Chapter 11

Digital Television and Program Pricing

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Abstract: I explore several ways that the development of digital television technology can improve price discrimination by program producer/distributors--especially by the movie studios. These include development of video-on-demand systems, improved quantity discounting, and of particular interest, improved segmentation of consumers according to their demands for different levels of television transmission quality. I consider HDTV and DVD as examples of quality segmentation opportunities, and conclude that the result will be more revenues for program distributors and thus increased production investments in movies and other programs.

1. INTRODUCTION

To most people, digital television still means High Definition Television, or HDTV. As many are becoming aware, though, digital technology can accomplish a range of improvements in television. In particular, digital compression permits program distributors (broadcast stations, cable operators, DBS, etc.) simply to transmit larger numbers of "regular," or standard resolution (NTSC), television channels within a given amount of spectrum space, instead of one HDTV channel. Another interesting digital technology introduced in 1997 is Digital Video Disks (or DVD), which offer digitally stored movies or other programs that can be watched on TV with a DVD player. Either DVD or compressed, standard resolution digital television transmissions can be enjoyed by consumers using an old-fashioned NTSC television set (with a converter box in the

D. Gerbarg (ed.), *The Economics, Technology and Content of Digital TV*

latter case). Thus, digital television technology extends well beyond the prospect of spectacular television pictures (plus high fidelity sound), and the expensive new TV sets that will be required to enjoy them.

In this paper, I focus on one aspect of the economic opportunities for program producers--especially the movie studios-- that are made possible by these and related digital television technologies: that of more efficient program pricing. Basically, pricing efficiency--or price discrimination--simply means the ability to set different prices for different consumers according to their willingness to pay. The more efficient is price discrimination, the less money is "left on the table" by consumers--to the enrichment of the movie or other program producers and distributors. While pricing efficiency is just one facet of digital TV's economic potential, it is central to the economic fortunes of program providers--and thus central to the quantity and production quality of programming those providers can make available to consumers.

I discuss several ways that digital technology can improve pricing efficiency, including development of video-on-demand (VOD) and near-video-on-demand (NVOD) systems, and improved quantity discounting. My main focus, though, is on how movie studios and other program suppliers might employ digital technology in order to more efficiently segment audiences according to their demands for transmission quality or other technical quality features of the television or video media that they use. That is, "high value" (high willingness to pay) consumers can be induced to pay high prices for higher resolution, high fidelity HDTV presentations, while "low value" consumers pay low prices for lower resolution NTSC quality pictures and sound. Similarly, DVD technology can separate high value from low value home video users according to those consumers' willingness to pay for the video and audio quality, or the conveniences, of their viewing experience. To the extent that program producers and distributors realize such benefits from digital technology in the form of higher revenues, consumers should benefit by increased production investments in feature films and other programs.

I continue in Section II below with a brief discussion of digital television technology. In Section III, I turn to the economics of price discrimination. I first describe how price discrimination is already practiced in the release sequence for theatrical feature films--the type of programming which digital technology seems especially likely to benefit. In that context, I first discuss how digital technology can improve VOD and NVOD, and facilitate quantity discounting. I then employ a simple numerical model to illustrate my main hypothesis that digital technology can improve product quality segmentation. I offer some empirical data to suggest that quality segmentation is already taking place between DVD player owners and VCR

owners. In Section IV, I briefly consider likely results of improved pricing for consumers.

Before proceeding, one caveat. This is a speculative paper, and in one sense, my analysis is quite "bullish" on the economic prospects of digital television technology. But my optimism is conditional. I align myself with neither the bears nor the bulls in terms of when (if in fact, ever) television will complete a transition to digital technology. There is great disagreement on how many people will buy digital TV sets or DVD players, or how fast those technologies might diffuse. I do not take sides in this aspect of the soothsaying business. In that respect, my arguments are of the "if....then" variety.

2. DIGITAL TECHNOLOGY AND TELEVISION

By translating pictures into a series of on-off pulses, digital television transmission is fundamentally distinguished from analog transmission, which relies on modulating "waves." of electrical signals.[1] Digital television technology, though, is nearly as old as television. Analog production, transmission, and reception have dominated television until now because cost-effective analog hardware was developed first. Propelling the inertia of analog television has been a U.S. government-set standard: NTSC (National Television Standards Committee). On the one hand, it is at least possible to do almost anything in television (VOD, interactive TV, HDTV (including hi fidelity audio), etc.) with analog technology. The prospects for digital television now on the horizon, however, reflect remarkable, mostly recent advances in technology that put the cost/quality tradeoffs overwhelmingly in favor of the digital option. In recognition of this potential, the FCC established a U.S. standard for digital television in 1996.

An NTSC analog television channel occupies a 6 MHZ bandwidth space, whether sent over the air or via cables or wires. A full motion digital signal meeting the FCC's digital television standard for HDTV occupies far more bandwidth--about 45 MHZ.[2] However, digital compression can squeeze one HDTV signal into a 6 MHZ bandwidth space without noticeable video quality degradation. Progressively more severe compression can squeeze more and more digital channels into a given bandwidth--but they are of progressively lower and lower resolution. Roughly six to 12 channels, each with resolution comparable to a standard NTSC signal can fit into one 6 MHZ channel. Direct TV now compresses its digital DBS satellite transmissions at about a 6-1 ratio on average. Recently, Telecommunications, Inc.(TCI) began offering its cable subscribers a

"digital tier" which squeezed 14 cable channels into one 6 MHZ slot. Complaints by subscribers, though, induced them to revert to a 12-1 ratio.[3]

Digital transmission thus offers a basically continuous tradeoff between programming quality and quantity. In order to receive pictures that are substantially better than NTSC quality requires the purchase of a new, digital TV set. However, as DBS and some cable subscribers already experience, digitally compressed, NTSC quality signals can be viewed on a standard analog TV set using a converter box that translates the digital signals back into analog language. For any higher resolution pictures to be enjoyed at the reception end, of course, programming must be created in a comparably higher resolution format. For most made-for-TV programming, this will mean higher resolution HDTV cameras and related equipment. For most theatrical movies, though, including studio libraries going way back in time, conversion is straightforward since 35mm film is already higher resolution than the FCC's HDTV standard.

In an attempt to spur development of digital television in the United States, the FCC also required in 1996 that over a nine year period, all broadcasters must install digital transmission equipment and begin digital broadcasting. To that end, the FCC has "loaned" all TV stations in the U.S. an additional 6 MHZ channel so that both analog and digital transmissions can be made simultaneously until the analog transmissions are discontinued in 2006. However, whether broadcasters are to use that extra channel to deliver a single HDTV signal, or to broadcast multiple low definition TV signals instead, is not made explicit.

Digital technology stretches further to home video recordings, but little claim to novelty can be made in this case. Digital laserdiscs, about 14" in diameter and mostly prerecorded with theatrical movies, were commercially introduced in the U.S. about 20 years ago. This technology, however, has served only a very narrow niche of consumers, about 1% of US households, who have purchased laserdisc players. DVD is basically just son of laserdisc--but the discs are enough smaller, cheaper, and more durable, and the hardware attractively enough priced, to give program distributors, especially the movie studios, new hope of successful adoption.

DVD is widely reported to significantly improve video quality on NTSC sets, although these differences are relatively marginal compared to that between NTSC and HDTV transmission. Compared to VHS videocassette technology, DVD has other quality attributes. It is easier to start and stop a DVD movie, and to move around within it, and there is less risk of damaging the software. DVD players, like laserdisc players before them, are playback only. Combination record and playback DVD consumer technology exists, though, and could soon become cost-effective for the consumer market. Digital technology can be also applied to other home

video devices, including videocassette recorders, but the brightest current hopes remain with DVD technology.

3. DIGITAL TV AND PRICE DISCRIMINATION IN THE MOVIE INDUSTRY

How can these digital technologies make price discrimination in the sale of television programming more efficient? It is first necessary to describe the basic economic mechanisms by which price discrimination already takes place in the sale of programming. By far the most important application of these mechanisms is the system by which theatrical feature films are released over time, first to theaters, then to video, pay television, and a variety of other video media. Movies--especially theatrical films-- are the prevalent content on videocassettes (about 80%), PPV (about 60%), and monthly subscription pay television (about 80%), and movies are quite prominent on basic cable and broadcast television.[4] Furthermore, while series program, sports, and other program categories all stand to benefit from digital technology, the potential of digital technology to improve price discrimination seems greatest for theatrical movies.

We are all generally familiar with how major feature films are released to different media over time in the U.S. Although there are many variations, most movies appear on home video about six months after their initial theatrical release. About two months later, the film is shown on PPV cable or DBS. Then about one year after theatrical release, the PPV window closes and HBO or other monthly subscription pay television networks begin to show the film. Usually about 30 to 36 months after theatrical release, broadcast television networks, independent broadcast stations, or basic cable networks begin showing the movie. Since the "video revolution" began in about 1980, the economic importance of the video media to the movie studios has vastly increased. In 1995, theaters accounted for only about 29% of total theatrical distributor gross revenues in the U.S., and over about 47% came from prerecorded videocassettes alone.[5]

Most authors accept the notion that the movie release system is basically a form of price discrimination in which high value movie consumers are induced to pay high prices for theaters and other media early in the sequence, and low value consumers pay low prices (or nothing) for later exhibitions.[6] The key requirement for any successful price discrimination is the ability to segment, or to keep separate, the high value from the low value consumers; otherwise, the high value consumers will take advantage of the low prices needed to attract the low value customers.

Many segmentation devices are found in retail industry. Airlines, for example, price discriminate between high value business travelers and low value vacation travelers by requiring a 7 to 21 day advance purchase for low priced seats. Supermarkets discriminate by offering discount coupons which only lower value consumers take the time and trouble to clip from newspapers.

The movie release sequence appears to involve two main segmentation devices: The principal device is the time separation between release to the different media. High value consumers having intense demand for a particular movie (or for movies in general) are induced to pay higher prices for a first run theatrical exhibition, for example, while others are willing to wait for the video, pay TV, or later exhibitions.

Table 2 PRICES FOR THEATRICAL FEATURE FILMS 1995

Media	Retail price (per transaction)	Effective retail price per viewer
	$	$
Theaters	4.32	4.32
Video sales	14.00	na
Video rentals	2.36	.79
PPV cable	3.69	1.23-2.46
Premium cable	8.54	.43
Broadcast networks	0	0

Assumptions: Number of individual viewings per transaction: video rentals: 3; PPV cable: 1.5-3; premium cable and broadcast networks: 1.5. Premium cable price per viewer based on 20 new movies available per month.

Sources for retail price data: Theatres, Motion Picture Association of America (MPAA), Paul Kagan Associates. Individual viewings per transaction based on A.C. Nielsen Co., Video Store Magazine surveys.

The second segmentation device in movie distribution is product quality. In general, a movie theater offers a higher quality visual experience than does a television exhibition. Similarly, the ability of a VCR to start and stop a movie, or the absence of commercials on PPV or monthly subscription pay television, are quality attributes which tend to attract higher

value consumers. Quality segmentation is apparently common in the sale of products and services, including, for example, transportation (first class vs. coach airline seats) and durable goods (high end models of cars or stereo receivers.)[7] The theoretical basis of quality segmentation is modeled and discussed further below for the digital TV case. Other segmentation factors, such as media access, also play a role for movies. Only about half of cable television subscribers, for example, are on systems that are equipped with PPV technology. Those consumers probably have higher income and other demographic characteristics that are correlated with high willingness to pay, and so may be charged higher prices than otherwise.

However the segmentation may actually be accomplished, price discrimination seems to work in movie distribution. As Table 1 illustrates, effective retail prices paid per individual movie viewer tend to decline over the release sequence. As we would expect to observe, media with higher technical quality attributes tend to go toward the front of the sequence. Note also that media which offer unbundled (movie-by-movie) pricing, such as theaters, videocassettes, and PPV television, tend to be placed near the front, while media that are less efficient for "cream skimming, " such as monthly subscription cable networks, and advertiser-supported cable and broadcast media, bring up the rear.

Programming other than theatrical movies also make some use of this system. "Direct-to-video," and "made-for-pay" movies, for example, simply start at a later point in the sequence. Made-for-TV movies and network series programs typically are syndicated later to basic cable and independent broadcast stations, but actual price discrimination with these programs is almost non-existent since they are free to consumers from the first. Discrimination with sports programming, second to movies in prevalence on the "pay" media, is also difficult to accomplish because its value is almost totally time sensitive.[8]

How might digital technology improve the price discrimination system for movies or other programming? I consider in turn three possibilities: expansion of NVOD and VOD systems, improved quantity discounting, and then improved product quality segmentation.

4. EXPANSION OF NVOD AND VOD SYSTEMS

A straightforward, though actually indirect improvement in pricing efficiency already in progress follows from the greater channel capacity that digital compression permits. Near-video-on-demand (NVOD) systems, such as that used now by DirecTV, use compression to offer a wider variety of

PPV movies, sports, or other events. Also, some channels are used to offer the same relatively popular movies at staggered start times. These developments improve opportunities for more efficient unbundled pricing, (although they improve actual discrimination only indirectly) by expanding available product variety. For example, different start times for the same movie is an improvement in product variety, because to be consumable, a movie is inherently packaged with other attributes, including the time that it is available. As digital compression is adopted by cable and other video media, these improvements in movie availability will inevitably increase.

Similarly, digital technology can be used to construct "true" VOD systems--in which subscribers select a particular movie by remote control, and a digital server responds by delivering it at any time desired. Although cost-effective video servers still have quite limited capacity in terms of the number of different movies they can make available, VOD systems of the future offer potentially "perfect" product variety in terms of times and flexibility, and would thus appear to please any consumer's whim.

Although both VOD and NVOD can be accomplished with analog technology, it is very difficult to do so cost effectively without the compression, server configurations, and other technical advantages of digital technology. Of course, it remains unclear how viable NVOD or especially, VOD systems (which are now experimental only), will eventually prove to be. To date, all PPV programming accounts for only about 1% of total movie distributor revenues, but this figure seems bound to increase as the technology diffuses.[9]

5. QUANTITY DISCOUNTING

A second potential improvement from digital technology is in the efficiency of segmenting high value and low value viewers according to the number of times each consumer wants to watch the same movie. A characteristic of consumers with high value demand for a particular movie is that they are more likely to want to watch it again. The release sequence currently offers several ways that distributors can extract this higher value through repeat viewing. One way, of course, is that a patron can simply buy a second theater ticket, rent the video again, or buy the video and watch it as many times as desired. Similarly, the release sequence over time undoubtedly encourages consumers who have already watched a movie on one medium, such as a theater, to see it again by renting the video, watching it on HBO, on broadcast TV, etc.

These mechanisms, however, are quite imperfect, especially perhaps in the videocassette industry. A high value viewer, for example, might watch a

rented video several times during the 2-3 day rental period, while a lower value viewer watches it only once. But both pay the same price. Similarly, if the high value viewer chooses to rent the movie twice, the same price must generally be paid again. In reality, though, consumer demands to watch a given movie more than once are generally subject to diminishing returns. That is, if the first viewing is worth $5 to the consumer, the second is very likely to be worth less, say $3, etc.

An example of how digital technology might improve the pricing of repeat movie viewings in home video is DiVX, a variation on DVD technology introduced in Summer, 1998. DiVX allows movie distributors to meter the number of times a movie is watched through a telephone line hookup between the DVD player and a central computer. For example, one play might cost $5, two plays $8, and unlimited plays (like a videocassette sale today) might cost $25. Although the success of DiVX is far from certain, movie distributors have long searched for such "metering" technologies. It is evident that a VOD or a reasonably sophisticated NVOD system would also have the technical potential to provide quantity discounting for viewings of the same movie.

I now turn to what seems the most interesting and lucrative possibility for improved price discrimination created by digital technology.

6. PRODUCT QUALITY SEGMENTATION IN THEORY

The higher video and audio transmission potential of digital television offers a natural opportunity for audience segmentation. For example, high value movie consumers will be more inclined than low value consumers to buy digital TV sets which are capable of receiving the higher quality transmissions. First, such consumers will tend to have higher incomes and higher value movie demands in general, so their willingness to pay will be greater. Secondly, as we discuss further below, those consumers are likely to have relatively high demand for technical quality compared to that of low value consumers.

Under these circumstances, a programming distributor, such as a PPV cable operator or a monthly subscription pay cable network, might charge a high price for a HDTV exhibition, and a low price for a NTSC quality exhibition, of the same movie. An important feature of such quality segmentation, however, is that consumers in general need not have higher demand for high quality exhibition. The essence of the movie seller's

opportunity is only to exploit *differences* in consumer demand for that quality.

It is useful to demonstrate these points with a simple economic model.[10]

Table 2 illustrates price demands of two types of consumers, labeled high value and low value, for two distinct product choices, high quality and low quality. Let us say, for example, that the high quality product is HDTV and the low quality is standard NTSC transmission. The price demands shown can be interpreted as the maximum amounts that the two types of consumers would be willing to pay for a PPV exhibition of a given movie or other program, in either transmission mode.

Table 3 Price Discrimination Model: Product Quality Segmentation

	Consumers	
	High value	Low value
High quality	10	5
Low quality	6	4

All costs = 0

Case I: Only low quality available
Optimal price = 4; profit = 8
Case II: Both low and high quality available
Optimal prices: low quality = 4; high quality = 7; profit = 11
Case III: Only high quality available
Optimal price = 5 or 10; profit = 10

I assume that all costs (production, transmission, sets, etc.) are zero. This assumption simply permits us to focus initially on the central feature of the model, that of using quality differences to segment consumers.

Say that in the initial case, only low quality, NTSC transmission is available. The optimal price for the distributor to charge is 4. At that price, both consumers will buy the movie for a total distributor profit of 8. Alternatively, if price were set at 6, only the high value consumer would buy at all, resulting in a profit of 6.

Now imagine that HDTV becomes available along with NTSC. The distributor can now profitably discriminate by pricing the NTSC version of the program at 4 and the HDTV version at 7, for a total profit of 11. The price of 4 for NTSC extracts all of the benefit from the low value consumer. The HDTV price of 7 extracts as much value from the high value consumer as is possible. That is, even though the high value consumer values HDTV at

10, that consumer could realize a greater net benefit by taking advantage of the NTSC transmission at a price of 4 unless HDTV is priced at 7 or below. Still, however, seller profits rise by 3 compared to Case I.

To illustrate that the essential feature of the model is consumer segmentation rather simply higher demand for better quality transmission itself, note that if only the high quality HDTV transmission were available, maximum profits would be 10, a reduction of 1. That is, the HDTV price could either be set at 5 to attract both consumers, or at 10 to attract only one of them. Without the ability to segment, then, profits fall.

A key assumption of this numerical model is that the high value consumer's marginal price demand for quality is relatively great (from 6 to 10 vs. from 4 to 5). Otherwise, segmentation will not be profitable.[11] Empirical observation, however, seems consistent with this assumption in general. First class airline passengers, the owners of luxury cars, etc., are apparently willing to pay substantially greater marginal amounts of money for higher quality products and services.

7. EVIDENCE OF QUALITY SEGMENTATION

The quality segmentation opportunities inherent in the numerical model are suggested by available cost/revenue data for some different media reported in Table 3. First, compare DVD with videocassettes. DVD is a significantly cheaper technology than videocassettes. (Manufacturing costs are only about $1 per disk, plus another dollar for packaging, while it costs about $2.10 to manufacture, and another $1.40 to package, a videocassette). Although not shown in the table, shipping costs for DVD are surely less than cassettes because the disks are far smaller and lighter. Note from Table 3, however, that DVD software (virtually all of it movies) is priced at a *higher* level than prerecorded cassettes. Of course, that could be because DVD production is still too limited for economies of scale in manufacturing and distribution to be realized. While that is a possible factor, an alternative explanation is that the owners of DVD players are higher value consumers. First, DVD machine owners are likely to have higher incomes and higher willingness to pay for movies in general. Secondly, those who buy DVD players are likely have higher relative valuations for quality. That is, those consumers will pay relatively more for the improved audio and video, even on their NTSC sets, and for the greater convenience and reliability of the discs as compared to cassettes.

The pricing of laserdiscs and audio music further suggests that the price differentials between DVD and videocassettes will persist. As Table 3

shows, laserdiscs cost significantly more to manufacture and package than do videocassettes. But those costs would not appear to account for the more than $20 greater retail price of laserdisc movies--a price differential that has persisted for many years. More likely, laserdiscs are priced so high because the approximately 1% of TV households who own a laserdisc player are a niche of high value movie consumers who have a high valuation of transmission quality.[12] Similarly for audio music formats. As the Table 3 data suggest, audio cassettes and CDs have fairly similar manufacturing and packaging costs. CD retail prices, however, are substantially greater than cassette prices on average. A reasonable explanation for this differential is that CDs appeal to consumers with a relatively high valuation of high fidelity music.[13]

Table 4. RETAIL PRICE/COST MODELS 1995-96

Media	Retail price	Wholesale price	Manufacture / packaging cost
	$	$	$
Videocassette sales	14.00	10.20	3.35
DVD	24.95	16.24	2.00
Laserdisc	35.00	24.00	7.00
Audio CD	12.70	10.30	1.30-1.80
Audio cassette	8.45	6.85	.75-.80

Sources: Video cassette sales. DVD, laserdisc; Paul Kagan Associates, Sanford C. Bernstein & Co.: audio CD and cassettes: Recording Industry Association of America; US News & World Report, Chicago Tribune

8. CAN QUALITY SEGMENTATION ENDURE IN THE LONG RUN ?

The economic model and the analogies above suggest that digital technology can benefit movie distributors by enabling them to segment consumers into different groups with different willingness to pay for transmission or other technical attributes of movie quality. An interesting question the model raises, however, is whether this ability to segment is only transitional--that is, only as we are in the process of moving from a universe of "regular" NTSC television sets to a population of HDTV television sets, or from a population of analog VHS cassette players to an all-DVD world.

Recall from the model that program distributors are actually worse off with only the high quality option than if both the high and low quality options persist, because their ability to segment audiences with respect to quality preference disappears.

Program distributors, then, might only benefit from a transition to the new technology not the arrival of its universal adoption. In practice, however, even a complete transition to digital technology will provide the technology to allow quality segmentation to persist because digital TV sets which have differing audio and video qualities can be manufactured. It is already evident that sets which fully take advantage of the FCC's HDTV standard will cost much more to manufacture than sets which offer a compromised, but still improved quality. A range of set qualities sufficiently wide to permit profitable quality discrimination could well persist in the market even if analog technology disappears.

Similarly, DVD can be easily produced with different information capacities, and thus different picture resolution capacities. Thus, progressively higher resolution disks, including those for full resolution HDTV sets, could be sold for progressively higher prices to suit the quality of set which the user owns.

In any case, it appears likely that for some years, low resolution analog sets are likely to co-exist alongside of digital HDTV sets, and that VHS videocassette players will co-exist along with DVD, providing lucrative opportunities for price discrimination as the transition occurs.

There is also a possible downside for program distributors if market penetration of HDTV quality TV sets, and HDTV quality DVD players, becomes high. Movie distributors currently benefit from the separation of demand for theater exhibition from that for home video and other television exhibitions. An element preserving that segmentation is that theater exhibitions have a substantially higher quality of viewing experience, at least in terms of picture resolution and audio quality. To the extent that HDTV narrows this gap, separation of the theater and video windows will likely become harder to maintain. The result would be a diminished ability of movie distributors to price discriminate.

Finally, however, there is another respect in which distributors may greatly benefit from a transition to digital television that should only improve with greater penetration. Consumers, especially families with children, now maintain large libraries of videocassettes.[14] As the transition to digital television occurs, consumers will be induced to turnover their video libraries into the new, higher quality formats. In this case, a complete transition to DVD, especially if accompanied by a transition to HDTV,

would only increase benefits to the studios as more and more households retire their old libraries of videocassettes.

9. THE RESULTS

To the extent that digital television technology permits movie distributors and other program suppliers to more efficiently price their products to consumers, the total flow of funds into movie and other program production will increase. As in any industry, competitive forces will induce the suppliers to expand their production investments.

Ostensibly, such expansion of investments will benefit consumers with even greater choice and production values. To the extent that higher quality video equipment, notably HDTV, finds its way into consumers' homes, it is easy to imagine even more spectacular special effects and other elements of Hollywood extravaganza. If past is prologue, however, its a good bet that a major chunk of the money will go straight into the pockets of Jack Nicholson, Bruce Willis, Sharon Stone, and their high flying colleagues.

Note:
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[1].See A. Michael Noll. Television Technology:Fundamentals and Future Prospects (Artech House, 1988).

[2].For a discussion of HDTV technology, see M Dupagne and Peter S. Seel, "High Definition Television: A Global Perspective, (Iowa State University Press, 1997)

[3].J. Brinkley, "Cable TV in Digital Push to Get in More Channels, New York Times, November, 1997,. P. C1.

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[7].L. Philips, The Economics of Price Discrimination (Cambridge U. Press, 1983).

[8].Exceptions are the Olympics, which have been offered as PPV and free broadcast exhibitions simultaneously, the former with more specialized commentary and without commercials. A form of price discrimination with televised sports is the presentation by sports bars of large screen PPV events at which patrons purchase drinks or other bar services, while others watch on PPV at home.

[9].Paul Kagan Associates, Pay TV Newsletter, January, 1996.

[10].The economics of quality segmentation is developed in M. Mussa and S. Rosen, "Monopoly and Product Quality," Journal of Economic Theory, 18, (1978), p. 301-317. An exposition of this article and later contributions is in H. Varian, "Price Discrimination," in R. Schmalensee and R. Willig, Handbook of Industrial Organization, (North Holland, 1989), Ch. 10. Recent extensions appear in S. Rosen and A Rosenfield,

Ticket Pricing, Journal of Law and Economics, XL, No. 2, October, 1997, p. 351-376. The model of this paper employs basic assumptions that are consistent with the established theory.

[11].Technically, the necessary assumption is that the high value viewer not only has a higher absolute demand for the high quality product at all prices, but that the high value viewer has a higher marginal demand for quality as well.

[12].Lack of economies of scale in manufacturing and distribution probably contribute to the higher per unit prices of laserdiscs.

[13].Similar phenomena can be found in other industries. For a collection of instances, including others in recorded music, see R.J. Deneckere and R. P. MacAfee, Damaged Goods, Journal of Economics and Management Strategy, 5(2); 149-174, 1996.

[14].A 1997 Video Store Magazine survey found that the households with kids under 12 owned an average of 66.4 prerecorded videocassettes, compared to 35.4 for households without kids under 12 (June 15-21, 1997, p. 44.)