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DETERMINANTS OF CABLE SYSTEM PRODUCT DIVERSIFICATION – AN INVESTIGATION OF THE U.S. CABLE SYSTEMS

By

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ABSTRACT

DETERMINANTS OF CABLE SYSTEM PRODUCT DIVERSIFICATION – AN INVESTIGATION OF THE U.S. CABLE SYSTEMS

By

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Product diversification has been happening in the cable industry on a large scale for the past decade. The purpose of the study is to examine cable system diversification into non-traditional services: pay-per-view (PPV) television, high-speed internet access, and telephony. An econometrics model based on the Industrial Organization model (the I/O model) is employed to explore the factors that have lead to variation in diversification among cable systems. Specifically, I look at how three sets of variables, namely, cable system characteristics, market structure, and market demographics, influenced cable system diversification.

Binary logistic regressions were employed to identify factors that influenced cable system diversification into PPV, high-speed internet access, and telephony, respectively. Regression results indicate that systems owned by multiple system operators (MSOs) are more likely to diversify into PPV, systems with larger basic subscriber bases are more likely to diversify into PPV and high-speed Internet access service, systems operating in franchise areas with more broadcast television stations receivable over-the-air (OTA) are more likely to diversify into PPV and high-speed Internet access service, and systems operating in franchise areas with more high-speed internet service providers are less likely to diversify into high-speed internet access service.

Multiple linear regression was employed to identify the determinants of cable system total degree of diversification, which is defined to be the number, from zero to three, of the three non-traditional services offered by a cable system. Regression results indicate that MSO ownership, the number of basic cable service subscribers, and the number of broadcast television stations receivable OTA all had a statistically significant positive relationship to cable system total degree of diversification, whereas the number high-speed Internet service providers in a cable franchise area had a statistically significant negative relationship to cable system total degree of diversification.

To my dear mother
Yongfen Gao
for many reasons

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INTRODUCTION

Current technological developments in media and telecommunications industries, convergence of markets, and liberalizing legislation have removed many of the conventional entry barriers affecting media markets. As traditional market boundaries and barriers began to blur, competition in these markets has greatly increased (Doyle, 2002). In response to increased competition, many media and telecommunications firms have adopted operations-based strategies, such as integration, diversification, niche products and internationalization (Picard, 2004).

In the past two decades, diversification in media and telecommunications industries has proceeded at a rapid pace. Many media and telecommunications firms have diversified into new product or geographic markets in order to expand their product portfolios, to diversify the sources of revenue, to reduce risk, to gain access to content, or to overcome regulatory barriers (Albarran & Porco, 1990; Chan-Olmsted & Chang, 2003; Picard & Rimmer, 1999). As a result, the literature on various aspects of diversification, including structural analysis of diversified firms, determinants of firms' diversification, and the relationship between diversification and firm performance, has grown over years.

Although there are plenty of studies of diversification in the media literature, there is a need for further study. First, most studies of diversification in media and telecommunications industries are cross-industry research, and thus pay little attention to diversification within one particular industry. Second, although diversification of some media and telecommunications industries such as the newspaper industry (Picard & Rimmer, 1999) and the publishing industry (Kranenburg, Hagedoorn & Pennings, 2004) has been addressed in the literature, that of other major media and telecommunications industries, in particular, the cable television industry, has not been adequately studied. Last, determinants of media and telecommunications firms' diversification have not been extensively studied in the literature. Only a few studies have explored determinants of media firm diversification (Albarran & Porco, 1990; Dimmick & Wallschlaeger, 1986).

The purpose of the present study is to examine cable system diversification into non-traditional services. In this study, the term cable system diversification is used to mean cable systems' offering other services in addition to subscription-based video programming services. Three services that cable systems have diversified into are: pay-per-view[1] (PPV) television, high-speed internet access, and telephony. In particular, this study seeks to apply the Industrial Organization Model (the I/O model) in examining cable system diversification. The I/O model argues that the structure of the economic market affects the conduct and performance of participants. This study aims to identify the determinants of cable system diversification by examining the relationship between market structure and cable system diversification strategies. Specifically, I look at how three sets of variables, namely, cable system characteristics, market structure, and market demographics, influence cable system diversification.

Diversification in the cable industry is worthy of investigation for the following reasons. First, cable television is the dominant multichannel video programming distributor (MVPD). As of June 2004, cable operators served approximately 69.4 percent of all MVPD subscribers (FCC, 2006). Second, diversification has been happening in the cable industry at a large scale. In addition to the traditional video programming service, many cable operators have offered interactive services, cable telephone service, and high-

[1] PPV is a pay cable service that allows cable television subscribers to access movies and special one-time only events.

speed internet access service in the past decade. Last, diversification is an important conceptual and practical issue for cable managers. The forces behind cable systems' diversification are of general management interest to practitioners in the industry.

This paper is organized as follows. Chapter 1 analyzes the cable industry's current positions in MVPD, PPV, high-speed internet access, and telephone services. In this chapter, an analysis of developments in technology, changes in regulation, and major competitors to cable systems in providing each of the above services is provided.

The literature on diversification and industrial organization is reviewed separately in Chapter 2 and Chapter 3. Chapter 2 provides a review of definitions, motives, forms, and measures of product diversification, theoretical views on diversification, the literature on diversification in media and telecommunications industries, and the literature on cable systems' product offerings. Chapter 3 first provides a historical overview of the I/O model, followed by a review of applications of the I/O model in diversification research, especially diversification studies of media and telecommunication firms.

In chapter 4, the design of the study is described. Chapter 4 first describes the study's stratified random sampling technique, then the study's dependent and independent variables. Three binary dependent variables (0, 1) are used to measure cable system diversification into PPV, high-speed internet access, and telephony, respectively. The fourth dependent variable measures a cable system's total degree of diversification into the above three services. Also, how three sets of independent variables – cable system characteristics, market structure, and market demographics – are operationalized and constructed, and their anticipated relationships with the dependent variables, are discussed. A framework for the analysis of cable system diversification is presented at the end of Chapter 4.

Data analysis method and results are reported in Chapter 5. Binary logistic regressions were employed to identify factors that influenced cable systems' decisions to upgrade to higher capacity hybrid networks of fiber optic and coaxial cable, and cable system diversification into PPV, high-speed internet access, and telephony, respectively. Multiple linear regression was employed to identify the determinants of cable system total degree of diversification. In Chapter 6, I discuss the regression results, the contributions and limitations of the present study, and offer suggestions for future research.

CHAPTER 1
CABLE SYSTEM DIVERSIFICATION

1.1 An Overview of the Cable Industry

Cable television began in 1948 as an alternate television service to households where reception of broadcast television station signals receivable over-the-air (OTA) was poor. In cable television's early days, cable systems only retransmitted local broadcast television station signals. Beginning in the 1960s, cable systems started experimenting with importation of distant signals. Cable television took off in the 1970s when satellite technology enabled video signals to be transmitted economically via satellites nationwide. Today, the cable industry has grown into a multi-billion industry.

A cable system needs to obtain a cable franchise from a local franchising authority (city, town, or county) to operate in that local area. A cable system pays a cable franchise fee, which is usually 5 percent of a cable system's gross revenue, to a local government in exchange for the privilege of using the public right of way (Head, Spann & McGregor, 2001). Offering cable television service also requires a significant investment in infrastructure. At the outset, a cable system must make a substantial investment in facilities construction, receiving and distribution equipment, and wiring neighborhoods and households (Massey & Baran, 2001). For cable systems offering a wider variety of services such as high-speed internet access and cable telephone services, there is a need to upgrade network infrastructure.

Broadband is a general term used to described high bandwidth equipment or systems. A broadband system is able to deliver multiple channels and services to users or subscribers. Since the passage of the Telecommunications Act of 1996, the cable industry has spent billions of dollars upgrading their systems to meet rising demand for broadband applications such as digital television, high-speed internet access, and cable telephony (NCTA, 2005, see Figure 1-1). The upgrading is fairly expensive. In 2005 alone, the cable industry invested $9.56 billion in upgrades. Between 1996 and 2004, the cable industry invested about $106 billion in upgrading its facilities. The upgrades involved rebuilding more than one million miles of cable plant with fiber optic technology (NCTA, 2005). It equates to about $1,300 per customer spent to upgrade cable systems and launch new broadband services (NCTA, 2004).

Cable has dominated the multichannel video programming market for years. Now, technological innovations have made cable diversification into PPV, high-speed internet access, and telephony technically feasible and economically attractive, and regulatory initiatives have removed most of the legal barriers that separate cable and other telecommunications industries (Doyle, 2002). These new developments allow cable companies to explore growth opportunities elsewhere through diversification. In the following sections of this chapter, the cable industry's current positions in MVPD, PPV, high-speed internet access, and telephone services are examined.

1.2 Cable's Current Position in MVPD Services

The cable industry has enjoyed its leading position in the multichannel video programming market for years. Cable is the largest MVPD in the U.S. – as of June 2005, 69.4 percent of MVPD subscribers received video programming from a cable operator (FCC, 2006). However, cable's share of MVPD subscribers has been declining in recent years. Cable operators face increasing competition in the multichannel video programming market. Today, the U.S. television consumers can choose from a variety of MVPDs, from cable companies to Direct Broadcast Satellite (DBS) service providers, and in some markets telephone companies (FCC, 2006).

DBS is the major competitor for cable in the multichannel video programming market. The penetration of DBS service was impeded in its early years because there were legal limitations on satellite companies' ability to transmit local broadcast television station signals (Bates & Chambers, 2004). On November 19, 1999, Congress enacted the Satellite Home Viewers Improvement Act (SHVIA). SHVIA offers DBS service providers the option of providing local broadcast station signals to subscribers living in the stations' local market area, and also grants DBS service providers the authority to provide distant or national broadcast programming to subscribers[2]. DBS penetration has been increasing since. The growth of DBS penetration can be partially attributed to the passage of SHVIA (FCC, 2002).

DBS has become the most serious threat to cable television in MVPD services. In June 2004, DBS had over 23.97 million subscribers, which represented a 24.34 percent of all MVPD households (NCTA, 2005). The top two U.S. DBS companies are DirecTV and EchoStar (marketed as the DISH Network). DirecTV is the largest DBS provider and

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[2] http://www.fcc.gov/mb/shva/

the second largest MVPD. DirecTV served 14.67 million MVPD subscribers as of June 2005; the second largest DBS provider and third largest MVPD EchoStar served approximately 11.45 million MVPD subscribers as of June 30, 2005 (NCTA, 2005).

Another competitor to cable in MVPD services is the telephone companies. The Telecommunications Act of 1996 gave telephone companies the option of offering video programming service service[3]. Some large U.S. local exchange carriers (LECs) have made substantial progress in rolling out multichannel video programming service in the past several years. For example, Verizon Communications received franchises from many local communities, and began offering multichannel video programming service under the brand name "FiOS" in some of the local communities that they are franchised to serve (FCC, 2006).

Telephone companies have obtained statewide television franchises in several states. In August 2005, the Texas legislature passed a bill that would allow telephone companies to apply for a statewide franchise to provide television services to cities throughout Texas (Haugsted, 2005, August 10). Statewide franchise bills are advancing in Florida, California, New Jersey and several other states. Also, telephone companies now are lobbying for a national franchise license for providing video programming services. The passage of a national video franchising scheme would help telephone companies avoid the long franchise negotiation procedure, and thus accelerate telephone companies' entry into the video programming market (Hearn, 2006, March 13).

The cable industry's revenue has been growing. From 1997 to 2005, the cable industry's revenue from the subscription-based video programming market increased from $24.96 billion in 1997 to $37.54 billion in 2005 (FCC, 2002, 2006, see Figure 1-2).

[3] The Telecommunications Act of 1996, TITLE III – Cable Services, Section 302

In constant dollars, it increased by 27.30 percent from 1997 to 2005 (in 2005 dollars, \$24.96 billion from 1997 is worth \$29.49 billion, using the GDP deflator). U.S. GDP increased by 27.94 percent over the same period, measured in year 2000 dollars. However, confronted with increased competition, the cable industry has experienced declining market share in the multichannel video programming market. Cable's market share of the multichannel video programming market decreased from 95 percent in 1994 to 72 percent in 2004 (FCC, 2005).

1.3 Cable Provision of PPV Service

Many cable systems offer PPV services that allow cable subscribers to watch movies and sport events for a one-time fee at a scheduled time (Head, Spann & McGregor, 2001). The signal on each cable PPV channel is scrambled until a cable subscriber chooses to view programming on that channel. A cable subscriber can order PPV programming either by telephone or by remote control. Cable PPV services depend on addressability – after receiving an order from a subscriber, a video server at the cable headend activates an addressable converter near the subscriber's television set (Head et al., 2001). The addressable converter then descrambles the PPV program ordered for its duration.

DBS service providers such as Dish Network and DirecTV Inc provide PPV services that compete with cable PPV services. The digitally enhanced DBS channels allow DBS service providers to offer their subscribers more PPV programming choices than can be offered by cable operators offering analog services, and the DBS services are also able to schedule more frequent start times for repeated programs, such as movies, than can their cable competitors. Cable PPV is limited by the number of channels that can be allocated to PPV programming. This is a disadvantage for cable PPV in competing with DBS PPV. The upgrade to hybrid networks of fiber optic and coaxial cable allows cable systems to expand their channel capacity. With these upgraded networks, cable companies are able to provider their subscribers with more PPV programming choices.

1.4 Cable Operators in High-speed Internet Access Service

Many cable operators view providing high-speed internet access service as an important revenue source. Most cable operators provide high-speed internet access service with one proprietary Internet Service Provider (ISP) created and owned by the cable operator (NCTA, 2005). For example, Comcast Communications offers the service under the "Comcast High-speed Internet" brand name; Charter offers the service under the "Charter High-Speed" brand name; and Cox offers the service under the "Cox High Speed Internet" brand name (NCTA, 2005).

The cable industry has a lead over other technologies in the residential high-speed internet access market. The number of cable modem customers has been increasing steadily over the past years (NCTA, 2005, see Figure 1-3). As of June 2005, the cable industry had 23 million high-speed internet access service customers (NCTA, 2005). However, cable's leading position in this market has eroded as telephone companies and other service providers have begun to provide competing services. In the past year, cable operators have seen erosion in their ability to sign up new high-speed internet access service customers (The FCC, 2006).

The primary high-speed internet access service competitors to cable companies are the telephone companies that provide digital subscriber line (DSL) service. On June 27, 2005, the Supreme Court of the United States upheld a declaratory FCC ruling that classified high-speed Internet access service provided by cable companies as an information service[4]. This decision confirmed the FCC's ruling exempting high-speed Internet access service provided by cable companies from common-carrier obligations. In

[4] National Cable & Telecommunications Association et al. V. Brand X Internet Services, declaratory ruling and notice of proposed rulemaking, 17 FCC Rcd 4798 (2002) (Cable Modem Declaratory Ruling and NPRM).

order to promote competition in the high-speed Internet market, the FCC redefined high-speed Internet access service provided by telephone companies over DSL as an information service at year end 2005[5].

In response to price competition from DSL providers, cable operators lowered cable high-speed internet access service rates. According to Current Analysis Inc., residential cable high-speed Internet access service rates have fallen from an average of $44.35 per month at the end of the fourth quarter of 2003 to an average of $40.85 per month at the end of the first quarter of 2004. Also, some cable systems have begun to provide "higher-speed" connections than DSL, especially download speeds, in order to maintain their share of the high-speed Internet access service market (Scanlon, 2005, January 24).

[5] FCC Eliminates Mandated Sharing Requirement on Incumbents' Wireline Broadband Internet Access Services. WC Docket Nos. 05-271 and 04-242. CC Docket Nos. 98-10, 95-20, 02-33, and 01-337.

1.5 Cable Provision of Telephone Service

The cable industry was separated physically and legally from the telephone industry in its early years (Bates & Chambers, 2004). Cable operators used to only provide multichannel video programming services, whereas telephone companies used to only provide telephone services. The Telecommunications Act of 1996 removed both cable and telephony's local monopoly status, and encouraged those industries to compete directly with one another[6]. With the passage the Telecommunications Act of 1996, cable companies nationwide have been certified as competitive local exchange carriers (CLECs).

The development of technology and the trend of deregulation of telecommunication industries have opened up the telephone market to cable companies. Cable companies have recently expressed an increased interest in providing telephone service. They invested in upgrading their systems to meet the technological requirements for providing telephone service. The upgrades include two-way fiber lines that can send and receive data, large quantities of devices to convert a phone's signals into digital cable signals, and equipment to link cable systems to the existing public phone networks (Healey, 1998, October 27).

Larger multiple system operators (MSOs) such as Cox Communication, Cablevision, MediaOne, Time Warner, and Comcast have begun to offer telephone service to customers. Most cable operators provide telephone service through a subsidiary specifically created and owned by the cable operator (FCC, 2006). For instance, in Virginia, Cox Communication offers cable telephony to its customers through its wholly

[6] Telecommunications Act of 1996, TITLE III – Cable Services, Section 302 & Section 303

owned subsidiary, Cox Telcom Virginia, Inc[7].

While some cable systems have offered traditional circuit-switched telephone service for years, many cable systems have recently launched voice over Internet protocol (VoIP) service. The increasing availability of VoIP cable telephone services has attracted thousands of new subscribers (NCTA, 2005). Despite of the difficulties that cable companies confront as new entrants in the telephone market, the number of cable telephone customers has been growing. The number of cable telephone phone customers has increased from 1.5 million at year end 2001 to 5.6 million at year end 2005 (NCTA, 2005, see Figure 1-4).

[7] Retrieved July 11, 2006 from: http://www.cox.com/fairfax/telephone/faqs.asp

CHAPTER 2
THE PRODUCT DIVERSIFICATION LITERATURE

Diversification emerged in the beginning of the 20th century as a result of firms' efforts to supply entire lines of inter-related products (Didrichsen, 1972). For several decades, product diversification has been a popular strategy pursued by firms all over the industrialized world (Bengtsson, 2000; Geringer, Tallman & Olsen, 2000). In this chapter, a review of definitions, motives, relatedness, modes, and measures of product diversification, and the literature on diversification in media and telecommunications industries is presented.

2.1 Definitions of Product Diversification

Product diversification is a multidimensional phenomenon that has been studied from different perspectives (Kranenbrug, 2004). Therefore, diversification researchers have included in the definitions of product diversification references to various dimensions of product diversification, such as the criteria for firms' diversification, the method of entering the new businesses, the driving forces behind diversification, and the levels of relatedness between a firm's base business to its target businesses (Brost & Kleiner, 1995).

Product diversification has been defined in various ways in the literature. Product diversification in its broadest sense can be defined as entering into a new business activity by an existing business entity (Brost & Kleiner, 1995). In the early definitions, scholars assumed industry boundaries as given, and viewed product diversification as an increase in the number of industries in which firms operate (Ramanujam & Varadarajan, 1989). For example, Kamien and Schwartz (1975) define product diversification as the extent to which firms classified in one base industry produce goods classified in another industry.

Media scholars use the term product diversification to refer to the expansion of media companies' business activities across different product markets (Kranenbrug, Hagedoorn & Pennings, 2004). Subscribing to this definition, media markets can be segmented by a variety of criteria, more or less narrowly defined. One possible means to segmenting media markets is by the four-digit NAICS codes, such as wired telecommunication carriers (5171), cable and other program distribution (5175), and Internet service providers (5181)[8].

For the purpose of this study, cable system diversification is defined as a cable system offering other services in addition to subscription-based video programming services. It means if a cable system has provided a service other than subscription-based video programming services, the system has diversified into that service. In the present study, the focus is on the three major services that cable systems have diversified into: PPV, high-speed internet access, and telephony.

8 http://www.census.gov/epcd/naics02/naicod02.htm

2.2 Diversification Concepts

The diversification literature covers a variety of topics: what are the motives for firms to diversify? What is relatedness of diversification? What are the modes of diversification? Should firms diversify through internal market and product development, or external acquisition, or merger, or joint venture, or venture capitalization? (Brost & Kleiner, 1995; Oster, 1999). In this section, I look at several issues involving diversification, including motives for diversification and diversification relatedness and modes.

Motives for Diversification

One of the central topics of diversification research is firms' motives for diversification (Brost & Kleiner, 1995). Scholars suggest a number of different motives for firm diversification: the search for growth, profitability, economies of scope and synergies, financial risk reduction, and increased market power (Amit & Livnat, 1988; Ansoff, 1965; Rumelt, 1974; Stimpert & Duhaime, 1997).

Firms may diversify to seek growth opportunities and profit. For firms operating in mature industries with slow growth rates, diversification has been considered the only way to promote growth (Oster, 1999). Scholars suggest that firms operating in industries with slow growth rates, and also firms operating in declining industries characterized by low profitability and few growth opportunities, pursue diversification to improve their profitability (Delios & Beamish, 1999; Rumelt, 1974; Stimpert & Duhaime, 1997).

Firms may pursue diversification strategies to create synergies and economies of scope (Amit, 1988; Oster, 1999). Synergy exists 'where it is more advantageous to combine two or more activities than to undertake them separately' (Smith, 1985, p.69).

The concept of synergy is based in part on economies of scope, which exist when the cost of joint production is less than the cost of producing each output separately (Amit & Livnat, 1988; Brost & Kleiner, 1995). Economies of scope may be achieved through combining manufacturing facilities, sharing a common sales force, or advertising jointly (Ansoff, 1965).

Firms may pursue diversification for financial motives (Amit, 1988). The financial motive can be viewed from a portfolio perspective. Managing a portfolio of different products is expected to spread a firm's risk across a range of products, markets, and industries (Ito & Rose, 2004). Firms can reduce the financial risks associated with depending solely on a single operation by diversifying into products and markets that are not perfectly correlated with their primary products and markets (Amit, 1988; Brost & Kleiner, 1995; Montgomery, 1985; Oster, 1999).

Scholars suggest that firms use diversification as either a reactive strategy or proactive strategy. Firms may diversify in reaction to government policies, performance problems, or uncertainties about future cash flow or because of various managerial motivations (Lubatkin & Rogers, 1989; Prahalad and Bettis, 1986; Ramanujam and Varadarajan, 1989). Others consider that diversification is used more as a proactive strategy to limit resource dependency and ensure organizational survival (Dimmick & Wallschlaeger, 1986; Lubatkin & Rogers, 1989).

Diversification Relatedness

Firms can diversify into related or unrelated businesses, or diversify by expanding into new product or geographic markets. Rumelt (1974) refers to relatedness as the logic and extent by which a firm's different lines of business are connected to each other.

A firm's businesses could be related either because they share markets, distribution systems, product and process technologies, or manufacturing facilities, or because they rely on common technologies, managerial capabilities and routines and repertoires (Grant 1988; Rumelt, 1974; Winter, 1987). Cable systems' diversification into PPV, high-speed internet access and telephone services are related diversification. Cable systems' diversified businesses are related to their base business of video programming primarily through the sharing of a common distribution network.

Diversification Modes

Diversification can take a variety of forms, including diversification through internal market and product development, external acquisition, merger, joint venture or venture capitalization, and licensing of new business activities (Brost & Kleiner, 1995). Diversification by acquisition requires a significant degree of financial commitment and financial health, while diversification by expansion typically requires less, but still significant, up-front financial commitments (Yip, 1982).

2.3 Theoretical Perspectives on Diversification

Rumelt (1974) emphasized the study of product diversification strategy and generated an important line of diversification research. Most of the new theory development with regards to diversification strategy extends Rumelt's (1974) original diversification strategy studies. The topic of diversification has received considerable attention in the industrial organization, strategic management, and finance literatures. The industrial organization literature mostly compares the profitability of diversified and undiversified firms, the strategic management literature emphasizes the benefits of diversifying into related businesses, and the finance literature mostly examines the motives for diversifying into unrelated businesses (Amit, 1988).

Scholars have considered this topic from a range of different theoretical perspectives. Montgomery (1994) summarized the three main theoretical perspectives that have been advanced to explain diversification strategies: (1) The market power perspective, which suggests that firms use diversification to increase their market power; (2) The resource-based perspective, which argues that firms diversify to exploit unutilized resources available to the firm; and (3) Agency theory, which views diversification as a strategy chosen by managers who are looking for more power and prestige.

The Market Power Perspective

Market power exists when a firm is able to sell its products at prices above competitive levels. Diversification was long seen as the consequence of the growth and development of large, successful companies, because they can transfer their accumulated resources from their primary market to new markets (Porter, 1985). Early literature on diversification based on industrial organization economics asserted that diversified firms could exploit market power in selling their products and buying their raw materials (Amit & Livnat, 1988). Economists' initial interests in diversification reflected concerns with its potential anti-competitive effects: large diversified firms may have strategic options that are not available to their more specialized competitors (Oster, 1999).

Different from other perspectives on diversification, the market power view emphasizes the anti-competitive consequences of diversification, rather than the motives for diversification or efficiencies or inefficiencies that may be involved in diversification (Montgomery, 1994). The market power perspective suggests that diversified firms use diversification strategies to increase their market power through cross-subsidization, mutual forbearance, and reciprocal buying activities (Piscitello, 2004). Diversification scholars posit that these practices may lead to reduced competition and increased industry concentration. However, the literature only provides limited support for the view that diversification increases market power (Oster, 1999).

The Resource-Based Perspective

The strategic management literature examines diversification strategy with respect to corporate structure, internal processes and systems, and functional policies (Brost & Kleiner, 1995). The resource-based view is one of the commonly accepted perspectives on firm diversification in strategy research (Montgomery, 1994; Piscitello, 2004; Ramanujam & Varadarajan, 1989). This perspective argues that rent-seeking firms diversify in response to unutilized resources – resources that exceed what is required for the long-run profitable operation of a production process (Teece, 1982). The resource-based perspective suggest that a firm has an incentive to diversify as long as diversification provides a more profitable way of employing its excess resources, (Montgomery, 1994).

The resource-based perspective acknowledges the importance of firms' resources in shaping their diversification strategies. It suggests that the portfolios of diversifying firms are critical in predicting the resource characteristics of the industries into which they will diversify (Montgomery & Hariharan, 1991). Leveraging resources across product lines may produce economies of scope due to competencies that can be applied to multiple lines of business (Geringer, Tallman & Olsen, 2000). The resource-based perspective predicts that firms choose to enter markets that are close to their existing product lines (Montgomery & Hariharan, 1991; Piscitello, 2004; Robins & Wiersema, 2003).

Agency Theory

Agency theory is another widely accepted perspective on firm diversification in the strategic management literature (Denis, Denis & Sarin, 1999). Agency theory suggests that separation of ownership (shareholders) and control (managers) may cause corporate assets to be deployed to benefit managers rather than shareholders. Scholars applying this perspective argue that diversification strategies represent corporate decisions where there exists a fundamental conflict of interest between managers and shareholders (Denis, Denis & Sarin, 1999). According to agency theory, the adoption of diversification strategies is predicted by personal benefits that managers can derive from diversification. Some studies in this research stream find a negative relationship between large shareholdings by management and diversification levels (Amihud & Lev, 1981; Denis, Denis & Sarin, 1999).

2.4 Measures of Product Diversification

The two most accepted measures of product diversification are continuous business count measures and categorical measures (Kranenbrug, Hagedoorn & Pennings, 2004). The difference between the two is that the former approximate the amount, or degree, of diversification while the latter approximate the type of diversification, or the relationship that a firm's business units have to its base business (Reed & Sharp, 1987).

Continuous business count measures are developed from Standard Industrial Classification (SIC) codes, in which each of a firm's establishments is classified according to its primary classification or activity, and are considered to be more objective (Hall & John, 1994). Researchers use both unweighted and weighted continuous business count measures (Montgomery, 1982). In measuring firm diversification with unweighted continuous business count measures, researchers simply count the number of different products or businesses a firm is operating in, while with weighted continuous business count measures, researchers weight the products or businesses by relative size of sales or assets.

The unweighted measures are simple to compute from data that are readily available and do not require detailed business level sales data. At the same time, the major weakness of the unweighted measures is that they are based on the assumption that SIC codes are measured on an interval or ratio scale with equal distances between adjacent SIC codes (Hall & John, 1994; Montgomery, 1982; Rumelt, 1982). The advantage of the weighted-measures over the unweighted measures is that they take into consideration different levels of firm involvement in the lines of business it operates in (Montgomery, 1982).

The categorical approach is a subjective way to measure diversification, which is based on the conceptualization of the core activities of a company, ranging on a spectrum from single business, to dominant business, to related business, to unrelated business. For example, Rumelt (1974) proposes a set of diversification categories, which include single business, dominant business, related constrained, related linked, and unrelated business. Rumelt's classification system uses two steps to assign a firm to 1 of 10 diversification categories: (1) Assign a firm to a diversification category based on the percentage of its sales that can be attributed to a discrete business; and (2) Further differentiation is made based on the pattern of linkages among the firm's businesses (Rumelt, 1974). This two-step process requires firm-specific information on activities such as marketing, distribution, R&D, technology, production, and also firm history (Montgomery, 1982).

The two approaches both have their advantages and disadvantages. The major merit of the continuous business count approach is that it is a continuous, quantitative measure that can identify and measure differences in diversification, both between firms and across time (Grant, Jammine & Thomas, 1988). Categorical measures are superior to continuous business count measures in the sense that they consider both qualitative and quantitative data in making classification decisions and thus overcome a weakness inherent in continuous business count measures. However, the major disadvantages of the categorical approach are that it demands detailed business-level information such as data on sales or revenues from activities, and that it is largely based on understanding the underlying logic behind the firm's intentions and the assumed relatedness between businesses. It thus has untested reliability and researcher-specific subjective classifications (Kranenbrug, Hagedoorn & Pennings, 2004; Hall & John, 1994; Lubatkin, Merchant & Srinivasan, 1993).

2.5 Diversification Studies of Media and Telecommunication Industries

With advances in technologies and the trend of convergence of different information and communications markets, media companies have adapted to these changes and responded to create or to sustain their competitive advantages. For several decades, product diversification has been a highly popular strategy pursued by many media firms (Lacy, 2004). Picard (2002) points out that media firms' diversification was mostly caused by the market growth and market share problems in individual media industries.

In the context of media research, diversification can be conceptualized as the variety of businesses in which a media firm engages, the diversity of its product offerings, or the range of geographic regions in which a media firm does business (Dimmick, 2004). Some scholars use the term 'diagonal integration' – common ownership across different media sectors – to refer to diversification (Doyle, 2004). Interests in various aspects of product diversification, such as structural analysis of diversified firms, the determinants firms' diversification strategy, and the relationship between diversification and economic performance, have grown over the years in both media industry and academia.

Some studies analyze the structure of diversified media firms and industries. For example, Dimmick and Wallschlaeger (1986) initially apply Rumelt's (1974) index to investigate the relationship between prior diversification of TV network parent companies and their future diversification into the new media. In a later study, Albarran and Porco (1990) adopt the Dimmick and Wallschlaeger (1986) index of diversification to measure the degree of diversification of corporations operating pay cable channels (Time Incorporated, Viacom Incorporated, Walt Disney Company and Playboy enterprises). Kranenburg, Hagedoorn and Pennings (2004) examine the diversification strategies of large publishing companies and conclude that the publishing companies mostly diversify into related activities and businesses.

Another stream of study of product diversification in media and telecommunication industries examines the relationship between firms' diversification strategies and performance (Jung, 2003; Jung & Chan-Olmsted, 2005; Kranenburg, Hagedoorn & Pennings, 2004). Jung (2003) examines the degrees of product diversification by media conglomerates since the Telecommunications Act of 1996 and tests the impact of product diversification on their financial health. Jung and Chan-Olmsted (2005) examine the impact of media firms' diversification on their financial performance, based on the product and geographic diversification activities and performance of the top 26 media firms from 1991 to 2002. Kranenburg, Hagedoorn and Pennings (2004) investigate the relationship between diversification and performance among large publishing companies that differed in both product and international diversification. They find that the large diversified publishing companies do not outperform the more focused publishing companies.

Last, a few studies in the literature address the determinants of media companies' diversification strategies. Scholars propose a variety of determinants for corporate diversification. Albarran and Porco (1990) posit that the degree of corporate activity involving mergers and acquisition has an impact on media companies' diversification. Eisenmann (1999) concludes that two dimensions of organizational form – a firm's level of diversification and its CEO's status as an agent versus owner-manager – predict a cable company's propensity to either expand horizontally through acquisition or to exit the cable industry. Also, scholars suggest that media companies' future diversification is influenced by their prior diversification experience. For example, Dimmick and Wallschlaeger (1986) suggest that TV network parent companies that had more prior diversification experience are more likely to diversify into the new media. In recent studies, determinants of diversification for media companies have been examined in a more systematic manner. Using a case study approach, Chan-Olmsted and Chang (2003) analyze the top seven global media conglomerates' product and geographic diversification strategies and propose a set of determinants that might affect the extent, relatedness, and mode of diversification for global media conglomerates.

The cable industry is one of the major U.S. telecommunication industries. Some aspects of cable system diversification have been explored in the literature. Woroch (1997) accesses the strategic merits of different ways that cable television might enter into telecommunications, including direct entry, acquisition and joint venture. Albarran and Porco (1990) study the degree of diversification of four media corporations operating pay cable channels and examine the relationship between the degree of corporate diversification and the degree of corporate involvement in acquisitions and ventures. Fofana (1997) investigates whether the geographic market diversification of the largest U.S. cable operators affects pricing behavior.

Many other aspects of the cable industry have been addressed in the media economics literature, especially, factors that determine cable system program offerings (Chipsy, 2001; Dertouzos & Wildman, 1990; Goolsbee & Petrin, 2004; Kim, 1997). These studies indicate that a variety of factors, including system specific characteristics (e.g., the length of the system plant, the number of homes passed, age of the headend, channel capacity, and whether or not a system is owned by an MSO), market demographic characteristics (e.g., ethnic audience composition, projected population growth, employment rate, income, home ownership, and VCR ownership), and market structure (the number of broadcast television station signals receivable OTA, DBS penetration) predict cable system program offerings, prices, and subscriptions.

CHAPTER 3
THEORETICAL FRAMEWORK

Technological advances enable cable systems to provide other services in addition to traditional subscription-based video programming services. With their infrastructure in place, cable systems can provide these services at a relatively low incremental cost compared to introducing such services without a pre-existing network infrastructure. Some of them did, some of them did not, and those that did diversified to differing degrees. In this study, an econometrics model based on the I/O model is employed to explore the factors that have lead to variation in cable system diversification.

3.1 The I/O Model

The Bainsian I/O Model

Industrial organization is the study of the functioning of markets (Tirole, 1988). The I/O model focuses on the linkages between strategy and the external environment. A prime example of this approach is Porter's analysis of industry structure and competitive positioning, which specifies that the structure of the industry in which a firm chooses to competes determines the state of competition and the context for corporate strategies, and thus the profitability of individual corporate strategies (Porter, 1979, 1980).

The 'old' I/O model, or the Bainsian I/O framework of analysis, assumes a causal link from market structure to conduct to performance. The Structure-Conduct-Performance Paradigm (SCP Paradigm) was first proposed by Bain (1968). The SCP paradigm was the dominant paradigm in industrial organization from 1950 until the 1970s. Analyzing industries using the SCP Paradigm often involves three factors: market structure, market conduct, and market performance (Busterna, 1988).

Tirole (1988) defines a market as " involving either a homogenous good or a group of differentiated products that are fairly good substitutes (or complements) for at least one good in the group and have limited interaction with the rest of the economy" (p.13). Market structure refers to the number and size distribution of firms in a market (Kranenburg & Hogenbirk, 2005). The key dimensions of market structure include: (1) *Concentration of buyers and sellers*, which refers to the number and size distribution of buyers or sellers in a given market; (2) *Product differentiation*, which refers to the differences perceived by buyers to exist among the products available in a given market (3) *Barriers to entry*, which refers to the obstacles new sellers must overcome to enter a given market; (4) *Cost structures*, which refers to the relationship between fixed costs and variable costs in a given market; and (5) *Vertical integration*, which refers to the degree of the common ownership or control of successive stages of the production and distribution process for a good or service (Albarran, 1996; Busterna, 1988).

There are four basic models of market structures: monopoly, oligopoly, monopolistic competition, and perfect competition. The intensity of competition varies across market structures. According to the I/O model, competition is strongest in perfectly competitive markets, where there are a large number of buyers and sellers producing a homogenous product; competition is nonexistent in a monopoly market, where a single seller dominates the market (Albarran & Dimmick, 1996).

Market conduct refers to "the policies and behavior exhibited by sellers and buyers in a market" (Albarran, 1996, p.37). Five specific areas of market conduct include (1) *Pricing behavior*, which refers to the procedures used by sellers to determine prices; (2) *Product strategy*, which refers to decisions made by sellers about the design, quality, and package of a product; (3) *Research and innovation*, which refers to the efforts made by sellers to improve or differentiate a product from their competitors' products; (4) *Plant investment*, which refers to the resources employed to create or acquire the physical plant for the production of goods; and (5) *Legal tactics*, which includes the entire range of legal actions utilized by a firm in a given market (Albarran, 1996; Busterna, 1988).

The New I/O Model

An important emphasis of Bainsian type I/O has been empirical testing of the 'structure-conduct-performance' hypothesis. These studies focus on the impact of industry structure on industry performance. As a consequence, initial I/O analyses did not pay too much attention to firm conduct. The Bainsian I/O model is criticized because it ignores the dynamic effects that firms' strategic actions could have on market structure and ignores various forms of feedback from performance to structure or conduct, and thus cannot properly depict the relationships between market participants (Chan-Olmsted, 1997; Ramsted, 1997; Young, 2000). New I/O theorists' contributions to the Bainsian I/O framework are: (1) Lines of causality, which address the effects of conduct and structure on performance; and (2) Feedback loops, which make the model more dynamic and evolutionary (Scherer & Ross, 1990).

The new I/O model developed through the 1980s and the 1990s employs advanced oligopoly theory based on Game Theory. The new I/O model pays more attention to firm decisions, conduct, and strategic interaction in markets (Lacy & Bauer, 2005). Especially, it provides a better theoretical foundation for firm behavior in conditions of oligopoly (Young, 2000).

A major implication of the new I/O theory is that the assumed causal relationship between market structure and performance is weakened and the relationship is viewed as decided by the nature of the strategic interaction between firms (Young, 2000). Though the new I/O model does not completely overcome some of the criticisms of the traditional I/O model, it can provide scholars with a powerful tool to analyze the conduct of media firms (Lacy & Bauer, 2005).

3.2 Applications of the I/O Model in Media Diversification Research

The I/O model has several strengths as an explanatory tool for understanding the functioning of media markets, including: (1) The model provides a systematic way of examining the participants in a media market; (2) The model provides a framework for analyzing how various market participants interact with each other; (3) The model helps us better understand why market processes may break down; and (4) The model helps us better understand how market performance can be improved through means other than direct governmental control (Busterna, 1988).

The I/O model suggests that the external environment should be the primary determinant of a firm's strategic actions. According to the I/O model, a firm's optimal expansion strategy is governed by external factors, such as the characteristics of the industry that the firm operates in, as well as internal factors that define the constraints and opportunities placed on the firm by its resources (Delios & Beamish, 1999; Luo, 2002). Scholars suggest a variety of major influences on firms' decisions to diversify, including: (1) The general environment (i.e., the legal-political-economic-technological-social-ecological environment in which a firm operates); (2) The industry's competitive environment, such as the structure of the base industry of a firm, slowing industry growth rates, market share erosion in a firm's traditional market, and the structure of target markets; and (3) Specific characteristics of firms, such as a firm's degree of prior diversification, firm size and financial strength (Abell & Hammond, 1979; Kashlak & Maheshkumar,1994; Ramanujam & Varadarajan, 1989).

The I/O model has been applied to media diversification research. Some studies examine the determinants of firm diversification. For example, Kashlak and

Maheshkumar (1994) explored two external variables that constrained Regional Bell Operating Companies' (RBOCs) diversification decisions: (1) Market growth in a RBOC's core industry of telecommunications access provision; and (2) Regional government regulation. They concluded that RBOCs' diversification strategies were influenced by the external contingencies of their domestic regulatory environments and growth in their core business.

CHAPTER 4
STUDY DESIGN

This chapter describes the two-stage stratified sampling scheme used for sample selection, the construction of the dependent variables and independent variables, and the anticipated relationships between the dependent variables and the independent variables. Also, a framework for analyzing cable system diversification is proposed.

4.1 Sampling

As of December 2005, there were about 7,505 operating U.S. cable systems. 850 cable systems were excluded from the database for this study because of missing data. 103 overbuild cable systems were also excluded from the study. The sample size for this study is 327, which represents about 5 percent of the 6,552 remaining cable systems. A two-stage stratified sampling scheme was used to select the sample for this study. First, cable systems were stratified by the size of their owners (the number of systems owned). Cable system owners vary in terms of the number of systems they own, ranging from one to nearly one thousand cable systems. At this stage, all cable systems were organized in a list starting with all cable systems owned by the cable owner that owns most cable systems (Charter Communications with 990 cable systems), then cable systems owned by the cable owner that owns the second most cable systems (Cebridge Connections with 745 cable systems), etc. As a result, all the one-system owners are at the bottom of the list, then all the two-system owners next above them, etc.

At the second stage, cable systems were further stratified by cable system size as measured by the number of basic service subscribers. Cable systems in the sample vary in terms of the number of basic service subscribers, ranging from four to 1,400,000 basic service subscribers. The systems of each cable system owner were listed in descending order according to size, with the cable system with the most basic subscribers at the top, the cable system with the second most basic subscribers next, etc. The two-stage stratifying strategy ensures that a randomly-selected sample will accurately represent the ownership and size structure of the population of cable systems as a whole.

Systematic random sampling was then performed. The sampling ratio is 1/20, which means for the stratified list of cable systems, every 20th cable system was selected. To avoid any possible human bias in using this method, a random number between 1 and 20 should be selected as the first cable system to be selected from the list. The random number drawn was 16.

4.2 Dependent and Independent Variables

This study focuses on three important services that cable systems have diversified into: PPV, high-speed internet access, and telephony. The unweighted business count approach of product diversification was used to measure cable system diversification into these services. A cable system's diversification into each service was measured by a binary variable (0, 1), indicating whether or not a cable system has diversified into a service. The four dependent variables in this study are: (1) D_PPV, a cable system's diversification into PPV; (2) D_INT, a cable system's diversification into high-speed internet access service; (3) D_TEL, a cable system's diversification into telephony; and (4) D_TOTAL, the sum of a cable system's binary variables for diversification into the above three sets of services (see Table 4-1). The first three dependent variables measure cable system diversification into each individual service, whereas D_TOTAL measures a cable system's overall degree of diversification. Dependent variable D_TOTAL was treated as a continuous variable, and its value ranges from 0 to 3. D_TOTAL has value of zero if a cable system did not diversify at all, one if a cable system diversified into at least one of the three services, two if a cable system diversified into any two of the three services, and three if a cable system diversified into all three services.

As reviewed in the previous chapter, the determinants of cable system diversification can be located in the structure of the markets where they operate as well as in cable system characteristics that determine their constraints and opportunities when they diversify into other services. Three sets of variables that might influence cable system diversification are examined: system characteristics, market structure, and market demographics. These variables are listed in Table 4-1.

System Characteristics

Three variables are included in the system characteristics category. Dummy variable MSO has a value of one if a cable system is owned by an MSO and zero otherwise. According to NCTA, MSO refers to a company that operates multiple cable systems. In this study, if a cable operator operates more than one cable system, it is considered an MSO. On the other hand, an independent system refers to an individually owned and operated cable system not part of an MSO.

The nature of diversification depends, in part, on the financial resources available to the firm (Chatterjee & Wernerfelt, 1991). Due to the substantial amount of funds required for upgrading investments, cable systems often need external resources for funding. MSO systems can benefit from the financial resources available from their parent companies. For some MSO systems, diversification is a corporate strategy. Many MSOs specifically established subsidiaries to provide high-speed internet access or telephone services at the state level. Therefore, ownership of multiple cable systems influences strategic choice regarding diversification. The variation in diversification between MSO systems and independent systems, if any, can shed some light on the impact of ownership on cable system diversification strategies.

SUB refers to the number of a cable system's basic service subscribers. SUB is included because it indicates the potential demand for services offered by cable systems. Cable systems with larger numbers of basic subscribers might find it more profitable to diversify into other services than systems with smaller subscriber counts because they can sell these services to their existing customers (NCTA, 2004). As a result, cable systems with larger basic subscriber counts might be more motivated to upgrade their systems and to diversify into other services.

DEN measures the population density of the territory served by a cable system as the number of households per mile of cable plant. DEN is calculated by dividing the number of households passed by a cable system by the number of miles of the cable system's plant. A mile of feeder plant costs the same whether it passes 10 households or 10,000 households. Therefore, the per household cost is lower for cable systems with higher density to build and upgrade their systems. Cable systems with higher density might be more likely to diversify into new services, motivated by a higher rate of return on investment.

The dummy variable HFC indicates whether a cable system has upgraded to a higher capacity hybrid fiber/coaxial (HFC) system or not. It indicates the technological status of a cable system. HFC has a value of one if a cable system has upgraded to HFC system and zero otherwise. MHz capacity of a cable system is an indicator of whether it has already upgraded to modern HFC systems. Traditional coaxial cable systems typically operated with 330 MHz or 450 MHz of capacity, whereas those that have expanded to 750 MHz or more are HFC systems. In this study, cable systems with a capacity of 450 MHz or less are classified as traditional coaxial systems, and those with 750 MHz or more are classified as HFC systems.

According to industry experts consulted by this researcher, this method for categorizing coaxial systems and HFC systems was reasonable. But a small minority of the cable systems in the sample (about 5 percent) has a capacity of more than 450 MHz and less than 750 MHz. Telephone interviews were conducted to find out the upgrade status of those systems. The telephone interviews show that the majority of those cable systems have upgraded to HFC systems, and only a few have not. These systems were classified according to their revealed status. Also, information on upgrade status for a few cable systems could not be gathered either because the cable companies refused to release information on their upgrade status or they could not be reached. HFC for these systems was coded as missing data.

Fiber optics became economically viable in the early 1990s, and cable systems began using it to upgrade their systems. The cable industry adopted this technology for upgrading a portion of its transmission plant to transform traditional coaxial systems into HFC systems – systems consisting of a combination fiber optic and coaxial distribution systems. Cable upgrades during the 1990s have focused on increasing both bandwidth and two-way capability. Cable systems added more fiber optic cable to their existing systems, and moved fiber nodes closer to the individual subscribers (Chiddix et al., 2000).

The cable industry typically thinks of a channel as a contiguous 6 MHz block of the spectrum. The range of frequencies used by cable systems is from 5 MHz to 860 MHz. Video channels are offered between the 50 – 860 MHz range, and the rest is used for upstream communications from subscribers' homes (Overview, 2006). To deliver data services over a cable network, one television channel (in the 50 - 860 MHz range) is typically allocated for downstream traffic to subscribers' homes, and another channel (in the 5 - 42 MHz band) is used to carry upstream signals (Overview, 2006).

Cable system characteristics data were collected from *The 2005 Television & Cable Factbook (*The *Factbook)*, a standard data source for the cable industry. The *Factbook* is compiled from survey responses from approximately 8,000 U.S. cable franchises. For each cable franchise listed, information is provided on its ownership, channel capacity, length of plant, the number of homes with access to cable within a system's franchise area, the number of subscribers to basic cable, the number of broadcast television station signals receivable OTA in a cable franchise area, and if a cable system offers PPV, high-speed internet access, and telephony, etc.

In the *Factbook*, each cable franchise area is listed under a township, city or county. Zip codes for these cable franchise areas were collected from www.zip-codes.com. Zip code information was later used to collect market structure and market demographic information for the cable systems in the sample. Most cable franchise areas in the sample are associated with only one zip code, and a small percentage are associated with multiple zip codes. For franchise areas with multiple zip codes, an averaging approach was used to aggregate data for all market structure and market demographic variables reported on a zip code level[9].

Market Structure

The market structure of cable systems' primary business of video programming services and of the services that they might diversify into could influence their diversification strategies. The structure of the video programming service market was measured in terms of competition from broadcast and satellite television. Telephone companies were not considered as competitors to cable companies in the video programming service market because video programming services provided by telephone companies are available only in a limited number of local communities.

Currently in the U.S., there are three primary technologies that deliver video programming services to individual households: OTA broadcast television, cable

[9] For example, for a cable franchise area with three zip codes, values of market structure and market demographic variables reported on a zip code level is the average for the three zip code areas.

television, and DBS. The competition for cable in the video programming service market is represented by the following variables: the number of broadcast television station signals receivable OTA in a cable franchise area (STA), and DBS penetration at the state level (DBS).

Where available, television households can choose between having access to only OTA broadcast signals for free or obtaining the broadcast channels as well as cable networks over a cable system or satellite for a monthly subscription fee. TV households that do not subscribe to an MVPD service rely solely on OTA transmission of local broadcast television signals. The FCC estimated that 15.36 million U.S. TV households did not subscribe to an MVPD service as of 2004, representing 14 percent of all U.S. TV households (FCC, 2005a).

Studies have found that OTA broadcast television has significant competitive effects on some aspects of cable service. For example, Dertouzos and Wildman (1990) found that OTA signals influence cable systems' market conduct such as program service offerings and pricing. They conclude that the economic effects of OTA signals on cable service in markets that receive five or more OTA signals are similar to those of overbuild cable systems. More broadcast television station signals receivable OTA in a franchise area means more competition for cable television. Competition from broadcast television might lead to cable systems' product diversification by influencing cable systems' performance in the video programming service market.

Following the rise of DBS as an alternative MVPD service, some studies have explored the impact of satellite competition on cable program offerings (Goolsbee & Petrin, 2004; U.S. General Accounting Office (2000). In a report responding to congressional requests, the U.S. General Accounting Office found that in the calendar year 1998, cable systems tended to provide more channels to subscribers in franchise areas where DBS penetration was high, suggesting that cable systems responded to DBS entry by increasing the number of channels they provide to consumers. Goolsbee and Petrin (2004) examined the competitive effects of the introduction of DBS on cable service by examining how cable prices and service characteristics respond to DBS. They found that higher quality DBS in a franchise area is correlated with lower cable prices, and they also found evidence of modest improvements in cable quality in response to DBS entry.

As cable operators respond to competition from DBS by lowering price and improving quality, they might also respond by expanding their product portfolios to generate new revenue sources. Diversification could offer cable operators a lucrative opportunity at a time when cable operators confront increasing competition from DBS companies in video programming markets (Woroch, 1997).

Cable system diversification might be influenced by the structure of target markets. In this study, the structure of cable systems' target markets was measured in terms of competition from other service providers. These structural factors are represented by the following variables: the number of high-speed ISPs operating in the primary zip code area associated with a cable system (INT) and the number of CLECs operating in the primary zip code area associated with a cable system (TEL). These factors indicate the competitiveness of the target markets that cable systems might diversify into.

Data on the number of high-speed ISPs and CLECs by zip codes were collected from FCC's 477 form. In order to determine the extent of broadband deployment and local telephone competition throughout the U.S., in March 2000 the FCC adopted a semi-annual reporting requirement – FCC Form 477 – for facilities-based providers of broadband connections to end users, facilities-based providers of mobile telephone services and all local exchange carriers. The FCC generated annual reports from the Form 477 that they collected. The FCC's 2005 report, *Number of High-speed Internet Service Providers by Zip Codes*, was used to collect data on the number of high-speed ISPs operating in the zip code areas associated with the cable systems in the sample. The FCC's 2005 report, *Number of Competitive Local Exchange Carriers by Zip Codes*, was used to collect data on the number of CLECs operating in the zip code areas associated with the cable systems in the sample.

The effect of the competitiveness of the target markets on cable system diversification is a question that has not been answered yet in the literature. On the one hand, cable systems are less likely to diversify into a new market if that market is already very competitive. On the other hand, cable systems might enter a new market and compete with existing service providers in that market, due to the desire for new revenue source regardless of how competitive it is, or due to the threat of competitor's entry into cable' primary market of video programming service. Diversification allows cable companies to offer service bundles, including triple-play services – video, data and voice – when their competitors do, and thus helps cable companies retain their existing customers. These competing hypotheses are tested in this study.

Market Demographics

In order to control for variation in customers' demands across cable franchise areas, market demographic variables were included in the model. It is important to control for market demographic variables because they reflect unobserved tastes for services (Goolsbee & Petrin, 2004). Market demographic characteristics controlled for include: percentage of Black or African American population (BAA), percentage of Hispanic population (HIS), median household income (INC), and home ownership rate (OWN). I also controlled for the geographic region in which a cable franchise was located – northeast, midwest, south or western U.S. (REG).

Market demographic data at the zip code level were collected from American Community Survey (ACS) provided by the U.S. Census Bureau. The ACS collects survey data each year to measure key social, economic, and housing characteristics for the U.S. population. In the ACS reports, data on basic housing and population characteristics, such as ethnic audience composition, projected population growth rates, median household income, and home ownership rates, are reported at both the county and city levels. Demographic data for the zip code areas associated with the cable systems in the sample were collected.

4.3 A Framework for Analyzing Cable System Diversification

Based on the diversification literature and the I/O model, a framework for analyzing cable systems' upgrade to HFC and cable system diversification is proposed in this study. The framework proposes that three sets of independent variables – system characteristics, market structure, and market demographics – influence cable systems' decisions to upgrade to HFC and cable system diversification. These three sets of variables might influence cable system diversification in the following two ways: (1) Direct effects on cable system diversification; and (2) Indirect effects on cable system diversification via HFC. The framework is depicted in Figure 4-1. The solid lines in Figure 4-1 describe direct effects of these variables on cable system diversification, and the dashed lines describe potential indirect effects of these variables on cable system diversification through HFC.

Cable systems upgrade to HFC for different reasons. Cable systems may invest in upgrading to HFC because it is the best way to offer PPV, high-speed internet access and telephone services. Also, they may upgrade to HFC for some other motives, such as to expand channel capacity and to create more tiered video programming options for their subscribers. However, once a cable system has upgraded to HFC, the cost of upgrades required for offering other services is considerably lower than it was before. It is possible that cable systems upgraded to HFC for reasons other than diversifying into the three services considered here, but subsequent possession of HFC plant influenced the decisions regarding diversification. These two sets of motives for cable systems' upgrade to HFC open up the possibility of direct effects and indirect effects of the other independent variables on cable system diversification. Based on the above two sets of motives, two models were examined in this study: a direct effects-only model and a model with direct and indirect effects. Two sets of regressions are employed in the following sections to test these two models.

HFC is different from other independent variables in the sense that it is an endogenous variable acting as an independent variable in this study. My framework hypothesizes direct and indirect effects of the e other independent variables on cable system diversification. Cable system characteristics, market structure, and market demographic variables may have only direct effects on cable system diversification if a cable system's initial objective in upgrading to HFC was not diversification into new services. On the other hand, these variables may have direct and indirect effects on cable system diversification if a cable system's initial objective in upgrading to HFC was diversification into new services but factors that make diversification into one or more of the new services studied here attractive also made upgrading to HFC plant attractive at an earlier point in time.

Market structure variables, including STA, DBS, INT, and TEL, might influence cable systems' decisions to upgrade to HFC and diversify. Cable system diversification might be influenced by the structure of cable's primary business of video programming service and that of its potential target markets. The competitiveness of cable's primary business is measured by STA and DBS. The competitiveness of cable's target high-speed internet access market is measured by INT, and the competitiveness of cable's target telephone market is measured by TEL. The I/O model suggests that the structure of a target market influences the attractiveness of that market and also imposes constraints on firms' diversification into that market. In addition to STA and DBS, INT might influence cable system diversification into high-speed internet access service, and TEL might influence cable system diversification into telephone service. All of the four market structure variables are proposed to have an influence on D_TOTAL, cable system total degree of diversification.

The set of market demographic variables includes BAA, HIS, EMP, INC, OWN and REG. These variables indicate the variation in customers' demands for services provided by cable systems across cable franchise areas. The literature on cable system product offerings suggests that cable product offerings are influenced by the demographic characteristics of the markets that they operate in. The same market demographics that influence cable product offerings might also influence cable system diversification, because diversification is a means for cable systems to respond to the changes in the environment by expanding the scope of their product offerings.

Based on the preceding analysis, the following six research questions are addressed:

RQ1: What factors influence the likelihood that a cable system will upgrade to HFC?

RQ2: How do cable system characteristics including ownership, the number of basic service subscribers, density, and whether upgraded to HFC influence cable system diversification into PPV, high-speed Internet access, and telephone services?

RQ3: How does the competitiveness of the video programming market influence cable system diversification into PPV, high-speed Internet access, and telephone services?

RQ4: How does the competitiveness of the local high-speed Internet access market influence a cable system's decision on whether to diversify into high-speed Internet access service?

RQ5: How does the competitiveness of the local telephone market influence a cable system's decision on whether to diversify into telephone service?

RQ6: What factors influence the number of services that cable systems diversify into?

CHAPTER 5
DATA ANALYSIS

5.1 Descriptive Analysis

Table 5-1, Table 5-2 and Table 5-3 present the descriptive statistics for the dependent and independent variables. Table 5-1 shows that as of 2005, 149 (45.6 percent) of the cable systems in the sample diversified into PPV, 164 (50.2 percent) diversified into high-speed internet access service, and only 27 (8.3 percent) diversified into telephony.

Table 5-2 presents frequency of cable system total diversification scores, D_TOTAL. It shows that 132 of the cable systems in the sample (40.4 percent) had not diversified at all, 73 (22.3 percent) diversified into only one of the three services considered in this study, 103 (31.5 percent) diversified into two of the three services, and only a small minority of the cable systems – 19 (5.8 percent) – diversified into all of the three services. Most, but not all of the cable systems that diversified into telephony also diversified into PPV and high-speed internet access services..

Table 5-3 presents descriptive statistics for the independent variables. As regards the system characteristics, the majority – about 92 percent – of the systems in the sample were MSO-systems, and 8 percent were independent systems. The average number of basic service subscribers was 9,517, and the average plant density was 55 households/mile. Upgrading to HFC was not that common among the cable systems – about 31 percent of the cable systems have upgraded to higher capacity HFC systems.

As for the market structure variables, on average, there were 8 broadcast television station signals receivable OTA, 4 high-speed ISPs, and 4 CLECs in operation in cable franchise areas. On average, DBS penetration was about 23 percent.

For the market demographic variables, on average, African Americans and Hispanics were 8.6 percent and 5.6 percent of the populations in zip code areas associated with cable franchise areas respectively. The average home ownership rate was 61 percent. Average median household income was $33,850. As for geographic distribution, 28 (8.6 percent) of the systems were in northeast U.S., 119 (36.4 percent) were in the midwest, 122 (37.3 percent) were in the south, and 58 (17.7 percent) were in the west.

Table 5-4 presents the correlation matrix for the variables.

5.2 Regression Results for Cable System Diversification (The Direct Effects-Only Model)

In this section, cable system diversification was modeled as if only direct effects as depicted in figure 4-1 were possible. This section presents the results of regressing cable system diversification into each of the three services (D_PPV, D_INT and D_TEL) and cable system total degree of diversification (D_TOTAL) on cable system characteristics excluding HFC, market structure variables, and market demographic variables. Binary logistic regressions were employed to identify factors that influenced cable system diversification into PPV, high-speed internet access, and telephony, respectively. Multiple linear regression was employed to explore the determinants of cable system total degree of diversification.

Cable System Diversification into PPV

Diversification into PPV is the most closely related type of diversification for cable systems. The primary difference between PPV and cable's primary business of video programming services is that PPV is not subscription-based, but priced per consumption episode. Equation (1) assumes that a cable system's diversification into PPV (D_PPV), is determined by cable system characteristics excluding HFC, the structure of the system's video programming service market, and the demographics of its franchise area.

$$(1)\ D\_PPV = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 BAA + \alpha_7 HIS + \alpha_8 EMP + \alpha_9 INC + \alpha_{10} OWN + \alpha_{11} REG + e_1.$$

Results for the binary logistic regression for D_ PPV are described in Table 5-5. Overall, the model correctly categorized 84.5% of the cases. The percent in the modal category for D_PPV was 54.4%. The model correctly predicted 30.1% more of the cases compared to the mode value frequency. MSO, SUB and STA were the only three independent variables for equation (1) with statistical significance at the .01 level or higher. The odds ratio for MSO is 28.08, indicating that the odds of an MSO system offering PPV service is about 28 times the odds of an independent system offering PPV service, holding other independent variables constant. The odds ratio for SUB is 3.92. It means that for every 1,000 increase in a cable system's basic service subscribers, the odds of a cable system offering PPV service increases by a factor of 3.92, holding other independent variables constant. The odds ratio for STA is 1.22. It means adding a broadcast television station receivable OTA to a cable franchise area increases the odds of a cable system offering PPV service by a factor of 1.22, holding other independent variables constant.

Cable System Diversification into High-speed Internet Access Service

Equation (2) assumes that D_INT, a cable system's diversification into high-speed internet access, is determined by cable system characteristics excluding HFC, the structure of the system's video programming service market, the structure of the local high-speed internet market, and the demographics of its franchise area.

(2) $D\_INT = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 INT + \alpha_7 BAA$
$+ \alpha_8 HIS + \alpha_9 EMP + \alpha_{10} INC + \alpha_{11} OWN + \alpha_{12} REG + e_2$.

Results for the binary logistic regression analysis for D_INT are described in Table 5-6. Overall, the model correctly categorized 79.1% of the cases. The percent in the modal category for D_INT was 50.2%. The model correctly predicted 28.9% more of the cases compared to the mode value frequency. SUB, STA and INT were statistically significant at the level of .01 or higher. The odds ratio for SUB is 3.20. It means that for every 1,000 increase a cable system's basic service subscribers, the odds of the cable system offering high-speed internet access service increases by a factor of 3.20, holding other independent variables constant. The odds ratio for STA is 1.17. It means adding a broadcast television station receivable OTA to a cable franchise area increases the odds of a cable system offering high-speed internet access service by a factor of 1.17, holding other independent variables constant. The odds ratio for INT is 0.61. It means that with the addition of one more high-speed ISP to a cable franchise area, the odds of the cable system offering high-speed internet access service decreases by a factor of 0.61, holding other independent variables constant.

Cable System Diversification into Telephone Service

Equation (3) assumes that D_TEL, a system's diversification into telephony, is determined by cable system characteristics excluding HFC, the structure of the system's video programming service market, the structure of the local telephone market, and the demographics of its franchise area.

$$(3)\ D\_TEL = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 TEL + \alpha_7 BAA + \alpha_8 HIS + \alpha_9 EMP + \alpha_{10} INC + \alpha_{11} OWN + \alpha_{12} REG + e_3.$$

Results for the binary logistic regression analysis for D_TEL are presented in Table 5-7. Overall, the model correctly categorized 91.8% of the cases. The percent in the modal category for D_TEL was 91.7%. The model correctly predicted only 0.01% more of the cases compared to the mode value frequency. The model does not improve much over just using modal category. There was no statistically significant independent variable for D_TEL in the model.

Cable System Total Degree of Diversification

Equation (4) assumes that a cable system's total degree of diversification, D_TOTAL, is determined by cable system characteristics excluding HFC, the structure of the system's video programming service market, the structure of the local telephone service market, the structure of the local high-speed Internet market, and the demographics of its franchise area.

(4) $D\_TOTAL = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 INT + \alpha_7 TEL + \alpha_8 BAA + \alpha_9 HIS + \alpha_{10} EMP + \alpha_{11} INC + \alpha_{12} OWN + \alpha_{13} REG + e_4.$

Multiple linear regression was employed to identify the determinants of cable system total degree of diversification. The distribution of SUB and INC shows some skewness to the right, suggesting that a log version of the model might improve the fit of the model. Therefore, a log version of the model where LNSUB, the natural log of SUB, and LNINC, the natural log of INC, were used instead of SUB and INC was run and compared to the original model. The log version of the model showed a better fit.

The correlation matrix table, Table 5-4, shows a high positive, and statistically significant, correlation coefficient for INT and TEL (R= 0.728). Also, in a regression collinearity diagnosis, INT and TEL show low tolerance values[10], 0.401 and 0.302, respectively. Therefore, TEL was eliminated from Equation (4) to control for multicollinearity. The revised model is presented in Equation (5):

(5) $D\_TOTAL = \alpha_0 + \alpha_1 MSO + \alpha_2 LNSUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 INT + \alpha_7 BAA + \alpha_8 HIS + \alpha_9 EMP + \alpha_{10} LNINC + \alpha_{11} OWN + \alpha_{12} REG + e_5.$

[10] Tolerance values take values between 0 and 1. Tolerance values closer to 0 indicate higher collinearity.

Results for the multiple linear regression analysis for D_TOTAL are presented in Table 5-8. Overall, the model explained about 61.9 percent of the variation in the dependent variable D_TOTAL. MSO, LNSUB, STA and INT were statistically significant at the .01 level or higher. Regression results show that MSO systems on average scored .09 higher than independent systems on D_TOTAL, holding other independent variables constant. SUB had the largest positive effect on D_TOTAL. For every percent increase in a cable system's basic service subscribers, D_TOTAL increases by 0.73, holding other independent variables constant.

The coefficient for STA was positive and significant. For each additional broadcast television station signal receivable OTA in a cable franchise area, D_TOTAL increases by .17. To the contrary, INT, another market structure variable, had a statistically significant negative relationship to D_TOTAL. For each additional high-speed ISP in a cable franchise area, D_TOTAL decreases by .11.

Summary

As shown in Table 5-1, 45.6 percent of the cable systems in the sample diversified into PPV, 50.2 percent diversified into high-speed internet access service, and 8.3 percent diversified into telephony. How would one unit increase in the statistically significant independent variables influence the probability of a statistically representative cable system's diversification into PPV, high-speed internet access and telephone services? Table 5-9 shows the estimated change in the probability of cable system diversification following one unit change in the independent variables that were statistically significant at the 0.01 level or higher for the model that only allows for direct effects.

For a statistically representative cable system in this sample, the probability of offering PPV service increases from 0.456 to 0.959 if the ownership changes from independent to MSO, holding other independent variables constant. The probability of a statistically representative cable system in the sample diversifying into PPV increases from 0.456 to 0.767 if the number of its basic cable service subscribers increases by 1,000, holding other independent variables constant. The probability of a statistically representative cable system in the sample diversifying into PPV increases from 0.456 to 0.506 if one more broadcast television station receivable OTA is added to its cable franchise area, holding other independent variables constant.

The probability of a statistically representative cable system in the sample diversifying into high-speed internet access service increases from 0.502 to 0.763 if the number of its basic cable service subscribers increases by 1,000, holding other independent variables constant. The probability of a statistically representative cable system in the sample diversifying into high-speed internet access service increases from

0.502 to 0.542 if one more broadcast television station receivable OTA is added to its cable franchise area, holding other independent variables constant. The probability of a statistically representative cable system in the sample diversifying into high-speed internet access service decreases from 0.456 to 0.382 with the addition of one more high-speed ISP to its cable franchise area, holding other independent variables constant.

5.3 Binary Logistic Regression for Cable Systems' Decision to Upgrade to HFC

In this section, the question of why cable systems invested in upgrading their systems to HFC is explored. While interesting in its own right, the results of this analysis are employed in the two-stage least squares regressions examining the economics of cable system diversification into PPV, high-speed internet access, and telephony in the following section. Binary logistic regression analysis was employed to examine which cable system characteristics, market structure variables, and market demographic variables influenced cable systems' decisions whether to upgrade to HFC or not.

Cable systems may have been motivated to upgrade to HFC for different reasons. Two plausible hypotheses regarding the motives for cable systems' decisions to upgrade to HFC were examined in this study. (1) Cable systems upgraded to HFC plant as part of their plans for diversification into one or more of the new services examined in this study: PPV, high-speed internet access, and telephony. (2) Alternatively, systems may have upgraded to HFC for reasons unrelated to diversification into one of these services. However, once in possession of HFC plant, they may have found diversification into one or more of the new services more appealing when the opportunity arose at a later date.

Two equations corresponding to the two alternative hypotheses, equation (6) and equation (7), were specified for analyzing cable systems' decisions to upgrade to HFC. Because the same (relatively slow-changing) factors describing systems and market features may have influenced both types of decisions, the same system characteristics and market demographic variables were included in both equations. The difference is in the competition variables. Equation (6) only includes competition from broadcast television as a competition factor influencing cable systems' decisions to upgrade to HFC, whereas equation (7) includes variables reflecting competition from broadcast television, competition from DBS companies in the multichannel video programming market, and the competitiveness of the local high-speed internet and local telephone service markets.

Equation (6) assumes that whether a cable system has upgraded to HFC (HFC=1) is determined by cable system characteristics, the number of broadcast television station receivable OTA in its cable franchise area, and the demographics of its franchise area.

$$(6)\ HFC = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 BAA + \alpha_6 HIS + \alpha_7 EMP + \alpha_8 INC + \alpha_9 OWN + \alpha_{10} REG + e_6.$$

Odds and odds ratios are important basic terms in binary logistic regression. Odds is the ratio of the probability something is true divided by the probability that it is not. Odds ratio is the ratio of two odds. For binary logistic regressions, the odds ratio is a summary measure of the effect size of the independent variable(s) on the dependent variable's odds. For example, if the odds ratio for an independent variable is 3, we may say that the odds that the dependent variable is a one increases by a factor of 3 with one unit increase in the independent variable, holding other independent variables constant.

The odds ratio takes values between zero and infinity. An odds ratio of one means that there is no change in the dependent variable due to a change in the independent variable. An odds ratio larger than one indicates a positive relationship between an independent variable and a dependent variable, whereas an odds ratio smaller than one indicates a negative relationship between an independent variable and a dependent variable. An odds ratio close to zero or infinity indicates a larger change.

Table 5-10 presents the logistic regression coefficient, standard error of the coefficient, the Wald statistic, probability level, and the odds ratios for each independent variable. Overall, the model correctly categorized 83.5% of the cases. The percent in the modal category for HFC was 69.0%. The model correctly predicted 14.5% more of the cases compared to the mode value frequency. SUB, STA and OWN were the only three independent variables for equation (6) with statistical significance at the .01 level or higher. The odds ratio for SUB is 1.18, indicating that for every 1,000 increase in the number of basic service subscribers, the odds of a cable system's upgrade to HFC system increases by a factor of 1.18, holding other independent variables constant. The odds ratio for STA is 1.17. It means adding a broadcast television station receivable OTA to a cable franchise area increases the odds of a cable system upgrading to HFC system by a factor of 1.17, holding other independent variables constant. The odds ratio for OWN is 0.02. It means for every percentage increase in the home ownership rate in a cable franchise area, the odds of a cable system's upgrade to HFC system decreases by a factor of 0.02, holding other independent variables constant.

Equation (7) assumes that whether a cable system has upgraded to HFC (HFC=1) is determined by cable system characteristics, the structure of the system's video programming service market, the structure of the system's target markets, and the demographics of its franchise area.

$$(7)\ HFC = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 STA + \alpha_5 DBS + \alpha_6 INT + \alpha_7 TEL + \alpha_8 BAA + \alpha_9 HIS + \alpha_{10} EMP + \alpha_{11} INC + \alpha_{12} OWN + \alpha_{13} REG + e_7.$$

Results for the binary logistic regression for HFC are described in Table 5-11. Overall, the model correctly categorized 83.5% of the cases. The percent in the modal category for HFC was 69.0%. The model correctly predicted 14.5% more of the cases compared to the mode value frequency. The odds ratio for SUB is 1.20, indicating that for every 1,000 increase in the number of basic service subscribers, the odds of a cable system's upgrade to HFC system increases by a factor of 1.20, holding other independent variables constant. The odds ratio for STA is 1.17. It means adding a broadcast television station receivable OTA to a cable franchise area increases the odds of a cable system upgrading to HFC system by a factor of 1.17, holding other independent variables constant. The odds ratio for OWN is 0.01. It means for every percentage increase in the home ownership rate in a cable franchise area, the odds of a cable system's upgrade to HFC system decreases by a factor of 0.01, holding other independent variables constant. In addition to SUB, STA, and OWN, INT was an independent variable for equation (7) with statistical significance at the .05 level. The odds ratio for INT is 0.76. It means adding a high-speed ISP to a cable franchise area decreases the odds of a cable system upgrading to HFC system by a factor of 0.76, holding other independent variables constant.

The difference in the results for the binary logistic regression analysis for HFC using equation (6) and equation (7) is that the results for equation (7) reveal that the number of high-speed ISPs in a local market had a statistically significant negative relationship to HFC. It indicates that the competitiveness of the high-speed internet access service market influenced cable systems' decisions to upgrade to HFC. This result is consistent with the difference in the results for the binary logistic regression for D_INT using equation (2) and the results for the multiple linear regression for D_TOTAL using equation (5) in the sense that when included, a variable representing the competitiveness of high-speed internet access service had a statistically significant negative relationship to cable systems' decisions to upgrade to HFC in a HFC upgrade regression or to diversify into high-speed internet access service in the corresponding diversification regression. If cable systems upgrade to HFC in part to facilitate diversification into high-speed internet service and if the likelihood of diversifying into high-speed internet service diminishes with the number of competitors offering this service (strength of competition), then we should expect the likelihood of HFC upgrades to diminish as competition in high-speed internet access increases.

5.4 Regression Results for Cable System Diversification (The Model with Direct and Indirect Effects)

In this section, cable system diversification was modeled as if both direct and indirect effects were possible. This section presents the results of regressing cable system diversification into each of the three services (D_PPV, D_INT and D_TEL) and cable system total degree of diversification (D_TOTAL) on cable system characteristics including HFC, market structure variables, and market demographic variables.

As mentioned in Chapter 4, HFC is an endogenous variable acting as an independent variable in the diversification equations. As a result, the error terms in the diversification equations are not independent of the error term in the HFC equation. Therefore, two-stage least squares regression analysis was used for the set of diversification regressions in this section to address the issue of endogeneity that would arise if cable systems upgraded to HFC for reasons other than diversifying into the three services considered here, but subsequent possession of HFC plant influenced the decisions regarding diversification. Endogeneity is an issue because many of the factors influencing cable systems' diversification decisions are likely to influence their decisions to upgrade to HFC. Each of these factors changes relatively slowly over time, and this study employs a single year's observations. Therefore, simultaneous equations techniques were employed to explore the possibility of endogeneity.

Two-stage least squares analysis includes two regression analyses in two steps: (1) Regress each endogenous variable acting as an independent variable on all the exogenous variables in the system of simultaneous equations, and save the predicted values for these endogenous variables; and (2) Regress the dependent variable on these predicted values and other exogenous variables included in the system of simultaneous equations (Kennedy, 1998).

Two-stage least squares regression analysis was employed for each of the four dependent variables measuring diversification. HFC was first regressed on all the exogenous variables in the system of simultaneous equations at step one, and predicted values for HFC, PRE_HFC, were calculated using equation (7). At step two, a diversification variable was regressed on PRE_HFC and the other exogenous variables included in the system.

Cable System Diversification into PPV

Equation (8) assumes that a cable system's diversification into PPV (D_PPV), is determined by cable system characteristics, the predicted values for HFC, the structure of the system's video programming service market, and the demographics of its franchise area. Binary logistic regression was employed to identify important factors influencing cable system diversification into PPV.

$$(8)\ D\_PPV = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 PRE\_HFC + \alpha_5 STA + \alpha_6 DBS + \alpha_7 BAA + \alpha_8 HIS + \alpha_9 EMP + \alpha_{10} INC + \alpha_{11} OWN + \alpha_{12} REG + e_8.$$

Results for the binary logistic regression for D_ PPV are presented in Table 5-12. Overall, the model correctly categorized 85.1% of the cases. The percent in the modal category for D_PPV was 54.4%. The model correctly predicted 30.7% more of the cases compared to the mode value frequency. MSO, SUB and STA were the only three independent variables for equation (8) with statistical significance at the .01 level or higher. The odds ratio for MSO is 25.49, indicating that the odds of an MSO system offering PPV service is more than 25 times the odds of an independent system offering PPV service, holding other independent variables constant. The odds ratio for SUB is 3.82. It means that for every 1,000 increase in a cable system's basic service subscribers, the odds of a cable system offering PPV service increases by a factor of 3.82, holding other independent variables constant. The odds ratio for STA is 1.20. It means adding a broadcast television station receivable OTA to a cable franchise area increases the odds of a cable system offering PPV service by a factor of 1.20, holding other independent variables constant.

Cable System Diversification into High-speed Internet Access Service

Equation (9) assumes that D_INT, a cable system's diversification into high-speed internet access, is determined by cable system characteristics, the predicted values for HFC, the structure of the system's video programming service market, the structure of the local high-speed internet market, and the demographics of its franchise area.

(9) $D\_INT = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 PRE\_HFC + \alpha_5 STA + \alpha_6 DBS$
$+ \alpha_7 INT + \alpha_8 BAA + \alpha_9 HIS + \alpha_{10} EMP + \alpha_{11} INC + \alpha_{12} OWN + \alpha_{13} REG + e_9.$

Results for the binary logistic regression analysis for D_INT are described in Table 5-13. Overall, the model correctly categorized 81.2% of the cases. The percent in the modal category for D_INT was 50.2%. The model correctly predicted 31.0% more of the cases compared to the mode value frequency.SUB, INT and PRE_HFC were statistically significant at the level of .01 or higher. The odds ratio for SUB is 2.58. It means that for every 1,000 increase a cable system's basic service subscribers, the odds of the cable system offering high-speed internet access service increases by a factor of 2.58, holding other independent variables constant. The odds ratio for INT is 0.65. It means that with the addition of one more high-speed ISP to a cable franchise area, the odds of the cable system offering high-speed internet access service decreases by a factor of 0.65, holding other independent variables constant. The odds ratio for PRE_HFC is 364.10, indicating that the odds of an HFC system offering high-speed internet access service is more than 364 times the odds of a traditional coaxial system offering high-speed internet access service, holding other independent variables constant.

Cable System Diversification into Telephone Service

Equation (10) assumes that D_TEL, a system's diversification into telephony, is determined by cable system characteristics, the predicted values for HFC, the structure of a system's video programming service market, the structure of the local telephone market, and the demographics of its franchise area.

$$(10)\ D\_TEL = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 PRE\_HFC + \alpha_5 STA + \alpha_6 DBS + \alpha_7 TEL + \alpha_8 BAA + \alpha_9 HIS + \alpha_{10} EMP + \alpha_{11} INC + \alpha_{12} OWN + \alpha_{13} REG + e_{10}.$$

Results for the binary logistic regression analysis for D_TEL are presented in Table 5-14. Overall, the model correctly categorized 91.8% of the cases. The percent in the modal category for D_TEL was 91.7%. The model correctly predicted only 0.01% more of the cases compared to the mode value frequency. PRE_HFC was the only independent variable with statistical significance for equation (10) at the level of .01. The odds ratio for PRE_HFC is 9.08, indicating that the odds of an HFC system offering telephone service is more than 9 times the odds of a traditional coaxial system offering telephone service, holding other independent variables constant.

Cable System Total Degree of Diversification

Equation (11) assumes that cable system total degree of diversification, D_TOTAL, is determined by cable system characteristics, the predicted values for HFC, the structure of a system's video programming service market, the structure of the local telephone service market, the structure of the local high-speed Internet market, and the demographics of its franchise area. In equation (11), LNSUB, the natural log of SUB, and LNINC, the natural log of INC, were used instead of SUB and INC.

$$(11)\ D\_TOTAL = \alpha_0 + \alpha_1 MSO + \alpha_2 SUB + \alpha_3 DEN + \alpha_4 PRE\_HFC + \alpha_5 STA + \alpha_6 DBS + \alpha_7 INT + \alpha_8 TEL + \alpha_9 BAA + \alpha_{10} HIS + \alpha_{11} EMP + \alpha_{12} INC + \alpha_{13} OWN + \alpha_{14} REG + e_{11}.$$

The correlation matrix table, Table 5-4, shows a high positive, and statistically significant, correlation coefficient for INT and TEL (R= 0.728). Also, in a regression collinearity diagnosis, INT and TEL show low tolerance values, 0.346 and 0.266, respectively. Therefore, TEL was eliminated from Equation (11) to control for multicollinearity. The revised model is presented in Equation (12):

$$(12)\ D\_TOTAL = \alpha_0 + \alpha_1 MSO + \alpha_2 LNSUB + \alpha_3 DEN + \alpha_4 PRE\_HFC + \alpha_5 STA + \alpha_6 DBS + \alpha_7 INT + \alpha_8 BAA + \alpha_9 HIS + \alpha_{10} EMP + \alpha_{11} LNINC + \alpha_{12} OWN + \alpha_{13} REG + e_{12}.$$

Results for the multiple linear regression analysis for D_TOTAL are presented in Table 5-15. Overall, the model explained about 60.0 percent of the variation in the dependent variable D_TOTAL. MSO, LNSUB, PRE_HFC, STA and INT were statistically significant at the .01 level or higher. Regression results show that MSO systems on average scored .082 higher than independent systems on D_TOTAL, holding other independent variables constant. SUB had the largest positive effect on D_TOTAL.

For every one percent increase in a cable system's basic service subscribers, D_TOTAL increases by 0.62, holding other independent variables constant. HFC systems on average scored .16 higher than traditional coaxial systems on D_TOTAL, holding other independent variables constant.

The coefficient for STA was positive and significant. For each additional broadcast television station receivable OTA in a cable franchise area, D_TOTAL increases by .13. To the contrary, INT, another market structure variable, had a statistically significant negative relationship to D_TOTAL. For each additional high-speed ISP in a cable franchise area, D_TOTAL decreases by .12. This is consistent with the results for the regression for D_INT using equation (9).

Summary

Table 5-16 shows the estimated change in the probability of cable system diversification following a one unit change in the independent variables that were statistically significant at the 0.01 level or higher for the model that allows for both direct and indirect effects. For a statistically representative cable system in the sample, the probability of offering PPV service increases from 0.456 to 0.955 if the ownership changes from independent to MSO, holding other independent variables constant. The probability of a statistically representative cable system diversifying into PPV increases from 0.456 to 0.762 if the number of its basic cable service subscribers increases by 1,000, holding other independent variables constant. The probability of a statistically representative cable system diversifying into PPV increases from 0.456 to 0.501 if one more broadcast television station receivable OTA is added to its cable franchise area, holding other independent variables constant.

The probability of a statistically representative cable system diversifying into high-speed internet access service increases from 0.502 to 0.722 if the number of its basic cable service subscribers increases by 1,000, holding other independent variables constant. The probability of a statistically representative cable system diversifying into high-speed internet access service decreases from 0.502 to 0.396 with the addition of one more high-speed ISP to its cable franchise area, holding other independent variables constant. For a statistically representative cable system in this sample, the probability of offering high-speed internet access service increases from 0.502 to 0.997 if the upgrade status changes from traditional coaxial cable plant to HFC plant, holding other independent variables constant.

For a statistically representative cable system in this sample, the probability of offering telephone service increases from 0.083 to 0.451 if the upgrade status changes from traditional coaxial cable plant to HFC plant, holding other independent variables constant.

5.5 Comparison of the Direct Effects-Only Model and the Model with Both Direct and Indirect Effects

Table 5-9 and Table-16 show the regression results for the direct effects-only model and the model with both direct and indirect effects, respectively. By comparing these two tables, we can see that the regression results for the model with both direct and indirect effects show that HFC influenced cable systems' decisions to diversify into high-speed internet access and telephone services, and the odds ratios for the statistically significant independent variables, including MSO, SUB, STA, and INT, did not change much from their values in the direct effects-only model. This suggests that although the model with both direct and indirect effects allows for the possibility of indirect effects, it did not provide evidence that the indirect effects were very important in determining cable system diversification into the three services examined in this study. Also, regression results show that the factors that influenced cable systems' decisions to upgrade to HFC, including SUB, STA, and INT, also influenced cable systems' decisions to diversify into the three services considered in this study.

In the direct effects-only model, STA had a statistically significant and positive influence on D_INT in the equation for cable system diversification into high-speed internet access service. To the contrary, in the model with direct and indirect effects, STA was not a statistically significant independent variable in the equation for cable system diversification into high-speed internet access service, whereas HFC had a positive influence on cable system diversification into high-speed internet access service. This suggests a plausible explanation for this finding is that once cable systems have upgraded to HFC, they would diversify into high-speed internet access service regardless of the competitiveness of their primary business of video programming. Another plausible explanation is that cable systems upgraded to HFC in part so they can offer high-speed internet access service.

CHAPTER 6
DISCUSSIONS

6.1 Discussion of the Results

Technological advances and regulatory initiatives have made competition in the multichannel video programming service market possible to a degree that was once assumed to be economically infeasible. The cable industry now faces more competition than ever before. Cable's primary business of video programming service is confronted with increased competition from satellite companies and telephone companies. The old system of cable monopoly is gradually being replaced with a competitive marketplace.

This study is an application of the I/O model to cable system diversification. The model used in this study focuses on interaction between cable systems and the other service providers when cable systems have the opportunity to diversify into PPV, high-speed internet access, and telephone services. It examines how cable systems diversify in response to the structure of both their primary markets and their target markets, and thus explores the sensitivity of cable systems' conduct to market structure at the cable franchise level. It thereby contributes to our understanding of the forces behind the cable industry's diversification. Results for the set of regressions corresponding to the direct effects- only model are discussed in the following paragraphs.

SUB had a positive effect on HFC, D_PPV and D_INT. These results suggest that the number of basic cable service subscribers is one of the factors that influenced cable systems' decisions to upgrade to HFC and to diversify into PPV and high-speed internet access services. Potential revenues that can be generated from providing PPV and high-speed internet access services to existing customers might have increased the motivation for cable systems to upgrade and diversity into these services.

STA had a positive effect on HFC, D_PPV and D_INT. My regression analysis indicates that cable systems operating in franchise areas with more broadcast television signals are more likely to upgrade to HFC and to diversify into PPV and high-speed internet access services. More broadcast television receivable OTA implies more local channels for cable systems to carry, which increases the value of additional bandwidth. Also, more broadcast television signals means more competition for cable television. OTA television is a substitute for cable television for some customers. Confronted with more competition from OTA television, cable systems might be responding by upgrading and diversifying in order to create new revenue sources.

My regression analysis indicates that MSO systems are more likely to diversify into PPV service than independent systems. Cable operators that provide PPV services obtain PPV programming from PPV networks and major suppliers of PPV programming to cable systems like Viewer's Choice and Request TV, and split the viewing fees with them based on a negotiated percentage. This suggests a plausible explanation for this finding is that MSOs are more likely to be able to negotiate a higher percentage for themselves and achieve higher buy-rates because they have a larger subscriber base and thus more bargaining power compared to independent systems.

In this study, two competing hypotheses, that the effect of competitiveness of the target markets on cable system diversification into these markets is either positive or negative, were considered. INT, the number of high-speed ISPs in a cable franchise area, which measures the competitiveness of the high-speed internet market, had a negative coefficient in the equation for cable systems' upgrade to HFC and cable system diversification into high-speed internet. It suggests that cable systems are less likely to upgrade to HFC and to diversify into high-speed internet access service when there are more competitors in the high-speed internet market. More high-speed ISPs in a cable franchise area means more competition for a cable system. A plausible explanation for these results is that a lower potential market share, especially where other high-speed ISPs have already acquired a substantial market share, and thereby a lower rate of return on investment might discourage a cable system operating in a local market with more high-speed ISPs from investing in HFC and diversifying into highs-speed internet access service. To the contrary, the market structure variable that measures the competitiveness of a cable system's local telephone market, did not have a statistically significant coefficient in the equation for cable systems diversification into telephony. It suggests that a cable system's decision to diversify into telephony was not influenced by the competitiveness of its local telephone market. None of the factors included in the equation had a significant coefficient in the direct effects-only model. In the set of regressions corresponding to the model with both direct and indirect effects, HFC was the only independent variable that had a statistically significant coefficient in the equation for cable systems diversification into telephony; also, HFC systems are more likely to diversify into telephone service than traditional coaxial systems. The primary advantage of digital cable telephone service over traditional circuit-switched service for cable operators is its cost advantage. It costs between 17 percent and 25 percent less to serve a digital cable telephone service subscriber than a traditional circuit-switched cable telephone service subscriber (Cable telephony, 2006). This cost advantage is a plausible explanation for why HFC cable systems are more likely to provide telephone service.

My analysis indicates that cable systems are more likely to upgrade to HFC in cable franchise areas with lower home ownership rates. According to the U.S. Census Bureau's Housing Vacancy Survey (U.S, Census Bureau, 2005), as of 2004 the home ownership rate was 53.8 percent for central city households, 75.4 percent for suburban households, and 76.4 percent for rural households. Home ownership rate is the lowest in central cities where rental apartment living is more often chosen. It costs cable systems less per household to upgrade to HFC in central cities because household unit density is higher there. Having compared the expense of cable plant upgrades to the number of potential subscribers in central cities and in urban areas with higher rates of home ownership, cable systems operating in central cities may have expected a higher return on investment than those in urban areas.

6.2 Suggestions for Future Research

I suggest future research explore the management implications of diversification for cable systems, especially the impacts of pursuing diversification on cable companies' organization structures. Diversified cable systems have to adapt to the requirements of providing multiple services. Studies in this area can be useful for cable managers looking for guidance in managing their diversified organizations.

Also, I suggest that future research assess the competitive effects of telephone companies' entry into the traditional video programming market on cable systems' product offerings and pricing policies. There is little discussion about the effects of telephone companies' entry into the video programming market on cable systems' product offerings and pricing policies in the literature perhaps because they are just starting to do so. With more telephone companies providing video programming services, it would be meaningful to assess whether the FCC's objective of promoting competition in MVPD services has been achieved. I suggest that future research investigate how telephone's entry into video influences the cable industry's product offerings and pricing policies in the multichannel video programming market.

Last, I suggest that future research look at the new services that cable systems have diversified into in addition to those examined here. Cable systems' investments in upgrading their systems have enabled them to provide more new services such as streaming media, interactive television, and video-on-demand. It would be meaningful to study cable system diversification into these new services once cable systems provide them on a large scale.

6.3 Limitations of the Study

Four limitations of this study should be noted. First, DBS penetration data at the state level instead of at the cable franchise area level were used for the cable systems in the sample. The FCC only provided DBS penetration data at the state level, and no data sources on DBS penetration by cable franchises areas were available that could be obtained with the budget available for this study. Ideally my analysis could be replicated with franchise level data on DBS penetration in the future.

The second limitation is the study's imprecision in data matching: cable system characteristics data were reported at the cable franchise area level, but market structure and market demographic data were reported at the zip code level. For cable franchise areas associated with multiple zip codes, simple averaging instead of a more refined weighting was used to aggregate data. As mentioned in Chapter 4, some cable franchise areas are associated with multiple zip codes. For those cases, a weighted sum with weighting by population in each zip code should be used for the cable franchise area, and this weighting would be applied to all variables reported on a zip code level. However, information on the distribution of cable system subscribers in each zip code was not available for this study.

The third limitation is that one year's observations were used to draw inferences about motives for events that occurred sequentially over time. Two-stage least squares techniques were employed to address the issue of endogeneity that would arise if cable systems upgraded to HFC for reasons other than diversifying into the three services considered here but subsequent possession of HFC plant influenced the decisions regarding diversification. In the two-stage least squares regressions, the other independent factors that might influence cable system diversification were used for the equation for HFC, but they may not be adequate for identifying the factors that influenced cable systems' HFC upgrade decisions because it is impossible to determine when the upgrade to HFC was complete using one year's data. Systems that upgraded recently and those that did so considerably earlier are of necessity treated the same, but the expectations for revenues from new services may have been different for those that upgraded most recently and those that upgraded much earlier.

The fourth limitation is that all the cable operators with two or more systems are treated the same by using a simple binary MSO dummy variable. It is possible that the largest MSOs are different from the other MSOs when they make their diversification decisions. This issue could have been addressed if the total number of basic cable subscribers for the largest MSOs had been employed as an independent variable in this study.

Table 4-1 Dependent Variables and Independent Variables

Category	Variable	Operationalization	Expected Sign	Source
Dependent Variables	D_PPV	Binary variable =1 if a system offered PPV service, 0 otherwise	n.a.	[1]
	D_INT	Binary variable =1 if a system offered high-speed Internet access service, 0 otherwise	n.a.	[1]
	D_TEL	Binary variable =1 if a system offered voice telephone service, 0 otherwise	n.a.	[1]
	D_TOTAL	The sum of D_PPV, D_INT and D_TEL	n.a.	[1]
Independent Variables				
System characteristics	MSO	Dummy variable = 1 if a system is MSO-owned, 0 otherwise	+	[1]
	SUB	The number of a cable system's basic service subscribers (in thousands)	+	[1]
	LNSUB	Natural log of SUB	+	
	DEN	The number of households per mile of cable plant	+	[1]
	HFC	Dummy variable = 1 if a system has a capacity of 750 MHz or higher, and 0 if a system has a capacity of 450 MHz or lower; systems with MHz capacity between 450 and 750 were coded based on telephone interview results.	+	[1]
	PRE_HFC	Predicted values for HFC	+	

Table 4-1 (cont'd)

Market structure	STA	The number of over-the-air broadcast television receivable in a cable franchise area	+	[1]
	DBS	Penetration of DBS at the state level	+	[2]
	INT	The number of high-speed Internet access service providers in a zip code area that associate with the cable franchise area	+/-	[3]
	TEL	The number of CLECs a zip code area in a zip code area that associate with the cable franchise area	+/-	[4]
Market Demographics	BAA	Percentage of Black or African American population in a zip code area that associate with the cable franchise area	n.a.	[5]
	HIS	Percentage of Hispanic population in a zip code area that associate with the cable franchise area	n.a.	
	EMP	Employment rate in a zip code area that associate with the cable franchise area	n.a.	[5]
	INC	Median household income in a a zip code area that associate with the cable franchise area (in thousands)	n.a.	[5]
	LNINC	Natural log of INC	n.a.	
	OWN	Home ownership rate in a zip code area that associate with the cable franchise area	n.a.	[5]

Table 4=1 (cont'd)

REG	Dummy variable = 0 if a cable system is in the midwest, 1 if in the northeast, 2 if in the south, and 3 if in the west	n.a.	[5]

[1] *The Television & Cable Factbook* (2005). Cable vol. 1&2
[2] NCTA (February 2005). The video market is fully competitive: Almost 27 million consumers now subscribe to cable's competitors.
[3] FCC Form 477 (2005) *Number of High-Speed Service Providers by Zip Codes*
[4] FCC Form 477 (2005) *Number of Competitive Local Exchange Carriers by Zip Codes*
[5] U.S. Census (2004), American Community Survey.

Table 5-1 Relative Frequency of Cable System Product Diversification and HFC Upgrades

	Frequency	**Percent**
PPV	149	45.6
Internet	164	50.2
Telephone	27	8.3
HFC	100	31.0

Table 5-2 Relative Frequency of Cable System Total Degree of Diversification

Score	Frequency	Percent	Cumulative Percent
0	132	40.4	40.4
1	73	22.3	62.7
2	99	30.3	93.0
3	23	7.0	100.0
Total	327	100.0	

Table 5-3 Descriptive Statistics for the Sample

	N	Minimum	Maximum	Mean	Std. Deviation
MSO	327	0	1	0.92	.27
SUB	327	0.004	460	9.52	37.39
DEN	297	2	744	55.44	60.35
HFC	310	0	1	0.31	.46
STA	320	1	23	7.80	3.47
DBS	327	9.00	39.00	23.00	5.00
INT	315	0	16	3.52	2.72
TEL	315	0	19	3.50	3.60
BAA	316	0	83.20	8.63	15.89
HIS	316	0	84.60	5.34	10.79
EMP	314	12.90	86.50	59.42	9.53
INC	316	13.46	112.76	33.85	12.65
OWN	315	1.00	93.00	61.00	.13
REG(0)	28	n.a.	n.a.	n.a.	n.a.
REG(1)	119	n.a.	n.a.	n.a.	n.a.
REG(2)	122	n.a.	n.a.	n.a.	n.a.
REG(3)	58	n.a.	n.a.	n.a.	n.a.

Table 5-4 Correlation Matrix for the Variables

	D_PPV	D_INT	D_TEL	D_TOTAL	MSO	SUB	DEN	HFC	STA	DBS	INT	TEL	AA	HIS	EMP	INC	OWN
D_PPV	1	.581**	.239**	.860**	.178**	.264**	.170**	.622**	.419**	-.168**	.390**	.407**	.046	.095	.271**	.248**	-.116*
D_INT		1	.210**	.853**	.069	.240**	.192**	.593**	.362**	-.128*	.270**	.365**	.015	.053	.171**	.250**	-.109*
D_TEL			1	.503**	.006	.262**	.114*	.239**	.212**	-.140**	.200**	.260**	.016	.109*	.075	.206**	-.017
D_TOTAL				1	.126**	.326**	.215**	.680**	.451**	-.188**	.387**	.461**	.026	.105	.242**	.308**	-.118*
MSO					1	.058	.078	.103*	.037	.012	.095	.097	-.005	.101	.014	.029	-.003
SUB						1	.125*	.313**	.231**	-.225**	.300**	.431**	.172**	.141	.099	.190**	-.082
DEN							1	.243**	.196**	-.068	.229**	.225**	-.015	.186*	.111	.105	-.081
HFC								1	.370**	-.165**	.373**	.428**	.046	.071	.177**	.185**	-.226**
STA									1	-.319**	.447**	.489**	.036	.280**	.215**	.366**	.015
DBS										1	-.164**	-.367**	.069	-.050	-.152**	-.269**	-.018
INT											1	.728**	.075	.207**	.256**	.367**	-.079
TEL												1	.222**	.206**	.149**	.368**	-.069
AA													1	.011	-.249**	-.194**	-.102
HIS														1	.042	.085	-.137*
EMP															1	.519**	.201**
INC																1	.304**
OWN																	1

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 5-5 Cable System Diversification into PPV (Direct Effects-Only Model)

Nagelkerke's R^2	.707							
Significance	<.0001							
N=283								
Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	3.335	1.275	6.842	1	.009	28.076	2.307	341.668
SUB	1.365	.250	29.845	1	.000	3.918	2.400	6.394
DEN	-.005	.003	3.105	1	.178	1.094	.989	1.001
STA	.201	.074	7.335	1	.007	1.223	1.057	1.415
DBS	-1.342	4.947	.074	1	.786	.261	.000	4244.435
BAA	.024	.015	2.461	1	.117	1.024	.994	1.055
HIS	.000	.019	.001	1	.980	1.000	.963	1.039
EMP	.037	.025	2.183	1	.140	1.038	.988	1.091
INC	.014	.031	.216	1	.642	1.014	.955	1.077
OWN	-.750	1.623	.214	1	.644	.472	.020	11.363
REG			5.463	3	.141			
REG(1)	-.566	1.201	.222	1	.637	.568	.054	5.974
REG(2)	-1.973	1.321	2.231	1	.135	.139	.010	1.852
REG(3)	-.612	1.336	.210	1	.647	.542	.040	7.440
Constant	3.335	1.275	6.842	1	.009	28.076	2.307	341.668

Comparison of Actual and Predicted Results

		Predicted		Percent Correct
		0	1	
Actual	0	136	14	90.7
	1	30	103	77.4
Percent Correctly Predicted				84.5
Percent in Modal Category				54.4

Table 5-6 Cable System Diversification into High-Speed Internet Access Service (Direct Effects-Only Model)

Nagelkerke's R^2 .584

Significance <.0001

N=262

Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR Lower	95% C.I. for OR Upper
MSO(1)	.073	.553	.018	1	.895	1.076	.364	3.183
SUB	1.162	.219	28.225	1	.000	3.196	2.082	4.906
DEN	.003	.007	.247	1	.619	1.003	.991	1.016
STA	.159	.066	5.748	1	.017	1.172	1.029	1.335
DBS	6.318	4.423	2.041	1	.153	5.685	.095	32.792
INT	-.489	.125	15.400	1	.000	.613	.481	.783
BAA	-.005	.013	.160	1	.689	.995	.971	1.020
HIS	.003	.018	.026	1	.871	1.003	.969	1.038
EMP	-.002	.020	.012	1	.913	.998	.960	1.038
INC	.028	.028	1.014	1	.314	1.028	.974	1.085
OWN	-.605	1.451	.174	1	.677	.546	.032	9.385
REG			3.579	3	.311			
REG(1)	-.648	.997	.422	1	.516	.523	.074	3.696
REG(2)	-1.404	1.075	1.706	1	.191	.246	.030	2.019
REG(3)	-1.318	1.168	1.273	1	.259	.268	.027	2.641
Constant	-2.373	1.782	1.773	1	.183	.093		

Comparison of Actual and Predicted Results

		Predicted 0	Predicted 1	Percent Correct
Actual	0	112	20	84.8
	1	39	111	74.0
Percent Correctly Predicted				79.1
Percent in Modal Category				50.2

Table 5-7 Cable System Diversification into Telephone Service (Direct Effects-Only Model)

Nagelkerke's R^2	.268							
Significance	<.0001							
N=282								
Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	-.873	.843	1.072	1	.301	.418	.080	2.181
SUB	.008	.006	1.981	1	.159	1.008	.997	1.020
DEN	.001	.004	.050	1	.822	1.001	.994	1.008
STA	.055	.077	.508	1	.476	1.057	.908	1.230
DBS	-8.034	7.533	1.138	1	.286	.000	.000	836.588
TEL	.112	.085	1.744	1	.187	1.118	.947	1.320
BAA	-.023	.024	.899	1	.343	.977	.932	1.025
HIS	.005	.023	.042	1	.839	1.005	.961	1.050
EMP	-.018	.032	.338	1	.561	.982	.923	1.044
INC	.042	.024	3.132	1	.177	1.043	.995	1.094
OWN	-2.519	1.924	1.714	1	.191	.081	.002	3.499
REG			.720	3	.868			
REG(1)	.258	.986	.069	1	.793	1.295	.188	8.941
REG(2)	.813	1.140	.508	1	.476	2.254	.241	21.056
REG(3)	.326	1.253	.068	1	.795	1.385	.119	16.137
Constant	-.301	2.518	.014	1	.905	.740		

Comparison of Actual and Predicted Results

		Predicted		Percent Correct
		0	1	
Actual	0	256	3	98.8
	1	20	3	13.0
Percent Correctly Predicted				79.1
Percent in Modal Category				50.2
Percent Correctly Predicted				91.8
Percent in Modal Category				91.7

Table 5-8 Cable System Total Degree of Diversification (Direct Effects-Only Model)

R^2	0.619
Significance	<.0001

	Standardized beta coefficient	t	Probability
(Constant)		-1.978	.049
MSO	.091	2.378	.018
LNSUB	.732	13.055	.000
DEN	-.026	-.632	.528
STA	.171	3.511	.001
DBS	.030	.607	.545
INT	-.106	-2.088	.038
BAA	-.040	-.869	.386
HIS	-.026	-.604	.547
EMP	.086	1.759	.180
LNINC	.039	.691	.490
OWN	-.023	-.529	.597
NORTHEAST	-.045	-.959	.338
SOUTH	-.070	-1.337	.182
WEST	-.047	-.965	.335

Table 5-9 Change in Probability of Cable System Diversification Following One Unit Increase in the Statistically Significant Independent Variables (Direct Effects-Only Model)

	Original	After One Unit Change			
	Probability*	MSO	SUB**	STA	INT
D_PPV	45.6	95.9	76.7	50.6	--
D_INT	50.2	--	76.3	54.2	38.2

* Value for statistically average system

** One unit is one thousand basic service subscribers

Table 5-10 The Effects of System Characteristics, Competition from Broadcast Television, and Market Demographics on Cable Systems' Upgrade to HFC

Nagelkerke's R^2	.50							
Significance	<.0001							
N=263								
Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	.600	.694	.748	1	.387	1.823	.467	7.110
SUB	.165	.040	17.303	1	.000	1.179	1.091	1.274
DEN	.005	.004	1.583	1	.208	1.005	.997	1.013
STA	.157	.061	6.600	1	.010	1.170	1.038	1.320
BAA	-.002	.013	.017	1	.895	.998	.973	1.025
HIS	-.024	.024	1.016	1	.313	.977	.933	1.023
EMP	.025	.023	1.212	1	.271	1.025	.981	1.072
INC	-.012	.020	.356	1	.551	.988	.951	1.027
OWN	-4.045	1.403	8.316	1	.004	.018	.001	.274
REG			.959	3	.811			
REG(1)	-.691	.727	.905	1	.341	.501	.121	2.081
REG(2)	-.585	.768	.580	1	.446	.557	.124	2.511
REG(3)	-.726	.850	.731	1	.393	.484	.092	2.557
Constant	-1.443	1.602	.811	1	.368	.236		

Comparison of Actual and Predicted Results

		Predicted		Percent Correct
		0	1	
Actual	0	171	9	95.0
	1	36	57	61.3
Percent Correctly Predicted				83.5
Percent in Modal Category				69.0

Table 5-11 The Effects of the System Characteristics, Market Structure, and Market Demographic Variables on Cable Systems' Upgrade to HFC

Nagelkerke's R^2 .53
Significance <.0001
N=263

Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	.510	.690	.546	1	.460	1.665	.430	6.445
SUB	.183	.046	16.203	1	.000	1.201	1.099	1.313
DEN	.006	.005	1.405	1	.236	1.006	.996	1.016
STA	.158	.064	6.035	1	.014	1.171	1.032	1.328
DBS	5.268	4.332	1.479	1	.224	193.957	.040	943510.331
INT	-.275	.115	5.744	1	.017	.760	.607	.951
TEL	.265	.093	8.117	1	.114	1.304	.986	1.565
BAA	-.010	.015	.519	1	.471	.990	.962	1.018
HIS	-.027	.026	1.090	1	.296	.973	.925	1.024
EMP	.039	.025	2.540	1	.111	1.040	.991	1.091
INC	-.025	.022	1.327	1	.249	.975	.935	1.018
OWN	-4.437	1.511	8.624	1	.003	.012	.001	.229
REG			.575	3	.902			
REG(1)	-.456	.803	.322	1	.570	.634	.131	3.060
REG(2)	-.553	.883	.393	1	.531	.575	.102	3.245
REG(3)	-.768	1.027	.559	1	.455	.464	.062	3.475
Constant	-2.823	1.819	2.408	1	.121	.059		

Comparison of Actual and Predicted Results

		Predicted		Percentage Correct
		0	1	
Actual	0	169	10	94.4
	1	35	58	62.4
Percent Correctly Predicted				83.5
Percent in Modal Category				69.0

Table 5-12 Cable System Diversification into PPV (Model with Both Direct and Indirect Effects)

Nagelkerke's R^2	.707							
Significance	<.0001							
N=283								
Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	3.238	1.293	6.275	1	.012	25.493	2.023	321.208
SUB	1.339	.258	26.875	1	.000	3.816	2.300	6.332
DEN	-.006	.004	2.798	1	.114	.994	.987	1.001
STA	.184	.087	4.515	1	.034	1.202	1.014	1.425
DBS	-1.608	4.993	.104	1	.747	.200	.000	3565.730
BAA	.024	.015	2.451	1	.117	1.024	.994	1.055
HIS	.003	.021	.028	1	.868	1.003	.963	1.045
EMP	.034	.026	1.665	1	.197	1.035	.982	1.090
INC	.017	.032	.297	1	.586	1.018	.956	1.083
OWN	-.274	2.054	.018	1	.894	.760	.014	42.619
REG			5.116	3	.164			
REG(1)	-.450	1.283	.123	1	.726	.638	.052	7.888
REG(2)	-1.829	1.415	1.670	1	.196	.161	.010	2.572
REG(3)	-.467	1.434	.106	1	.744	.627	.038	10.412
PRE_HFC	.812	2.214	.134	1	.714	2.251	.029	172.592
Constant	-7.534	2.500	9.084	1	.003	.001		

Comparison of Actual and Predicted Results

		Predicted		Percent Correct
		0	1	
Actual	0	137	12	91.9
	1	30	103	77.4
Percent Correctly Predicted				85.1
Percent in Modal Category				54.4

Table 5-13 Cable Diversification into High-Speed Internet Access Service (Model with Both Direct and Indirect Effects)

Nagelkerke's R^2	.554							
Significance	<.0001							
N=262								
Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
MSO(1)	-.328	.572	.328	1	.567	.720	.235	2.212
SUB	.947	.238	15.912	1	.000	2.579	1.619	4.108
DEN	.000	.007	.000	1	.991	1.000	.986	1.014
STA	.045	.080	.319	1	.572	1.046	.895	1.223
DBS	4.374	4.592	.907	1	.341	79.340	.010	642838.944
INT	-.428	.127	11.384	1	.001	.652	.508	.836
BAA	-.005	.013	.178	1	.673	.995	.969	1.020
HIS	.020	.018	1.214	1	.270	1.021	.984	1.058
EMP	-.025	.022	1.298	1	.255	.975	.934	1.018
INC	.044	.029	2.294	1	.130	1.045	.987	1.107
OWN	2.890	2.018	2.051	1	.152	18.002	.345	939.881
REG			1.901	3	.593			
REG(1)	.227	1.040	.048	1	.827	1.255	.164	9.626
REG(2)	-.406	1.129	.129	1	.719	.667	.073	6.097
REG(3)	-.219	1.224	.032	1	.858	.804	.073	8.856
PRE_HFC	5.897	2.280	6.688	1	.010	364.099	4.170	31793.489
Constant	-4.080	1.921	4.510	1	.034	.017		

Comparison of Actual and Predicted Results

		Predicted		Percent Correct
		0	1	
Actual	0	115	17	87.1
	1	36	114	76.0
Percent Correctly Predicted				81.2
Percent in Modal Category				50.2

Table 5-14 Cable Diversification into Telephone Service (Model with Both Direct and Indirect Effects)

Nagelkerke's R^2	.292							
Significance	<.0001							
N=282								

Variables	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR Lower	Upper
MSO(1)	-1.220	.887	1.892	1	.169	.295	.052	1.679
SUB	.004	.006	.548	1	.459	1.004	.993	1.015
DEN	-.001	.004	.036	1	.849	.999	.992	1.007
STA	-.004	.085	.002	1	.965	.996	.844	1.176
DBS	-7.244	7.145	1.028	1	.311	.001	.000	862.416
TEL	.051	.088	.336	1	.562	1.053	.885	1.251
BAA	-.020	.023	.734	1	.391	.980	.936	1.026
HIS	.019	.024	.663	1	.416	1.019	.973	1.068
EMP	-.034	.033	1.066	1	.302	.966	.906	1.031
INC	.043	.024	3.070	1	.180	1.044	.995	1.095
OWN	-1.089	2.088	.272	1	.602	.337	.006	20.160
REG			.694	3	.875			
REG(1)	.271	.954	.081	1	.776	1.311	.202	8.498
REG(2)	.782	1.098	.507	1	.476	2.185	.254	18.780
REG(3)	.242	1.219	.039	1	.842	1.274	.117	13.894
PRE_HFC	2.206	1.187	3.453	1	.063	9.080	.886	93.028
Constant	-.263	2.557	.011	1	.918	.768		

Comparison of Actual and Predicted Results

		Predicted 0	Predicted 1	Percent Correct
Actual	0	256	3	98.8
	1	20	3	13.0
Percent Correctly Predicted				91.8
Percent in Modal Category				91.7

Table 5-15 Cable System Total Degree of Diversification (Model with Both Direct and Indirect Effects)

R^2	0.600
Significance	<.0001

	Standardized beta coefficient	t	Probability
(Constant)		-2.329	.021
MSO	.082	2.052	.041
LNSUB	.615	7.909	.000
DEN	-.044	-1.026	.306
PRE_HFC	.161	1.810	.071
STA	.126	2.323	.021
DBS	.031	.608	.544
INT	-.116	-2.216	.028
BAA	-.029	-.627	.531
HIS	-.005	-.114	.909
EMP	.023	.458	.647
LNINC	.076	1.354	.177
OWN	.005	.109	.913
NORTHEAST	-.029	-.604	.547
SOUTH	-.076	-1.432	.153
WEST	-.050	-.995	.320

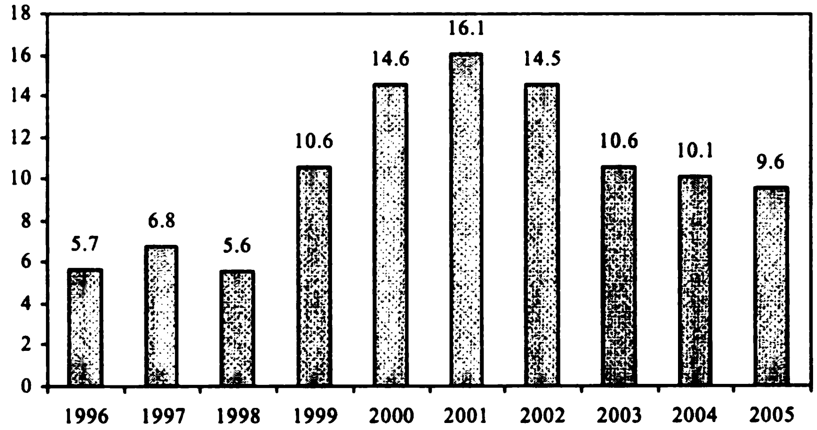
Table 5-16 Change in Probability of Cable System Diversification Following One Unit Increase in the Statistically Significant Independent Variables (Model with Both Direct and Indirect Effects)

	Original	After One Unit Change				
	Probability*	MSO	SUB**	STA	INT	PRE_HFC
D_PPV	45.6	95.5	76.2	50.1	--	--
D_INT	50.2	--	72.2	--	39.6	99.7
D_TEL	8.3	--	--	--	--	45.1

* Value for statistically average system

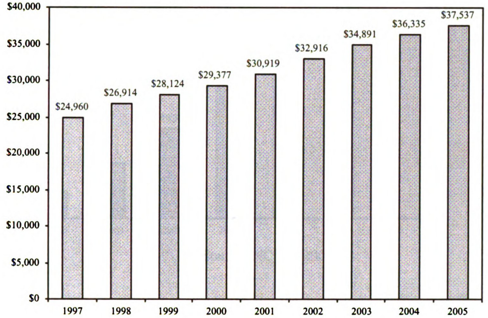
** One unit is one thousand basic service subscribers

Figure 1-1 Cable Industry Infrastructure Expenditure: 1996-2005 (in $ billions)



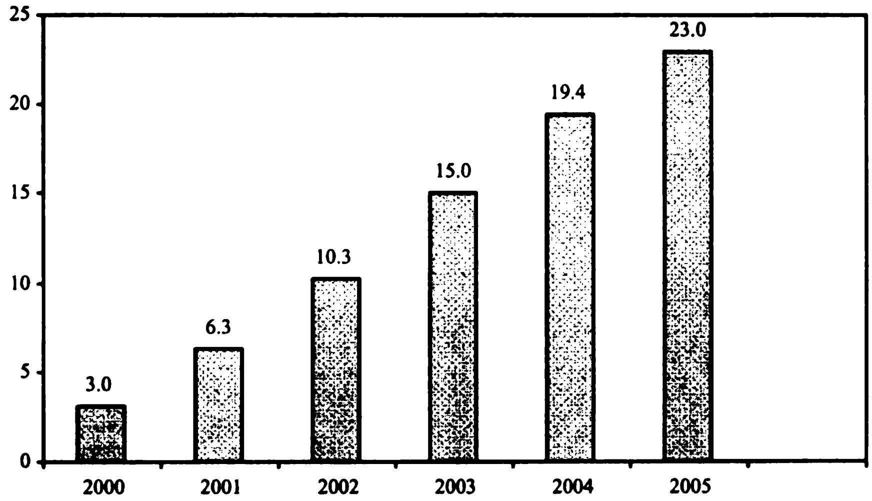
Source: NCTA (2006)

Figure 1-2 Cable Industry Revenue from Subscription-Based Video Programming Service: 1997-2005 (in $ millions)



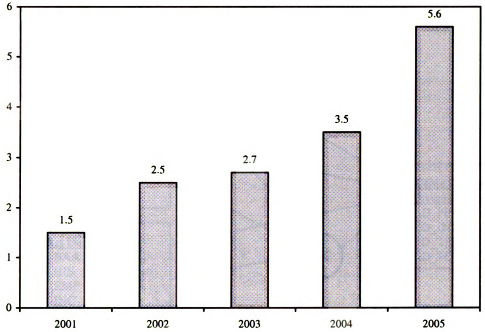
Source: FCC (2002, 2006)

Figure 1-3 Cable High-speed Internet Customers: 2000-2005 (in millions)



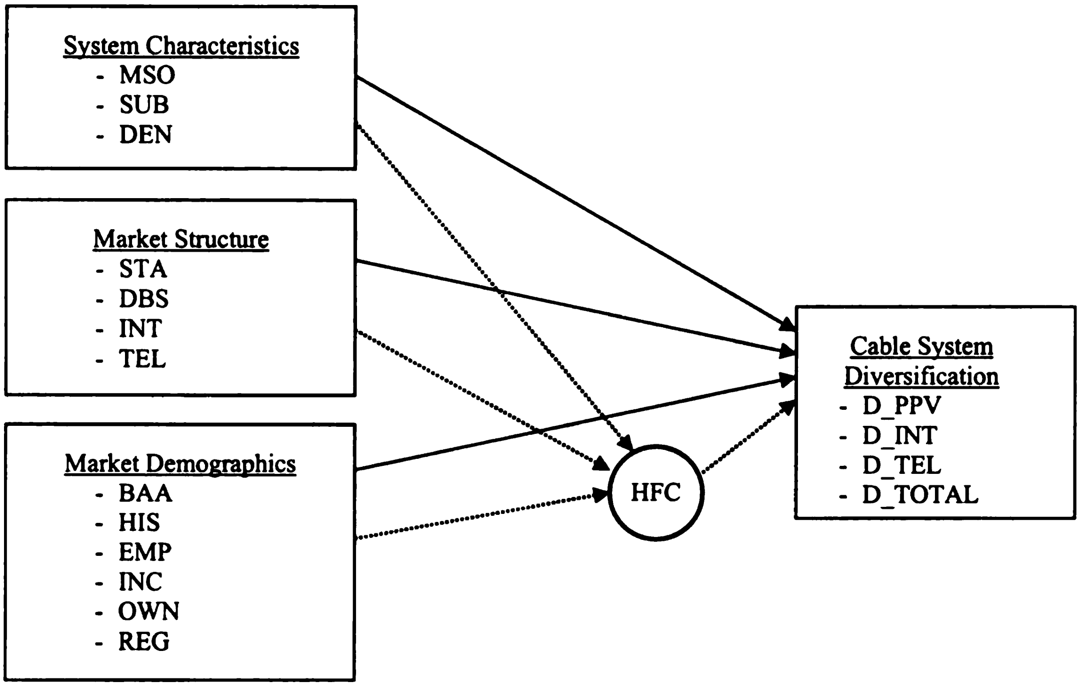
Source: NCTA (2005)

Figure 1-4 Cable Phone Customers: 2000-2005 (in millions)



Source: NCTA (2005)

Figure 4-1: A Framework for Analyzing Cable System Diversification



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