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**COMPETING ON QUALITY: TWO-SIDED MARKETS, THE
SUTTON PARADIGM, AND THE MULTICHANNEL VIDEO
INDUSTRY: A GRAPHICAL APPROACH**

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Abstract

This paper applies the Sutton game-theoretic framework to explain observed behavior in the multichannel video industry. Additionally, incorporating the more recent two-sided markets literature into Sutton's sunk cost model suggests that two-sided industry with significant endogenous sunk costs, like the multichannel video industry, will experience less price competition and more quality competition than a single-sided market with significant endogenous sunk costs. As a result, evolving multichannel video competition may lead to higher prices, not lower, but also will result in higher quality video products and channels. Thus, improvements in consumer welfare in this industry are perhaps better understood in terms of the extent of ongoing improvements in the quality of video programming, rather than static metrics of market structure and performance, such as trends in industry concentration and price-cost margins.

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I. Introduction and Overview

This paper proposes that the Sutton game-theoretic framework provides a more coherent and consistent explanation of observed conduct and performance in the contemporary multichannel video market than the Bain paradigm of industrial organization. Traditional industrial organization and horizontal product differentiation models tend to predict that increasing market size will decrease market concentration.¹ By contrast, the Sutton framework predicts a breakdown in the monotonic relationship between market share and market size at the point where endogenous sunk costs dominate exogenous sunk costs of market entry. At that point, market participants', particularly incumbents', ability to expend greater resources on endogenous sunk costs, perhaps due to greater financial resources or to first mover advantage, shifts the focal point of competitive rivalry from price competition to product quality and innovation such that a single firm, or just a few firms, will dominate the market and thus *increase* market concentration with increasing market size. Market forces in both the cable programming network and multichannel distribution segments appear to be consistent with this pattern of evolutionary structural development rather than one of structural fragmentation.² Although counterintuitive, consumer welfare is not necessarily adversely affected by this prospective increase in market concentration. This paper identifies the implicit trade-offs and economic circumstances that may lead to gains in consumer welfare, at least for some consumer groups, as the multichannel video industry experiences greater concentration.

Additionally, the paper explores the integration of Sutton's game theoretic framework with basic elements of two-sided market theory. As described in more detail below, a two-sided market exists where two sets of customers of a special-type firm, namely, a *platform*, are dependent on each other. The business firm supplying a two-sided market renders a "matchmaking" service to both sets of customers. In the case of the multichannel video industry, multichannel video distributors, like cable operators and DBS providers, provide a platform to connect consumers with programming networks. The analysis herein indicates that two-sided markets with significant endogenous sunk costs, like the multichannel video market, will experience less price competition and more quality competition than a single-sided market with significant endogenous sunk costs.

Cable operators as multichannel video platform businesses have been raising prices much faster than general inflation over the last decade, despite the entry of, and dramatic growth of, by what appear to be nationwide competitors, namely, Direct Broadcast Satellite ("DBS") providers. The price fluctuations for cable services as well as the current pricing of DBS indicate that competition from DBS provides only a weak constraint on the market power of cable companies.³ This hypothesis is supported by the observation that cable prices drop dramatically where a second cable operator

¹ Useful references on horizontal product differentiation include Anderson, de Palma, and Thisse (1992) and Martin (2002).

² Referring to cable programming as an "upstream" market and to multichannel video distributors as a "downstream" market is traditional nomenclature in cable industry and regulatory policy discussions. It is less meaningful, however, when viewing the multichannel video industry as a two-sided market. We therefore refer to these activities as "sides" of the same market, as the "programming network" side and the "multichannel distribution" side.

³ See Wise and Duwadi (2005).

overbuilds an existing system, but cable prices rise quickly everywhere else in the country. Even as the market has grown in the last decade, price competition has not intensified, contrary to the predictions of traditional industrial organization theory that envisions market expansion, new entry, and market fragmentation as factors that encourage price competition. Instead, multichannel distributors have steadily increased quality, adding large numbers of additional channels, high-speed Internet access, digital services, video-on-demand, and high definition services, as predicted by the Sutton framework when endogenous sunk costs dominate exogenous sunk costs.

In the programming network side of the market, program networks do not sell directly to consumers, but rather provide their programming services to multichannel video distributors, which then package cable networks as bundles of programming sold to consumers. (In the terminology of two-sided markets, multichannel video distributors function as "platforms.") Programmers thus appear to have little incentive to compete on price, preferring instead to gain a large market share within a programming niche through quality improvements and innovation. This dynamic appears to drive upward the price of programming and, hence, the price of multichannel video service. In other words, since both the platform operator and program networks face significant sunk costs, and compete on quality *a la Sutton*, the effect of increasing quality and increasing prices for consumers is intensified. Specifically, consumers pay more for the multichannel video product because multichannel distributors increase quality to compete *and* pass through the costs of video programmers increasing quality in order to seek dominance within programming categories or niches.

This paper applies Sutton's game theoretic analysis of market entry, price, and quality competition to the multichannel video industry, and links this theory in a novel way to two-sided market theory. Together, these two strands of recent economic theory neatly unravel the apparent paradox of increasing entry but anemic price competition in the U.S. multichannel video distribution industry. The paper predicts that, at some point, endogenous sunk costs will dominate exogenous sunk costs for both multichannel video platform operators and program networks such that non-price rivalry replaces price as the critical dimension of competitive rivalry.⁴ In the extreme, such non-price rivalry may, but not necessarily, reduce to an intense race for complete market dominance: all participants engage in fierce competition for market share and, ultimately, the emergent winner takes all and other competitors exit the market. Additionally, cost increases incurred by multichannel video distributors due to non-price rivalry in the programming network side of the market are passed through to consumers. Thus, price effects on consumers from non-price rivalry appear greater in this two-sided market than in single-sided markets generally. As a result, the paper predicts that evolving multichannel video competition may lead to higher prices, not lower, but also will result in program choices that closely track the preferences of consumers with a high willingness to pay.

The paper advocates the application of Sutton's game theoretic analysis for analyzing competition in the multichannel video industry. This analysis further

⁴ In other words, vertical product differentiation, *i.e.*, product quality or product innovation, replaces price as the primary nexus of competitive interaction.

indicates that the two-sided nature of the market is central to understanding the nature of competitive forces in the multichannel video industry. The paper shows that extant multichannel video competition is unlikely to constrain future increases in prices; that reliance on DBS market share as a metric for increasing competition will be misleading; and that the state of price competition taken alone is an incomplete, if not incorrect, indicator of market performance in the multichannel video industry. Rather, improvements in consumer welfare and market performance in the U.S. multichannel video distribution industry are perhaps better understood in terms of the extent of vertical product differentiation that benefits consumers, i.e., ongoing improvements in the quality of video programming available to consumers of multichannel video services.

The paper is organized as follows. Section II discusses the nature of the contemporary multichannel video industry. Additionally, Section II reviews a selective but representative group of papers that examine certain aspects of the multichannel video industry from diverse analytical perspectives. This literature review provides a context of evaluating the distinct analytical contribution of the present paper. Section III develops the conceptual framework for understanding two-sided markets, and competition on quality (rather than price) in general and, in particular, Sutton's game-theoretic paradigm of contemporary industrial organization theory. To improve understanding, aspects of Bain's familiar structure-conduct-performance paradigm are reviewed and contrasted with the Sutton paradigm. Section IV presents pertinent industry data to explore whether predictions of the Sutton paradigm conform to observed industry experience. Finally, Section V summarizes the analysis of the paper and suggests conclusions. The Appendix provides a rudimentary review of the meaning and implications of vertical product differentiation and how the consequences of vertical product differentiation for market performance differ from the more familiar concept of horizontal product differentiation.

II. Background and Previous Research

Government policy toward cable rates reflects confusion about the nature of the multichannel video industry and the proper role of public policy. In recent memory, cable rates have been deregulated (1984), re-regulated (1992), and then deregulated again (1996). Additionally, court rulings have prevented promulgation of statutorily-mandated ownership limitation regulations on the cable industry. In a market that is viewed as potentially competitive in the traditional sense, deregulation and the entry of competitors should result in decreasing prices over time. This anticipated result has not occurred, despite various forms of entry and a growing market. Deregulation of cable rates has always occurred in response to, or in reference to, some form of competition, either local broadcast channels (1984) or other multichannel competitors (1996). The persistence of rapid price increases, however, indicates that the mere presence of additional competitors has not increased the intensity of price competition.

A. Nature of the Multichannel Video Industry

The process of creating and distributing programming to viewers involves three distinct economic activities: (1) the production of programming; (2) the packaging of

programming into programming networks; and (3) the distribution of programming to consumers, either by free over-the-air broadcast signals or by subscription via cable, wireless, or satellite. Some entities participate in two or more of these activities (*i.e.*, exhibit vertical integration), while other entities participate in a single activity. This paper is concerned chiefly with the second and third activities, *i.e.*, multichannel video platform operators and program networks.

B. Multichannel Video Programming Distribution

Multichannel video platform operators consist of firms ranging in size from single-system cable operators with only a few dozen subscribers to multiple system operators ("MSOs") that own many systems and serve millions of subscribers. Multichannel video programming distributors bundle programming networks into groups of channels or "tiers" and sell this programming to consumers, deriving revenues from subscription fees and the sale of advertising time.⁵ Cable systems consist of a central distribution headquarters, or "headend," in each local market that receives local or distant signals and then transmits them via cable television networks to individual households. By law, the supply of cable services is provided through "local franchises." The market, therefore, for multichannel video distribution service is local. Cable system operators are awarded the right to offer service to a given area based on negotiations with the governments of local communities. Adjacent communities often receive service from different cable systems at different prices, depending upon which cable systems serve those areas.

By contrast, contemporary DBS, which began service in 1993,⁶ is a service offered to almost the entire nation at essentially the same terms and prices.⁷ DBS operators transmit signals from ground stations to geostationary satellites in the southern sky, which, in turn transmit signals to millions of subscribers. This system architecture of "few to many" (*i.e.*, from a few satellites to many millions of subscribers) differentiates DBS technically from cable service. DBS is inherently limited in the spectrum available based on the number of satellite channels available, although compression technologies can and have alleviated this constraint. Additionally, it is more technically difficult for DBS operators to transmit signals to limited groups of subscribers (such as local-into-local broadcast signals to the communities from which they originate) than for cable operators that have a presence in each local community. Until recently, DBS capacity was not an issue, because they offered more and higher-quality (from using an all-digital transmission system) channels than cable operators. More recently, however, cable operators have upgraded most systems with digital technology, thus increasing the number and quality of their video services, and have also begun offering ancillary services that are difficult for DBS operators to match, such as high-speed Internet access and telephone service. Whether this dynamic becomes increasingly important in

⁵ MVPDs generally do not package all of their programming into tiers, but sell some programming on a per-channel or per-program basis. Premium services such as HBO and Showtime, for example, may be sold on a per-channel basis. Sports events and movies are sometimes sold on a per program, or "pay-per view," basis.

⁶ Primestar, a "medium power" satellite provider, began service in 1993. Current providers of DBS service provide a "high powered" service, the main difference being a smaller dish. DirecTV began offering the first "high powered" DBS service in 1994, and acquired Primestar's subscribers in 1999, and converted them to "high powered" DBS service.

⁷ The earliest DBS was provided by COMSAT in 1982. It was a commercial failure.

competition between cable and DBS remains to be seen, but the analysis of this paper implies that it may, since quality of overall service appears more important than price.

Distribution of multichannel video programming involves substantial sunk costs. Initial construction of a cable system or launch of a satellite is an enormous sunk cost. Subsequent events can lead to additional sunk costs. As described below, competition occurs in the multichannel distribution segment predominantly in terms of quality rather than price, and increasing quality involves additional sunk costs for multichannel video distributors.⁸ Much of these sunk costs involve investments in network improvements that allow carriage of additional programming networks, improved quality networks (i.e., digital transmission and high-definition), and new services (e.g., video-on-demand).⁹ Most importantly in the context of this paper, these ongoing sunk costs are endogenous. As described in more detail below, exogenous sunk costs are those necessary for entry into the market; endogenous sunk costs are voluntary and strategic, incurred in order to enhance consumers' willingness to pay for a service. Clearly, sunk costs incurred to increase channel capacity as a competitive response to other multichannel video distributors is an endogenous sunk cost, not an exogenous one, and this fact is critical for application of the Sutton paradigm to this market.

C. Programming Networks

Producers of programming use a mixture of highly specialized and non-specialized inputs to create programs.¹⁰ Programming networks produce their own programming and/or acquire programming produced by others. The programming network side of the market consists of a wide variety of firms, ranging from entities that own one programming network and largely acquire their programming from unaffiliated program producers (e.g., the Outdoor Channel), to large corporations such as Discovery, which owns many programming networks and whose package of programs includes programming that is produced in-house, to AOL Time Warner which produces many of its own programs, owns many programming networks, and owns its own cable system.

The programming network side of the business involves high program production costs. The traditional view of the production of programming networks is that it involves high sunk costs, but near-zero marginal costs of production and, indeed, the incremental cost of showing an existing program to one additional viewer is nearly zero. This is somewhat oversimplified, however, because it gives the impression that once a

⁸ Multichannel distributors can increase quality to a limited degree without incurring large sunk costs, especially when they have unused channel capacity available simply by filling the unused channel capacity with additional networks. Ongoing quality competition, however, will eventually exhaust existing network capacity and require the investment of additional sunk costs. Thus, the story of ongoing quality competition in this market requires continuing expenditure of sunk costs.

⁹ Some aspects of programming costs are also sunk and endogenous, at least as far as carriage of channels involves long-term contracts that cannot be renegotiated. Some carriage contracts for some networks can be renegotiated, however, and if a multichannel video distributor goes out of business, it stops paying the fees in such contracts. Since investments for capital improvements of existing, operating networks clearly constitute endogenous sunk costs, those investments are the focus of the analysis of endogenous sunk costs in this paper.

¹⁰ More specifically, program producers use both labor and non-labor inputs in program production. Labor inputs may be divided into two groups. The first group consists of stagehands, cameramen, film editors, and similar craftsmen. This group is characterized by relatively homogeneous resources that are readily available to the industry. The second group of labor inputs includes specialized or "talent" inputs, which may consist of actors, directors, writers, and producers. These resources are heterogeneous with respect to the salaries they can command in the marketplace, their ability to produce output which appeals to large audiences, and their ability to earn in their best alternative employment, i.e., their opportunity cost. As a result, they are higher cost and have fewer available substitutes. (See FCC, 1990.)

programming network has the basic equipment and personnel to produce programming, it can produce all the programming it wants at no additional cost. This is clearly not true. Some fixed and/or sunk costs for producing programming are spent once, or only as equipment must be replaced, but others recur. Rather, marginal cost is near zero to transmit any program already produced, but marginal costs for additional programs may be quite high even after fixed and/or sunk costs are spent. Additionally, some fixed costs are on-going and repeated, beyond the sense faced by any industry such as for the replacement of worn-out or obsolete equipment. Examples of on-going fixed and/or sunk costs are the renewal of sports rights, renewal of contracts for on-air personalities, and new technology required for the production of new, original programming.

As an example, take the case of ESPN and its "Sunday Night NFL Football." To launch the network 24 years ago, ESPN incurred fixed and/or sunk costs for certain essential inputs, such as cameras, satellite links, and production facilities. In the terms discussed below, these costs are clearly exogenous. ESPN has repeatedly incurred sunk costs on contracts for on-air personalities, at higher and higher rates as the personalities have become household names. Subsequently, when renegotiating the contract for "Sunday Night NFL Football," it spent an enormous quantity of money on a new sunk cost, the rights to broadcast the NFL on Sunday night. This cost will be repeated as often as the contract comes up for renewal. These repeated sunk costs are partially exogenous, but largely endogenous, i.e., not strictly necessary for continuing operation, but incurred to increase consumer willingness to pay for the network and as a strategic response to existing or potential competition. Further, the marginal cost for producing each Sunday night game is clearly *not* zero - personnel and equipment must be moved to the game site and employees must be paid for their time. Only the marginal costs of transmission are near-zero, meaning that it costs ESPN no more if every cable operator in the country carries the game than if only one does.

The implication of this description is that there is considerable risk involved in running a programming network, because there is an initial set of sunk costs before any revenue is generated, and then ongoing decisions about spending on new sunk costs. Incur the wrong sunk costs, then popularity drops, advertising revenues drop, and perhaps even carriage on cable systems drops. Fail to incur the right sunk costs, and perhaps another network acquires the programming, and then popularity and revenues shift to that other network. Management of this risk is critical in the business.

The existence of this kind of risk encourages a "race for dominance" among programming networks, particularly within programming categories or niches. As described in greater detail below, networks do not sell directly to consumers, but instead sell indirectly to consumers through the platform provided by multichannel video distributors, and even more indirectly since most networks are sold as part of a tier of other networks. Thus, networks cannot make themselves more desirable to consumers by lowering price; they can only increase consumer interest by increasing quality. As with multichannel distributors, this involves expenditure of endogenous sunk costs to secure critical content (such as NFL carriage rights for a sports network). Thus, programming networks have little incentive to reduce the cost of their services, and

significant incentive to increase the cost of their services to the maximum extent that they can pass through to consumers through multichannel distributors.

Clearly, multichannel video distributors have the option of assuming all the risk themselves by producing their own programming. This happens to some extent, most clearly when cable operators own and operate regional sports networks that are only carried by their own systems. Over time, however, all types of vertical integration between cable operators and programming networks have decreased.¹¹ Even when vertical integration was much higher in the industry, however, no national networks were owned and carried exclusively on the owner's cable systems. Cable operators still shared the risk of wholly-owned cable networks by offering them for carriage on other cable operators and with DBS operators. Moreover, given the drop in the level of vertical integration over the past ten years, it appears that cable operators have decided that, in many cases, the best way to deal with this risk is through buying programming rather than making programming.

Assumption of this risk is spread between programmers and multichannel video distributors based on the terms of carriage agreements. Programmers bear the risk of any costs not covered by license fees, in that they must sell enough advertising to make up the difference. Multichannel video distributors bear the share of the risk resulting from the fees they pay and from devoting the channel space to the network, channel space that might carry other networks. When one multichannel video distributor does not cover costs, other multichannel video distributors must cover the difference or the programmer will be forced to reduce expenditures or exit the market. Thus, one way to view the market is a strategic effort to shift risk onto other parties. This is a vast oversimplification, however, because there is a clear interdependence between cable operators and programmers.

A more nuanced interpretation invokes the literature of two-sided markets. Programmers realize that they must have carriage to survive. Multichannel video distributors realize they must have quality programming to survive, and that it is profit maximizing to have rapidly escalating rates for more and higher-quality programming, as demonstrated by their drive to add channels and increase rates over time, and their willingness to pay programmers increased license fees for higher-quality programming. Multichannel video distributors act as platforms, joining programming networks and consumers. Both consumers and programming networks receive value from attaching to the distribution network, and both create value by joining the network. Programmers and multichannel video distributors negotiate both to share risk and to internalize the network externalities that accrue.

To summarize the critical elements of the previous two sections, multichannel video distribution is a two-sided market, where multichannel distributors act as a platform connecting programming networks and video subscribers or viewers. Both the platform operator and program suppliers, i.e., network, incur substantial exogenous sunk costs to enter the market and compete through the expenditure of endogenous sunk costs.

¹¹ DBS operators have traditionally been vertically integrated only minimally, although the recent merger between News Corporation and DirecTV created the first heavily vertically-integrated DBS operator.

Programming networks, in particular, have little to no ability to compete based on price, since they do not sell directly to their end users, who observe only network quality as a means of choosing between networks. In other words, multichannel video distributors provide the platform for this two-sided market and expend endogenous sunk costs in order to compete by carrying more and more programming networks that are expending endogenous sunk costs to compete within their programming categories. These costs are, in some or substantial part, passed on to consumers.

D. Previous Research

While papers have been produced concerning direct competition among multichannel video platforms, few papers have closely studied the effect of market structure (usually concentration) on the performance of the multichannel video industry. Chipty, in three papers, studied different aspects of the organization of the cable industry. The first and third studied the effect of cable operator ownership of programming networks (Chipty, 1994 and 2001). The second studied whether national size had an effect on bargaining power and pricing (Chipty, 1995).

A considerable body of research has developed that studies the effect of sunk costs and other characteristics that alter the performance of markets in the presence of competition and with respect to concentration in other industry. Berry and Waldfogel (2003), for example, use the Sutton (1991) framework to examine vertical product differentiation in urban markets. They found that markets where products are differentiated based on quality either fragment, when quality is produced by variable costs, as in the restaurant industry, or remain concentrated with increasing quality and market size, when quality is produced by fixed costs, as in the newspaper industry. Shaked and Sutton (1987) also present this result.¹² Ghosal (2003) finds that increased sunk costs reduce the number of firms in an industry and the variability in the number of firms.¹³

Evans and Schmalensee (2001) described the characteristics and performance of what they term "dynamically competitive industries," which relate strongly to industries that bear substantial sunk costs. Many of the participants in these industries are new technology companies that can quickly be displaced by new companies with new and innovative technologies. These industries (1) have low marginal costs and high fixed costs; (2) are labor and human capital intensive; (3) have network and system effects; (4) involve races to dominance through unique products and/or innovation; and (5) have highly profitable industry leaders.

¹² There can be some debate as to whether the multichannel market presents mainly a vertical differentiation story (*i.e.*, one product, different levels of quality) or a horizontal differentiation story (*i.e.*, multiproduct firms). The second characterization appears to have some relevance because different subscribers subscribe to different services offered by MVPDs, and these services (groups of satellite channels, antenna service, premium movie services, high-speed Internet access, etc.) have different characteristics. Nonetheless, the vertical differentiation is emphasized in this paper given its powerful explanatory value: the vast majority of MVPD subscribers buy the most popular video products offered. This service then acts as a gateway for selling consumers additional services. Indeed, until recently, law and regulation required cable subscribers to purchase a basic service from cable operators to gain access to other services, and many consumers probably are not aware that this restriction has been lifted. Additionally, Matraves and Rondi (2005) find that gains from endogenous quality improvements are only sustainable in markets with some product differentiation as seen in the multichannel video distribution market. They also find that endogenous investment in product quality in such a market will reduce turbulence of market share. For a discussion of horizontal differentiation generally, see Shaked and Sutton (1990).

¹³ Ghosal (2003) also finds that higher profit uncertainty reduces the number of firms entering and exiting an industry.

As discussed elsewhere in this paper, both multichannel video platform operators and program networks share some of these characteristics, with several qualifications. For example, in terms of the second criterion, both are human capital intensive in that they require a highly-trained workforce, with workers with specialized skills, even though labor costs are quite small in comparison to capital costs. (See Evans and Schmalensee (2001) at 8.) Moreover, in terms of the third criterion, both sides of multichannel video markets experience network effects similar to other network-based industries.

Evans and Schmalensee indicate that traditional antitrust analysis, which measures static market share and barriers to entry, is inadequate for dynamically competitive industries. Instead, the key measure of competition in a dynamically competitive industry is the level of dynamic competition, *i.e.*, the threat that another company will introduce a drastic innovation and capture the market. While this is clearly true in the cases that Evans and Schmalensee discuss, it is less relevant to the multichannel video industry, for which the substantial barrier to entry of building a network to connect to subscribers exists.¹⁴ Concerning programming, within established niches that have a dominant programmer, such as sports with ESPN, successful entry is extremely unlikely because the dominant programmer has exclusive access to the best content.¹⁵ The exception to this is the entry into a new, unoccupied programming niche (such as the launch of the Food Network) by a network that subsequently reduces viewership of networks in other niches.

The pioneering paper reference on the economics of two-sided markets is Jean-Charles Rochet and Jean Tirole (2003).¹⁶ Evans (2003), in an article slightly more applicable to the discussion in this paper, described the economics of two-sided markets, or markets in which an intermediary provides a link, or platform, on which buyers and sellers can meet to conduct business. Prices in each market do not follow the marginal costs of each side of the market but instead “optimize output by harvesting the indirect network effects available to both sides.” (Evans (2003) at 89.) This is applicable to the multichannel video market in two ways. First, MVPDs provide a platform on which programming networks reach their ultimate consumers, viewers. Second, both MVPDs and programming networks act as intermediaries between advertisers and consumers. Evans indicates that there are special considerations for antitrust examination of two-sided markets, most notably that prices will not follow marginal cost in either market, and that coordination that might form a *per se* antitrust violation in other markets is an absolute necessity in two-sided markets.

Economidies (2004) investigates the characteristics of network industries, and finds that no adequate legal structure currently exists to apply policy to them. Economidies

¹⁴ Schmalensee (2004) discusses the effects of sunk costs, such as those incurred in building an MVPD network to deliver video programming to consumers, on barriers to entry and antitrust policy.

¹⁵ Indeed, entry was attempted by CNN SI, but even with the backing of Time Warner, the second largest cable operator, and the brand name of Sports Illustrated magazine, this channel failed after only a few months. Fox also attempted to launch a national sports network, but ultimately concentrated instead on regional sports. Rupert Murdoch, the owner of Fox has recently spoken about another attempt at competing in the national sports network niche, but has stated that he would not attempt entry without exclusive content from the National Football League. Also, Time Warner backed a financial news network, CNNfn, in an attempt to enter against the niche leader CNBC that also ultimately failed. (Time Warner has had very bad luck in this area. Most other companies do not try.)

¹⁶ See, *infra*, Section III.A for further discussion of the two-sided markets literature.

finds that network industries may tend toward "natural oligopolies," with a few dominant players, a "winner take most" scenario, similar to the "winner take all" scenario posited by Frank and Cook (1995). Competition often is for the market rather than in the market, as may be the case in competition between incumbent cable operators and overbuilders. He finds that network products violate the law of demand because the value to the consumer increases with increasing consumption, rather than decreasing marginal returns. He describes the characteristics of network industries: (1) the ability to charge on both sides of a network, like a two-sided market, above; (2) externalities are not always internalized, in that a new subscriber is not always compensated for the benefits he or she brings to others on the network;¹⁷ (3) a more rapid penetration in the market, following an "S-shaped" curve as has been observed in the multichannel distribution and programming sides of the market; (4) monopoly may maximize total surplus, and no anti-competitive acts are necessary to create market inequality; and (5) free entry does not lead to perfect competition, as we discuss elsewhere herein for either multichannel video platforms or program networks. Economidies recommends that antitrust enforcement for network industries take into account the nature of such markets, allowing for the significant inequalities that are likely to develop in such markets, and not trying to impose a highly competitive equilibrium that is probably unstable and not surplus maximizing.

This literature review offers a representative view of the relevant industrial organization literature that may illuminate structure, conduct, and performance in the contemporary multichannel video industry. This review suggests that the extant literature may provide an incomplete understanding of the nature of the multichannel video industry and observed economic rivalry. Specifically, two-sided and game theoretic market analysis of the multichannel video industry is lacking. This paper provides an exploratory analysis that addresses this limitation in the current literature. An essential insight of the discussion that follows is that the capital investment by a cable system operator necessary to add channel capacity to carry additional programming networks in response to competition from other multichannel video distributors is an endogenous sunk cost, i.e., one intended to increase the willingness to pay of cable subscribers for the multichannel video delivery service. Also, much of the expense incurred by programming networks to improve quality and thus viewership is also endogenous and sunk. In other words, a cable distribution network, unlike a telephone network, offers no intrinsic utility to the subscriber unless programming is delivered over it. Higher quality, and presumably more expensive, programming, and more programming choices, increases the value of the program delivery service provided by the cable system operator and increases the willingness to pay of subscribers with the ability to pay. In this sense, capital expenditures by multichannel video distributors and expenses for cable programmers to improve quality of programming are analogous to advertising expenditures and R&D spending focused on improving product quality in output markets generally. Such expenditures increase the level of demand facing the firm.

III. Conceptual Framework

¹⁷ This is particularly true for the multichannel video industry: additional subscribers create network effects by increasing the amount paid by advertisers, but those benefits flow only to the programmers and distributors, not to the subscribers that added the value.

This paper joins two strands of recent economic theory in developing its analysis of quality competition in the multichannel video industry, namely, (1) the theory of two-sided markets and (2) Sutton's game theoretic analysis of markets where both exogenous and endogenous sunk costs are important and product quality is the focal point of competitive rivalry. Consistent with the style of the paper, the joining of these two theories is informal and intuitive. Nevertheless, this informal analysis provides a revealing perspective on the likely evolution of market structure, conduct, and performance in the multichannel video industry.

A. Economics of Two-Sided Markets

A two-sided market exists where two sets of customers are *dependent* on each other.¹⁸ The business firm supplying a two-sided market, called a *platform*, supplies a "matchmaking" service to both sets of customers where one customer group also supplies an input of production to the platform operator. 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 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*.¹⁹ 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

¹⁸ 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.

¹⁹ 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.²⁰ 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.



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.²¹ 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.²² Further, suppose the monopoly MVPD platform operator is selling its "output" to customers in both groups--network programmers and

²⁰ 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.

²¹ See Rochet & Tirole (2003) and Hagiu (2005).

²² The following discussion relies in substantial part on Evans (2003).

subscribers—using a common metric, say, units of *access*. Thus, MVPD subscribers buy *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:

$$D_T = D_1(p_1) \times D_2(p_2) \quad (1)$$

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.²³ 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.

From a two-sided market perspective, 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 one side of the market or the other is economically arbitrary.²⁴ 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:

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

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 .²⁵ 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

²³ 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).

²⁴ 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.

²⁵ The standard formula for the own price elasticity of demand for output i is $(p_i / D_i)(dD_i / dp_i)$.

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 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,

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

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.²⁶ In symbols,

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

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,

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

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 .

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-

²⁶ See Evans (2003), p. 342.

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. In the sections that follow, this paper provides an exploratory discussion of the multichannel video industry viewed as a two-sided market but where *competition in quality* rather than price explains observed market conduct and performance.

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 an 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

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

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 perturbate the price structure relationship shown in equation (6), even if the *nominal* prices p_1 and p_2 remain unchanged.

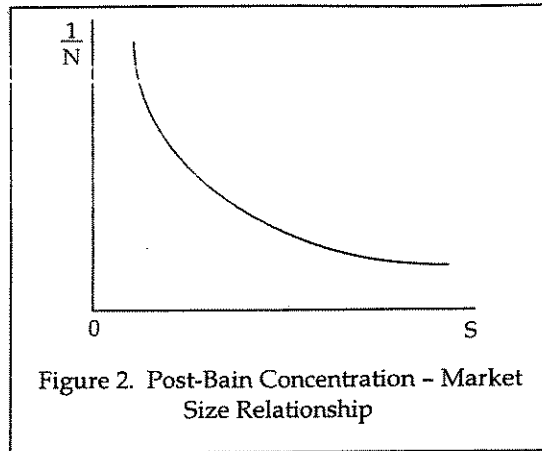
In practical terms, competition in quality in MVPD markets would be observed in several ways. From the subscriber side of the market, a particular MVPD platform becomes more valuable to a subscriber if the technical attributes of the network are improved, such as the conversion from analog to digital 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 section III.C.

B. Bain's Structure-Conduct-Performance Paradigm

The nature and extent of competitive rivalry and market performance in any industry depends on elements of market structure: the number and size of buyers and sellers; product differentiation; barriers to entry and exit facing new firms; cost functions of incumbent firms and entrants; and other factors. For many years, the Bain paradigm (Bain, 1956) was the dominant hypothesis in industrial organization and provided a one-way causal link connecting market structure to market conduct and performance. In empirical work, Bain's structure-conduct-performance paradigm often modeled market structure in terms of industry concentration, which, in turn, influenced market conduct. The chosen measure of conduct, in turn, determines market performance as measured in terms of profitability. Bain hypothesized that observed market structure (i.e., the extent of industry concentration) is explained by the presence and height of three major types of barriers to entry: economies of scale, advertising, and research and development ("R&D") intensity, i.e., the ratio of spending on R&D relative to industry sales. Within the Bain paradigm, barriers to entry are exogenously determined and not considered an economic variable subject to optimizing behavior by firms.

Bain's paradigm, however, does not fully model the nexus between industry concentration and market size as measured in terms of total industry sales, number of consumers, consumer income, or some other market size metric. Broadly speaking, the post-Bain literature has generally presumed that market size and concentration are inversely related as suggested in Figure 2. N represents the number of independent firms in the industry; $1/N$ represents the single-firm concentration ratio, and S measures market size. The curve in Figure 2 hypothesizes that industry concentration falls monotonically as market size grows larger.



The negative relationship shown in Figure 2 might be rationalized in several ways. For example, as market size increases, incumbent firms exhaust their economies of scale, while their profitability increases as a consequence of pricing that reflects the higher unit costs of production of smaller volumes before expansion of the size of market. This improved profitability of incumbent firms then attracts entrants which add productive capacity and additional output to the market such that concentration falls. As will be shown, the Sutton paradigm identifies the economic circumstances which contradict this simple story of declining market concentration and growing market size.

C. Sunk Costs and Two-Stage Games

In recent years, empirical research in industrial organization has moved from Bain's paradigm to game-theoretic analyses of industry structure and conduct. Game-theoretic analyses, especially multistage game-theoretic models, differ from the Bain paradigm in several important ways. (See Sutton (1991) at 23-24.) First, the game-theoretic paradigm emphasizes a two-way chain of causality between market structure and conduct rather than the one-way flow of causation from structure to conduct. Two-stage game-theoretic models explicitly analyze the effects of market structure on conduct and conduct on market structure.²⁷ Second, the Bain paradigm views levels of advertising expenditure as an exogenously-determined barrier to entry along with economies of scale and R&D outlays that may explain observed industry concentration within a regression function. Within the game-theoretic paradigm, the level of advertising expenditure and R&D outlays are *endogenous* variables and provide the basis of explanations for high measured profits that do not attract new firms to the industry. Third, the game-theoretic paradigm provides a new explanation that resolves observed discrepancies between predicted lower bounds on concentration based on estimates of minimum efficient scale and observed levels of industry concentration. Finally, game-theoretic analyses emphasize analytical differences between product differentiation and advertising rather than viewing advertising as an empirical proxy for product differentiation, as is commonly done in empirical studies within the Bain paradigm. (See Sutton, 1991, at 24-25.) The Appendix to this paper explains the origins of Sutton's game-theoretic analysis as rooted in the vertical product differentiation literature.

²⁷ Such causal interdependence is not viewed primarily as an econometric problem resolved by simultaneous equation estimation, which often typified empirical work within the Bain paradigm.

Sutton's game-theoretic analysis explains observed market structure, *i.e.*, industry concentration, by viewing expenditures on advertising and R&D as sunk costs incurred by a firm to enhance consumers' willingness to pay for the products that the firm produces.²⁸ 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 production and is, therefore, viewed as exogenous to the firm's decision-making process.²⁹

The analytical focus of Sutton's game-theoretic approach is the interaction of exogenous and endogenous sunk costs in determining the equilibrium pattern of 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.³⁰ For the multichannel video distribution segment, exogenous sunk costs are considerable, and may include headend equipment, or satellite earth stations, and then direct network connections to consumers' homes, either through wired or wireless means. These large sunk costs limit both entry and the intensity of price competition in the multichannel distribution side of the market, as discussed below.

²⁸ 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.

²⁹ 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.

³⁰ 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).

D. 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 day-to-day pricing policy. There is, however, 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 analysis. Sutton proposes that market demand for a given product is given by the equation $X = S/p$, where X measures the total quantity demanded of the given product; S measures total spending for the products 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_0 , is jointly produced 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., $\sigma N^* = \Pi_0$ or $N^* = \Pi_0 / \sigma$. In other words, equilibrium market structure will consist of as many firms as the setup costs per firm and total profit, Π_0 , 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^* , producing 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 $\sigma > 0$, 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 .³¹ 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*.

E. 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 . The functional relationship linking

³¹ 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.

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.)

Including two-sided markets theory within this framework as applicable to the multichannel video market requires only a slight modification. 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 can be modified to $F(\delta) = \sigma + A(\delta) + B(\sum \delta k)$, where the summation sign sums endogenous sunk costs for all networks network 1 through k carried on a particular multichannel video distributor. $A(\delta)$ represents the endogenous sunk costs incurred by the multichannel video distributor; $B(\sum \delta k)$ represents the sunk costs incurred by all programming networks carried by that distributor. It is clear from this formula that a two-sided market will experience a more rapid increase in total fixed and sunk costs that must be recovered from consumers in the form of higher prices.³² Additionally, there is a clear feedback effect: for every increase in $A(\delta)$ incurred by a multichannel distributor to increase channel capacity and thus the number of networks carried, the summation in $B(\sum \delta k)$ will also increase. Thus price increases resulting from quality competition in a two-sided market in which both sides incur substantial endogenous sunk costs will be greater than in a market that is not two-sided. For simplicity below, we return to the representation of total fixed and sunk costs as $F(\delta) = \sigma + A(\delta)$, but 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 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

³² To be completely precise, not all of the fixed and sunk costs must be covered by consumers; some are recovered from advertisers.

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.)

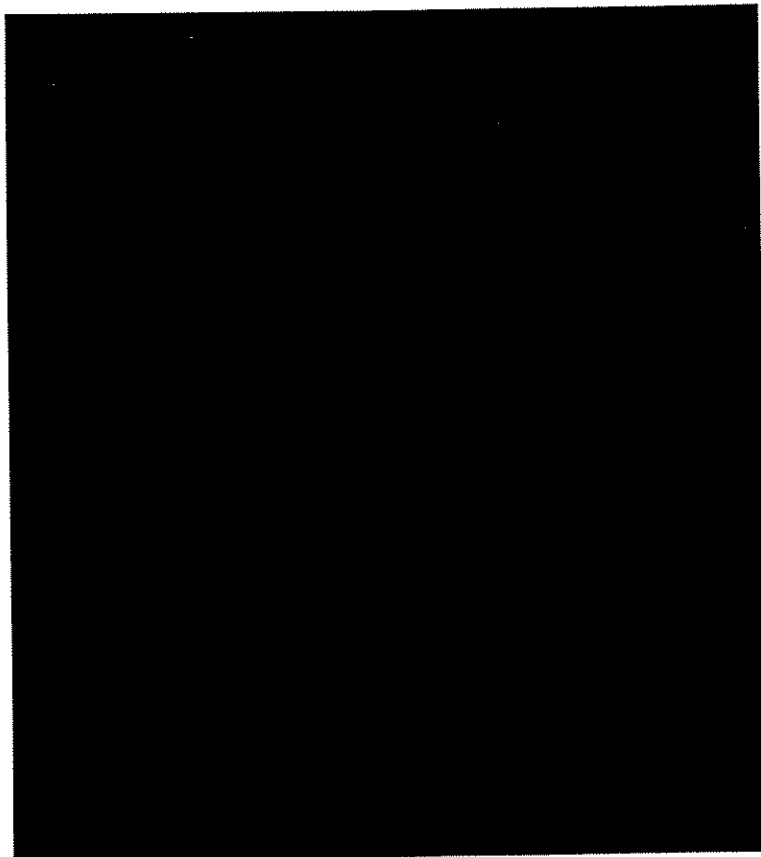


Figure 3 summarizes the implications of Sutton's game-theoretic analysis of market structure as applied to the contemporary multichannel video industry where market size grows through time. Figure 3, in a novel fashion, illustrates the implications of Sutton's insights when applied to two interdependent markets (i.e., a two-sided market) that both are affected by the presence of endogenous sunk costs. Panel A of Figure 3 plots the relationship between MVPD concentration viewed nationally, measured by $(1/N)$, and market size, S .³³ 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 multichannel distribution side of the 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 $F(\delta)$ is increased. Sutton shows that if a/γ is greater than σ , i.e., if 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 strong incentive to respond to entry with expenditure on endogenous sunk costs that increase quality rather than by answering entry with price competition.³⁴ 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 .

³³ The relationship between national MVPD concentration and market size shown in Panel A of Figure 3 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.

³⁴ 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 analysis summarized in Panel A in Figure 3 suggests that additional multichannel distribution entry, such as by DBS, may not necessarily continue to reduce market concentration over the longer term. If rivalry between and among MVPD firms 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.

The locus of points represented by the curve EF in Panel B in Figure 3 suggests an implication of the Sutton analysis for the multichannel video distribution side of the market when extended into the programming network side of the market, namely, that as concentration among MVPDs increases, 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 MVPDs increases. Although the precise shape, or elasticity, of the curve EF is not known, the empirical findings of an FCC experimental economics study (BKS Study (2002)) confirm 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 3 is inverse as suggested 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 3 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 3 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 in the multichannel distribution side of the market, 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 3 makes explicit a fundamental trade-off inherent in the analysis of Figure 3: 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 programming niche. Thus, as the number of programming networks 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.

IV. Some Empirical Aspects of the Contemporary Multichannel Video Industry

Post-Bain industrial organization generally hypothesizes that increasing market size tends to decrease market concentration. Application of the Sutton paradigm to the multichannel video industry predicts that this relationship will not hold in either the programming network side or the multichannel distribution side of the market once endogenous sunk costs dominate exogenous sunk costs. At that point, market participants able to expend greater resources on endogenous sunk costs, perhaps due to greater financial resources or to first mover advantage, will shift the focal point of competitive rivalry from price competition to product quality and innovation such that a single firm, or just a few firms, will dominate the market and thus increase market concentration with increasing market size.

It is beyond the scope of this paper to provide either (1) a rigorous statement of Sutton's game-theoretic foundations supporting the explanations and predictions concerning structure, conduct, and performance of the multichannel video industry or (2) econometric evidence that calibrates the critical parametric values and elasticities implied by the conceptual functions and relationships shown in Figure 3. It is possible, however, to examine briefly selected descriptive industry data to see whether casual observation offers any empirical support for competition in quality rather than price competition as the principal dimension of competitive rivalry in today's multichannel video industry.

Table 1 reports data on the general rate of price inflation (CPI), cable rate increases, and cable system and DBS market penetration (roughly, market shares). Table 1 shows that entry has occurred in the multichannel distribution side of the market viewed from a nationwide perspective and that DBS has gained a 25 percent penetration rate by 2004. Notwithstanding this growth of such a significant competitor in multichannel distribution across the United States, Table 1 shows that cable rates have continued to *increase* at a rate exceeding the annual rate of price inflation as measured by the CPI.

This result appears incongruous with the expected effect of market entry on the pricing of output of a monopoly firm. A closer look at the data, however, reveals that price competition is not the critical dimension of competitive rivalry between and among cable system operators and DBS entities. Rather, cable system operators have modified their output which is ordinarily a menu of channel packages sold as a bundle to subscribers. As Table 1 shows, the growth in rate *per channel* for cable is lower than the inflation rate in all years but one over the last ten, and is negative for three years. Such pricing behavior appears consistent with competition on product quality, where expanding the number and variety of channels included in a package where price per channel is constant or falling in real terms may be viewed as a rough proxy for quality improvement.³⁵ In short, Table 1 provides some indicative empirical evidence that competition in quality as contemplated by the Sutton paradigm pervades the multichannel distribution side of the market for multichannel video distribution.

Table 1
Rate Changes and Penetration in the Multichannel Video Industry³⁶

Year	CPI*	Cable Rate Increase*	Per Channel Rate Increase*	Cable Penetration	DBS Penetration
1995	2.5%	0.6%**	-1.1%	90.67	3.21
1996	3.0%	7.5%	2.3%	87.74	5.92
1997	2.2%	8.9%	2.8%	87.10	6.85
1998	1.7%	6.8%	1.6%	85.34	9.40
1999	2.1%	6.8%	-0.5%	82.45	12.46
2000	3.7%	6.0%	0.5%	79.84	15.65
2001	2.7%	7.6%	1.7%	77.54	18.67
2002	1.5%	8.2%	1.2%	75.91	20.83
2003	2.1%	7.8%	-2.1%	73.58	22.68
2004	3.0%	5.4%	1.2%	71.62	25.09

Similar evidence exists for the same dynamic in the programming network side of the market. While it is difficult to create a systematic record of the effect of endogenous sunk costs and the race to dominance within programming niches in the programming

³⁵ Determining a "quality-adjusted" price is complicated for the multichannel video industry. Cable channels are sold in packages for a monthly fee, but few consumers watch all of the channels in the package. Therefore, individual consumers perceive some channels as worthless and some channels as highly valuable (sufficiently valuable to cause them to purchase the package even though they do not value all of the channels in the package), and, of course, the value of individual channels varies from consumer to consumer. Therefore, a per channel rate is only a rough proxy for quality.

³⁶ * Indicates increase from the previous year. Other columns are the value as of the year in question. ** This cable rate increase was held artificially low due to rate regulation. Cable Rate Increase and Per Channel Rate Increase are for cable services the FCC defines as "most popular," i.e., the first two packages of channels taken by more than 90% of subscribers. Cable and DBS Penetration figures are the percentage of MVPD subscribers taking to the service. Table sources: CPI from the Bureau of Labor Statistics. Cable Rate Increase, Per Channel Rate Increase, Cable Penetration, and DBS Penetration from FCC (1998-2002 and 2004).

network side of the market, some anecdotes illustrate the point. In the sports category, ESPN has long been recognized as the dominant player. Still, both Time Warner and Fox attempted to enter the national sports network market: Time Warner by launching CNN/Sports Illustrated in December 1996 and News Corporation by acquiring a group of regional sports networks and redirecting a portion of their programming toward national sports. Despite the backing of large corporations, strong brand names and, in the case of Time Warner, a guaranteed distribution system, neither was able to survive: Time Warner shut down operations of CNN/Sports Illustrated in 2002, and News Corporation returned the focus of its channels to regional sports. Currently no other network competes with ESPN in the national sports network category. Similarly, in the financial news category, CNBC is the longstanding dominant player. Time Warner attempted to launch a competitor, CNNfn, in December 1995, but ceased operations in December 2004. Bloomberg Television still competes with CNBC, but is a minor player in the U.S. market, both in terms of carriage and especially in terms of ratings. (Bloomberg is much more significant internationally.) This dynamic is also seen in terms of smaller niches. In 1998 and 1997, two Soap Opera channels, SoapNet backed by Disney/ABC, and SoapCity backed by Sony Corporation, launched. Only SoapCity remains. In the health and fitness niche, at one point there were three competitors: Discovery Health, the Health Network (run by News Corporation), and FitTV, an independent. First, the Health Network merged with FitTV, and this merged entity was subsequently acquired by Discovery. Discovery then redirected its Discovery Health channel to mostly medical programming, and relaunched the acquired network as FitTV, devoted to health and fitness.

Obviously, a monopoly result within a niche is the limit case. In other niches, one network becomes dominant, and other marginal players remain. For example, Lifetime is the dominant network in the niche for "women's programming." Two other network major networks compete in this niche, WE and Oxygen, but neither boasts the near-universal carriage of Lifetime, or the ratings; Lifetime is consistently the top rated or next-to-top rated cable network. Finally, given these examples, it is likely that there exist unobserved cases, in which a programmer seeks to enter a niche but either cannot find carriage, or simply gives up after analyzing the prospects for success, *i.e.*, recovery of the exogenous and endogenous sunk costs implied by entry.

V. Summary and Conclusions

The Sutton paradigm applied to the multichannel video industry, in combination with two-sided market theory, together suggest that in the multichannel distribution and programming sides of the market, endogenous sunk costs will eventually dominate exogenous sunk costs at some point and price competition will give way to non-price rivalry where product quality or product innovation replace 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 (or most) and other competitors exit the market. Since this is a two-sided market in which both markets face significant sunk costs, non-price rivalry and winner take all dynamics will be intensified beyond what will occur in a single market with significant sunk costs. In the

multichannel distribution side of the market, this will manifest in the addition of more and higher quality video services, and in the addition of new services such as high-speed Internet access and telephone service. The addition of these services will necessitate higher rates and, as a result, MVPD competition may lead to higher prices, not lower.³⁷ In the programming side of the market, competition on quality will lead networks in each niche to seek dominance in that niche through the expenditure of endogenous sunk costs to acquire unique talent and content inputs. Since programming networks are sold by MVPDs as part of a package, they cannot offer discounts to their ultimate customers, the consumers, so they have little incentive to control spending in the race to dominance. Only popularity, as measured by ratings, driven by the quality of programming, increases the incentive for MVPDs to carry them. Thus, again, competition on quality among programmers increases MVPD rates instead of decreasing them. A feedback dynamic results, in which MVPDs incur endogenous sunk costs to add programming networks incurring endogenous sunk costs, and this further increases rates paid by consumers, but also the quality of the product consumers receive.

An 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 either the programming network side of the market or the multichannel video distribution side of the market. 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 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 3. This paper does not provide a consumer welfare analysis that might reveal whether

³⁷ Sutton (1986) indicates that price increases driven by vertical differentiation will be limited by consumers' willingness to pay for quality increases and by the increase in unit variable cost associated with such improvements.

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.³⁸ 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 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. The additional complication that the multichannel market is a two-sided market enhances and intensifies the effect of endogenous sunk costs, especially with respect to the prices paid by and quality received by consumers.

³⁸ 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.

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 shape the industry during the early twenty-first century.

APPENDIX

Vertical Product Differentiation and Competition in Quality:

Foundations of the Sutton Paradigm

The Sutton paradigm is rooted in the industrial organization literature on vertical product differentiation, in particular, papers by Shaked and Sutton (1982, 1987).³⁹ Vertical product differentiation refers to the increase or decrease in the absolute quantities of all characteristics of one unit of a good (Lancaster, 1979, p. 28). Thus, more of a desired attribute of good, such as the processing speed of a computer, is taken as an indicator of quality: the more of the desired attributes possessed by the good, the higher is the quality of the good, all other things remaining the same. As a consequence, all consumers agree on the preference rankings of products of different qualities. This section briefly reviews the logic of vertical product differentiation models closely following a recent paper by Berry and Waldfogel (2003). This discussion develops the intuition of the Sutton paradigm, especially the circumstances leading to the *finiteness property* which holds that industry concentration will not fall below a lower bound in markets where consumers prefer higher rather than lower quality goods even as market size becomes arbitrarily large.

Consider a simple model of vertical product differentiation where the (net) utility that a consumer derives from consuming a single unit of product j ($q_j = 1$) is given by the linear relationship

$$u_{ij} = \theta_i \delta_j - p_j \quad (\text{A. 1})$$

where δ_j measures the quantity of product quality of product j ; and p_j measures the unit price of product j . Equation (A.1) ignores income effects and assumes that u_{ij} is measured in dollars such that θ_i can be interpreted as consumer i 's marginal willingness-to-pay for quality. It is further assumed that θ_i is distributed over the interval $(0, \infty)$. Thus, consumers clearly differ in their preference intensities for quality, where consumers with higher θ 's are willing to pay higher prices for higher quality product j .

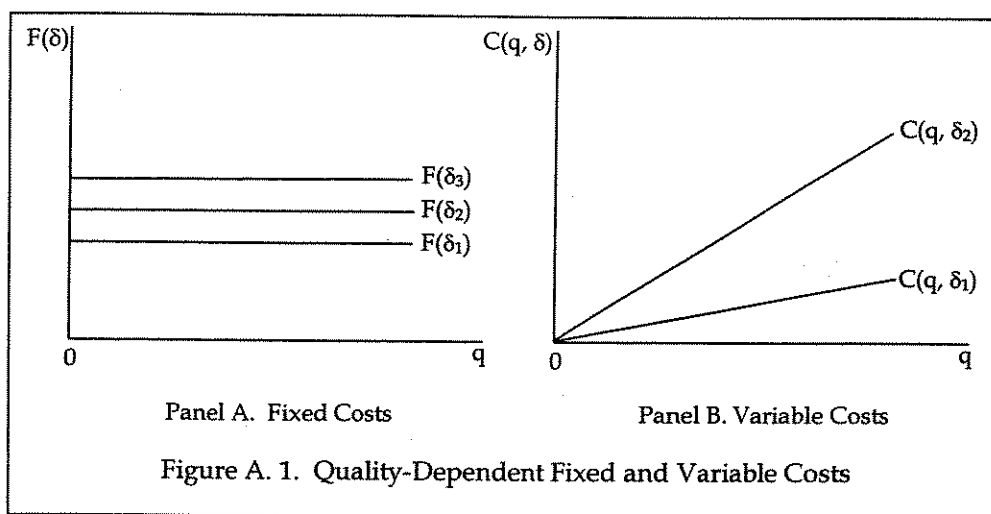
The production of quality, δ_j , may be reflected in (1) an increased marginal cost of output resulting from the usage of more expensive variable inputs of production; or (2) higher fixed costs. Sutton emphasizes that expenditures on research and development (R&D) represent fixed and sunk costs that are expected to improve product quality. Sutton also emphasizes that advertising is also a fixed and sunk cost that increases the consumer's perception of the quality of a product and raises the consumer's willingness-to-pay for what is now perceived as a higher quality product. Shaked and Sutton (1987) show that the relationship between market size and the distribution of quality observed

³⁹ Also see Gabszewicz and Thisse (1979, 1980, 1982).

in market equilibrium depends on whether quality is produced in terms of changes in variable or fixed costs of production. Suppose that marginal cost, mc , is constant with respect to the quantity of output produced, q_j , and is increasing in quality such that total variable cost can be expressed as

$$C(q_j, \delta_j) = q_j mc(\delta_j) \quad (\text{A. 2})$$

Panel B in Figure A. 1 shows two linear total variable cost functions for two different values of δ , namely, δ_1 and δ_2 , where $\delta_2 > \delta_1$. The slopes of $C(q, \delta_1)$ and $C(q, \delta_2)$ Panel B measure marginal cost, mc , which is constant with respect to the quantity of output, q , produced. As Panel B clearly shows, the marginal cost of production implied by $C(q, \delta_1)$ is only slightly positively affected by the quantity of product quality produced represented by δ_1 .



By hypothesis, fixed costs of production which, by definition, are invariant to the level of output produced, also depend on the quantity of quality produced. In symbols,

$$FC = F(\delta_j) \quad (\text{A. 3})$$

where FC measures fixed costs. It is assumed that FC is strictly positive and that economies of scale always exist. As suggested in Panel A in Figure A. 1, fixed costs are increasing in quality, where $\delta_1 < \delta_2 < \delta_3$ such that $F(\delta_1) < F(\delta_2) < F(\delta_3)$. The slope of $F(\delta)$ is zero, by definition of fixed costs.

Competition in markets where product quality is a focal point of rivalry among firms is naturally modeled as a multi-stage game. Firms initially decide in the first stage whether to enter the market or not. In the second stage of the game, firms that entered the market must decide how much quality, δ , to embed in their output. Finally, firms set their output prices, given some model of price competition such as Cournot competition in quantities or Bertrand competition in prices. Assuming that every firm

that competes in price in the final stage of the game produces only a single product, the profit function for firm j may be written as

$$MV(\delta_j, \delta_{-j}) - F(\delta_j) \quad (\text{A. 4})$$

where M is a measure of market size, such as the number of customers, and $V(\delta_j, \delta_{-j})$ is a per capita variable profit, i.e., $(p_j - mc_j)/M$, function that is dependent on a vector of quality quantities, δ , reflecting oligopolistic interdependencies among firms respecting the quantity of quality produced. The profitability of any firm depends, therefore, on market size, the specific type of price competition prevailing in the final stage of the game, and both how and to what extent δ affects the variable and fixed costs of production.

Whether the number of products (and firms under existing assumptions) differentiated in terms of the amount of quality embedded in each product may be expected to increase as market size grows depends on whether the cost of quality affects mainly marginal cost or fixed cost. Since consumers uniformly prefer higher quality to lower quality products, all other things remaining the same, there is the possibility that a firm producing a higher quality product could undercut a firm producing a lower quality product and drive its sales to zero. As Shaked and Sutton (1987) show, this outcome is unprofitable so long as marginal cost resembles $C(q, \delta_2)$ in Panel B in Figure A. 1. Firms producing a lower quality product represented by $C(q, \delta_1)$ in Panel B and pricing at marginal cost can still earn variable profit sufficient to recover fixed costs if market size is large enough. As shown in Panel B, the marginal cost of higher quality output, i.e., $\delta_2 > \delta_1$, is greater than that of lower quality output. As a result, prices reflecting the marginal cost of product will differ between higher and lower quality products. Market equilibrium will be characterized by multiple products reflecting multiple levels of quality at prices reflecting different marginal costs.

The persistence of multiple products of differing quality in market equilibrium resembles the outcome often found in models of horizontal product differentiation. Assuming that output is priced at marginal cost, the utility function for consumer i shown in equation (A. 1) may be rewritten as

$$u_{ij} = \theta_i \delta_j - mc(\delta_j) \quad (\text{A. 5})$$

Consumer i 's optimal consumption of product quality δ_j is given by

$$\frac{\partial u_{ij}}{\partial \delta_j} = \theta_i - \frac{\partial mc}{\partial \delta_j} = 0 \quad (\text{A. 6})$$

Equation (A. 6) shows that different consumers with different marginal willingness to pay, θ , will maximize their individual economic well-being by consuming units of

product quality up to the point where the marginal cost of quality just equals their marginal willingness to pay. As Berry and Waldfogel (2003) show in an appendix to their paper, product qualities tend to proliferate and the maximum quality available will increase as market size grows larger so long as marginal cost is increasing in the quantity of quality produced. Additionally, this result also assures that market concentration will tend toward zero as market size grows, assuming as before that each firm produces a single product (Berry and Waldfogel 2003, p. 5).

If the cost of quality depends largely on fixed rather than marginal cost as suggested in Panel A in Figure A. 1, then the product proliferation result and the analogy to horizontal product differentiation models break down. Unlike the previous case where the cost of quality affects marginal cost, it may be possible in this second case for firms producing high-quality products to undercut the pricing of firms producing lower-quality products and drive the sales of lower-quality firms to zero. Thus, where increasing product quality has little or no effect on marginal cost, Shaked and Sutton (1987) show that market concentration will not approach zero as market size increases. Rather, the market share of the largest product will approach a lower bound as market size becomes larger, and at least one high-quality product will survive in market equilibrium. Market size constrains the maximum level of product quality such that ever-increasing levels of product quality occur as market size grows. (Berry and Waldfogel, 2003, p. 6.)

The analysis of quality competition in the multichannel video industry developed in this paper assumes that improvements in product quality predominantly affect fixed rather than the marginal cost of output. This conceptual focus is reflected in Sutton's theory of endogenous sunk cost which is reviewed and applied in the main body of this paper.

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