THE EFFECTS OF CONSUMER SWITCHING COSTS ON COMPETITION BETWEEN DIRECT BROADCAST SATELLITE AND CABLE

by

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(Under the Direction of Hugh J. Martin)

ABSTRACT

This study examines and measures the effects of switching costs as a barrier to DBS entering the market to compete with cable. The study finds switching costs exist and that switching costs don't deter new residents choosing a service for the first time from choosing a new competitor entering the market. The study also finds the Satellite Home Viewer Improvement Act of 1999 allows DBS and cable to become more substitutable products, which makes switching cost a more important factor in consumers' decisions to switch products.

INDEX WORDS: Consumer switching costs, DBS, Direct broadcast satellite, Cable, Satellite Home Viewer Improvement Act of 1999, Residential mobility, Product differentiation

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CHAPTER 1

Introduction

Multi-channel video distribution services (i.e. cable) faced limited competition in the past. Most consumers had only a limited choice of receiving television programming from Ultra High Frequency (UHF) and Very High Frequency (VHF) broadcast signals, or from a single cable service. This triggered debates asking if cable was a natural monopoly, if cable should be regulated, and how best to promote competition. The Satellite Home Viewer Act of 1988 made direct broadcast satellite (DBS) services, a technological innovation, potential competitors for cable. The act was intended to encourage development of DBS, which would consequently reduce consumer prices for cable and other multi channel services.

There is one other form of competition that can potentially lower cable prices. An area where two cable companies compete directly for the same customers is commonly referred to as an "overbuild." The Federal Communications Commission reported that incumbent cable companies in overbuilt areas were unable to raise prices as much as those in noncompetitive areas (FCC, 2005). This shows the importance of introducing competition in cable markets, but cable overbuilds are relatively rare. Adelphia, a major cable company, identified only 3.7% of its network as facing direct competition from other cable companies (Adelphia, 2005).

In 1994, six years after the original satellite act, DBS providers began offering competition to most cable systems nationwide. A second version of the act passed in

1999, making it easier for DBS providers to add local broadcast television channels, and removing what satellite companies considered a regulatory barrier to competition. By 2005 there were two established DBS services: DirecTV and the Dish Network. DirecTV had 15.6 million subscribers by October of 2006 (directv, 2007). The Dish Network added its 11 millionth subscriber in January of 2005 (dishnetwork, 2006). Both services together have more than 26 million subscribers in the United States. By comparison, there were more than 73 million cable customers in the U.S in September of 2003 (Nielsen Media Research, 2003).

A new cable company or DBS provider entering a market with an incumbent cable company faces two barriers. The first is financing the costs associated with entry. The second is attracting new customers from the incumbent cable company or from consumers who do not already have cable. This study will focus on the second problem and examine if consumer switching costs are inhibiting competition between DBS and cable.

CHAPTER 2

Literature Review

Some economists define cable as a natural monopoly to explain the lack of competition in most cable television markets. Hoskins, McFadyen, and Finn (2004) define a natural monopoly as existing "where economies of scale mean that market demand can be met at the lowest cost by one firm producing the entire output," and they assume a cable franchise to be a natural monopoly (p.171). Economies of scale occur when "a proportionate increase in all inputs results in a more than proportionate increase in output" (Waldman & Jensen, 2007, p.39). If two cable providers on a single street attract equal numbers of subscribers, then each company will have a higher average cost per subscriber to lay and maintain cable.

These conditions caused federal appellate judge Richard Posner to consider the theory of a natural monopoly in a 1982 case regarding cable franchises in the City of Indianapolis heard by the Seventh Circuit U.S. Court of Appeals (Omega Satellite Products Co. v. Indianapolis). The Omega Satellite Products Company installed satellite dishes on apartment buildings to deliver cable services to the building's residents. The company was not regulated because it didn't require access to the public right-of-way (Omega Satellite Products Co. v. Indianapolis). In May of 1981 Omega tried to add an additional apartment building to its system by running a cable to a building across the street. The company did not have a local cable franchise (Omega Satellite Products Co. v. Indianapolis). Posner's discussion of natural monopoly was a response to Omega,

which unsuccessfully appealed the denial of a preliminary injunction to prevent the enforcement of the local cable television ordinance in Indianapolis (Omega Satellite Products Co. v. Indianapolis). Posner noted that natural monopolies can be regulated under federal anti-trust law, and that cable companies can also be regulated if they use public right of way to string their cables. The suggestion that cable franchises fall within the definition of a natural monopoly is central to the debate about regulating cable.

Many local governments regulate cable through franchises because cable systems need access to the public right-of-way. Local governments can avoid the complex problem of setting cable rates, which requires detailed knowledge of the companies' costs and other market conditions, by requiring cable companies to bid for a franchise. In the simplest scenario, companies will submit bids that set price equal to average cost if competition for the franchise is intense. However, there are numerous complicating factors such as efforts by bidders to influence local officials with offers of concessions such as special fees, equipment, or government channels that benefit the officials (Hackett, 2008).

The exclusive franchises from local governments create a government regulated monopoly, protecting cable systems from competition. Local governments commonly request application fees and franchise fees, and encourage other non-price concessions in franchise bids. Zupan (1989) found in a 1984 survey of 250 cable systems that many franchises required that cable companies provide non-cash concessions. The companies' expenditures for these concessions accounted for 26% of construction costs and 11% of operating costs, which would likely result in bids with higher prices (Zupan, 1989).

Hazlett (1986) argues that monopoly franchising is inefficient and generates losses of welfare. Hazlett (1986) explains that a legal monopoly can add another economic barrier in the market. Concessions cable providers offer to local governments "often result in inefficient allocations of resources" (Hazlett, 1986, p.1335). The franchising process itself can also be expensive. The government offering the franchise might value products differently than consumers would value products in a free market (Hazlett, 1986). This presents a strong argument that exclusive franchise agreements can be inefficient, even if cable systems competitively bid to obtain a franchise.

Even if cable is a natural monopoly, that fact alone may not justify regulation. Demsetz (1968) argues the mere presence of a natural monopoly does not necessarily imply monopoly pricing power is present. Even when a single company can best serve a market at the lowest price, the company must offer competitive prices to deter potential competitors from entering to take control of the market (Demsetz, 1968). However, this rationale assumes that barriers do not keep potential competitors from freely entering and exiting the market. This is why it is important to research barriers in public utility industries, such as cable. Demsetz (1968) also argues removal of regulation can eliminate legally protected markets for the regulated industry. This is an important argument, since regulation can create a barrier to entry.

In the early 1980s the Los Angeles awarded exclusive access to one cable provider in some parts of the city (Los Angeles v. Preferred Communications, Inc.). Additional space for another company's cable was still available on utility poles. Preferred Communications, Inc. was denied a franchise to operate a competing cable system because it did not participate in bidding for the exclusive franchise (Los Angeles

v. Preferred Communications, Inc.). Preferred Communications challenged the city for violations of the First amendment and anti-trust law. The allegations of Sherman Act violations were dismissed by the federal district court (Los Angeles v. Preferred Communications, Inc.). The Ninth Circuit Court of Appeals affirmed the district court's dismissal, and the U.S. Supreme Court did not consider that decision (Los Angeles v. Preferred Communications, Inc.). However, the Court of Appeals and the Supreme Court reversed the district's court decision to dismiss the alleged First Amendment violations (Los Angeles v. Preferred Communications, Inc.).

The Supreme Court did not settle the arguments, but it sent that case back to the district court saying "the First Amendment values must be balanced against competing societal interests" (Los Angeles v. Preferred Communications, Inc). The case showed that exclusive franchises could be challenged on First Amendment grounds, but franchises were not violations of anti-trust laws.

Meanwhile, most local governments lost the ability to regulate cable prices when the Cable Communications Policy Act of 1984 became effective on December 29, 1986. The act ended local price regulation because most cable systems faced what the legislation described as effective competition (Benjamin, Lichtman, & Shelanski, 2001, p. 413). Effective Competition existed when cable subscribers could receive three or more over-the-air television signals (Benjamin, Lichtman, &Shelanski, 2001, p. 413).

Jaffe & Kanter (1990) argue this act limited competition for franchises to nonprice terms. Jaffe & Kanter's (1990) study used the value of cable systems as a proxy for market power, and found that deregulation increased the price of cable systems that

were sold in areas where there was no significant broadcast competition. The price of systems did not increase in areas with significant broadcast competition.

The General Accounting Office found that rates for the most popular cable services increased an average of 26% from December 1986 to October 1988 (General Accounting Office, 1989). However, subscribers paying higher prices also received an average of five more channels, enjoyed a decrease in the cost of premium services, and were offered additional options for installing multiple cable outlets in a home (General Accounting Office, 1989). This makes it difficult to determine if consumer welfare increased or decreased after price deregulation. Rubinovitz (1993) attempted to examine supply and demand functions for the cable industry in 1984 and again in 1990. Rubinovitz's (1993) study found that prices increased 18%, and deregulation accounted for 43% of that increase after controlling for quality and costs. Hazlett (1996) argued the Cable Communications Policy Act of 1984 meant "cable television operators were effectively freed from rate regulation, and subsequently enjoyed monopoly franchise protection with free market pricing."

The definition of effective competition was changed by the Cable Consumer Protection and Competition Act of 1992, which allowed local governments to regulate prices if cable franchises did not face effective competition (Benjamin, Lichtman, & Shelanski, 2001, pp. 413-415). However, Hazlett's (1996) study argues that subsequent price controls did not lower quality-adjusted prices. Crawford (2000) found that the 1992 Cable Act had no effect on consumer welfare. Crawford (2000) argues cable systems still control "what programming to offer, how to bundle that programming into services, and how to price those services" (Crawford, 2000, p. 446). Crawford (2000) suggests

any additional regulation should "carefully consider the product and price responses of [cable] systems" and that promoting competition may be a more effective way to improve consumer welfare.

The Cable Protection and Competition Act of 1992 also made it illegal for local regulators to offer an exclusive franchise to a single cable system. In 2005 the FCC began proceedings to determine if there had been "unreasonable refusals to grant additional competitive franchises" (FCC, 2007, p. 2). This shows a current that local franchising agencies may still be creating barriers to competition. The 1992 act also tries to promote competition by regulating distribution of programming owned by multi-channel video programming distributors, such as cable companies. Congress was concerned that a lack of access to programming could also serve as a barrier to competition in the multi-channel video programming distribution market.

Competition for Cable

Increased competition could pressure cable systems to operate more efficiently. Subscribers and advertisers might pay lower prices. Consumers might be offered a wider range of programming if companies compete by differentiating their products. However, competition between cable companies is rare when the current definition of "effective competition" is applied.

The Federal Communications Commission, citing 47 U.S.C. § 543(l)(1)(A-D), states effective competition for cable systems exists when one of four tests is met:

> (1) fewer then 30 percent of households subscribe to the cable operator's service (herein referred to ad the "low penetration test"); (2) at least two multi-channel video programming distributors ("MVPDs") serve 50 percent of more of households and at least 15 percent of those households take service other than from the largest MVPD (the "50/15 test"); (3) a municipal MVPD offers service to at least 50 percent of households (the "municipal test"); or (4) a local exchange

> carrier ("LEC") or its affiliate (or any using the facilities of the LEC or its affiliate) offers MVPD service (other than direct broadcast satellite service) comparable to the service of an unaffiliated MVPD (the "LEC test"). (FCC, 2006a)

The first three tests were added to definition of "effective competition" by the Cable Consumer Protection Act of 1992. The fourth test was added to the definition by the Telecommunications Act of 1996.

The FCC's 2005 *Report on Cable Industry Prices* determined that only 8% of cable subscribers nationwide subscribed to a system facing 'effective competition' (FCC, 2006a). In the markets with effective competition, 39% of subscribers have a choice of two or more competing wireline cable systems. In other words, approximately 3.1% of all cable subscribers in the country have a choice of cable companies (FCC, 2006a).

The report shows consumers benefit from competition because cable rates were 7.6% lower in markets defined as having effective competition compared to markets without effective competition (FCC, 2006a). For the markets with direct wireline competition, monthly cable rates were 15.7% lower than markets without effective competition (FCC, 2006a). The legal guidelines for "effective competition" are artificially and politically created by the U.S. Congress, but the data show areas with more competition can produce gains for cable consumers. However, economies of scale make it very difficult for cable companies to enter markets where incumbents are already operating. Adelphia identified only 3.7% of its network as facing direct competition from other cable companies[1] (Adelphia, 2005). Charter Communications' *2007 Annual Report* identified direct competition for between 7% and 8% of homes passed by its

[1] Direct competition means competition for the same customers.

service (Charter, 2008).[2] This shows wireline competition between cable companies affects only a small percentage of all households passed by cable companies.

In contrast, DBS services compete with cable companies nationwide for any household with a clear view of the southern sky. The clear view is needed so a dish can receive signals from the DBS company's satellite. There are very high costs to enter DBS markets, including launching and maintaining expensive satellites. However, there are no additional costs to enter a cable market once the satellite is operating and the receivers are made available to consumers. DBS can effectively compete as a multi-channel video programming distributor, but technological barriers prevent DBS companies from bundling telephone and internet services through their satellites. Despite this technological barrier, the FCC's twelfth *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming* reports over 26 million DBS subscribers as of June 2005 (FCC, 2006b). The large number of subscribers allows DBS services to cover the costs of developing and operating satellites.

Goolsbee & Petrin (2004) studied effects on prices and quality from competition between cable and DBS in 2001. The study examined data from 30,000 households in 317 markets. Cable prices would be approximately 15% higher without competition from DBS, according to estimates in the study. The quality of cable, measured by channel capacity and premium services like pay-per-view, was improved to respond to DBS competition (Goolsbee & Petrin, 2004). The study estimated annual gains in consumer welfare - the difference between the maximum consumers were willing to pay, and what they actually paid -- for individual DBS subscribers as $127 to $190 a year. This totaled approximately $2.5 billion for all DBS consumers (Goolsbee & Petrin, 2004). The

[2] This excludes competition from telephone companies.

estimated annual gains in consumer welfare for individual cable subscribers were approximately $50, totaling approximately $3 billion for all cable subscribers in the U.S. (Goolsbee & Petrin, 2004). This provides further evidence of the importance of competition in cable markets and why research should examine entry barriers.

New technologies could potentially become a more efficient way of allowing households access to video services. Telephone companies are potential competitors for cable systems. AT&T bundles its services with subscriptions to the Dish Network and DirecTV (AT&T, 2008). By the end of 2007 AT&T offered a broadband video service called U-verse that reached 231,000 subscribers through a fiber optic network (AT&T, 2008). AT&T also offers video access to wireless telephone customers. According to Verizon's 2007 *Annual Report* the company has statewide franchises to distribute video in California, Indiana, Florida, New Jersey, and Texas (Verizon, 2008). Verizon provides high speed data, telephone, and video services through a fiber optic network that passes over 9.3 million homes (Verizon, 2008). The network has approximately 943,000 video subscribers (Verizon, 2008). A wide array of video sources also can be accessed through a computer and a broadband internet connection. These include websites, such as abc.com, cbs.com, nbc.com, cnn.com, espn.com, and youtube.com. There are 102 not-for-profit electric utilities in the U.S. that offer video services to consumers (FCC, 2006b).

This shows there is increasing competition for cable companies in many markets. However, in 2004, ten years after DBS companies entered these markets, the National Cable Television Association estimated cable companies still captured 72.71% of the market for multi-channel video program distribution. The DBS services had 24.34% of

the market. Cable and DBS together had 97% of the market for multi-channel video program distribution (NCTA, 2004). Competitive pressure from DBS caused a small decline in the number of basic cable subscribers from 66.9 million in 2001 to 65.4 million in 2004 (FCC, 2006b). This represents a decrease of 2.2% in cable subscribers. This shows DBS was the most important competitor for cable in 2004. However, the still low market share for DBS suggests barriers such as consumer switching costs and government regulations might be limiting competition in cable markets.

Switching Cost Theory

Porter (1979) first proposed a list of potential entry barriers that a firm can use to decrease competition and increase profits.[3] Porter (1980) added switching costs to the list. Switching costs "are one-time costs of switching brands or switching from one supplier's product to another's" (Porter, 1980, p. 33-34). McFarlan (1984) argues new technology can create a switching cost that deters competitors from entering a market. Karakaya and Stahl (1989) found empirical evidence in a decision making exercise by 49 executives of *Fortune* 500 companies that switching costs, along with Porter's (1980) five other barriers to entry were a significant factor in decisions to enter a market. [4]

Klemperer (1987a) identified three different types of switching costs, which are (a) learning costs, (b) transaction costs, and (c) artificial switching costs. Learning costs are the opportunity costs consumers endure learning to use another brand (Klemperer, 1987a). Klemperer (1987a) uses new computer technology adoption as an example. People operating the new computer need to learn how to use its software and hardware.

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[3] Porter (1979) lists economies of scale, product differentiation, capital requirements, cost disadvantages, access to distribution channels, and government policy as potential barriers to entry.

[4] Karakaya and Stahl (1989) also addressed cost advantages, product differentiation, capital requirements, access to distribution channels, and government policy in their survey.

Transaction costs are costs of closing an account with one firm and opening a new account with a competitor (Klemperer, 1987a). Artificial switching costs are created by companies to reward customers for repeat business, such as "repeat-purchase coupons and 'frequent-flyer' programs" (Klemperer, 1987b, p. 138). All three types of switching costs penalize customers who switch brands.

There have been several studies of switching costs and market entry in mobile telephony. Lee, Kim, Lee, & Park (2006) found a regulation allowing consumers to switch mobile telephone providers and keep their phone numbers lowers switching costs. Shi, Chiang, and Rhee (2006) had similar findings in a study of the Hong Kong market that also found lower switching costs caused companies to reduce the fixed prices paid by their subscribers. This shows consumers can benefit from reduced switching costs.

Two forms of switching costs may be present if a consumer switches from an incumbent to a rival cable company or a DBS provider. The first is learning costs, which occur if the consumer has to learn the new cable or satellite platform. For example, the consumer may have to learn the new channel lineup or how to use an interface, such as a receiver or a remote. Transaction costs are the other forms of switching costs. Installation fees become part of the transaction costs paid by subscribers switching cable or DBS services. Klemperer (1987a) argued transaction costs also include the effort and time to close an account and reopen an account with a new firm. Cable subscribers switching providers also pay these costs.

Wise and Duwadi (2005a) found consumers are more likely to switch from cable to DBS in communities with larger increases in cable prices compared with communities with smaller increases in price. This shows incumbent cable companies can keep

customers by limiting the size of price increases. Wise and Duwadi (2005a) attribute this to switching costs consumers face or to differentiation between cable and DBS products. An earlier version of their study claims that cable services almost always charge installation fees to connect new customers (Wise & Duwadi, 2005b). However, Wise and Duwadi (2005b) did not examine the impact of transaction costs and the impact of waiving installation fees as a competitive strategy to lower transaction costs. For example, DirecTV has offered customers free installation with a year-long commitment to its DBS service (DirecTV.com, 2006).

Knittel (1997) found searching for a new long distance carrier is also a switching cost to consumers. The study only examined telephone service, but consumers planning to switch cable or DBS companies could also face search costs to find the available options. All of these costs may become significant barriers that prevent subscribers from switching from an incumbent cable provider, even if a rival provides differentiated or cheaper services.

Knittel (1997) also found switching and search costs were one reason the divesture of AT&T in 1984 did not have the intended immediate effects of lowering rates and reducing the market power of long distance carriers. This shows the importance of understanding switching costs as an anti-competitive force in a telecommunications market, if policy makers are trying to encourage competition.

Building on previous research, Klemperer (1987b) created a model that considers how switching costs affect new and existing customers. The model is designed to measure differences in a firm's power to raise prices by comparing markets with changing consumer tastes to markets with fixed tastes. The model goes beyond the scope

of this study, but Klemperer (1987b) did consider the difference between new and existing customers. This is an important consideration in a cable market, because when people move they disconnect from their existing cable provider, becoming a potential customer for another cable or DBS provider at their new residence.

Government Policy

Porter (1979) listed government policy as a potential barrier to entry into a market. Karakaya and Stahl's (1989) survey found that managers consider government policy when making decisions to enter a market.

There have been two major policy changes intended to encourage competition in cable markets. The first was the Satellite Home Viewer Act (SHVA) of 1988, which allowed DBS providers to retransmit broadcast television signals to households not served by those broadcasters – in other words households outside the local broadcast market. However the law did not allow DBS providers to offer local signals within a broadcaster's market unless the local broadcasters gave their consent. This presented a distinct disadvantage for DBS providers when service began in 1994 as they tried to attract customers watching local broadcasts on cable systems.

A second law, the Satellite Home Viewer Improvement Act (SHVIA) of 1999, would change that. The act allowed DBS providers to offer local television broadcasts in the same markets where the stations were located. The DBS provider did not have to pay royalties. However, the act created a carriage obligation to transmit the signals of all local broadcast stations in the market. DBS providers still needed a station's consent if they only wanted to offer one station.

According to the Dish Network's 1998 annual report, the DBS service only provided local channels to 13 local markets, all in major cities (Dish Network, 1999).[5] The report also mentioned the Dish Network only provided these local channels to "unserved households in the local areas from which those channels originate" (Dish Network, 1999). By the end of 2003, four years after the law changed, the Dish Network offered local channels in "110 of the largest television markets in the United States," representing more than 85% of television households in the U.S. (Dish Network, 2004). The 1997, 1998, and 1999 annual for DirecTV reports failed to address how many local stations the service carried and which consumers in those local markets had access to local television stations prior to SHVIA of 1999.

Clements & Brown (2006) studied the impact of SHVIA of 1999 on the cable industry. The study found a positive relationship between the number of networks cable operators carry and DBS services offering local broadcast stations (Clements & Brown, 2006). That study also found no relationship between cable prices and DBS carriage of local broadcast channels (Clements & Brown, 2006).

Cable systems are facing increasing competition. Direct wireline competition between cable companies exists, but only a small portion of television households benefit from this type of competition. However, starting in 1994 DBS was able to compete with cable systems nationwide. The cable industry is now facing a growing threat of competition from other sources. Traditional telephone companies, such as Verizon and AT&T, are starting to grow fiber optic broadcast networks at a rapid pace. This shows

[5] The 13 markets listed in the report includes Atlanta, Boston, Chicago, Dallas/Ft. Worth, Denver, Los Angeles, Miami, New York, Phoenix, Pittsburgh, Salt Lake City, San Francisco, and Washington D.C.

the importance of researching the effects switching costs might have as a barrier to entry in cable markets.

CHAPTER 3

Conceptual Model

Previous Conceptual Approaches

Previous studies researched consumer switching costs several different ways. Karakaya and Stahl (1989) used a decision making exercise given to 49 *Fortune* 500 executives and found switching costs were a significant factor in decisions to enter a new market. This shows consumer switching costs plays a role in how many businesses function, but the study did not survey consumers. Consumers ultimately decide if switching costs are a barrier for a competing company entering the market. The study, Karakaya & Stahl (1989), also failed to examine industry data to observe effects caused by switching costs.

Another way to research consumer switching costs is directly survey consumers. No survey was found that examined consumer switching costs for cable and DBS. However, there have been studies of mobile telecommunication markets that used surveys to examine switching costs (Hu & Hwang, 2006; Lee, Kim, Lee, & Park, 2005). Lee, Kim, Lee, & Park (2005) surveyed mobile telephone customers in Seoul, Korea and found phone number portability could significantly lower switching costs. Consumer surveys examine details of how consumers make choices and the reasons for those choices. However, these surveys only examine the perceptions of consumers. Consumer surveys fail to examine industry-level effects of consumer switching costs and the size of the barriers to market entry created by consumer switching costs.

Knittel (1997) developed a model that used industry-level data to indirectly study their effects of consumer switching costs. The model has been used in studies of long distance telephone markets (Knittel, 1997) and of competition between cable and DBS providers (Wise & Duwadi, 2005a). Knittel's model will be adapted for the current study.

The Model

Knittel's (1997) conceptual framework is designed to look for evidence of switching costs in markets with two homogenous products that have different prices. The model states consumers will not switch until the price difference is large enough to equal the cost of switching.

Formally, Knittel's (1997) model states consumers switch from firm A to firm B when:

$$P_A > P_B + C, \quad (1.1)$$

where P_A and P_B is the price of the product from firm A and firm B, respectively, and C is the cost of switching. This would give firm A market power, since firm A has the ability to raise price over that of firm B without consumers switching from firm A to firm B (Knittel, 1997). Knittel (1997) also accounted for consumer search costs, which are the costs of finding information about different products available in a market. Knittle (1997) built the following model from the theory in model 1.1 in order to test for search and switching costs:

$$\frac{(P - MC)_i}{P} = f(S_i(t), X_i(y)), \quad (1.2)$$

where $S_i(t)$ is the function of the costs of searching on the determinants of search costs, $X_i(y)$ is the function of the cost of switching on the determinants of switching costs, P is price, and MC is marginal costs.

Knittel (1997) used the model to study the interstate long distance telephone market from 1984 to 1993. The study used industry-level data, which included price and a measure of marginal costs. Knittel (1997) used the Lerner Index – an indicator of the difference between price and marginal cost – to measure of market power. The study found the ability to raise prices above costs was related to transaction fees that new customers paid to join a long distance service. These fees create consumer switching costs in a market with homogenous products.

Only one study was found that attempted to examine the effects of switching costs in the competition between cable systems and DBS providers. Wise & Duwadi (2005a) built on Knittel's (1997) conceptual approach, using industry-level data to examine the effects of consumer switching costs on DBS subscription rates. Knittel's (1997) model was for markets with two homogenous products. However, cable and DBS services are differentiated products.

Wise & Duwadi (2005a) did not control for differentiation. Instead, the study examined two specifications. In the first specification Wise & Duwadi (2005a) examined the effects of the monthly charge per cable channel by cable systems had on DBS penetration. Wise & Duwadi (2005a) did not find a significant relationship between the monthly charge per cable channel by cable systems and DBS penetration. Wise & Duwadi (2005a) concluded that switching costs were present, which kept consumers from switching regardless of the price per channel charged by cable systems or that cross-price elasticity between cable and DBS was insignificant. In other words, overall prices for either service did not significantly affect subscriptions to the rival service.

In the second specification Wise & Duwadi (2005a) utilized three dummy variables for the change in the monthly price per channel from 2001 to 2002: one to represent cable systems that decreased their price per channel by more than 10%, another to represent cable systems that increased price per channel by more than 10%, and a third for cable systems that made less than a 10 percent price change in either direction. Wise & Duwadi (2005a) found a strong, positive, and statistically significant relationship between local DBS penetration and the dummy variable representing cable systems with a 10% or higher increase in the monthly price per cable network. There was no significant relationship between DBS penetration and the two other dummy variables. Wise & Duwadi (2005a) attribute the findings of the second specification to consumer switching costs. Wise & Duwadi (2005a) also found significantly lower DBS penetration if cable systems offered regional sports channels as a form of product differentiation.

These findings should be examined cautiously. Wise & Duwadi (2005a) acknowledge poor instrumentation for the dummy variable representing cable systems with a 10% or more annual increase in price per channel. The model used also assumes consumers value equally every channel carried by a cable system. Wise & Duwadi (2005a) briefly discuss differences in consumer value in channels in a footnote, but fail to mention how effects from providing tiers of channels would affect their results. For example, some cable systems could carry fewer channels that have higher ratings and are more highly valued by consumers, which could increase the cost per channel. Inversely, a cable system could carry more lower rated, cheaper to produce channels. This would the lower the cost per channel. Either strategy could affect the prices charged by a cable system.

The dummy variables fail to examine how much each cable system would need to increase or decrease its price per network carried to equal the price of a DBS service. The study also fails to test if consumers are more likely to switch when products are equal in price, or when the price of DBS equals the price of cable plus the cost of switching.

Also, it is difficult to control for all aspects of product differentiation using Knittel's (1997) model to measure consumer switching cost between cable and DBS. While Wise & Duwadi (2005a) make efforts to control for some aspects of product differentiation, such as the number of premium channels offered on cable, offering of foreign channels, offering of regional sports channels, and the number of local broadcast stations carried, many aspects of product differentiation and consumers' perceptions of product value caused by product differentiation are not controlled for and would be very difficult to control for.

The study does show consumers are willing to switch from a cable service to a DBS service and that some product substitutability exists between cable and DBS. It is also a safe assumption that many aspects of DBS and local cable systems are homogenous. For example, ESPN is a cable network commonly carried on most local cable systems as well as DBS.

Wise & Duwadi (2005a) also find evidence of some product differentiation between local cable systems and DBS and when they examine the effects of regional sports networks. There are cable networks unique to each product. There are also potential differences in the quality of the signals received by consumers, differences in

analog and digital technologies, and differences in the ability to bundle with other products such as telephone and internet access.

Knittel's (1997) model for analyzing consumer switching costs should be adapted to reflect these differences. Consumers would need to actually experience the differences between cable and DBS to determine the full effects of differentiation. However, some differences can be described to consumers before they subscribe, so differentiation can also be treated as a search good. This study develops a revised model to account for the effects of differentiation and switching costs.

Revised Model

This study argues that in the case of DBS and cable consumers will switch from the incumbent cable companies to entering DBS services when:

$$DS_C + DE_C - P_C < DS_{DBS} + DE_{DBS} - P_{DBS} - C, \quad (2.1)$$

where DS_C and DS_{DBS} is the increase from differentiation in the consumer value of cable and DBS, respectively. This difference in value can be discovered by consumers through searching, as indicated by the S. The increase in value from differentiation that consumers actually experience is indicated by DE_C and DE_{DBS} for cable and DBS, respectively. Prices represented by P_C and P_{DBS} are subscription prices for cable and DBS, respectively, and C is the cost of switching.

Residential Mobility

Measuring all aspects of product differentiation would be very difficult to accomplish. However, the unique attributes of cable and DBS markets can offer a different approach to test for switching costs. In these markets a group of incumbent

cable services faced limited competition.[6] The first DBS services became available nationwide in 1994.

The cost of switching from cable to DBS is influenced by more than the price and services available. The effects of switching costs are not static for consumers, instead changing as the consumer's income or circumstances change.

When an individual moves to a new residence, they begin without existing cable or DBS service. Therefore, the switching costs that are always present are absorbed into the fixed costs of moving. This could mean switching costs are less of a deterrent to the adoption of a DBS provider or a cable provider just entering the market. Therefore, incumbent cable providers may lose some potential customers when those customers change residences. A new resident may be more easily attracted to a service with a lower price or a differentiated product than an existing resident who still has to overcome the cost of switching. The new resident would switch under the following condition:

$$DS_C + DE_C - P_C < DS_{DBS} + DE_{DBS} - P_{DBS}, \quad (2.2)$$

while the existing residents would not switch until the condition that exists in equation (2.1), which includes switching costs. The left side of equations (2.1) and (2.2) are identical. However the right side of the equation differs. Under the following condition:

$$DS_{DBS} + DE_{DBS} - P_{DBS} \neq DS_{DBS} + DE_{DBS} - P_{DBS} - C \quad (2.3)$$

It is expected that new residents would switch to DBS more often than existing residents and that would be the result of switching costs, C, in the market.

[6] Before DBS entered the multi-channel video distribution market cable faced limited competition from other cable companies in a few areas, C-Band satellite services, and wireless cable services.

Therefore, this study will examine the effects residential mobility could have on consumer choice to switch services, since residential mobility can be used as a measure of new residents.

Product Differentiation

Since the effects of product differentiation are the same between new residents and existing residents, there is no reason to believe any significant relationships between residential mobility and cable subscriptions or DBS subscriptions could be caused by product differentiation. Switching costs separate the differences in choices between new and existing residents, but not product differentiation.

However, a potential problem product differentiation might pose for Knittel's (1997) revised approach is when the following situation exists:

$$DS_C + DE_C - P_C \geq DS_{DBS} + DE_{DBS} - P_{DBS.} \quad (2.4)$$

In Knittel's (1997) original model, consumers will not switch between competing companies with homogenous products if there are no price savings. Adding differentiation to the model, consumers would not switch if differentiation adds enough value to a service to compensate for any price differences, even in the absence of switching costs. If this situation exists, the service that is at a disadvantage due to differentiation has an incentive to imitate attractive features offered by its rival. This would reduce differences between services, increasing the importance of switching costs for consumers choosing between two increasingly homogenous products.

Something like this occurred in the competition between cable and DBS. When DBS companies first entered the market in 1994, legal and contractual barriers prevented these firms from carrying signals for local broadcasts in many markets. These barriers

were eliminated by SHVIA of 1999, allowing DBS services to include local television signals in most markets.[7] This reduces differentiation, allowing DBS companies to offer products that imitated their cable rivals in one important dimension.

Time

Time is another important factor. Because DBS did not begin competing with cable nationwide until 1994, there is no reason to predict residential mobility had a significant relationship with the number of cable subscribers before that date. After 1994 it would create the condition brought forth in equation (2.1). The changes in SHVIA of 1999 allowing DBS services to add local broadcast signals made DBS a more substitutable and homogenous product with cable, then it could be predicted that cable consumers that were facing the following condition:

$$DS_C + DE_C - P_C \geq DS_{DBS} + DE_{DBS} - P_{DBS}, \quad (2.5)$$

prior to 1999 could end up facing the following situation:

$$DS_C + DE_C - P_C \leq DS_{DBS} + DE_{DBS} - P_{DBS}. \quad (2.6)$$

After 1999 switching costs could become a deciding factor for consumers who found DBS more attractive once it offered local broadcast stations. Therefore, it is important to examine the relationships between residential mobility and subscriptions to cable or DBS throughout the period when DBS first entered the market and then was able to offer local broadcast signals.

[7] In 2006 DirecTV did not provide local television service to approximately 6% of U.S. television households and did not provide local HD channels to 35% of U.S. television households (DirecTV, 2006). In 2006 the Dish Network did not provide local television service to less than 4% of U.S. television households and did not provide local HD channels to more than 50% of U.S. television households (DishNetwork, 2006).

Consumer Income

There are different types of switching costs, and consumer income could have different effects on how consumers react to differing costs. The different types of switching costs could also make it difficult to properly examine any effects income might have on how consumers react to switching costs.

Some costs are monetary. If consumers must pay to switch because there is a connection fee or a charge for new equipment, households with more disposable income can more easily pay these costs. However, households with less disposable income might be willing to pay these short-term costs, if a service has lower long-term prices that generate savings.

Switching costs can also be non-monetary. Examples are time and effort spent searching for and comparing services, time spent waiting for installation of the new service, and learning to use the new service. It is important to distinguish kinds of switching costs because of possible differences in income effects. All switching costs can prevent a consumer from switching brands, but the effects of switching costs might be greater for some consumers than others.

A household with more disposable income might not consider monetary switching costs as important as non-monetary costs, if there were relatively small potential savings from switching to a new service. Inversely, a household with limited income might consider monetary costs more important than non-monetary costs. This would be true if enduring non-monetary switching costs resulted in financial savings that were large enough to be significant for households with lower incomes.

Hypothesis

Wise & Duwadi (2005a) suggest switching costs could be a reason cable companies limit price increases, so this study will look for empirical evidence that switching costs created a barrier to DBS providers competing for existing cable customers. The study will examine relationships between residential mobility, the number of people moving in and out of cable markets, and the change in cable subscriptions in those markets. This is consistent with arguments that switching costs include installation fees, transaction costs associated with the creation of new accounts, and the costs of learning to use a particular company's technology. Therefore this study proposes the following hypothesis:

H1: Residential mobility will have a negative association with the effects of switching costs facing cable company subscribers.

Mobility rates alone may be insufficient to have a measurable effect on switching costs. The literature review suggests increases in competition also may be necessary to significantly affect switching costs. Most cable companies first faced significant competition when DBS was introduced in 1994. This unique situation allows for a natural experiment to examine how new competition affected the relationship between residential mobility and in cable subscriptions. Therefore, this study proposes a second hypothesis as an alternative to the first:

H2: Residential mobility will have a stronger negative association with the effects of switching costs for cable subscribers after 1994.

Clements & Brown (2006) found that cable companies responded to SHVIA of 1999 by offering subscribers more networks in areas where DBS began carrying local

broadcast channels. If SHVIA of 1999 removed a competitive barrier, but switching costs remained constant, then more consumers could choose DBS over cable after 1999. The new law allowed DBS to become more homogenous when compared to cable, increasing the value of DBS. This increased value might offset switching costs for some. Therefore, this study also offers a third hypothesis:

> H3: Residential mobility will have a stronger negative association with switching costs for cable subscribers after 1999.

Income is another variable that could influence consumer switching costs. Consumers with higher disposable incomes may be less likely to pay costs of switching services, if there are limited savings compared to those with less disposable income. Of course, it is also possible consumers with higher incomes can more easily afford monetary-based switching costs, therefore those with higher incomes let switching costs effect them less than those with lower incomes. A household with less disposable income could be more likely to overcome non-monetary switching costs, such as time and effort, to gain price savings, whereas a household with higher income might not overcome the non-monetary switching costs for the same price savings. In either case, income is likely to moderate the relationship between mobility and switching costs, since income might affect the size of the barrier switching costs poses on an individual consumer. This study will not be able to examine this topic in detail and is unable to measure the differences between monetary-based switching costs and non-monetary based switching costs. Since these two types of switching costs can relate to consumer income in different ways it will be important to adequately control for each type of switching cost. However, since income can potentially affect how consumers respond to

switching costs, income will be included as a control variable and the following research questions are examined:

RQ1: What is the direction of the relationship between income and switching costs for cable subscriptions?

RQ2: Does income moderate the predicted relationships between residential mobility and switching costs for cable subscriptions?

CHAPTER 4

Empirical Model and Method of Estimation

Measures Used in the Study

This study examines how residential mobility affected annual changes in cable subscribers as DBS services entered the market beginning in late 1994. The dependent variable is changes in cable subscriptions, and the independent variables are DBS competition and switching costs.

This study will use U.S. states and the District of Columbia as geographic units for measurement of the variables. Alaska, Georgia, and New Hampshire were not included because there was incomplete data available for those states. That left the study with annual data for 47 states and the District of Columbia. This creates 48 cross sectional groups and 13 annual time periods. The data set is strongly balanced.

Data from Nielsen Media Research's *U.S. Television Household Estimates*, which is published annually, will be used to measure annual changes in cable television households. The estimates report the number of cable television households for each state. Annual changes will be computed by subtracting the number of cable television households for the current year from the previous year.

Data directly measuring switching costs was not available. Instead, the study will measure a variable that influences switching costs, residential mobility. Mobility will be measured with existing home sales data from the National Association of Realtors' monthly publication *Real Estate Outlook*. The publication reports sales by state. Data

include the sale of any existing home, condo, or co-op. The data does not include the sale of new homes and condos, or information on rented homes, apartments, or condos. Comparable data on rented households could not be found. Alaska, Georgia, and New Hampshire were excluded because data for existing home sales was not available for three or more years in each of these states. Data was also missing for Maine in 1991 and for Delaware in 1996 and 1997, so those states were excluded from the analysis during those years.

Comparable data for new home sales was excluded from the study because effects from these sales are likely to be captured by another variable, the annual change in television households.

The Census Bureau did not issue annual estimates of residential mobility, which would capture changes in residence for any reason, until 2001. These estimates are based on the American Community Survey, which is not valid for all states in all years. Several other variables that might influence cable subscriptions or consumer switching costs were included as controls.

Income likely affects consumer reaction to switching costs. Median household income was measured with data from the U.S. Census Bureau bureau's Annual Economic and Social Supplement of the Current Population Survey (U.S. Census, 2008). Data for all years is adjusted for inflation by the U.S Census Bureau and represents the value of the dollar in the same year.

The number of households using televisions is used to measure potential cable customers within each market. This data is also found in Nielsen Media Research's *U.S. Television Household Estimates* and is published annually. The annual change in

television households will be calculated the same way as the change in cable subscribers. Households using televisions is expected to be affected by changes in home vacancy rates, creation of new homes, destruction of old homes, residents who are first time television viewers, and residents who no longer use or have a television.

Data on the number of households subscribing to DBS is not available at the state level. The DBS companies do publish the total number of subscribers they have throughout the country by year, but they don't release the location of those subscribers. However, DBS programming is available nationwide, making satellite services available in all cable markets. Therefore, the study indirectly measured the effects of DBS competition on cable systems by examining changes in the number of cable households during the period before DBS was available, when DBS first became available, and then after SHIVIA of 1999 was enacted.

There are other potentially important variables left out of this study because data was not available for most years, and because of problems of endogeneity that cannot be adequately controlled. The price of different cable services was omitted for these reasons, along with measures of quality and the number of different cable providers in each market.

Changes over time were measured by dummy variables for each year from 1992 to 2003. Two interaction variables were created for the period from 1992 to 1999, and 2000 to 2003. The interaction variables were for mobility rates and income.

All data was aggregated at the state level because (a) consistent measurements at of smaller geographic units were not available and (b) this may reduce the bias from omitting some variables.

For example, cable systems frequently do not cover an entire county or exist in more than one county. Therefore, data for the number of subscribers is not restricted by county. Data for median household income is not comparable because it is collected for each county. This problem was overcome by aggregating data at the state level.

Differences in these omitted variables are most likely to exist across smaller geographic units, such as counties. At the state level, these differences would be averaged together. This would make variations in state averages of the omitted variables, such as price, smaller than the variations that would exist between counties or between individual cable system operators. Therefore, by conducting the study at the state level, the researcher hopes to reduce the biased effects from these omissions.

It should be noted that cable franchises are mostly regulated locally by cities or counties. Aggregating data at the state level could also lesson the effects of unseen differences in local regulation practices.

The aggregation has similar effects on variables that are included, such as existing home sales, changes in cable subscribers, and median household income.

Data Analysis

The study uses a regression with fixed-effects transformation. The fixed effects transformation is a method of creating time-demeaned data (Wooldridge, 2006, pp. 485-489). It will average the data within each state and observe the yearly differences from the average for each year in each state (Wooldridge, 2006, pp. 486). Therefore each data value, x_{it}, is transformed to $(x_{it} - \bar{x}_i)$. Similarly, y_{it} is transformed to $(y_{it} - \bar{y}_i)$. After fixed-effects transformation, the transformed data is regressed using ordinary least squares.

Using a regression with fixed-effects transformation offers several advantages. Since the data are aggregated at the state level, there are only 48 usable cross-sectional cases with obtainable data for this study. Using a panel data set with a fixed-effects estimator increases the number of observations to better observe potential relationships between the dependent and independent variables. Fixed-effects estimation also allows the study to use a panel data set and test for differences in a given estimator during different time periods within the same model. This will test the hypothesized relationships at different times before and after competition is introduced from DBS.

Fixed-effects estimators automatically control for any omitted variables that are left constant throughout the study. Wise & Duwadi (2005a) found a significant relationship between DBS penetration and latitude, since households in higher latitudes are more likely to have obstacles between their satellite dish and the DBS satellite in geostationary orbit. Geostationary orbit is a type of geosynchronous orbit where the satellite is positioned approximately 35,790 kilometers directly above the equator (NASA, 2008). Therefore, the further you travel away from the equator toward the north and south poles, the steeper the angle a DBS satellite dish must be tilted to face a satellite in geostationary orbit. A satellite in lower latitudes that is tilted at a more upward angle is less likely to face interference from trees, terrain, and buildings. Fixed effects estimation only examines differences in time demeaned data, so variables such as latitude are already controlled for.

Many apartments do not allow installation of satellite dishes to maintain the aesthetic appeal of the property, prevent damage to buildings, and to maintain contracts with cable systems. Other apartments may operate their own cable systems. Cable

systems that exist only on private property are mostly unregulated, because they do not require access to the public right-of-way to deliver video signals to residents. This study assumes rules regulating satellite dishes for renters are not changed frequently, if at all. The fixed effects model will also control for any local rules and regulations which remain constant during the study. However, changes in rules and regulations are not controlled for and could potentially have a biasing effect on the results of the study.

Annual dummy variables are included in the regressions to control for annual effects that are not caused by the other independent variables in the study. These effects could include nationwide changes in regulation, changes in product quality, product quantity, price, advertising expenditures, or in business operations. Controlling for such changes is particularly important with DBS companies because, unlike cable, DBS companies operate nationwide. These companies offer identical products in all markets, with the exception of local broadcast stations. The price of DBS service is also the same nationwide. However, the dummy variables do not control local changes by cable operators or by DBS companies in local advertising markets.

In order to test the conceptual model and hypothesis this study will utilize a fixed-effects panel regression to test the following model:

$$\begin{aligned} chcblhh = {} & \beta_0 + \beta_1 chtvhh + \beta_2 hmsl + \beta_3 mhi + \delta d92 + \delta d93 + \delta d94 + \delta d95 + \\ & \delta d96 + \delta d97 + \delta d98 + \delta d99 + \delta d00 + \delta d01 + \delta d02 + \delta d03 + \beta_4 d9599hmsl + \\ & \beta_5 d0003hmsl + \beta_6 d9599mhi + \beta_7 d0003mhi + u \end{aligned} \qquad (1)$$

where

i. chcblhh is the annual change in cable subscribers;

ii. chtvhh is the annual change in television households;

iii. hmsl is the annual total of existing homes and condos sold;

iv. mhi is the median household income;

v. d92, d93,...,d03 are annual dummy variables;

vi. d9599hmsl is the interacted variable between hmsl and a dummy variable representing 1995 to 1999;

vii. d0003hmsl is the interacted variable between hmsl and a dummy variable representing 2000 to 2003;

viii. d9599mhi is the interacted variable between mhi and a dummy variable representing 1995 to 1999;

ix. d0003mhi is the interacted variable between mhi and a dummy variable representing 2000 to 2003;

x. u represents the error term.

This model includes the relationship between existing home sales and the annual change in cable subscribers, and also tests for changes in the relationship before and after DBS entered the market. This will be accomplished by interacting the variable hmsl with d9599, which is a dummy variable that represents every year after DBS entered the market until the SHVIA of 1999. The model will also interact hmsl with d0003, which is a dummy variable representing every year in the study after the 1999. Therefore, the estimation of annual existing home sales without an interaction term will represent an estimation of the relationship between existing home sales and annual changes in cable subscribers prior to DBS' entry into the market. Using the interaction terms with annual existing home sales will set up a natural experiment to test the effects of the relationships before and after DBS' entry into the market and before and after SHVIA of 1999.

Median household income will also be interacted twice; first with a dummy variable representing the years 1995 to 1999 and second with a dummy variable representing the years 2000 to 2003.

However, this will leave mhi without the interactions to represent effects of income from 1991 through 1994. The research questions ask about the effect income has on switching costs, so it is important to also examine income during periods when switching costs do not exist and compare it to periods when switching costs do exist.

This study will also examine the following model, which omits income:

$$\text{chcblhh} = \beta_0 + \beta_1\text{chtvhh} + \beta_2\text{hmsl} + \delta\text{d92} + \delta\text{d93} + \delta\text{d94} + \delta\text{d95} + \delta\text{d96} + \delta\text{d97} + \delta\text{d98} + \delta\text{d99} + \delta\text{d00} + \delta\text{d01} + \delta\text{d02} + \delta\text{d03} + \beta_3\text{d9599hmsl} + \beta_4\text{d0003hmsl} + u \quad (2)$$

This model will help determine if median household income affects the estimations of the relationships between existing home sales and annual changes in cable subscribers. If the estimations for hmsl, d9599hmsl, and d0003hmsl are similar to estimates from the first model, that will suggest median household income does not have a relationship with consumer switching costs. However, if the estimations in this model are different, that will be evidence that median household income have a relationship with consumer switching costs.

The annual change in cable subscribers is used instead of total cable subscribers because existing home sales represent a change in ownership of an existing household. This should make the units of these variables more comparable, since they each represent households facing a type of change. Annual changes in television households will be used as a control. The number of television households should be highly correlated with

the number of cable households. The television variable should be a good proxy for annual changes in cable households caused by construction of homes, destruction of homes, and changes in vacancy rates Each of these changes could potentially be problematic because they influence demand for cable.

However, population growth changes the demand for homes, which influences mobility rates. This would create covariance that cannot be controlled for between mobility rates and annual changes in television households. Therefore, this study will also examine the third model, which omits changes in television households:

$$\text{chcblhh} = \beta_0 + \beta_1\text{hmsl} + \beta_2\text{mhi} + \delta\text{d92} + \delta\text{d93} + \delta\text{d94} + \delta\text{d95} + \delta\text{d96} + \delta\text{d97} \quad (3)$$
$$+ \delta\text{d98} + \delta\text{d99} + \delta\text{d00} + \delta\text{d01} + \delta\text{d02} + \delta\text{d03} + \beta_3\text{d9599hmsl} + \beta_4\text{d0003hmsl}$$
$$+ \beta_5\text{d9599mhi} + \beta_6\text{d0003mhi} + u$$

This model might be affected by omitted variable bias, but it will examine the differences between a model affected by multicollinearity and a model without multicollinearity.

Data Summary

Table 4.1 provides summary statistics for the measures of cable subscriptions, television households, income and mobility. The variable chcblhh has a mean of 29,675 subscribers and a standard deviation of 49,068 subscribers per state. Similar to chcblhh, chtvhh has a mean of 23,300 households and a standard deviation of 44,532 households per state. Annual existing home sales have a mean of 100,579 homes sold and a standard deviation of 108,989 homes sold per state. Median Household income has a mean of $43,939 and a standard deviation of $6,813. Median household income has a relatively smaller standard deviation, while the previous three variables have large standard deviations compared to the means.

In addition to overall statistics, Table 4.1 reports the standard deviations, minimums, and maximums of the data estimated by within group effects and between group effects. The between group effects examine differences between the states in the study. The within effects examine time demeaned differences within each state. The within effects estimated standard deviations, minimums, and maximums should represent summary statistics for the data after the fixed effects transformation, since the fixed effects estimator is a within effects estimator.

Table 4.2 provides summary statistics for each variable for 1993, 1997, and 2002. The 1993 statistics are a year prior to DBS' entry into the multi-channel video market. The 1997 statistics are three years after DBS' entry into the multi-channel video market. The 2002 statistics are three years after SHVIA of 1999.

Table 4.2 shows mean changes in subscriptions to cable households decreasing over time. The number of households with televisions decreased, before increasing again. The mean number of existing home sales increased along with household income. Summary Statistics for all annual cross-sections are provided in Appendix A.

Figure 4.1 is a line plot of the annual means for chcblhh, chtvhh, hmsl, and mhi. Home sales increased steadily. Inflation adjusted income increased steadily at a small rate of change. However, the annual changes in households with cable and television fluctuated, and did not usually vary in the same direction. This may be because television purchases are a one-time expense, but cable subscriptions are recurring expenses.

Table 4.3 shows the correlation coefficients for chcblhh, chtvhh, hmsl, and mhi. It shows chcblhh and hmsl is negatively correlated, however the correlation coefficient is

relatively small. This is not unexpected because no relationship is hypothesized for these variables during the years before DBS' entry into the multi-channel video market. Table 4.3 also shows chtvhh and hmsl are strongly correlated with one another.

Table 4.1

Summary statistics of panel data with between group and within group components before fixed effects transformation

		Mean	Std. Dev.	Min	Max	Observations	
chcblhh							
	overall	29674.90	49068.11	-132980	404490	N=	624
	between		33720.71	-556.15	141645.40	n=	48
	within		35951.29	-172627.40	292519.50	T=	13
chtvhh							
	overall	23200.03	44532.29	-199470	396410	N=	624
	between		26408.56	-315.38	126376.90	n=	48
	within		36043.67	-196024.60	294045.40	T=	13
hmsl							
	overall	100579.10	108988.90	6800	733500	N=	621
	between		103967.50	9238.46	552776.90	n=	48
	within		35523.24	-59474.78	284225.20	T=	12.9375*
mhi							
	overall	43936.01	6812.897	27221	61819	N=	624
	between		6206.89	31980.54	57064.46	n=	48
	within		2938.051	33386.78	53885.55	T=	13

*Represents an average, since three data values are missing.

Table 4.2

Summary statistics of data for the years 1993, 1997, and 2002 before fixed effects transformation

		Mean	Std. Dev.	Min	Max	Observations
chcblhh						
	1993	43324.79	44559.64	-2100	220610	n= 48
	1997	26066.46	33026.03	-3230	141530	n= 48
	2002	25666.46	37174.51	-28720	183410	n= 48
chtvhh						
	1993	22308.75	26343.47	-21640	114490	n= 48
	1997	19836.46	29398.11	-4360	129130	n= 48
	2002	23569.58	31929.81	-35090	152370	n= 48
hmsl						
	1993	85704.17	81860.86	9400	436800	n= 48
	1997	97834.04	98907.03	8100	555400	n= 47
	2002	112027.1	116545.4	10600	565100	n= 48
mhi						
	1993	41018.9	6431.175	29522	56756	n= 48
	1997	43995.96	6373.70	31731	58244	n= 48
	2002	45448.04	6757.60	31870	61231	n= 48

Table 4.3

Correlations between chcblhh, chtvhh, hmsl, and mhi after fixed effects transformation for all years

	chblhh	chtvhh	hmsl	mhi
chcblhh	1			
chtvhh	0.316	1		
hmsl	-0.055	0.458	1	
mhi	-0.017	0.207	0.348	1

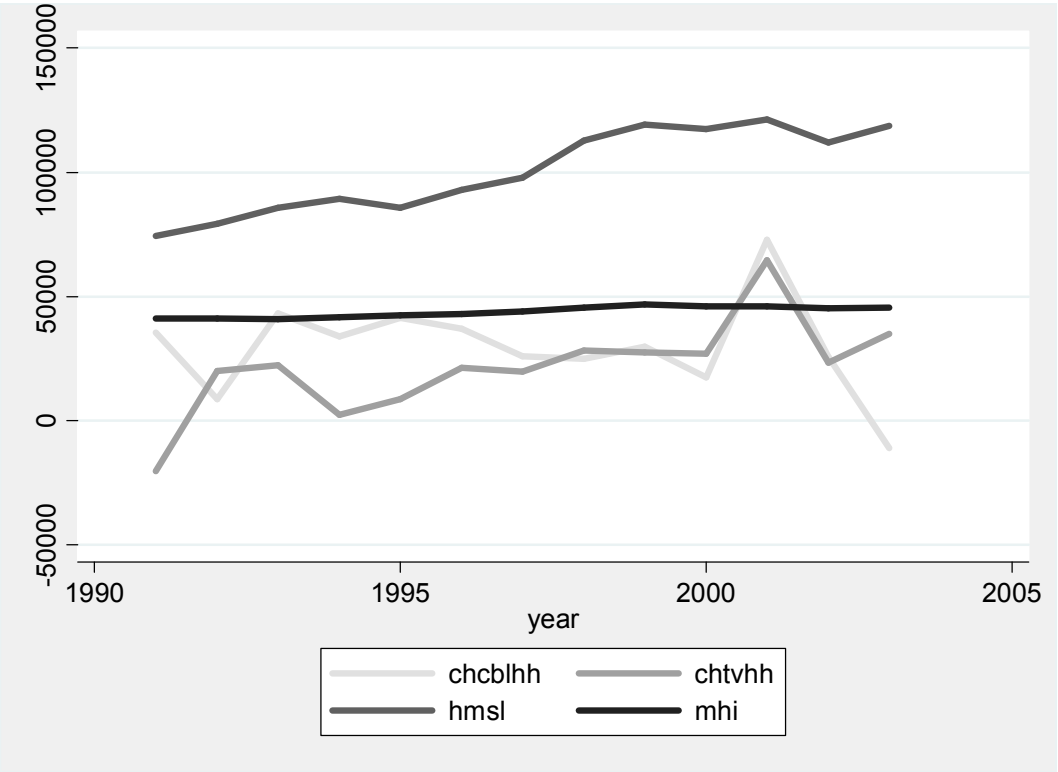

Figure 4.1

Annual means of chcblhh, chtvhh, hmsl, and mhi from 1991 to 2003

CHAPTER 5

Results

Results for empirical models (1), (2), and (3) are shown in table 5.1. There is evidence in all three models that residential mobility was negatively associated with annual changes in cable subscribers. However, the association was not significant until 2000 to 2003. These results support the first hypothesis predicting a negative relationship between mobility and switching costs for cable subscribers. The results during different periods are also consistent with the theoretical discussion of switching costs in cable markets. The variable hmsl, representing home sales from 1991 through 1994, is statistically and economically insignificant. There was no competition from DBS in this period, so there is no expectation of a relationship between mobility and annual changes in cable subscribers.

The second hypothesis predicts a stronger association between mobility and switching costs after DBS entered the market in 1994. There is weak support for this hypothesis. The estimator in model 1 for 1995 to 1999, d9599hmsl, has a negative association with changes in cable subscribers. However, the p value is only .115, less than the standard 95% confidence level for rejecting the null hypothesis that no relationship exists.

If these results are not by chance, the estimation suggests that each increase of 100 home sales was accompanied by a decrease of 6 more cable subscriptions than the

earlier period from 1991 to 1994. The theoretical discussion predicted increased rejection of cable in markets with high mobility after DBS entered the market.

The third hypothesis predicted an even stronger association between mobility and switching costs after DBS began carrying local broadcast signals. This hypothesis is supported by the strong negative association between home sales from 2000 to 2003, d0003hms, in all three models. This association is significant at the 99.9% confidence level in each model.

The estimator in model 1 shows an increase of 100 home sales was accompanied by a decrease of nearly 19 additional cable subscribers, compared with the period from 1991 through 1994. This change is expected if switching costs exist and if residential mobility reduces the effect of switching costs.

A post-estimation test of model 1 was conducted to determine if the estimators for d9599hmsl and d0003hmsl were significantly different from one another. With $F(1, 544) = 28.33$, $p < 0.001$ d0003hmsl was found to be different than d9599hmsl with very strong statistical significance. This shows that the relationship between existing home sales and annual changes in cable subscribers increased significantly for the years 2000 through 2003 compared to the years 1995 through 1999.

The study also asked two research questions about the relationship between income and switching costs. The first question asked what the direction of the relationship is. There is a positive association in model 1 between median household income and cable subscriptions. However, the association is not statistically significant. The closest to significance is the estimator for 2000 to 20003, d0003mhi, but that is only at the 83.4% confidence level. This estimator is unexpectedly large, suggesting a

$1increase in income was associated with an increase in subscriptions of six tenths of a household more than increases in the period from 1991 through 1994.

The second research question asked if income moderates the relationship between mobility and switching costs. The findings show income does moderate the relationship between mobility and switching costs. A comparison of the estimations in models (1) and (2) shows including median household income does affect the estimated relationships between hmsl and hmsl interacted with the time period dummy variables. However, the changes were relatively small. The R^2 increased from .430 to .435 when income was included. The size of the estimates for d9599hmsl and d0003hmsl increased slightly. The estimate for home sales from 1995 to 1999 also moved a bit closer to statistical significance, the p-value changed from 0.148 in model 2 to 0.115 in model 1. Similar changes to the estimates for d0003hmsl show including median household income improved the model's goodness of fit.

The change in television households was included as a control variable because it might capture effects from unobserved changes in the number of households in a market. There was a positive correlation between television households and home sales in Table 4.3. Models 1 and 2 in Table 5.1 show a strong, positive association between changes in television households and changes in cable subscribers. These findings are all consistent with the argument for including this variable.

However, the correlation between home sales and television households suggests the regression models could be affected by multicollinearity. Table 5.2 examines this possibility.

Results in Table 5.2 are for regressions using home sales as a dependent variable. The R^2 of hmsl regressed with fixed effect estimation on median household income and change in television households is .277. The R^2 increases to .328 if yearly dummies are included. This shows there is a moderate level of multicollinearity between home sales and the other variables. Multicollinearity leads to increased variance in estimators of variables that are correlated with other independent variables, but removing variables causing multicollinearity can lead to omitted variable bias (Wooldridge, 2006, pp. 102-104). Multicollinearity can increase the variance for the estimator of hmsl, however removing chtvhh can bias the estimation of hmsl. Large sample sizes can decrease the variance of estimators (Wooldridge, 2006, pp. 102-104). Since this study uses panel data with 621 observations, a moderate level of multicollinearity is not likely to substantially change results for significance tests.

Removing television households from the models in Table 5.1 provides an additional check. Model (3) shows a persistent negative and significant relationship between d0003hmsl and changes in cable subscriptions after television households were removed. However, the estimator for d0003hmsl in model (3) is -0.136, compared to −0.188 in model (1). This shows omitting television households from the model (1) would result in omitted variable bias. Therefore, model (1) was used to examine the results of this study.

Table 5.1

Results of fixed effects estimation on chcblhh

Independent variables	(1)	(2)	(3)
hmsl	.014 (.066)	.009 (.066)	.094 (.072)
d9599hmsl	-.058[a] (.036)	-.052 (.036)	.005 (.040)
d0003hmsl	-.188* (.039)	-.179* (.039)	-.136* (.042)
mhi	.633 (.652)		.421 (.717)
d9599mhi	.057 (.036)		-.141 (.499)
d0003mhi	.636[b] (.459)		.606 (.506)
chtvhh	.435* (.040)	.433* (.040)	
annual dummies included	yes	Yes	Yes
observations	621	621	621
groups	48	48	48
T-bar	12.9	12.9	12.9
R^2 (within)	.435	.430	.314

* $p < .001$
[a] $p = .115$
[b] $p = .166$

Table 5.2

Results of fixed effects estimation on hmsl

Independent variables	(1)	(2)
mhi	3.19* (.439)	.556 (.616)
chtvhh	.399* (.036)	.375* (.039)
annual dummies included	no	Yes
observations	621	621
groups	48	48
T-bar	12.9	12.9
R^2 (within)	.277	.328

* $p < .001$

CHAPTER 6

Conclusions

The study found consistent evidence of consumer switching costs in the multi-channel video distribution industry. The indirect measures of switching costs also show consumers can overcome some of these costs when they change residences. This allows new residents to avoid switching costs when they choose between an incumbent and a rival company entering the market.

These effects are demonstrated by the size of the relationships and when they occur. Conceptually, any relationship between existing home sales and annual changes in cable subscribers before DBS entered the market is not important. The regressions included this period because changes in the relationship are important after DBS entered the market. The estimated relationship between home sales and changes in cable subscribers is negative after DBS' 1994 entry into the market and before SHVIA 1999. This matches theoretical predictions that if switching costs exist, residential mobility will reduce effects from those costs. However the estimator is statistically insignificant at the 95% confidence level, so the study fails to reject the null hypothesis of no change in the relationship between existing home sales and annual changes in cable subscribers. This doesn't mean a change in the relationship doesn't exist. The estimation still is consistent with the theory. Additional study is needed to tell if the predicted estimation occurred by chance or actually exists from 1995 to 1999.

The estimator representing the change in the relationship between sales and subscriptions from 2000 to 2003 was significant and negative. These results are consistent with the predictions that DBS was more competitive after it offered local broadcast television channels. This result solidifies the finding that switching costs are present in the multi-channel video distribution market.

The findings show more than the existence of consumer switching costs. The findings also show how switching costs as an entry barrier can change over time. Consumers can temporarily overcome switching costs each time they move. This probably occurs because the costs of switching services are absorbed into the fixed costs of moving. Data from the U.S. 2000 Decennial Census show 45.9% of the population of the U.S. changed residences from 1995 to 2000 (U.S. Census Bureau, 2003). This is a promising figure for a DBS company, since nearly half the consumers in its market move in five years.

The effects from moving provide a way for an organization entering the market to partially overcome the barrier of consumer switching costs. However, the entrant must be able to finance its costs while waiting for potential consumers to move. If the organization can wait, then it can compete with existing cable providers using price and differentiation of attributes such as quality, service, and content. This competition to attract new residents will increase consumer welfare.

The Satellite Broadcasting and Communications Association of America (SBCA) lobbied on behalf of the DBS industry to show the need for easier access to local channels on DBS systems. In a presentation to the FCC, the SBCA stated that 55% of consumers who investigated DBS systems did not choose to buy DBS because of a lack

of local channels (FCC, 1998). In this case, lobbying from the SBCA helped the market become more competitive and increase consumer welfare.

This effect also has implications for capital requirements. Consumer switching costs are also an effective cost facing the new organization entering the market, because it must raise additional capital to finance operations during the time it takes consumers to switch. The new organization must also recover that investment, perhaps in the form of long-term contracts or higher prices for some services.

There are also spatial implications. Residential mobility allows residents to overcome switching costs, so organizations entering cable markets with lower residential mobility will face higher entry barriers. Inversely, organizations entering markets with higher residential mobility will face lower entry barriers.

The incumbent cable company might also use price discrimination to offset effects from mobility. A cable company might offer competitive pricing to residents who move frequently compared to residents who do not, allowing the company to maintain the pricing power allowed by switching costs. This could limit increases in consumer welfare.

Currently, cable and DBS companies commonly attract customers by offering introductory pricing lasting up to a year. If consumers choose providers by introductory prices instead of long-term prices, companies could gain market power in pricing for consumers who do not move and must overcome switching costs. This strategy could increase welfare for consumers who frequently move, and decrease welfare for consumers who do not move. Further research should examine these potential effects

from introductory pricing. If adverse effects are discovered, regulators might require that companies disclose to consumers the differences in cost from short and long-term prices.

This study also shows the importance of the changes in SHVIA of 1999 allowing DBS to carry local broadcast television stations. The legislation was effective, allowing DBS to become more competitive against cable system operators. This demonstrates the importance of carrying local broadcast stations that many consumers demand. By carrying local broadcast stations, cable and DBS became more homogenous and substitutable. This provides insight into how product differentiation affects consumers. A lack of programming valued by consumers by itself is a barrier to entry. In this case, the barrier was created by asymmetric government regulation; therefore policy was also an important barrier to entry for DBS in cable markets.

There is also an economically and statistically significant relationship between median household income and annual changes in cable subscribers. Median household income made small changes in the estimation of how home sales affect changes in cable subscribers. This shows median household income may be related to consumer switching costs. The estimations did not show a direct relationship between consumer switching costs and income. The estimates do provide evidence of consistent relationships between existing home sales, median household income, and changes in cable subscribers. Both relationships – income and home sales -- could be caused by cable and DBS becoming increasingly substitutable. However, this study is unable to conclude there is a relationship between consumer switching costs and median household income. This study also did not examine different types of consumer switching costs, which could relate to

income differently and effect the estimation. These relationships warrant further study in the future.

Further research can also examine if switching costs exist for consumers who do change residences. For example, consumers might still have to overcome the cost of learning to use a DBS receiver if they are familiar with a cable system. Many consumers move, but stay in the same service area. This might allow them to transfer service instead of choosing a new provider. This could become increasingly important for DBS providers, since most residents will stay within the national service area when they move. DirecTV has a customer service section on its website to help individuals when they move. It promotes free installation of a satellite dish at the new residence if the customer brings their receivers and remotes (Directv.com, 2008).

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APPENDIX A

Annual Cross-sectional Summary Statistics

Table A.1

Annual summary statistics for chcblhh

Year	Mean	Std. Dev.	Min	Max	Observations
1991	35515.63	62863.75	-56360	3426340	48
1992	8685.00	28909.43	-43840	107350	48
1993	43324.79	44559.64	-2100	220610	48
1994	33895.42	35070.21	-2570	151990	48
1995	41527.29	41339.20	670	179220	48
1996	37130.00	38320.20	-2730	163030	48
1997	26066.46	33026.03	-3230	141530	48
1998	24897.92	38066.15	-6900	204070	48
1999	29878.75	43879.47	-5830	248150	48
2000	17477.71	27272.62	-14690	119820	48
2001	72838.13	85389.11	-33930	404490	48
2002	25666.46	37174.51	-28720	183410	48
2003	11129.79	46370.97	-132980	148680	48

Table A.2

Annual summary statistics for chtvhh

Year	Mean	Std. Dev.	Min	Max	Observations
1991	20333.54	57969.47	-199470	117100	48
1992	20058.33	28893.51	-9940	164820	48
1993	22308.75	26343.47	-21640	114490	48
1994	23265.83	29693.30	-67270	161390	48
1995	8700.21	26033.57	-58850	118060	48
1996	21439.79	24970.10	-8260	100770	48
1997	19836.46	29398.11	-4360	129130	48
1998	28395.00	48005.82	-5510	248800	48
1999	27598.75	44768.21	-2420	252610	48
2000	27030.83	31947.36	-3070	165420	48
2001	64695.00	79571.21	6900	676600	48
2002	23569.58	31929.81	-35090	152370	48
2003	35035.42	39117.89	-190	180050	48

Table A.3

Annual summary statistics for hmsl

Year	Mean	Std. Dev.	Min	Max	Observations
1991	74536.17	75389.06	7800	425400	47
1992	79427.08	77741.64	9500	427800	48
1993	85704.17	81860.86	9400	436800	48
1994	89252.08	88407.13	10400	482800	48
1995	85741.67	825155.68	8800	425600	48
1996	92904.26	92103.93	8400	505400	47
1997	97834.04	98907.03	8100	555400	47
1998	112785.40	129357.70	6800	665400	48
1999	119241.70	139501.90	6900	708700	48
2000	117379.20	139443.60	7200	733500	48
2001	121266.70	136285.60	6900	676600	48
2002	112027.10	116545.40	10600	565100	48
2003	118668.80	121104.00	11400	577600	48

Table A.4

Annual summary statistics for mhi

Year	Mean	Std. Dev.	Min	Max	Observations
1991	41175.90	62863.75	-56360	342340	48
1992	41186.81	6547.77	9500	427800	48
1993	41018.90	6431.18	29522	56756	48
1994	41839.46	6006.85	30702	55088	48
1995	42488.52	6123.92	31648	55873	48
1996	43010.02	6182.69	31076	58802	48
1997	43995.96	6373.70	31731	58244	48
1998	45643.90	6650.11	31939	59821	48
1999	46757.27	6700.29	34319	61153	48
2000	46859.58	7081.93	33340	61819	48
2001	46088.71	6885.08	32723	59033	48
2002	45448.04	6757.60	31870	61231	48
2003	45655.04	6664.51	33961	59476	48