

# Vertical Integration, Market Foreclosure, and Consumer Welfare in the Cable Television Industry

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*I examine the effects of vertical integration between programming and distribution in the cable television industry. I assess the effects of ownership structure on program offerings, prices, and subscriptions, and I compare consumer welfare across integrated and unintegrated markets. The results of this analysis suggest two general conclusions. First, integrated operators tend to exclude rival program services, suggesting that certain program services cannot gain access to the distribution networks of vertically integrated cable system operators. Second, vertical integration does not harm, and may actually benefit, consumers because of the associated efficiency gains. (JEL L10, L22, L40)*

The strategic effects of vertical mergers and their impact on consumer welfare have long been a source of debate in economics and antitrust.<sup>1</sup> Theory suggests that vertical integration may be used to facilitate the strategic practice of market foreclosure, by which an integrated firm denies a rival access to an input for the purpose of gaining monopoly power. In such instances, vertical integration can raise prices of both intermediate and final goods and harm consumer welfare.<sup>2</sup> Theory also suggests that vertical in-

tegration may have a number of efficiency-improving effects that ultimately lower prices, improve product quality, and thus increase consumer welfare.<sup>3</sup> In practice, vertical mergers may well result in a combination of strategic and efficiency effects. Thus, assessing the welfare effects of integration requires weighing the relative importance of the various effects.<sup>4</sup>

This paper examines vertical relationships between programming and distribution in the cable television industry to determine the effects of vertical integration. The paper catalogs a number of important strategic and efficiency effects that suggest that integrated firms engage in foreclosure but are also able to eliminate successive monopoly markups, internalize the choice of product mix, and lower transactions costs. The analysis offers a methodology to assess

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<sup>1</sup> Martin K. Perry (1990) summarizes the extensive literature on vertical integration.

<sup>2</sup> In the 1950's and 1960's, the Department of Justice used the principle of preventing vertical foreclosure as a rationale for stopping a number of vertical mergers. In the 1970's and 1980's, critics of foreclosure theory (including Richard A. Posner, 1976; Robert H. Bork, 1978; Posner and Frank H. Easterbrook, 1981) argued convincingly that market foreclosure could never be a rational business strategy, and the principle of vertical foreclosure was removed from the 1982 and 1984 U.S. Department of Justice *Merger Guidelines*. More recently, a group of papers (Michael A. Salinger, 1988a; Oliver Hart and Jean Tirole, 1990; Janusz

A. Ordovery et al., 1990) has developed rigorous theoretical models in which vertical foreclosure can occur in equilibrium. This development has resulted in a new wave of antitrust concern about vertical foreclosure.

<sup>3</sup> Vertical integration can eliminate successive monopoly markups, internalize service and quality externalities, and reduce transactions costs. See Fritz Machlup and Martha Taber (1960), Oliver E. Williamson (1979), and Salinger (1991) for discussion of these effects.

<sup>4</sup> Fred M. Westfield (1981) and Herman C. Quirmbach (1986a, b) show, in rigorous theoretical models, that final product prices may rise or fall as a result of vertical integration, depending on the relative magnitudes of strategic and efficiency effects.

the relative importance of these effects and then determines, in the case of cable television, the net effect of integration on consumer welfare.

The cable television industry provides an ideal setting for the study of vertical integration. The industry is characterized by varying degrees of integration between program service providers and cable system operators. Program service providers are upstream firms, which include both providers of premium services such as Home Box Office (HBO) and providers of basic services such as Nickelodeon. Cable system operators, such as Time Warner and Tele-Communications Inc. (TCI), are downstream firms that distribute program services to final consumers. Integration between programming and distribution has raised concerns that competition among services may be stifled and consumers harmed if cable operators, anxious to favor the services they control, strategically foreclose competing services.<sup>5</sup> Refusal to carry rival services is the form of market foreclosure thought to be prevalent in the cable industry, but the question of whether vertically integrated firms actually refuse to carry competing services on their distribution networks has not as yet been answered. Moreover, the net effect of vertical integration on consumer welfare is unknown.

Using system-level data from the 1991 *Television and Cable Factbook (Factbook)*, I study the effects of ownership structure on downstream-business practices. The standard industrywide practice is to sell a bundle of basic program services, called "basic cable," and to tie the sale of individual premium services to the sale of basic cable. Within this framework, cable operators have available a number of different instruments to maximize profits. In 1991, operators were able to choose how many and which basic and premium services to carry on their cable systems, and what prices to charge. I estimate the effects of vertical integration on product offerings, prices, and number of subscriptions.

I find that vertical integration within the cable industry has a number of important effects.

<sup>5</sup> See Federal Communications Commission (FCC) (1992), Thomas G. Krattenmaker (1994 p. 419), and Federal Trade Commission (FTC) (1996).

First, integration does result in some degree of market foreclosure.<sup>6</sup> Operators who own premium services offer, on average, one fewer premium service and one to two fewer basic services than do other operators. In particular, operators who own premium movie services are less likely to carry the rival basic movie service, American Movie Classics (AMC). In addition, TCI and Comcast, two operators who own the basic shopping service QVC, are less likely to carry rival shopping service Home Shopping Network (HSN), and they are less likely to carry both QVC and HSN.<sup>7</sup> These results are statistically significant and establish that premium operators and certain basic operators are less likely to carry rival services.<sup>8</sup>

There are also significant efficiency gains from vertical integration. The results show that vertically integrated operators strongly prefer to carry their own services, suggesting that integration either reduces program service-specific transaction costs or eliminates the double monopoly markup for the affiliated service. Consistent with the elimination of double markups, the results show that operators integrated with basic programming successfully sell more basic cable subscriptions, despite their tendency to exclude certain program services from their distribution networks. These operators stimulate demand by offering somewhat larger basic cable packages with less program duplication and more premium services. Similarly, operators integrated with premium programming successfully sell more premium subscriptions. While these operators offer significantly fewer premium choices at higher prices, they manage to

<sup>6</sup> Christopher M. Snyder (1995) summarizes the empirical literature on vertical foreclosure.

<sup>7</sup> This finding confirms allegations of foreclosure by HSN executives against Tele-Communications Inc. (TCI). See *The Wall Street Journal* (1992).

<sup>8</sup> Salinger (1988b) and David Waterman and Andrew A. Weiss (1996) use 1987 and 1988 industry data, respectively, to study the effects of vertical integration between premium cable networks and cable system operators. As does this paper, both report evidence that premium operators offer fewer premium services, are more likely to carry their own program services, and less likely to carry rival premium services. Neither paper considers the effect of integration with premium services on basic program offerings or the effects of integration with basic services.

stimulate demand for premium services by offering smaller, cheaper basic cable packages.<sup>9,10</sup>

Whether consumers are better or worse off in markets served by vertically integrated operators depends on the relative importance of the strategic and efficiency effects. For example, vertical integration with premium services improves consumer welfare if the smaller basic packages, which premium operators offer, are cheap enough to compensate for the fewer, more expensive premium services available to consumers in integrated markets. Using structural analysis, I estimate equivalent variation measures of consumer surplus. I then assess the net effect of vertical integration on consumer welfare by comparing, across integrated and unintegrated markets, the monetary compensation one would have to give consumers for taking away their cable television and leaving them just as well off as before.

Estimates suggest that consumers are better off in integrated markets than in unintegrated markets, although the differences are not statis-

tically significant. These findings suggest that consumers in unintegrated markets are certainly no better off than consumers in integrated markets, despite the tendency of integrated operators to exclude certain program services. Moreover, the efficiency effects may indeed dominate the strategic effects, and thus, the net impact of vertical integration between programming and distribution may be to improve consumer welfare.

This paper provides one of the most comprehensive empirical studies of the effects of vertical integration. It documents a rich set of effects arising out of a business setting that is inherently more complex than those contemplated by the theoretical literature. The results reveal some expected effects—for example, that integration gives an operator the incentive to sell more subscriptions. The results also reveal some surprising effects—for example, that basic operators achieve higher subscription sales not by lowering price, but rather by offering more basic and premium programming. The paper provides systematic evidence that integration does result in some degree of market foreclosure, but that it also results in a number of other efficiency-improving effects. An important contribution of the paper is the analysis of the net effect of integration on consumer welfare. The paper provides an empirical methodology to assess the net effects of vertical integration and shows, in the case of cable television, that the harmful effects of market foreclosure are offset by the efficiency-enhancing effects of vertical integration.

## I. Cable Industry Structure

Both the division of the cable industry into a large number of distinct local markets and the varying degrees of vertical integration between program services and cable system operators across these local markets make it possible to measure the effects of vertical integration on business practices. The industry structure is shown in Figure 1. At the top are program producers, such as Paramount Pictures and Universal Studios. These producers sell programming to program services (the upstream firms), such as HBO and the American Movie Classics (AMC). Each program service negotiates the

<sup>9</sup> Salinger (1988b) reports mixed evidence for prices and does not investigate the effects of vertical integration on penetration rates. Waterman and Weiss (1996) find no effect of vertical ties on prices or penetration rates. Unlike those studies, this paper shows that vertical integration with premium services has important effects on prices and penetration rates. A number of factors, ranging from choice of sample year to specification, can explain these differences. For example, Salinger (1988b) uses price data that reflect 1987 prices for some cable systems and pre-1987 prices for other cable systems. This is problematic because 1987 marks the beginning of price deregulation in the cable industry.

<sup>10</sup> A number of other related empirical papers deserve mention. Curtis M. Grimm et al. (1992) study the effects of vertical integration in the railroad industry and conclude that vertical mergers have the potential for resulting in market foreclosure because the evidence suggests that firms with monopoly power over one segment of the market cannot, for whatever reason, fully leverage their position to extract monopoly rents in the competitive segment of the market. Snyder (1996) and Joseph C. Mullin and Wallace P. Mullin (1997) use event-study methodology to study the stock market response of firms to announcements of long-term contracts or vertical integration in the U.S. steel industry and British beer industry, respectively. Snyder (1996) finds the stock market response and wholesale price data to be more consistent with market foreclosure. Mullin and Mullin (1997) conclude the net effect of the stock market response to be more consistent with efficiency gains than with foreclosure.

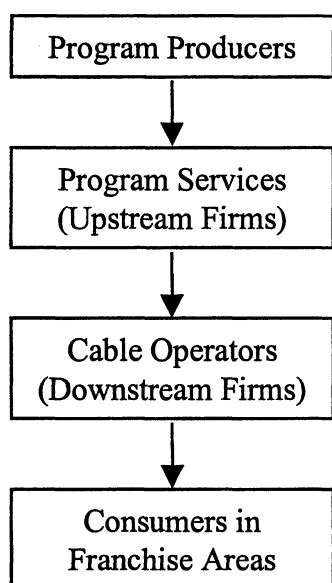


FIGURE 1. INDUSTRY STRUCTURE

terms of sale for the distribution of its programming with individual cable operators (the downstream firms), such as Viacom and Comcast. These cable operators sell to consumers in exclusive franchise areas.<sup>11</sup> In 1991, there were approximately 11,000 cable systems, 1,600 cable system operators, and 140 national and regional program services, including cable-only networks and superstations.<sup>12</sup> About 50 of these 140 program services were vertically integrated with cable operators. About 2,300 cable systems, or about 60 percent of all homes with cable access, were controlled by vertically integrated operators.<sup>13</sup>

Cable operators choose the number, the types (e.g., music, movies), and the brands (e.g., HBO, Showtime) of services to carry. Operators also set prices. While basic cable prices have been regulated at various times, they were not

regulated during the time period studied. All operators sell a bundle of basic cable services, for a single price per month, and most sell à la carte certain premium movie and sports services. Basic cable is tied to the premium services. Consequently, a consumer who wants a premium service must first purchase the basic package. In the analysis sample, cable operators offer an average of 16.5 services in the basic package and 3.4 premium services.<sup>14</sup> If an operator refuses to carry a program service, that service cannot reach consumers in the operator's franchise areas.<sup>15</sup>

For ease of presentation, I use the terms "basic operator" and "premium operator" to refer to a cable system operator that owns at least one basic or premium program service, respectively. I also use the terms "basic integration" and "premium integration" to refer to vertical integration with a basic or premium program service, respectively. Finally, I use the terms "basic markets," "premium markets," and "unintegrated markets" to refer to local franchise areas served by basic operators, premium operators, or unintegrated operators, respectively.

Vertically integrated cable operators may well have incentives to strategically exclude competing services. Such exclusion may increase viewership of the integrated service within the operators' franchise area and can ultimately benefit the integrated service in unaffiliated franchise areas.<sup>16</sup> Vertically integrated firms may also enjoy cost savings. For example, integration may reduce the costs of negotiation

<sup>14</sup> Some systems offer multiple tiers of basic packages, instead of a single basic package. In 1991, the year of the data, this practice was far less common than it is today. The final sample studied in this paper includes only those systems that offer a single basic package and at least one premium service.

<sup>15</sup> In 1991, viable alternative forms of distribution were generally not available.

<sup>16</sup> A program service with only limited access to final consumers may not be viable. For example, the Home Shopping Network claimed that it could not survive in the industry because of its inability to reach consumers in TCI's franchise areas (see the *The Wall Street Journal*, 1992). Thus, the alleged exclusion of HSN from TCI's franchise area not only benefited QVC (TCI's affiliate shopping service) in TCI markets, but also benefited QVC in non-TCI markets because of QVC's heightened market power in the upstream market.

<sup>11</sup> In 1991, there were competing cable operators in only about 200 of the 11,039 cable franchises in the United States. These systems, where the downstream firm was not a monopoly distributor, are not included in my data sample.

<sup>12</sup> The analysis does not include local or distant broadcast stations.

<sup>13</sup> This estimate is constructed by defining operators with any ownership interest in a program service as vertically integrated. "Homes with cable access" are homes passed by the cable system, not subscriptions sold.

between program services and cable operators, who negotiate and periodically renegotiate affiliate fees paid by the operator to the program service. Consequently, both strategic and efficiency effects of vertical integration are likely to be present.

The history of the cable television industry has been fraught with concerns over strategic foreclosure and consumer welfare. For example, the recent Time Warner and Turner Broadcasting merger was heavily scrutinized because of concern that unaffiliated program services would not be able to access the extensive distribution networks of Time Warner and TCI, both large shareholders of Turner Broadcasting.<sup>17</sup> Despite such concerns, legislators and antitrust authorities historically have permitted vertical mergers between programming and distribution.

## II. Data

The analysis uses cable system-level data from the 1991 *Factbook*, which are compiled from survey responses from all existing cable franchises. For each of the 11,039 cable franchises in the United States, the data contain information on the system's owner, its channel capacity, and the number of homes with access to cable, referred to as homes passed, within the system's franchise area. The data also contain a description of the system's program offerings, price, and quantity.<sup>18</sup>

I determine horizontal firm size and the ex-

tent of vertical integration for each cable operator, using several different sources.<sup>19</sup> System owners are treated as the same if there is a common principal with more than a 50-percent stake in each firm. An operator's horizontal size is measured as the total number of homes passed nationally by all its systems. A system owner is considered vertically integrated if it owns any portion of a program service that serves the system's franchise area.<sup>20,21</sup> This definition errs on the side of labeling too many operators as vertically integrated and may, if anything, underestimate the effects of ownership structure. The analysis employs several measures of affiliation, including number of basic services with which the operator is vertically integrated, the number of premium services with which the operator is vertically integrated, whether the operator owns the shopping service

<sup>19</sup> While the *Factbook* provides some information on ownership structure, it does not identify many horizontal and vertical relationships. For example, the *Factbook* does not document that cable operator ATC and cable operator Warner Cable are in fact wholly owned subsidiaries of Time Warner. Similarly, the *Factbook* does not provide detailed information on the vertical structure of the industry. Ownership structure, defined to reflect the 1991 industry configuration, was painstakingly constructed using information from a number of different sources. Primary sources for checking and updating both horizontal and vertical ownership information include the *Factbook*, Dun and Bradstreet's *Who Owns Whom* (1991), various issues (every biweekly issue from 1989 to 1991) of *Cablevision*, and World Wide Web home pages for program service ESPN and cable operators Viacom, Time Warner, Jones International, Cox, Continental Cablevision, Comcast, Cablevision Systems Corporation, and TKR.

<sup>20</sup> For example, suppose an operator controls three cable systems and owns only two regional program services, each of which serves only one of the operator's systems. For each system that receives one of these program services, the operator is defined as vertically integrated to one program service. For the third system, which does not receive the operator's program services, the operator is defined as un-integrated. In 1991, there were 16 regional program services.

<sup>21</sup> In a few instances, data limitations prohibit the identification of vertically integrated operators. For example, Time Warner owned 23.47 percent and TCI owned 19.61 percent of Turner Broadcasting. Other, unidentified multi-system operators together owned 5.4 percent of Turner Broadcasting. Consequently, only Time and TCI are treated as integrated with the Turner program services. This data limitation, however, should not significantly impact the findings because, at a minimum, the principal owners are identified in all cases.

<sup>17</sup> See the FTC (1996) for a discussion of this case.

<sup>18</sup> Shortcomings of the *Factbook* data are that they are frequently out of date and potentially inaccurate. To address these concerns, I verified *Factbook* information in several ways. Ownership structure was verified and updated using a number of other sources, which are described below. In addition, the data were subjected to various logic checks; for example, systems that report offering more program services than channel capacity were dropped. Systems with outdated information were also dropped, and only those systems that had updated their information between 1990 and 1991 were retained. Further, systems with missing information were dropped. As a final check, in June 1991, a random selection of 150 cable systems with updated information was telephoned to verify price and program service offerings. The information received over the telephone matched, for the most part, the information from the *Factbook*.

QVC, whether the operator owns premium movie services, and whether the operator owns the basic movie service AMC.

In 1991, there were about 133 program services, not including distributors of satellite services or pay-per-view services. Each of these services is classified by programming content and by distribution method. Programming content refers to the type of programming carried most regularly by the service. Services are assigned to 19 distinct types, including shopping, music, and educational services; these are summarized in Appendix Table A1.<sup>22</sup> Distribution method refers to whether the service is a basic service or a premium service. Of the 133 services, eight are premium; of these eight, five are national movie services, one is a regional general entertainment program service, and two are regional sports services.<sup>23</sup> Services with similar programming content are likely to compete more directly than services with highly differentiated programming. Basic program duplication is defined as number of program services divided by number of service types.

In addition to system and owner characteristics, I use local demographic information, at the county level, from the U.S. Bureau of the Census: *1988 City and County Data Book* and *USA Counties 1994*. Finally, I obtain for each system Arbitron's ranking of television market size, known as the Area of Dominant Influence Rank (ADIR), and the number of television households by ADIR, from *Television Universe Summary and Estimates* (Arbitron, 1991–1992).

Variables measuring owner characteristics are constructed using the entire population of cable franchises and program services. In an

attempt to hold constant the products sold by each cable franchise, I dropped from the sample systems that do not offer at least one premium service and those that offer multiple basic-cable packages. After the elimination of observations for missing values and for various other logical-check criteria, the analysis sample is an unbalanced panel of 1,919 cable systems and 340 cable system operators.

Table 1 presents variable definitions and some sample descriptive statistics. About 34 percent of systems in the sample are controlled by vertically integrated cable operators, compared to 21 percent in the total population. Also, about 61 percent of homes passed in the sample are controlled by vertically integrated cable operators, compared to 57 percent in the population.

### III. Program Offerings

I first investigate the reduced-form effects of vertical integration on program offerings. If vertical integration results in market foreclosure, then integrated operators will tend to exclude program services, particularly those that directly rival their upstream affiliates. If vertical integration results in efficiency gains, then integrated operators will prefer to carry their own programming and will tend to offer more program services. Comparing operators' decisions about how many and which program services to offer can provide insights into the relative importance of strategic versus efficiency effects of ownership structure.

I consider in my analysis several measures of product offerings, two aggregate measures and several individual program service-level measures. The two aggregate measures are the number of program services included in the basic package and the number of premium services offered to basic subscribers. The individual program service-level measures include a series of indicator variables that reflect the operator's decision to offer individual program services. In particular, my analysis focuses on the effects of ownership structure on the decision to carry the home shopping services QVC and HSN, and the decision to carry the basic movie service AMC.

The econometric models of product offerings include measures of owner characteristics, system characteristics, and demographic

<sup>22</sup> Some services, such as shopping or music video, are easy to classify, but other services, such as family and general entertainment services, are more difficult. I have experimented with various classifications, but the one chosen here seems to be most sensible.

<sup>23</sup> The national premium movie services are HBO, Cinemax, Showtime, The Movie Channel, and the Disney Channel. The regional general entertainment premium service, Prism, serves the areas of northern Delaware, southern New Jersey, and eastern Pennsylvania. The two premium regional sports services are Sportschannel Ohio (serving Kentucky, Ohio, West Virginia, and western Pennsylvania) and Sportschannel New England (serving Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont).

TABLE 1—VARIABLE DEFINITIONS AND MEANS ( $N = 1919$ )

| Theoretical construct             | Empirical measure  | Level       | Mean         |
|-----------------------------------|--|-------------|--------------|
| Demographic variables             |  |             |              |
| Size of the television market     | Area of dominant influence rank (ADIR). Higher numbers denote smaller television markets.  | ADIR market | 65.75        |
| Income                            | Number of television households.   | ADIR market | 862,831.89   |
| Older viewership                  | Median household income.   | County      | 16,127.70    |
| Younger viewership                | Percentage of population over age 65.  | County      | 12.32        |
| Non-white viewership              | Percentage of population between ages 5 and 15.  | County      | 15.05        |
| Household size                    | Percentage of population non-white.  | County      | 9.54         |
| Urban                             | Persons per household.   | County      | 2.69         |
|                                   | Population density.  | County      | 424.75       |
| Price-quantity-service variables  |  |             |              |
| Price of premium cable            | Cost of living adjusted, average monthly price of premium cable.   | System      | 9.42         |
| Price of basic cable              | Cost of living adjusted, monthly price of basic cable.   | System      | 16.11        |
| Basic penetration rate            | Fraction of homes passed that subscribe to basic cable, defined as basic subscriptions divided by homes passed.                                | System      | 0.65         |
| Basic-only penetration rate       | Fraction of homes passed that subscribe only to basic cable, defined as (basic subscriptions – premium subscriptions) divided by homes passed. | System      | 0.28         |
| Premium penetration rate          | Fraction of homes passed that subscribe to premium cable, defined as premium subscriptions divided by homes passed.                            | System      | 0.37         |
| Premium-also penetration rate     | Fraction of basic subscribers that subscribe also to premium cable, defined as premium subscriptions divided by basic subscriptions.           | System      | 0.59         |
| Premium services                  | Number of premium program services offered.  | System      | 3.39         |
| Basic services                    | Number of basic program services offered.  | System      | 16.47        |
| Basic program duplication         | Number of basic program services offered/number of program service types offered.  | System      | 1.66         |
| System and owner characteristics  |  |             |              |
| System age                        | Number of years since franchise began.   | System      | 14.55        |
| System size                       | Channel capacity.  | System      | 38.40        |
|                                   | Number of homes covered locally.   | System      | 18,963.17    |
| Owner's horizontal size           | Number of homes covered nationally.  | Owner       | 3,539,030.36 |
| Integration with basic services   | Number of basic program services with which the system owner is vertically integrated.   | Owner       | 2.58         |
| Integration with premium services | Number of premium program services with which the system owner is vertically integrated.   | Owner       | 0.11         |

characteristics. Owner characteristics include various measures of vertical integration and owner's horizontal size.<sup>24</sup> For models of the

aggregate measures of program offerings, the specification includes two measures of vertical integration: the number of basic program services and the number of premium services with which the cable operator is integrated. For mod-

<sup>24</sup> Horizontal size is measured here as the number of homes passed nationally by all of the owner's cable systems. Previous specifications have also included the number of cable systems the operator owns nationally. Inclusion of

this measure of operator size does not alter any of the main results.

els of the decision to offer individual program services, measures of vertical integration depend upon whether the system operator is integrated with the particular program service and with close rival program services.

System characteristics include system age and size. System age is defined as the number of years since the franchise began. System size is measured both by channel capacity and by the number of homes passed within the system's local franchise area. Channel capacity affects both the total number of program services carried and the probability of carriage for a particular program service. For two reasons, however, estimates are constructed with and without channel capacity. First, it may well be the case that channel capacity is an endogenous system characteristic, jointly determined with the dependent variable. Second, measuring the effects of vertical integration holding channel capacity constant may not be appropriate because vertical integration could conceivably affect channel capacity. As it turns out, however, the measured effects of vertical integration are similar in these two specifications.<sup>25</sup>

Demographic variables include population density, percentage of the population between ages 5 and 15, percentage of the population over age 65, median household income, persons per household, and size of the local television market. The size of the television market is measured both by Arbitron's ADIR, which ranks markets on the basis of importance for television ratings, and by the number of television households within the area of dominant influence. These characteristics are likely to affect consumer demand and are typically considered important determinants of television-viewing patterns (Nielsen Media Research, 1990; Arbitron, 1991–1992).

For the aggregate measures of product offerings, reduced-form parameters are estimated equation by equation, using ordinary least squares. For individual program offerings, reduced-form parameters are estimated equation by equation, using probit maximum likelihood. The data set used in this analysis is an unbalanced panel of

cable operators and the multiple cable systems they control. Recall that the sample consists of 340 cable operators and 1,919 cable systems. Consequently, the results reported below present both the usual *t*-statistics, using standard errors from ordinary least squares and probit maximum likelihood, and robust *t*-statistics, which are computed using robust standard errors. Robust standard errors allow for heteroskedasticity and for correlation in errors across systems controlled by the same cable operator.<sup>26</sup>

#### A. Number of Basic and Premium Services

Both the strategic and the efficiency effects of vertical integration may influence the number of basic and premium services offered. Descriptive statistics, presented in Table 2, suggest that basic operators offer more basic services than unintegrated or premium operators.<sup>27</sup> Premium operators offer fewer premium services than unintegrated or basic operators. These data suggest that integration may indeed affect program offerings.

The patterns in the descriptive statistics are confirmed by a regression analysis that controls for system, demographic, and other owner characteristics. Table 3 presents estimated reduced-form effects for two different specifications, with and without channel capacity. These results indicate that the average effect of basic

<sup>26</sup> Previous versions of this paper have estimated the parameters using the random-effects estimator, instead of ordinary least squares, and probit random effects, instead of the usual probit estimator. The usual random-effects estimation method assumes that owner-specific unobservables are equi-correlated. The approach used in this paper does not require the correlation in owner-specific effects to be the same across owners, and thus is more robust than random-effects estimation. The results and conclusions, however, are invariant to estimation technique. For a description of the robust standard errors, see Kung-Yee Liang and Scott L. Zeger (1986) and Liang et al. (1992).

<sup>27</sup> Table 2 divides cable systems into three mutually exclusive groups: those operated by unintegrated operators, those operated by basic operators, and those operated by premium operators. Basic operators are defined here as those that own basic program services but no premium services, unintegrated operators are those that are not vertically integrated, and premium operators are those that own premium services. All operators who own premium services (e.g., Time Warner, Viacom, and Cablevision Systems Corporation) also own basic program services.

<sup>25</sup> Structural analysis in Section V, subsection A, presents a specification test that rejects the exogeneity of channel capacity.



TABLE 2—AVERAGE PRODUCT CHARACTERISTICS BY OWNERSHIP STATUS

| Variable                          | Full sample<br>N = 1,919 | Unintegrated<br>systems<br>N = 1,269 | Basic<br>systems<br>N = 544 | Premium<br>systems<br>N = 106 |
|-----------------------------------|--------------------------|--------------------------------------|-----------------------------|-------------------------------|
| Price of basic cable              | 16.383                   | 15.984                               | 17.273                      | 16.596                        |
| Price of premium cable            | 9.573                    | 9.523                                | 9.490                       | 10.599                        |
| Basic penetration rate            | 0.652                    | 0.649                                | 0.656                       | 0.673                         |
| Basic-only penetration rate       | 0.284                    | 0.310                                | 0.232                       | 0.239                         |
| Premium penetration rate          | 0.369                    | 0.339                                | 0.425                       | 0.434                         |
| Premium-also penetration rate     | 0.592                    | 0.546                                | 0.683                       | 0.676                         |
| Premium services                  | 3.388                    | 3.160                                | 4.002                       | 2.972                         |
| Basic services                    | 16.475                   | 14.809                               | 19.890                      | 18.887                        |
| Integration with basic services   | 2.580                    | 0.000                                | 7.763                       | 6.868                         |
| Integration with premium services | 0.105                    | 0.000                                | 0.000                       | 1.906                         |

Notes: Unintegrated systems are systems where the operator is vertically unintegrated. Basic systems are systems where the operator owns at least one basic service, but no premium services. Premium systems are systems where the operator owns at least one premium service.

integration in basic markets is to increase the offerings in the basic package by about one program service.<sup>28</sup> The average effect of premium integration in premium markets is to reduce the offerings in the basic package by one to two program services and to reduce premium offerings by one program service.<sup>29</sup> Thus, vertical integration with basic services results in an efficiency gain, as evidenced by the small but statistically significant increase in the total number of basic services offered. Integration with premium services, on the

other hand, results in the exclusion of both basic and rival premium services. Both the efficiency and strategic effects are statistically significant and robust across specifications.

The analysis provides a number of other new findings. The results indicate that cable system size, measured both as the number of homes passed locally and as channel capacity, has a positive effect on the number of basic and premium services offered. The results also suggest that older cable systems offer fewer basic and premium services. Moreover, this effect of system age is magnified when channel capacity is excluded from the specification, suggesting correctly that older systems tend to have lower channel capacity. Finally, the findings indicate that cable systems in urban areas, as measured by population density, tend to offer more premium services.

#### B. Basic Shopping Services QVC and HSN

Studying cable operators' decisions to offer QVC and HSN allows me to determine whether operators integrated with basic programming engage in market foreclosure.<sup>30</sup> While both pro-

<sup>28</sup> The average effect of basic integration on the basic package is computed by multiplying the marginal effect of basic integration, which is the coefficient on integration with basic services in Table 3, by the average number of basic services owned by basic operators, which is reported in Table 2. Using specification 1, for example, the average effect of basic integration on the basic package in basic markets is  $0.176 \times 7.763 = 1.366$ , with a standard error of 0.459.

<sup>29</sup> Because premium operators also own basic programming, it is necessary to account for the average effect of basic integration in premium markets, as well as the average effect of premium integration in premium markets, in order to impute the net effect of vertical integration in premium markets. The effect of premium integration in premium markets is to reduce basic program offerings, while the effect of basic integration in premium markets is to increase basic program offerings. The estimated net effect of vertical integration in premium markets is to reduce basic program services by half a program service. This small, but statistically significant, effect indicates that the basic package is somewhat smaller in premium markets relative to unintegrated markets.

<sup>30</sup> There were a total of four shopping networks: HSN, HSN II, QVC, and the JC Penney Shopping Channel. The JC Penney Shopping Channel was not nearly as prominent as either HSN or QVC, and eventually went out of

TABLE 3—EFFECTS OF INTEGRATION ON THE EQUILIBRIUM NUMBERS OF BASIC AND PREMIUM SERVICES OFFERED

| Variable                                     | Panel A: Number of Basic Services Offered |                               |                            |             |                               |                            | Panel B: Number of Premium Services Offered |                               |                            |             |                               |                            |
|--|---|-------------------------------|----------------------------|-------------|-------------------------------|----------------------------|---|-------------------------------|----------------------------|-------------|-------------------------------|----------------------------|
|  | (1)                                       |                               |                            | (2)         |                               |                            | (3)   |                               |                            | (4)         |                               |                            |
|  | Coefficient                               | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient                                 | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS |
| Constant                                     | 23.967                                    | 1.814                         | 2.759                      | 4.039       | 0.314                         | 0.429                      | -11.265                                     | 3.075                         | 4.125                      | -13.496     | 3.558                         | 4.918                      |
| Integration with<br>basic services           | 0.176                                     | 2.975                         | 5.968                      | 0.150       | 3.396                         | 4.664                      | -0.015                                      | 1.126                         | 1.604                      | -0.018      | 1.334                         | 1.895                      |
| Integration with<br>premium<br>services      | -0.931                                    | 5.541                         | 3.908                      | -0.759      | 2.882                         | 2.916                      | -0.604                                      | 12.734                        | 8.07                       | -0.585      | 12.726                        | 7.725                      |
| Natural log of<br>owner's<br>horizontal size | 0.034                                     | 0.297                         | 0.620                      | 0.052       | 0.435                         | 0.875                      | 0.051                                       | 2.254                         | 2.963                      | 0.053       | 2.239                         | 3.047                      |
| System age                                   | -0.044                                    | 3.020                         | 3.329                      | -0.099      | 6.316                         | 6.968                      | -0.005                                      | 0.908                         | 1.305                      | -0.012      | 1.876                         | 2.799                      |
| Natural log of<br>homes passed               | 2.218                                     | 17.412                        | 26.230                     | 2.714       | 19.841                        | 30.850                     | 0.365                                       | 8.506                         | 13.751                     | 0.421       | 10.282                        | 16.438                     |
| Channel capacity                             | 0.181                                     | 12.181                        | 19.253                     |             |                               |                            | 0.020                                       | 4.685                         | 6.855                      |             |                               |                            |
| Natural log of<br>income                     | -0.909                                    | 0.721                         | 1.143                      | -0.197      | 0.172                         | 0.227                      | 0.237                                       | 0.834                         | 0.950                      | 0.317       | 1.112                         | 1.255                      |
| Natural log of<br>population<br>density      | -0.016                                    | 0.113                         | 0.131                      | 0.139       | 0.920                         | 1.052                      | 0.097                                       | 1.743                         | 2.534                      | 0.114       | 2.055                         | 2.960                      |
| Younger<br>viewership                        | -12.484                                   | 1.044                         | 1.203                      | -26.207     | 2.047                         | 2.316                      | 1.243                                       | 0.395                         | 0.381                      | -0.293      | 0.091                         | 0.089                      |
| Older viewership                             | -6.090                                    | 1.046                         | 1.430                      | -4.077      | 0.663                         | 0.887                      | 1.201                                       | 0.846                         | 0.897                      | 1.426       | 0.993                         | 1.053                      |
| Non-white<br>viewership                      | 2.111                                     | 1.337                         | 1.940                      | 2.031       | 1.329                         | 1.708                      | 0.494                                       | 1.141                         | 1.444                      | 0.485       | 1.117                         | 1.401                      |
| Household size                               | 0.420                                     | 0.283                         | 0.350                      | 1.894       | 1.110                         | 1.446                      | 0.226                                       | 0.607                         | 0.599                      | 0.391       | 1.019                         | 1.025                      |
| Natural log of<br>television<br>households   | -1.599                                    | 3.602                         | 4.332                      | -0.635      | 1.364                         | 1.590                      | 0.473                                       | 1.784                         | 4.077                      | 0.581       | 2.143                         | 4.993                      |
| Area of dominant<br>influence rank           | -0.026                                    | 3.044                         | 3.727                      | -0.011      | 1.138                         | 1.405                      | 0.007                                       | 1.464                         | 3.078                      | 0.008       | 1.818                         | 3.842                      |
| Adjusted $R^2$                               |   | 0.624                         |                            |             | 0.551                         |                            |   | 0.389                         |                            |             | 0.374                         |                            |

Notes: Parameters estimated using ordinary least squares. Robust variance estimation allows for heteroskedasticity and for correlation in errors across systems owned by the same owner. Absolute value of *t*-statistics shown in columns adjacent to coefficient.

gram services feature home shopping programming, they have drastically different ownership structures. In 1991, QVC was owned by cable operators TCI and Comcast, while HSN had no partner in cable distribution. Anecdotal evidence from the trade press suggests that TCI, the largest cable operator in the United States, did foreclose HSN from its markets.<sup>31</sup>

business. Because only a few systems in the population reported carrying HSN II, for the purpose of estimation, a system that carries either HSN or HSN II is counted as carrying HSN.

<sup>31</sup> The trade press records long-standing allegations by HSN that TCI "refused to carry Home Shopping because of its own sizeable stake in rival QVC." See *The Wall Street Journal* (1992). Further, legislators have debated whether HSN should be included on the list of "must-carry" stations for cable operators nationwide. The proponent of this legislation, Representative Bilirakis from Florida—the home

Both descriptive statistics and regression analysis suggest that integrated operators TCI and Comcast engage in the exclusion of rival shopping service HSN. The raw data show that 28 percent of all systems carry HSN, while only 6 percent of Comcast and TCI systems carry HSN. Similarly, 9 percent of all systems carry both QVC and HSN, while only 5 percent of Comcast and TCI systems carry both shopping services. Table 4 presents the estimated marginal effects for two different specifications, with and without channel capacity. Controlling

state of HSN—has suggested that HSN should be protected because "cable operators [were] exploiting their local monopoly power to keep their programming competitors out of the market." Interestingly, a vocal opponent of this legislation was a House member from Pennsylvania, the home state of QVC. See Howard Troxler (1992).

TABLE 4—THE CASE OF THE SHOPPING SERVICES

| Variable  | Panel A: Carry HSN              |                            |                            |                 |                            |                            |
|---|---------------------------------|----------------------------|----------------------------|-----------------|----------------------------|----------------------------|
|   | (1)                             |                            |                            | (2)             |                            |                            |
|   | Marginal effect                 | <i>t</i> -statistic robust | <i>t</i> -statistic probit | Marginal effect | <i>t</i> -statistic robust | <i>t</i> -statistic probit |
| System owner vertically integrated with QVC (1 = yes, 0 = no) | -0.249                          | 6.590                      | 8.626                      | -0.253          | 6.890                      | 8.766                      |
| Natural log of owner's horizontal size                        | 0.012                           | 1.270                      | 2.281                      | 0.012           | 1.310                      | 2.254                      |
| System age  | -0.002                          | 0.700                      | 1.208                      | -0.003          | 1.470                      | 2.550                      |
| Natural log of homes passed                                   | 0.063                           | 6.100                      | 7.020                      | 0.078           | 7.960                      | 9.096                      |
| Channel capacity  | 0.006                           | 5.770                      | 6.729                      |                 |                            |                            |
| Natural log of income   | -0.107                          | 1.090                      | 1.335                      | -0.082          | 0.850                      | 1.023                      |
| Natural log of population density                             | 0.013                           | 1.000                      | 0.994                      | 0.019           | 1.480                      | 1.487                      |
| Younger viewership  | -1.313                          | 0.960                      | 1.254                      | -1.714          | 1.230                      | 1.645                      |
| Older viewership  | 0.766                           | 1.370                      | 1.767                      | 0.784           | 1.420                      | 1.804                      |
| Non-white viewership  | -0.065                          | 0.500                      | 0.613                      | -0.073          | 0.540                      | 0.685                      |
| Household size  | 0.312                           | 1.920                      | 2.624                      | 0.347           | 2.140                      | 2.929                      |
| Natural log of television households                          | -0.079                          | 1.680                      | 2.182                      | -0.044          | 0.910                      | 1.231                      |
| Area of dominant influence rank                               | -0.002                          | 2.030                      | 2.754                      | -0.001          | 1.360                      | 1.936                      |
| 1-logL/log0   |                                 | 0.177                      |                            |                 | 0.157                      |                            |
| Predicted fraction of all systems that carry HSN              |                                 | 0.234                      |                            |                 | 0.239                      |                            |
| Fraction of all systems that carry HSN = 0.280                |                                 |                            |                            |                 |                            |                            |
| Variable  | Panel B: Carry QVC              |                            |                            |                 |                            |                            |
|   | (1)                             |                            |                            | (2)             |                            |                            |
|   | Marginal effect                 | <i>t</i> -statistic robust | <i>t</i> -statistic probit | Marginal effect | <i>t</i> -statistic robust | <i>t</i> -statistic probit |
| System owner vertically integrated with QVC (1 = yes, 0 = no) | 0.328                           | 5.430                      | 7.194                      | 0.313           | 5.010                      | 6.906                      |
| Natural log of owner's horizontal size                        | 0.020                           | 1.920                      | 3.091                      | 0.020           | 1.890                      | 3.088                      |
| System age  | 0.002                           | 0.630                      | 0.970                      | 0.000           | 0.010                      | 0.016                      |
| Natural log of homes passed                                   | 0.090                           | 6.510                      | 8.538                      | 0.105           | 7.510                      | 10.313                     |
| Channel capacity  | 0.006                           | 3.380                      | 5.192                      |                 |                            |                            |
| Natural log of income   | -0.233                          | 1.690                      | 2.392                      | -0.203          | 1.500                      | 2.097                      |
| Natural log of population density                             | 0.033                           | 1.970                      | 2.201                      | 0.038           | 2.320                      | 2.556                      |
| Younger viewership  | -0.428                          | 0.270                      | 0.339                      | -0.845          | 0.540                      | 0.671                      |
| Older viewership  | 1.240                           | 1.700                      | 2.377                      | 1.247           | 1.700                      | 2.404                      |
| Non-white viewership  | -0.003                          | 0.020                      | 0.020                      | -0.010          | 0.060                      | 0.075                      |
| Household size  | 0.250                           | 1.290                      | 1.705                      | 0.290           | 1.480                      | 1.982                      |
| Natural log of television households                          | -0.006                          | 0.080                      | 0.330                      | 0.024           | 0.330                      | 0.535                      |
| Area of dominant influence rank                               | 0.000                           | 0.210                      | 0.003                      | 0.001           | 0.580                      | 0.901                      |
| 1-logL/log0   |                                 | 0.200                      |                            |                 | 0.189                      |                            |
| Predicted fraction of all systems that carry QVC              |                                 | 0.403                      |                            |                 | 0.405                      |                            |
| Fraction of all systems that carry QVC = 0.421                |                                 |                            |                            |                 |                            |                            |
| Variable  | Panel C: Carry Both QVC and HSN |                            |                            |                 |                            |                            |
|   | (1)                             |                            |                            | (2)             |                            |                            |
|   | Marginal effect                 | <i>t</i> -statistic robust | <i>t</i> -statistic probit | Marginal effect | <i>t</i> -statistic robust | <i>t</i> -statistic probit |
| System owner vertically integrated with QVC (1 = yes, 0 = no) | -0.043                          | 3.620                      | 3.907                      | -0.049          | 3.550                      | 3.926                      |
| Natural log of owner's horizontal size                        | 0.007                           | 1.700                      | 2.583                      | 0.007           | 1.620                      | 2.469                      |
| System age  | 0.001                           | 0.620                      | 0.828                      | 0.000           | 0.340                      | 0.456                      |
| Natural log of homes passed                                   | 0.017                           | 3.740                      | 4.388                      | 0.024           | 4.740                      | 6.019                      |
| Channel capacity  | 0.003                           | 5.600                      | 7.212                      |                 |                            |                            |
| Natural log of income   | -0.004                          | 0.090                      | 0.103                      | 0.001           | 0.030                      | 0.030                      |
| Natural log of population density                             | 0.011                           | 2.260                      | 1.960                      | 0.017           | 3.200                      | 2.776                      |
| Younger viewership  | -0.402                          | 0.720                      | 0.841                      | -0.631          | 1.050                      | 1.213                      |
| Older viewership  | 0.493                           | 2.800                      | 2.741                      | 0.527           | 2.740                      | 2.630                      |
| Non-white viewership  | -0.034                          | 0.700                      | 0.699                      | -0.045          | 0.830                      | 0.817                      |
| Household size  | 0.067                           | 1.320                      | 1.226                      | 0.083           | 1.540                      | 1.384                      |
| Natural log of television households                          | 0.004                           | 0.250                      | 0.303                      | 0.020           | 1.080                      | 1.341                      |
| Area of dominant influence rank                               | 0.000                           | 0.120                      | 0.145                      | 0.000           | 0.610                      | 0.761                      |
| 1-logL/log0   |                                 | 0.270                      |                            |                 | 0.227                      |                            |
| Predicted fraction of all systems that carry both             |                                 | 0.043                      |                            |                 | 0.052                      |                            |
| Fraction of all systems that carry both = 0.96                |                                 |                            |                            |                 |                            |                            |

Notes: Parameters estimated using probit maximum likelihood. Robust variance estimation allows for heteroskedasticity and for correlation in errors across systems owned by the same owner. Constant term included, but not shown. See G. S. Maddala (1983) for a discussion on the calculation of marginal effects and their standard errors.

for demographics and system characteristics, TCI and Comcast are about 25 percent less likely to carry rival HSN and still about 4 percent less likely to carry both QVC and HSN. Comparing these estimated marginal effects to the predicted probability that a system will carry HSN and both HSN and QVC suggests that, controlling for other factors, Comcast and TCI have a near zero probability of carrying HSN or both QVC and HSN. These estimated effects are statistically significant and robust across specifications. These results provide evidence of the existence of market foreclosure by operators who own basic programming.<sup>32</sup>

The results also provide evidence of efficiency gains from vertical integration. The descriptive statistics show that system owners TCI and Comcast are 38 percent more likely to carry their own service, QVC, than are unintegrated operators. Regression analysis confirms this pattern. Estimated marginal effects show that TCI and Comcast are about 30 percent more likely to carry QVC than are other unintegrated cable operators. This finding is statistically significant and robust across specifications. It indicates that vertical integration either eliminates double marginalization or reduces transaction costs associated with acquiring programming, as evidenced by operators' strong preference for carrying their own programming.

### C. Basic Movie Service AMC

Studying differences in the operators' decisions to carry the basic movie service AMC allows me to determine whether operators integrated with premium movie services tend to exclude rival basic movie services. Recall that the results have already shown that operators integrated with premium services offer one to two fewer basic services. In this subsection, I provide some information about which basic services tend to be excluded by premium operators. The basic movie service AMC is perhaps the most likely of the basic program services to

compete directly with the programming content of the premium movie services: HBO, Cinemax, Showtime, and The Movie Channel. AMC is jointly owned by system operators TCI and Cablevision Systems Corporation, while HBO and Cinemax are both owned by operator Time Warner, and Showtime and The Movie Channel are both owned by operator Viacom. Therefore, premium operators Viacom and Time Warner might be expected to specifically exclude the basic movie service, AMC.

Both the descriptive statistics and the regression analysis suggest that the premium operators do tend to exclude AMC from their basic package. The descriptive statistics show that 32 percent of all systems carry AMC, while only 25 percent of Time Warner and Viacom systems offer AMC. Table 5 presents estimated marginal effects, with and without channel capacity. Controlling for demographics and systems characteristics, the premium operators Time Warner and Viacom are about 15 percent less likely to offer AMC. These estimates are statistically significant and robust across specifications.

Next, I investigate whether premium operators' exclusion of AMC is a targeted strategy to exclude a rival movie service or whether it is simply part of a general strategy to exclude a certain number of all basic services. To this end, I estimate the marginal effects of owning premium movie services on the decisions to carry other basic services. In particular, my analysis considers the decisions to offer the basic services QVC, E! Entertainment, the Discovery Channel, and Nick-at-Nite. None of these other services is as likely to compete with the programming content of the premium movie services. As expected, the findings are that premium movie operators Time Warner and Viacom do not systematically exclude any of these other basic services.<sup>33</sup> These results support the

<sup>32</sup> It is interesting to note that in January 1992, HSN claimed that its survival was in jeopardy because of its inability to reach customers in TCI's franchise areas. See *The Wall Street Journal* (1992). By the end of the calendar year, HSN filed for bankruptcy.

<sup>33</sup> In fact, the estimates suggest that they are 14 percent more likely to carry basic shopping service QVC, a service whose programming content does not compete with the premium movie services. Further, there is some evidence that premium movie operators Time Warner and Viacom are 3 percent more likely to carry E! Entertainment, which is jointly owned by Time Warner, Newhouse, Cox, and Continental Cablevision. On the other hand, owning AMC has a statistically significant, negative effect on the decision to carry Time Warner's service E! Entertainment and Viacom's service Nick-at-Nite. It has a statistically positive

TABLE 5—THE CASE OF THE BASIC MOVIE SERVICE AMC

| Variable  | Carry AMC       |                            |                            |                 |                            |                            |
|---|-----------------|----------------------------|----------------------------|-----------------|----------------------------|----------------------------|
|   | (1)             |                            |                            | (2)             |                            |                            |
|   | Marginal effect | <i>t</i> -statistic robust | <i>t</i> -statistic probit | Marginal effect | <i>t</i> -statistic robust | <i>t</i> -statistic probit |
| System owner vertically integrated with a premium movie service (1 = yes, 0 = no) | -0.155          | 2.250                      | 3.430                      | -0.147          | 2.260                      | 3.180                      |
| System owner vertically integrated with AMC (1 = yes, 0 = no)                     | 0.321           | 2.620                      | 7.340                      | 0.298           | 2.420                      | 6.900                      |
| Natural log of owner's horizontal size  | 0.004           | 0.220                      | 0.560                      | 0.003           | 0.220                      | 0.510                      |
| System age  | 0.002           | 1.560                      | 1.540                      | 0.000           | 0.210                      | 0.220                      |
| Natural log of homes passed   | 0.092           | 5.760                      | 9.650                      | 0.110           | 6.330                      | 11.860                     |
| Channel capacity  | 0.007           | 5.640                      | 7.010                      |                 |                            |                            |
| Natural log of income   | 0.008           | 0.080                      | 0.090                      | 0.029           | 0.330                      | 0.340                      |
| Natural log of population density   | -0.007          | 0.350                      | 0.490                      | 0.001           | 0.060                      | 0.080                      |
| Younger viewership  | 2.134           | 1.540                      | 1.810                      | 1.541           | 1.190                      | 1.320                      |
| Older viewership  | -0.122          | 0.170                      | 0.270                      | -0.100          | 0.140                      | 0.220                      |
| Non-white viewership  | -0.178          | 0.960                      | 1.440                      | 0.191           | 1.090                      | 1.540                      |
| Household size  | -0.234          | 1.240                      | 1.740                      | -0.170          | 0.970                      | 1.270                      |
| Natural log of television households  | -0.068          | 1.310                      | 1.740                      | -0.280          | 0.255                      | 0.740                      |
| Area of dominant influence rank   | -0.001          | 1.280                      | 1.710                      | -0.001          | 0.630                      | 0.850                      |
| 1-logL/logL0  |                 | 0.216                      |                            |                 | 0.195                      |                            |

Notes: Parameters estimated using probit maximum likelihood. Robust variance estimation allows for heteroskedasticity and for correlation in errors across systems owned by the same owner. Constant term included, but not shown. See Maddala (1983) for a discussion on the calculation of marginal effects and their standard errors. See Appendix Table A2 for additional results on the effects of premium integration on the decisions to offer individual basic services.

conclusion that premium movie operators are more likely to exclude basic movie services, and provide additional evidence of strategic behavior.

This analysis also provides evidence of efficiency gains from vertical integration. Estimated marginal effects show that operators who own AMC are 33 percent more likely to carry it. These estimates are statistically significant and robust across specifications. As in the case of the home shopping services, these results show that operators have a strong preference to carry their own programming.

#### IV. Penetration Rates and Prices

If vertical integration successfully aligns upstream and downstream interests, then integrated operators should offer a combination of prices and

program offerings designed to achieve higher penetration rates for their own program services. The results thus far have already established that operators who own premium programming offer somewhat smaller basic packages and fewer premium services. Operators who own basic programming offer somewhat larger basic packages. It remains to be assessed what effect, if any, vertical integration has on prices, and whether the optimal mix of price and product offerings is successful at achieving the higher penetration rates. In this section, I estimate the effects of ownership structure on equilibrium prices and penetration rates.

This analysis considers the monthly price of basic cable, the average monthly price for a premium service, two measures of basic penetration rates, and two measures of premium penetration rates. Basic penetration is measured as (1) the fraction of homes passed that subscribe to basic cable—the “basic penetration rate,” and (2) the basic penetration rate minus an estimate of the fraction of homes passed that subscribe only to premium services—the “basic-only penetration

effect on the decision to carry QVC and the Discovery Channel, both of which are owned by cable operator TCI, owner of AMC. See Appendix Table A2 for full set of these results.

rate." The first is an estimate of the probability that a randomly chosen household will buy basic cable; the second is an estimate of the probability that a randomly chosen household will buy basic cable but not premium services. Premium penetration is measured as (1) premium subscriptions divided by total homes passed—the "premium penetration rate," and (2) premium subscriptions divided by basic subscriptions—the "premium-also penetration rate." The first is an estimate of the probability that a randomly chosen household will buy a premium service; the second is an estimate of the probability that a randomly chosen basic subscriber will also purchase a premium subscription.

Observed prices and penetration rates are determined by consumer demographics, system characteristics, and operator characteristics, which include the aggregate measures of vertical integration. Parameters of the price equations are estimated equation by equation, using ordinary least squares. Parameters of the penetration rate equations are estimated equation by equation, using a minimum chi-square estimation procedure.<sup>34</sup> As before, models are estimated with and without channel capacity.

#### A. Prices

It is unclear, *a priori*, what effect vertical integration will have on prices, since cable operators choose both price and product quality, here measured by the number of program services offered. Earlier results have shown that basic operators offer larger basic packages, and premium operators offer smaller basic packages. If larger basic packages are more costly to offer, then basic operators may charge more for basic cable than premium operators, despite any efficiency gains from integration. Indeed, the descriptive statistics, presented in Table 2, suggest that basic operators charge more for the basic cable package.

It is also unclear what effect vertical integration will have on prices when operators tie basic

cable to the sale of premium services. For example, basic operators may be able to increase the basic penetration rate by offering cheaper premium services. Descriptive statistics, which show that basic operators charge less on average for premium services than do premium or un-integrated operators, support this possibility.

The patterns in the descriptive statistics are confirmed by a regression analysis that controls for system, demographic, and other owner characteristics. These results are presented in Table 6. The main findings are that basic integration has a positive effect on the basic price, but a negative effect on the average premium price. Basic operators charge an estimated \$0.36 more, on average, for the basic package and \$0.26 less per premium service than do un-integrated operators.

Interestingly, premium integration has a negative effect on the basic price, but a positive effect on the average premium price. Premium operators charge an estimated \$0.38 less for the basic package and \$1.00 more on average per premium service.<sup>35</sup> These findings, with the exception of the effect of basic integration on the basic price, are statistically significant and robust across specifications. The effect of basic integration on the basic price is statistically insignificant, although the point estimates appear stable across specifications. Together with earlier findings, these results confirm that vertical integration significantly affects price and product offerings.

#### B. Penetration Rates

Next I turn to the effect of vertical integration on penetration rates. If vertical integration successfully aligns upstream and downstream interests, then the combination of price and program services offered by integrated operators should achieve higher penetration rates for the operators' affiliate program services. Indeed, descriptive statistics, presented in Table 2, show

<sup>34</sup> A minimum chi-square procedure, described in Maddala (1983), is a weighted least-squares procedure that corrects for the form of the heteroskedasticity which results from the fact that the dependent variable is an estimate of a probability.

<sup>35</sup> Integration with premium services reduces the price of the basic package by an estimated \$0.71. However, integration by premium operators with basic services increases the price of the basic package by an estimated \$0.32. Consequently, the net effect is that premium operators charge \$0.39 less for the basic package.

TABLE 6—EFFECTS OF INTEGRATION ON EQUILIBRIUM PRICES

| Variable                               | Panel A: Price of Basic Cable |                               |                            |             |                               |                            | Panel B: Price of Premium Cable |                               |                            |             |                               |                            |
|--|-------------------------------|-------------------------------|----------------------------|-------------|-------------------------------|----------------------------|---------------------------------|-------------------------------|----------------------------|-------------|-------------------------------|----------------------------|
|  | (1)                           |                               |                            | (2)         |                               |                            | (3)                             |                               |                            | (4)         |                               |                            |
|  | Coefficient                   | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient                     | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS | Coefficient | <i>t</i> -statistic<br>robust | <i>t</i> -statistic<br>OLS |
| Constant                               | 1.048                         | 0.107                         | 0.186                      | -2.168      | 0.226                         | 0.385                      | 7.477                           | 2.073                         | 2.652                      | 7.685       | 2.154                         | 2.745                      |
| Integration with basic services        | 0.049                         | 0.833                         | 2.538                      | 0.045       | 0.755                         | 2.310                      | -0.034                          | 2.002                         | 3.569                      | -0.034      | 1.997                         | 3.545                      |
| Integration with premium services      | -0.385                        | 3.833                         | 2.485                      | -0.357      | 3.827                         | 2.294                      | 0.516                           | 9.582                         | 6.670                      | 0.514       | 9.564                         | 6.653                      |
| Natural log of owner's horizontal size | 0.139                         | 1.123                         | 3.907                      | 0.142       | 1.146                         | 3.968                      | 0.067                           | 1.954                         | 3.771                      | 0.067       | 1.954                         | 3.762                      |
| System age                             | -0.044                        | 3.316                         | 5.093                      | -0.530      | 3.911                         | 6.222                      | 0.011                           | 1.937                         | 2.461                      | 0.011       | 2.152                         | 2.655                      |
| Natural log of homes passed            | 0.467                         | 3.207                         | 8.497                      | 0.547       | 3.827                         | 10.395                     | -0.037                          | 0.673                         | 1.224                      | -0.039      | 0.776                         | 1.484                      |
| Channel capacity                       | 0.029                         | 3.675                         | 4.781                      |             |                               |                            | -0.002                          | 0.542                         | 0.620                      |             |                               |                            |
| Natural log of income                  | 0.867                         | 0.903                         | 1.678                      | 0.982       | 1.045                         | 1.892                      | -0.200                          | 0.734                         | 0.774                      | -0.207      | 0.765                         | 0.804                      |
| Natural log of population density      | -0.378                        | 4.010                         | 4.801                      | -0.353      | 3.649                         | 4.468                      | -0.095                          | 1.732                         | 2.421                      | -0.097      | 1.782                         | 2.468                      |
| Younger viewership                     | 7.616                         | 0.928                         | 1.129                      | 5.402       | 0.682                         | 0.798                      | -4.831                          | 1.578                         | 1.434                      | -4.688      | 1.567                         | 1.395                      |
| Older viewership                       | -8.999                        | 1.650                         | 3.252                      | -8.674      | 1.600                         | 3.117                      | -0.489                          | 0.279                         | 0.354                      | -0.510      | 0.288                         | 0.369                      |
| Non-white viewership                   | 1.240                         | 1.290                         | 1.753                      | 1.227       | 1.268                         | 1.725                      | 0.033                           | 0.068                         | 0.094                      | 0.034       | 0.070                         | 0.096                      |
| Household size                         | 2.517                         | 2.211                         | 3.224                      | -2.279      | 2.021                         | 2.908                      | 0.381                           | 0.868                         | 0.978                      | 0.366       | 0.836                         | 0.941                      |
| Natural log of television households   | 0.646                         | 2.052                         | 2.694                      | 0.801       | 2.491                         | 3.354                      | 0.268                           | 1.421                         | 2.236                      | 0.258       | 1.376                         | 2.172                      |
| Area of dominant influence             |                               |                               |                            |             |                               |                            |                                 |                               |                            |             |                               |                            |
| rank                                   | 0.011                         | 1.796                         | 2.400                      | 0.013       | 2.165                         | 2.949                      | 0.001                           | 0.369                         | 0.617                      | 0.001       | 0.330                         | 0.550                      |
| Adjusted $R^2$                         |                               | 0.166                         |                            |             | 0.156                         |                            |                                 | 0.055                         |                            |             | 0.055                         |                            |

Notes: Parameters estimated using ordinary least squares. Robust variance estimation allows for heteroskedasticity and for correlation in errors across systems owned by the same owner. Absolute value of *t*-statistics shown in columns adjacent to coefficient.

that basic operators achieve higher basic penetration rates and premium operators achieve higher premium penetration rates than do unintegrated operators. Vertical integration may also result in lower penetration rates for rival services. Because basic cable is tied to premium services, operators who own premium services cannot afford to lower basic penetration. On the other hand, operators who own basic services may attempt to reduce premium penetration. However, descriptive statistics do not support this conjecture.

Regression analysis confirms only some of the patterns in the descriptive statistics. Table 7 shows that controlling for consumer demographics, system characteristics, and owner characteristics, vertical integration with basic

programming increases both measures of basic penetration. In contrast to the descriptive statistics, the results show that integration with basic programming reduces both measures of premium penetration. These estimates suggest that basic operators achieve, on average, 3-percent higher basic penetration, 5-percent higher basic-only penetration, 8-percent lower premium penetration, and 11-percent lower premium penetration as a fraction of basic penetration. These findings, with the exception of the effect of basic integration on basic penetration, are statistically significant and robust across specifications.

Vertical integration with premium services significantly increases the premium penetration

TABLE 7—EFFECTS OF INTEGRATION ON EQUILIBRIUM PENETRATION RATES

| Variable                               | Panel A: Basic Penetration Rate   |        |        |             |        |        | Panel B: Basic-Only Penetration Rate   |        |        |             |        |        |
|--|-----------------------------------|--------|--------|-------------|--------|--------|--|--------|--------|-------------|--------|--------|
|  | Coefficient                       | Robust | WLS    | Coefficient | Robust | WLS    | Coefficient                            | Robust | WLS    | Coefficient | Robust | WLS    |
| Constant                               | -1.097                            | 1.456  | 3.579  | -1.114      | 1.400  | 3.600  | 1.398                                  | 2.031  | 5.233  | 1.415       | 1.888  | 5.293  |
| Integration with basic services        | 0.004                             | 1.174  | 3.307  | 0.004       | 1.079  | 3.226  | 0.006                                  | 3.416  | 9.922  | 0.007       | 3.484  | 10.835 |
| Integration with premium services      | 0.009                             | 1.397  | 1.544  | 0.011       | 1.415  | 1.751  | 0.003                                  | 0.391  | 0.934  | 0.003       | 0.419  | 0.872  |
| Natural log of owner's horizontal size | -0.023                            | 2.448  | 7.236  | -0.023      | 2.397  | 7.148  | -0.022                                 | 3.180  | 11.116 | -0.023      | 3.103  | 11.376 |
| System age                             | 0.008                             | 5.503  | 16.570 | 0.008       | 6.016  | 17.837 | 0.008                                  | 9.417  | 19.371 | 0.008       | 9.246  | 18.780 |
| Channel capacity                       | -0.002                            | 2.561  | 5.968  |             |        |        | 0.001                                  | 2.121  | 4.394  |             |        |        |
| Natural log of income                  | 0.196                             | 2.751  | 6.444  | 0.198       | 2.684  | 6.453  | -0.108                                 | 1.490  | 5.958  | -0.118      | 1.586  | 6.305  |
| Natural log of population density      | -0.023                            | 2.539  | 5.036  | -0.028      | 3.027  | 6.042  | -0.003                                 | 0.460  | 2.222  | -0.001      | 0.070  | 1.485  |
| Younger viewership                     | -0.681                            | 1.056  | 1.737  | -0.675      | 0.625  | 1.705  | -0.836                                 | 0.882  | 0.799  | -0.924      | 0.962  | 1.098  |
| Older viewership                       | 1.103                             | 3.366  | 6.984  | 1.119       | 3.209  | 7.027  | 1.205                                  | 3.548  | 11.717 | 1.185       | 3.393  | 11.466 |
| Non-white viewership                   | -0.159                            | 1.752  | 3.777  | -0.176      | 1.839  | 4.136  | -0.189                                 | 2.327  | 6.593  | -0.183      | 2.140  | 6.379  |
| Household size                         | 0.212                             | 2.027  | 4.831  | 0.225       | 2.019  | 5.084  | 0.169                                  | 1.345  | 4.655  | 0.172       | 1.339  | 4.730  |
| Natural log of television households   | -0.025                            | 1.081  | 2.365  | -0.032      | 1.413  | 3.025  | -0.021                                 | 1.246  | 0.266  | -0.012      | 0.626  | 0.636  |
| Area of dominant influence rank        | -0.001                            | 1.008  | 2.672  | -0.001      | 1.204  | 3.115  | 0.000                                  | 0.205  | 2.927  | 0.000       | 0.536  | 3.739  |
| Adjusted R <sup>2</sup>                |                                   | 0.379  |        |             | 0.365  |        |  | 0.497  |        |             | 0.490  |        |
| Variable                               | Panel C: Premium Penetration Rate |        |        |             |        |        | Panel D: Premium-Also Penetration Rate |        |        |             |        |        |
|  | Coefficient                       | Robust | WLS    | Coefficient | Robust | WLS    | Coefficient                            | Robust | WLS    | Coefficient | Robust | WLS    |
| Constant                               | -3.650                            | 3.609  | 10.471 | -3.661      | 3.614  | 10.519 | -2.079                                 | 2.024  | 6.211  | -2.135      | 1.961  | 6.364  |
| Integration with basic services        | -0.010                            | 2.257  | 8.130  | -0.010      | 2.264  | 8.131  | -0.015                                 | 4.709  | 11.474 | -0.015      | 4.533  | 11.880 |
| Integration with premium services      | 0.030                             | 2.873  | 4.804  | 0.033       | 2.766  | 4.784  | 0.014                                  | 1.594  | 2.102  | 0.014       | 1.744  | 2.097  |
| Natural log of owner's horizontal size | 0.021                             | 1.463  | 5.821  | 0.021       | 1.463  | 5.832  | 0.038                                  | 3.383  | 10.659 | 0.039       | 3.311  | 10.810 |
| System age                             | -0.001                            | 0.717  | 1.839  | -0.001      | 0.713  | 2.005  | -0.008                                 | 5.620  | 14.584 | -0.008      | 5.611  | 14.159 |
| Channel capacity                       | 0.000                             | 0.219  | 0.621  |             |        |        | -0.001                                 | 1.343  | 3.732  |             |        |        |
| Natural log of income                  | 0.314                             | 3.391  | 9.381  | 0.314       | 3.393  | 9.378  | 0.299                                  | 2.503  | 8.650  | 0.308       | 2.491  | 8.867  |
| Natural log of population density      | 0.022                             | 1.398  | 4.510  | 0.023       | 1.352  | 4.746  | 0.022                                  | 1.977  | 4.326  | 0.019       | 1.608  | 3.799  |
| Younger viewership                     | -1.646                            | 1.312  | 3.384  | -1.647      | 1.308  | 3.386  | 0.079                                  | 0.046  | 0.168  | 0.213       | 0.124  | 0.452  |
| Older viewership                       | 0.341                             | 0.756  | 1.937  | 0.343       | 0.746  | 1.948  | -1.975                                 | 4.568  | 11.009 | -1.951      | 4.430  | 10.844 |
| Non-white viewership                   | 0.357                             | 4.150  | 7.835  | 0.358       | 4.155  | 7.862  | 0.318                                  | 2.451  | 7.117  | 0.312       | 2.330  | 6.968  |
| Household size                         | 0.338                             | 2.903  | 6.287  | 0.338       | 2.878  | 6.283  | -0.170                                 | 0.755  | 3.340  | -0.173      | 0.761  | 3.396  |
| Natural log of television households   | -0.008                            | 0.213  | 0.680  | -0.006      | 0.181  | 0.574  | 0.007                                  | 0.255  | 0.639  | 0.002       | 0.057  | 0.161  |
| Area of dominant influence rank        | 0.000                             | 0.561  | 1.574  | 0.000       | 0.543  | 1.503  | -0.001                                 | 0.769  | 1.838  | -0.001      | 0.840  | 2.263  |
| Adjusted R <sup>2</sup>                |                                   | 0.336  |        |             | 0.336  |        |  | 0.517  |        |             | 0.513  |        |

Notes: Parameters estimated using weighted least squares (WLS). Robust variance estimation allows for correlation in errors across systems owned by the same owner. Absolute value of *t*-statistics shown in each of the two columns adjacent to coefficient.

rate by an estimated 6 percent. In addition, point estimates suggest that premium integration raises basic penetration by an estimated 2 percent and basic-only penetration by an estimated 0.5 percent, but these findings are not statistically significant at conventional levels. Finally, premium integration raises premium subscriptions as a fraction of basic subscriptions by an

estimated 3 percent. This finding is statistically significant only at the 10-percent level.

These results indicate that both basic and premium operators are better at promoting their own services. Operators who own basic programming offer larger basic packages at somewhat higher prices. Moreover, their consumers have access to the same number of premium



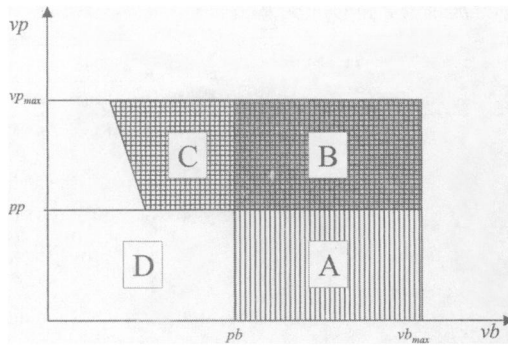


FIGURE 2. DEMAND FOR BASIC AND PREMIUM SERVICES

services at prices lower than those paid by consumers in unintegrated markets. Despite these lower premium prices, the penetration rate results suggest that the basic package offered in basic markets saturates consumers and reduces the demand for premium services. Operators who own premium services offer smaller basic packages at lower prices. Their consumers have access to fewer premium services at higher prices. The penetration rate results suggest that the smaller, cheaper basic package entices more consumers to purchase premium services.

### V. Welfare Analysis

In this section, I calculate the effects of vertical integration on consumer welfare. Reduced-form analysis establishes that vertical integration results both in the exclusion of rival program services from the distribution networks of the integrated firm and in efficiency gains. Ultimately, how consumers fare under vertical integration depends on the relative importance of these effects.

The surplus calculation I employ can be illustrated using basic economic principles. Figure 2 depicts how consumers fall into four different regions. In the figure,  $vb$  and  $vp$  reflect consumer valuations and  $pb$  and  $pp$  represent prices for basic and premium services, respectively. Consumers in region  $A + B + C$  all buy basic cable; however, consumers in region  $A$  buy only basic cable. Consumers in  $B + C$  buy premium services as well as basic services. Consumers in region  $C$  purchase basic in order to buy premium services. Consumers in region

$D$  will not purchase any cable services. The price-quality mix of the program services, in addition to demographic characteristics, will determine  $vb_{max}$  and  $vp_{max}$  and cause households to be distributed across and within the four regions. Net consumer surplus is a function of the consumer's valuation for basic cable, the price of basic cable, the consumer's valuation for premium services, the price of premium services, the basic penetration rate, and the premium penetration rate.<sup>36</sup>

Because vertical integration affects prices and product quality, it will change both the relative shapes of the regions and the distribution of households in  $vb-vp$  space. Estimating the effects of ownership structure on consumer surplus requires direct information, which can be obtained only from structural analysis, on consumers' valuation for basic and premium services. However, certain patterns in the reduced-form results might indicate whether integration harms or benefits consumers. For example, if we were to find that integrated operators offered fewer program services at higher prices, and achieved lower penetration rates for both basic and premium services, then we could conclude that vertical integration unambiguously harmed consumer welfare.

Reduced-form results for the cable television industry do not reveal such patterns. Instead, the results suggest that integration produces some changes that may harm consumers and others which may benefit them. It is unclear, from the reduced-form analysis, whether the larger basic packages with cheaper premium services compensate consumers in basic markets sufficiently

<sup>36</sup> Consumer surplus ( $CS$ ) is given by the sum of surplus in each of the three regions  $A$ ,  $B$ , and  $C$ :

$$\begin{aligned}
 CS = & \int \int_A f(vb, vp)(vb - pb)dvdvp \\
 & + \int \int_B f(vb, vp)[(vb - pb) + (vp - pp)]dvdvp \\
 & + \int \int_C f(vb, vp)[(vp - pp) - (pb - vb)]dvdvp
 \end{aligned}$$

where  $f$  is the distribution of consumers in  $vb-vp$  space.

for slightly higher basic prices. Similarly, it is unclear whether the smaller but cheaper basic packages compensate consumers in premium markets sufficiently for the fewer premium choices at higher prices. These limitations highlight the need for structural analysis in order to assess the welfare effects of vertical integration.

#### A. Demand Estimation

Structural analysis provides information about consumer preferences that can be used to construct measures of consumer welfare. I first estimate the parameters of a demand system for basic and premium services. Consumers' willingness to pay for basic cable and for premium services is a function of the price of basic cable, the average price of a premium service, consumer demographics, and product characteristics. Basic product characteristics include the number of basic services offered and a measure of program duplication in the basic package. Premium product characteristics include the number of basic services offered, a measure of program duplication in the basic package, and an indicator variable for whether the system offers the basic movie service AMC. Because basic cable is tied to the premium services, the price and quality of the basic package should affect the demand for premium services. Similarly, the average price of a premium service should affect the demand for basic cable. Finally, consumer demographics are those specified earlier in this paper.

Parameters of the basic and premium demand equations are jointly estimated using the generalized method of moments framework. As described earlier, the basic and the premium penetration rates are estimates of the probability that a given household in a particular franchise area will purchase basic and premium cable, respectively. Consequently, the reported standard errors allow for heteroskedasticity. As before, the error structure allows for correlation in errors across systems controlled by the same operator. It also allows for contemporaneous correlation of the system-specific errors in the basic and premium equations.

The endogenous variables in the model are the price of basic cable; the average price for

a premium service; the number of basic program services offered in the basic package; the amount of program duplication in the basic package; and whether or not the basic movie service, AMC, is included in the basic package. Instrumental variables include consumer demographics, system characteristics, and owner characteristics. System and owner characteristics include system age, system size as measured by the number of homes passed locally, operator's horizontal size, the number of basic program services with which the operator is integrated, the number of premium services with which the operator is integrated, and whether or not the operator owns AMC. Some specifications also include channel capacity as an additional instrumental variable. The results are reported in Table 8. A test of specific instrument validity rejects the null hypothesis that channel capacity is exogenous at the 5-percent level. A general test of the overidentifying restrictions provides support for the choice of demographics, system characteristics, and owner characteristics as instrumental variables.

As expected, own and cross prices have a negative effect on demand. Point estimates suggest that the basic own-price elasticity is about  $-5.9$  and the premium own-price elasticity is about  $-2.0$ .<sup>37</sup> Estimated cross-price effects, although statistically insignificant, suggest a premium price elasticity of basic demand of about  $-0.04$  and a basic price elasticity of premium demand of about  $-2.05$ .<sup>38</sup> Product characteristics are also

<sup>37</sup> The basic own-price elasticity is larger, in absolute value, than previously found. Robert N. Rubiovitz (1993) finds a basic own-price demand elasticity of  $-1.5$ . Roger G. Noll et al. (1973) find an elasticity of  $-1.95$ . The difference may be due to model specification. For example, previous studies do not control for premium price or basic program duplication in the demand for basic subscriptions. As far as I am aware, this paper is the first to present estimates on cross-price and premium own-price elasticities.

<sup>38</sup> The cross-price effects, the partial effect of basic price on premium penetration rates and the partial effect of premium price on the basic penetration rate, are not significantly different from each other, and I cannot reject the null hypothesis that the cross-price effects are equal. However, even without income effects, the cross-price effects may not be equal because basic cable is tied to premium services, whereas premium services are not tied to basic cable.

TABLE 8—STRUCTURAL DEMAND ESTIMATES

| Variable  | Panel A: With Channel Capacity |                     |                          |                     | Panel B: Without Channel Capacity |                     |                          |                     |
|---|--------------------------------|---------------------|--------------------------|---------------------|-----------------------------------|---------------------|--------------------------|---------------------|
|   | Basic penetration rate         |                     | Premium penetration rate |                     | Basic penetration rate            |                     | Premium penetration rate |                     |
|   | Coefficient                    | <i>t</i> -statistic | Coefficient              | <i>t</i> -statistic | Coefficient                       | <i>t</i> -statistic | Coefficient              | <i>t</i> -statistic |
| Constant  | 2.673                          | 1.949               | -0.933                   | 1.076               | 2.545                             | 1.857               | 0.122                    | 0.102               |
| Price of basic cable                                | -0.255                         | 4.459               | -0.021                   | 0.892               | -0.243                            | 4.320               | -0.047                   | 1.496               |
| Price of premium cable                              | -0.012                         | 0.215               | -0.046                   | 1.698               | -0.003                            | 0.053               | -0.080                   | 2.124               |
| Basic services offered                              | 0.158                          | 4.275               | 0.048                    | 1.034               | 0.152                             | 4.144               | 0.113                    | 1.747               |
| Basic program duplication                           | -2.232                         | 3.757               | -0.595                   | 0.776               | -2.161                            | 3.639               | -1.635                   | 1.544               |
| Offer AMC in the basic package<br>(1 = yes, 0 = no) |                                |                     | -0.291                   | 1.673               |                                   |                     | -0.546                   | 2.224               |
| Natural log of income                               | 0.267                          | 2.132               | 0.131                    | 3.575               | 0.250                             | 1.997               | 0.132                    | 2.673               |
| Natural log of population density                   | -0.120                         | 3.808               | 0.005                    | 0.294               | -0.113                            | 3.619               | -0.020                   | 0.785               |
| Younger viewership                                  | -0.190                         | 0.120               | 0.177                    | 0.307               | -0.189                            | 0.119               | -0.199                   | 0.254               |
| Older viewership                                    | -2.337                         | 2.871               | -0.622                   | 1.403               | -2.219                            | 2.736               | -1.126                   | 1.857               |
| Non-white viewership                                | 0.145                          | 0.873               | 0.023                    | 0.425               | 0.126                             | 0.759               | -0.013                   | 0.173               |
| Household size                                      | -0.413                         | 2.056               | -0.039                   | 0.550               | -0.388                            | 1.936               | -0.072                   | 0.769               |
| Natural log of television households                | 0.196                          | 2.643               | 0.088                    | 1.950               | 0.184                             | 2.491               | 0.142                    | 2.293               |
| Area of dominant influence rank                     | 0.289                          | 2.422               | 0.108                    | 1.763               | 0.270                             | 2.273               | 0.176                    | 2.080               |
| Omnibus test for instruments                        |                                |                     | 10.042<br>(0.123)        |                     |                                   |                     | 4.582<br>(0.333)         |                     |

Notes: Parameters of basic and premium penetration rate equations are jointly estimated using generalized method of moments. Variance estimation allows for heteroskedasticity, for correlation in errors across systems owned by the same owner, and for contemporaneous correlation between errors of the basic and premium equations.

strong determinants of demand. The basic penetration rate increases with the number of services but decreases with program duplication on the basic package. The premium penetration rate also increases with the total number of basic services, decreases with basic program duplication, and decreases when AMC is offered in the basic package. These findings suggest that large basic packages with diverse programming are valued by consumers and pose less of a barrier to the purchase of premium services than smaller basic packages with program duplication. Also, these findings suggest that the basic movie service, AMC, indeed competes with the premium services for viewership.

Further, consumer demographics have statistically significant effects on both basic and premium penetration rates. For example, higher levels of income are associated with higher demand for basic and premium cable services. Urban areas and areas with higher fractions of older people have lower demand for cable. In addition, large television markets, as measured both by the num-

ber of television households and area of dominant influence rank, have higher demand for cable.

### B. Surplus Calculation

I use the Marshallian demand estimates to compute equivalent variation measures of consumer surplus—that is, the amount of monetary compensation a consumer would require to be just as well off as in equilibrium if his or her basic and premium cable were taken away. I then compare average consumer surplus across integrated and unintegrated markets. Consumers who receive the greatest utility from their cable offerings will require the most monetary compensation.

Consumer surplus (*CS*) is derived from the expenditure function (*e*) as follows:

$$(1) \quad CS = e(pb^c, pp^c, u^*) - e(pb^*, pp^*, u^*)$$

where  $pb^*$  and  $pp^*$  are equilibrium prices of basic and premium services, and  $u^*$  is the level of utility attained in equilibrium;  $pb^c$  and  $pp^c$

are *choke* prices for basic and premium service, defined as the prices at which both basic and premium penetration rates are zero.<sup>39</sup> To derive choke prices, it is useful to express the deterministic portions of the demand equations estimated in the previous subsection as  $qb = a_1pb + a_2pp + aX_b$  and  $qp = b_1pb + b_2pp + bX_p$  where  $qb$  and  $qp$  are basic and premium penetration rates, respectively, and  $X_b$  and  $X_p$  each include a constant, product characteristics, and demographics. Setting  $qb = qp = 0$ , and simultaneously solving for  $pb$  and  $pp$ :

$$(2) \quad pb^c = \frac{a_2bX_p - b_2aX_b}{a_1b_2 - a_2b_1},$$

$$pp^c = \frac{b_1aX_b - a_1bX_p}{a_1b_2 - a_2b_1}.$$

Consumer surplus,  $CS$  from equation (1), can be rewritten as:

$$(3) \quad CS_1 = [e(pb^c, pp^c, u^*) - e(pb^*, pp^c, u^*)]$$

$$+ [e(pb^*, pp^c, u^*)$$

$$- e(pb^*, pp^*, u^*)]$$

which can further be rewritten as:

$$(4) \quad CS_1 = \int_{pb^*}^{pb^c} \frac{\partial e(pb, pp^c, u^*)}{\partial pb} dpb$$

$$+ \int_{pp^*}^{pp^c} \frac{\partial e(pb^*, pp, u^*)}{\partial pp} dpp$$

where  $\partial e(pb, pp^c, u^*)/\partial pb = h_b(pb, pp^c)$ , the Hicksian demand curve for basic cable, evaluated at the premium choke price, and  $\partial e(pb^*, pp, u^*)/\partial pp = h_b(pb^*, pp)$ , the Hicksian demand curve for premium services, evaluated at the equilibrium basic price.

Assuming that income effects are negligible

<sup>39</sup> If demands were nonlinear around zero, then  $pb^c = \infty$  and  $pp^c = \infty$ .

—a reasonable assumption given the relative magnitudes of the monthly basic cable price and the monthly median household income—Marshallian demands are good approximations for Hicksian demands.<sup>40</sup> Thus, consumer surplus is computed as:

$$(5) \quad CS_1 = \int_{pb^*}^{pb^c} qb(pb, pp^c) dpb$$

$$+ \int_{pp^*}^{pp^c} qp(pb^*, pp) dpp.$$

To verify that this calculation is robust to the path of integration, consumer surplus is recalculated in a number of ways. For example, consumer surplus from equation (1) can be rewritten as:

$$(6) \quad CS_2 = [e(pb^c, pp^c, u^*) - e(pb^c, pp^*, u^*)]$$

$$+ [e(pb^c, pp^*, u^*)$$

$$- e(pb^*, pp^*, u^*)]$$

which can be computed as:

$$(7) \quad CS_2 = \int_{pb^*}^{pb^c} qb(pb, pp^*) dpb$$

$$+ \int_{pp^*}^{pp^c} qp(pb^c, pp) dpp.$$

This is another estimate of the average amount of monetary compensation a consumer would require to be left just as well off as in equilibrium if his or her basic and premium cable were taken away. Figure 3 depicts these and six other paths, referred to as  $CS_3$  to  $CS_8$ , from  $(pb^*,$

<sup>40</sup> Robert D. Willig (1976) and Jerry A. Hausman (1981) both show that consumer surplus estimates using Marshallian demands are very close to those using Hicksian demands, when the product under consideration constitutes a small share of the consumer's budget.

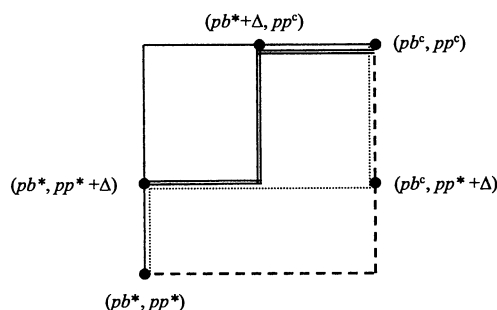


FIGURE 3. PATHS OF INTEGRATION FOR CONSUMER SURPLUS CALCULATION

$pp^*$ ) to  $(pb^c, pp^c)$ , which are used to construct estimates of consumer surplus.

Finally, I estimate the amount of monetary compensation a consumer would require if one were to take away only his or her premium cable. This calculation requires a choke price for premium cable such that only  $qp = 0$ , at the equilibrium level of  $pb$ . This choke price, found by setting only  $qp = 0$  in the demand equation above, is equal to:  $pp^c = (b_0pb + bX_p)/(-b_1)$ . Consumer surplus is then given by:

$$(8) \quad CS_9 = e(pb^*, pp^c, u^*) - e(pb^*, pp^*, u^*)$$

and is estimated by:

$$(9) \quad CS_9 = \int_{pp^*}^{pp^c} qp(pb^*, pp) dpp.$$

This is the monetary compensation that a consumer would require to be left just as well off as in equilibrium if his or her premium cable were taken away.

### C. Findings

Estimates of consumer surplus are reported in Table 9.<sup>41</sup> The rows provide estimates of  $CS_1$  to  $CS_9$ . The columns divide systems into one of

<sup>41</sup> Choke prices are constructed using parameter estimates. Standard error of consumer surplus estimate, computed using the delta method, properly accounts for the use of estimates both as arguments of the function and the limits of vertical integration.

three groups: those whose operator is not vertically integrated (unintegrated), those whose operator is vertically integrated with basic services but no premium service (basic), and those whose operator is vertically integrated with premium services (premium). For each system, the surplus is evaluated using system-specific prices and product characteristics, and full-sample average demographic characteristics. Holding demographics constant across the three types of cable systems avoids confusing the effects on consumer surplus derived from differences in prices and product offerings with those derived from differences in demographics. Individual system surplus is then averaged for each of the three groups. The first three columns of the table present estimates of consumer surplus using the specification with channel capacity, while the second three present estimates using the specification without channel capacity. A comparison of estimates across  $CS_1$  to  $CS_8$  provides information on their stability. Comparing surplus estimates across the columns reveals whether consumers are better off on average with the product-price mix in unintegrated, basic, or premium markets.

Because specification testing rejects the exogeneity of channel capacity, this discussion focuses on surplus estimates using specification 2, even though the conclusions are robust across specifications. Surplus calculations  $CS_1$  through  $CS_8$  represent the monetary compensation required to take away basic and premium services, leaving the consumer just as well off as in equilibrium. Estimates across paths of integration are not statistically different from each other, indicating that they are path independent.<sup>42</sup> Five of the eight methods produce estimates that are significantly different from zero at conventional significance levels. Averaging across the eight methods, I find that consumers in unintegrated markets have \$1.58 of surplus, consumers in basic markets have \$1.96 of surplus, and consumers in premium markets have \$2.00 of surplus. Estimates across markets are not statistically different from each other. The weakest interpretation of these findings is that

<sup>42</sup> I cannot reject the null hypothesis that any two estimates within a column are the same, at conventional significance levels. Further, 95-percent confidence intervals overlap for each pair of these estimates.

TABLE 9—ESTIMATES OF EXPECTED CONSUMER SURPLUS (PER MONTH) CONSTRUCTED USING TABLE 8 ESTIMATES

| Path of integration | Panel A: With Channel Capacity |                     |                     | Panel B: Without Channel Capacity |                     |                     |
|---------------------|--------------------------------|---------------------|---------------------|-----------------------------------|---------------------|---------------------|
|                     | Unintegrated                   | Basic               | Premium             | Unintegrated                      | Basic               | Premium             |
| $CS_1$              | 1.865*<br>(1.093)              | 2.181*<br>(1.293)   | 2.290<br>(1.481)    | 1.475**<br>(0.591)                | 1.686**<br>(0.712)  | 1.872**<br>(0.882)  |
| $CS_2$              | 1.730**<br>(0.846)             | 2.030*<br>(1.064)   | 2.126**<br>(1.073)  | 1.122***<br>(0.352)               | 1.251***<br>(0.457) | 1.411***<br>(0.452) |
| $CS_3$              | 3.439***<br>(1.269)            | 4.133***<br>(1.799) | 4.129**<br>(1.692)  | 2.780**<br>(1.362)                | 3.457**<br>(1.560)  | 3.463**<br>(1.623)  |
| $CS_4$              | 3.148**<br>(1.438)             | 3.749**<br>(1.775)  | 3.792**<br>(1.815)  | 2.431*<br>(1.480)                 | 2.991*<br>(1.595)   | 3.037*<br>(1.588)   |
| $CS_5$              | 2.857<br>(1.763)               | 3.366<br>(1.581)    | 3.455<br>(2.129)    | 2.082**<br>(1.065)                | 2.524**<br>(1.131)  | 2.612**<br>(1.156)  |
| $CS_6$              | 2.125**<br>(1.064)             | 2.432**<br>(1.131)  | 2.599**<br>(1.158)  | 1.217<br>(1.362)                  | 1.386<br>(1.386)    | 1.542<br>(1.524)    |
| $CS_7$              | 2.175**<br>(1.002)             | 2.488**<br>(1.053)  | 2.659**<br>(1.077)  | 1.273<br>(1.337)                  | 1.455<br>(1.349)    | 1.615<br>(1.484)    |
| $CS_8$              | 2.225**<br>(0.941)             | 2.544***<br>(0.976) | 2.272***<br>(0.997) | 1.329<br>(1.312)                  | 1.523<br>(1.313)    | 1.688<br>(1.446)    |
| $CS_9$              | 1.259*<br>(0.741)              | 1.623*<br>(0.947)   | 1.592*<br>(0.964)   | 0.713**<br>(0.338)                | 0.942**<br>(0.435)  | 0.949**<br>(0.468)  |

Notes: Standard errors in parentheses. Surplus is computed using a vector of sample average demographics and system-specific product characteristics.

\* Estimates are statistically different from 0 at the 10-percent level.

\*\* Estimates are statistically different from 0 at the 5-percent level.

\*\*\* Estimates are statistically different from 0 at the 1-percent level.

consumers in integrated markets are no worse off than those in unintegrated markets. The strongest interpretation is that consumers in integrated markets are somewhat better off.

Surplus calculation  $CS_9$  represents the monetary compensation required to take away premium services only, leaving the consumer just as well off as in equilibrium, at the equilibrium price of basic cable. These estimates are significantly different from zero at the 5-percent level. The point estimates suggest that consumers in unintegrated markets need to be compensated by \$0.71 a month, consumers in basic markets need \$0.94, and consumers in premium markets need \$0.95 to be just as well off without premium services. While estimates are not statistically different across integrated and unintegrated markets, they suggest that consumers of premium service are weakly better off in integrated markets. Further, they suggest that gross surplus from premium services is higher in premium markets than in basic markets, where premium price is lowest. Finally, subtracting the compensation for premium from the compensation for the basic and premium combination yields an estimate of the surplus di-

rectly attributable to the consumption of the basic package. Consumers in unintegrated markets retain \$0.87 of surplus, consumers in premium markets retain \$1.02 of surplus, and consumers in premium markets retain \$1.05 of surplus from the basic package.

These findings support the conclusion that vertical integration does not harm, and may actually benefit, consumers. They indicate that consumers prefer the smaller but cheaper basic packages offered by the premium operators to the larger, more expensive packages in other markets. They also suggest that the product-price mix offered by vertically integrated cable operators sufficiently compensates the average consumer for any harm suffered because of the market foreclosure of rival program services.

## VI. Summary and Conclusion

This paper studies the effects on consumer welfare of vertical integration between programming and distribution in the cable television industry. Theory suggests that vertical integration can result in both market foreclosure and efficiency gains. Market foreclosure will

tend to raise prices and harm consumers, while efficiency effects will tend to lower prices, improve product quality, and benefit consumers. Indeed, there is much speculation that both strategic and efficiency effects exist in the cable television industry. This paper provides empirical evidence that vertical integration has important effects on product offerings, prices, and penetration rates.

Vertical integration between cable operators and premium program services results in the exclusion of rival services. Premium operators offer fewer premium services. They also offer fewer basic services; in particular, they exclude the basic movie service, AMC, which most directly rivals their own premium movie services. There is less evidence that vertical integration between cable operators and basic program services results in foreclosure. A study of the shopping services, however, reveals that operators who own the basic shopping service QVC tend to exclude the rival shopping service HSN. These results provide empirical evidence for the existence of exclusionary practices. They also suggest that, in this industry, efficiency gains from vertical integration may be more important than associated strategic effects.

The empirical evidence presented in this paper shows clearly that vertical integration

between cable system operators and program services results in efficiency gains. Integrated operators are better at promoting their products than are unintegrated operators. Basic operators offer more basic services and achieve higher basic penetration rates, while premium operators offer fewer basic services and achieve higher premium penetration rates. The evidence also suggests that integrated operators prefer to carry their own programming.

Up until now, the theoretical debate over the practice of foreclosure has wrestled with its existence but has been silent on the issue of consumer welfare. Policy makers, on the other hand, have scrutinized vertical mergers that are likely to result in foreclosure out of concern that they will decrease consumer welfare. The analysis presented in this paper offers a methodology to evaluate the net effect of vertical integration on consumer welfare. In the case of cable television, the analysis shows that the harmful effects of integration due to foreclosure are offset by the efficiency-enhancing effects of integration; the evidence suggests that consumers in integrated markets are weakly better off, and statistically no worse off, than consumers in unintegrated markets.

*(Appendix follows)*

## APPENDIX

TABLE A1—CLASSIFICATION OF SERVICES BASED ON PROGRAMMING CONTENT

| # Service type               | Number of services |
|------------------------------|--------------------|
| 1 Movie                      | 1                  |
| 2 Sports                     | 32                 |
| 3 Family                     | 6                  |
| 4 Family/educational         | 3                  |
| 5 Educational                | 4                  |
| 6 General entertainment      | 12                 |
| 7 News                       | 9                  |
| 8 Text only                  | 10                 |
| 9 Financial news             | 3                  |
| 10 Shopping                  | 4                  |
| 11 Comedy                    | 3                  |
| 12 TV guides                 | 3                  |
| 13 Audio only                | 9                  |
| 14 Music videos              | 5                  |
| 15 Special interest services | 14                 |
| 16 Travel                    | 1                  |
| 17 Adult entertainment       | 2                  |
| 18 Political/social issues   | 2                  |
| 19 Religious                 | 10                 |

*Notes:* Services assigned to types on the basis of programming content. The last column presents the number of services with programming of a certain type, including both basic and premium services.

TABLE A2—THE CASE OF THE BASIC MOVIE SERVICE AMC

| Variable  | Panel A: Carry E! Entertainment |                            |                            | Panel B: Carry QVC |                            |                            |
|---|---------------------------------|----------------------------|----------------------------|--------------------|----------------------------|----------------------------|
|   | Marginal effect                 | <i>t</i> -statistic robust | <i>t</i> -statistic probit | Marginal effect    | <i>t</i> -statistic robust | <i>t</i> -statistic probit |
| System owner vertically integrated with a premium movie service (1 = yes, 0 = no) | 0.034                           | 1.732                      | 1.630                      | 0.140              | 2.413                      | 2.226                      |
| System owner vertically integrated with AMC (1 = yes, 0 = no)                     | -0.027                          | 1.916                      | 2.245                      | 0.267              | 2.210                      | 5.880                      |
| Natural log of owner's horizontal size  | 0.011                           | 2.900                      | 3.534                      | 0.021              | 1.756                      | 3.111                      |
| System age  | 0.000                           | 0.126                      | 0.134                      | 0.001              | 0.524                      | 0.762                      |
| Natural log of homes passed   | 0.021                           | 4.407                      | 5.675                      | 0.088              | 6.113                      | 8.393                      |
| Channel capacity  | 0.002                           | 4.655                      | 6.190                      | 0.006              | 3.406                      | 5.121                      |
| Natural log of income   | -0.009                          | 0.253                      | 0.268                      | -0.207             | 1.469                      | 2.144                      |
| Natural log of population density   | 0.003                           | 0.522                      | 0.651                      | 0.024              | 1.273                      | 1.626                      |
| Younger viewership  | -0.544                          | 1.699                      | 1.272                      | -0.508             | 0.323                      | 0.404                      |
| Older viewership  | 0.076                           | 0.293                      | 0.441                      | 1.126              | 1.524                      | 2.168                      |
| Non-white viewership  | 0.052                           | 1.058                      | 1.194                      | 0.024              | 0.150                      | 0.186                      |
| Household size  | 0.090                           | 1.797                      | 1.857                      | 0.224              | 1.160                      | 1.528                      |
| Natural log of television households  | 0.008                           | 0.502                      | 0.593                      | -0.005             | 0.071                      | 0.121                      |
| Area of dominant influence rank   | 0.000                           | 0.860                      | 1.029                      | 0.000              | 0.194                      | 0.312                      |
| 1-logL/logL0  |                                 | 0.257                      |                            |                    | 0.193                      |                            |

*Notes:* 1. Parameters estimated using probit maximum likelihood. Robust variance estimation allows for heteroskedasticity and for correlation in errors across systems owned by the same owner. Standard errors for marginal effects computed using the delta method. Absolute value of *t*-statistics shown in columns adjacent to coefficient. 2. Operators Time Warner and Viacom own the premium movie services. Operators TCI and Cablevision Systems Corporation own AMC. Time Warner is one of the owners of E!, TCI is one of the owners of QVC and the Discovery Channel, and Viacom owns Nick-at-Nite.



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