

**Diagnosing the DVD Disappointment:
A Life Cycle View**

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I. Introduction

Development of the DVD (Digital Versatile Disc, formerly known as the Digital Video Disc) was perhaps the most significant innovation in entertainment since color television. DVD players and pre-recorded films penetrated U.S. homes at a rate faster than any consumer electronics device on record.¹ Movie studios realized unprecedented revenue growth, with DVD sales of movies rivaling and even exceeding corresponding box office receipts. Furthermore, the new digital format neatly replaced the quickly aging medium of VHS, while offering studios a far higher profit margin than its analog predecessor (66% vs. 45%)². In 2003, a mere eight years after the invention of the DVD, it appeared that Hollywood had found a high growth machine for the next decade.

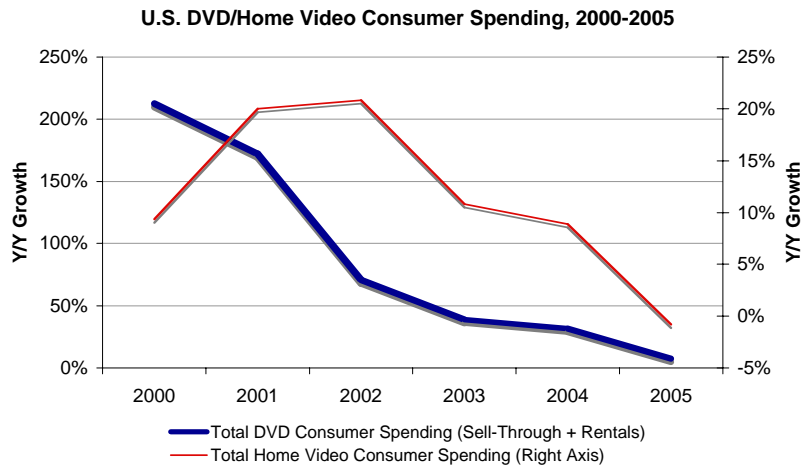
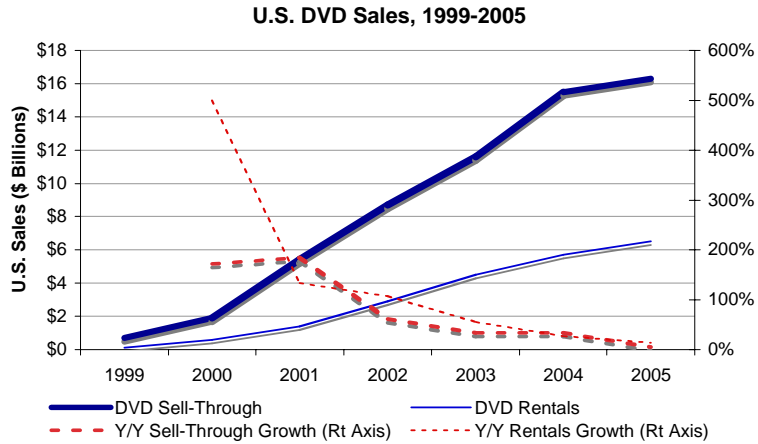
Then, suddenly, the trends shifted. In 2005, unit growth in U.S. shipments of DVD films and TV shows fell to just 9% year-over-year, compared to 50% growth in both 2003 and 2004.³ As prices fell, DVD sell-through (i.e. sales to end consumers on a buy-to-own basis) in dollar figures grew just 5%. When including the shrinking VHS market, overall consumer spending on home video actually shrank by 1% from 2004-2005.⁴

¹ Data from Consumer Electronics Association eBrain Market Research statistics, dating back to 1954.

² According to a 2004 study by Jessica Reif-Cohen, media and entertainment Research Analyst at Merrill Lynch.

³ Data and chart from the Digital Entertainment Group, a nonprofit trade consortium.

⁴ Data from Bernstein Equity Research team.



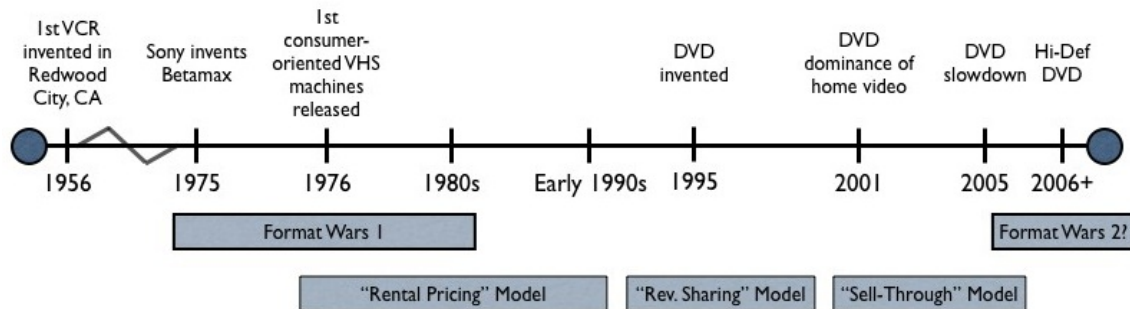
Sales trends for DVD hardware took a similar turn in 2005. The NPD group analyzed retail sales on Black Friday⁵ 2005 vs. 2004, showing that DVD players experienced double-digit declines on par with CRT televisions and portable CD players.

Retail Sales Growth in Consumer Electronics: Black Friday 2005 vs. 2004		
	Unit Growth	Rev. Growth
LCDs over 26"	1008.3%	556.4%
Plasma TVs	210.0%	154.2%
LCDs under 26"	393.9%	133.1%
MP3 Players	194.1%	126.4%
Satellite Radios	203.1%	101.0%
DVD Recorders	163.9%	56.1%
Portable DVD Players	48.3%	5.8%
Camcorders	0.9%	-0.7%
Direct View TVs (Regular CRT)	-26.9%	-29.0%
DVD Players	-44.0%	-45.2%
CRT Rear Projection	-42.5%	-51.5%
Personal CD Players	-49.7%	-52.7%

⁵ Black Friday, one of the major U.S. holiday shopping days, falls on the day after Thanksgiving every year.

A number of theories explain this rapid and abrupt deceleration in DVD sales growth, including illegal piracy, new technology substitution such as video-on-demand and pay-per-view (Exhibits 1 & 2), and the growing popularity of rent-by-mail services like Netflix (Exhibit 3). While these are all legitimate and likely contributing factors, this paper seeks to explain the changing growth trends through a market penetration hypothesis. By examining home video sales data, academic research, and historical trends in consumer electronics, the data presents a life cycle driven theory for the rapidly slowing DVD business. The popularity and understanding of this view is growing in the entertainment industry, and this paper seeks to quantify and clearly illustrate a concern that was recently articulated by Steve Beeks, President of Lionsgate Entertainment: “We all anticipated the maturing of the DVD business, and the corresponding slow-growth business that it would become, but it happened more quickly than we had anticipated.”

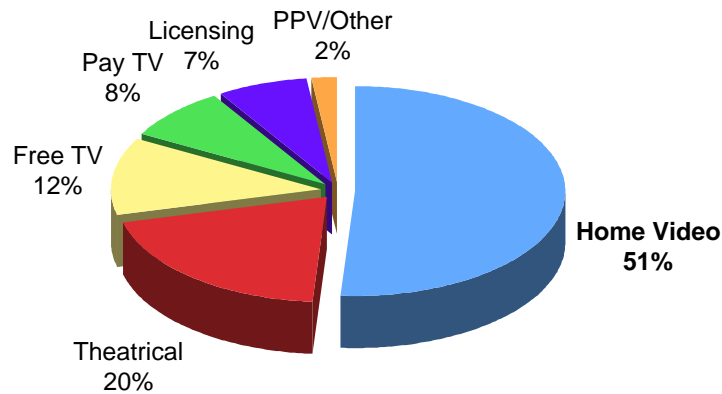
II. A Brief History of Home Video



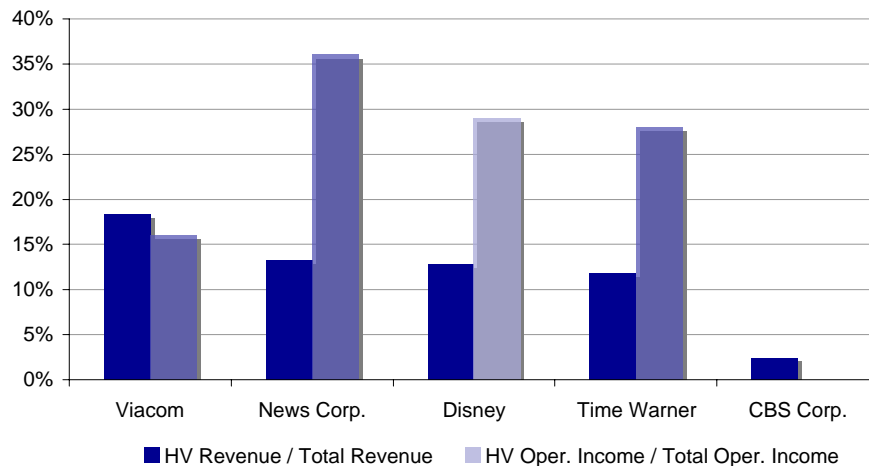
Sony introduced the first commercially successful videocassette recorder (VCR) in 1975. It was a bulky and expensive Betamax machine for which there was little prerecorded software at the time. Just 11 years later, movie studios “generated more in domestic wholesale gross revenues from [sales and rentals of] home video (about \$2

billion) than from theatrical (\$1.6 billion) sources.”⁶ The home video market continued to grow through the 1990s, becoming the largest single component of studio revenues alongside theatrical receipts, sales to TV networks (i.e. Free TV), pay TV revenues, and licensing fees. By 2004, home video sales accounted for 51% of studio top lines.⁷ By 2005, home video profits at the major U.S. media conglomerates made up as much as 35% of total firm operating income.⁸

Studio Revenue Breakdown, 2004



Media Firm's Exposure to Home Video, 2005



⁶ Vogel, pg. 103.

⁷ Kagan Research estimates, based on \$45.6 billion in 2004 worldwide studio revenue.

⁸ Home Video estimates from Bernstein Research (revenue data) and Goldman Sachs Research (operating income data).

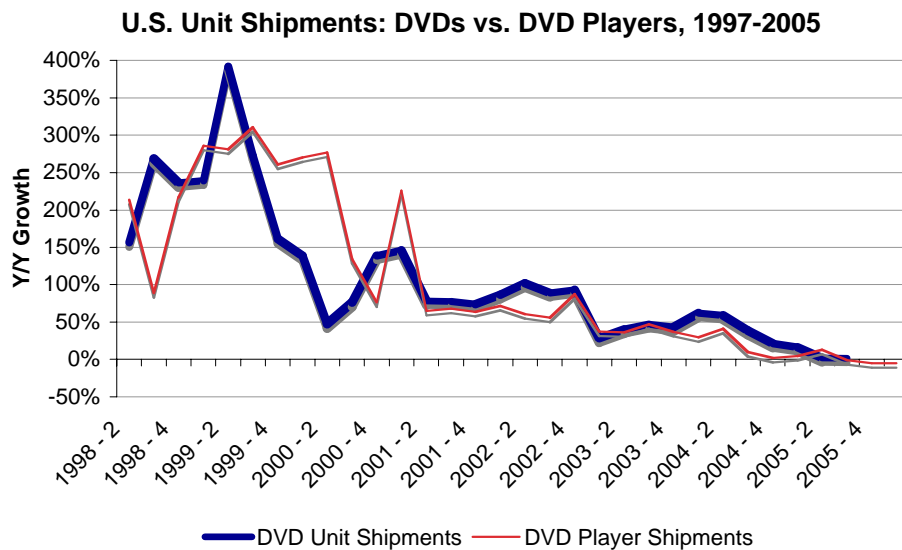
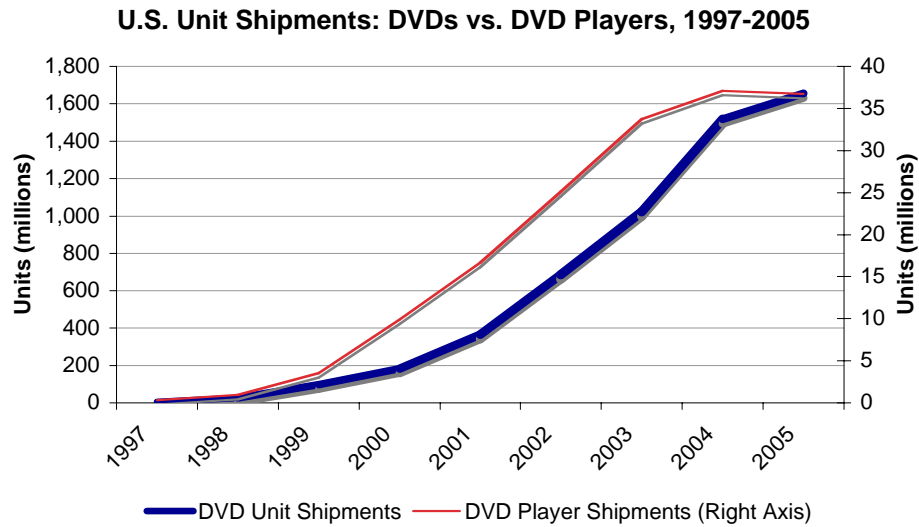
During this period, Hollywood also began to shift its pricing model for home video products. In the late 1970s and through the 1980s, “rental pricing” meant that studios charged exorbitant prices (up to \$100 per VHS tape) to rental shops such as Blockbuster Video. These retailers would then loan the movie out as many times as possible in order to recoup their initial outlay and eventually turn a profit. The early 1990s ushered in the “revenue sharing” model, in which studios sold VHS tapes to the same retailers for far less (as low as \$5 per unit), but shared in the resulting rental revenues.

The DVD era of the late 1990s and early 2000s led to today’s “sell-through” model. This system focuses on the consumer buy-to-own market rather than the video rental market. Studios charge retailers like Wal-Mart anywhere from \$10-\$30 per disc, and Wal-Mart then sells the products directly to consumers. These changes in pricing models have drastically affected consumer behavior. In fact, sell-through purchases now dominate rental purchases, making up over 70% of home video sales in 2005 (Exhibit 4). The emergence of the sell-through model also coincided with the decline in sales of pre-recorded VHS tapes. Exhibit 5 illustrates the breakdown of all home video sales (sell-through *and* rental) between DVD and VHS tapes, with the latter representing just 6% of 2005 home video revenues in the U.S.

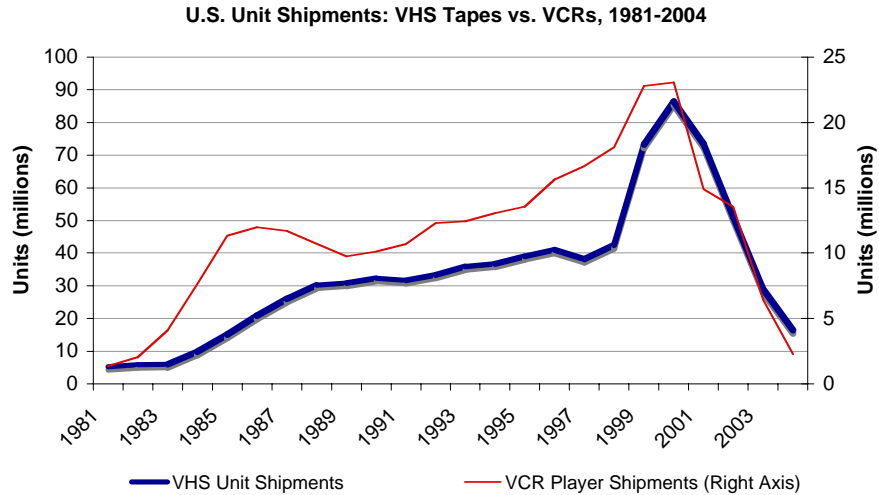
III. Rise of the DVD – The Hardware-Software Connection

Sales of DVDs, like sales of VHS tapes, depend upon customers possessing the hardware equipment to view the content at home. Therefore, growth trends for discs should reflect growth patterns for DVD hardware (i.e. players), while trends for VHS

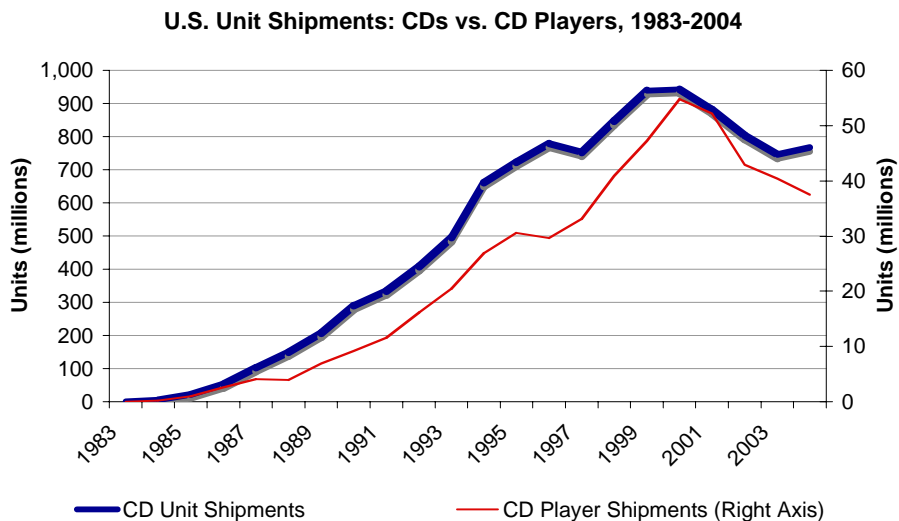
tapes should mirror those for VCRs. Data from the Digital Entertainment Group⁹ and Adams Media Research confirm this hypothesis, as the unit shipment and growth charts below indicate similar sell-through trends for DVDs/DVD players and VHS tapes/VCRs.



⁹ Note: The charts above include sales data for DVDs from the Digital Entertainment Group (DEG). Figures include set-top and portable DVD players, Home-Theater-in-a-Box systems, TV/DVD and DVD/VCR combination players.



This link between software and hardware sales is prevalent for audio products as well. The chart below indicates that shipments of music CDs closely mirror shipments of CD players.¹⁰ This makes intuitive sense, as both video and audio markets share similar characteristics of upfront hardware purchases followed by multiple software purchases. Furthermore, both products exhibit the hump-shaped growth curve common to consumer durables. This will be discussed further in section five.

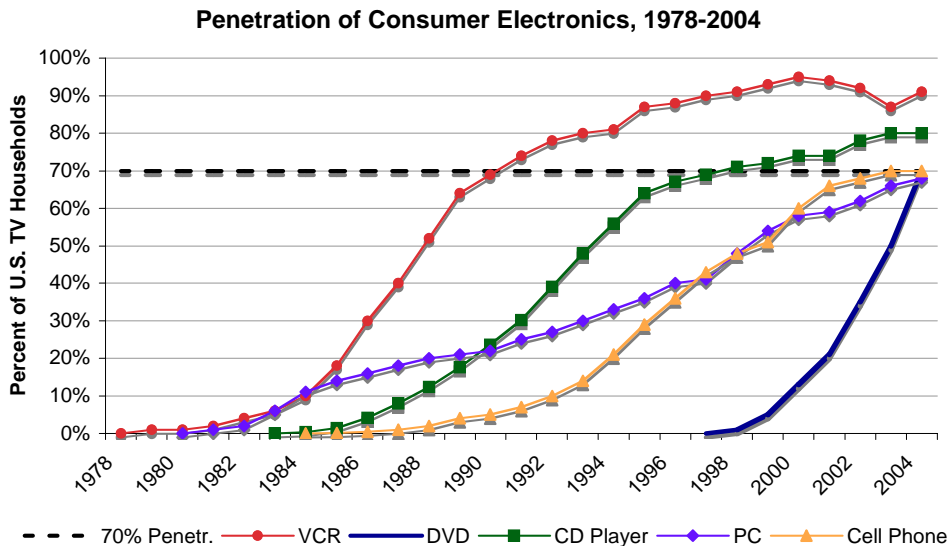


¹⁰ Data from the Recording Industry Association of America (CD units) and Consumer Electronics Association eBrain Market Research statistics (CD players).

IV. Rise of the DVD – Historical Comparisons of Hardware Penetration

Section 3 illustrated the close relationship between video players and discs, whereby hardware growth seemingly dictates the direction and magnitude of software growth. Therefore, Hollywood executives should be able to simply forecast sales of DVD players in order to gauge growth trends in DVD software.¹¹ Why, then, were so many of these same executives shocked when sales of DVD movies slowed dramatically in 2005?

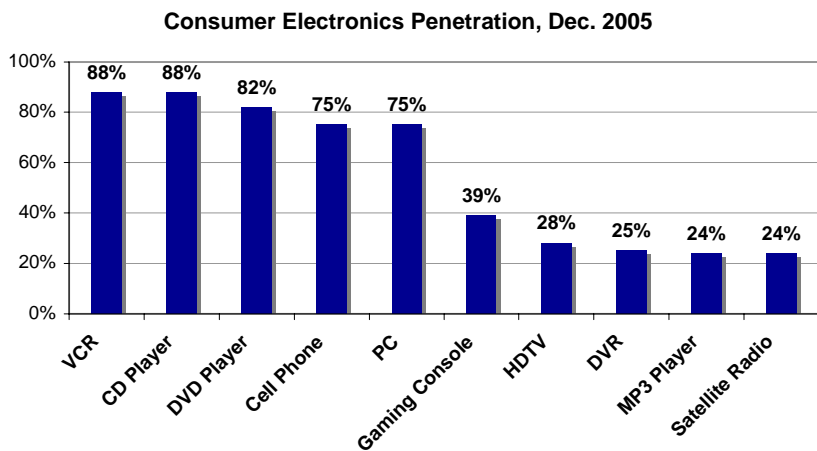
The answer lies in the remarkably rapid penetration of DVD players across the U.S. Few people could have predicted that DVD players would reach over 70% of American TV households a mere six years after commercial introduction. VCRs achieved this same penetration rate in twelve years, CD players required 14 years, cell phones 18 years, and PCs nearly a quarter century (below).¹²



¹¹ There is research that shows the reverse effect of complementarity between DVD software availability and subsequent DVD player purchases, most notably by Pinar Karaca-Mandic at University of California at Berkeley. Nevertheless, the relationship still stands between discs and players, whereby hardware sales and software sales move in tandem.

¹² Data from Consumer Electronics Association eBrain Market Research statistics.

The FCC compiled a similar chart of consumer product penetration, dating back to 1876 (Exhibit 6). It is important to note that since the mid-20th century, rates of penetration have increased steadily for new or replacement technologies, a topic that will be addressed in section five. Although DVD players are not included in the FCC chart, there is no other consumer product that matches DVD's 70% penetration in seven years. Furthermore, no other product has moved up the lower segment of the penetration curve as quickly as DVD players. Exhibit 7 shows that DVD hardware was in 25% of U.S. homes just 5 years after the technology was *invented*, displaying an outstanding rate of growth early in the product life cycle. A consumer survey conducted in December 2005 by IPSOS Public Affairs showed that DVD Players are now in over 80% of U.S. homes, eclipsing cell phone and PC penetration (below).



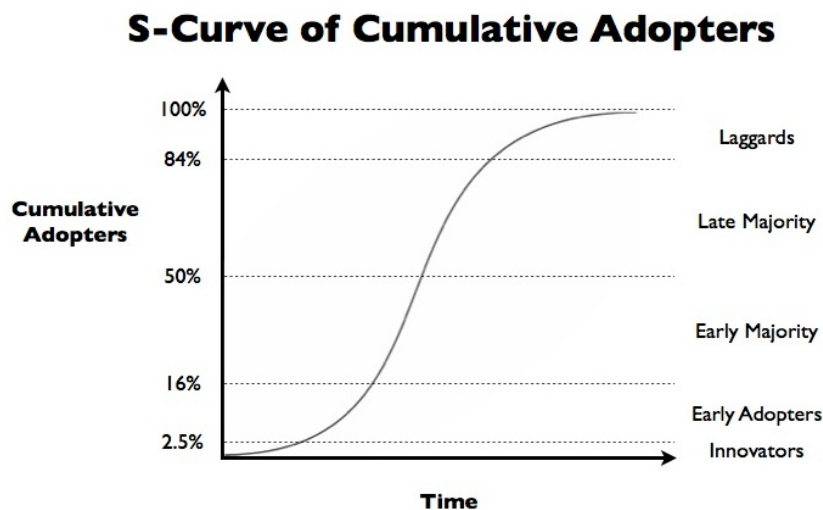
There are numerous reasons for the rapid penetration of DVD hardware, such as inclusion of DVD players in PCs and gaming consoles, an easy-to-grasp technology transition from VCRs, and rapidly falling prices for the players themselves. Various research models address these issues and shed light on the factors behind general

consumer product growth. The next section presents academic insights to explain the meteoric rise of the DVD, while also offering a glimpse into the future of the format.

V. Rise of the DVD – Academic Models

Everett Rogers and Innovation Diffusion

The most well known research on technological adoption comes from Everett Rogers, who published his first edition of *Diffusion of Innovations* in 1962. In this book, Rogers formalized the theory that technological innovations spread through society in an S-Curve of cumulative adoption. Various consumer groups along this curve are categorized as innovators, early adopters, early majority, late majority, or laggards, based on their time of adoption and personal characteristics (below).



The S-Curve model not only identifies adopter groups, it also provides insights into product growth over the course of the life cycle. For example, the S-shaped curve of adoption “takes off” in the range of 10-20 percent adoption. Rogers identifies this segment as the “heart of the diffusion process,” after which point it is often impossible to stop further spread. Conversely, diffusion growth slows in the 70-80 percent range, as

fewer remaining individuals adopt the innovation. These theories are consistent across numerous consumer products, and modern research confirms that, “U.S. consumer adoption rates begin to flatten dramatically at penetration levels between 65% and 80%.”¹³

Rogers also conducted research that examined rates of adoption, defined as “the relative speed with which an innovation is adopted by members of a social system.”¹⁴ This rate is typically measured by the number of people who adopt a product each year, and it serves as an indicator of the steepness of the adoption curve for a particular innovation. Rogers’ writings indicate five variables that explain “from 49-87 percent of the variance in adoption rates”: relative advantage, compatibility, complexity, trialability, and observability. These variables are classified under the title Perceived Attributes of Innovations, and DVD player technology scores highly across all these categories. Rogers also offers four additional variables, including type of innovation-decision, communication channels, nature of social system, and extent of change agents’ promotion efforts. Again, DVDs score well in all these areas that display a linear relationship to rate of adoption (Exhibit 8).

The Bass Model

Professor Frank M. Bass from Purdue University used Rogers’ insights to develop a quantitative product growth model for consumer durables. First proposed in 1969, the model identified two adopter categories; imitators, who are influenced by word-of-mouth communication (internal influence), and innovators, who are influenced by mass media

¹³ Nathanson, pg. 4.

¹⁴ Rogers, pg. 206.

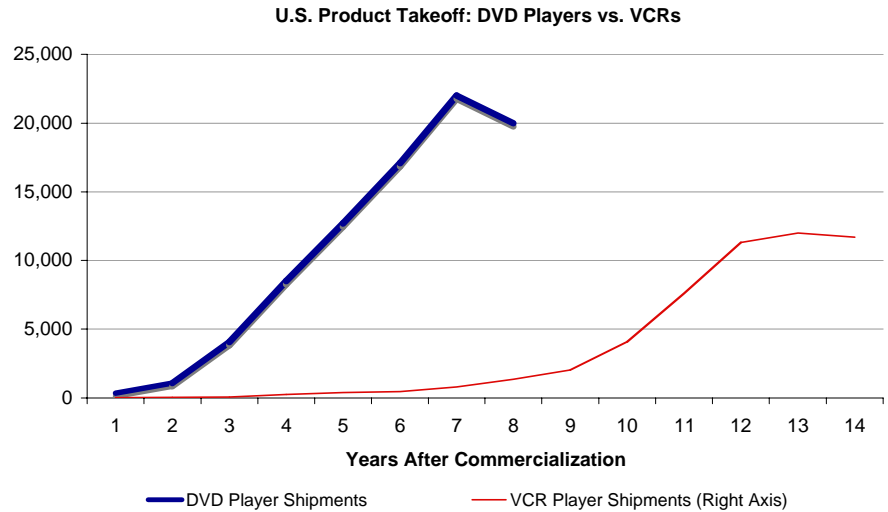
communication (external influence). The Bass Model converts this concept to a quantitative form, in which each influence is represented by a variable. The former variable is referred to as the “coefficient of imitation” while the latter is referred to as the “coefficient of innovation.”

This model has been used to accurately predict and explain product growth trends over the past 40 years. Critics claim that Bass’ work is overly simplistic, as it considers only two adopter categories and uses past data for comparable products as the basis for future predictions. Nevertheless, the Bass Model illustrates a growth pattern (Exhibit 9) very similar to that proposed by Rogers and entirely consistent with the eight years of data available from the DVD hardware industry.

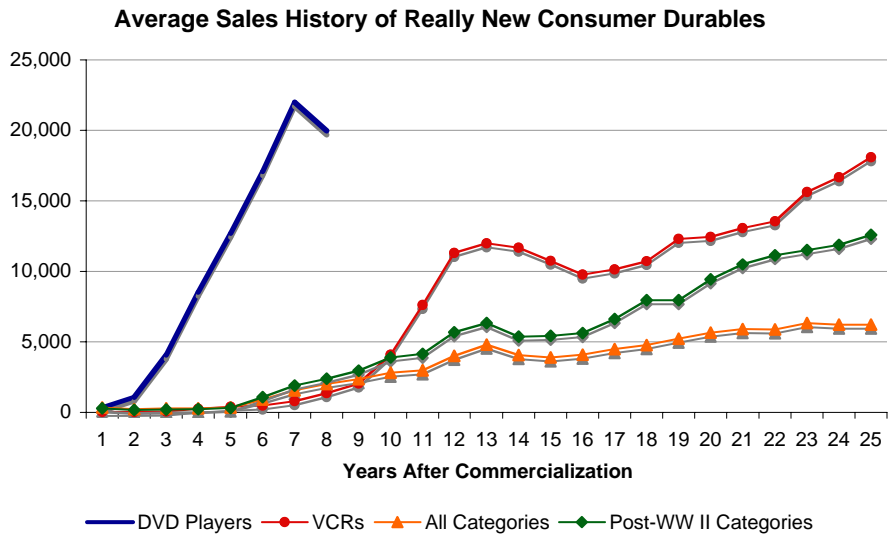
The Takeoff Model

Research by Professor Peter Golder (NYU Stern School of Business) and Gerard Tellis (USC Marshall School of Business) provides additional insight into rates of product adoption. Their “takeoff model” predicts the distinct point in the product life cycle at which the transition occurs from introductory stage to growth stage. This is represented as an elbow-shaped discontinuity in the sales curve, typically with an “average sales increase of over 400%.” This feature is often ignored in diffusion models, which tend to depict adoption of new consumer durables with smooth curves. As mentioned earlier, Everett Rogers made brief reference to this phenomenon, broadly characterizing product takeoff as the time between 10-20 percent penetration.

By following Golder and Tellis' model, we can show that DVD player takeoff occurred in early 1999, just two years after commercialization and at a rate far greater than takeoff for VCRs (below).¹⁵



In fact, DVD player sales have far outpaced historical sales averages for new consumer durables, as calculated by Golder and Tellis (below).¹⁶



¹⁵ Data from Consumer Electronics Association eBrain Market Research statistics.

¹⁶ Golder P. and G. Tellis. (2004, Vol. 23, No. 2), pg. 213.

Two years following commercial introduction, DVD hardware shipments eclipsed 500,000 units per quarter at a growth rate of 300% on a year-over-year basis. By comparison, Golder and Tellis found that the average time to takeoff for 16 post-World War II categories is six years. To understand DVD's rapid movement into the growth stage, it is important to examine the primary drivers of takeoff. The research identifies three primary independent variables (price, year of introduction, market penetration) and two control variables (product-specific characteristics and economic conditions). As in the Rogers model, we find that DVD technology exceeds the averages for each of these variables, leading to a remarkably early and strong takeoff for the product (Exhibit 10).

Evolving Process Model for new Product Sales

The three previous academic models explained rates of hardware adoption in the U.S., however it is worth examining a relatively unrelated theory that applies to DVD software purchasing. Rather than confront the early growth segment of the life cycle, Professor Peter Fader at Wharton considers repeat purchases that occur after consumers gain more experience with a product. This evolving process model assumes that consumers become more regular in their buying behavior over time, moving from an initial stage of exponential purchasing to a steady state. While Fader's model deals primarily with the regularity of timing between purchases, there is significant evidence that also shows a decrease in buying frequency for DVDs.

A USA Today article from early 2005 claimed, "if you look at the average number of DVDs bought by the DVD homes, the peak of 25 was in 1998; the past few

years it has been about 15.”¹⁷ According to Dan Ernst, a media analyst with Soleil Securities, in 1999 the average owner of a DVD player was buying 20 DVDs each year. By mid-2005, he wrote that the number had dropped to about 14 DVDs sold per household per year.¹⁸ Holly Wagner, senior editor with Home Media Retailing, offered anecdotal evidence, “Now that everyone has a DVD player, they aren’t rushing out to buy the first of everything.”¹⁹

It appears that as the market matures for DVD players, household purchasing of DVDs has cooled as the novelty and excitement of technological adoption wears off.

VI. The Next S-Curve?

Movie studios and home video executives are beginning to realize that the golden goose of DVD is near its end. Scott Hettrick, editor-in-chief of trade publications Video Business and DVD Exclusive said it best, “The DVD market matured much more quickly than anyone expected...there is little growth left.”²⁰ DVD hardware sped up the diffusion S-Curve more quickly than any other consumer product in American history. As a result, sales of DVD players and discs came to a screeching halt well before the industry predicted. Perhaps the largest factor, as described in Golder and Tellis’ takeoff model, was falling prices for hardware (below) that spurred rapid adoption in the U.S. In their follow-up research,²¹ the two professors found significant evidence that product

¹⁷ Snider, M. (2005, January 5). DVD Continues Spinning Success. *USA Today*.

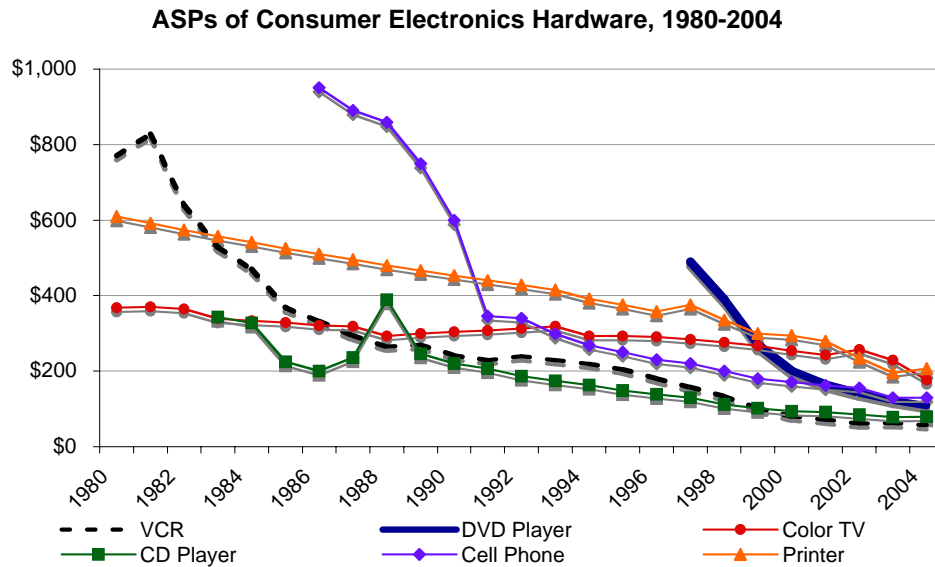
¹⁸ Fost, D. (2005, September 5). Consumers Changing DVD Buying Habits. *San Francisco Chronicle*.

¹⁹ Same as above.

²⁰ Snider, M. (2006, January 4). Video Slips as DVD Market Matures; Hopes Pinned on ‘High-Def.’ *USA Today*.

²¹ Golder P. and G. Tellis. (2004, Vol. 23, No. 2), pg. 213.

slowdown is positively correlated with adoption, specifically that “every 1% increase in penetration is associated with a 3.9% increase in the probability of a slowdown.”²² As Mr. Hettrick stated in early 2006, “The industry shot itself in the foot by lowering DVD prices too much and too quickly.”



Golder and Tellis’ work on product slowdown has other important implications for the fading future of the DVD business. The researchers discovered that products with large sales increases at takeoff tend to have larger sales declines at slowdown, an ominous portent for DVDs. Additionally, the two found that leisure-enhancing products (e.g. DVD players, color TVs, VCRs) have a negative effect on the duration of the growth stage.

The multi-billion dollar question in Hollywood is, of course, what’s next? Online downloads and pay-per-view purchasing offer a glimpse into a disc-less future, but the industry is placing its high-growth bets on High Definition DVD. This upgrade to

²² Golder and Tellis define slowdown as the first year, of two consecutive years after takeoff, in which sales are lower than the highest previous sales. Although this point has not yet arrived for the DVD industry, it could very well occur in 2007 or 2008.

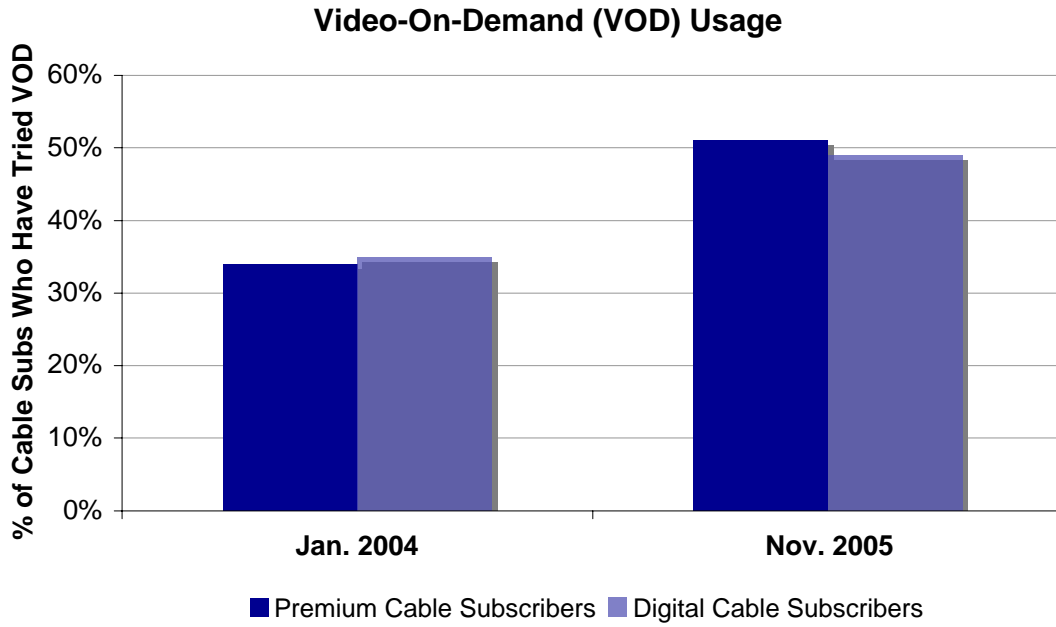
existing DVD technology offers increased storage space that allows for even higher-resolution video and a wealth of additional content, in addition to superior profit margins.

However, as this paper illustrates, there are numerous variables that affect the success of a new consumer product. Companies must work together to introduce a technology that possesses Rogers' key ingredients and has strong takeoff potential. At the same time, content producers and hardware manufacturers should avoid excessive supply-side increases that lead to rapid price reductions and shorter product life cycles. On a positive note, recent research into new product development identified demand growth as a second leading factor in successful launches.²³ Agarwal and Bayus found that, "outward shifting supply *and* demand curves lead to market takeoff." Thus, firm entry and activity geared towards increasing product quality may be just as important as price declines in determining success. This is certainly good news for product managers, and it suggests that, "sales growth does not have to necessarily come at the expense of compressed profit margins."

If the home video industry can strike the right balance between innovation and supply-side management, perhaps there is another round of growth ahead. Just in time to replace the relatively young – yet faltering – DVD.

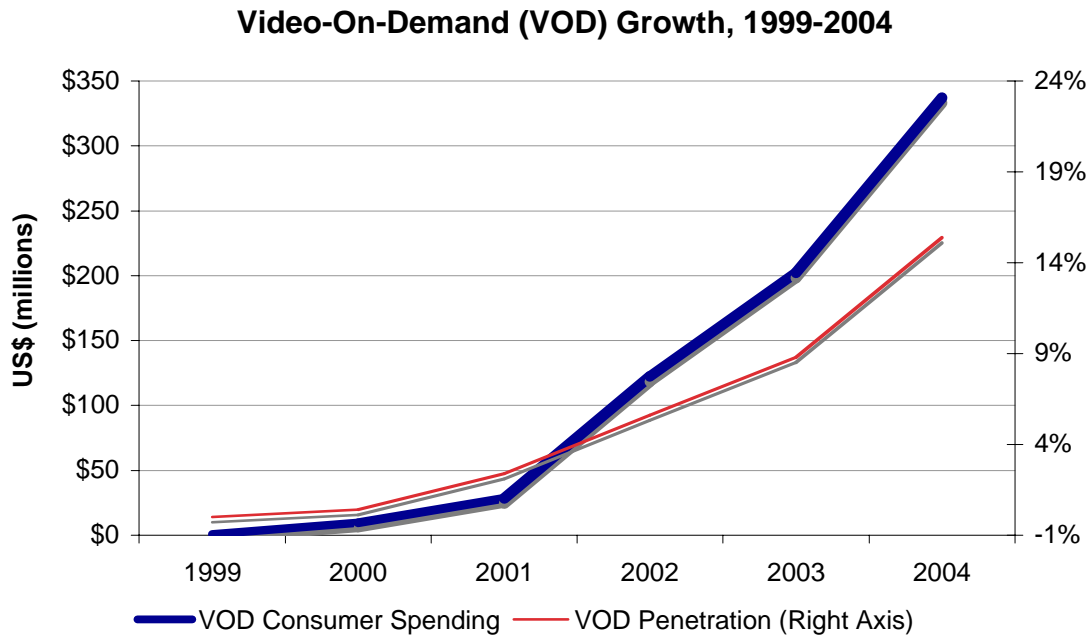
²³ Agarwal, R. and B. Bayus.

Exhibit 1



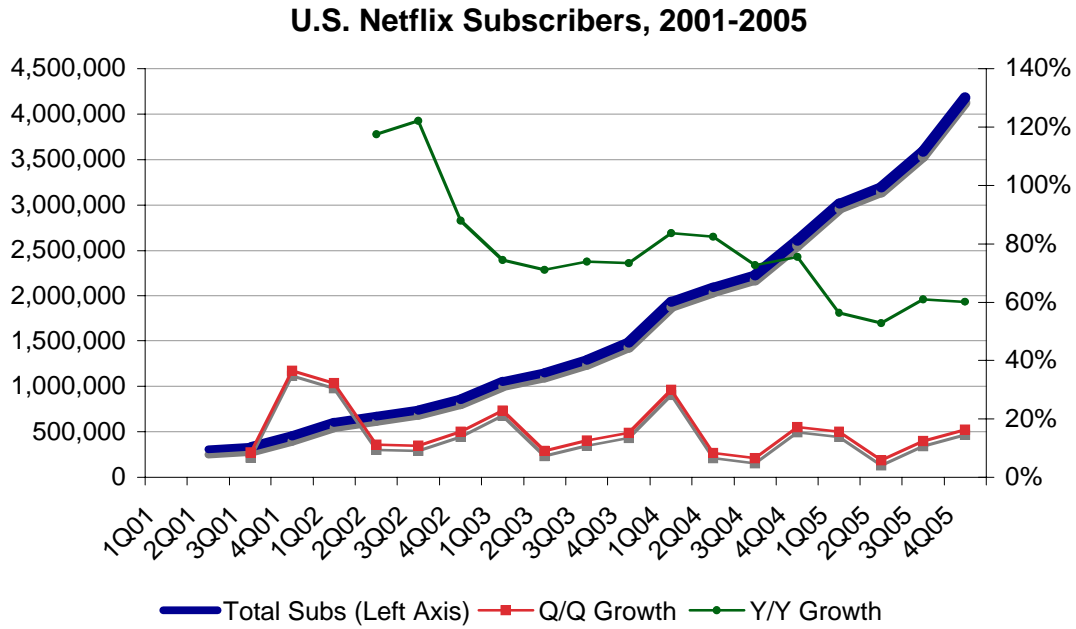
Source: ICR CENTRIS Omnibus Survey (conducted 11/11/05-11/16/05)
 Base used is total digital cable households where Video-On-Demand is available

Exhibit 2



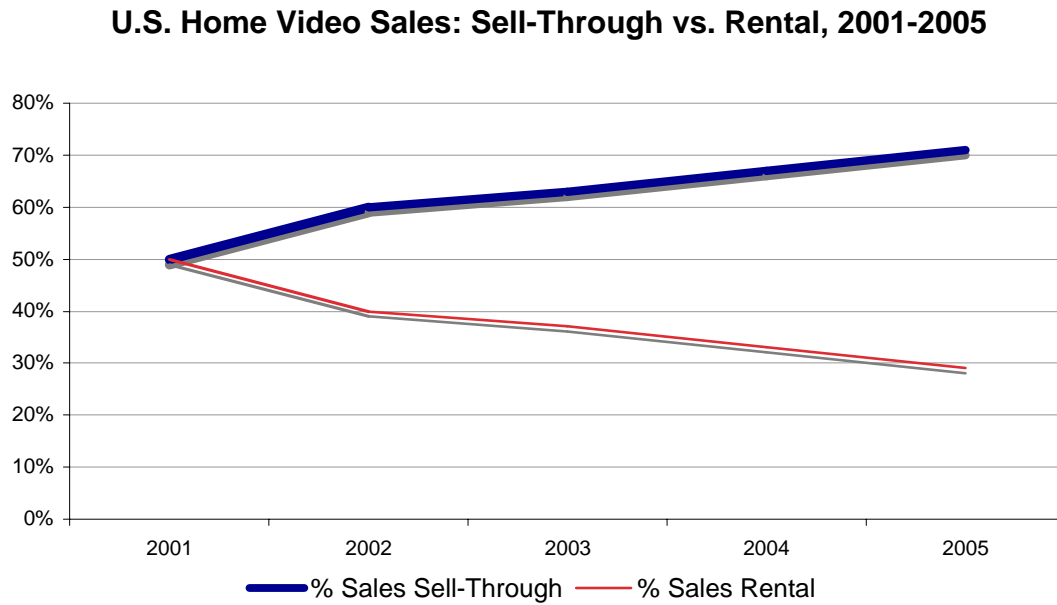
Source: Nielsen Media Research, Adams Media Research, Video Store Magazine

Exhibit 3



Source: Netflix company data

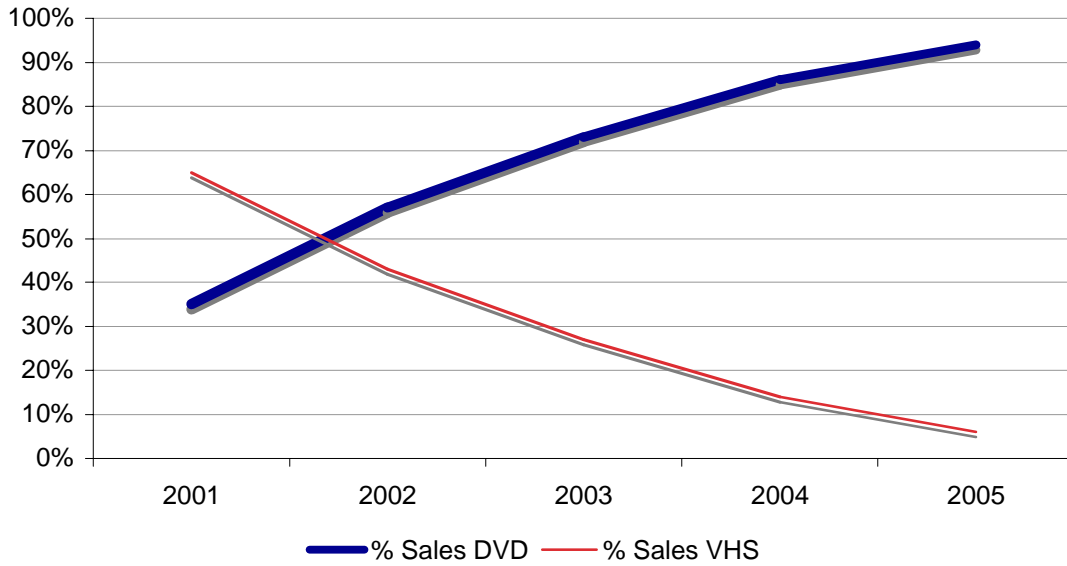
Exhibit 4



Source: The Digital Entertainment Group, 2006

Exhibit 5

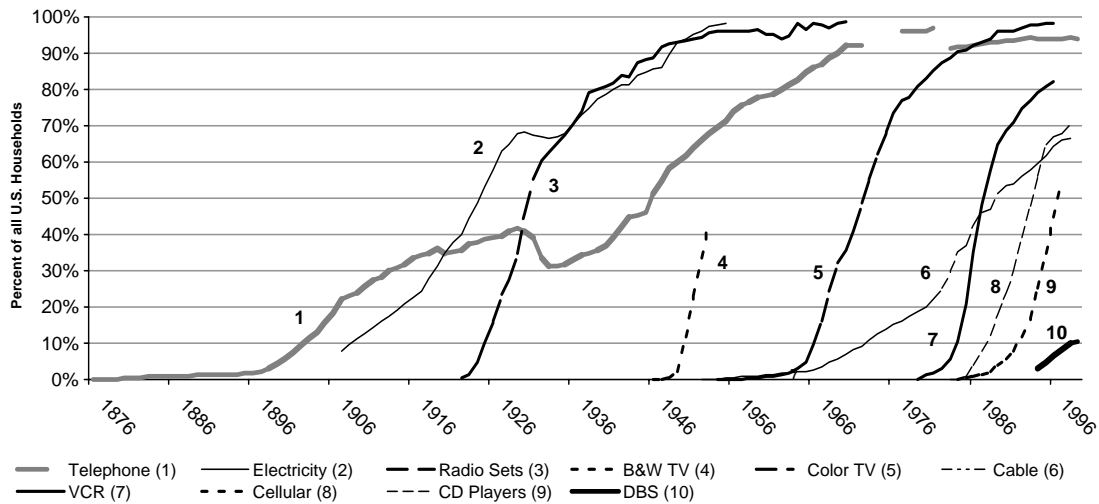
U.S. Home Video Sales: DVD vs. VHS, 2001-2005



Source: The Digital Entertainment Group, 2006

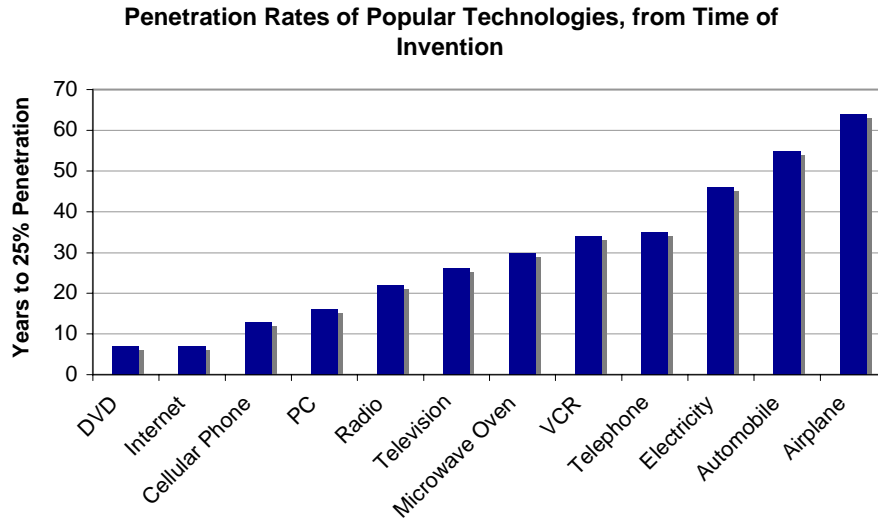
Exhibit 6

Penetration of Consumer Technologies, 1876-19



Source: For "households" (1876-1900) and "homes with electricity" (1908-11, 1913-16, 1918-20), FCC staff estimates based on Census Bureau information. For CD players, Consumer Electronics Manufacturers Association data (June 1999). For Direct Broadcast Satellite, THE SATELLITE REPORT 1999, by Global Satellite Research, C.E. Unterberg, Towbin (1999). For all other data, STATISTICAL ABSTRACTS OF THE UNITED STATES, by US Department of Commerce, Bureau of the Census (1972, 1974, 1976, 1978, 1979, 1982-83, 1987, 1989, 1990, 1992, 1995, 1997, 1998) and HISTORICAL ABSTRACT OF THE UNITED STATES: FROM COLONIAL TIMES TO 1970, by US Department of Commerce, Bureau of the Census (1975).

Exhibit 7



Source: Federal Reserve Bank of Dallas, Consumer Electronics Association

Exhibit 8

Variables Determining the Rate of Adoption of Innovations	
	<u>DVD Diffusion in the U.S.</u>
I. Perceived Attributes of Innovation	
1. Relative advantage	Substantial benefits over analog technology: improved sound and picture, more content, fast scene selection, smaller physical footprint. Economic benefit of falling prices for players and discs over time, becoming even cheaper than VCRs and VHS tapes.
2. Compatibility	Single format for DVD reduced consumer confusion and facilitated production of hardware and peripherals (i.e. avoided costly VHS-Beta war). DVD falls neatly within the home entertainment product landscape and is compatible with American beliefs regarding technological innovation and improved quality of life.
3. Complexity	Relatively easy to understand and use. DVDs are also very similar in function to preceding analog VCR technology (i.e. playback, FF, Rewind, etc).
4. Trialability	Wide range of trial options, including friends, neighbors, and electronics stores.
5. Observability	Benefits of DVD innovation are clearly observable, in the form of drastically improved video resolution, quick access to content, and superb sound.
II. Type of Innovation-Decision	Individual, optional purchase decision does not require groups or higher authority.
III. Communication Channels	Well organized mass media channels plus widespread interpersonal communication (i.e. word of mouth).
IV. Nature of the Social System	Technologically advanced, with highly interconnected communication network.
V. Extent of Change Agents' Promotion Efforts	Coordinated advertising and marketing from electronics and entertainment industries.

Source: Everett Rogers *Diffusion of Innovations*

Exhibit 9

Bass Model Formulation

$$\text{Cumulative number of adopters} = N_t = N_{t-1} + p(m - N_{t-1}) + q \frac{N_{t-1}}{m} (m - N_{t-1})$$

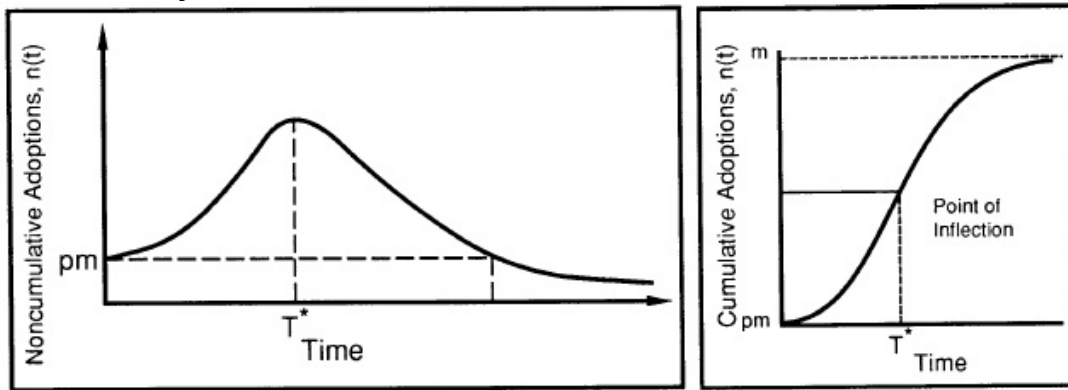
m = number of people who will adopt (i.e. total market size)

$N(t-1)$ = number who have already adopted at a point in time t

p = tendency to adopt (coefficient of innovation – external factors such as media coverage)

q = likelihood of adoption (coefficient of imitation – internal factors such as word of mouth/social contagion)

Analytical Structure of the Bass New Product Diffusion Model



Source: Mahajan, V., Muller, E., & Bass, F.M. (1990, Vol. 54, No. 1). New Product Diffusion Models in Marketing: A Review and Directions for Research. *Journal of Marketing*, pg. 4.

Exhibit 10

Variables Determining Takeoff

I. Independent Variables	Golder & Tellis Comments	Average Takeoff	DVD Takeoff
1. Price	"Probably the single most important factor." To standardize measurements of price, G&T divided the price of each product in each period by that product's initial price.	Price = 63% of introductory price.	Price = 58% of introductory price.
2. Year of Introduction	G&T posit that the introductory stage of the product life cycle is shortening over time, and takeoff occurs earlier than in the past. Thus, they expect year of introduction to be positively correlated with takeoff.	Time from introduction to takeoff = 6 years	Time from introduction to takeoff = 2 years
3. Market Penetration	Defined as the percentage of households that have purchased the new product. Everett Rogers' research on diffusion indicates a distinct threshold (2.5%) at which products move to mass market. Plus, availability of complementary products implies relationship between market penetration and takeoff.	Penetration at takeoff = 1.7%	Penetration at takeoff = 2.1%
II. Control Variables			
1. Product-Specific Characteristics	These include type of product (leisure, time-saving, electronic good) and whether sales depend on externalities such as software.	Not significant	DVD is an electronic good
2. Economic Conditions	These include GNP, total number of households, consumer sentiment.	Not significant	Strong GDP growth, budget surplus, and high consumer sentiment may be factors

Source: Golder and Tellis "Will It Ever Fly? Modeling the Takeoff of Really New Consumer Durables."

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