicated programs is also sold separately by the syndicator.

Although the observed transaction in the television advertising market is for commercial time, the actual product sold by television stations is viewers watching commercials. Advertisers are interested in buying commercial time on a program only if the program is watched by viewers. A "commercial exposure"[10] is defined as one viewer watching one commercial and hereafter is treated as the product sold by television stations.

The price per commercial exposure is not directly observed in the market. Advertisers are interested in showing commercials to viewers and are only willing to pay for air time if viewers are exposed to those commercials. Thus the price paid by an advertiser and observed in the market is directly related to the number of people who are exposed to the commercial. This direct relationship is

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[10]The term is used by Beals (1980) and is similar to others used in the industry, examples being: "impressions" (same meaning as exposures), "reach" (the share of the audience which sees a commercial at least once), "frequency" (the average number of times a commercial is seen by those who see it at least once), and "gross rating points" (the product of reach and frequency). See Christensen (1981) and deKluyver and Givon (1981).

confirmed by the industry practice of calculating "price per thousand viewers" for advertising expenditures and by including provisions in advertising contracts guaranteeing a minimum number of program viewers.[11]

Television stations contemplating collusion to maximize joint profit have the same objectives as a multi-station television monopoly. Such a monopoly chooses the number of commercials and the program characteristics of each station to maximize profit from sale of commercial exposures. Some characteristics of programs can be changed without changing program cost. A police drama can be produced for the same cost as a hospital drama, for example. For simplicity, these program characteristics are assumed constant.[12] Other characteristics of programs are costly and are here labelled program quality. Improving a given police drama by hiring more popular actors is an example of a change in program quality.

If costless program characteristics are held constant, the monopoly chooses number of commercials and program quality for each station so as to maximize $R = \sum R_i$, $i=1,\ldots,m$ where:

$$R_i = pn_i A_i(n_1,\ldots,n_m,q_1,\ldots,q_m) - wq_i - k_i \qquad (1)$$

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[11]For examples of these two practices see Television Bureau of Advertising (1980-81) and *Broadcasting*, 27 October 1980, p. 7.

[12]Choice of program characteristics by monopoly and competing firms in a dynamic environment is explored in Hull (1982).

and:

R_i = station profit or net revenue;

p = price per commercial exposure, assumed to be a function of total exposures[13] in the local market and uniform for all stations;

n_i = number of commercials shown by the station;

A_i = station i's audience size function;

q_i = station program quality index;

w = cost per unit of program quality, assumed exogenous and uniform for all stations;[14]

k_i = station fixed costs, assumed exogenous.

Hence, n_iA_i is the number of commercial exposures produced by the ith station. The model assumes $\partial A_i/\partial n_i < 0$, $\partial A_j/\partial n_i > 0$, $\partial A_i/\partial q_i > 0$, $\partial^2 A_i/\partial q_i^2 < 0$, and $\partial A_j/\partial q_i < 0$ for stations $j \neq i$. As the number of commercials (n_i) increases, the number of viewers (A_i) of station i falls[15] and the number of viewers of other stations increase. If program quality (q_i) increases, the number of viewers of station i increases (but at a decreasing rate) and the number of viewers of other stations falls. The profit function

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[13]A reasonable assumption to the extent advertisers substitute commercials between stations.

[14]Using a non-linear cost function adds complexity to the model without altering its implications.

[15]Some small number of interruptions in a program increase the number of viewers, since viewers surely prefer some interruptions to none. However, profit-maximizing stations will always add commercials until the marginal effect of additional interruptions is to reduce audience size.

contains no term for the cost of producing commercials. Additional commercials are assumed to displace programming of identical cost.

If the NAB code successfully restricts the number of commercials shown by colluding stations, and if stations produce that program quality chosen by a monopoly, joint station profit is maximized. However, nothing in economic theory assures successful collusion. Each station is tempted to cheat, first by increasing its number of commercials. The temptation increases if station misbehavior is difficult to punish (the code is voluntary). The difficulties experienced by the OPEC cartel are a good example of the tendency of conspirators to exceed voluntary output restrictions.

Since quantity is not the only dimension of the television product, even perfectly enforced output standards do not assure joint profit maximization. A television station cartel controlling only the number of commercials leaves room for stations to compete in program quality and such competition may dissipate part or all potential monopoly profit.

Assume colluding stations establish a standard for number of commercials (n*) shown by each station. The number of commercials is set at the joint profit-maximizing level. For simplicity, stations are assumed identical so the standard is the same for all stations. Given the optimal number of commercials, colluding stations would choose program quality for each station to maximize profit. From equation (1):

$$\frac{\partial R}{\partial q_i} = n^*A_i\frac{\partial p}{\partial q_i} + n^*p\frac{\partial A_i}{\partial q_i} - w + (m-1)\frac{\partial R_j}{\partial q_i} = 0 \qquad j \neq i \qquad (2)$$

The first term represents the loss of revenue due to the lower price from sale of additional commercial exposures.[16] The second term is the additional revenue from the increase in i's audience because of higher quality programs. The third term (w) is the marginal expense of additional quality. The last term is the effect on profit to other stations of increases in i's program quality and is negative for two reasons. As q_i increases, the price of commercial exposures falls, and as q_i increases, other stations lose viewers.

If it set a standard for number of commercials a cartel would choose n*. But given that standard, individual stations may be tempted to compete on the uncontrolled dimension, program quality. Assume that individual stations

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[16] $\partial p/\partial q_i$ is negative when the increase in exposures produced by station i is not completely offset by decreases in commercial exposures produced by all other stations, a reasonable conclusion if a change in quality by station i has more effect on station i's audience than on audiences of other stations. Fournier (1985) assumes and cites research which shows that total audience (A) is largely independent of station actions ($\partial A/\partial q_i=0$). If so, $\partial p/\partial q_i=0$ since the increase in audience to i is exactly offset by a decrease in audience to other stations. The derivative also equals zero if stations are price takers in relevant markets (Fournier and Martin, 1983). This paper's conclusions are unaffected by adopting Fournier's assumption.

take n* as given and maximize individual profit with respect to program quality (q_i). Also assume each station believes other stations' program quality choice remain constant. That is, each station makes a Cournot-like assumption by ignoring the effect of its choice of quality on behavior of other stations.[17] Equation (3) rearranges such a firm's first order condition. Equation (4) rearranges the monopoly condition of equation (2).

$$n^*p\frac{\partial A_i}{\partial q_i} = -\ n^*A_i\frac{\partial p}{\partial q_i} - w \qquad (3)$$

$$n^*p\frac{\partial A_i}{\partial q_i} = -\ n^*A_i\frac{\partial p}{\partial q_i} - (m-1)\frac{\partial R_j}{\partial q_i} - w \qquad (4)$$

Starting at the monopoly level of quality, marginal value of quality (left side term) is the same in both equations. The marginal cost of quality is lower for the competing station, however. The first terms to the right of the equality and w are the same in both equations, but the monopoly has an additional cost of quality. The monopoly must consider the lower profit to all other stations for an increase in i's quality. Given that the marginal cost of doing so is lower, an imperfectly colluding station which only faces a restriction on number of commercials chooses

[17]This assumption is used in other television research (Fournier, 1985) and is common in other work on non-price competition (Douglas and Miller, 1974). The assumption seems consistent with the rivalrous nature of television programming and with behavior in many other markets, even those with a small number of firms (Kwoka, 1979).

more program quality than is desired by perfectly colluding stations.

Since imperfectly colluding stations choose higher program quality than a monopoly, joint station profit must also be lower than the monopoly maximum. Stations are dissipating monopoly profit by competing on an uncontrolled variable. Whether all monopoly profit is dissipated depends on the nature of the cost functions.

Ignoring fixed costs, if the marginal cost of quality (or marginal cost of exposures) is everywhere greater than average cost, an equilibrium obtains where stations earn some monopoly profit.[18] Since entry of new stations is effectively eliminated in most markets by FCC frequency allocation limits, such profit persists. Although the direct cost of quality (w) is assumed constant, the opportunity cost of quality includes the other right side term in equation (3). Marginal cost increases if the derivative of the term with respect to q_i is positive, which will be true so long as the second derivatives of A_i and A_j with respect to q_i are negative.[19] This diminishing marginal effectiveness of program quality is a reasonable assumption, at least for sufficiently high levels of quality.

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[18]This is a sufficient condition. The necessary condition is that average revenue be greater than average cost.

[19]$\partial A_i/\partial q_i$ is positive by our definition of quality.

The model thus shows that stations competing with program quality may retain part of monopoly profit. The model cannot guarantee that profit is protected, however. For one, sufficiently high fixed costs eliminate the profit. In addition, the marginal effect on audience may not everywhere diminish. Even if positive, monopoly profit to stations may be of a trivial magnitude. Profit may be lower if each station makes assumptions about other station response different from the Cournot assumption made in this model. Profit is further dissipated if restrictions on number of commercials are imperfectly enforced by the Code Authority.

A rule of reason decision in the Television Code case requires determining the anticompetitive effect of the Code. Although suggestive, economic theory alone cannot prove that the Code increases station profit even if it manages to reduce the number of commercials broadcast by member stations. The remainder of this paper evaluates empirical evidence of Code's effect on station profit.

III. Single-Equation Regression Results

The previous section demonstrates that it is theoretically possible for a cartel to raise joint station profit by restricting the number of commercials, even though the industry's output is commercial exposures. Joint profit maximization is not assured, however. Profit may be dissipated by competition in program quality or by weak or inefficient enforcement. Nevertheless, television stations subscribed to the code, and so the possibility that the code functioned as an effective supply-reducing cartel must be entertained.

The analysis to follow examines two hypotheses. First, a station was more likely to subscribe to the code if subscribing enhanced the code's cartel effectiveness. Second, station profits were higher, *ceteris paribus*, if the station operated in a market where its major competitors were subscribers. This section describes the data base and presents the results of three single-equation models. The next section presents a two-equation "dummy endogenous variable" model.

Data

A successful television station cartel increases station profit. The measure of station profit used here is station sale price,[20] Station sale price has two key advantages over its alternative and several disadvantages. An important advantage of sale price is that it directly measures the desired information: present value of current and anticipated net revenue. The usual alternative measure of profit, based on accounting data,[21] only shows present performance and may not meaningfully measure economic profit and expected risk.[22] Station sale price data are also readily available and in the public domain.

Station sales price is not without fault. Sale price misstates station profit if markets for capital assets are imperfect, although this is a statistical problem only if the errors are systematic in one direction. Another disadvantage is the relatively small sample of stations sold. We modify our conclusions accordingly.

The sample points consist of eighty-nine U.S. commercial television stations sold between January, 1976 and the NAB's suspension of the Code's advertising provisions in March, 1982. Cases are excluded if the station had no commercial

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[20]Levin (1964, 1975) uses station sale price in studying the television industry. Levin does not examine NAB or code effects, however.

[21]A number of authors use accounting data. Again, none of these authors examine the potential effects of the NAB or its code. See Fournier and Martin (1983), Boyer and Wirth (1981), and Park, Johnson, and Fishman (1976). FCC Network Inquiry Special Staff (1980) uses both accounting data and station sales price. The same source (Appendix A, pp. 39-64) has an excellent summary of television market statistical research.

[22]Besen (1976) uses commercial time rates as a proxy for station profit.

television competitors in its market or if the sale involved satellite or cable assets which could not be separated when determining sale price or audience size.

The relevant local market is taken to be the "designated market area" (DMA) defined by A. C. Nielsen Company. For each station or DMA, fourteen variables were recorded. They are summarized in Table 1.

TABLE 1

VARIABLES USED IN REGRESSIONS

Name	Source	Definition
Praw	1	Station sale price ($millions).
HH	3	Number of television households in the DMA in November 1979 (1000 homes).
Ca	3	Percent of DMA households wired for cable.
Sp	3	Station market share.
Sd	3	Percent of station viewers residing in the DMA.
SSt	3	Sum of shares of commercial stations in DMA.
SSoc	3	Sum of shares of commercial stations subscribing to the code in the DMA, <u>excluding</u> the sample station.
Nc	3	The number of large commercial stations viewable in the DMA. Includes some powerful stations in adjacent DMAs and excludes satellite stations and stations so small that Nielsen records no market share.
Y	5	Per capita income in the DMA in 1979.
T	1	Number of months between sale date and 3/82.
C	4	One if station was code subscriber

		at or immediately following date of sale, zero otherwise.
B	2	One if the station was NAB member, zero otherwise.
V	3	One if station had VHF channel (2-13), zero otherwise.
N	3	One if station was network affiliate, zero otherwise.

Sources:

1. *Broadcasting-Cablecasting Yearbook*, various years.
2. *Code News*, various issues.
3. A. C. Nielsen, and Co., *Market Daypart Summaries.*
4. *Spot Television Rates and Data*, various issues.
5. *County and City Data Book*, 1983.

Unless otherwise stated, data are recorded at time of sale.

The analysis also uses several transformed variables. The variable A is station audience size, defined as (Sp/Sd)HH. CP is an index of potential cartel effectiveness, defined as 100[Sp(C)+SSoc]/SSt. CPo is a second index of potential cartel effectiveness which excludes the given station and is defined as 100(SSoc/SSt). P_i is station sale price adjusted for differences in year of sale and is defined as $Praw_i e^{r(T-28)}$. T=28 for November 1979 and r = .00844 = G/12. G is the geometric mean annual Moody Aaa corporate bond yield for 1976-81.[23] %ΔCP is the percentage point change in code penetration when the sample station subscribes to the code.

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[23]This measure ignores depreciation but yields better statistical fits that our alternative which adjusted Praw by a price index.

Analysis of Subscriber Motivation

Television stations obviously subscribed to the code (and paid a discriminatory fee to do so). The question of interest here is whether one of the motives for such behavior was to benefit from and to enhance the code's cartel effects.

We model the sale price of station i at time 0 as follows:

$$P_i(0) = \int_0^{\infty} R_i(t)e^{-rt}dt + \int_0^{\tau} R_i^c(t)e^{-rt}dt \qquad (5a)$$

R_i is the component of net revenue which would obtain in the absence of any code output restrictions and R_i^c is the component attributable to the workings of the code as a cartel. For the latter term, the upper limit of integration (τ) will be finite if stations accurately foresaw the demise of the code's advertising provisions.

Furthermore, we assume the following:

$$\begin{aligned} R_i(t) &= R[A_i(t),\ V_i,\ N_i(t),\ Y_i(t),\ MS_i(t)] \\ R_i^c(t) &= R^c[C_i(t),\ CP_i(t),\ MS_i(t)] \end{aligned} \qquad (5b)$$

Station audience size (A_i) may itself depend on some of the other variables in equations (5b). MS represents one or more aspects of local market structure and influences both components of net revenue; Nc and Ca are used as the market structure measures. The variables CP and CPo measure "code penetration" or "potential cartel effectiveness" with and without participation by the sample station, respectively.

Probit analysis is one approach to determine whether membership in the code was influenced by the code's ability to influence market behavior. Let C_i^* be the unobserved index of incentive for station i to subscribe to the code. C* is assumed to be function of a number of station and market characteristics which may or may not be related to the code. C* can then be modeled as follows (omitting i subscripts):

$$C^* = a_0 + a_1 A + a_2 Ca + a_3 Nc + a_4 Y + a_5 V + a_6 N + a_7 CPo + a_8 \%\Delta CP + a_9 T \qquad (6)$$

$$C = 1 \text{ if } C^* > 0;\; C = 0 \text{ otherwise}$$

If cartel effects are important, we expect $a_7 > 0$, $a_8 > 0$, and $a_9 \geq 0$.

A complete probit regression yielded the following results:

$$\hat{C}^* = \underset{(1.22)}{-3.281} + \underset{(3.02)}{0.015A} + \underset{(0.55)}{0.008Ca} - \underset{(1.29)}{0.113Nc} + \underset{(1.90)}{0.380Y} - \underset{(1.42)}{0.551V} + \underset{(2.12)}{1.081N} - \underset{(0.11)}{0.002CPo} + \underset{(0.02)}{0.0003\%\Delta CP} + \underset{(0.42)}{0.004T} \qquad (7)$$

[|t-ratios| in parentheses; R_p^2=.26; $\bar{R}_p^2$=.37; pc= 76%]

For this and other probit regressions, summary statistics are defined as follows [see Maddala (1983), sec. 2.11]:

R_p^2 = pseudo-R^2 = $1 - (L_\omega/L_\Omega)^{2/n}$

$\bar{R}_p^2$ = adjusted pseudo-R^2 = $R_p^2/(1 - L_\omega{}^{2/n})$

pc = percent of cases correctly predicted.

where: L_ω = maximized likelihood,
L_Ω = restricted likelihood (slope parameters a_j, $j \geq 1$, constrained to zero,
n = sample size.

The coefficients on CPo, %ΔCP, and T are statistically insignificant in equation (7). Because of collinearity, we test the null hypothesis that $a_7 = a_8 = a_9 = 0$. Imposing this restriction, we obtain the likelihood-ratio test statistic $\chi_3^2 = 0.266$ and cannot reject the null hypothesis at the 10% level.

If all insignificant variables are dropped from equation (7), we obtain the following probit results:

$$\hat{C}^* = -3.45 + 0.013A + 0.347Y + 0.982N \qquad (8)$$
$$\quad (2.45) \quad (2.93) \quad (1.92) \quad (2.57)$$

[|t-ratios| in parentheses, $R_p^2 = .23$; $\bar{R}_p^2 = .33$; pc = 74%]

The coefficients of A, Y, and N do not change noticeably, and all remain significant at the 5% level (one-tailed tests).

Analysis of Sale Price and Market Share

In equations (5a) and (5b), we hypothesize that sale price depends on audience size, market and station characteristics, and possibly also on cartel effects of the code. In the probit analysis above, code membership incentive is addressed directly and seems unaffected by its potential cartel advantages. Another approach is to use linear regression analysis to see if the cartel potential of the code affects station sales price (as a measure of station profit).

For reasons explained below, a log-linear regression specification is used (i subscripts omitted):

$$LnP = \beta_0 + \beta_1 LnA + \beta_2 LnCa + \beta LnNc + \beta_4 LnY + \beta_5 V + \beta_6 N + \beta_7 C + \beta_8 LnCP + u^P \qquad (9)$$

Estimation by OLS yields the following:

$$\begin{aligned} LnP = &\underset{(2.32)}{-3.052} + \underset{(8.99)}{1.029LnA} + \underset{(0.66)}{0.057LnCa} + \underset{(0.88)}{0.235LnNc} + \underset{(0.67)}{0.402LnY} \\ &+ \underset{(1.05)}{0.205V} - \underset{(2.34)}{0.594N} + \underset{(1.47)}{0.331C} - \underset{(0.38)}{0.050LnCP} \qquad (10) \end{aligned}$$

[|t-ratios| in parentheses; $R^2 = .59$; $\bar{R}^2 = .55$]

Only the audience size and network affiliation elasticities are significantly different from zero at the 5% level, and the latter is unexpectedly negative. Testing the null hypothesis that $\beta_7 = \beta_8 = 0$, we obtain a test statistic $F_{2,80} = 1.05$ and cannot reject the null hypothesis at the 30% level.

The unexpected signs and low t-ratios in equation (10) are due in part to strong collinear relationships among the exogenous variables. In particular, LnA is an approximately linear combination of several of the others and A was a significant explanatory variable in equation (8). We must therefore determine if cartel effects of the code were influential after all, but were felt indirectly as determinants of audience size.

The log-linear specification of equation (9) splits A = (Sp/Sd)HH into the sum of two logarithmic terms. Define S = 100(Sp/Sd) as the "share factor". Since the code could hardly influence the number of households in a market, we examine the determinants of LnS. Estimation by OLS yields the following results:

$$\begin{aligned} LnS = {} & \underset{(1.64)}{1.526} + \underset{(0.13)}{0.008LnCa} - \underset{(2.46)}{0.488LnNc} + \underset{(0.91)}{0.409LnY} \\ & + \underset{(4.76)}{0.669V} + \underset{(8.22)}{1.542N} + \underset{1.03)}{0.162C} - \underset{(1.12)}{0.111LnCP} \qquad (11) \end{aligned}$$

[|t-ratios| in parentheses; $R^2 = .71$; $\bar{R}^2 = .68$]

Income appears to have no effect on market share, as expected, and cable penetration is also insignificant. Code and code penetration have individually insignificant coefficients. A test of the null hypothesis that the coefficients of C and LnCP are jointly zero yields $F_{2,81}$ = 0.865, and we cannot reject the null hypothesis at the 40% level.

For completeness, we also report the "best" (in terms of $\bar{R}^2$) market share and sale price regressions:

$$LnS = \underset{(6.11)}{1.964} - \underset{(2.77)}{0.511LnNc} + \underset{(4.47)}{0.642V} + \underset{(9.67)}{1.626N} \qquad (12)$$

[|t-ratios| in parentheses; R^2 = .70; $\bar{R}^2$ = .69]

$$LnP = \underset{(8.04)}{-7.388} + \underset{(8.88)}{0.906LnS} + \underset{(8.86)}{1.156LnHH} + \underset{(1.20)}{0.225C} \qquad (13)$$

[|t-ratios| in parentheses; R^2 = .58; $\bar{R}^2$ = .56]

In equation (12), the principal determinants of station market share appear to be the number of large competing stations, possession of a VHF channel, and network affiliation. This is plausible. The negative effect of LnNc needs no explanation. VHF signals carry farther and with greater clarity than UHF, so a larger share of any market tends to watch a VHF channel. Network affiliation may capture the effects of program quality and type which appeal to the majority of viewers and which we cannot measure separately.

Equation (13) tells us that the major predictor of sale price is audience size and that the two components of audience size are individually significant. Code membership has a positive coefficient, but is insignificant at the 10% level. Equations (12) and (13) together suggest that the reason why N has a negative sign and LnNc and V are insignificant in equation (10) is due to the strong side relation between these three variables and the share component of audience size. By this line of reasoning, we would also conclude that per capita income and cable penetration are merely unimportant factors in determining sale price in our sample.

Thus far it seems that code membership and code penetration have no statistically significant effect, singly or jointly, on sale price, audience size, or motivation to join the code. One more issue needs examination, however. The decision to subscribe to the code is not exogenous in the sale price equation. We see in equation (8), for example, that audience size has a positive effect on the probability that a station subscribes to the code. But audience size and price are highly correlated, as equations (10) and (13) confirm.[24] If P is substituted for A in equation (8), the results are largely unchanged. If C affects P, but P affects C, then our single-equation regressions suffer from simultaneous equations bias.[25] A two-equation specification is called for, and to this we now turn.

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[24]The sample correlations are r(A,P) = .79 and r(LnA,LnP) = .74.

[25]If each has a direct (positive) effect on the other, then the OLS estimates of the coefficient of C in the price equations will be biased upward.

IV. Simultaneous-Equation Regression Results

For simultaneous-equation analysis, we employ a slightly expanded version of the dummy endogenous variable (DEV) model developed by Heckman (1978) and subsequently modified in Maddala (1983, sec. 5.8).

Define $\overset{*}{E}_i$ as an unobserved index of the "cartel potential" of the code in the i^{th} station's market. As before, let C^*_i represent the unobserved incentive for the i^{th} station to subscribe to the code. Adopting the log-linear specification of the previous section and omitting i subscripts and constant terms, write:

$$\overset{*}{E} = a_1C + a_2LnCPo + a_3LnCa + a_4LnNc + u^e \qquad (14a)$$

$$LnP = b_1C + b_2\overset{*}{E} + b_3LnS + b_4LnHH + b_5LnCa + b_6LnNc + b_7LnY + b_8V + b_9N + u^p \qquad (14b)$$

$$C^* = \overset{*}{E} + c_1LnP^{(0)} + c_2T + c_3B + u^c \qquad (14c)$$

$$C = 1 \text{ if } C^* > 0;\ C = 0 \text{ otherwise.} \qquad (14d)$$

Equation (14a) hypothesizes that cartel effectiveness of the code depends upon market structure, code penetration without participation of the sample station, and whether or not the sample station is a code subscriber. Equation (14b) can best be understood by referring to equations (5a) and (5b). The term $b_1C + b_2\overset{*}{E}$ represent the cartel component R^c

in (5a). Market structure variables appear twice on the right hand side as in (5b). Equation (14c) models the station's incentive to subscribe to the code as a function of cartel effectiveness, on the sale price of the station if it does not subscribe [$LnP^{(0)}$ = LnP with $b_1 = 0$ in (14b)], and on other factors.

Some parameters in equations (14) must be restricted to ensure logical consistency. Substitution of (14a) and (14b) into (14c) yields $C^* = a_1(1+b_2c_1)C$ + [other terms]. However, the probability of the event "station subscribes" (a function of C*) cannot depend on whether the event has already occurred (C = 1 or 0). Hence, $a_1(1+b_2c_1)$ must be zero. Since the possibility that $b_2 = 0$ is of interest in this analysis, the chosen restriction is $a_1 = 0$. C is dropped from equation (14a) and $\overset{*}{E}$ becomes $\overset{*}{E}^{(0)}$.[26]

This logical consistency parameter restriction cleans up the DEV model. With $\overset{*}{E}^{(0)}$ on the right hand side of (14b), the effect of subscribing to the code is confined to the b_1C term. In equation (14c), $LnP^{(0)}$ now accurately reflects the sale price of a station when it does not subscribe, since it now equals LnP when both a_1 and $b_1 = 0$. Subscription by the sample station does not affect LnCPo.

Substituting (14a) into (14b) and (14c) yields the following regression model in observable variables or events:

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[26] Logical consistency conditions are derived rigorously in Maddala (1983).

$$\overset{*}{C} = \gamma_0 + \gamma_1 \text{LnCPo} + \gamma_2 \text{LnS} + \gamma_3 \text{LnHH} + \gamma_4 \text{LnCa} + \gamma_5 \text{LnNc}$$
$$+\gamma_6 \text{LnY} + \gamma_7 V + \gamma_8 N + \gamma_9 T + \gamma_{10} B + w^C \qquad (15a)$$

$$\text{LnP} = \beta_0 + \beta_1 C + \beta_2 \text{LnCPo} + \beta_3 \text{LnS} + \beta_4 \text{LnHH}$$
$$+ \beta_5 \text{LnCa} + \beta_6 \text{LnNc} + \beta_7 \text{LnY} + \beta_8 V + \beta_9 N + w^P \qquad (15b)$$

$$C = 1 \text{ if } \overset{*}{C} > 0; \; C = 0 \text{ otherwise.} \qquad (15c)$$

Equations (15) constitute a partially reduced form of the structural model in equations (14), and several structural parameters are overidentified, as can be seen from the parameter and error term correspondence list in Table 2.

Since $\overset{*}{E}$ measures an index of positive cartel effectiveness in equations (14a) and (14c), we anticipate $a_1 > 0$ and $a_2 > 0$. Competition from cable systems might reduce this index, suggesting $a_3 \leq 0$. In view of Stigler's (1964) observations on oligopoly and collusion, we expect cartel restrictions to be harder to establish and enforce when the number of sizeable competitors is large, implying $a_4 < 0$. If the code had a positive effect on station profits and asset values, then b_1 and/or $b_2 > 0$ is expected. Parameters b_3, b_4, b_7, b_8, and b_9 are expected to be positive and b_5 and b_6 negative.

The parameters in (14c) bear explanation. Equation (14c) corresponds to equation (5.70) in Maddala's revision of the Heckman model (Maddala, 1983, p. 132). The time-until-code-suspension (T) and NAB membership dummy (B)

TABLE 2

STRUCTURAL PARAMETERS AND REGRESSION COEFFICIENTS

Profit Equation	Incentive Equation
$\beta_1 = b_1$	$\gamma_1 = a_2(1+c_1b_2)$
$\beta_2 = a_2b_2$	$\gamma_2 = b_3c_1$
$\beta_3 = b_3$	$\gamma_3 = b_4c_1$
$\beta_4 = b_4$	$\gamma_4 = a_3 + c_1(a_3b_2 + b_5)$
$\beta_5 = a_3b_2 + b_5$	$\gamma_5 = a_4 + c_1(a_4b_2 + b_6)$
$\beta_6 = a_4b_2 + b_6$	$\gamma_6 = b_7c_1$
$\beta_7 = b_7$	$\gamma_7 = b_8c_1$
$\beta_8 = b_8$	$\gamma_8 = b_9c_1$
$\beta_9 = b_9$	$\gamma_9 = c_2$
	$\gamma_{10} = c_3$
$w^p = b_2u^e + u^p$	$w^c = (1+b_2c_1)u^e + c_1u^p + u^c$

variables have been included to aid in model identification; $c_2 \geq 0$ and $c_3 > 0$ are expected. Recall that a station may be a code subscriber, an NAB member, both, or neither. The activities of the NAB are primarily of a technical or national nature. NAB influence in local television markets, if any, would be felt through the Television Code and the NAB's Code Authority subsidiary. Yet the major networks and most of their affiliated stations are both NAB members and Code subscribers. Hence, we take B (the result of a station's NAB membership decision) to be exogenous to this model. However, we expect that B will be a good predictor of, even if not causally related to, the code subscription decision.

We expect $c_1 > 0$ in (14c). The fact that C appears on the right hand side of (14b) and $LnP^{(0)}$ on the right hand side of (14c) is the source of possible simultaneity in the DEV model. A positive sign for c_1 need not be indicative of cartel effectiveness, however, since stations may subscribe to the code for other reasons, such as reduced risk of problems with FCC license renewal. Higher-value stations presumably have more to protect in these circumstances,[27] and are therefore more apt to become code subscribers.

Combining these sign expectations with the parameter correspondences, we expect β_5, β_6, γ_4, and γ_5 to be negative in equations (15). The remaining parameters should be ≥ 0. From the single-equation results of the previous section, we know there will be data matrix conditioning problems. An additional complication is that the probit technique to be applied to (15a) estimates the γ coefficients only up to a

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[27]This thesis is central to Galbraith's New Industrial State (1967), for example.

scale factor. We will find it helpful to estimate both the full DEV model and a limited version with some variables omitted or relocated.

Full DEV Model

The identification and estimation of equations (15) are discussed in Maddala and Lee (1976) and extended in Maddala (1983). Two-stage nonlinear least squares (2NLS), an asymptotically efficient estimation technique, is employed. Equation 15a is estimated by probit maximum likelihood methods. After fitted values $\hat{C}*$ are substituted for C, equation (15b) is estimated by OLS.

Table 3 presents the estimated coefficients and summary statistics for two versions of the DEV model. The asymptotic standard errors, obtained from the variant of the Nelson-Olsen method demonstrated in Maddala (1983, pp. 244-45), are in parentheses. Column (1a) lists the probit estimates of the reduced form incentive-to-subscribe equation (15a). B is the only individually significant predictor. Eighty-three percent of stations were correctly assigned to the C = 0 or C = 1 category.[28] The second-stage estimates of sale price equation (15b) are in column (1b). About fifty-five percent of the variation in LnP is explained. LnS and LnHH have positive coefficients which are significantly different from zero at the one percent

[28]If B is omitted, the prediction level falls to 75% and the coefficients of LnS and LnHH are jointly significant.

level. The coefficients of LnNc, LnY, V, and N have the expected sign, but are not significant at the ten percent level. The coefficient of LnCa is insignificantly positive, as before.

With regard to the effect of the code on sale price, we observe that the estimate of the elasticity with respect to code penetration is negative, but not significantly different from zero at ten percent. The anomaly is that β_1, the coefficient of C is significantly negative. Since $\beta_1 = b_1$, we conclude that the mere act of subscribing to the code did not increase a station's sale price or asset value. We return to this matter below.

Finally, from the list of parameter correspondences in Table 2, we see that the direct estimates of b_3, b_4, b_7, b_8, and b_9 are positive, while the estimates of γ_2, γ_3, γ_6, and γ_8 are positive, as anticipated. Thus, the bulk of the evidence suggests that $c_1 \geq 0$. Overidentification prevents a more precise test.

Short DEV Model

Inasmuch as collinearity within equations may have reduced the efficiency of the above parameter estimators, a smaller DEV model is also estimated. Several variables are omitted altogether: LnCa and T because they are insignificant in all previous regressions; V and LnNc because their influence seems wholly captured by the market share (LnS) variable. Income and network affiliation

TABLE 3
DEV MODEL ESTIMATES[1]

Dep. Var.	C (1a)	LnP (1b)	C (2a)	LnP (2b)
Con.	-4.435 (3.784)	-9.750 (2.422)	-5.701 (3.272)	-7.361 (1.162)
C	-.-	-0.446 (0.140)	-.-	-0.284 (0.115)
LnCPo	-0.113 (0.190)	-0.163 (0.125)	-0.130 (0.185)	-0.131 (0.108)
LnS	0.097 (0.307)	0.942 (0.199)	0.041 (0.252)	0.987 (0.132)
LnHH	0.345 (0.330)	1.320 (0.217)	0.341 (0.302)	1.262 (0.166)
LnCa	-0.055 (0.233)	0.049 (0.126)	-.-	-.-
LnNc	-0.683 (0.575)	-0.032 (0.378)	-.-	-.-
LnY	1.502 (1.409)	1.097 (0.895)	1.597 (1.352)	-.-
V	-0.632 (0.476)	0.271 (0.289)	-.-	-.-
N	0.880 (0.782)	0.079 (0.529)	0.725 (0.702)	-.-
T	0.0003 (0.010)	-.-	-.-	-.-
B	1.839 (0.404)	-.-	1.722 (0.372)	-.-
$\bar{R}^2$	-.-	.50	-.-	.53
$\bar{R}_p^2$	.55	-.-	.51	-.-
pc	83%	-.-	84%	-.-

[1]Sample size = 89; asymptotic standard errors in parentheses; $\bar{R}^2$ = adjusted R^2; $\bar{R}_p^2$ = adjusted

pseudo-R^2; pc = percent of cases correctly predicted.

figured positively in the incentive-to-subscribe equation (8), but not in the second-stage estimates of column (1b) in Table 3. Hence, a reformulation of equations (14) is entertained. Parameters a_3, a_4, and b_5 to b_9 are set at zero, eliminating LnCa, LnNc, LnY, V, and N from equations (14a) and (14b). We set $c_2 = 0$ and add terms c_4LnY and c_5N to equation (14c), expecting $c_4 > 0$ and $c_5 > 0$. Substitution and simplification yields a regression model similar to equations (15).

The probit reduced-form results for this shorter DEV model are listed in column (2a) of Table 3, and the second-stage estimates in column (2b). Looking at the former, observe that c_4 and c_5 appear to be positive, but only B is a significant predictor (as before). Omission of insignificant variables improves the fit ($\bar{R}^2$) for the sale price equation, and the audience size variables (LnS and LnHH) are significantly positive. As with the complete DEV model, the coefficient of LnCPo is negative and insignificant, while that of C is significantly negative at the 1% level.

In summary, sale price seems to depend primarily on audience size, which itself is determined in part by the station's equipment, network affiliation, and number of competitors. Neither code penetration nor code subscribership raises profits or asset values. Penetration is wholly irrelevant, based on the results above, but subscribership seems to have a negative effect, and this is the anomaly that we cannot adequately account for. We offer some thoughts on this before the final summary in Part Five.

If the code did not serve as a successful output-restricting institution, then stations may have subscribed merely for the "insurance and reputation" motives discussed earlier. This would make subscription a cost, which should show up negatively in a profit or revenue function. But this would be a small cost, and, given the voluntary nature of the code, completely avoidable. It is extremely surprising, therefore, that the coefficient of C should be so significantly negative as it is in Table 3.

An alternative explanation which is more probable is that stations subscribed to the code when profits (asset values) were low, in hopes of raising them. A pooled cross-section time-series data base might be necessary to explore this possibility. But this explanation is contradicted by two sets of findings in this paper. First, the incentive to subscribe seems positively related to audience size in Part Three, and audience size is virtually a proxy for sale price. Second, the indirect evidence from the DEV model suggests that $c_1 \geq 0$ in equation (14c), meaning that the more valuable a station was without subscribing, the more likely it was to subscribe--it was at least not <u>less</u> likely to subscribe.

A final possibility is that the code did in fact restrict the supply of commercial exposures, so stations frittered away their profits in the uncontrolled program quality dimension. Individual (not joint) profit maximization subject to the output constraint would result in lower profits than would otherwise obtain. If this were the case, however, the effect would almost certainly show up in association with the code penetration, not the code subscribership, variable. The coefficient of LnCPo is negative in the DEV models, but it is never remotely significant in any of the regressions. Since none of these explanations are satisfactory, the significantly negative coefficient of C is a "disturbing artifact" which we can report but not explain.

5. Summary and Conclusions

The theory developed in part one demonstrates the ability of a television trade association to raise industry profit by reducing the number of commercials, even though the actual product is commercial *exposures*. It is not clear to what extent this extra profit might be eroded by increased competition along the dimensions of program quality, type, and scheduling. It is clear, however, that the Justice Department brought an antitrust suit against the NAB for restricting the number of commercials. If the suit had economic justification, then the prosecution must have believed that the commercial restrictions either could have or actually did raise station profits above the competitive level.

Under a *per se* rule, the government's case is substantiated if the television code could have raised profits through cartel operations. But under a rule of reason, normally applied in trade association cases, the successful prosecution of the suit requires evidence that the code actually did raise station profits.

The empirical results in this paper are based on such indirect evidence as is available. They show that code penetration or code membership in the local market area had no discernible direct effect on profits.

In interpreting these results, it must be kept in mind that code membership may have been chosen for reasons unrelated to cartel output restrictions. The code provided monitoring and other services to members for a nominal (if discriminatory) fee. These services reduce station risk at license renewal time. Membership may also be valuable in signalling the station's reputability to potential advertisers and interested community groups.

Thus, a finding of anticompetitive or cartel effect of the code depends heavily on the code penetration variable. Surely a cartel is more effective in any given market area the higher the proportion of members it has. Yet the various measures of penetration are not positively related to station profitability even in the "best" simultaneous equation regressions (*i.e.*, those in Table 3).

Given these results, our findings are that: (1) the television code did not successfully increase member station profits through restrictions on the output of commercial exposures, (2) since stations chose to become members, code membership appears to have been determined by factors which were unrelated to the antitrust suit, and therefore (3) the government's antitrust suit was economically ill-advised, especially if a "rule of reason" was to be applied to evaluating industry conduct and performance.

These findings are deliberately cautious for both legal and statistical reasons. Had the antitrust case been decided in court under a rule of reason, the NAB would have to be acquitted unless found guilty beyond reasonable doubt. The evidence in this paper favors the NAB but is based on indirect estimates obtained with asymptotically efficient methods applied to a relatively small sample of observations on station sale prices. A cross-sectional census of actual station profits and audience size for, say, 1978 (before the code was challenged) could undoubtedly deliver more definitive results, although we have no reason to believe the conclusions of such a study would differ from those presented here.

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