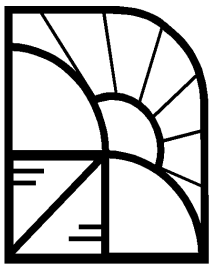

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Changing Industry Structure: The Economics of Entry and Price Competition

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Changing Industry Structure: The Economics of Entry and Price Competition*

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Abstract: The Telecommunications Act of 1996 (the "1996 Act"), by stressing the reduction or elimination of entry barriers that prevent the fragmentation of market structure and an increase in the number of competitors, established competition and deregulation as the foundation for public policy towards the telecommunications and commercial broadcasting industries. By lowering barriers to entry, telecommunications markets should be expected to grow as new firms expand industry capacity and broaden the scope of consumer choice. Presumably, market concentration will decline as entry continues, eventually producing sufficient fragmentation that competitive rivalry will obviate the continuing need for regulation. Suppose, however, that the ongoing process of competitive entry becomes truncated and market concentration fails to continue falling even if market size continues to grow so that concentration appears to reach a lower bound. There is some evidence suggesting that such a lower bound may, in fact, exist in local telecommunications markets, notwithstanding the statutory provisions of the 1996 Act reducing barriers to entry. This Policy Paper draws from the

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analyses of competition developed over the last decade or so that offers new insights about the market size-market concentration relationship. The Policy Paper proposes that this new economic thinking is directly applicable to understanding the evolution of entry and competition in telecommunications markets and the growing concentration in commercial broadcasting markets following adoption of the 1996 Act. Moreover, this new economic thinking, unlike the more standard analyses of market structure and competition, provides guidance for public policy towards both telecommunications and broadcast markets.

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I. Introduction

The Telecommunications Act of 1996 (the "1996 Act") established competition and deregulation as the foundation for public policy towards the telecommunications and commercial broadcasting industries.[1] Although the Federal Communications Commission ("FCC") had opened monopoly telecommunications markets to entry for more than twenty years prior to the adoption of the 1996 Act, the Communications Act of 1934, which the 1996 Act

1 Pub. L. No. 104-104, 110 Stat. 56 (1996).

amended, still reflected a presumption that telecommunications markets were monopolies subject to regulation by both the FCC and state public utility commissions, and commercial radio and television broadcasting markets, while not monopolies, would be subject to strict entry and ownership regulation. The 1996 Act eliminated legal barriers to entry in local telecommunications and cable television markets and envisioned local telephone companies entering cable television markets and vice versa. At the same time, broadcast ownership restrictions were relaxed to permit radio and television broadcasters to own more stations in local markets to realize the economies of scale and scope of larger broadcasting firms.

While encouraging entry and the development of competition, the 1996 Act did not articulate an explicit model of competition as the conceptual foundation of its pro-competition and deregulation goals. From the many provisions of the 1996 Act intended to implement its pro-competition purposes, it is possible to impute, however, some vision of competition that animates the 1996 Act. In general, the 1996 Act appears to invoke a view of competition that resembles Bain's structure-performance paradigm.[2] The 1996 Act stresses the reduction or elimination of entry barriers that prevent the fragmentation of market structure and an increase in the number of competitors. Beyond eliminating legal barriers to entry, the 1996 Act requires, among other things, incumbent local exchange carriers (local telephone companies) to unbundle various components of their local networks and make them available to potential competitors. Such unbundling requires, in effect, that incumbent local exchange carriers "share" with their competitors the inherent economies of scale built into their ubiquitous local networks. Bain considered economies of scale, along with advertising and expenditures on research and development (R&D), as barriers to entry that protect incumbent firms from the rivalry that additional firms in the market would provide. Policies to reduce or otherwise ameliorate the effects of such barriers would be consistent with Bain's views on how to strengthen competitive rivalry and improve market performance.

Although Bain's structure-performance paradigm provided the foundation for a generation of empirical industry studies in industrial organization, its limitations both conceptually and empirically are now widely recognized.[3] In

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[2] Joe S. Bain, *Barriers to New Competition* (Cambridge, MA: Harvard University Press, 1956).

[3] See, for example, the discussion provided by Stephen Martin, *Advanced Industrial Economics* (Cambridge, MA: Blackwell Publishers, Inc., 1993), Chapter 16.

particular, the structure-performance paradigm does not calibrate with much precision the relationship between market size and market concentration beyond the simple intuition that market concentration should decline as market size increases. Understanding this relationship with greater specificity is critical, however, in evaluating the success of the 1996 Act. By lowering barriers to entry, telecommunications markets should be expected to grow as new firms expand industry capacity and broaden the scope of consumer choice. Presumably, market concentration will decline monotonically as entry continues, eventually producing sufficient fragmentation that competitive rivalry will obviate the continuing need for regulation by the FCC and state public utility commissions.[4]

Suppose, however, that the ongoing process of competitive entry becomes truncated and market concentration fails to continue falling *even if* market size continues to grow. In other words, market concentration appears to reach a *lower bound,* despite continuing growth in the size of the market. There is some evidence suggesting that such a lower bound may, in fact, exist in local telecommunications markets, notwithstanding the statutory provisions of the 1996 Act reducing barriers to entry. Whether or not legislative change or long term regulatory intervention rather than deregulation is appropriate depends on whether the apparent lower bound on market concentration is only transitory or whether the lower bound reflects economic and technological constraints that continuing growth in market size will *not* affect. Clearly, Bain's structure-performance paradigm as embodied in the 1996 Act does not provide an obvious answer to this critical question.

Fortunately, analyses of competition developed over the last decade or so offer new insights about the market size-market concentration relationship. This paper proposes that this new economic thinking is directly applicable to understanding the evolution of entry and competition in telecommunications markets and the growing concentration in commercial broadcasting markets following adoption of the 1996 Act.[5] Moreover, this new economic thinking,

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[4] In other words, given existing barriers to entry, growth in the size of the market increases the profitability of incumbents which induces the entry of new firms that find it profitable to overcome the entry barriers. The resulting entry decreases the level of market concentration.

[5] This paper is influenced by the pioneering work of John Sutton and relies on Sutton's general conceptual framework for its theoretical orientation. Sutton, however, does not study either telecommunications or broadcasting industries in his published work. See John Sutton, *Sunk Costs and Market Structure* (Cambridge, MA: The MIT Press, 1996).

unlike the structure-performance paradigm implicit in the 1996 Act, provides guidance for public policy towards both telecommunications and broadcast markets.

II. Two-Stage Model of Oligopolistic Competition

The typical analysis of competition in communications markets, at least those prevalent in the academic and regulatory arenas, evaluates the prices and profits of firms given some fixed number of rivals or assuming that entry and exit are costless. Entry, if considered at all, is handled informally or is treated as exogenous to, or independent of, the nature and extent of price competition. In this paper, the analysis is extended into a two-stage game of competition, where the entry decision is treated formally. The multistage game of competition is an important economic tool for understanding competition in communications markets and, importantly, improving competition policy. Indeed, modern competition policy in the communications industries is more about changing industry structure than it is about price competition. Indeed, the intensity of price competition cannot be regulated. Price competition is, at best, an indirect consequence of policies that increase or decrease the number of rival firms or other structural characteristics of markets.[6] When monopoly is the status-quo in so many communications markets, a change in industry structure requires entry. Policy analyses, therefore, must focus on the entry process and the influence of price competition on that process.

In order to capture both the entry decision of firms and the intensity of price competition following entry, the model of competition presented here is formulated as a two-stage game.[7] At the first stage, each of a number of potential firms decides whether or not to enter the market. Entry may require *set-up costs* that are sunk costs. Entry into telecommunications markets typically requires sunk set-up costs, such as building a telecommunications network and the acquisition of customers through advertising. Although the precise extent of the sunkeness of an investment cannot be determined *ex ante*, it is likely that a non-trivial proportion of the investment in network switches, transmission facilities,

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[6] By reducing the sunk costs of entry, a market may become more contestable so that prices fall without entry. See William J. Baumol, John C. Panzar & Robert D. Willig, *Contestable Markets and The Theory of Industry Structure*, Revised edition, New York: Harcourt Brace Jovanovich (1982), p. 290.

[7] The model of oligopolistic competition is general and applicable to any industry.

marketing, and even the lobbying of regulatory and legislative bodies will be sunk, since it is difficult or impossible to redeploy such assets to purposes other than those initially intended. At the second stage of the game, those firms that have entered engage in price competition.

For analytical convenience, this model of competition assumes homogeneous products and identical firms.[8] As in common in two-stage games of this type, the equilibrium of the second stage is determined first, because the entry decision of Stage 1 depends critically on the profitability of the firm in Stage 2. Therefore, the determination of profitability, at least generically, is necessary to evaluate the entry decision.

A. *Stage 2: Price Competition*

Let the demand curve be $Q = S/p$ where Q measures the quantity demanded of a particular communications service which for present purposes is assumed to be homogeneous; p measures the unit price of the product or service; and S measures total consumer expenditure on a product or service at a specific time and is *independent* of market price.[9] S also provides a measure of *market size* and quantity demanded for the market is simply $Q = \Sigma q_i = q_i \cdot N$, where N is the number of firms. Since this market demand function has a constant, unit own-price elasticity (the demand curve is isoelastic), it can be shown that the profit-maximizing monopoly price approaches infinity for any marginal cost greater than zero. For analytical convenience, it is assumed that sales fall to zero above some cut-off price p_m. Thus, p_m corresponds to the profit-maximizing monopoly price.[10]

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[8] Economic models of oligopolistic competition often contain many simplifying assumption in order to make the analysis mathematically tractable. As a result, the complex and multifaceted nature of rivalry in actual markets does not easily conform to modern models of oligopolistic competition. The models offer insights on how *specific* characteristics of competition, such as nature of demand, supply, and information, will affect the properties of the equilibria. No *single* model can analyze all the relevant features of oligopolistic competition.

[9] This specification of demand is derived from a linear utility function. Market size, S, depends only on the sum of personal incomes. *See* Sutton (1991), p. 32.

[10] For the isoelastic demand curve, sales are positive regardless of price so that the monopoly price is undefined.

Suppose N facilities-based carriers decide to enter the market in State 1 of the game. The profit function of a representative firm i in Stage 2 of the game is given by

$$\pi_i = (p(Q) - c)q_i \tag{1}$$

where q_i is firm i's level of output and p is market price, which is a function of total market output $\{p = p(Q)\}$, and c is marginal cost. Differentiating equation (1) with respect to q_i produces the first-order condition for firm i:

$$\frac{d\pi_i}{dq_i} = p + q_i \frac{dp}{dQ}\frac{dQ}{dq_i} - c = 0 \tag{2}$$

where marginal cost is assumed constant across all output levels.[11] For reasons illustrated shortly, let the conjectural variation term, dQ/dq_i, equal ϕ (where $\phi \geq 0$).[12] The conjectural variation term measures firm i's guess regarding how other firms will react to its output changes and is a critical assumption in models of oligopolistic competition. Setting $q_i = q$ for all i (all firms are identical), equation (2) can be solved for the conjectural variation equilibrium price:

$$p = c\left\{\frac{N}{N - \phi}\right\} \tag{3}$$

unless equation (3) exceeds p_m, the price at which sales become zero, in which case $p = p_m$ (the monopoly price). Consistent with the typical expectations of increases in the number of competing firms, equation (3) shows that for any given $\phi > 0$, increases in the number of firms reduces price. In the limit, price approach marginal cost as the number of firms increases.

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[11] The assumption is made that all the relevant second order conditions are appropriately signed.

[12] The more traditional manner by which to describe the conjectural variation term is $dQ/dq = dq/dq + dQ/dq = 1 + \lambda$ (Michael Waterson, *Economic Theory of the Industry*, Cambridge: Cambridge University Press, 1984, p. 18). For convenience, the term $1 + \lambda$ is written as ϕ.

Different oligopoly theories can be viewed as assuming different conjectures about ϕ.[13] Two benchmark cases are widely used to forecast pricing behavior in oligopolistic markets, namely, (1) *Cournot competition in quantities*; and (2) *Bertrand competition in prices*. In the Cournot model, rival firms choose the quantity they wish to offer for sale. Each firm maximizes profit on the assumption that the quantity produced by its rivals is not affected by its own output decisions. In other words, the conjectural variation of the Cournot firm is equal to one ($\phi = 1$) so that $p = c\{N/(N - 1)\}$. Note that Equation (3) is a Cournot Nash Equilibrium for $\phi = 1$. With Cournot competition, price approaches marginal cost as the number of rivals increases ($p \rightarrow c$ as $N \rightarrow \infty$). Competition analysis by virtually every regulatory, antitrust, and policymaking body is firmly rooted in the Cournot perspective.[14] For example, the Herfindahl-Hirschman Index Index, used by antitrust authorities in the United States, is derived from the Cournot model of competition.[15]

Alternatively, the Bertrand model of price competition hypothesizes that rivals choose their output price to maximize profit, taking the output prices set by their competitors as given. Since the output of Bertrand firms is homogeneous, each firm has an incentive to undercut its rival's price and capture the entire market. As a result, Bertrand competition results in an equilibrium where output price equals marginal cost with only two firms. For Bertrand competition, if $\phi = 0$ so that $p = c$ for any number of firms exceeding one.[16]

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[13] *Id.* p. 18.

[14] In the Cournot model, rival firms choose the quantity they wish to offer for sale. Each firm maximizes profit on the assumption that the quantity produced by its rivals is not affected by its own output decisions. In other words, the conjectural valuation of the Cournot firm is equal to one. The Cournot equilibrium asserts that prices and quantities approach competitive levels as the number of firms supplying the market increase.

[15] Martin (1993), Ch. 19.

[16] Several characteristics of communications markets make the distinction between Cournot- and Bertrand-type competition less fundamental. For instance, the decision to enter a market may require investing in plant of a given capacity. This capacity decision may be viewed as a commitment to produce a level of output equal to the output capacity of the plant. Indeed, recent formulations of oligopoly models show that when firms must first choose capacity plant size, the equilibrium of Bertrand competition in prices is identical to that of the simple Cournot model. See D. Kreps & J. Scheinkman, Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes. 14 Bell J. Econ. 326 (1983). Note that the Cournot outcome of the two-stage capacity game of oligopolistic pricing is not robust when excess capacity exists. Given the lumpiness and

(Footnote Continued. . . .)

Both Cournot competition in quantities and Bertrand competition in prices assume that all rivals make their pricing and output decisions non-collusively. In other words, both types of competition assume that rivals are aware of the pricing and output decisions of their competitors, but there is neither implicit nor explicit cooperation among competitors in making such decisions. It remains possible, however, that following market entry, rivals may adopt a tacit collusion pricing strategy to maximize joint profits in the second stage of the game. The game-theoretic basis for this outcome is a repeated game, or supergame, that replaces the one-shot concept of the second stage of the game with an infinite-horizon dynamic game. Without considering the formal structure and logic of such a game, the result of this repeated game is that the industry price is equal to the monopoly price and joint profits are maximized. In our general specification of industry price, collusion is indicated by values of ϕ in excess of one.[17] Generally, ϕ can be viewed as a measure of the weakness of price competition with higher values of ϕ indicating less intense price competition.[18] Figure 1 illustrates the relationship between price and ϕ.

long life of a telecommunications facilities as well as the nontrivial potential for partial network failure, the total capacity of existing network may well exceed its utilization in the short term. The telecommunications carrier, however, will not likely view its maximum network capacity as the relevant index of its contribution to satisfying market demand.

17 The maximum of ϕ is equal to the value producing price p_m, the monopoly price.

18 Equation (3) could be written as $p = m \cdot c$, where m is the markup rule equal to $\{N/(N - \phi) > 0\}$. Note that an increase in the number of firms decreases m ($dm/dN < 0$) and decreases in the intensity of price competition increases m ($dm/d\phi > 0$).

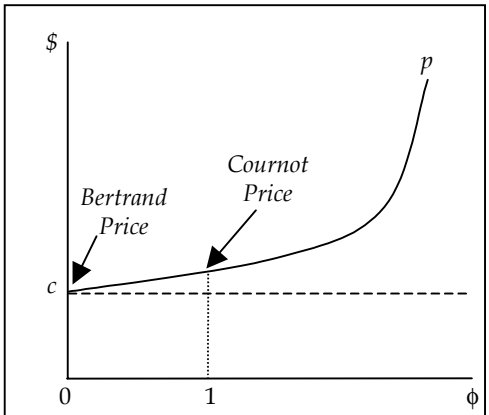

Figure 1. Equilibrium Price and the Intensity of Price Competition

At equilibrium market price p, equilibrium output per firm is $q_i = S/Np$. Firm i's profit, therefore, is

$$\pi_i = \frac{\phi S}{N^2}. \tag{4}$$

Assuming S or market size is constant, profits realized are clearly dependent on the number of competitors, N, that enter the market and the intensity of price competition (ϕ). For a fixed level of the intensity of price competition, equation (4) shows that as the number of firms increases, the equilibrium level of profit approaches zero. Alternatively, holding N constant, an increase in the market size, S, will tend to increase the equilibrium level of profits. As expected, the more intense is price competition (the lower is ϕ), other things constant, the lower is firm profit. Note that the intensity of price competition can be viewed as scaling market size, with more price competition being (mathematically) equivalent to a smaller market size.[19]

[19] A smaller market size is not based on lower prices, because the demand elasticity is assumed to be one. Market size is unchanged by price.

A. *Stage 1: Entry and Equilibrium Concentration*

Given an expression for the profitability in equation (4), the two-stage game may be stated more formally. The entrant's *strategy* in the game takes one of two forms: (1) do not enter; or (2) enter and set *output* at the second stage of the game as a function of the number of firms that enter the market at the first stage. The entrant's *payoff* is either zero (if the firm chooses *not* to enter), or else it is equal to the profit earned at the second stage of the game. Given the entry decisions of other firms, firm i incurs sunk cost κ in stage 1 upon entry. The net profit of firm i is

$$\{\phi S/(M+1)^2\} - \kappa \tag{5}$$

where M is the number of other firms choosing to enter. Entry is profitable if the expression in equation (5) is positive. Entry continues in Stage 1 of the game until profits just equal the sunk cost of entry, so that the number of firms in equilibrium is the integer part of

$$N^* = \sqrt{\frac{\phi S}{\kappa}} \tag{6}$$

where N^* is the equilibrium number of firms in the industry and $1/N^*$ is the equilibrium level of concentration. Because we have assumed all firms are identical, $1/N^*$ also is equal to the Herfindahl-Hirschman Index. Note that the equilibrium number of firms N^* is expressed as a function of market size (S), the level of sunk entry costs (κ), and the intensity of price competition (ϕ). In the Cournot case, $\phi = 1$ and $N^* = \sqrt{S/\kappa}$.

Alternately, Bertrand competitors will force price down to marginal cost so that each firm realizes a loss equal to the sunk investment in set-up costs, κ. If, however, only one firm enters the market, it will set a profit-maximizing monopoly price in the second stage of the game, assuming that the level of monopoly profit actually realized is at least as large as the set-up cost, κ. Thus, at the entry stage of the game, the optimal response by a Bertrand competitor to the entry decisions of its rivals is to enter the market if and only if no other rival also enters. Bertrand price competition implies, therefore, that only one firm enters the market in the first stage of the game and sets a profit-maximizing monopoly price in the second stage, so long as set-up costs are greater than zero. Thus, for Bertrand competition, $\phi = 0$ and $N^* = 1$ (by definition). In other words, with sunk

entry costs, monopoly is the consequence of intense (Bertrand) price competition in Stage 2.

1. *Entry Costs*

Equation (6) shows that the number of firms in equilibrium is inversely related to the level of set-up cost, κ. If set-up costs are trivial, the number of firms in equilibrium will be arbitrarily large and the equilibrium level of profit will approach zero. The relationship between equilibrium industry concentration and set-up costs is illustrated in Figure 2. In the figure, equilibrium industry concentration is measured along the vertical axis and the level of entry costs along the horizontal axis. As sunk costs rise (κ increase), equilibrium industry concentration approaches monopoly ($N^* = 1$).

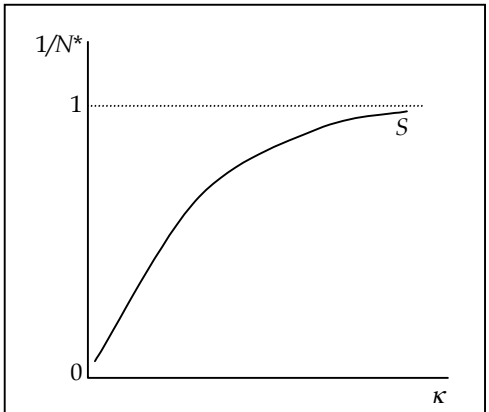

Figure 2. Sunk Costs and Concentration

The implication of the two-stage game for communications markets characterized by significant sunk costs is that the equilibrium market structure will always be relatively concentrated compared to industries where entry does not require substantial set-up costs.[20] The relationship between the number of firms and market power, where market power is defined as the ability of firms to

[20] For a thorough theoretical analysis of equilibrium market structure, *see* William J. Baumol and Dietrich Fischer, *Cost-Minimizing Number of Firms and Determination of Industry Structure*, 92 Q. J. ECON. 439-67 (1978).

price above marginal cost, implies that that some communications firms will now, and in the future, possess some degree of market power.

Another important implication of the two-stage game is that regulation can influence industry structure by altering the level of sunk entry costs. Unbundling of network elements, for example, reduces the sunk costs of entry by allowing entrants to provide services without duplicating the entire local distribution network of the incumbent monopolists. The impact of unbundling requirements, by reducing sunk entry costs, will be to lower industry concentration. Regulation also can increase sunk entry costs and, as a consequence, increase equilibrium industry concentration. An example is provided later in this paper.

2. *Market Size*

An *increase* in the size of the market, *S*, relative to the level of set-up costs would result in a less concentrated (or more fragmented) market structure. The relationship between market size and concentration is illustrated in Figure 3.

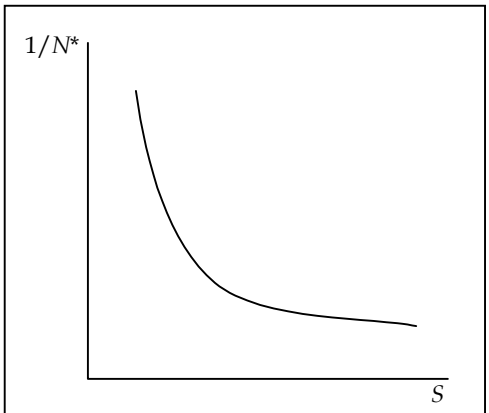

Figure 3. Equilibrium Industry Structure and Market Size

As discussed in the previous section, regulation can increase (decrease) the sunk cost of entry, thus increasing (decreasing) industry concentration. Likewise, regulation can alter industry concentration by altering market size. In the U.S. domestic local exchange market, for example, the Federal Communications

Commission does not require ILECs to provide unbundled local switching for small business customers with more than three access lines.[21] The lack of access to unbundled switching limits the ability of potential entrants to serve this particular (and related) local exchange markets and customers, shrinking the available market and increasing concentration. The consequence of such restrictions is to raise industry concentration unless acceptable alternatives to unbundled switching are available in these markets and for these particular customers. Restricted access to voice mail and operator services as an unbundled element may have similar effects on industry structure. Thus, it is important for regulators to confirm that alternate suppliers of particular services exist and are capable of providing such services to competitive local exchange carriers before removing a service from the list of unbundled elements.

3. *Price Competition*

Within the context of the two-stage game with sunk entry costs, the more intense is price competition the higher is industry concentration. The relationship between the intensity of price competition and industry concentration is illustrated in Figure 4. In Figure 4, the intensity of price competition is measured along the horizontal axis, with the intensity of price competition declining at larger values of ϕ. With Bertrand competition, $\phi = 0$, the equilibrium industry structure is monopoly ($N = 1$). If price competition weakens, then for any given market size S the equilibrium industry structure is lower.

[21] Federal Communications Commission, *Third Report and Order and Fourth Further Notice of Proposed Rulemaking,* CC Docket No. 96-98 (FCC 99-238), September 15, 1999.

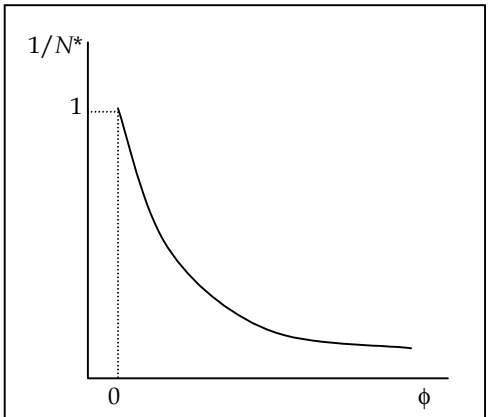

Figure 4. Equilibrium Industry Structure and the Intensity of Price Competition

The paradox between the conclusions of the two-stage game and more traditional views of competition is as apparent as it is important. The typical view of competition has price competition increasing with declines in industry concentration. In other words, the more firms in a market, the more "competitive" that market is. This more traditional view of the relationship between concentration and price competition is the core of competition analysis for both regulatory and antitrust agencies. The two-stage game, alternately, shows that high concentration can be the result of intense price competition. Thus, perhaps the most important insight from the two-stage game is that it exposes the limitations of applying traditional competition analysis to the communications industries, or any market for which sunk costs are an important element of the cost structure of firms.

III. An Analysis of Endogenous Sunk Costs

Equation (6) shows that the equilibrium number of firms in an industry, or inversely, the equilibrium level of concentration depends on the extent of sunk set-up costs together with the intensity of price competition and size of the market. Critical differences in the nature of sunk costs can affect the relationship between sunk costs and market concentration shown in Figure 2. More specifically, sunk costs may be classified as either exogenous or endogenous. Exogenous sunk costs refer to a firm's irreversible investments in productive capacity. Ordinarily, the fixed outlays required to construct a single plant of minimum efficient scale and establishing a product line may be viewed as exogenous sunk set-up costs, since the nature of technology more than the firm's

discretionary decision-making behavior drives the investment decision. Some aspects of regulation, such as licensing requirements or compliance with uniform technical standards and other rules, may be viewed as exogenous sunk costs of entering a regulated industry.

Endogenous sunk costs ordinarily refer to expenditures, such as advertising and research and development (R&D), where the firm retains substantial discretion in deciding the optimal level of outlays. Similar to exogenous sunk costs, endogenous sunk costs, once made, are irreversible. In terms of Sutton's framework, endogenous sunk costs are intended to enhance the consumer's willingness to pay for the firm's output. Thus, R&D spending may result in improvements in the quality of the firm's output; advertising expenditures inform consumers of the quality improvements or enhance the consumer's perception of product quality such that consumer willingness to pay is increased. A consequence of such endogenous expenditures is that the firm's products are differentiated from those of the firm's competitors in terms of actual or perceived quality differences.

The distinction between exogenous and endogenous sunk costs recasts Bain's barriers to entry, namely, economies of scale, advertising, and R&D, into a very different perspective. To the extent that economies of scale largely mirror the technology of production, then investment in a plant of minimum efficient scale is exogenous. Moreover, as market size increases relative to the magnitude of exogenous sunk costs, market concentration may be expected to decline. Bain's advertising and R&D barriers to entry represent, however, endogenous sunk costs that may have a very different long-term effect on market concentration. More specifically, as endogenous sunk costs begin to dominate over exogenous sunk costs, the monotonic, inverse relationship between market size and concentration is broken such that further market growth may actually result in increasing concentration. Thus, the effects of Bain's barriers to entry on equilibrium market structure will differ profoundly as market size varies. As a result, the intuitive expectation that market growth through time will tend to diminish the entry-deterring effects of Bain's barriers becomes questionable as a general policy presumption.

In terms of Sutton's game-theoretic perspective, expenditures that improve product quality and, hence, the consumers' willingness to pay constitute endogenous sunk costs. More generally, the extent of vertical differentiation, or quality, may be represented by u. The functional relationship linking the level of u to sunk expenditures intended to enhance perceived product or service quality is represented by $A(u)$. The cost represented by $A(u)$ is fixed, because it is independent of the level of output produced.

Introducing the function $A(u)$ facilitates an important analytical distinction between exogenous sunk set-up costs, κ, and the endogenous sunk costs of improving quality. With this distinction established, the two-stage game may be modified to include an intermediate stage between the first and second stages. In this more complex model, N firms enter at the first stage of the game with each incurring a set-up cost equal to κ. At the new second stage, the N firms choose optimal values for u, which, in turn, determines the fixed cost $A(u)$. This fixed cost is also sunk, since it is incurred at the second stage and is irrecoverable at the last stage. Finally, the N firms engage in price competition, taking the optimal value of u as fixed. This more complex game specifies the total fixed and sunk costs for a given firm as the expression

$$F(u) = \kappa + A(u) \tag{7}$$

where $A(u)$ may be given a specific parametric structure reflecting empirical knowledge about the effectiveness of expenditures on u to influence the consumer's willingness to pay.

If spending on quality effectively increases the consumer's willingness to pay, then firms may be expected to compete on the basis of quality. Such competition will tend to raise the total fixed and sunk costs, i.e., $\kappa + A(u)$, required to enter and compete successfully in a market. The effect of this increase in sunk costs is that there will not be room within a given market for more firms as market size increases. As a result, the monotonic relationship between a reduction in concentration as market size increases as shown in Figure 3 is effectively broken. Thus, the emergence of non-price competition in the form of vertical product differentiation may actually halt a decline in concentration as market size increases and may even foster greater concentration.

The extent that endogenous sunk costs may lead to greater concentration even as market size increases depends critically on the responsiveness of $A(u)$ to increases in u. Sutton specifies the functional form

$$A(u) = \frac{\alpha}{\gamma}(u^{\gamma} - 1) \tag{8}$$

where $u \geq 1$.[22] Sutton shows that specification of $A(u)$ embodies the assumption that increases in endogenous sunk costs will increase the consumer's willingness to pay, but such expenditures will reflect diminishing returns and the absence of threshold effects, i.e., the possibility that some minimal expenditures on quality are required before an effect on enhanced willingness to pay is observed. Within the current context, α is a parameter representing the unit cost of an increment of quality, and γ is a parameter governing how rapidly diminishing returns occurs as a result of increases in endogenous sunk costs. Higher values of γ imply a more rapid onset of diminishing returns.

Given the specific functional form in equation (8), equation (7) may be rewritten as

$$F(u) = \kappa + \frac{\alpha}{\gamma}(u^{\gamma} - 1) \tag{9}$$

A useful relationship for understanding the effects of endogenous sunk cost on concentration is the sensitivity of total fixed outlays, $F(u)$, with respect to changes in u. This relationship is precisely defined by the elasticity

$$\frac{u}{F}\frac{dF}{du} = \gamma\left\{1 - \frac{\kappa - \alpha/\gamma}{F}\right\} \tag{10}$$

As $u \to \infty$, then $F(u) \to \infty$, and $(\kappa - \alpha/\gamma)F \to 0$.[23] Consequently, $(u/F)(dF/du)$ will tend toward γ in the limit, and is independent of both κ and α. For values of u and $F(u)$ less than infinity, the elasticity assumes values either greater or lesser than γ as follows:

$$\frac{u}{F}\frac{dF}{du} > \gamma \quad \text{if} \quad \kappa < \frac{\alpha}{\gamma} \tag{11}$$

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[22] Sutton (1991), p. 52.

[23] *Id.*

$$\frac{u}{F}\frac{dF}{du} < \gamma \quad \text{if} \quad \kappa > \frac{\alpha}{\gamma} \tag{12}$$

$$\frac{u}{F}\frac{dF}{du} \text{ is constant for all } \kappa = \frac{\alpha}{\gamma} \tag{13}$$

The formal development of the logic of a three-stage Cournot game is too complex to summarize here.[24] It is possible, however, to summarize the major implications that result from incorporating endogenous sunk costs into the two-stage game. The major implication affects the relationship between market size, S, and market structure measured by the level of concentration, $1/N$. Figure 5 shows how the predicted relationship between S and $1/N$ is affected by the recognition of endogenous sunk costs (assuming $\phi = 1$). The effect of different values of set-up costs κ on the market structure-market size curves is illustrated by the multiple curves labeled κ_1, κ_2, and so forth, where $\kappa_1 > \kappa_2 > \ldots > \kappa_5$. Clearly, decreases in the size of set-up costs shift the market structure-market size curve to the left and downward. Thus, reductions in set-up cost reduce concentration for any given market size, all other things remaining constant.

[24] The model is fully developed in *id.*, Chapter 3.

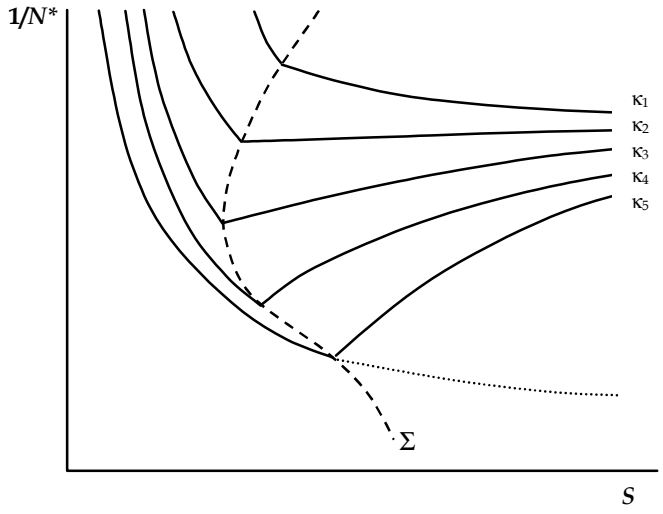

Figure 5. Concentration and Market Size for Different Setup Costs

The major difference between the more complex game and the simpler two-stage game is that increases in market size do not lead to a continuing fall in the level of concentration. The curve labeled κ_5 extended by the broken or dotted line represents the market structure-market size relationship implied by the two-stage game shown in Figure 3. The curve shows the monotonic relationship whereby concentration falls continuously as market size increases. The locus of points traced out by the curve labeled Σ shows, however, the points of discontinuity in the relationship implied by the three-stage game. Thus, concentration falls as market size increases up to the point of discontinuity. At the point of discontinuity, the rate of decline in concentration will tend to slow up if set-up costs are large, such as κ_1. Alternatively, concentration may actually begin to increase at the point of discontinuity if set-up costs are smaller than κ_1, such as κ_3, κ_4, or κ_5.

More specifically, the line labeled Σ defines two distinct regimes regarding the concentration-market size relationship. To the left of Σ defines the regime where $\kappa > \alpha/\gamma$, and concentration falls monotonically as market size increases. In this regime, sunk set-up costs predominate over endogenous sunk costs in determining how many firms can operate profitably in a given market. To the right of Σ, endogenous sunk costs predominate over sunk set-up costs in determining concentration. The special case where $\kappa = \alpha/\gamma$ is represented by the curve labeled κ_2 in Figure 5. In this case, an increase in market size beyond the point of discontinuity has no effect on concentration. Thus, this curve may be

viewed as a lower bound on the extent of concentration. Finally, if $\kappa < \alpha/\gamma$ as represented by the curves labeled κ_3, κ_4, and κ_5 in Figure 5, then an increase in market size actually increases market concentration.

The case where $\kappa < \alpha/\gamma$ deserves emphasis. Once the point of discontinuity is reached, the endogenous sunk costs of vertical product differentiation become large relative to set-up costs. Thus, competition in quality enhances the dominance of the few firms that survive this type of competitive rivalry.

The curves shown in Figure 5 represent a particular parametric structure of the underlying three-stage game. While showing the interrelationship of set-up costs, concentration, and market size, it may obscure the essential difference between the two-stage and three-stage games. Figure 6 summarizes the key distinctions. The broken or dotted curve in Figure 6 corresponds to the market structure-market size curve, assuming Cournot competition in the second-stage of the game. This curve assumes that all firms produce a homogenous product or service. By contrast, the solid curve is a simplified characterization of the family of curves shown in Figure 5. This curve assumes that entrants vertically differentiate their output quality or otherwise attempt to influence the willingness to pay of their consumers.

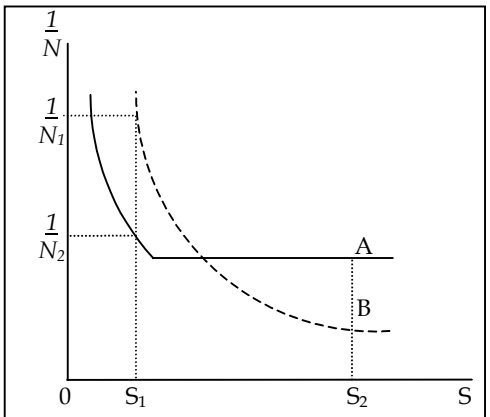

Figure 6. Market Structure-Market Size Relationship with Homogenous Output and Vertical Product Differentiation

Figure 6 highlights two inferences concerning the effects of product differentiation. First, product differentiation encourages entry, since it may create new product niches for potential entrants. This effect is shown in Figure 6 by the leftward shift of the solid curve relative to the broken curve that assumes

product homogeneity. Thus, at market size represented by S_1, concentration is less at point $(1/N)_0$ read from the curve reflecting product differentiation compared to point $(1/N)_1$ read from the curve reflecting homogenous output. Second, product differentiation enhances the effectiveness of expenditures intended to influence the willingness to pay of consumers at some critical market size. Therefore, at market size S_2 in Figure 6, the market is more concentrated, because point A along the curve reflecting product differentiation corresponds to a larger value of $(1/N)$ compared to point B along the curve reflecting homogeneous output.

IV. Applications

In this section, some applications of the multi-stage models to the communications industries are provided. These applications are not intended to be a thorough, empirical analysis of sunk costs and industry structure in the communications industries. Rather, the brief case studies illustrate how multi-stage models of competition (that formally consider the entry process) might be applied in an analysis of competition and industry structure in communications markets.

A. *The U.S. Domestic Long Distance Industry*

The history of relatively high concentration in the United States long distance telecommunications industry, a market that is very large in terms of expenditures (about $99 billion in 1999), is an excellent illustration of the applicability of the multistage game of competition.[25] In 1984, AT&T dominated the long distance industry with a market share of 90.1 percent. Over the next 15 years, AT&T's market share would fall to 40.7 percent. MCI-WorldCom and Sprint hold the bulk of the non-AT&T market share. The three largest firms had a combined market share of 74 percent at the end of 1999. The HHI in the long distance industry in 1999 was 2,314, falling from 8,145 in 1984. While this decline in industry concentration was precipitous, the HHI remains relatively high with a numbers equivalent (equal to 1/HHI) of 4 firms.[26] In fact, the U.S. domestic

[25] *Trends in Telephone Service*, Industry Analysis Division, Federal Communications Commission (December 2000).

[26] Interestingly, industry concentration in the fiber capacity market (for U.S. interexchange carriers) changed little between 1985 and 1997, falling from 2262 to 2228 (Jonathan M. Kraushaar, *Fiber Deployment Update Report: End of Year 1998*, Federal Communications Commission, Industry Analysis Division, Table 12).

long distance industry remains so concentrated that in the summer of 2000, the proposed merger of MCI-WorldCom and Sprint was abandoned due to the challenge of the merger by antitrust authorities.

Under the typical, single stage analysis of competition, the degree of competition is often inferred from the level of industry concentration, where higher levels of concentration indicate the presence of market power. In the two-stage game presented above, the simple relationship between market power and industry concentration is broken. The presence or persistence of high concentration in a market, such as the long distance industry, can be the result of high sunk costs, intense price competition, or some combination of both. High industry concentration, therefore, does not necessarily imply weak price competition. Within the context of the two-stage (or three) stage game, high industry concentration can be the result of intense price competition.

Relatively high concentration in the long distance industry most likely is driven by a combination of intense price competition, exogenous and endogenous sunk costs. Recent empirical analysis finds that the industry is intensely price competitive.[27] The exogenous sunk costs of constructing a nationwide long distance network is paralleled by the endogenous sunk costs of acquiring customers. Acquiring telecommunications consumers -- whether long distance, wireless, or local -- in a competitive market is costly and much of the expense is sunk. For example, Galbi (1999) estimates AT&T's annual marketing expenses to be approximately two billion per year (during the years 1994 through 1997).[28] Galbi (1999) also provides evidence that marketing expenses in the long distance industry are characterized by substantial economies of scale, indicating that advertising expenses are more fixed in nature.

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[27] *See, e.g.,* Michael R. Ward, "Product substitutability and competition in long-distance telecommunication," *Economic Inquiry*, Volume 37, Issue 4, pp. 657-677; George S. Ford, *Flow-through and Competition in the IMTS Market*, PHOENIX CENTER POLICY PAPER NO. 7 (September 2000); R. Carter Hill and T. Randolph Beard, *A Statistical Analysis of the Flow Through of Switched Access Charge Reductions to Residential Long Distance Rates*, Unpublished Manuscript (www.egroupassociates.com), May 1999.

[28] Douglas A. Galbi, *Some Cost of Competition*, Unpublished Manuscript (www.galbithink.org), January 25, 1999, Table 1.

B. *Regulation and Sunk Costs: The Cable Television Industry*

Sunk costs originate from a variety of sources. One such source is regulation and competition policy. Generally, the role of competition policy should be to reduce the influence of sunk costs on market structure:

> Rules must be devised to handle sunk costs problems. These may include encouraging technical changes that replace technologies involving large sunk costs with technologies that offer more opportunity for mobility or shared use. They may also include a careful look by policymakers at access rules to sunk facilities. … The single most important element in the design of public policy for monopoly should be the design of arrangements which render benign the exercise of power associated with operating sunk facilities. … Virtually any method will do as long as there are contractual or other arrangements that are nondiscriminatory and permit easy transfer or lease or shared use of these cost commitments.[29]

In an attempt to "render benign" the influence of sunk costs, regulatory agencies across the globe now require incumbent telephone monopolists to lease particular elements of their networks to competitive local exchange carriers. These leased elements, or unbundled elements, allow the CLECs to combine their own networks with those portions of the ILEC's network so ridden with sunk costs that duplication of those network elements is financially precluded.

While policy can play an important role in quarantining sunk costs, regulation also can increase the sunk cost of entry. For example, "level playing field" rules require entrants to provide service under the identical conditions as an incumbent monopolist, including politically-motivated cross subsidies and universal service obligations. Although level playing field law is defended on equity grounds (*i.e.*, symmetric regulation), this defense ignores the fundamental asymmetry between entrant and incumbent. As Baumol, Panzar, and Willig explain,

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[29] E. E. Bailey, "Contestability and the Design of Regulatory and Antitrust Policy, *American Economic Review*, Vol. 71, No. 2, May 1981, pp. 179, 182.

> . . . [t]he need to sink money into a new enterprise, whether into physical capital, advertising, or anything else, imposes a difference between the incremental cost and the *incremental risk* that are faced by an entrant and an incumbent. The latter's funds are already committed and are already exposed to whatever perils participation in the industry entails. On the other hand, a new firm must take the corresponding amount of liquid capital and turn it into a frozen asset if it enters the business. Thus, the incremental cost, as seen by a potential entrant, includes the full amount of the sunk cost, which is a bygone to the incumbent. Where the excess of prospective revenues over variable costs may prove, in part because of the actions of rivals, to be insufficient to cover sunk costs, this can constitute a very substantial difference. This risk of losing unrecoverable entry costs, as perceived by a potential entrant, can be increased by the threat (or the imagined threat) of retaliatory strategic or tactical responses of the incumbent.[30]

This asymmetry discussed above is captured generally by Equation (5), which illustrates that the ability of a firm to incur sunk costs depends on the number of competitors. Because the monopoly profit is at least twice the duopoly profit, the incumbent both is willing and able to incur sunk costs that a second entrant could not. In fact, under the level playing field law, an incumbent monopolist may cooperate with regulators to increase its own sunk costs in order to raise the sunk cost of the entrant, deterring entry by doing so.[31]

Hazlett and Ford (1999) provide evidence that the level playing field law, common in the cable television industry in the United States, increases sunk cost and reduces entry.[32] Using a probit model and a sample of 290 monopolistic and duopolistically competitive cable television markets, Hazlett and Ford find that cable markets in states with level playing statutes are much less likely to

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[30] William J. Baumol, John C. Panzar & Robert D. Willig, *Contestable Markets and The Theory of Industry Structure*, Revised edition, New York: Harcourt Brace Jovanovich (1982), p. 290.

[31] *See* Hazlett and Ford, *id*. Also see Steve Salop, "Strategic Entry Deterrence," *American Economic Review*, Vol. 69, pp. 335-338.

[32] Thomas W. Hazlett and George S. Ford, "The Fallacy of Regulatory Symmetry: An Economic Analysis of the Level Playing Field in Cable TV Franchising Statutes," Business & Politics Vol. 3 (April 2001).

experience competitive entry than markets in states without such statutes, other things equal. The level playing field statute is estimated to reduce the prospect for competitive entry by 20%, on average.

C. *Non-Price Competition in Commercial Broadcast Markets*

Although different in many ways from telephony and cable television, commercial radio broadcasting reflects substantial exogenous and endogenous sunk costs that affect the conditions of entry in commercial radio markets. A commercial radio station produces two major outputs, namely, (1) a jointly-supplied bundle of programming and advertising consumed by listeners; and (2) access to listeners of radio programming sold to advertisers. For expository convenience, the former product may be referred to as *programming* and the latter as *advertising*. Additionally, these two products are sold in *separate* markets inasmuch as the identity and purchasing motivation of the consumers in each market are entirely different.[33] Listeners "purchase" programming through a barter transaction exchanging their tolerance for utility-reducing commercial messages over a defined time interval for radio programming that provides consumers utility or otherwise enhances consumer welfare. By contrast, advertisers purchase minutes of advertising time for a money price that provides access to listeners who hear the advertiser's commercial message, respond by purchasing the advertiser's product or service, and thereby increase the advertiser's profits.

Although radio advertising may constitute a separate market relative to advertising using other mass media[34], not all radio advertising provided on different stations is easily substituted for each other. Indeed, a fundamental

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[33] Obviously, advertisers may also be listeners to radio programming--and probably are--but this consumer participation by advertisers in *both* the programming and advertising markets just reflects the usual duality of individuals as a consumer when not working and a producer when not consuming.

[34] The U.S. Department of Justice has found in its analysis of mergers in the commercial radio industry that radio advertising constitutes a separate market for antitrust purposes. See *Affidavit of Dr. Sean Ennis*, Attachment C appended to In Re Applications of Triathlon Broadcasting Company and Capstar Radio Broadcasting Partners, *Comment and Petition for Hearing*, filed by the U.S. Department of Justice before the Federal Communications Commission, October 19, 1998, paragraphs 15 and 16, pp. 6-7. Econometric evidence generally supporting the views of the Department of Justice is provided by Robert B. Ekelund, Jr., George S. Ford, and John D. Jackson, "Is Radio Advertising a Distinct Local Market? An Empirical Analysis," *Review of Industrial Organization* 14 (May 1999): 239-256.

business objective driving the growth of *format radio* is the creation of a radio advertising product that *cannot* be easily substituted by another radio station that might also reach an advertiser's target market.[35] Radio formats are intended to attract specific demographic groups desired by advertisers. Thus, a Top 40 format targets listeners aged 18-24, while Adult Contemporary attracts listeners aged 25-34. For many, if not most, advertisers, a Top 40 format and its accompanying listeners and an Adult Contemporary format and its demographics are *not* acceptable substitutes, irrespective of the price per minute of commercial time. Thus, within the commercial radio industry advertising market that excludes advertising provided on radio stations *even if their signal contours overlap* will in most instances be viewed by advertisers as distinctly different, generally non-substitutable *separate products*. As a result, radio stations adopting the same format and supplying programming and advertising to listeners and advertisers in largely the same geographic area may be viewed as direct competitors. Even then, each radio station *even if competing with the same general format* will nevertheless *differentiate* its programming and advertising by adopting a specialized variant of the same format and by improving the *quality* of its programming. Competitive rivalry, therefore, in modern commercial radio advertising markets is both complex and subtle and extends well beyond price competition.

A realistic analysis of competition in contemporary commercial radio advertising markets requires, therefore, a market definition framework that captures the various facets of the output that commercial radio actually offers to advertisers. The notion of *strategic groups* as advocated by Caves and Porter as applied to commercial radio advertising markets is especially useful.[36] In brief, Caves and Porter envision distinct clusters of firms within a defined market or industry that appear to share a common business strategy, e.g., pursuing a common format. As a result, the concept of entry barriers into a defined market may be broadened to include *mobility barriers* into a defined strategic group *within* the defined market. As Caves and Porter explain,

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[35] A short history of the emergence of format radio as a dominant local advertising medium is provided by Jonathan David Tankel and Wenmouth Williams, Jr., "The Economics of Contemporary Radio" in *Media Economics: Theory and Practice*, 2nd ed., eds. Alison Alexander, James Owers, and Rod Carreth (Mahwah, NJ: Lawrence Erlbaum Associates, 1998), pp. 185-197.

[36] R. E. Caves and M. E. Porter, "From Entry Barriers to Mobility Barriers: Conjectural Decisions and Contrived Deterrence to New Competition," *Quarterly Journal of Economics* 91 (May 1977): 241-261.

> The key to conjoining barriers to entry to a more general theory of interscale mobility of firms is the hypothesis that sellers within an industry are likely to differ systematically in traits other than size, so that the industry contains subgroups of firms with differing structural characteristics; we refer to them simply as *groups*. The firms within a group resemble one another closely and recognize their mutual dependence most sensitively; group boundaries impede (but do not prevent) the development of oligopolistic consensus, and thus an industry with a more complex structure of groups shows more competitive performance *ceteris paribus*. Barriers to entry then become specific to the group rather than protecting all firms in the industry equally, and barriers to mobility *between groups* rest on the same structural features as barriers to entry into any group from outside the industry.[37]

When properly applied, the concept of a strategic group ordinarily implies that only a relatively few firms will be included within its boundaries so that competitive rivalry will be oligopolistic in nature, although the number of firms actually populating the industry aggregated over all strategic groups may be quite numerous. Caves and Porter explain that

> Because of their structural similarity, group members are likely to responding the same way to disturbances from inside or outside the group, recognizing their interdependence closely and anticipating their reactions to one another's moves quite accurately. Profit rates may differ systematically among the groups making up an industry, the differences stemming from competitive advantages that a group may possess against others. . . . The industry's profits and (perforce) the average level of its groups' profit depend on the general structural traits of the industry and also the internal heterogeneities that demarcate its groups.[38]

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[37] *Id.* p. 250. (Emphasis in the original.) Porter adopts the term *strategic group* in his business monograph on competitive strategy. See Michael E. Porter, *Competitive Strategy: Techniques for Analyzing Industries and Competitors* (New York: The Free Press, 1980), Chapter 7.

[38] Caves and Porter, "From Entry Barriers to Mobility Barriers," pp. 251-52.

Competition in contemporary radio advertising markets is increasingly about competitive rivalry *within* a given format strategic group. In general, this analysis assumes that competitive rivalry within any given strategic group is largely *independent* of competitive rivalry in other strategic groups.[39]

The endogenous sunk costs of improving the quality and productivity (i.e., improved listenership) of radio programming represent an investment in mobility barriers that deters new entry into any given format strategic group. New entry into the commercial radio broadcasting industry itself (in contrast to a format strategic group) is often deterred, or outright prohibited, if there are no vacant allotments of spectrum channel capacity in the given local radio market. Although there still remains today vacant radio channel allotments in some rural or thinly-populated regions of the United States, no vacant channels remain in many densely-populated, urban areas of the country. As a result, the entry of new, full-power radio stations in many local radio markets is impossible: the number of competing radio stations in such markets is effectively *fixed* as a consequence of the technical limit on the number of channels available to any given geographic area as governed by the regulatory requirements to limit signal interference to acceptable levels. Given the technical barriers to entry implied by the limited quantity of local radio channels, entry into the commercial radio broadcasting industry is neither free nor easy. Entry into different strategic groups is not constrained, of course, by channel capacity but is constrained by the mobility barriers represented by the endogenous sunk costs of investment in a particular format.

These specific conditions of entry *into* and *within* the commercial radio broadcasting industry have had a significant effect on industry concentration following passage of the 1996 Act. Section 202(a) of the 1996 Act directed the FCC to eliminate all national restrictions on the number of commercial radio stations that a single entity may own or control and to liberalize the number of stations a single entity may own in a "local radio market" as defined in terms of

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[39] This strong assumption will not always be true, although it does simplify an otherwise complicated study of competitive rivalry. A recent study that develops a theme of submarkets within a market where a weaker assumption of only "approximate independence between and among submarkets" is maintained is provided by John Sutton, *Technology and Market Structure: Theory and History* (Cambridge, Mass.: The MIT Press, 1998)..

the FCC's principal community contour overlap rule.[40] The current local radio market ownership caps are shown in Table 1.

Table 1.

Post-1996 Act Commercial Radio Ownership Caps

Number of Commercial Radio Stations in the Local Market	*Maximum Number of Stations*	*Maximum Number of Same-Service Stations*
45 or more	8	5
30-44	7	4
15-29	6	4
14 or Fewer	5	3[a]

[a] No entity may own, operate, or control more than 50 percent of the stations in a market within 14 or fewer commercial radio stations.

These post-1996 Act ownership caps represent a substantial relaxation of the prior radio ownership restrictions, namely, (1) a cap of two AM and two FM stations with 15 or more stations, if the combined audience share did not exceed 25 percent; and (2) three stations in markets with 14 or fewer stations, with no more than two stations in the same service (i.e., AM or FM), if the combination would not control 50 percent or more of the stations in the market. The relaxation of the local radio ownership caps has resulted in a substantial increase in concentration in many local radio advertising markets.[41] For example, current

[40] The FCC defines a radio market as the geographic area encompassed by the principal community contours of the mutually overlapping stations proposing to have common ownership. The number of stations in the defined radio market is based on the principal community contours of all commercial stations whose principal community contours overlap or intersect with the principal community contours of the commonly-owned and mutually overlapping stations. Although the FCC's definition of a radio market may not represent the relevant economic or antitrust market for radio advertising compared to the relevant Arbitron radio metro, it does provide a consistent method for defining radio markets in cases where an Arbitron metro is defined and in cases where an Arbitron metro is not defined. At present, Arbitron radio metro's are not defined for nearly half of the operating commercial radio stations in the United States. For further discussion of the FCC's contour overlap rule, see Federal Communications Commission, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, MM Docket 91-140, 7 FCC Rcd 6387 (1992).

[41] A market-by-market study of increases in local radio market concentration is provided by Federal Communications Commission, Mass Media Bureau, Policy and Rules Division, *Review of the Radio Industry, 2000*, January, 2001. For empirical estimates of the effects of increased concentration in radio, *see* Robert B. Ekelund Jr., George S. Ford, and Thomas Koutsky, "Market Power in Radio Markets: An Empirical Analysis of Local and National Concentration," *Journal of Law and Economics*, Vol. 43, 2000, pp. 157-184.

data suggest that in 85 out of a total of 270 Arbitron radio markets, two owners control 80 percent of radio advertising revenue, and in 143 markets, two owners now control more than 70 percent of such revenue.[42] Taking all Arbitron radio markets, the average share of revenue controlled by the single top group owner is 45 percent.[43]

Apart from predictable effects in price competition in local radio advertising markets, the increased market concentration resulting from the relaxation of the local radio ownership caps and elimination of the national ownership cap has facilitated the emergence of very large, well-financed commercial radio firms, such as Clear Channel Communications, Inc., which now owns more than 1,200 commercial radio stations nationwide. Given their substantial financial and programming resources, such large radio enterprises are steadily shifting the focal point of competitive rivalry in the commercial radio industry from price competition toward non-price competition stressing program quality and uniqueness within increasingly specialized format strategic groups. Thus, consolidation and growing market concentration have substantially increased the role and importance of endogenous sunk costs on competition in the commercial radio industry.

The three-stage game discussed in the previous section implies that mobility barriers protecting any given strategic group are likely to differ from one strategic group to another and that mobility barriers may increase through time if group-specific endogenous sunk costs became increasingly important relative to the sunk costs of entry into the commercial radio broadcasting industry. Consequently, the conditions of entry into any particular strategic group will differ from one group to another, and the profitability of stations within different strategic groups may be expected to differ significantly, as Caves and Porter predict. One special case of extreme concentration within a strategic group is considered here, namely, non-price competition so intense that the format is completely dominated by a single station. This case highlights the circumstances where intense non-price competition in quality may convert a fragmented

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42 *See* Federal Communications Commission, *Biennial Review Report*, MM Docket No. 98-35, FCC 00-191 (adopted May 26, 2000), at paragraph 55.

43 Derived from BIA Database, March, 2000.

strategic group into a monopoly in the absence of strategic or anticompetitive behavior by the ultimate monopoly station.

Figure 7 reproduces one market structure-market size curve from Figure 5. Between the points a and b concentration within the strategic group declines as additional stations enter in response to growth in the size of the strategic group. At point b, $\kappa = \alpha/\gamma$, and concentration begins to increase as non-price competition in quality intensifies. At point c, a critical mass in both market size and format quality is reached such that a single station completely dominates or monopolizes the format. In other words, non-price competitive rivalry effectively collapses and leaves the strategic group dominated by a single station. This extreme case of non-price competition in radio broadcasting is called Howard Stern economics in this paper, reflecting Stern's success in creating within the general format category of "talk radio" the more specialized niche of "shock jock". Although some radio talent attempts to copy the Stern format, Stern even today is viewed as a unique format in commercial radio broadcasting.

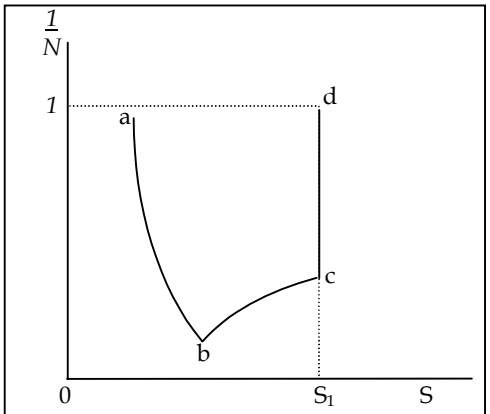

Figure 7. Howard Stern Economics

Howard Stern economics within the context of the commercial radio broadcasting industry may be viewed as an example of the broader phenomena of winner-take-all markets recently popularized by Frank and Cook.[44] In such markets, one or several individuals emerge as "best in class" in terms of talent,

[44] Robert H. Frank and Philip J. Cook, *The Winner-Take-All Society* (New York: The Free Press, 1995).

ability, or unique capability or service such that other individuals just slightly less talented or gifted are not considered acceptable substitutes by customers or clients. Winner-take-all markets share two important attributes. First, financial rewards tend to be determined by relative rather than absolute performance. Whatever the merits of Howard Stern's talents in some absolute sense, it is quite apparent that he does it much better than any other competitor. Second, financial rewards tend to be concentrated in the hands of a few top performers, with small differences in talent or effort resulting in huge differences in incomes.[45] In the case of Howard Stern, he overwhelmingly dominates the shock-jock programming format. The essential point of Howard Stern economics is that intense non-price competition within a given strategic group may over time result in virtual monopolization of the strategic group. Such concentration within the strategic group reflects not anticompetitive strategic behavior by incumbent radio stations but an attribute of the commercial radio broadcasting business that highly values unique programming talent that may result in winner-take-all results.

Viewed even more broadly, winner-take-all markets represent a specialized form of Edwin Chadwick's notion of "competition for the field" rather than "competition within the field."[46] Although Chadwick's concept was reintroduced in a modern guise by Demsetz, it has been applied within the narrow confines of natural monopoly markets.[47] Chadwick, however, always envisioned the phenomenon of competition for the field much more expansively and argued its social benefits were substantial even in markets, such as that for undertakers, which would not satisfy any modern concept of natural monopoly. The special case of Howard Stern economics suggests, however, that competition for the field may be a more ubiquitous phenomenon in industrial organization than is commonly supposed. While, perhaps, troubling in its implications for concentration within some strategic groups in the commercial radio broadcasting industry, it does emphasize again the importance of innovation and talent as critical dimensions of rivalry in radio broadcasting.[48] In this sense, it underscores

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45 *Id.* p. 24.

46 *See* W. M. Crain and R.B. Ekelund Jr., "Chadwick and Demsetz on Competition and Regulation," *Journal of Law and Economics*, Vol. 19 (April 1976) 149-62.

47 H. Demsetz, "Why Regulate Utilities?" *Journal of Law and Economics,* Vol. 12 (October 1968): 55-65.

48 In broad terms, the non-price competition increasingly observed within radio format strategic groups resembles the "innovation competition" observed in contemporary high-tech

(Footnote Continued. . . .)

the potential social value of innovative entrants in radio broadcasting so long as their entry brings programming that is distinctive, responsive to listener preferences that have been poorly met or ignored, or simply improves on existing radio programming sufficiently to attract listeners from other stations.

V. Conclusion

The economic forces that govern the nature and extent of competitive rivalry in contemporary telecommunications and broadcasting markets are quite complex. Public policies focused on deconcentrating telecommunications markets and improving the economic performance of broadcasting markets may prove disappointing if both the pervasiveness and implications of exogenous and endogenous sunk costs are not fully appreciated. If exogenous sunk costs are relatively more important than endogenous sunk costs, then growth in market size may lead to market deconcentration, although the presence of sunk set-up costs will ultimately constrain the number of competitors that can profitably enter the market. Cable television markets appear to represent this dominance of exogenous over endogenous sunk costs. Conversely, if endogenous sunk costs tend to dominate exogenous costs, then growth in market size may not result in market deconcentration. Indeed, growth in market size may actually accompany an increase in concentration. Both long distance telecommunications and commercial radio broadcasting markets may well represent this dominance of endogenous over exogenous fixed costs.

The main consequence of both exogenous and endogenous sunk costs in telecommunications and broadcasting markets is that both types of markets are likely to remain relatively concentrated for the foreseeable futures notwithstanding the intent of the Telecommunications Act of 1996 to reduce various types of barriers to entry and foster new entry. Moreover, a root cause of

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markets. There may exist a trade-off between price competition and innovation competition, i.e., public policies intended to maintain or strengthen price competition may adversely affect innovation competition and the consumer benefits that innovation provides. This paper does not calibrate the potential welfare losses attributable to weakened price competition within a radio format strategic group with strong winner-take-all attributes versus the potential welfare gains that an innovative format may provide both advertisers and listeners. A clear discussion of the attributes of innovation competition in high-tech markets is provided by Joseph Farrell, "Competition in the Digital Age," testimony before the U.S. Senate Judiciary Committee, November 4, 1997. On innovation competition and its implications for antitrust enforcement, see Anticipating the 21st Century: Competition Policy in the New High-Tech, Global Marketplace, A Report of the Federal Trade Commission Staff, May, 1996.

such persistent market concentration is pervasive sunk costs. This critical economic reality complicates the design of regulatory policy in both telecommunications and broadcasting markets. Certain types of regulation, such as "level playing field" requirements in cable television markets, may tend to accentuate rather than attenuate the effects of sunk costs on market concentration. On the other hand, the network unbundling requirements of the 1996 Act requiring the ILECs to "share" with competing CLECs the economies of scale inherent in local telecommunications network distribution facilities may have the effect of "virtual deconcentration" in local telecommunications markets, where pervasive exogenous sunk costs greatly compresses the room for facilities-based competitive entry. Similarly, some restrictions on the merger of competing commercial radio stations that otherwise comply with the ownership caps prescribed by the 1996 Act may be essential to maintain some degree of competitive rivalry in radio format strategic groups that otherwise reveal strong winner-take-all proprieties.

In short, the timing and extent of deregulation should reflect the relative importance of exogenous verses endogenous sunk costs. While market growth may attenuate the effects of exogenous sunk costs on Cournot competitors and reduce the ongoing need for various types of network access regulation, the growing dominance of endogenous costs in the face of market growth may, in fact, suggest a continuing need for regulatory and antitrust oversight. Any evaluation of the success or failure of the 1996 Act to produce its competition and deregulatory goals should distinguish between the cases where market growth fosters economic deconcentration and where it does not. The analysis of competition in this paper with its emphasis on exogenous and endogenous costs provides a way to help calibrate the extent of regulatory intervention required to promote good market performance where competition among the few may well represent long term equilibrium industry structure.