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# **Competition between Cable Television and Direct Broadcast Satellite – It's More Complicated than You Think**

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# Competition between Cable Television and Direct Broadcast Satellite – It’s More Complicated than You Think

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FEDERAL COMMUNICATIONS COMMISSION

## Abstract

Direct Broadcast Satellite (“DBS”) is often considered a substitute for basic cable service, but current cable subscribers may face substantial switching costs to move from cable to DBS services. We use aggregate firm-level price data and other related demographic variables to examine the cost of switching from cable to DBS and vice versa. We find some firm-specific attributes and demographic variables that influence consumer choice and switching costs that appear to affect consumers’ desire to switch from one service to another. We then use observation-specific dummy variables that stratify cable price based on changes in the level of cable prices between two periods to examine whether consumer behavior varies depending on the size of price change. We find that when quality-adjusted prices for basic cable services increase substantially, subscribers will switch from cable to DBS, presumably at the point at which the price change is larger than the cost of switching.

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## Table of Contents

|       |                                       |    |
|-------|---------------------------------------|----|
| I.    | Introduction.....                     | 3  |
| II.   | Background and Previous Research..... | 4  |
| III.  | Switching Cost Theory.....            | 6  |
| IV.   | Conceptual Framework.....             | 7  |
| V.    | Empirical Model.....                  | 9  |
| VI.   | Data.....                             | 14 |
| VII.  | Results.....                          | 15 |
| VIII. | Conclusion.....                       | 20 |
| IX.   | Appendix.....                         | 23 |

## I. Introduction

In this paper, we study substitution between cable television and Direct Broadcast Satellite (“DBS”) multichannel services, particularly for the basic cable services to which the vast majority of cable customers subscribe, and any industry characteristics that may affect substitution. Previous examinations of whether cable television prices are constrained by competition have produced inconsistent results. Using different methods and different data sets, economists have examined whether the presence of different competitors can restrain incumbent cable operators from charging supracompetitive prices. This issue is highlighted by persistent increases in inflation-adjusted cable prices, even in the face of what appears to be expanding competition from DBS, and obscured by simultaneous quality increases and new service offerings. Difficulties in acquiring comparable data between cable and its competitors, particularly DBS, have made rigorous examination of substitution between cable and its alternatives even more complicated. We have access to comparable data at the local level, which assists our examination of cable-DBS substitution.

Both cable operators and DBS operators offer a variety of service packages. Cable operators offer a basic package, or *tier*, which by law must include local broadcast channels but often does not include much else.<sup>1</sup> Usually, cable operators offer one or more additional packages of satellite channels in addition to the basic tier, sometimes called “Cable Programming Service Tiers” (“CPSTs”). We follow FCC (2003) in combining the first two packages (i.e., the basic tier and first CPST) of cable service as the “most popular” service. “Most popular” is an apt term, because more than 90% of cable subscribers take these two tiers together before adding any additional services. Together, these two tiers of service form the basis for the cable rates we study, including any per channel rates. Cable operators may also offer other CPSTs and packages of channels transmitted digitally, but these packages tend to have much lower penetration rates. Additionally, cable operators generally offer for an additional charge premium movie channels (termed “premium services” below), such as HBO and Showtime, either a la carte or in packages, and some cable operators offer pay-per-view movies and events, high-speed Internet access, and local telephone service. DBS operators offer various large packages of satellite channels, roughly comparable to cable operator CPSTs, but, due to demand conditions and satellite capacity, can only offer local broadcast stations in some communities, generally in a package by themselves for a few dollars a month. DBS operators, like cable operators, offer premium services for an additional fee.

One study (Goolsbee and Petrin, 2004) found that premium cable is a closer substitute for DBS than the equivalent of cable’s most popular services. In this paper, we focus on the question of whether DBS competition constrains cable pricing for the most popular service and how the presence of switching costs affects substitution between non-premium cable and DBS services.<sup>2</sup> We hypothesize that cable’s most popular service is a substitute for similar DBS service, and vice versa, but that the presence of switching costs limits substitution for small quality-adjusted price changes.

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<sup>1</sup> Cable operators are allowed to offer all of their channels on one large package, but almost never do this. At a minimum, premium movie services are generally offered separately. Cable operators rarely will, however, offer a large number of satellite channels on the lowest tier of service. Cable operators typically offer a small basic tier with little more than local broadcast signals (required to be carried on the basic tier by law) and any channels required by the franchise agreement, plus one or more large packages of channels (CPSTs) consisting exclusively or principally of satellite channels. In many cases, operators bundle niche and broad-appeal channels together. Combining these two types of channels allows operators to differentiate their content from that offered by the local over-the-air broadcasters. Such a strategy also allows cable and satellite operators to price discriminate among consumers, since certain groups of consumers will buy additional bundles of programming and other groups of consumers will not. See Owen and Wildman (1992) for a discussion on the economics of bundling.

<sup>2</sup> In 2002, the FCC analyzed the proposed merger of DBS providers DirecTV and EchoStar and concluded that the two firms’ products were closer substitutes for each other than either product was for cable service. Like Goolsby and Petrin (2004), our data does not distinguish between the two DBS providers, and consequently cannot provide any evidence of cross-price elasticities of demand between the two DBS products.

This paper investigates the substitutability between DBS and cable; identifies proxies that affect consumers' decisions to switch from one service to another; and comments on the policy implications of the results. Using data from the FCC's 2003 survey of cable industry prices, including DBS penetration, we examine whether the cost of switching from cable to DBS plays an important role in substitution between DBS service and the most popular cable service. In other words, we study whether the presence of real or perceived costs discourages consumers from switching between cable and DBS in response to price changes. We find evidence of switching costs, and that switching will occur with sufficient changes in quality-adjusted cable price.

We examine substitution between DBS and cable services using a two-stage process. First, we examine the cross-price elasticity for cable's most popular service for the entire industry by regressing the DBS penetration variable against quality-adjusted cable price, firm-specific cable variables, and demographic variables. The resulting cross-price elasticity is less than unity, suggesting that there is only a limited amount of substitution based on price. Additionally, the coefficient of quality-adjusted cable price is not significant. Other measures of cable quality, such as the number of premium movie channels offered (consistent with Goolsbee and Petrin, 2004), and demographic variables that affect the availability of DBS, however, appear to have an effect on DBS penetration. An inelastic cross-price elasticity can mean that significant switching costs exist for homogenous products or that the two products are differentiated. Second, we examine the reactions of consumers facing different levels of cable price changes. This reveals that consumers faced with large changes in quality-adjusted cable prices for the most popular service will substitute between cable and DBS services, depending upon the magnitude and direction of the price change. Economic theory dealing with consumer switching costs predicts this type of behavior where consumers are reluctant to switch to a competing product due to explicit or implicit switching costs.<sup>3</sup>

## II. Background and Previous Research

For the purposes of this paper, multichannel video service consists of multiple channels or packages of channels of video networks sold to consumers for a subscription fee. Cable's "most popular service" is defined as the basic tier plus the first CPST. Cable service is sold under a system of local franchises, whereby the local government grants a franchise to a cable company to provide service in its area, and regulation is bifurcated between local and federal governments. Cable service can and does vary widely in terms of quality and price even between bordering communities. DBS service, in contrast, is provided to the entire country with very few differences from community to community in terms of quality and price.<sup>4</sup> Access to DBS service is limited to those who can view the satellite by placing a satellite dish facing south without obstruction, so some at more northerly latitudes, or those living in multiple dwelling units not facing south, may be unable to receive DBS service.

Other video providers compete with cable operators, such as overbuilders, wireless video systems, and telephone-provided video services, but these services are provided only in a few areas and

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<sup>3</sup> See Klemperer (1995) for a survey of the literature on switching cost theory. For further detail, see Klemperer (1987a), (1987b), (1992), Beggs and Klemperer (1992), and Klemperer and Padilla (1997).

<sup>4</sup> In general, prices are the same for DBS service, although some short-term promotions may change this temporarily for some consumers or communities. In terms of quality, DBS service is the same for most communities, although DBS offers local broadcast channels in some communities and not others, and more northern latitudes (and the non-continental states and territories) have more difficulty acquiring signals from the satellites, and may not be able to purchase all services.

also vary from community to community.<sup>5</sup> All studies have shown clearly that cable prices are lower and cable quality higher for the most popular cable service in a local service area where an overbuilder is present.<sup>6</sup> Whereas cable prices for the most popular service drop in the presence of an overbuilder, nationwide cable prices continue to rise at a rate much higher than general inflation, notwithstanding the presence of DBS service which is generally equal or superior in quality to the video services offered by cable companies.

Cable television service, or, more broadly, multichannel video service, began in the United States in various small rural communities as a means of bringing broadcast signals from distant urban locations to rural communities that had none. For years, cable television systems only offered this type of “antenna” service. In the 1970’s, however, programmers, beginning with Home Box Office, a premium movie service, began transmitting content via satellite to cable systems for distribution to consumers. A proliferation of satellite-transmitted networks followed, and the modern multichannel video industry was born. During the 1970’s, 1980’s, and early 1990’s, cable systems faced competition only from overbuilders, which existed in only a few communities and almost always went out of business; from wireless video systems in a few more places; and from “C-Band” satellite.<sup>7</sup> C-Band satellite was limited, however, by the multiple thousands of dollars cost of the eight-foot diameter dish that was required and by its inability to provide local broadcast signals. It was, therefore, mainly a luxury item (C-Band generally provided more channels than cable systems) or found in rural areas where cable was not available.

DBS service was launched in 1993, and has grown rapidly ever since.<sup>8</sup> DBS service consists of one or more small satellite dishes placed on the outside of a residence, which receives signals from geostationary satellites. Originally, DBS was technically superior, offering more channels with digital video and CD-quality sound, and perhaps appealed mainly to wealthier multichannel video consumers. DBS had certain limitations, however, such as high set-up costs (\$1000 for equipment and professional installation in 1994 (FCC 2004)) and long-term contracts. DBS was also prohibited from offering local broadcast stations. Over time, the differences in terms of capacity and quality between cable and DBS have narrowed, however, with cable upgrading the number of channels and the quality of its service, DBS set-up costs dropping, and changing laws and regulations that allowed DBS to provide local broadcast stations.<sup>9</sup>

Prior to 1996, little research on the effects of DBS on the cable industry existed. Since then, however, several researchers have attempted to analyze the competitive effects of DBS on cable. For example, Hausman (1999), in comments on the relationship between cable prices and DBS, concluded that DBS is not a substitute for cable, because cable prices only respond in the presence of another cable

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<sup>5</sup> For instance, less than one percent of the more than 33,000 cable local service areas in the country have been certified by the FCC as having “effective competition” from an overbuilder (*i.e.*, 50 percent of subscribers having access to an overbuilder and 15 percent subscribing to service from the overbuilder). (FCC, 2004.)

<sup>6</sup> See, *e.g.*, FCC, 1999-2003.

<sup>7</sup> C-Band satellite was a predecessor to today’s DBS service. It was delivered by satellite to consumers who owned an 8-foot diameter satellite dish. Setup costs limited its effectiveness as a competitor to cable, and today subscribership has fallen to less than one percent of MVPD subscribers (FCC, 2004), with many former C-Band subscribers switching to DBS service.

<sup>8</sup> An earlier attempt at launching DBS service in the late 1980’s by a subsidiary of COMSAT failed. The provider that launched in 1993, PrimeStar, used a slightly different technology than current providers, and PrimeStar has since been absorbed by current providers. The first provider using current technology, DirectTV, launched in 1994.

<sup>9</sup> See <http://www.fcc.gov/mb/shva/> for a summary of the change that allowed DBS carriage of local broadcast signals.

competitor, not to the universal presence of DBS. Hausman attributed this fact to product differences between cable and DBS, such as the inability to provide local broadcast signals, and high DBS start-up costs. Recent work by the FCC and General Accounting Office found significant cable price decreases and cable quality increases where cable overbuild competition exists, but cable price increases everywhere else (GAO, 1999; FCC, 1999-2003). Goolsbee and Petrin (2004) found that premium cable is a closer substitute for DBS than the equivalent of cable's most popular services, but also that all cable subscribers enjoy substantial welfare gains from the entry of DBS from lower cable prices and higher cable quality. Savage and Wirth (2005) found that overbuild entry is more likely in monopoly cable markets with high population density, income, and household growth, and that cable operators in these markets offered more channels with a lower price per channel for basic service, but without examining the effects of DBS competition. GAO (2002) found that the ability of DBS operators to offer local broadcast channels to a local community raised penetration in that community, but did not affect cable prices.

We also follow previous research concerning the cable industry and issues relating to its own-price elasticity, such as Rubinovitz (1993) and Ford and Jackson (1997), both of which employed models similar to the one we specify below.<sup>10</sup> Crawford (2000) studied the consumer welfare effects of the 1992 Cable Act, finding that cable operators responded strategically to rate regulation, moving services and changing product offerings, and that there was no net consumer welfare gain from the 1992 Cable Act. Crawford's finding is relevant to the conclusions we reach below.

The review above indicates a paucity of studies that examine cable and its possible substitutes, especially the effect of DBS service on demand for and pricing of cable's most popular service. In particular, we know of no study that examines the effects of switching costs on consumer choice in this industry. Due to improvements in FCC data collection and a new method of examining this problem, we are able to provide some insight on cable-DBS competition.

### III. Switching Cost Theory

In many markets, consumers face costs of switching between different services large enough to change consumer behavior and limit substitution. Klemperer (1987) identified three types of switching costs: transaction costs, learning costs, and artificial or contractual costs.<sup>11</sup> Transaction costs are incurred to begin service with a provider and/or to terminate service with a previous provider. Learning costs are those required to become comfortable with a new product or service. Firms create artificial switching costs through marketing or contractual terms, such as long-term contracts, to "lock in" a consumer to the firm's product. In addition to explicit costs, implicit switching costs also exist, particularly based on a lack of knowledge about a substitute service.

We anticipate that all three types of explicit switching costs exist in the MVPD industry. Both cable and DBS charge installation fees, and DBS charges for equipment in some cases: these are transaction costs.<sup>12</sup> Additionally, there is the time and inconvenience required to research alternative

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<sup>10</sup> Other important studies of the cable industry include Mayo and Otsuka (1991), Chipty (1994, 1995, and 2001), Beil, et al. (1993), Otsuka (1993), and Emmons and Prager (1997). Older research on substitution between cable and other products does exist, but it is of limited value, because the industry has changed so drastically in the interim. (See, e.g., Webbink, 1986; Bykowski and Sloan, 1990).

<sup>11</sup> We follow Chen and Hitt (2002) in this discussion.

<sup>12</sup> Cable almost always charges an installation fee, although sometimes consumers can self-install. DBS subscribers can also self-install, but will still have to pay any equipment fee. Given the nature of installing DBS equipment (climbing on the roof, aiming the satellite dish at a satellite, running wiring to televisions), we expect most consumers would rather pay a fee than self-install. With some limited-time offers, consumers can

services and to have one installed. Learning costs may be substantial, particularly for a consumer switching from an older, less-advanced cable service to DBS service. DBS, in particular, uses long-term contracts in exchange for reduced installation or equipment fees.

Knittel (1997) offers the following model in his application of switching costs to long distance telephone service, which we adapt to this study. A consumer pays  $c$  to sign up with a cable company, A, and must pay  $c$  to change to another MVPD, such as a DBS provider. If  $c$  equaled zero, then a consumer would switch between MVPDs whenever the price of another firm fell below that of the current provider. With the presence of a positive switching cost, however, the consumer will not switch providers unless the price of another firm is more than  $c$  below cable company A's price. Hence, even if other providers charge below the price for cable, cable company A can earn positive profits at a higher price.

An obvious implication of switching costs is that purchase of a service in the current period depends positively on the purchase of the same service in the previous period. Additionally, consumers will switch in a second period when their switching cost is overcome through a change in price charged in the first period that is larger than the switching cost. We exploit these two implications to search for evidence of switching costs in the MVPD industry.

We hypothesize that switching costs exist in the MVPD industry and affect consumer substitution between cable's most popular service and comparable DBS service. Thus, each provider has some ability to raise prices within a range without losing subscribers, but, if price rises by more than the switching cost, consumers will switch between services. We model these factors below. We use quality-adjusted price to account for differences in packaging between otherwise homogeneous services. We also use differences in price changes faced by consumers in different communities to observe whether sufficiently large price changes can induce switching.

### III. Conceptual framework

Our analysis is based on an examination of consumer behavior in a multi-product market. According to economic theory, individuals select goods and services that provide the maximum level of utility or satisfaction subject to an income restraint. An individual's decision to consume is influenced by consumer preferences, the product's characteristics, price, prior consumption or use of the product, and socio-economic factors. Switching costs may also affect consumer choice.

The switching cost associated with consumer choice may be measured by using direct or indirect methods. The direct method uses consumer-level data that represent revealed or stated preferences of the consumers regarding particular goods or services. Individual consumption patterns and histories may be collected by various methods, including consumer surveys (Office of Fair Trading, 2003). The direct method for measuring switching costs is based on the random utility framework pioneered by McFadden (1974), and yields the best information regarding switching costs, but we are prevented from using it here by the lack of consumer level data.

The indirect method uses aggregate firm data rather than individual consumer data to estimate switching costs. Since demand elasticities are related to consumer choice, the indirect method estimates the cross-price elasticity to identify the existence of switching costs. More specifically, a low cross-price elasticity of demand for products that are functionally homogeneous usually indicates the existence of a

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avoid installation and/or equipment costs for DBS, but this often is for limited service (all televisions must watch the same program) or requires long-term contracts, which constitutes a contractual switching cost.

high level of switching costs between products. Simply stated, when consumers are faced with products that are homogeneous, a low cross-price elasticity of demand would mean that a seller could raise its price without significant loss of its current customers. Of course, a low cross-price elasticity of demand could also mean that the products are not functionally homogeneous, but we examine this possibility more thoroughly with the second specification we estimate. Additionally, although price is the key identifier of switching costs, consumer choice is also influenced by product- and firm-specific characteristics, including quality, breadth of product variety, and ease of use. These product- and firm-specific characteristics may increase or decrease switching costs.

In the present analysis, in order to simplify estimation, we first assume that cable and DBS provide “most popular” services that are functionally equivalent when examined using quality-adjusted cable prices. While differences between cable and DBS services still exist, the services have become increasingly similar over time. Since DBS operators now are allowed to distribute local broadcast channels, and since many cable operators have upgraded their systems to offer more channels and digital services, DBS and cable provide similar services. We realize that this is a simplification that may not be accurate in all local multichannel video markets, but we believe that it is a reasonable simplification.<sup>13</sup> Further research using different econometric methods can more fully examine whether this simplification fully captures the nuances of the multichannel video market. Under this assumption, we estimate firm-level demand functions for DBS using cable prices and firm-specific information. We expect that the estimated cross-price elasticity from the DBS demand function will indicate the presence or absence of switching costs between cable and DBS. The presence of switching costs for functionally equivalent goods would be revealed by a positive cross-price elasticity of demand of less than one (Office of Fair Trading, 2003).<sup>14</sup> We specify this DBS demand function as follows:

$$DBSP = f(P^S, P^O, Q^C, Y) + \varepsilon \quad (1)$$

where DBSP is DBS penetration;  $P^S$  is the price of substitutes;  $P^O$  is DBS price;  $Q^C$  is a vector of firm-specific cable attributes that affect consumer choices and reasons to switch from one product to another;  $Y$  is a vector of exogenous factors that can shift demand; and  $\varepsilon$  represents random fluctuations in demand. Since DBS service generally is offered for the same price everywhere, our estimated specifications include only cable prices.<sup>15</sup>

We realize that the assumption of functional equality of cable and DBS services may not hold in all markets, so that the finding of a cross-price elasticity of demand below one does not, by itself, provide strong evidence for the existence of switching costs sufficient to discourage substitution. As noted above, however, in the presence of switching costs, current consumption depends positively upon previous

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<sup>13</sup> One piece of evidence supporting this idea is a recent Beta Research study showing that DBS and cable subscribers have very similar viewing preferences (Horeb, 2004). This implies that consumers do not feel they must turn to one service or another for particular programming or services.

<sup>14</sup> With perfectly homogeneous goods, any price elasticity less than infinity would indicate the presence of switching costs. Since there is some differentiation between the goods examined in this case, we would not expect that result. Given that some differences remain between the cable and DBS goods examined, a positive price elasticity less than one indicates the presence of switching costs, or significant differentiation.

<sup>15</sup> DBS providers do offer promotions under which, for example, installation is offered free, a limited amount of equipment is subsidized (i.e., for one television), or monthly rates are discounted for a few months, but these are all short-term offers. Otherwise, DBS subscribers to a particular provider pay essentially the same rates for the same package of service everywhere in the country. The discounts and promotions may lower the existence or perception of switching costs mentioned elsewhere in the paper. Differences in local taxes may also affect relative prices and the effect of switching costs.

demand, and consumers will switch products with switching costs, but only when the price exceeds the switching cost. We, therefore, estimate a second specification that stratifies communities based on the change in quality-adjusted cable price between 2002 and 2001. If the estimation results show that consumers facing different levels of price change reacted differently, *e.g.*, substituted to a greater extent in the face of larger price changes, the case for the presence of significant switching costs is strengthened. This second function is the same as equation (1) above but cable price ( $P^S$ ) is divided into three separate variables based on cable price changes between 2001 and 2002. Therefore, the reactions of consumers facing particularly large cable price increases or decreases are captured separately from those facing small cable price increases or decreases. This specification will reveal whether consumers facing large quality-adjusted price changes react differently, thus implying that switching costs exist and can be overcome by large price changes.

### III. Empirical Model

As mentioned above, we estimate two specifications. Our aim in estimating these specifications is to examine the factors that affect consumer's decision to subscribe to DBS and to reveal the relative importance of costs of switching from cable to DBS. We include several cable specific variables in the specification to examine the effect of cable characteristics on a consumer's decision to switch from cable to DBS, such as the number and/or presence of premium, regional sports, foreign language, and high definition channels locality-by-locality. The first specification is a fairly straightforward measure of the effect of various cable system characteristics and demographic variables on DBS penetration. This specification has been used previously to study the MVPD industry, such as in Rubinovitz (1993) and Ford and Jackson (1997). Using the demand function in Equation (1), we assume constant elasticities, so that the estimated demand equation takes the form:

$$DBSP = e^{B_0} P^S B_1 Q^c B_2 Y^{B_3} e^\varepsilon \quad (2)$$

Taking the natural log of each side yields:

$$\ln DBSP = B_0 + B_1 \ln P^S + B_2 \ln Q^c + B_3 \ln Y + \varepsilon \quad (3)$$

Note that the coefficients represent elasticities in this model specification. Specifically, the first specification we estimate is as follows:

$$\begin{aligned} LDBSP_i = & B_0 + B_1 * LCABPERSAT_i + B_2 * LPREM_i + B_3 * CABINT_i + B_4 * CABREGSPORT_i + \\ & B_5 * CABFOREIGN_i + B_6 * CABHIDEF_i + B_7 * LNOVERAIR_i + B_8 * LNLAT_i + \\ & B_9 * LPOVERTY_i + B_{10} * LMULTDWELL_i + B_{11} * DBSOVERAIR_i + \varepsilon_{1i} \end{aligned} \quad (4)$$

Where:

LDBSP is the log of DBS penetration, or the percentage of television households taking DBS, in a local community also served by cable;

LCABPERSAT is log of the monthly charge per cable satellite channel for the basic tier plus the next additional package of channels, a quality-adjusted price for cable;<sup>16</sup>

<sup>16</sup> "Satellite channels" are channels such as CNN and ESPN that cannot be received locally via over-the-air antennas. A "per satellite channel" charge represents a quality-adjusted price, because it represents the per unit charge for channels that cannot be received without cable or DBS service. Determining a "per unit" price is complicated for the multichannel video industry. Cable channels are sold in packages for a monthly

LPREM is the log of the number of premium movie channels offered by the cable system;

CABINT is a dummy variable for whether the cable system offers high-speed Internet access;

CABREGSPORT is a dummy variable for whether the cable system offers one or more regional sports channels;

CABFOREIGN is a dummy variable for whether the cable system offers one or more foreign language channels;

CABHIDEF is a dummy variable for whether the cable system offers one or more channels in high definition format;

LNOVERAIR is the log of the number of local broadcast channels in the community;

LNLAT is the log of the latitude of the community;

LPOVERTY is the log of the percentage of households under the poverty limit in each community;

LMULTDWELL is the log of the percentage of households within multiple dwelling units (“MDUs”);<sup>17</sup>

DBSOVERAIR is a dummy variable for whether one or both DBS operators offers local broadcast signals in the community;

and  $\epsilon$  is the random error term. Subscript  $i$  denotes cross-section observations 1 through 525.

The second specification is an extension of the first, but it uses observation-specific dummy variables to divide communities according to the change in price per satellite channel each community faced between July, 2001 and July, 2002. The method can reveal differing consumer behavior in choosing between DBS and cable in reaction to different quality-adjusted cable price changes. The second specification we estimate is as follows:<sup>18</sup>

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fee, but few consumers watch all of the channels in the package. Therefore, individual consumers perceive some channels as worthless and some channels as highly valuable (sufficiently valuable to cause them to purchase the package even though they do not value all of the channels in the package), and, of course, the value of individual channels varies from consumer to consumer. “Quality adjusted” price is also complicated, in that various measures of quality (ratings, Emmy awards, license fees, etc.) could be used. In our model, for simplicity, we use the monthly rate divided by number of channels for the first two packages of channels. We chose to use the first two packages because these together represent the most popular cable service received by more than 90% of subscribers, and we believe that it is reasonable to assume that the quality-adjusted price of these services plays a pivotal role in consumer choice between cable and DBS services.

<sup>17</sup> We define a multiple dwelling unit as one that contains two or more housing units in one building.

<sup>18</sup> We thank Kit Baum, Greg Crawford, George Ford, and Tracy Waldon for assistance in improving this specification from an earlier version.

$$\begin{aligned} \text{LDBSP}_i = & C_0 + C_1 * \text{PLUSTENDROP}_i + C_2 * \text{NEG10TO10}_i + C_3 * \text{PLUS10RISE}_i + \\ & C_4 * \text{LPREM}_i + C_5 * \text{CABINT}_i + C_6 * \text{CABREGSPORT}_i + C_7 * \text{CABFOREIGN}_i + \\ & C_8 * \text{CABHIDEF}_i + C_9 * \text{LNOVERAIR}_i + C_{10} * \text{LNLAT}_i + C_{11} * \text{LPOVERTY}_i + \\ & C_{12} * \text{LMULTDWELL}_i + C_{13} * \text{DBSOVERAIR}_i + \varepsilon_{2i} \end{aligned} \quad (5)$$

Where all the variables are as above, except:

PLUSTENDROP is an interactive dummy variable that equals the log of the 2002 cable monthly charge per satellite channel for the basic tier plus the next additional package of channels if the local community experienced a 10 percent or larger drop in that price between 2002 and 2001, or zero if not;

NEG10TO10 is an interactive dummy variable that equals the log of the 2002 cable monthly charge per satellite channel for the basic tier plus the next additional package of channels if the change in the local community price was between a ten percent drop and a ten percent rise between 2002 and 2001, or zero if not;<sup>19</sup>

PLUS10RISE is an interactive dummy variable that equals log of the 2002 cable monthly charge per satellite channel for the basic tier plus the next additional package of channels if the local community experienced a 10 percent or greater rise in that price between 2002 and 2001, or zero if not;

and  $\varepsilon$  is the random error term. Subscript  $i$  denotes cross-section observations 1 through 525.

See the Appendix for details on the number of localities that fell within each of these categories. We believe this method will reveal points, if they exist, at which consumers switch from cable to DBS services or vice versa.

We recognize that the functional forms of these specifications do not constitute demand functions in the classic sense, in which the quantity demanded (*i.e.*, a number of units; in this case, subscriptions) is modeled as a function of its own price and characteristics; the price and characteristics of substitutes; and demographic variables. In this case, we use DBS penetration instead of number of subscriptions. We follow other studies that use cable penetration instead of number of subscriptions, such as Mayo and Otsuka (1991) and Chipty (2001).<sup>20</sup> Since very few households purchase more than one subscription, both penetration and number of subscriptions are relevant measures of demand.<sup>21</sup> Additionally, we use no measure of DBS price, but this is appropriate since DBS price does not vary from locality to locality.

In the second specification, we examine current period price for cable, but stratified into three groups according to the change in quality-adjusted price since the previous period, between 2002 and 2001. We believe this specification will capture both the current period cross-elasticity for each group,

<sup>19</sup> Admittedly, this is a wide middle range, and it would be preferable to have additional price change strata. Difficulties in instrumenting for more variables, however, prevent us from looking for more break points.

<sup>20</sup> Another possible approach is a discrete choice demand specification, following Goolsbee and Petrin (2004).

<sup>21</sup> A limited number of households purchase both cable and DBS, presumably because those consumers want features from both services. The Federal Communications Commission does not have a current estimate for the current number of households that subscribe to more than one service, but characterize it as “low” and ignore the effect of these subscribers when estimating total MVPD subscribers in the industry (FCC, 2004).

and the cross-period nature of switching costs, i.e., that in the presence of switching costs, current consumption depends on previous consumption and on whether changes in price overcome switching costs. Thus, if the second specification shows that consumers faced with large changes in quality-adjusted cable price switch between cable and DBS, and the first specification shows a positive but less than unitary cross-price elasticity, we would hypothesize that this indicates that switching costs hinder switching in the presence of small changes in price.

One concern with estimating these specifications is that consistent estimation of the parameters is precluded if there exists a simultaneous relationship between LDBSP and LCABPERSAT, PLUSTENDROP, NEG10TO10, and PLUS10RISE. A C-Statistic test reveals the existence of this problem, so that OLS estimators will not be consistent.<sup>22</sup> Simply put, LDBSP may partially determine these variables, which may in turn partially determine LDBSP. To handle this problem, we employ an instrumental variable least squares regression technique. The variables we use as instruments in the first specification are **OVERBUILD**, **CABVERTINT**, **LCABSUBSYS**, where:

**OVERBUILD** is a dummy variable, which equals one if the cable system faces an overbuild competitor and zero if not;

**CABVERTINT** is a dummy variable, which equals one if the cable system is vertically integrated with a provider of programming, and zero if not; and

**LCABSUBSYS** is the log of number of subscribers to the cable system that serves the local community.

The second equation required additional instrumental variables. We used the above variables as instruments and added **LNATIONALSUBS**, **LOWPENETRATION**, **LDENSITY**, where:

**LNATIONAL SUBS** is the log of the number of total subscribers served in the U.S. by the owner of the local cable system;

**LOWPENETRATION** is a dummy variable, which equals one if the cable system meets the FCC effective competition test for low penetration, and zero if not;<sup>23</sup> and

**LDENSITY** is the log of the population density for each community.

We follow Crawford (2000) in using instruments that affect the marginal cost of providing cable service. **CABVERTINT** captures the ability of cable operators to lower costs by purchasing programming from their affiliates at true marginal cost (Chipty, 2001). **LCABSUBSYS** and **LNATIONALSUBS** reflect increased bargaining power and cost savings gained from horizontal size (Chipty, 1995). Population density affects system maintenance costs. Neither **OVERBUILD** nor **LOWPENETRATION** are related to marginal cost, but cable systems in both of these situations price differently than other systems (FCC, 2003), and correlation tests reveal no relationship between these variables and LDBSP.

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<sup>22</sup> See Baum, Schaeffer, and Stillman (2003) for a discussion of the C-statistic, or “difference-in-Sargan” test.

<sup>23</sup> The “low penetration” test of effective competition specifies that cable operators with less than 30 percent penetration are exempt from rate regulation.

A second concern when estimating both specifications is the existence of heteroskedasticity, given the form of the specifications and the cross-sectional data set. In this case, the variance of  $\varepsilon_{1i}$  and  $\varepsilon_{2i}$ , denoted  $\sigma_{1i}^2$  and  $\sigma_{2i}^2$ , respectively, may not be fixed. Heteroskedasticity is a common problem in cross-section studies where observations may not be perfectly homogeneous. Because the data set employed considers communities with widely differing characteristics, the possibility of non-constant variance raises the issue of the efficiency of the estimator. To account for this problem, we report robust coefficient estimates; these are efficient in the presence of arbitrary heteroskedasticity. Multicollinearity is also a potential problem, but a variance inflation factors test shows no evidence of it.

We note that we have excluded digital cable service tiers from the model, although we do include cable systems that offer digital tiers. We choose to focus on the per-satellite channel price of the first two packages of service. Taken together, these two tiers are by far the most popular services on cable systems, with penetration rates typically above 90% of cable subscribers. These two tiers almost always are transmitted in analog format. Additional CPSTs and digital packages tend to have much lower penetration rates. Obviously, digital cable services are valuable to some consumers, and play a role in the decision to choose between cable and DBS. We believe our contribution, however, is to illustrate the effect that the presence of DBS has on the basic services that almost every cable subscriber receives and that some, especially low income subscribers, receive exclusively. This complements Goolsbee and Petrin (2004), which showed that premium cable is the closest substitute for DBS service. Additionally, given the high penetration rates, we believe that it is reasonable to assume that the quality-adjusted price of the first two packages of service play a pivotal role in consumer choice between cable and DBS services.

A positive coefficient for LCABPERSAT would indicate that DBS penetration increases with the quality-adjusted price of cable, and supports our assumption that consumers view cable and DBS as substitute goods. A coefficient below one would indicate that DBSP is relatively unresponsive to changes in cable price and thus would be consistent with the presence of significant switching costs. A negative sign for the coefficients of LPREM, CABREGSPORT, and CABHIDEF would indicate that DBS penetration is lower where cable systems offer more high-value channels, perhaps indicating that the addition of these services reduces the benefit from switching to DBS. Similarly, negative coefficients on the CABINT variable would indicate that DBS penetration is suppressed in communities where cable operators offer Internet access. In other words, it would indicate that consumers value receiving this service from their cable provider, and thus attach a lower benefit to switching from more advanced cable systems to DBS. Additionally, negative and significant coefficients for CABFOREIGN and LNOVERAIR would indicate that subscribers view foreign language cable networks and local broadcast channels as significant factors when deciding between DBS and cable services.

Another factor affecting consumer choice of multichannel video distributor is the latitude, represented in our specifications as LNLAT.<sup>24</sup> Latitude increases moving from south to north. In the United States, DBS satellites are in the southern sky. The quality of DBS reception may deteriorate with a move to the northern latitudes, because the angle of the dish points closer to the horizon with higher latitude, and creates a greater chance that an obstruction will prevent a household from receiving DBS service. A negative and significant coefficient for LNLAT would indicate that DBSP is suppressed at higher latitudes because of the dish angle. Similarly, a negative coefficient for LMULTDWELL would indicate that DBSP is suppressed where a higher percentage of households are multiple dwelling units (MDUs), because a certain percentage of those living in MDUs do not have access to the southern sky.

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<sup>24</sup> Goolsbee and Petrin (2004) alerted us to the importance of this variable, and Keith Brown and Noel Uri suggested it to us independently, and gave us the necessary data.

We expect the sign of the coefficient of LPOVERTY to be negative, indicating consumers below the poverty line are less able to afford DBS service due to an inability to afford setup costs and monthly fees.<sup>25</sup> Consumers unable to afford DBS service may instead choose cable, or may not be able to afford any kind of MVPD service.

Finally, we expect the coefficient of DBSOVERAIR to be positive, showing that DBS provision of local broadcast signals increases penetration in that area. Since cable operators are required to provide these signals, DBS provision reduces differences between the services. DBS operators have consistently maintained that the ability to provide local broadcast signals increases DBS penetration in those areas (FCC, 2004).

Assuming that switching costs are shown in the first specification, as evinced by a low cross-price elasticity, our second specification is designed to show additional evidence for switching costs, even if cable and DBS services are differentiated products in some markets. As noted above, a low cross-price elasticity may indicate switching costs, or that DBS and cable are differentiated products. If consumers facing small changes in price do not substitute, but those facing large changes in price do substitute, this provides additional evidence that something is interfering with substitution. Under this scenario, consumers facing small price changes will show little substitution between DBS and cable: the coefficient for NEG10TO10 could be either positive or negative, but we would expect that the coefficient will not be statistically significant in the presence of switching costs, because we would not expect a relationship between DBS penetration and small changes in cable price. Consumers facing significant changes in quality-adjusted cable price, however, will overcome their switching costs (*i.e.*, the gain in welfare from switching between services will be greater than the switching cost), and substitution between DBS and cable service will increase or decrease DBS penetration. The coefficient of PLUSTENDROP should be negative, indicating a lower DBS penetration in areas where the quality-adjusted cable price recently has dropped significantly. Conversely, the coefficient of PLUS10RISE should be positive, indicating a higher DBS penetration in areas in which the quality-adjusted cable price recently has risen significantly.

#### IV. Data

In the past few years, new sources of data have become available that make possible the direct comparison of local cable characteristics with DBS penetration. This study uses data on DBS collected by the FCC in recent years as part of its *Annual Survey of Cable Industry Prices* (“*Price Survey*”). The survey collects cable operator-reported data on cable systems, and also asks operators to estimate how many consumers subscribe to DBS within the local area. The sample is intended to be representative of U.S. cable systems. All of the data come from July 2002, unless otherwise noted below. Demographic data come from the Census Bureau. The data from the Census Bureau are two years older (as of 2000) than the other data, with the exception of the MDU data, which are from 1999. For descriptive statistics for all the variables, see the Appendix.

One objection to this data set is that the sample for the *Price Survey* was chosen to be representative of the cable industry nationwide, rather than representative of the DBS industry. The cable survey data set, however, is very large, and was chosen to be representative of a nationwide industry serving almost every community in the nation. It should, therefore, also be representative of communities served by DBS nationwide. Once matched up with the DBS data, the total number of observations is 525. A second possible objection is that the DBS data are cable-operator reported, so that the data on DBS for

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<sup>25</sup> Additionally, a consumer must have a credit card in order to receive DBS service. Those below the poverty line are less able to gain approval to receive a credit card.

some communities may be inaccurate. Many cable operators purchase actual DBS subscriber numbers by zip code from *SkyReport*, but others do not. Unfortunately, we are unable to quantify the extent of this potential measurement error, but we believe that it is reasonable to assume that cable operators are knowledgeable about the extent of DBS competition in the areas they serve.

Finally, the potential bias of this sample should be noted. The sample was chosen to be representative of cable service received by the average cable subscriber, and most cable subscribers receive their cable service from large systems. As a result, the communities that appear in the sample tend to be served by cable systems with a large number of subscribers. These are systems that, on average, offer a higher number of channels at higher prices, and thus communities served by smaller cable systems may be underrepresented. This potential bias, however, may make it less likely that DBS and cable are differentiated products for the markets in the sample, since DBS operators offer packages that are equivalent or superior to the offerings of large cable systems. Therefore, our approach for treating cable and DBS as homogeneous services would be appropriate for this sample.

## **V. Results**

The results from the estimations using equations (4) and (5) are summarized in Tables 1 and 2. In general, these specifications measure the sensitivity of DBS penetration to various factors. These specifications may be viewed as demand equations. The second specification is considerably less robust than the first, probably due to difficulties in instrumenting for three variables, but still is statistically significant and provides interesting insights into the question of whether switching costs affect consumer behavior in this market. The main difficulty in interpretation concerns coefficients of cable characteristics; these can represent either, or both, substitution behaviors (i.e., reasons why people shift between cable and DBS), and/or consumer demand for those characteristics. We attempt to interpret the results in light of this duality.

TABLE 1

## FIRST SPECIFICATION: DBS PENETRATION AND FULL INDUSTRY QUALITY-ADJUSTED CABLE PRICE

## THE FULL MODEL REGRESSION COEFFICIENTS AND GOODNESS OF FIT STATISTICS

(t-statistics in parentheses)

| First Stage<br>Variable                  | Estimated Coefficient | t Statistic |
|------------------------------------------|-----------------------|-------------|
| LPREM                                    | -0.08***              | (4.91)      |
| CABINT                                   | -0.15***              | (4.98)      |
| CABREGSPORT                              | -0.09**               | (3.02)      |
| CABFOREIGN                               | -0.04                 | (1.30)      |
| CABHIDEF                                 | 0.00                  | (0.05)      |
| LNOVERAIR                                | 0.06*                 | (1.78)      |
| LNLAT                                    | 0.25***               | (3.19)      |
| LPOVERTY                                 | 0.01                  | (0.83)      |
| LMULTDWELL                               | -0.00                 | (0.01)      |
| DBSOVERAIR                               | -0.04                 | (1.56)      |
| OVERBUILD                                | -0.06                 | (1.09)      |
| CABVERTINT <sup>26</sup>                 | 0.09***               | (4.33)      |
| LCABSUBSYS                               | -0.01                 | (1.25)      |
| Constant                                 | -0.68                 | (2.07)      |
| Observations                             | 525                   |             |
| Centered R-Squared                       | 0.38                  |             |
| Shea Partial R-Squared                   | 0.04 <sup>27</sup>    |             |
| F-Statistic Test of Excluded Instruments | 7.67***               |             |
| F-Statistic                              | 14.35***              |             |

  

| Second Stage<br>Variable | Estimated Coefficient | t Statistic |
|--------------------------|-----------------------|-------------|
| LCABPERSAT               | 0.82                  | (0.80)      |
| LPREM                    | -0.13                 | (1.30)      |
| CABINT                   | 0.11                  | (0.58)      |
| CABREGSPORT              | -0.13                 | (0.97)      |
| CABFOREIGN               | 0.27**                | (2.19)      |
| CABHIDEF                 | -0.06                 | (0.41)      |
| LNOVERAIR                | -0.20                 | (1.31)      |
| LNLAT                    | -1.15***              | (2.66)      |
| LPOVERTY                 | -0.12**               | (2.00)      |
| LMULTDWELL               | -0.16**               | (2.26)      |
| DBSOVERAIR               | 0.13                  | (0.99)      |
| Constant                 | 3.03**                | (2.32)      |
| Observations             | 525                   |             |
| R-Squared                | 0.12                  |             |
| F-Statistic              | 4.36***               |             |
| Hansen J Statistic       | 8.40**                |             |

\*\*\* - significant at 99% confidence level, \*\* - significant at 95% confidence level, \* - significant at 90% confidence level

<sup>26</sup> Similar to Crawford (2000), CABVERTINT has the greatest explanatory power.<sup>27</sup> For this specification, the Shea partial R-Squared equals the standard partial R-Squared, because the estimation includes only one endogenous variable. See Baum, Schaeffer, and Stillman (2003).

**TABLE 2**  
**SECOND SPECIFICATION: DBS PENETRATION AND STRATIFIED QUALITY-ADJUSTED CABLE PRICE**  
**THE FULL MODEL REGRESSION COEFFICIENTS AND GOODNESS OF FIT STATISTICS**  
**(t-statistics in parentheses)**

| Variable           | Estimated Coefficient | t Statistic |
|--------------------|-----------------------|-------------|
| PLUSTENDROP        | -1.12                 | (0.32)      |
| NEG10TO10          | 0.91                  | (0.58)      |
| PLUS10RISE         | 14.21**               | (2.10)      |
| LPREM              | 0.06                  | (0.30)      |
| CABINT             | 0.15                  | (0.51)      |
| CABREGSPORT        | -0.36                 | (1.37)      |
| CABFOREIGN         | 0.19                  | (0.75)      |
| CABHIDEF           | -0.51*                | (1.82)      |
| LNOVERAIR          | -0.19                 | (0.83)      |
| LNLAT              | -1.54**               | (2.29)      |
| LPOVERTY           | -0.22**               | (2.15)      |
| LMULTDWELL         | -0.15                 | (1.30)      |
| DBSOVERAIR         | 0.41*                 | (1.74)      |
| Constant           | 4.89*                 | (1.88)      |
| Observations       | 525                   |             |
| F-Statistic        | 2.05**                |             |
| Hansen J Statistic | 6.97*                 |             |

\*\* - significant at 95% confidence level, \* - significant at 90% confidence level

| <b>First Stage Diagnostics</b> |             |             |            |                 |                                     |
|--------------------------------|-------------|-------------|------------|-----------------|-------------------------------------|
|                                | F-Statistic | Centered R2 | Partial R2 | Shea Partial R2 | F-Statistic of Excluded Instruments |
| PLUSTENDROP                    | 2.05***     | 0.11        | 0.06       | 0.04            | 3.21**                              |
| NEG10TO10                      | 10.87***    | 0.32        | 0.05       | 0.03            | 3.87***                             |
| PLUS10RISE                     | 1.91**      | 0.06        | 0.02       | 0.01            | 2.03*                               |

\*\*\* - significant at 99% confidence level, \*\* - significant at 95% confidence level, \* - significant at 90% confidence level

The F-statistic and partial R-squared for the first stage indicate that the first stage regression has a reasonably high explanatory power for the endogenous variable.<sup>28</sup> The Hansen J statistic, an overidentification test of all instruments, indicates that the model is correctly specified, and that the instruments meet orthogonality conditions.<sup>29</sup> Results from the diagnostics tests of the second specification are somewhat less encouraging, perhaps due to the inclusion of three endogenous variables in the specification.<sup>30</sup> Given the diagnostic test results reported above, we are very confident in the

<sup>28</sup> Bound, Jaeger, and Baker (1995) recommend using first stage statistical tests as a means of examining whether the endogenous variable is correctly identified.

<sup>29</sup> See Baum, Schaeffer, and Stillman (2003).

<sup>30</sup> We omit reporting the first stage results for all three endogenous variables for the second specification due to space concerns. The reported diagnostics should allow the reader to assess the validity of the specification.

identification of PLUSTENDROP and NEG10TO10. We are less confident in PLUSTENRISE, which may suffer from weak instrumentation, and thus its coefficient should be interpreted with caution.

In the first specification, the coefficient of LCABPERSAT is positive but not statistically significant. There are two possible interpretations. The first interpretation is that switching costs are sufficiently high to discourage substitution between cable and DBS services. A second, alternative interpretation is that the low and insignificant cross-price elasticity indicates that cable and DBS are differentiated products. This is a testable hypothesis requiring additional work beyond the scope of this paper. Switching cost, where the products are differentiated, would require estimation of cross-price elasticity of demand over time (Office of Fair Trading, 2003). Additionally, the magnitude of the coefficient indicates that DBS penetration is relatively unresponsive to changes in the monthly charge per cable satellite channel. For the purposes of this paper, we assume we have accounted for differences between cable's most popular tier and DBS through the specification of our model, particularly through the use of quality-adjusted cable price. We examine this assumption further in the second specification, which we interpret as showing evidence of significant switching costs for consumers choosing between cable and DBS services.

In the second specification, the observation-specific dummy variables for cable price, PLUSTENDROP, 10TO10RISE, and PLUS10RISE, indicate the presence of significant switching costs. The coefficient of PLUSTENDROP is negative, showing lower DBS penetration in areas with a large drop in cable per-satellite channel price, perhaps through substitution to cable, or simply through a lack of substitution to DBS. The coefficient of PLUSTENDROP is not statistically significant, however, creating doubts about strong interpretations of this variable. One possible explanation of the low statistical significance of the coefficient is that DBS subscribers are less able or willing to switch back to cable even when cable prices drop significantly, perhaps due to long-term contracts signed with DBS providers. Long-term contracts represent an artificial switching cost, as discussed above. The coefficient of PLUS10RISE, representing communities with large quality-adjusted cable price increases, is positive and has a large magnitude, showing higher DBS penetration in these areas, perhaps through substitution from cable to DBS. The coefficient of NEG10TO10 has a positive sign, but, as expected, no statistical significance, showing that in communities with little cable price change, cable price has little or no relationship to DBS penetration. We believe it is reasonable to conclude that there is no relationship between cable price and DBS penetration in these communities, at least partially because of the presence of switching costs.

In the first specification, the coefficient for LPREM is negative but not significant, indicating perhaps that the number of high-value video services offered by the cable operator plays a role in the penetration of DBS, as would be expected. This result is consistent with the findings of Goolsbee and Petrin (2004) that premium cable is a closer substitute for DBS than the most popular service. Thus, the quality of cable service available as measured by the number of premium services offered may affect acceptance of DBS. This result, in combination with the low t-statistic for LCABPERSAT, may mean that cable and DBS compete in terms of quality instead of price, consistent with the findings of GAO (2003). In the second specification, the coefficient is positive, but very close to zero, and of almost no statistical significance, perhaps reflecting difficulties in instrumentation. A similar interpretation for the negative coefficient of the CABHIDEF variable in both specifications is reasonable, that cable provision of high-value video services lowers DBS penetration. We note that very few cable systems in the sample offered high-definition channels, and that consumer ability to receive high-definition signals on an appropriate television was quite low at the date of the survey.<sup>31</sup>

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<sup>31</sup> Again, in the second specification, the statistical significance drops, perhaps reflecting difficulties in instrumentation.

The positive signs for the coefficients of CABINT and CABFOREIGN may represent consumer demand for advanced services, and parallel demand for DBS as an advanced service. Because DBS offers foreign language channels at a level at or above most cable systems, this is particularly true for CABFOREIGN in the first specification, which is significant at a 95% confidence level. CABINT is not statistically significant in either specification, however, indicating that Internet access service is not an important factor in choosing between cable and DBS.<sup>32</sup>

The negative sign for the coefficient of CABREGSPORT in both specifications, although with low statistical significance, indicates that DBS penetration is suppressed in areas where cable operators offer regional sports channels. This result is interesting due to a peculiarity in regulation of cable operator-owned cable networks. The FCC's "program access" rules require programming networks that are affiliated with cable operators to offer their service to cable competitors such as DBS operators, with one Congressionally-mandated exemption. Vertically integrated networks can deny access to their program networks if the networks are delivered terrestrially, instead of via satellite. (Wireless microwave transmission is also used, and is not covered by program access rules.) Additionally, there is no requirement that non-vertically integrated networks offer their services to competitors to cable, so it is possible for cable incumbents to negotiate exclusive carriage agreements with non-vertically integrated networks. Terrestrial delivery is impractical for national networks, because no cable operator owns a sufficiently broad terrestrial distribution network to deliver a programming network to the entire country. In some areas, however, cable operators' distribution networks are broad enough to transport regional networks terrestrially, and thus the networks could be exempt from program access regulations. Some cable operators have bought or developed regional sports networks and, in some cases, cable operators have also bought the sports franchises that are carried on these regional sports networks.

We, therefore, can think of three circumstances that may be contributing to reduced DBS penetration where cable operators carry regional sports networks. First, cable operators may be reducing DBS penetration by making unavailable to DBS providers affiliated regional sports networks transmitted terrestrially.<sup>33</sup> Second, cable operators may be able to make unavailable to DBS providers non-vertically integrated regional sports networks, which are not covered by FCC program access rules, by signing exclusive carriage agreements. Third, the terms of the carriage agreements for some regional sports networks, either affiliated or unaffiliated with cable operators, may make them uneconomical for DBS providers to carry. In other words, the revenue gained through carriage of regional sports networks may not exceed the cost of carrying them, even if not carrying the networks reduces subscribership in some areas.<sup>34</sup> The low statistical significance of the variable, however, cautions against giving strong weight to these interpretations. Additionally, it is unlikely that the result can be explained exclusively based on vertically integrated regional sports networks, since, as far as we know, only Comcast SportsNet in

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<sup>32</sup> We note that almost all consumers who can subscribe to cable Internet access service can do so without subscribing to the cable operator's video service, although sometimes at a higher cost. Frequently, consumers also have the choice of DSL high-speed Internet access service. Therefore, it is perhaps not surprising that cable provision of high-speed Internet access service is not a significant factor for consumers in deciding which *video service* to subscribe to.

<sup>33</sup> See FCC (2004), pp. 80-81 for a discussion of this issue. Firms that compete with incumbent cable operators indicate that circumvention of program access rules through regional terrestrial delivery is a significant problem, but cable operators dispute this assertion.

<sup>34</sup> For instance, EchoStar has declined to carry the Yankees Entertainment and Sports Network (YES Network), a regional sports network that is unaffiliated with cable operators and is made available to all MVPDs. DirecTV carries YES Network, and claims that it has increased subscribership. (See <http://www.skyreport.com/skyreport/apr2002/041002.htm>.) Another factor in the calculation for DBS operators is channel capacity: in some cases, it may not be worth using a nationwide slot for a regional channel that will appeal mainly to viewers in one region.

Philadelphia is both delivered terrestrially and denied to DBS operators. Therefore, to the extent that this result is valid, it is likely due to a combination of the factors listed above.

In both specifications, the negative signs for the coefficients of LNOVERAIR, LNLAT, LPOVERTY, and LMULTDWELL are all as expected. Broadcast channels are a substitute for subscription video services for some consumers, such that areas with more broadcast channels have lower DBS penetration. As explained above, consumers at higher latitudes are less likely to be able to receive DBS service, and the estimation reflects this negative relationship. Similarly, consumers living in MDUs potentially have more difficulty pointing a satellite dish in the necessary southern direction. Finally, consumers below the poverty line are less able to afford DBS service, probably due to set-up costs and a requirement for a subscriber to have a credit card to initiate service. Each of these variables represents non-cable characteristics of local markets that affects DBS penetration.

Finally, both specifications show a positive coefficient for DBSOVERAIR, as expected. Apparently, the ability to provide local broadcast signals does increase DBSP in a local area. One way to think of this result in the context of this model is that the provision of local broadcast signals lowers the cost to consumers of switching to DBS, in that they do not have to install or pay for installation of a broadcast antenna in addition to the cost of DBS equipment.

## VI. Conclusion

Overall, this paper generates interesting results that point to areas for further investigation, and complements and extends previous work on cable-DBS substitution by Goolsbee and Petrin (2004). Given the current debate over cable rate increases, the results presented above, particularly from the second estimated specification, have important policy implications. These results indicate that, as previously shown by Goolsbee and Petrin, consumers view DBS as a substitute for cable in terms of higher quality services offered, such as premium movie and high-definition channels. Additionally, even for basic cable services, consumers appear to turn to DBS as a substitute for cable when facing large quality-adjusted cable price increases, but may turn to cable as a substitute for DBS to a lesser extent when presented with large quality-adjusted cable price decreases. The latter result may be due to long-term contracts for DBS service that increase the cost to consumers of switching from DBS to cable. The presence of switching costs, however, limits substitution between cable and DBS services when quality-adjusted price changes are small.<sup>35</sup> These findings are consistent with the hypothesis that DBS providers are a constraining factor on quality-adjusted price increases for basic cable services by cable firms. Previous studies that examine per channel cable prices indeed show that, on average, per channel cable prices change very little from year to year, for an average of 0.9% per year between 1998 and 2002. (See, *e.g.*, FCC, 2003, and Table 3, below.) Taken in concert with rapidly rising total cable subscription rates (an average of 7.1% for programming and equipment between 1998 and 2002), this implies that most cable operators are adding satellite channels nearly as fast, or faster, than they are raising their total package prices.

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<sup>35</sup> Obviously, other factors may also limit switching between cable and DBS, such as cable offering bundles of services, or offering advanced services such as video-on-demand. Our model only addresses the effects of price changes on the switching decision.

TABLE 3

## CABLE PER CHANNEL RATE VERSUS CONSUMER PRICE INDEX

|                                                        | July<br>1995 | July<br>1996    | July<br>1997    | July<br>1998    | July<br>1999     | July<br>2000    | July<br>2001    | July<br>2002    | Average '98-<br>'02 |
|--------------------------------------------------------|--------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|---------------------|
| Rate per channel<br><i>percent change year-to-year</i> | \$0.604      | \$0.618<br>2.3% | \$0.635<br>2.8% | \$0.645<br>1.6% | \$0.642<br>-0.5% | \$0.645<br>0.5% | \$0.656<br>1.7% | \$0.664<br>1.2% | 0.9%                |
| Consumer Price Index                                   | 152.5        | 157.0<br>3.0%   | 160.5<br>2.2%   | 163.2<br>1.7%   | 166.7<br>2.1%    | 172.8<br>3.7%   | 177.5<br>2.7%   | 180.1<br>1.5%   | 2.3%                |
| Cable CPI                                              | 201.1        | 214.9<br>6.9%   | 231.1<br>7.5%   | 246.5<br>6.7%   | 255.4<br>3.6%    | 267.3<br>4.7%   | 279.7<br>4.6%   | 297.3<br>6.3%   | 5.2%                |

Source: FCC (2003).

One possible way of looking at the multichannel video market, supported by the results in this paper, is in the context of the theory of switching costs. In the multichannel video market, the incumbent cable operator commands a large market share, and cable subscribers may consider switching from cable to DBS as implying a perceived or real switching cost. In a situation where price discrimination between new customers and repeat customers is not possible, and where the consumer switching cost is high, the incumbent would charge supra-competitive rates to existing subscribers and not compete for new subscribers. The new entrant would compete only on the fringe of the market and serve new subscribers. The incumbent may also provide a whole array of services (e.g., cable operators providing high speed Internet services), thus making the cost of switching to other multichannel services higher than before for its current subscribers. Our results point to this possibility, since it appears that consumers switch multichannel video providers only in response to relatively large price changes, not small ones. In other words, consumers are reluctant to change due to real or perceived switching costs, but can be pushed over that hurdle by price increases that exceed their perceived switching cost.

We also find that DBS penetration is lower where cable operators carry regional sports channels. This is likely due to a combination of factors discussed above. Two of the factors may involve cable operators limiting DBS operator access to regional sports networks. If this is true, cable operators may be able to offset competitive pressures from DBS, and thus may be able to impose larger price increases without losing subscribers to DBS where they are able to transmit vertically-integrated regional sports networks terrestrially, or are able to reach exclusive carriage agreements with non-vertically-integrated regional sports networks. There may be, however, benefits from the program access exception for terrestrial delivery (such as providing incentives for cable operators to develop regional programming) that outweigh the harms from reduced competition.

As noted above, it appears that DBS can act as a constraint on cable prices even for basic services, because sufficiently large quality-adjusted price increases result in increased DBS penetration. Thus, large quality-adjusted price increases for the most popular or basic cable service may not be sustainable for cable operators. Additionally, if DBS has driven quality improvements in the market, the lack of consumer substitution in response to small cable price changes may be less important for consumer welfare (i.e., consumer welfare gain from quality improvements may outweigh welfare loss from higher prices). The restraining effects of competition appear discontinuous or "lumpy," although ultimately effective in restraining the market power of cable operators. Analyses of market competition that fail to take into account switching costs may conclude that competition with DBS will not constrain cable prices, or even be used to justify cable rate regulation. The results of this paper do not support such conclusions. Additionally, Crawford (2000) found no net consumer welfare benefit from cable rate regulation, even in the absence of competition, due to evasion of the regulation. Moreover, over time, the

two products have become more similar, and with reduced setup costs for DBS, perhaps consumers will substitute more readily between cable and DBS in the future.

The findings in this paper point to areas for additional research, such as estimation of a differentiated products model to examine further the role of switching costs in this market, and the addition of digital cable service to this type of study. Moreover, monitoring the presence and effect of switching costs in this market will support an economically efficient government policy by revealing with more precision the interaction between competitors in the market.

# APPENDIX

TABLE 4

## DESCRIPTIVE STATISTICS\*

| Variable       | N** | Mean     | Standard Deviation |
|----------------|-----|----------|--------------------|
| DBSPC          | 525 | 0.16     | 0.13               |
| PERSAT02       | 525 | 0.83     | 0.31               |
| PLUSTENDROP    | 55  | 0.76     | 0.31               |
| NEG10TO10      | 410 | 0.84     | 0.32               |
| PLUS10RISE     | 60  | 0.86     | 0.26               |
| PREM           | 525 | 76.1     | 44.5               |
| CABINT         | 374 | N/A      | N/A                |
| CABREGSPORT    | 408 | N/A      | N/A                |
| CABFOREIGN     | 374 | N/A      | N/A                |
| CABHIDEF       | 30  | N/A      | N/A                |
| OVERAIR        | 525 | 11.3     | 4.36               |
| LAT            | 525 | 38.5     | 4.85               |
| POVERTY        | 525 | 0.09     | 0.07               |
| MULTDWELL      | 525 | 0.30     | 0.17               |
| DBSOVERAIR     | 307 | N/A      | N/A                |
| OBDUM          | 24  | N/A      | N/A                |
| VERTINT        | 265 | N/A      | N/A                |
| SUBSYS         | 525 | 90,311.0 | 135,908.7          |
| NATSUB         | 525 | 333.9    | 121.6              |
| LOWPENETRATION | 52  | N/A      | N/A                |
| DENSITY        | 525 | 2,748.5  | 5,338.1            |

\* In this table, we report the true numerical value of these variables, not the log of that number, so some of the variables no longer carry an “L” or an “LN” prefix.

\*\* For dummy variables, N reflects the total that equaled one. For the interactive dummy variables, N reflects the total that fell within the range of price change reflected in that variable, described above. The mean and standard deviation for interactive dummy variables reflects the per cable satellite channel charges for communities within the range.

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