Games of survival in the US newspaper industry

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I. INTRODUCTION

Since 1958 the number of United States cities with competing central-city newspapers has dwindled from 70 to 19. This evident drift toward monopoly has provoked public concern over the loss of independent editorial voices. Economically, it raises important questions about what cost structures can mandate a 'natural monopoly' and how rival firms in small-numbers markets behave when structural conditions favour a monopoly equilibrium in the long run. The general properties of newspapers' cost structures are well known from Rosse's research.1 What has not been explored systematically is the rival behaviour of two or three sellers in a market where monopoly profits may substantially exceed those of duopoly or triopoly.

A newspaper is an economically complex firm that sells information to readers and readers' attention to advertisers. (Section II of this paper sets out the formal optimizing conditions for a single newspaper.) In each of these roles the central-city newspaper faces many competitors, and monopolistic competition is clearly the general model applicable to the markets both for media of information and entertainment and for advertising messages. However, central-city newspapers are in what Rosse (1967) called 'isolated competition' within these general market structures. Most readers and advertisers, are assumed to regard competing central-city newspapers as better substitutes for each other than for other media. Therefore, newspapers' rivalry can be assumed to take place in a distinct market segment. Section III considers this rivalry in terms of a seller's choice between sharing duopoly profits and investing resources to make a rival leave the market. Then Section IV presents an econometric model of the demand for and pricing of central-city newspaper advertisements and circulation, to test the implications of our models of decision-making by the single newspaper and games of survival among small-numbers rivals.

II. THE SINGLE NEWSPAPER FIRM

In this section the first-order conditions for profit-maximization by a single newspaper are derived making use of the several instruments at its command. The resulting first-order

conditions give rise to the system of estimating equations used in Section IV. The newspaper firm is modelled here as a monopolistic competitor that faces downward sloping ceteris paribus demand curves for both circulation and advertising. The model is developed from Corden’s (1952–53; also Reddaway, 1963) pioneering exposition of the unusual relationship between the newspaper’s circulation and advertising functions, which stands out most clearly if it is initially assumed that the newspaper’s circulation price per copy is fixed (by convention, perhaps) while its other policy instruments are adjusted to optimal values. Then the first-order conditions that result when the circulation price is also variable are set out.

Circulation and editorial quality

The following variables are defined:

\[ R_c = \text{revenue generated from circulation}, \]
\[ q_c = \text{circulation or quantity of copies}, \]
\[ p_c = \text{price per copy (assumed fixed)}. \]

Then \( R_c = p_c q_c \). Let the demand for newspapers \( q_c^d \) depend on the ‘quality’ of the paper, where quality is determined solely by monetary expenditures on reporting, editorial staff, etc. The usual assumption of diminishing marginal returns to expenditures is made; denoting these expenditures on quality by \( e \), we require:

\[ q_c^d = q_c^d(e), \quad e > 0, \quad q_c^d(0) = 0 \quad (A1) \]
\[ \frac{dq_c^d}{de} > 0, \quad \frac{d^2 q_c^d}{de^2} < 0. \]

The costs due to circulation may be broken down into three components: a fixed cost, \( F_c \); a cost that increases in proportion to circulation, \( V_c q_c \); and expenditures \( e \) which affect circulation demand. Let \( f \) denote the inverse demand function for circulation. Then total costs as a function of circulation are:

\[ TC_c = F_c + V_c q_c + f(q_c) \quad (1) \]

From Assumption (A1) \( f' > 0 \) and \( f'' > 0 \), thus \( f \) is convex and monotonically increasing. Average costs are:

\[ AC_c = \frac{F_c}{q_c} + V_c + \frac{f(q_c)}{q_c} \quad (2) \]

The slope of the average cost curve is then:

\[ \frac{d}{dq_c} (AC_c) = \frac{1}{q_c^2} [f'(q_c) - f_c]. \quad (3) \]

Since \( f \) is convex we know that \( f' > f'q_c \) or \( q_c f' - f > 0 \) so that the sign of the average cost curve’s slope depends on how large the fixed cost \( F_c \) is relative to \( (q_c f' - f) \). For relatively large fixed costs, the average cost curve is initially downward-sloping, but as \( q_c \) increases the slope will become positive since \( (q_c f' - f) \) is strictly increasing in \( q_c \) and unbounded from above. This gives us the usual U-shaped average cost curve.
Advertising demand and price

The newspaper's pricing of advertising messages is now incorporated, defining the following variables:

\[ R_a = \text{revenue generated from advertising}, \]
\[ q_a = \text{quantity of lines of advertisement per copy}, \]
\[ p_a = \text{price per line of advertisement}. \]

Because the firm has some monopoly power in this market, the demand for advertising \( q_a^d \) is assumed to be a function of price \( p_a \). It is also supposed that advertising demand is related to the newspaper's circulation, \( q_c \), a higher circulation inducing a larger demand for advertising lineage. Thus:

\[
q_a^d = q_a^d(p_a, q_c), \quad \frac{d}{dq_c} (q_a^d) > 0, \quad \frac{d}{dp_a} (q_a^d) < 0 \tag{A2}
\]

Advertising revenues \( R_a \) are then \( p_a q_a(p_a, q_c) \).

The cost associated with any level of advertisement is a combination of some fixed costs \( F_a \) and a charge \( V_a \) that is proportional to the lines of advertisement per copy. Total and average costs are then:

\[
TC_a = F_a + V_a q_a q_c \tag{4a}
\]
\[
AC_a = \frac{F_a}{q_a} + V_a q_c \tag{4b}
\]

The behaviour of average costs of advertising for increasing levels of circulation are shown in Fig. 1.²

²Rosse (1967, 1970) concluded that, with product quality held constant, scale economies exist in advertising and news space per issue of the newspaper—especially when these functions are taken together, not so significantly when they are analysed separately. He did not find such substantial scale economies for circulation itself. An indirect cost study based on newspapers' national advertising rates and total advertising outputs led to the finding that the elasticity of unit costs with respect to total advertising output (column-inches per subscriber) is negative and highly significant statistically.
Profit maximization

The firm's problem of maximizing the profits accruing from both advertising and circulation gives rise to the following objective function:

\[ \Pi(q_c, p_a) = p_c q_c + p_a q_a - [F_c + F_a + (V_c + V_a q_a) q_c + f(q_c)] \]  

(5)

The firm chooses an optimal \( p_a \) and an optimal \( q_c \) (hence \( e \)). The first-order conditions for such an optimum yield the following two relations:

\[ p_c + p_a \frac{\partial q_a}{\partial q_c} = V_c + V_a q_a + V_a q_c \frac{\partial q_a}{\partial q_c} + \frac{\partial f}{\partial q_c} \]  

(6a)

\[ q_a + p_a \frac{\partial q_a}{\partial p_a} = V_a q_c \frac{\partial q_a}{\partial p_a} \]  

(6b)

Equation 6a states that at the optimum, the marginal revenue accruing from increasing circulation one unit (the price of the additional copy plus the increase in advertising revenue due to higher circulation-induced demand) should be equated to the marginal cost of an additional copy (advertising and circulation expenditures). Equation 6b may be more easily interpreted by first defining the price-elasticity of advertising demand as \( \psi(p_a, q_a, q_c) = (p_a/q_a) (\partial q_a/\partial p_a) \) and then rewriting the equation as:

\[ p_a \left( 1 + \frac{1}{\psi} \right) = V_a q_c \]  

(7)

Equation 7 is the familiar price-markup relation for a monopolist. The two first-order conditions may then be solved simultaneously for the optimal advertising price and level of circulation (which implies a unique level of expenditures on editorial quality).

These conditions show how the optimal circulation price depends on the ability of additional circulation to induce additional advertising, which feeds back positively to the increase in total revenue resulting from any decrease in the circulation price. They also indicate the joint vulnerability of these revenue streams to exogenous shifts in either advertising demand (say, due to the arrival of television) or circulation demand (say, due to the movement of households from the central city to the suburbs). As Rosse (1978) stressed, an adverse shift in either demand function shrivels both revenue streams.\(^3\)

Although these factors stand out more clearly when circulation price is not included as an instrument, its optimal adjustment (along with \( e \) and \( p_a \)) must be allowed in a full set of first-order conditions. Suppose that newspaper demand depends on both circulation price \( p_c \) and editorial expenditures \( e \), i.e., \( q_e = q_e^d(e, p_c) \) and assume that:

For any fixed \( p_c \), \( \frac{\partial q_e^d}{\partial e} > 0 \),  \( \frac{\partial^2 q_e^d}{\partial e^2} < 0 \).  

(A3)

The firm then chooses \( p_c \), \( p_a \), and \( e \) in order to maximize profits \( \Pi \) where:

\[ \Pi(e, p_c, p_a) = p_c q_c(e, p_c) + p_a q_a - [F_c + F_a + (V_c + V_a q_a) q_c(e, p_c) + e] \]  

(8)

\(^3\)This tendency for disturbances to cumulate is further amplified when it is recognized that the demand for circulation may depend positively on the amount of advertising carried by the newspaper. This relation is incorporated in the empirical work below.
Games of survival in the US newspaper industry

Define the quantity $A$ as:

$$ A = \left[ p_c + (p_s - q_s V_s) \frac{\partial q_s}{\partial q_e} (V_c + V_s q_a) \right] $$

(9)

and let $\eta(p_s, q_s, q_e) = \frac{\partial \ln q_s}{\partial \ln p_s}$ be the price elasticity of advertising demand. Then the first-order conditions for maximizing $\Pi$ yield the following three relations:

$$ p_s \left( 1 + \frac{1}{\eta} \right) = V_s q_c $$

(10a)

$$ A \frac{\partial q_e}{\partial p_c} = -q_c $$

(10b)

$$ A \frac{\partial q_e}{\partial q_e} = 1 $$

(10c)

Combining Equations 10b and 10c gives the familiar Dorfman–Steiner relation. Hence, the conditions 10 imply the following two equalities:

$$ p_s \left( 1 + \frac{1}{\eta} \right) = V_s q_c $$

(11a)

$$ \frac{p_c q_e}{e} = \frac{\varepsilon}{\gamma} $$

(11b)

where $\varepsilon = \frac{\partial \ln q_c}{\partial \ln p_c}$ and $\gamma = \frac{\partial \ln q_e}{\partial \ln e}$ are the price-elasticity of circulation demand and the editorial expenditure-elasticity of circulation demand respectively.

III. PREDATION IN THE NEWSPAPER INDUSTRY: THEORY AND RESEARCH DESIGN

Research design

The preceding section supplies first-order conditions that will serve as the basis for a statistical test of the behaviour of a cross-section of 50 major newspapers located in 30 US metropolitan areas. Specifically, a model derived from Equations 10, which indicate how the newspaper determines its circulation and advertising prices and its outlays on editorial quality will be estimated in cross-section (for the year 1980). The advertising price is in fact a vector of prices for national, retail, and classified respectively. Demand functions are also estimated for circulation and advertising that correspond to Assumptions A1–A3; these both serve to complete the model and to test various structural factors that should significantly affect the competitive process in rival newspaper markets.

The sample includes some observations of monopoly central-city newspapers, some of newspapers in duopoly or triopoly markets. However, the theoretical model so far has not provided for interaction among rivals. Our strategy for detecting and characterizing rivalry is as follows. It is assumed that rival markets at the time of observation were either undergoing games of survival or else were in some other oligopoly equilibrium (its form need
not be specified exactly). Because a game of survival is intrinsically a transient state, it will probably not be observed in all rival markets, even if it can be established a priori that newspaper markets are prone to such states. To support this empirical procedure, structural reasons were first established as to why newspaper markets should be prone to games of survival. Then, in the section that follows, the econometric model sketched above is constructed so that the data may discriminate among monopoly newspapers, those engaged in games of survival, and those in other oligopoly equilibria.

**Theoretical bases for predation**

Existing models of games of ruinous competition establish various sets of circumstances (financial constraints, incomplete information, etc.) under which one firm may profitably invest in ruining a rival. The paper does not seek to extend those models, but rather to draw upon them to identify structural traits that might dispose newspaper markets toward ruinous competition.

1. **High fixed costs.** It can be shown that the scope for predatory action by a duopolist increases with the importance of fixed costs. The assumption that newspapers have high fixed (first-copy) costs is strongly supported by the evidence. Wagner's (1981) review of the evidence indicated that for mass-circulation papers first-copy costs are about half of total costs, and Rosse's (1978) figure for smaller-circulation dailies was 40%. These data are significant in light of the positive influence of fixed costs on opportunities for predation. Technological change has been reducing these scale economies, but it first benefited small-circulation papers and diffused to the large ones too late to stay the decline of competition in central-city papers.

2. **Interdependence of advertising and circulation demands.** In Section I it was observed that because the demand for advertising depends on circulation as well as price, there are two channels through which a change in circulation may affect revenues. To the extent that this dependence amplifies the effect of changes in output upon profits, predation will be more likely since such linkages will have a tendency to decrease the levels of output required to ruin a rival ceteris paribus, hence lowering the costs of predation.

3. **Random disturbances.** It can be shown that one duopolistic rival is more likely to find itself in a Stackelberg position where predation is profitable, the more do the rivals' costs or revenue-productivity levels differ. As an empirical counterpart, random disturbances may affect the preferences of advertisers and readers for one newspaper relative to another, so that the division of duopoly profits between them may differ substantially among states of

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4In addition to the classic reference on games of survival by Shubik (1959), more recent references include Friedman (1979), Maskin and Tirole (1983), Benoit (1984), Fudenberg and Tirole (1984) and Ghemawat and Nalebuff (1985).

5This is demonstrated in Appendix 1 of the discussion-paper version of this study.

6Changes in type-setting technology have lowered the importance of fixed costs somewhat, especially for smaller-circulation papers, but have apparently not drastically changed these numbers.

7Norton and Norton (1986) found that the largest-circulation papers had on average gained market share during 1964–1981, as had the medium-size classes, but the size-class corresponding roughly to smaller central-city dailies lost share.

8Models of ruinous competition have not been extended to two-product markets. Thus, the proposition in the text is conjectural, yet the conjecture seems sound on the basis of Bulow, Geanakoplos and Klemperer (1985), for example.

9This proposition is demonstrated in Appendix 1 of the discussion-paper version of this study.
nature. A sufficient reason for this is that the effect on circulation of outlays on editorial quality contains a random component, so that a paper’s editorial-expenditure policy that was optimized \textit{ex ante} may prove unsuccessful \textit{ex post}. As a result, in any given state of nature, one paper may be earning higher profits (from larger circulation and/or higher advertising) than it expected, the other one lower profits. The effect of this on the incentive to ‘prey’ is that the former firm needs to sacrifice less profit in order to produce losses for the latter. Therefore, the greater this randomness in newspapers’ fortunes, the greater the chances that one paper will find itself in a situation where predation is profitable.\textsuperscript{10} This uncertainty may, however, theoretically depress the scope for predation by inducing firms to use a higher discount rate that makes ruinous competition less likely.

4. \textbf{Low re-entry threat}. The payout to predation is less, the more the subsequent monopoly profits are constrained by the threat of entry. Easy exit is a necessary condition for contestability and easy entry. However, it may not be sufficient to the extent that goodwill assets belonging to incumbents require entrants to incur shakedown losses or sunk promotional outlays (with uncertain returns). If newspaper readership rests on habituation and custom, the compensation required by the typical reader of newspaper B to shift to incumbent paper A may be substantially less than that required to shift to a new and unfamiliar paper.\textsuperscript{11} Newspapers do not seem to be among the class of goods for which buyers have tastes for variety, rotating their purchases among “acceptable” varieties and therefore requiring only small inducements to try a new one.\textsuperscript{12}

5. \textbf{Small sunk costs}. The strategy of predation is more likely to be profitable, the shorter the period for which losses are endured before the victim exits. That period is shorter, the greater the degree to which the firm’s fixed (first copy) costs are not also sunk. Although in most industries fixed and sunk costs are highly correlated,\textsuperscript{13} significant parts of newspapers’ fixed costs are sunk only for short periods. Editorial personnel are not employed on long-term contracts, and buildings and the equipment used in the distribution system have alternative uses. Presses and related specialized equipment, however, may have limited salvage value. Thus, as industries go, newspapers represent one in which the losing firm’s exit is relatively unhampered by fixed costs that are sunk or contractually unavoidable. A countervailing factor, however, is negative salvage value due to pension and severance-pay liabilities to pressmen and printers.\textsuperscript{14}

6. \textbf{Weakening product differentiation}. Formal theories of ruinous competition assume a homogeneous product, and it is obvious that sufficiently small direct and cross-elasticities of

\textsuperscript{10}This case bears an important relation to the formal model of advantages stemming from lower fixed costs. Because the newspaper’s fixed inputs affect its differentiation, the paper that enjoys random superiority in its fixed assets is observed to hold a disproportionate market share; in terms of the model, it can be thought of as enjoying lower fixed costs than its rival for attaining any given market share (see Rosse’s (1978) discussion).

\textsuperscript{11}Accordingly, Glazer (1985, p. 474) found that first entrants into daily newspaper markets tend significantly to outlive second entrants. Similar reasoning implies that a newspaper employing a strategy that proves unsuccessful cannot quickly change it.

\textsuperscript{12}It has been suggested to us that newspaper readership may be subject to bandwagon effects, because newspapers’ content adds substantially to the conversational currency of daily life and thereby creates an externality in demand. This factor would increase the scope for asymmetrical positions making ruin a profitable strategy for one rival.

\textsuperscript{13}Baumol and Willig (1981) to the contrary notwithstanding.

\textsuperscript{14}The less sunk are the newspaper’s costs, the less appropriate may be the assumption (in Appendix 1 of the discussion paper) that newspapers are capital-constrained (see Telser, 1966). However, the uncertain effectiveness of newspapers’ investment-type outlays (point 3 \textit{supra}) favours the assumption.
demand for individual papers could make multi-firm markets viable and predation unprofitable even in the face of the factors already outlined. It is, therefore, relevant that historical accounts of US newspaper markets (Rosse, 1978) stress the decreasing differentiation of newspapers in terms of alignment with particular political parties, social classes, or ethnic groups, bases that might strongly depress cross-elasticities of circulation demand. Some US newspaper markets exhibit significant vertical differentiation by class or quality, but others do not; the absence of objective data on quality blocked its incorporation in our model (compare Thompson, 1988).

IV. AN ECONOMETRIC MODEL

With this background we turn to the details of the model, which will contain three equations for advertising prices (national, local, classified), three corresponding equations for advertising demand, equations for circulation price and demand, and an equation for editorial inputs (quality). The quantities demanded and the instrument settings chosen by the newspapers are of course jointly determined, so the model is estimated by two-stage least squares.

Demand equations

The estimated equations for total 1980 advertising lineage (national – ADN, retail and other local – ADR, classified – ADC) and circulation (CIRC) are conveniently reported first. Their inclusion both completes the simultaneous model and provides the chance to evaluate several relationships that are significant for rivalry in the newspaper industry. Variables are defined briefly in the text, more precisely in an appendix table that gives their sources.

The quantity demanded of each class of advertising should be negatively related to its price, expressed as a weighted average of standardized line rates for weekday and Sunday editions, with total advertising lineage used as weights. These are denoted PADN (national), PADR (retail), and PADC (classified), and all are list prices quoted in trade sources or by the newspapers themselves. It was not possible to ascertain to what extent bargaining depresses transaction prices below those quoted rates (the discrepancy may be significant for local retail advertising). The price variables as defined ignore the favourable combined rates offered to advertisers who place the same ads in separate morning and evening editions. Therefore, a regressor was included as a dummy variable indicating that a newspaper offers a combined rate (DCMB). The 'bundling' strategy of a combined rate implies that the effective price of advertising lies below that measured by the line-rate variables, and so DCMB's coefficient should be positive (see Simon, Primeaux, and Rice 1986). What the advertiser demands is of course messages delivered to individual newspaper readers, and so combined daily and Sunday circulation (CIRC) is included as a separate regressor expected to yield a positive influence.15

Various terms can serve to test whether the demand for advertising in a particular paper is affected by the availability of substitute advertising media such as suburban daily papers,

15Ferguson (1963) found that retail advertisers enjoy lower scheduled rates than national advertisers and also get volume discounts.

16Some research on newspaper advertising works with rates expressed per unit of both space and circulation. The structure of the present model calls for separating these dimensions.
television and radio stations. The numbers of TV and radio stations in each newspaper's metropolitan area were obtained and a calculation was also made of the share of daily-newspaper circulation in each metropolitan area held by the largest two suburban dailies, weighted by the fraction of population in the metropolitan area residing outside of the central city. This variable (SUBCON) should be negatively related to the demand for advertising lineage in the metropolitan daily if SUBCON succeeds in capturing the degree to which the suburban papers provide an effectively differentiated alternative medium. Finally, note was taken of the proposition commonplace in newspaper circles that national and retail advertisers have a preference for the leading newspaper in a metropolitan area and therefore will ceteris paribus place a lesser volume of advertising in follower papers. This conjecture was tested because of its importance for the viability of rivalry, and so included a dummy variable (DFOL) set equal to one for each newspaper that ranks second or third in circulation in its metropolitan area.

Table 1. Determinants of demand for advertising lineage

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variable</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>ADN</td>
<td>ADR</td>
</tr>
<tr>
<td>PADb</td>
<td>-0.716**</td>
<td>-1.509*</td>
</tr>
<tr>
<td></td>
<td>(1.86)</td>
<td>(3.35)</td>
</tr>
<tr>
<td>DCMB</td>
<td>0.309*</td>
<td>0.464*</td>
</tr>
<tr>
<td></td>
<td>(2.59)</td>
<td>(3.35)</td>
</tr>
<tr>
<td>CIRC</td>
<td>1.050*</td>
<td>1.549*</td>
</tr>
<tr>
<td></td>
<td>(2.71)</td>
<td>(3.57)</td>
</tr>
<tr>
<td>SUBCON</td>
<td>-0.026</td>
<td>-0.113**</td>
</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td>(1.69)</td>
</tr>
<tr>
<td>DFOL</td>
<td>-0.018</td>
<td>-0.212*</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(1.33)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.159*</td>
<td>2.271</td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td>(0.96)</td>
</tr>
</tbody>
</table>

*t-statistics appear in parentheses below the regression coefficients. Levels of significance (one-tail tests) are: *, 1%; **, 5%; †, 10%.
bPADN, PADR, PADC in the equations for ADN, ADR, and ADC respectively.

Table 1 presents logarithmic regressions

There are logarithmic regressions of lineage for the three types of advertising on the variables just defined. Because the price variables are endogenous in the system, these equations were estimated by the method of two-stage least squares. The coefficients of the price variables can be read directly as elasticities and exhibit reasonable values for each class of advertising. They are statistically significant, as are values of the combination-rate dummy (DCMB) and weighted circulation (CIRC). The variable indicating the strength of competing suburban dailies (SUBCON) takes the expected sign but is significant only for retail advertising. The dummy for newspapers lower-ranked in circulation (DFOL) is weakly significant for retail advertising but not for national advertising. The dummies DCMB and DFOL were omitted from the equation for classified advertising, where they are deemed inappropriate, and the equation for ADC exhibits substantially less explanatory power than


That is, logarithms were taken of all variables other than those taking the forms of dummies.
the others.\textsuperscript{18} It was thought that the logarithmic relation of advertising lineage to circulation might be non-linear (compare Ferguson, 1983). Addition of a quadratic term indicated no such non-linearity for \textit{ADN} or \textit{ADR}, but it did prove significant and considerably improved the fit of the equation for \textit{ADC}. The numbers of TV and radio stations are omitted; these variables’ coefficients exhibited incorrect positive signs and \textit{t}-statistics that were substantial although not statistically significant. It was decided that they did not belong in the model,\textsuperscript{19} and their presence makes little difference to the coefficients of other variables.

The other demand equation pertains to circulation (\textit{CIRC}), which should be negatively related to its price (\textit{PCIRC} - weighted average of daily and Sunday single-copy prices). \textit{CIRC} should increase with the number of households in the metropolitan area and with household disposable income; a degree of freedom is preserved and a superior fit results when the product of these two variables (\textit{INCOME}) is employed. Circulation should increase with the quality of the paper and decrease with the availability of good substitutes. It was assumed that the quality of a newspaper for household readers increases with its number of personnel in editorial positions (\textit{QUAL}), which is taken to indicate the extent and quality of local news coverage; and with the volume of retail and classified advertising (\textit{ADR}, \textit{ADC}).\textsuperscript{20} Newspaper circulation is assumed to decrease with the number of television stations in the metropolitan area (\textit{TV}), because they substitute for newspapers as sources of news and local retail advertising. It is also expected to decrease with extent of substantial competition from suburban dailies (\textit{SUBCON}). Finally, shifts in households’ leisure-time activities have tended to reduce the demand for evening papers relative to those delivered in the morning, so that evening papers (dummy \textit{DEVE}) should have lower circulation.

This model of the determinants of circulation was estimated in logarithmic form by two-stage least squares, as with the advertising-demand equations. It exhibited some instability in key coefficients, so a representative result is quoted and then the consequences of shifting the following specification are described.

\[
    \text{CIRC} = -8.188* - 0.557 \text{PCIRC} + 0.895* \text{INCOME} + 0.756* \text{QUAL} \\
    (3.52) \quad (0.96) \quad (6.465) \quad (3.62) \\
    + 0.272** \text{ADR} + 0.080 \text{SUBCON} - 0.770* \text{TV} \\
    (1.94) \quad (1.50) \quad (2.87)
\]

In this version of the model the signs of \textit{INCOME}, \textit{QUAL}, \textit{ADR} and \textit{TV} are correct and their coefficients are significant. The price elasticity is negative but not significant. The coefficient of the suburban-press substitute (\textit{SUBCON}) is unexpectedly positive and moderately significant, suggesting that metropolitan and suburban dailies may compete less for circulation than for retail advertising (compare the equation for \textit{ADR} in Table 1). This equation omits \textit{ADC}; when included, it obtains an insignificant coefficient with the wrong sign. It also omits \textit{DEVE}; when that variable is included, the coefficient of \textit{ADR} becomes significant only at 19\% while the coefficient of \textit{DEVE} is negative and significant; those two

\textsuperscript{18}For the corresponding ordinary least squares equations the adjusted \textit{R}^2 value for \textit{ADC} is zero, while it is 0.29 for \textit{ADN} and 0.47 for \textit{ADR}.

\textsuperscript{19}It is hypothesized that they pick up on balance not the abundance of substitute advertising media but otherwise unobserved traits determining the volume of advertising demanded in the metropolitan area. This hypothesis is strengthened by the consideration that the numbers of TV and radio stations obviously increase with the size and commercial importance of a metropolitan area.

\textsuperscript{20}National advertising, available to households inexpensively or free of charge via other media, is assumed not to influence the household’s demand for newspapers.
variables are correlated, and it cannot be distinguished whether evening papers are eschewed because of when they appear or because they offer less useful information. Finally, the coefficient of the circulation price is smaller in other specifications, ranging down —0.26 from the —0.55 shown above, but the coefficient does come to exceed its standard error. These magnitudes are similar to Reckie’s (1976) estimates.

Equations for price and editorial quality

This paper now turns to the core of the model, which consists of equations for five decision variables available to the newspaper—line rates for the various classes of advertising (PADN, PADR, PADC), the circulation price (PCIRC), and editorial quality (QUAL). Section II showed that the determinants of each price variable include the levels of those costs that vary with advertising and circulation and the factors that determine the elasticity of market demand (and its position) for each of them. Pricing should also be influenced by the strategic considerations discussed in Section III. The determinants of editorial quality should be explored in the form of the familiar Dorfman–Steiner relationship.

The data available on newspapers’ costs are fragmentary and not well adapted to estimating a fully specified cost function. Furthermore, the distinction between advertising and circulation costs made in Section II cannot be preserved. The best we can do to control for differences in newspapers’ variable costs is to measure three components that should contribute to explaining variations in the costs of both circulation and advertising.21 One of these is a measure of the composite hourly costs of labour to each newspaper (LABOR), calculated as a weighted average of labour costs in each of the newspapers’ five major departments. The second cost indicator is a measure of the population density of the central city in the metropolitan area (CCDENS). The newspaper’s distribution costs certainly increase with central-city congestion, and other costs (both variable and fixed) probably are affected adversely as well.22 Finally, evening papers (DEVE) experience higher costs of distribution because newspapers must be delivered through the congested afternoon rush hour. Thus, the prices of advertising and circulation should increase with LABOR, CCDENS and DEVE. The newspaper’s circulation volume (CIRC) also belongs in the model to control for the number of copies in which the advertising line appears.

The influence of competitive conditions on advertising line rates needs to be modeled with care. The sample includes both monopoly newspapers and those in diverse situations of small-group rivalry. Although the database is not rich enough to allow comparison of each paper’s own actual line rates to a custom-made counterfactual, numerous differences in market structure can be observed, its changes, and the observed paper’s position in its market. Because a game of survival is necessarily a transitory event, a cross-section research design must allow for the possibility that different types of rival conditions prevail in different markets. The variables that were used to make these distinctions are defined, then their joint interpretation in conjunction with the models that are estimated is explained.

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21 Important material inputs—paper and ink—are traded in national markets, and their costs should not vary substantially among newspapers.

22 It was also considered whether population densities in the metropolitan area’s suburban portions might have the opposite effect, with distribution costs increasing due to suburban sprawl. When that measure was used in the models estimated in Table 2, its coefficient was signed as expected but quite insignificant.
First of all, a distinction is made between cities with monopoly central-city newspapers (DMONOP) and others. Where rivalry exists, we focus on the price-setting behaviour of papers with differing market shares or ranks. The variable SHARE is defined as circulation of the newspaper in question as a fraction of the copies circulated of all metropolitan-area daily newspapers (including suburban); the variable was utilized for all newspapers, for only those with central-city rivals (SHAREC), or SHARE was allowed to take a different coefficient for papers with and without central-city rivals (SHAREC and SHAREM). A simpler strategy was to trichotomize papers in the sample into central-city monopolists (DMONOP), followers (DFOL), and leading circulation papers with central-city rivals (the residual category). Finally, because data are available on the circulation of individual daily papers in each area, a calculation could be made of any of the conventional measures of concentration.

Several dummies were employed to incorporate independent information on competitive behaviour and states of structural transition in these markets. Assume that a newspaper whose rival has exited cannot, for reasons of goodwill, immediately make any upward adjustment of its prices to a steady-state level appropriate to the new, more concentrated structure. Assume also that the existence of a competitor is associated with advertising rates depressed to reflect aggressive rivalry. Then a paper that had recently (during 1970–1980) lost a central-city rival should have been charging rates that were low for the market structure in which it found itself in 1980. DLOSS, indicating the recent exit of a rival, should therefore receive a negative coefficient. Public information on newspaper markets frequently includes comments that recognize the occurrence of 'warfare' conditions in certain markets. The dummy DWARF was set equal to one for papers in the Dallas, Denver, and Detroit markets, deemed from this information to exhibit warfare conditions during 1980. A third source of information on competitive conditions is the subsequent demise of a paper in the 1980 sample, or widespread reports appearing after 1980 but by 1984 that its survival was in doubt. The dummy DSICK was assigned a value of one for such papers, which we expected might be quoting high line rates in 1980 in an attempt to harvest what they could of their goodwill assets. Two other measures were used to describe the concentration of the observed newspaper’s competitors. SUBCON, already defined, represents the combined share of the largest two suburban dailies in the metropolitan area multiplied by the suburban portion's share of the metropolitan area’s population. HERFM is the Herfindahl concentration measure computed over all daily newspapers in the metropolitan-area market (including suburban) minus the square of the observed paper’s own share.

These variables could be logically grouped in several ways into models for estimation. SHAREC is a strategic variable to distinguish between passive (Cournot-type) behaviour and predatory strategies, because in the former case an oligopolist holding a larger share of a market tends to prefer higher price (by the rule of elasticity of derived demand). Conversely, a large-share predator in a game of survival would set a lower price. A competing specification relies on DFOL on the logic that a newspaper's position in a game of survival depends not on its own share of circulation but on whether it enjoys an advantage in market share over any central-city rival.\(^{23}\) The transitory-state variables DLOSS, DWARF, and DSICK, as well as DMONOP, can be employed with either SHARE or DFOL to make additional discriminations among states of rivalry.

\(^{23}\)The presence of competing theoretical predictions indicates that two-tail tests are appropriate for both SHARE and DFOL.
Table 2. Determinants of advertising lines rates*

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>PADN</th>
<th>PADR</th>
<th>PADC</th>
</tr>
</thead>
<tbody>
<tr>
<td>LABOR</td>
<td>0.076</td>
<td>0.088</td>
<td>-0.712**</td>
</tr>
<tr>
<td>(0.35)</td>
<td></td>
<td>(0.48)</td>
<td>(2.02)</td>
</tr>
<tr>
<td>CCDENS</td>
<td>0.061†</td>
<td>0.088*</td>
<td>0.074</td>
</tr>
<tr>
<td>(1.42)</td>
<td></td>
<td>(2.46)</td>
<td>(1.07)</td>
</tr>
<tr>
<td>DEVE</td>
<td>0.052</td>
<td>0.026</td>
<td>0.042</td>
</tr>
<tr>
<td>(0.63)</td>
<td></td>
<td>(0.37)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>CIRC</td>
<td>0.913*</td>
<td>0.850*</td>
<td>0.987*</td>
</tr>
<tr>
<td>(11.58)</td>
<td></td>
<td>(12.94)</td>
<td>(7.74)</td>
</tr>
<tr>
<td>DFOL</td>
<td>0.030</td>
<td>0.027</td>
<td>0.371*</td>
</tr>
<tr>
<td>(1.36)</td>
<td></td>
<td>(0.40)</td>
<td>(2.80)</td>
</tr>
<tr>
<td>DMONOP</td>
<td>-0.098</td>
<td>-0.041</td>
<td>-0.030</td>
</tr>
<tr>
<td>(1.22)</td>
<td></td>
<td>(0.60)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>DLOSS</td>
<td>-0.096</td>
<td>-0.185*</td>
<td>-0.291**</td>
</tr>
<tr>
<td>(1.21)</td>
<td></td>
<td>(2.80)</td>
<td>(2.26)</td>
</tr>
<tr>
<td>DWARF</td>
<td>-0.199**</td>
<td>-0.217*</td>
<td>-0.147</td>
</tr>
<tr>
<td>(1.96)</td>
<td></td>
<td>(2.56)</td>
<td>(0.89)</td>
</tr>
<tr>
<td>DSICK</td>
<td>0.138†</td>
<td>0.075</td>
<td>-0.053</td>
</tr>
<tr>
<td>(1.34)</td>
<td></td>
<td>(0.88)</td>
<td>(0.32)</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.575*</td>
<td>-4.815*</td>
<td>-3.601*</td>
</tr>
<tr>
<td>(9.42)</td>
<td></td>
<td>(11.92)</td>
<td>(4.58)</td>
</tr>
</tbody>
</table>

*t-statistics appear in parentheses below the regression coefficients. Levels of significance (one-tail tests except as noted in text) are: *, 1%; **, 5%; †, 10%.

Because formulations utilizing SHAREC and DFOL yield very similar results, Table 2 only shows the models employing DFOL. Following the functional form derived in Section II, all continuous variables were converted into logarithms and equations determining PADN, PADR, and PADC were estimated by the method of two-stage least squares. The basic results, appearing in Table 2, are somewhat mixed. The cost variables (LABOR, CCDENS, DEVE) are correctly signed except for LABOR in the equation for classified advertising, but their significance levels are quite low; it cannot be claimed that the components of incremental cost that underlie advertising line rates are accurately measured. Because it was believed that the labour-cost variable is quite an accurate measure of each newspaper’s actual costs, it was suspected that its failure throughout the model to control effectively for variable-cost differences may reflect the inclusion of significant rent components in wages. (See Wagner’s (1981) discussion of union power in newspapers.) Circulation (CIRC) is a highly significant variable, with line rates rising a bit less than proportionally with circulation.²⁴

DFOL, indicating a newspaper with a larger-share central-city rival, takes the positive coefficient which implies that followers charge higher prices—consistent with a differentiated-product seller facing the prospect of exiting. It is significant for classified advertising but not for national or retail advertising (in the appropriate two-tail test). If the equations in

²⁴The coefficients on CIRC of the national and classified advertising rates are not significantly less than unity, but that of the crucial retail advertising is less than one at the 5% confidence level in a two-tail test.
Table 2 are re-estimated with DFLOW replaced by SHAREC the same interpretation emerges: SHAREC's coefficient is negative, supporting a 'games of survival' interpretation, but is significant only for classified advertising rates. Of the other market-structure dummies, the coefficients of DLOSS confirm that newspapers which recently lost a competitor quoted line rates in 1980 that were below what their market structures otherwise indicated: DLOSS's coefficient is significant for retail and classified advertising. This finding is interesting in the context of DMONOP's coefficient, which fails to indicate that monopoly central-city papers charge higher advertising rates than those who retain one or more rivals. The lack of difference between monopoly and rival markets overall agrees with Ferguson (1983) but not with several other studies (Landon, 1971; Kerton, 1973; but compare Mathewson, 1972; Owen, 1983; Thompson, 1984; Simon, Primeaux and Rice, 1986). Newspapers engaged in widely noted warfare (DWARF) were charging significantly lower rates (except for classified advertising), and newspapers that later exited (or seemed likely to) were charging higher national and retail advertising rates (but not to a highly significant extent, and not for classified advertising).

The results do not indicate that games of survival were occurring in all rival central-city newspaper markets. However, the performance of DLOSS and DWARF implies that they do take place, as does DISICK's performance and the failure of DFOL (or SHARE) to indicate the alternative pattern of Cournot rivalry. These results must be strongly qualified by the lack of evidence that monopoly papers (in steady state) charge higher rates and the inability to secure good controls for differences in newspapers' variable costs. Significant relations were not obtained between advertising rates and numbers of radio or TV stations, although Ferguson (1983) did in a larger sample that included much smaller cities than in the present study.

Two more decision variables remain for analysis—the circulation price and the level of editorial quality. Little or nothing of the interim variation in circulation prices could be explained; a fact consistent with a theoretical consideration established in Section II. The optimized circulation price is set with regard not just to the incremental costs and demand elasticity for circulation, but also for the incremental advertising revenue that is obtainable when circulation increases; the available data are not rich enough to model that indirect connection properly. Furthermore, empirical evidence suggests that circulation prices are quite sticky and changed only infrequently (Merrilees, 1983), so that the variable cannot be assumed subject to continuous optimization. Therefore, we do not report the results in detail. The models that we estimated closely resembled those for advertising line rates except that total advertising lineage was included as an independent variable to capture costs associated with variations in the number of pages per copy. However, the theoretical model implies that the optimal circulation price need not increase with either this variable or total circulation, because of the interdependence between circulation and advertising revenue. In fact, neither variable has a significant influence on the circulation price. Only two robust influences on the circulation price were observed: evening newspapers charge less per copy (probably a reflection of demand elasticity), and duopolistic warfare (DWARF) did depress the circulation price.

Bucklin (1982, Chapter 4) developed a simple time-series analysis of selected newspaper markets for the period 1969-1980. Although it was seriously hampered by data limitations, it did yield the conclusion that a newspaper gaining market share tended to lower its national advertising rate per thousand circulation whereas papers losing share tended to raise theirs.
The model's final equation explains QUAL, the total number of editorial positions. The theoretical form of Equation 11b indicates that it should depend logarithmically on total revenue from circulation (REV) and factors determining the responsiveness of the quantity bought to editorial quality and to circulation price. The price-elasticity variables related to demand and competitive conditions are the same ones employed in Table 2 (determinants of advertising price). Variables determining the responsiveness of circulation to editorial quality are not easily devised, but a measure of the intensity of newspaper readership in the metropolitan area was employed, namely the total circulation of all daily newspapers divided by the number of households in the metropolitan area (PEN). SUBCON, the variable describing the extent of suburbanization and the concentration of suburban dailies was also used. LABOR is included as a cost-based determinant of editorial quality, with a negative coefficient expected. Taking logarithms of the continuous variables, estimation was by two-stage least squares. The following equation represents the results:

\[QUAL = 2.854 + 0.0299 \times REV - 0.059 \times SUBCON + 0.307 \times DMONOP + 0.247 \times DFOL - 0.221 \times DWARF - 0.062 \times DSICK + 0.148 \times DLOSS\]

The model reveals something about competitive influences, although it does not capture response elasticities well. REV behaves appropriately to normalize QUAL, but both PEN and LABOR proved entirely insignificant (they were dropped from this model). Central-city papers tend to reduce quality in the face of concentrated suburban competition, but the significance level of SUBCON's coefficient is low. Monopoly newspapers offer significantly higher editorial quality, perhaps reflecting the interaction of readers' positive preferences for quality with the fixed ('first copy') cost of providing editorial quality. Editorial quality tends to suffer in 'warfare' conditions, but (unlike advertising rates) it seems to be restored promptly after the loss of a competitor (perhaps an optimal response to capture readers loyal to the competitor). There is a weak tendency for 'sick' newspapers to sacrifice editorial quality, although followers in fact offer higher quality in markets that are rivalrous but not warring.

V. SUMMARY AND CONCLUSIONS

Central-city newspaper markets in the United States have trended rapidly toward monopoly status, not surprisingly in light of their cost and demand characteristics. In order to understand this process, we have modelled formally the optimizing decisions of the single newspaper, which sets three instruments (advertising and circulation prices, editorial quality) in selling to interrelated markets for circulation and advertising. We also showed that structural conditions in newspaper markets dispose them strongly toward yielding (in some states of nature) positive incentives for firms to undertake ruinous competition.

An econometric model was estimated of advertising and circulation demands and prices and editorial quality for a sample of 50 newspapers in 1980. The sample included both monopoly and rival markets. The model was designed both to test for the conditions

\(^{26}\)Other possible explanations come to mind, such as greater technical inefficiency and overstaffing in monopoly papers.
likely to make ruin a profitable option and to use extraneous information to determine whether it was in fact being pursued in some markets. The statistical results broadly confirm the hypothesis, revealing behaviour in some markets consistent with games of ruin occurring or having occurred. The evidence does not so much indict particular predators as it fails to reject the hypothesis that games of ruin were under way in some markets, and that some papers seemed to behave (the evidence is weak on this point) as if they were 'harvesting' in anticipation of their own exit or making the best of a rival's previous exit. Overall, Rosse's characterization of central-city newspapers as isolated competitors is supported, as is his diagnosis (Rosse, 1978) of the slide toward monopoly status.

Although the analysis yields no sharp recommendations for public policy, it does afford some guarded suggestions. Our results certainly support the general indications that the trend toward monopoly in US central-city newspaper markets is largely inevitable. Even the favourable trend in technology seems to have promoted suburban competitors more than it has mitigated the scale economies of central-city newspaper production. In this light, little can be said against joint operating agreements that preserve an independent editorial voice even if they do not preserve competition in advertising. Our statistical results identify no particularly large or deplorable differences between the behaviour of monopoly and duopoly sellers.

APPENDIX

Definitions and sources of variables used in statistical analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADN</td>
<td>Total number of lines of national advertising published by each newspaper during calendar 1980.</td>
<td>Annual survey of advertising lineage, <em>Editor and Publisher</em>, May 1981</td>
</tr>
<tr>
<td>ADR</td>
<td>Total number of lines of retail advertising published by each newspaper during calendar 1980.</td>
<td>See ADN</td>
</tr>
<tr>
<td>ADC</td>
<td>Total number of lines of classified advertising published by each newspaper during calendar 1980.</td>
<td>See ADN</td>
</tr>
<tr>
<td>CIRC</td>
<td>Weighted average of daily and Sunday circulation volume for each newspaper in September 1980.</td>
<td>Standard Rate and Data Service, <em>Newspaper Circulation Analysis</em> (Skokie, IL: Standard Rate and Data Service, September 1980)</td>
</tr>
<tr>
<td>PADN</td>
<td>List price per line quoted to national advertisers by each newspaper in September 1980.</td>
<td>See CIRC</td>
</tr>
<tr>
<td>PADC</td>
<td>List price per line quoted to classified advertisers by each newspaper at end of 1980.</td>
<td>Published line rates from each newspaper or direct telephone inquiry to each paper</td>
</tr>
<tr>
<td>Variable</td>
<td>Definition</td>
<td>Source</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>QUAL</strong></td>
<td>Total number of titled editorial positions at each newspaper, end of 1980.</td>
<td>Editor and Publisher, <em>Editor and Publisher International Yearbook</em>, 1981</td>
</tr>
<tr>
<td><strong>CCDEN</strong></td>
<td>Central city population divided by land area (square miles), 1980</td>
<td>US Bureau of the Census, <em>State and Metropolitan Area Data Book, 1982</em>, Tables A, B</td>
</tr>
<tr>
<td><strong>DFOL</strong></td>
<td>Dummy variable set equal to 1 for newspapers that faced rival central-city papers and did not have the largest circulation in September 1980, 0 otherwise.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>DMONOP</strong></td>
<td>Dummy variable set equal to 1 for newspapers that faced no central-city rivals in September 1980, 0 otherwise.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>SHARE</strong></td>
<td>Circulation of the newspaper divided by total circulation of all daily newspapers in the metropolitan area (including suburban).</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>HERFM</strong></td>
<td>Herfindahl concentration measure calculated over circulation shares of all daily newspapers in the metropolitan area, minus square of <strong>SHARE</strong>.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>SUBCON</strong></td>
<td>Combined shares of metropolitan-area daily newspaper circulation held by the largest two suburban daily papers, weighted by the fraction of metropolitan area population residing outside the central city.</td>
<td>See CIRC and <strong>CCDEN</strong></td>
</tr>
<tr>
<td><strong>DCMB</strong></td>
<td>Dummy variable set equal to 1 if the newspaper offered a combined advertising rate for morning and evening editions, 0 otherwise.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>PEN</strong></td>
<td>Percentage of households in the Area of Dominant Influence (ADI) subscribing to one or more daily newspapers. The ADI general coincides with the census definition of Standard Metropolitan Statistical Area, but is adjusted where necessary to reflect the reach of the central city’s television stations.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>INCOME</strong></td>
<td>Number of households in the Area of Dominant Influence (see <strong>PEN</strong>) multiplied by average household income.</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>TV</strong></td>
<td>Number of television stations serving the Area of Dominant Influence (see <strong>PEN</strong>).</td>
<td>See CIRC</td>
</tr>
<tr>
<td><strong>DSICK</strong></td>
<td>Dummy variable set equal to 1 for a newspaper that ceased publication between 1980 and 1985 or was reported to be running sustained losses, 0 otherwise.</td>
<td>Articles in <em>Editor and Publisher</em> and general business periodicals such as <em>Business Week, Wall Street Journal</em>.</td>
</tr>
<tr>
<td>Variable</td>
<td>Definition</td>
<td>Source</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
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</tr>
<tr>
<td>DWARF</td>
<td>Dummy variable set equal to 1 if trade press reported 'warfare' conditions among central-city newspapers in the metropolitan area during 1980.</td>
<td>See DSICK</td>
</tr>
<tr>
<td>DLOSS</td>
<td>Dummy variable set equal to 1 for metropolitan areas in which a central-city daily newspaper ceased publication during 1970–1980.</td>
<td>See CIRC</td>
</tr>
</tbody>
</table>

ACKNOWLEDGEMENTS

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Games of survival in the US newspaper industry


