IV. Quality Competition in the Multichannel Video Programming Industry

1. MARKET PERFORMANCE IN THE MULTICHANNEL VIDEO PROGRAMMING INDUSTRY

For more than a decade, consumers and policymakers alike have expressed recurring concern and frustration about certain aspects of the performance of the cable television industry, the dominant supplier in multichannel video programming distribution (MVPD) markets across the United States. Table 1 provides some insight concerning the performance of the cable television industry since the mid-1990's. As shown in the fourth column, cable operators have been raising prices considerably faster than the rate of general inflation as shown in the fifth column. Notwithstanding the increase in cable rates, the total number of basic cable subscribers grew steadily from 62.956 million subscribers in 1995 to 73.575 million subscribers in 2004. During the same time, competitors to local cable systems operators, predominantly direct broadcast satellite (DBS) operators, continued to acquire new subscribers, growing from 6.388 million subscribers in 1995 as shown in the second column of Table 1 to nearly 27 million subscribers in 2004.

TABLE 1

CABLE TELEVISION PERFORMANCE INDICATORS

Year	Basic Cable Subscribers[a] (Millions)	Non-Cable MVPD Subscribers[b] (Millions)	Annual Cable Rate Increase[c] (Percentage)	CPI[d] (Percentage)
1995	62.956	6.388	0.6	2.5
1996	64.654	8.871	7.5	3.0
1997	65.929	9.497	8.9	2.2
1998	67.011	11.234	6.8	1.7
1999	68.538	15.780	6.8	2.1
2000	69.297	18.680	6.0	3.7
2001	72.958	21.660	7.6	2.7
2002	73.525	22.690	8.2	1.5
2003	73.366	24.940	7.8	2.1
2004	73.575	26.870	5.4	3.0

[a] National Cable & Telecommunications Association (NCTA) website reporting estimates developed by Nielsen Media Research. Number of subscribers as of November of each year.

[b] NCTA website reporting estimates developed by NCTA research and data reported in the FCC's *Annual Report on the Status of Video Competition*. Number of subscribers as of December of each year, except 1997 (as of June); 1998 (as of June); 2002 (as of October); and 2004 (as of September).

[c] FCC's *Annual Review of Cable Industry Prices* and *Annual Report on the Status of Video Competition* for various years. The annual increase in cable rates refer to cable services that the FCC defines as "most popular," i.e., the first two packages of cable channels taken by more than 90% of cable subscribers.

[d] Bureau of Labor Statistics.

With such growth in the size of local MVPD markets across the United States and the entry and growth of competitors to local monopoly cable system operators, standard industrial organization models of price competition, such as the Bain structure-conduct-performance paradigm, would anticipate the competitive rivalry should intensify and prices decline with the addition of new productive capacity provided by new entrants.[1] Yet, notwithstanding the ongoing growth of DBS as a competitor to local cable systems,

[1] See Bain (1956).

cable rates has continued to *increase* even as the market share of non-cable MVPD operators have *increased*. Additionally, recent econometric evidence confirms the casual empirical observation that competition provided by DBS operators provides only a weak constraint on the market power of local cable system operators.[2] Thus, the observed pattern of growth in the size of local MVPD markets as measured in MVPD subscribership; the entry and growth in market share of MVPD competitors, especially DBS; and persistent increases in cable rates well in excess of the general rate of inflation suggest that price competition models do not fully capture all pertinent dimensions of rivalrous behavior in local MVPD markets. Consequently, viewing market performance in terms of such models may lead to faulty inferences with respect to the consumer welfare implications of observed metrics of market performance, such as price trends or price-cost margins.

The following discussion proposes an alternative to standard industrial organization models of price competition, such as the Bain paradigm, for understanding competitive rivalry and for predicting market performance in contemporary MVPD markets.[3] In short, it is proposed that *competition in quality* rather than price competition is the dominant dimension of competitive rivalry in contemporary MVPD markets and focusing on this specific dimension of firm conduct neatly resolves the apparent puzzle represented by the observed pattern of cable subscribership, growth in competition, and rising cable rates.

Table 2 provides suggestive evidence that competition in quality prevails in local MVPD markets. The second and fourth columns reproduce the annual cable rate increases and CPI, respectively, as reported in Table 1. The third column in Table 2 reports the annual

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[2] See Wise and Duwadi (2005).

[3] The proposal is developed at greater length in Duvall and Wise (2005).

cable rate increase shown in the second column expressed on a *per channel* basis. The data in the third column suggest that cable system operators have modified their output, which is ordinarily a menu of channel packages sold as a bundle to subscribers. It is evident that growth in cable rates per channel is *lower* than the general rate of inflation in all years but one over the last ten, and is negative for three years. Such pricing behavior appears consistent with competition in quality, where expanding over time the number and variety of channels included in a package with constant or declining price per channel may be viewed as a rough proxy for quality improvement.[4]

TABLE 2

CABLE RATES PER CHANNEL

Year	Annual Cable Rate (Increase Percentage)	Annual Cable Rate Increase Per Channel (Percentage)	CPI
1995	0.6	-1.1	2.5
1996	7.5	2.3	3.0
1997	8.9	2.8	2.2
1998	6.8	1.6	1.7
1999	6.8	-0.5	2.1
2000	6.0	0.5	3.7
2001	7.6	1.7	2.7
2002	8.2	1.2	1.5
2003	7.8	-2.1	2.1
2004	5.4	1.2	3.0

Moving from the data in Table 2 which is suggestive of competition in quality in MVPD markets to a model of multichannel video programming competition that treats

[4] Devising weights to adjust nominal cable prices is complicated in the multichannel video industry. Cable channels, except for those offered on an a la carte or per channel basis such as some premium or pay-per-view channels, are customarily sold to subscribers as a package, or service tier, for a fixed, monthly fee. Few subscribers, however, watch *all* the channels in the package. Individual subscribers perceive some channels in a package as virtually worthless while others are considered very valuable such that the entire package is sufficiently valuable that the package is purchased notwithstanding unwanted channels. In addition, the value of individual channels varies from consumer to consumer. In view of these complexities, a per channel rate represents a quality weight providing only a rough proxy for a quality-adjusted cable price.

both price and product quality as critical endogenous variables for explaining and predicting the conduct of cable system operators and resulting market performance is challenging. The response to this challenge proposed here is to join two strands of economic theory in developing an analysis of quality competition in the multichannel video industry, namely, (1) the theory of two-sided markets; and (2) John Sutton's game theoretic analysis of markets where both exogenous and endogenous sunk costs are important and product quality is the dominant focal point of competitive rivalry. The joining of those two theories in this paper is informal and intuitive but offers nonetheless a revealing perspective on the likely evolution of market structure, conduct, and performance in the multichannel video industry. The next section briefly reviews the basic economics of two-sided markets and illustrates its application to the multichannel video industry. Sutton's game theoretic competitive analysis and its application to the multichannel video industry follows.

2. QUALITY COMPETITION IN THE MULTICHANNEL VIDEO INDUSTRY

A. *Basic Economics of Two-Sided Markets*

A two-sided market exists where two sets of customers are *dependent* on each other.[5] The business firm supplying a two-sided market supplies a "matchmaking" service to both sets of customers. This matchmaking function is often referred to as a *platform*. Evans (2003) identifies three conditions for a market to be considered two-sided. First, there must exist two or more *groups of customers* that are served by the platform operator. Real-world examples include (1) a shopping mall as a platform with

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[5] Standard references on the economics of two-sided markets include Jean-Charles Rochet and Jean Tirole (2003) and Armstrong (2002). By contrast, "one-sided" or "single-sided" markets do not involve a dependency relationship between the customers and the input suppliers to a conventional business firm. For example, the clients of a law firm have no apparent dependency relationship with the suppliers of office supplies, supporting services, and other equipment to the law firm.

shopping mall retailers and customers as the two groups of customers; (2) a credit card company as a platform with shoppers using credit cards and merchants accepting credit cards as the two groups of customers; and (3) a personal computer operating system as a platform with software developers and software users as the two groups of customers. Often, one customer group consumes a different platform service than other customer groups, although the different platform services or products are related by the second condition.

Second, members of one customer group benefit in some way from the presence of members from some other customer group, i.e., there exists *network effects,* especially *indirect network effects.*[6] For example, video game developers value a particular game console (a platform) more if the console attracts more users. Similarly, game players value a game console more highly if the console supports more games.

Third, different customer groups *absent a platform* find it too difficult or too costly to internalize directly the network effects existing between or among themselves on a bilateral basis. Finding a way to reduce the high transactions cost of internalizing the network effects creates the business opportunity for a platform operator. The *business model* for a given platform is predicated on (1) choosing a pricing rule with respect to price *level* and price *structure,* i.e., the relationships of the usage prices charged to each customer class that assigns platform usage charges to customers in each customer group; and (2) implementing a rule for adjusting the price of platform usage to capture the

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[6] In general, network effects cause the value of a product to a consumer to increase as the number of consumers of the same product increases. Direct network effects occur if an increase in the size of a network increases the number of other network consumers or subscribers that a network subscriber can communicate or interact with. The increase in the number of potential contacts make network subscribership more valuable or beneficial to the network consumer since the network subscriber is provided "more product," i.e., potential points of contact. Indirect network effects occur if an increase in the size of a network expands the scope and variety of complementary products available to network subscribers.

value of network externalities created by a growing number of customers. A profit-oriented platform operator will implement a pricing rule that will optimize the number of customers brought "on board" on both sides of the platform.

The literature identifies many examples of two-sided markets, including dating clubs, computer operating systems, video games, payment cards (credit and debit), corporate bond trading, residential real estate brokerage, among other examples.[7] Figure 1 provides an abstract representation of the contemporary multichannel video industry viewed as a two-sided market. More specifically, Figure 1 shows two, competing MVPD platforms, say, a cable system operator and a DBS operator, in an arbitrary local MVPD market. The two, *dependent*, customer groups are program suppliers (or program networks) and MVPD subscribers, respectively. The double-headed solid arrows represent the supply-demand exchange relationships that exist between program networks and subscribers and the platform operator. The double-headed broken arrows show that both program networks and subscribers may, but not necessarily, have exchange relationships with *both* platforms simultaneously. By hypothesis of a two-sided market, the growing availability of additional, MVPD subscribers makes the MVPD platform increasingly valuable to program networks that require large audiences for recovering the substantially fixed and sunk costs of program development and production. Similarly, the increasing availability of more diverse and higher quality cable programming makes the MVPD platform increasingly valuable to MVPD subscribers.

[7] Evans (2002) provides a clear discussion of a number of diverse examples of two-sided markets and the business models that support the specific platforms utilized.

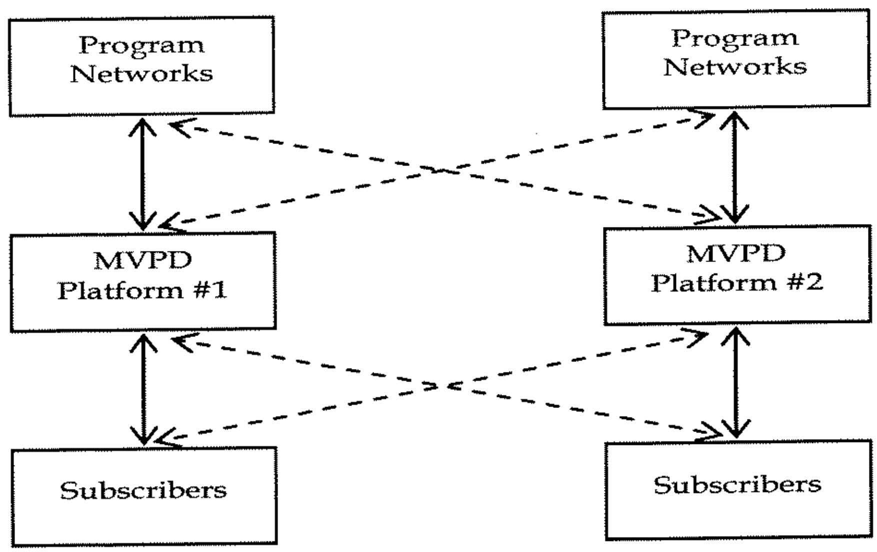

Figure 1. The Multichannel Video Industry as a Two-Sided Market

Two-sided markets represent a special type of market structure with unconventional implications for firm conduct, and, ultimately, market performance. In particular, the literature on two-sided markets tends to focus on the *pricing* behavior of the platform operator both from the perspective of profit-maximization and welfare-maximization.[8] Although a full explication of the pricing behavior of a platform firm is beyond the scope of this discussion, it is possible to develop an intuitive view of such pricing behavior and contrast it with analogous behavior of a firm selling output in a single-sided market. For simplicity, suppose that a MVPD platform operator is a monopolist in a given MVPD market.[9] Further, suppose the monopoly MVPD platform operator is selling its "output" to customers in both groups--network programmers and subscribers--using a common metric, say, units of *access*. Thus, MVPD subscribers buy

[8] See Rochet & Tirole (2003) and Hagiu (2005).
[9] The following discussion relies in substantial part on Evans (2003).

program access, where access is defined in terms of individual program networks, packages of program networks, basic antenna service, and the like. Similarly, program networks buy access to MVPD subscribers when they sell their programming to MVPD platform operators. Thus, program networks buy *subscriber access* from the platform operator.

Given the dependency and network effects existing between program networks and subscribers as customer groups, the *total* demand for MVPD platform access may be conceptualized as the multiplicative relationship:

$$D_T = D_1(p_1)\, X\, D_2(p_2) \qquad (1)$$

where D_T measures the total demand for MVPD platform access in units of access; $D_1(p_1)$ measures the demand for subscriber access by program networks in units of subscriber access expressed as a function of the unit price, p_1, of subscriber access; and $D_2(p_2)$ measures the demand for program access by subscribers expressed as a function of the unit price, p_2, of program access.[10] Although equation (1) is a highly simplified way to describe the total demand for the access that an MVPD platform supplies to both program networks and subscribers, it neatly captures the economic interaction and dependencies that exist between the two MVPD platform customer groups. For example, an increase in $D_2(p_2)$ on the subscriber side of the market increases total platform demand, D_T, through its interaction with $D_1(p_1)$ on the network program side of the market.

[10] Rochet and Tirole propose a multiplicative demand function to model the total flow of transactions which flow across a platform. See Rochet and Tirole (2003).

From a two-sided market prospective, certain variable costs of supplying platform access, either program or subscriber access, are either joint costs with respect to both customer groups or the allocation of such costs to on side of the market or the other is economically arbitrary.[11] To simplify, suppose that the per unit variable cost of supplying MVPD platform access is equal to c. Rochet and Tirole (2003) show that a profit-maximizing platform monopolist supplying a two-sided market will set a *total* price using the formula:

$$(p_T - c)/p_T = 1/E \qquad (2)$$

where $p_T = p_1 + p_2$, and E measures the price elasticity of *total* platform demand. E is the *sum* of the separate own-price elasticities of demand for program access, E_1, and subscriber access, E_2.[12] Equation (2), which is analogous to the Lerner formula for monopoly pricing in a one-sided market, shows that the price-cost margin shown on the left-hand side is a function of E, and as total platform demand becomes more elastic, i.e., as the absolute magnitude of E increases, the price-cost margin, or profit per unit, declines. Thus, with respect to the *total* price of MVPD platform access, the profit-maximizing monopoly pricing rule for a two-sided market is formally the same as a one-sided market. The key difference, however, is that an additional rule is necessary for *allocating* the total price between the two customer groups in a two-sided market.

As proposed by Rochet and Tirole (2003), a price allocation rule can be devised in the following way. Given the multiplicative total demand function in equation (1), a

[11] For example, as the total volume of access supplied by an MVPD platform increases, so will costs associated with fraud, bad debts, cost of funds, and the like which are not directly attributable to one side of the market or the other.

[12] The standard formula for the own price elasticity of demand for output i is $(p_i / D_i)(dD_i / dp_i)$.

change in total platform demand will be *proportional* to the percentage change in demand on either side of the market. For example, suppose there is a change in the price, p_1, of program access which induces a change in the quantity demanded of program access, D_1. In symbols,

$$\Delta D_T = [\Delta D_1(p_1)/D_1(p_1)] X D_T \qquad (3)$$

If the MVPD platform monopolist is already maximizing profit, then profitability cannot be improved by raising unit price on one side of the market and lowering unit price on the other. In other words, changing prices on either side of the market will have the same effect on total demand. Equation (3) implies that the percentage change in demand on *either* side of the market must be the same, since the change in total platform demand will just equal that percentage.[13] In symbols,

$$\Delta D_1(p_1)/D_1(p_1) = \Delta D_2(p_2)/D_2(p_2) \qquad (4)$$

Rochet and Tirole (2003) show that in equilibrium that the relationship shown in equation (4) implies that ratio of prices for the two sides of the market is proportional to the ratio of the price elasticities of demand for each side of the market. In other words,

$$p_1 / E_1 = p_2 / E_2 \qquad (5)$$

In effect, equation (5) provides a profit-maximizing price allocation rule for the monopoly MVPD platform operator, i.e., p_T is disaggregated between the two sides of the market depending on the relative magnitudes of E_1 and E_2.

[13] See Evans (2003), p. 342.

The monopoly profit-maximizing allocation rule for disaggregating total platform price clearly differs from the Lerner monopoly profit-maximizing pricing rule which applies to one-sided markets. In particular, the price allocation rule shown in equation (5) does *not* depend on c, the unit variable cost of platform access. By contrast, most variants of the Lerner pricing rule shown in equation (2) for *both* single-output and multioutput firms supplying one-sided markets express the profit-maximizing markup with respect to a price-cost difference. By contrast, the optimal price allocation for a two-sided market depends *solely* on relative price elasticities of demand for each side of the market. Thus, the standard result that a profit-maximizing output price in a one-sided market will tend to track the marginal cost of production or reflect a profit-maximizing markup over the marginal cost of production does not carry over in disaggregating total platform price in two-sided markets.

The effects of increasing price competition on a monopoly MVPD platform operator can be inferred from equations (2) and (5). The increasing availability of alternative MVPD platforms means that both program networks and subscribers may substitute the new platform for the incumbent monopoly MVPD platform. The possibility of substituting one platform for another tends to make the demand functions $D_1(p_1)$ and $D_2(p_2)$ more elastic, i.e., the absolute magnitudes of E_1 and E_2 grow larger, resulting in a *smaller* markup in equation (2). If the increased opportunity for platform substitution affects each side of the market somewhat differently, then the optimal allocation of total price between both sides of the market may change as well as suggested by equation (5). Indeed, if price competition becomes sufficiently intense, the incumbent monopoly platform operator may be forced to adopt a new business model that substantially alters the extant distribution of total price between the two customer groups.

An especially troubling implication of increased price competition for incumbent platform operators is the possibility that such competition may intensify to the point where the recovery of the substantial fixed and sunk costs of an MVPD platform becomes increasingly difficult, i.e., no new business model or reallocation of total price between the two sides of the market are sufficient to produce revenues adequate to recover the operating and capital costs of an MVPD platform. A fundamental premise of this discussion is that such potential adverse effects of intense price competition on MVPD platform operators are understood and believed by real-world MVPD platform operators and that Bertrand-like pricing conduct is avoided, even precluded, notwithstanding the possibility of entry by maverick firms. This outcome is achieved by shifting the focus of competitive rivalry from price to quality.

The *effects* of a competition in quality in MVPD markets can be understood by slightly modifying the equilibrium price structure relationship shown in equation (5). Letting δ_i represent on index of perceived quality for output i such that increases in δ_i; represent an increase in a consumer's marginal utility of consuming output i, then equation (5) may be rewritten as

$$(p_1 / \delta_1) / E_1 = (p_2 / \delta_2) / E_2 \qquad (6)$$

where (p_i / δ_i), $\delta_i \geq 1$, measures the *quality-adjusted* unit price for output i. Increased rivalry in quality between or among MVPD platforms will perterbate the price structure relationship shown in equation (6), even if the *nominal* prices p_1 and p_2 remain unchanged.

In practical terms, competition in quality in MVPD markets would be observed in several ways. From the subscriber side of the market, a particular MVPD platform becomes more valuable to a subscriber if the technical attributes of the network are improved, such as the conversion from analog to digital technology, or the introduction of expanded service capabilities, and if the diversity and quality of program networks are increased. From the program network side of the market, a particular MVPD platform becomes more valuable if the platform offers abundant channel capacity and if the signal provided to subscribers is reliable and of high quality. Additionally, platforms with a large number of subscribers with known demographic attributes are more valuable to a program network than a platform with fewer subscribers of undifferentiated demographics. Quality improvements both reinforce and amplify the network effects existing between both sides of an MVPD market.

Although the equilibrium price structure relationship shown in equation (6) shows the possible effects of competition in quality on both sides of an MVPD market, it does not explain how equilibrium levels of δ_i are determined. Sutton's game-theoretic analysis of market structure and competition in quality provides such an explanation and is considered in the next section.

B. Sutton's Analysis of Sunk Costs, Market Structure, and Competition in Quality

The discussion in this section applies Sutton's analysis to two aspects of local MVPD markets, namely, (1) cable systems as platform operators in two-sided markets facing actual competition from DBS operators or other suppliers of MVPD platform services; and (2) program networks which supply programming to cable systems and other MVPD platforms and, implicitly, acquire subscriber access service from the MVPD platform. Unlike MVPD subscribers on the other side of this two-sided market, both the MVPD platform operator and program networks incur substantial *sunk costs* in producing their respective output[14], i.e., platform services and cable programming. The Sutton analysis reveals the pivotal significance of sunk costs, most particularly, endogenous sunk costs in determining market structure, i.e., concentration, and market performance where competition in quality in a focal point of business strategy.[15]

Sutton's game-theoretic analysis explains observed market structure, i.e., industry concentration, by viewing expenditures on advertising and R&D as endogenous *sunk costs* incurred by a firm to enhance consumers' willingness to pay for the products that the firm produces. Such sunk costs affect the level of demand by increasing the quality, or perception of quality, of the products or services produced by the firm making the expenditures. This perspective differs from the Bain paradigm where both advertising and R&D outlays are viewed as exogenously-determined barriers to market entry that affect growth in industry supply, not demand. In terms of Sutton's analysis, both advertising and R&D outlays are choice variables to firms making the expenditures and are determined endogenously in achieving industry equilibrium. Sutton recognizes economies of scale as a supply-side constraint that determines how many firms may enter a given market profitably. More specifically, scale economies are recognized within the Sutton analysis by viewing a firm's investment in a single plant of minimum efficient scale as a sunk cost. Additionally, the level of sunk investment required to enter the market is determined by the technology of

[14] Sunk costs are expenditures on inputs of production, including certain services, intermediate goods, and durable, special-purpose assets, that once committed to a particular application have no alternative value in any other application, i.e., have no opportunity cost of production.

[15] Standard references on the conceptual foundations and empirical tests of the Sutton industrial organization paradigm include Sutton (1991) and Sutton (1998).

production and is, therefore, viewed as exogenous to the firm's decision-making process.[16]

The analytical focus of Sutton's game-theoretic approach is the interaction of exogenous and endogenous sunk costs in determining equilibrium market structure, in particular, the level of industry concentration. In its simplest formulation, Sutton's methodology for analyzing this interaction between exogenous and endogenous sunk costs for determining equilibrium industry structure is a two-stage game. In Stage 1, the firm decides whether or not to enter the market. If it decides to enter, it incurs a fixed setup cost equal to the investment required for a single plant of minimum efficient scale. For programming networks, exogenous sunk costs may include certain contractual commitments and other specialized investments essential to establishing and operating a programming network. Expenditures incurred for developing programming or acquiring non-transferable program rights are similarly sunk investments but are viewed as endogenous sunk costs. Given the differentiated nature of programming, market entry into a programming niche viewed within the Sutton model is envisioned as entry into an industry submarket, or *strategic group*, such that the nature of programming bought and sold within such a submarket is relatively homogenous.[17] For MVPD platform operators, exogenous sunk costs are extensive, and may include headend equipment, or satellite earth stations, and direct network connections to subscribers' homes, using wired or wireless technology.

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[16] In other words, the *size* of sunk cost investment in a plant of minimum efficient scale is not a decision variable for the firm. Rather, plant size is driven by the requirements of production technology which is beyond the control of management of the investing firm. Only the decision to enter and commit to making the sunk cost investment in a plant of minimum efficient scale is within the discretion of the firm's management.

[17] The notion of strategic groups within an industry is discussed in Caves and Porter (1977). A recent empirical analysis emphasizing submarkets or clusters of firms within an industry is provided by Sutton (1998).

(1) Intensity of Price Competition

In Stage 2 of the game, the firm engages in price competition with other entrants that have also made exogenous sunk cost investments in productive capacity upon entering the market. These sunk costs play no direct role in however, in day-to-day pricing policy. There is, nevertheless, an important interplay between Stage 1 and Stage 2. Suppose σ represents the sunk setup cost required on entering the market or relevant strategic group. For entry to be profitable for the firm, σ must be recovered ex post. Whether this cost recovery is actually realized depends, however, on the intensity of price competition in Stage 2 of the game. Excessive entry into the market may result in losses, since intensive price competition in Stage 2 of the game may reduce price-cost margins to the point that revenues are insufficient to recover the setup costs required for market entry. As a result, a basic tension persists between both stages: intense price competition in Stage 2 lowers post-entry profits and reduces the number of firms that choose to enter the market in Stage 1. As a result, equilibrium industry structure, i.e., industry concentration, will reflect the consequences of a growing number of entrants that tend to lower prices through price competition which, in turn, makes entry less attractive.

The intensity of price competition may be modeled within the Sutton analysis using a number of alternative pricing hypotheses or second-stage subgames. Sutton illustrates three pricing hypotheses, namely, (1) a monopoly subgame where the sum of the profits of all entrants is maximized (joint-profit maximization); (2) a Cournot competition in quantities subgame where competitors non-cooperatively determine the optimal quantities to produce and sell; and (3) a Bertrand competition in prices subgame where competitors undercut the prices of their rivals. (See Sutton (1991) at 30-37.) Price competition is more intense in the Cournot subgame compared to the monopoly subgame, and Bertrand price competition is more intense than Cournot competition in quantities. These different second-stage subgames generate different equilibrium market structures within the Sutton analysis.

The nature of these different equilibrium market structures may be illustrated by summarizing a few aspects of Sutton's technical analysis. Sutton proposes that market demand for a given product is given by the Technical equation X = S/p, where X measures the total quantity demanded of the given product; S measures total spending for the product and may be viewed as a measure of *market size*; and p measures unit market price. In the case of the monopoly joint-profit maximization subgame, total profit, Π_o, is jointly determined and, in Sutton's analysis, is invariant with respect to the number of firms joining the cartel. Equilibrium market structure as measured by the equilibrium number of firms, N^*, requires that each firm just recover its sunk costs, i.e., $\sigma N^* = \Pi_o$ or $N^* = \Pi_o / \sigma$. In other words, equilibrium market structure will consist of as many firms as the setup costs per firm and total profit, Π_o, will permit. (See Sutton (1991) at 33.)

Sutton shows that the Cournot second-stage subgame will result in equilibrium profits per firm just equal to $\Pi = S / N^2$, where N measures the number of firms. Producing the given product is profitable for the firm so long as $S / N^2 - \sigma > 0$. The equilibrium number of firms entering the market is given by the expression $N^* = \sqrt{S / \sigma}$, reflecting the substitution $\Pi = \sigma$. An implication of $\sqrt{S / \sigma}$ is that growth in market size relative to setup cost increases the equilibrium number of firms, N*, resulting in a more fragmented industry structure. (See Sutton (1991) at 31-32.)

Price competition is most intense in the second-stage Bertrand subgame. Bertrand competition in prices implies that firms will undercut the prices of their competitors until unit price falls to the marginal cost of production. At this point, each firm will realize a loss equal to σ. Therefore, it is profitable to enter the market only if no other firm chooses to do so. Consequently, for any σ > 0, equilibrium market structure is $N^* = 1$, i.e., any time a firm faces sunk costs, one firm enters the market and sets the monopoly price. Thus, where price competition is most intense, market structure is the most concentrated.

These alternative second-stage subgames produce different relationships between market concentration, measured by 1/N, and the size of the market, S.[18] In the monopoly subgame, market concentration falls monotonically as S/σ increases, i.e., as market size increases while collusive monopoly profits and σ remain fixed. If the second-stage subgame is Cournot competition in quantities, then $1/N$ also declines monotonically as S/σ increases, but market concentration is higher than the cartel case for any given value of S. In the Bertrand subgame, market concentration is invariant to any value of S, since equilibrium market structure consists only of one firm. These relationships emphasize an essential attribute of Sutton's analysis of exogenous sunk costs, namely, the intensity of price competition affects market structure such that a fundamental trade-off exists between intense price competition and equilibrium levels of market concentration. Sutton refers to this critical relationship as the *toughness of price competition.*

[18] Other pricing subgames are possible, although we do not consider them here. If few sellers face few, or a single, buyer rather than many as implicitly assumed in the three cases considered in the text, then a bilateral bargaining game may be the appropriate pricing hypothesis.

(2) Endogenous Sunk Costs and Market Concentration

Endogenous sunk costs ordinarily refer to expenditures, such as advertising and 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.

In terms of Sutton's game-theoretic analysis, the extent of vertical product differentiation, or quality, may be represented by δ as shown initially in equation (6). The functional relationship linking the level of δ to sunk expenditures intended to enhance perceived product or service quality is represented by $A(\delta)$. The cost represented by $A(\delta)$ is *fixed*, because it is independent of the level of output produced.

Introducing the function $A(\delta)$ facilitates an important analytical distinction between exogenous sunk set-up costs, σ, 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 setup cost equal to σ. At the new second stage, the N firms choose optimal values for δ, which, in turn, determines the fixed cost $A(\delta)$. 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 δ as fixed. This more complex game specifies the total fixed and sunk costs for a given firm as the expression $F(\delta) = \sigma + A(\delta)$, where $A(\delta)$ may be given a specific parametric structure reflecting empirical knowledge about the effectiveness of expenditures on δ to influence the consumer's willingness to pay. (See Sutton (1991) at 51-52.)

Since each network *1 through k* faces its own total fixed and sunk cost function as denoted above, and since these fixed and sunk costs must be recovered, the function above for an MVPD platform operator can be modified to $F(\delta) = \sigma + A(\delta) + B(\Sigma\delta k)$, where the summation sign sums endogenous sunk costs for all networks network *1 through k* carried on a particular MVPD platform. $A(\delta)$ represents the endogenous sunk costs incurred by the MVDP platform operator; $B(\Sigma\delta k)$ represents the sunk costs incurred by all programming networks carried by that platform. It is clear from this formula that an MVPD platform operator faces substantial upward cost pressure as platform and program quality improve resulting in higher prices that must be recovered from consumers.[19] Additionally, there is a clear feedback effect: for every increase in $A(\delta)$ incurred by a MVPD platform operator to increase channel capacity and thus the number of networks carried, the summation in $B(\Sigma\delta k)$ will also *increase*. Thus, price increases resulting from quality competition is a clear implication of pervasive endogenous sunk costs for both MVPD platform operators and program networks. (For simplicity in the discussion which follows, total fixed and sunk costs are again

[19] To be completely precise, not all of the fixed and sunk costs must be covered by consumers; some are recovered from advertisers.

represented as $F(\delta)=\sigma+A(\delta)$, although the more complex expression in this paragraph more accurately depicts the multichannel video industry.)

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 endogenous sunk costs, *i.e.*, $\sigma+A(\delta)$, required to enter and compete successfully in a market. At some level of endogenous sunk costs, the endogenous sunk costs come to dominate exogenous sunk costs so that there will not be room within a given market for more firms as market size increases. As a result, the monotonic relationship between reductions in concentration as market size increases is effectively broken. Thus, the emergence of non-price competition in the form of vertical product differentiation will actually halt a decline in concentration as market size increases, and may even foster greater concentration if endogenous sunk costs exceed the exogenous sunk costs of market entry.

The inclusion of endogenous sunk costs in Sutton's analysis provides a coherent explanation of the *finiteness property*, i.e., market concentration tends to approach a lower bound rather than decline monotonically as market size becomes ever larger. Additionally, Sutton's analysis of endogenous sunk costs identifies the critical importance of the *ratio* of exogenous to endogenous sunk costs in explaining why some industries tend to become increasingly concentrated even as market size increases. Finally, the inclusion of endogenous sunk costs in Sutton's analysis predicts the nature of competition likely to characterize rivalry in different markets. In markets where exogenous sunk costs tend to dominate endogenous sunk costs, the second-stage subgame will emphasize some type of price competition as modeled, for example, in terms of a Cournot or Bertrand subgame. Alternatively, in markets where endogenous sunk costs tend to dominate exogenous sunk costs, then price competition tends to give way to non-price rivalry where product quality or product innovation (as found, for example, in the computer software industry), replace product price as the critical dimension of competitive behavior. In the extreme, such non-price rivalry may reduce to an intense race for complete market dominance: all participants engage in fierce competition for market share and, ultimately, the winner takes all and all other competitors exit the market. (See Frank and Cook (1995); Economidies (2004) at 12.)

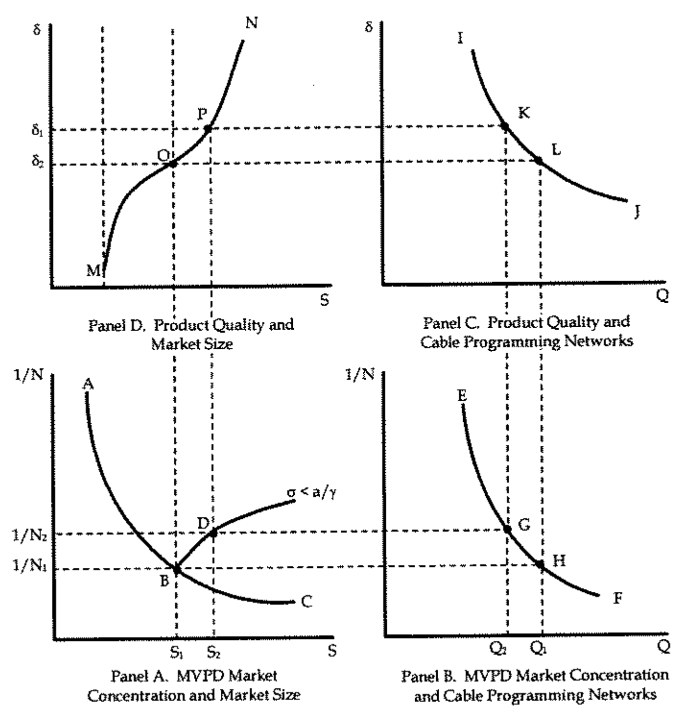

Figure 4. MVPD Market Concentration, Market Size, Product Quality, and Quantity of Cable Programming Networks

Figure 4 ties together and summarizes the implications of Sutton's game-theoretic analysis of market structure competition in quality as applied to the contemporary multichannel video industry where market size grows through time as suggested in Table 1. Figure 4, in a novel fashion, illustrates the implications of Sutton's insights when applied to MVPD market viewed as a two-sided market where endogenous sunk costs are pivotal. Panel A of Figure 4 plots the relationship between MVPD concentration viewed *nationally*, i.e., an aggregation of local MVPD markets, measured by $(1/N)$, and market size, S.[20] The locus of points between A and B and B and C represent different values for N and S given by the equation $1/N = \sqrt{\sigma/S}$ for a given value of σ. This expression is just the reciprocal of $N^* = \sqrt{S/\sigma}$, which determines the equilibrium number of firms that will enter the MVPD market in the first stage of the game. The curve bounded by points ABC is monotonic with respect to the number of firms entering the market as market size increases. In other words, if industry profits are at least equal to the level of exogenous sunk costs of market entry, σ, then additional firms will enter the market and reduce market concentration, $(1/N)$, as market size increases.

If vertical product differentiation, or product quality, becomes the focal point of competitive rivalry as market size increases, then the monotonic relationship between market concentration and market size will be broken. More specifically, suppose, following Sutton (1991, at 52-53), that the relationship linking perceived product quality, δ, with endogenous sunk expenditures on inputs, which improve product quality, together with σ may be written as $F(\delta) = \sigma + A(\delta) = \sigma + a/\gamma(\delta^{\gamma} - 1)$, where a measures the unit cost of expenditures on resources that enhance product quality or consumer willingness to pay, and γ is a parameter measuring how rapidly diminishing returns occur as F(δ) is increased. Sutton shows that if a/γ is greater than σ, i.e., if

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20 The relationship between national MVPD concentration and market size shown in Panel A of Figure 4 reflects a specific value of exogenous sunk cost, σ. Different values of σ will shift the relationship downward and to the left. Additionally, the relationship in Panel A is drawn to reflect the assumption that price competition in the second stage of the game is Cournot competition in quantities. For further discussion of the derivation of the relationship shown in Panel A in Figure 1, see Sutton (1991) at Chapter 3.

endogenous sunk costs dominate the exogenous sunk costs of market entry, then the market structure-market size relationship shown in Panel A will reach a switchover point at point B and trace an upward-sloping locus of points represented by the curve BD. (See Sutton (1991) at 56-60.) In other words, as market size continues to increase, rivalry among competitors tends to focus more on product quality or product innovation and less on price. In particular, the incumbent cable operator will have a strong incentive to respond to entry with expenditures on endogenous sunk costs that increase quality rather than by responding to entry with price competition.[21] If market growth is accompanied by growing endogenous sunk expenditures that effectively raise consumer willingness to pay, then fewer firms will find sufficient room in the market to recover the escalating sunk costs of both market entry and quality competition even if the market continues to grow larger. Thus, market concentration will reach a lower bound at point B and $(1/N_1)$ at market size S_1 and then begin to increase along BD reaching $(1/N_2)$ as market size grows to S_2.

The analysis summarized in Panel A in Figure 4 suggests that the entry of additional MVPD platforms, such as DBS, may not necessarily continue to reduce market concentration over the longer term. If rivalry between and among MVPD platforms over the longer term increasingly focuses on program innovation and quality, then the equilibrium number of MVPD firms constituting the lower bound on market concentration may only include a few firms, and possibly even *fewer* as market size, measured, say, by the total number of MVPD subscribers, continues to grow.

[21] Indeed, the question of whether certain sunk costs may be endogenous for the incumbent (i.e., increasing quality to respond to entry) but simultaneously exogenous for an entrant (i.e., necessary simply to survive in the market once the incumbent has improved quality) is not one addressed here, but this possibility is noted and it is recognized that such a dynamic could drive further quality improvements.

The locus of points represented by the curve EF in Panel B in Figure 4 suggests an implication of the Sutton analysis for the programming network side of the MVPD two-sided market, namely, that as concentration among MVPDs increases, the bargaining power of the large cable operators with respect to cable program networks is augmented to an extent that profits of at least some cable program networks are adversely affected. Consequently, the number of competing cable program networks within a programming strategic group or niche available to cable subscribers may be attenuated as concentration among national MVPD increases. Although the precise shape, or elasticity, of the curve EF is not known, the experimental results of an FCC experimental economics study (BKS Study (2002)) suggest that the relationship between MVPD concentration (1/N), and the number of cable programming networks within various niches, Q, shown in Panel B of Figure 4 is inverse as hypothesized by curve EF.

Given the concentration-programming relationship shown in Panel B, suppose that multichannel market size shown in Panel A increases from S_1 to S_2. Continuing to assume that σ is less than a/γ, then MVPD concentration increases from ($1/N_1$) to ($1/N_2$) as market size grows larger. In Panel B, the increase in MVPD concentration results in a movement along curve EF from point H to point G, with a corresponding reduction in the number of cable programming networks within a given programming genre from Q_1 to Q_2.

Panels C and D in Figure 4 make explicit the interdependencies of growth in market size, the quantity of quality embedded in output produced, and the number of cable programming networks within a strategic programming group surviving in market equilibrium. More specifically, the intensification of competition in quality represented by the movement from point B to point D in Panel A of Figure 4 and the subsequent reduction in the number of cable programming networks from Q_1 to Q_2 is also mirrored in Panel D as an increase in the equilibrium quantity of quality from δ_1 to δ_2. The curve shown in Panel D traced out by the locus of points M, O, P, and N, suggests that the quantity of quality will grow as market size increases since endogenous sunk costs are committed by firms incurring the exogenous sunk costs of market entry to enhance product quality or the consumer's perception of enhanced product quality. So long as exogenous sunk costs exceed endogenous sunk costs, it is reasonable to hypothesize that the increase in the quantity of quality, δ, increases at a decreasing rate along the segment bounded by points M and O until the inflection point is reached at point O at market size S_1, where endogenous sunk costs begin to exceed exogenous sunk costs. At this point, product quality increases at an increasing rate as competition in quality intensifies, and the number of competitors decreases notwithstanding the growth in market size. This panel reflects the effects of both quality competition on MVPD market structure, i.e., the equilibrium number of MVPD platforms, and of quality competition within programming niches, both of which may reduce the quantity of programming networks within a niche, but increase the quality of those that remain.

Panel C in Figure 4 makes explicit a fundamental trade-off inherent in the analysis of Figure 4 and reveals of an important implication of quality competition for consumers on the subscriber side of the MVPD market: as competition in quality intensifies and the quantity of quality increases, the number of cable programming networks within programming niches will tend to decline, thereby diminishing the extent of horizontal product differentiation available to subscribers within any given type of programming network. In other words, as long as the cost of quality is predominantly embedded in fixed costs, then lower quality programming networks will be displaced by higher quality programming networks and consumer choice between lower and higher quality networks will be restricted within a niche decreases from Q_1 to Q_2 in Panel B, the quantity of quality increases from δ_1 to δ_2 as shown in Panel D or, as shown in Panel C, the quantity of quality increases from point L to point K along the curve bounded by points I, K, L, and J.

The analytics of the Sutton paradigm embedded in Figure 4 may be usefully reinterpreted within the framework of basic two-sided market theory. Panel A shows the effects on MVPD market concentration as market size grows through time as competition in quality intensifies in response to increasing endogenous sunk cost investments. The third-stage pricing subgame determines the *total* price of MVPD platform services to both subscribers and program network following some variant of equation (2) reflecting the operable pricing hypothesis; e.g., Cournot competition in quantities. As shown in equation (6), the equilibrium *allocation* of total price between subscribers will depend on the own-price elasticity of demand for the particular platform service provided to each side of the market (which is not necessarily the same to each side) and the effects of quality changes on the platform services provided to subscribers and program networks. Panel B in figure 4 reveals the *effects* of the growth in MVPD market size and competition in quality on subgroups (programming niches) on the program network side of the MVPD market such that increasing concentration in the MVPD platform market results in fewer program networks within each program niche. Finally, Panel C in Figure 4 reveals the effects of the growth in MVPD market size and competition in quality on consumers on the subscriber side of the market in the sense that subscribers face a tradeoff of fewer program choices within a program niche in exchange for higher quality programming among the choices that remain.

3. CONCLUDING PERSPECTIVES

This paper suggests an alternative conceptual framework to the conventional price competition model of applied industrial organization for understanding and predicting the evolution of market structure; predicting the likely conduct of market participants; and evaluating observed metrics of market performance in the contemporary multichannel video industry. The proposed synthesis of Sutton's industrial organization paradigm with basic ideas derived from two-sided market theory is provocative as a matter of concept and still untested empirically in a formal sense. Yet both the intuition of the proposed synthesis and its rough congruence with observable behavior within the multichannel programming industry seem encouraging. The concluding perspectives offered here are, therefore, tentative rather than definitive given the exploratory character of the analysis.

One implication of the analysis in this paper is that growth of DBS market share does not necessarily mean that concentration among MVPDs will continue to decline as market size grows over time. Indeed, market entry may have little long-term effect on either cable or DBS pricing if the nexus of competitive rivalry is the diversity and quality of programs that MVPDs offer their subscribers. Thus, it may be that, at best, the presence of DBS may increase product quality but accompanied with price increases, and perhaps with different competitors serving different areas (*e.g.*, cable serving urban and suburban, DBS serving rural).

The analysis of this paper is both static and dependent on the quantitative magnitude of many parameters embedded in the Sutton model. Without this parametric knowledge, it is hazardous to predict long term, equilibrium market structures and patterns of conduct in the programming network side of the market or the MVPD platform market itself. It is plausible, however, to predict that, in the short term, competing on quality will increase product quality available to MVPD subscribers, both in terms of individual networks and of MVPD packages, but at the price of higher rates. In the longer term, the final result of this competition is indeterminate, and the outcome for consumers depends upon the number of competitors the MVPD platform market can support. If the market can support two or more competitors in the long run, consumers will preserve their quality gains, and quality will continue to improve as long as multichannel video consumers are both able and willing to pay for more and higher quality services. If the market can support only one provider in the long run, quality increases may stagnate, and prices may rise to monopoly levels.

This paper identifies a critical tradeoff between additional cable programming networks offering additional programming variety within a programming niche (horizontal product differentiation) for fewer but higher quality cable programming networks within any given programming niche as suggested in Panel C of Figure 4. This paper does not provide a consumer welfare analysis that might reveal whether point K or point L provides the higher level of consumer welfare. To the extent, however, that consumers freely purchase higher quality channel packages in preference to packages of more diverse but perhaps lower quality channels, a market equilibrium dominated by higher quality but less diverse programming may be a Pareto superior outcome. Such a conclusion accepts, however, that the extant distribution of income is acceptable and that market intervention to correct for distributional concerns is undesirable. Additionally, even as diversity within programming niches drops, the number of programming niches may increase (as has happened historically), allowing consumers access both to higher quality and more diverse programming.

The Sutton paradigm offers new, compelling hypotheses for understanding entry, market structure, and competition in oligopolistic markets where exogenous and endogenous sunk costs matter.[22] Although the scope of this paper precludes a detailed summarization of the subtle differences between a conventional Bain-type study of price competition in the multichannel video industry versus the Sutton-type of quality competition developed in this paper, a final observation on barriers to entry is illuminating for the design of public policy fostering competition. From Bain's perspective, barriers to entry–economies of scale, advertising, R&D spending–represent obstacles to market entry by new competitors that forestall or attenuate the level of competition from what might otherwise prevail in the absence of such barriers. The pro-competition public policy response is clear: market intervention to reduce barriers to entry is justified so long as the intervention itself is not a new type of barrier to entry or more costly than the value of the increment of consumer welfare that greater competition induced by new entry is expected to produce.

The Sutton paradigm implies, however, a very different view on Bain-type entry barriers. While the exogenous sunk costs of market entry are analogous in both principle and effect to a Bain-type barrier, namely, economies of scale, Sutton's endogenous sunk costs, *i.e.*, spending on advertising and R&D, are *not* obstacles to the realization of more intense competition but instead are the *result* or *consequence* of intense competition for quality. Paradoxically, according to Sutton, endogenous sunk costs emerge as Bain entry barriers only *after* an intense competitive struggle, *i.e.*, competition for the market, and not before the rivalry even occurs, as Bain would predict. In the Sutton paradigm, entry is *free* beyond the exogenous costs of entry, and

[22] Bresnahan (1992) offers an insightful analysis of Sutton's paradigm as a major contribution to the study of entry and industry in modern, post-Bain industrial organization.

concentration emerges as a consequence of competition for quality even as market size increases. This perspective contrasts sharply with the Bain viewpoint that all entry barriers are exogenous and, by definition, are preclusive of new competitors and more intense competition. Concentration under Bain is viewed as a consequence of a *lack* of entry, *not* free entry with intense competition for dominance in quality as Sutton describes. Unlike the Bain paradigm, the pro-competitive public policy implications of the Sutton paradigm respecting entry barriers are not clear, and represent an important topic for pro-competitive public policy research in the years ahead.

This paper represents only an initial effort in the exploration of alternative models beyond the Bain paradigm for understanding structure, conduct, and performance in the contemporary multichannel video industry. Although much additional theoretical and empirical work on applying the Sutton paradigm and two-sided market theory to the multichannel video industry remains to be done, this paper finds that competition in quality is a useful model for informing public policy toward the industry and for predicting and understanding the economic forces that will likely shape the industry during the early twenty-first century.