

Bundling in Cable Television: Incentives and Implications for Regulatory Policy*

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Abstract

Cable television systems bundle program networks into services for sale to consumers. The implications of this bundling for consumer welfare, however, are unknown and depend on systems' incentives to bundle. To address this issue, we estimate a model of demand for cable television services designed to assess the role of heterogeneous consumer tastes on bundling decisions. In particular, consumer tastes for each offered service are modeled to depend on the particular networks offered; unobserved tastes for each network, in turn, are permitted to (co-)vary in the population of consumers in each market. Preliminary results indicate that tastes for some groups of program networks may be negatively correlated, suggesting that bundling may act to sort consumers in a manner similar to 2nd-degree price discrimination. In light of these findings, we consider alternative regulatory policies in the industry.

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1 Introduction

Cable television systems bundle program networks into services for sale to consumers. The typical Basic cable service, for example, consists of the broadcast networks available in the local television market, a collection of cable networks, and assorted other networks of local interest.¹ While Basic service will often contain some of the most popular networks available on cable, including ESPN, WTBS, and CSPAN, others, including CNN, USA, TNT, HBO, and Showtime, are typically offered in somewhat smaller bundles or on an à-la-carte basis at additional cost.² Furthermore, in no case can consumers directly purchase access to a single network within a given bundle of networks.³

The implications of program bundling for consumer welfare in cable markets are generally unknown. In particular, they depend on the determinants of firms' bundling decisions. Three possibilities apply to cable television: complementarities in demand, complementarities in cost, and consumer sorting. In each of the first two cases, bundling likely increases consumer welfare as it reduces, respectively, the costs of consumption and production. In the latter case, however, bundling may decrease consumer welfare as it may sort consumers in a manner similar to 2nd-degree price discrimination.⁴ In this case, negative correlation in unobserved tastes for the program networks making up program bundles is critical as it increases the profitability of bundling by reducing consumer heterogeneity and permitting greater surplus extraction with linear prices.⁵ If present, such discrimination introduces a social cost in addition to the normal deadweight loss associated with monopoly pricing.

The purpose of this paper is to assess the importance of the discriminatory incentives to bundle in cable television markets. To do so, we specify and estimate a model of demand for each of the services offered in a cross-section of cable markets designed to assess the role of heterogeneous consumer tastes on systems' incentives to bundle. In particular, consumer tastes for each offered service are modeled to depend on the particular networks in the bundle; unobserved tastes for each network, in turn, are permitted to (co-)vary in the population of consumers in each market.⁶ As a consequence, we can estimate the correlation in unobserved tastes for networks, an indicator of the profitability of bundling as a price-discrimination mechanism.⁷

¹Different types of networks and services offered by cable systems are defined in Section 2.1.

²These smaller bundles are usually known as Expanded Basic services. À-la-carte services are usually known as Premium services.

³i.e. A network offered only as part of the bundle.

⁴Stigler (1968) was the first to recognize the discriminatory potential of bundling; Adams and Yellen (1976) were the first to formalize the argument.

⁵See McAfee, McMillan, and Whinston (1989) for a detailed theoretical analysis and Schmalensee (1984) for an application.

⁶This extends the work of Crawford (1999a) and Crawford (1999b) by permitting tastes for each network to co-vary in the consumer population.

⁷While we don't specifically *test* alternative incentives to bundle, the model presented here can be expanded to do so. We intend to pursue this line of research in future revisions.

The principal source of data used to pursue this investigation is drawn from the Television and Cable Factbook, a cable industry reference. The Factbook conducts detailed annual surveys of the population of United States cable systems. The data in this paper consist of observations from the 1996 volume for which complete information was available. In total, 1,201 systems are present in the sample.

Like recent work in the differentiated products literature, we identify individual tastes for cable services on aggregate market shares in a cross-section of markets.⁸ This requires an assumption on the distribution of unobserved individual tastes in each market.⁹ In this version of this paper, we assume that unobserved individual tastes are distributed according to a Type I Extreme Value distribution and provide indirect evidence of correlation in household tastes for program networks. We outline, however, how to estimate the model using more general taste distributions that will identify these correlations. For either case, estimation is by Generalized Method of Moments with cost shifters providing instruments for price.

The preliminary results indicate that there is weak negative correlation between *some* cable programming networks. While firmer conclusions await identification of the structural parameters of interest, we explore the implications of these findings for regulation in cable television markets.

The balance of this paper proceeds as follows. Section 2 describes the cable industry and describes possible incentives to bundle networks. Section 3 presents the economic model, followed by a discussion of the econometric model and estimation procedure in section 4. Section 5 introduces the data and presents the empirical specification. Section 6 describes our preliminary results. Section 7 concludes and provides directions for future research.

2 The Cable Television Industry and the Bundling Decision

2.1 The Cable Television Industry

Cable television systems select a portfolio of programming networks, bundle them into one or more services and offer these services to consumers in local, geographically separate, monopoly cable markets.¹⁰ This section briefly defines the types of programming and services common to all cable

⁸Recent examples include Berry, Levinsohn, and Pakes (1995), Bresnahan, Stern, and Trajtenberg (1997), and Nevo (1997).

⁹In the case of the dataset described above, further aggregation is required: while consumers select among all combinations of cable services, only the information about each individual service is available in the data. This is easily accommodated, however, by aggregating, for example, the predicted market share for all choices containing HBO to yield an aggregate HBO market share.

¹⁰This market structure historically resulted from the granting by local municipalities of exclusive franchises to cable systems in light of the perceived 'Natural Monopoly' features of cable service. The granting of exclusive franchises was annulled by the 1992 Cable Act. For a description of the franchising process, see Zupan (1989).

systems and describes the typical bundling of programming into services. This helps motivate the economic model developed in the next section.

Cable systems offer three main types of program networks. *Broadcast networks* are television signals broadcast in the local cable market by television stations and then collected and retransmitted by cable systems. Examples include the major, national broadcast networks – ABC, CBS, NBC, and FOX – as well as public and independent television stations. *Cable programming networks* are advertising-supported general and special-interest networks distributed nationally to systems via satellite. Among these are some of the most recognizable networks associated with cable, including MTV, CNN, and ESPN. *Premium programming networks* are advertising-free entertainment networks, typically offering full-length feature films. Among these are equally familiar networks like HBO and Showtime.

Broadcast and cable programming networks have historically been bundled by cable systems and offered as *Basic Service* while premium programming networks have typically been separated into individual services and sold on an à-la-carte basis as *Premium Services*. Some systems, however, elect to split Basic Service and instead offer some portion of their cable programming networks on multiple services, called *Expanded Basic Services*.

Despite the presence of separate Expanded Basic and Premium Services, consumers are not permitted to buy them directly; they are first required to purchase Basic Service.¹¹ Furthermore, consumers are not permitted to buy access to the individual networks offered in bundles; they must instead purchase the entire bundle. The purpose of this paper is to assess the welfare implications of these restrictions on consumer choice in cable markets.

2.2 Cable Program Bundle Heterogeneity

How much heterogeneity is there in systems' bundling decisions? Tables 1 and 2 address this question for the systems in our sample.

Table 1 describes the heterogeneity in *services* – defined as bundles of program networks – offered by the systems in our sample.¹² The first row of Table 1 presents the mean number of Basic, Premium, and Total Services offered by systems; the remaining rows present the frequency of these variables.¹³ As described above, all systems offer Basic Service and often offer many more services. For the systems in our sample, the average number of services offered is 3.93 and over 1/4 of all systems offer at least 6 services. Most of these are Premium Services; no system in our sample

¹¹This practice is known in the economic literature as a tying requirement. An often-ignored aspect of the cable purchase decision, it is naturally accommodated by the model specified in this paper.

¹²see Section 5 for more information about the dataset used in this paper.

¹³Basic Services are defined as Basic + Expanded Basic Services.

offered more than three Basic Services.

Of course, Basic Services consist themselves of bundles of individual networks. Table 2 describes the heterogeneity across systems in the allocation of networks across these bundles. In summarizing the portfolio of cable programming networks provided by systems, it is important to distinguish between more and less popular networks. To do so, we disaggregate these networks into groups according to the size of their potential audience.¹⁴ The top 40 such cable programming networks available in the United States as of December, 1992 are listed in Table 3.¹⁵ The first column of Table 2 presents the proportion of systems in the sample that carry each of the top-10 cable programming networks *on any Basic Service*. The remaining columns of the table examine the proportion of systems that carry each of the top-10 cable networks on each service they offer for systems that offer (a) only Basic Service, (b) Basic plus a single Expanded Basic Service, or (c) Basic plus two Expanded Basic Services.

Several interesting patterns emerge. First, note that the majority of the top-10 networks are offered on *some* service by the majority of systems. The very most popular networks, ESPN, CNN, and WTBS, are available on over 95% of all systems. In general, however, networks are allocated very differently among Basic and Expanded Basic services.¹⁶ Among systems offering a single Expanded Basic Service, only WTBS and CSPAN are more likely to be offered on Basic Service than on the Expanded Basic Service. As the majority of cable networks offered by these systems are carried on the Expanded Service, 13.83 versus 6.57, this is perhaps not surprising. Very different patterns emerge, however, for those systems offering *two* Expanded Basic Services. For these systems, the majority of networks are carried on *Basic*: 12.52 vs. 4.79 vs. 4.71. While many of the top-10 networks are, as a consequence, more likely to be offered there, others, including CNN, WTBS, USA, The Discovery Channel, and TNT, are more likely offered on one of the Expanded Basic Services.¹⁷

2.3 What Determines Cable Program Bundles?

The economic literature has identified three explanations for bundling that may apply to the cable television industry. These are complementarities in demand, complementarities in cost, and customer sorting.¹⁸

¹⁴This disaggregation is purely for expositional convenience. In the econometric estimation, each programming network is permitted a differential individual impact.

¹⁵This list is taken from Waterman and Weiss (1993)

¹⁶For systems that offer only Basic Service, there is no decision; these networks are all offered on Basic.

¹⁷This heterogeneity is extremely useful as the differential allocation of networks to Basic Services is one of the primary means of identifying information about the distribution of tastes for these individual networks.

¹⁸A fourth explanation, foreclosure, suggests that in a dynamic context a monopolist might bundle a competitive product with its monopoly product to 'extend' its monopoly into the competitive market. This explanation, for example, is the basis of the ongoing antitrust case against Microsoft's bundling of its web browser with its operating

The first explanation, complementarity in demand, suggests that products which consumers value in tandem are bundled and sold as a single product. Examples include shoes and shoelaces or fast-food value meals. Bundling reduces consumer search or decision costs and is more efficient than individual sales of the products. In this case, bundling is often not exclusive; individual sales are also maintained.

The second explanation, complementarity in cost, or economies of scope, suggests that products which are less costly to produce jointly are produced and sold as a bundle. Examples include health care services, financial services, and, possibly, telephone service.¹⁹ Bundling permits firms to share indivisible inputs (labor in the case of health care or financial services and capital in the case of telephone service) in the production of multiple products.

The third explanation, consumer sorting, suggests that bundling products is an effective way to sort consumers in a manner similar to 2nd-degree price discrimination. A large theoretical literature has found that the profitability of bundling stems from its ability to sort consumers into groups with different willingness to pay.

In the case of cable television, the first and second explanations of bundling behavior would manifest themselves as shocks to the *level* of demand and cost, respectively. For the case of complementarity in demand, aggregate subscriptions to cable services would be higher, *ceteris paribus*, when program networks were offered together as compared to when they were offered separately. For the case of complementarity in cost, prices of cable services would be lower, *ceteris paribus*, when program networks were offered together as compared to when they were offered separately.

Each explanation has merit. The sheer number of total networks offered by systems suggests consumers may prefer to choose among a smaller selection of *bundles* of those networks.²⁰ Similarly, while many systems now have the capability to exclude non-subscribers of cable services with an electronic signal from the cable headend, some still do not. For these systems, *unbundling* services requires the installation of traps, electro-mechanical devices that physically block the signal of unsubscribed services, at substantial cost.

The focus of this paper, however, is on the third explanation of firm bundling, that of consumer sorting. Since Adams and Yellen (1976), the bundling literature has found that the greater the negative correlation in consumer tastes for the components of the bundle across households, the greater is the profitability of bundling. Bundling products with negative correlation *reduces* the variability of consumer tastes. Consumer surplus may therefore more effectively be extracted with

system.

¹⁹Wholy (1996); Pully and Braunstein (1992); Gabel and Kennet (1994).

²⁰For the systems sampled in this paper, systems offer an average of 39 channels with some offering as many as 110. For more information about the systems in the sample, see Section 5.

a single price than can be achieved without bundling and multiple prices.²¹ This effect would manifest itself in the data as smaller variability in aggregate subscriptions, *ceteris paribus*, when program networks are offered together as compared to when they are offered separately.

In each case, incentives to bundle depend either on consumer's tastes for the components of the bundle (complementarities in demand, consumer sorting) or on the technology to produce the components of the bundle (complementarities in cost). To distinguish among them requires statistical techniques that can separate out taste and technology effects. The next section outlines how to identify the third effect, that of consumer sorting, in a model of demand for cable television services.²²

3 A Model of Demand for Cable Television Services

3.1 Overview

The goal of the model of demand is to assess the importance of heterogeneous consumer tastes for *the components* of program bundles on cable systems' incentives to bundle. This is accomplished in two steps. First, following Crawford (1999a), we specify a baseline household-level model of demand for combinations of cable services with tastes for each combination depending on the particular programming offered at the price charged. Second, we aggregate these household demands to the level of the data. This requires aggregating *both* over unobserved household-level tastes for each combination of service offered in cable markets and over combinations of services, themselves, to obtain market shares for each service offered in each market.²³ We differ from Crawford (1999a) by permitting household-level tastes for each program network to (co)-vary in the population of households. In this way, we are able to parametrize the correlation in unobserved tastes which impacts the profitability of bundling. Following Berry (1994), we invert the demand system to obtain mean utility levels for each service as a function of characteristics and prices and estimate the inverted system by Generalized Method of Moments. Cost shifters provide instruments for price. A detailed derivation of the model follows.

²¹In its dependence on the characteristics of the distribution of consumer tastes, the choice of optimal product bundles is quite similar to the choice of optimal non-linear price schedules. References to this literature include Spence (1980), Srinagesh (1991), and Armstrong (1996).

²²In future revisions, we will generalize this model to test for the other incentives to bundle.

²³The principal difficulty with the available cable data is that they do not report market shares for each element in the household's choice set, the combinations of cable services offered in that market. Instead, they report market shares for each service alone. See Crawford (1999a) for a detailed description of the restrictions this places on modeling demand in cable markets.

3.2 Household-Level Demand for Combinations of Cable Services

The structure of the model of household demand is designed to reflect as closely as possible the nature of household decision-making in cable markets.²⁴ Let S_n enumerate the set of services offered by the cable system in market n and let J_n enumerate the *combinations* of those services, $s \in S_n$, which may actually be purchased by the consumer. J_n defines the household choice set.²⁵

Each service combination in J_n is characterized by a vector of attributes, $(X_{jn}, p_{jn}, \xi_{jn})$. In this notation, p_{jn} stands for the price and (X_{jn}, ξ_{jn}) stand for observed and unobserved attributes of choice j in market n .²⁶

Following Berry (1994), we assume that household i 's utility for each of the set of service combinations, $j \in J_n$, is given by the following linear specification:

$$u_{ijn} = X'_{jn}\tilde{\beta}_i + \tilde{\alpha}_i p_{jn} + D'_n \gamma + \xi_{jn} + \epsilon_{ijn} \quad (1)$$

where $(X_{jn}, p_{jn}, \xi_{jn})$ represents observed and unobserved attributes of product j and $(\tilde{\beta}_i, \tilde{\alpha}_i, \epsilon_{ijn})$ represents individual i 's idiosyncratic taste parameters. Since aggregate tastes for cable service may also vary across markets, we incorporate a market-specific vector of demographic attributes, D_n , in the demand specification; γ parameterizes these differences in aggregate tastes.²⁷

Household tastes for networks and prices are assumed to have a simple structure:

$$\begin{aligned} \tilde{\beta}_i &= \beta + \zeta_i \\ \tilde{\alpha}_i &= \alpha + \iota_i \end{aligned} \quad (2)$$

where (β, α) represents mean tastes to program networks and prices, respectively, and (ζ_i, ι_i) represents mean-zero, individual-specific deviations from those means. Note that β is a column vector of length k . We consider alternative parameterizations for the distribution of (ζ_i, ι_i) in the empirical implementation; we denote its (joint) distribution here as $f_{\zeta, \iota}(\cdot | \Sigma)$, where Σ parameterizes the $(k + 1)$ -dimensional Variance-Covariance matrix of (ζ, ι) .

²⁴What follows is a brief description of the model developed in Crawford (1999a).

²⁵Two aspects of J_n deserve special mention. First, included in J_n is the option of not purchasing any cable services; consumers choosing this option choose to "purchase" (at zero price) whatever broadcast networks are offered in their service area. Second, excluded from J_n are combinations of cable services which do not include Basic Service; as Basic Service is tied to additional services, combinations of services which do not include Basic are not available to consumers and are therefore excluded from the choice set.

²⁶The parameterization of X_{jn} is critical to the accurate characterization of household demand for cable television services. The maintained assumption throughout this paper is that consumer tastes for cable services depend on the programming offered on those services. Reflecting this belief, X_{jn} is specified to include indicators of the particular programming networks offered on choice j . Because, however, the programming provided on any service combination may not exhaust all the relevant dimensions of that choice, an unobservable (to the econometrician) attribute, ξ_{jn} , is also incorporated into the demand for each service combination offered by cable systems. This unobservable attribute is called 'quality' and proxies for any of a host of idiosyncratic features of cable service that may impact demand. While not observed by the econometrician, quality is observed by both consumers and firms. This introduces price endogeneity into the demand specification which must be addressed in the econometric estimation.

²⁷Individual differences from this average are then captured by the ϵ_{ijn} .

This Variance-Covariance matrix, Σ , is the principal object of the demand analysis. It measures the covariance in unobserved tastes for the individual networks parameterized in X .²⁸ The greater tastes for given networks are negatively correlated, the greater will bundling these networks reduce consumer heterogeneity and increase system profits.

Equations 1 and 2 can be combined to yield the representation often seen in the literature:²⁹

$$\begin{aligned} u_{ij} &= X_j' \beta + \alpha p_j + D' \gamma + \xi_j + \nu_{ij} \\ &= \delta_j + \nu_{ij} \end{aligned} \quad (3)$$

where

$$\nu_{ij} = \left[\sum_k x_{jk} \zeta_{ik} \right] + \iota_i p_j + \epsilon_{ij} \quad (4)$$

where $\delta_j(X_j, p_j, \xi_j, D, \theta_1) \equiv X_j' \beta + \alpha p_j + D' \gamma + \xi_j$ stands for the mean utility to individuals in market n from the selection of product j , $\nu_{ij}(\theta_2)$ represents individual differences from that mean, the vector $\theta_1 = (\alpha, \beta', \gamma)'$ parameterizes mean consumer marginal utility for income, marginal utility for programming networks, and differences in aggregate tastes across markets arising from different demographic features of the market, and $\theta_2 = (\text{vech}(\Sigma))$ parameterizes characteristics of those differences. The vector of unobservable parameters to be estimated is $\theta \equiv (\theta_1', \theta_2')' = (\alpha, \beta', \gamma', \text{vech}(\Sigma))'$.

3.3 Aggregation Across Households and Service Combinations

The model as described is a model of *household* demand for *combinations* of cable services. The data, however, provide *market shares* for each of the *individual services* provided by the system. As a consequence, we must aggregate across both households and service combinations in order to identify the structure of tastes for cable service from the available data. This aggregation requires the specification of an assumption about the distribution of tastes, (ζ, ι, ϵ) , among households in each market.

Different households have different tastes and therefore make different choices. Each household is assumed to choose that combination of services which yields to them the greatest utility. Market demand for each product, $j \in J_n$, is then determined by the set of tastes in the population of consumers such that each is preferred to all others, denoted $A_j(\delta(X, p, D, \xi, \theta_1), \theta_2)$, or just A_j .³⁰

²⁸We identify as well the covariance in unobserved tastes between households' Willingness-To-Pay, measured by α , and the networks in X . This permits systems to capture unobserved heterogeneity in tastes for networks through the *price* of program bundles.

²⁹The market subscript, n , has been omitted for convenience.

³⁰See Berry (1994) for a detailed description of the set A_j .

In this paper, we partition the taste vector into sub-vectors, (ζ, ι) and ϵ . The distribution of ϵ_{ij} , conditional on (ζ_i, ι_i) is assumed to be continuously distributed within markets according to a Type I Extreme Value distribution, independent across individuals and products. Recall the marginal distribution of (ζ, ι) is denoted $f(\cdot|\Sigma)$; we consider several possible specifications in the empirical implementation. Given these assumptions, the market shares for products, w_j , are given by

$$\begin{aligned}
w_j(\delta(X, p, D, \xi, \theta_1), \theta_2) &= \int_{A_j} f_{\zeta, \iota, \epsilon}(\cdot|\theta_2) \\
&= \int_{A_j} f_{\zeta, \iota}(\cdot|\theta_2) f_{\epsilon}(\cdot) \\
&= \int_{\tilde{A}_j} \frac{\exp(\delta_j(X_j, p_j, \xi_j, \theta_1), \zeta, \iota)}{\sum_k \exp(\delta_k(X_k, p_k, \xi_k, \theta_1), \zeta, \iota)} f_{\zeta, \iota}(\cdot|\theta_2)
\end{aligned} \tag{5}$$

where j indexes the elements of J_n , \tilde{A}_j are the values of (ζ, ι) such that product j is preferred to all others, and we've integrated over ϵ in the last step to get the familiar logit market shares *conditional on* (ζ, ι) .

3.4 Inverting the Market Share System

If each w_j were observed, we could invert the system of market shares defined by $w = w(\delta, \theta)$ as described in Berry (1994) to solve for the mean utility levels, δ_j , as a function of the data and unobservable parameters and estimate the model, taking care to instrument for unobserved quality, ξ_{jn} . As described earlier, however, while the choice set is defined over all combinations of services ($j \in J_n$) offered to consumers in market n , only the market shares of each service ($s \in S_n$) are available in the data. To predict the shares observed in the data therefore requires aggregating across all combinations of services containing each service, yielding:

$$w_s(\delta(X, p, D, \xi, \theta_1), \theta_2) = \sum_{j \text{ cont. } s} w_j(\delta(X, p, D, \xi, \theta_1), \theta_2) \tag{6}$$

where $j \text{ cont. } s$ is defined to be those choices, $j \in J_n$, containing each service, $s \in S_n$, and w_s is the market share for service s . This aggregation in turn implies that the number of demand equations in each market is equal to the number of services offered by the system in that market.

Following Berry, to invert the market share system requires solving the system of equations defined by 6 above and rewritten as follows in Berry's notation:

$$s_s = w_s(\delta, \theta_2) \tag{7}$$

where s_s are the observed market shares and w_s are the market shares predicted by the model. At the true values of δ , 7 holds exactly and the system may be inverted to obtain the vector $\delta(s_s, \theta)$. As δ is linear in ξ , it can then be used in a standard GMM estimation algorithm.

The key condition to enable inversion of the system is of a “dominant diagonal” form, requiring

$$\sum_{t \neq 0} | -[\partial w_s / \partial \delta_t] / [\partial w_s / \partial \delta_s] | < 1 \quad (8)$$

or

$$\sum_{t \neq \{0, s\}} -\partial w_s / \partial \delta_t < \partial w_s / \partial \delta_s \quad (9)$$

In the case of disaggregated products, i.e. those where the market shares match the elements of the choice set, Berry notes that 9 above is satisfied as a consequence of homogeneity of degree zero of market shares in utility levels, i.e an increase in the utility of an outside good must lower the market shares of the inside goods:

$$\sum_{k=0} \partial w_j / \partial \delta_k = 0 \implies \sum_{k \neq 0} \partial w_j / \partial \delta_k = -\partial w_j / \partial \delta_0 > 0 \quad (10)$$

where we intentionally rewrite subscripts in terms of products, (j, k) , rather than services, (s, t) . This condition embodies the intuitive notion that every element of consumers choice sets are weak substitutes.

For market share systems with aggregated choices, 10 need not hold. For example, if a system offers 3 services,

$$\partial w_s / \partial \delta_t = \partial w_1 / \partial \delta_2 + \partial w_{12} / \partial \delta_2 + \partial w_{13} / \partial \delta_2 + \partial w_{123} / \partial \delta_2 \quad (11)$$

where s equals service 1 (e.g. Basic), t equals service 2 (e.g. Expanded Basic), and $\{1\}$, $\{12\}$, $\{13\}$, and $\{123\}$ equal the combinations of services including service 1 in the data (e.g. Basic alone, Basic + Expanded, Basic + HBO, and Basic + Expanded + HBO). As is evident from this example, some of the elements on the RHS of 11 may be positive (e.g. one would expect the market share of Basic + Expanded Basic to increase in the utility of Expanded Basic), violating the weak substitutability argument embodied in 10. For general distributions on tastes, then, the sufficient condition required of 9 need not hold.

Failing this sufficient condition requires relying on alternative solution techniques for the system of non-linear equations defined by 7. Experimentation with more general taste distributions correlating utility for Expanded Basic and Premium services yielded cycles in function iteration schemes (like Berry’s). This suggests applying more general solution techniques and is the focus of our current research efforts.

WHAT FOLLOWS IS OLD - SHOULD BE UPDATED ONCE THE INVERSION ROUTINE IS SOLVED

4 The Econometric Model

4.1 Identification

An instrument vector, $Z_{sn} = [X_{sn}, D_n, W_n]$, is defined for each service offered in the sample. Variables which shift marginal cost across markets, denoted W_n , provide instruments for price in the demand equations. The programming provided on each service, denoted X_{sn} , and demand shifters, D_n , serve as their own instruments.

The identifying population moment assumption made here is that, for each service, $s \in S_n$, $z'_{sn} = [X'_{sn}, D'_n, W'_n]$, the vector of instruments for the s th equation in the n th observation in the sample, is uncorrelated with ξ_{sn} , the unobservable component of demand for that service in market n , or $E(z_{sn}\xi_{sn}) = 0$.

Because most broadcast and cable programming networks are offered in bundles, the identification of the marginal utility to programming networks parameterized by β deserves special attention. For bundled products, identification is complicated by the commingling of the individual effects in each market. Identification of β therefore comes from two sources. First, systems differ in the portfolio of programming they offer to consumers. As a result, variation in the carriage of individual programming networks offered in any bundle of programming in conjunction with variation in the price of those bundles identifies the marginal utility to the network, albeit more weakly than in the absence of bundling. For some very popular networks, however, few systems elect not to carry them. In the extreme case – that all systems carry a given network – it could not be identified in this way. However, identification also arises from variation in the allocation of programming to different services. If some systems offer a given network on an Expanded Basic Service, while others offer it on Basic Service, its absence from the Basic Service in the former markets permits price-portfolio comparisons of the Basic Service across systems which identifies its contribution to individuals' utility.

4.2 Estimation

The sample analogs to the population moment restrictions defined above follow. We first solve for each ξ_s as a function of the parameters of interest, $\xi_s(\theta)$, where $\theta = (\alpha, \beta, \gamma)$. Stacking the equation-specific vectors of errors and instruments then yields a vector of demand errors, $\xi(\theta)$, and the matrix of instruments, Z :

$$\xi(\theta) = \begin{bmatrix} \xi_1(\theta) \\ \xi_2(\theta) \\ \vdots \\ \xi_N(\theta) \end{bmatrix} \quad X = \begin{bmatrix} Z_1 & 0 & \cdots & 0 \\ 0 & Z_2 & \cdots & 0 \\ \vdots & & \ddots & \\ 0 & 0 & & Z_N \end{bmatrix} \quad (12)$$

where N is the maximum number of services offered by systems in the sample.³¹

To estimate, let $\Omega = \text{Var}(Z'\xi)$ be the expected variance-covariance matrix of the orthogonality conditions. Then the estimated parameters solve

$$\theta = \arg \max_{\theta} \xi(\theta)'Z\Omega^{-1}Z'\xi(\theta) \quad (13)$$

Under the assumption that the instruments are uncorrelated with unobserved product quality, $E(Z'\xi) = 0$, minimizing this objective function with respect to the parameters, θ , yields consistent, asymptotically normal estimates of all the parameters in the model. The specification of X , D , and W , is discussed in detail in the next section.

Note that while Basic Service is offered in each market, each of the other services is not. For some observations, there are as many as 8 services offered, implying 8 equations, while for others there are as few as 2. As a result, market shares and prices are not observed for those services which the system elects not to provide. This is accommodated in the econometric estimation by defining each of the dependent, independent, and instrumental variables for a given service to be identically equal to zero in those markets which do not offer the service. This “balancing” of the unbalanced dataset has no impact on the parameter estimates of any of the equations, permitting the use of standard econometric statistical packages.

5 Data and Empirical Specification

5.1 Data

To estimate the model of demand, we compiled a market-level dataset on a cross-section of United States cable systems. The primary source of data for these systems is Warren Publishing’s Television and Cable Factbook Directory of Cable Systems database. The data for this paper consists of the

³¹The choice of N is described in the next section. In this paper, $N = 8$.

population of cable systems recorded in the 1996 Version of the Factbook for which complete information was available.³² From the population, a sample of 1,201 systems remained.³³

5.2 Empirical Specification

The estimating equations were given in equations ?? for services other than Basic and ?? for Basic Service. The set of services included in the system was chosen to capture the majority of service choices available in cable markets while maintaining a parsimonious model. Eight services are included: Basic Service; two Expanded Basic Services, numbered one and two; and 5 Premium Services, HBO, Showtime, The Disney Channel, Cinemax, and The Movie Channel.³⁴

The dependent variable in each of the eight equations is a function of the market share for each service, denoted w_s and defined as the number of subscribers to that service divided by the number of homes passed by the cable system. The number of homes passed is a very reliable measure of market size as it defines the set of households available to purchase cable services from each system. Prices for each service are denoted by p_s and the programming provided on each services is denoted by X_s .

Because of the sheer number of broadcast, cable, and premium programming networks offered by cable systems, permitting an individual effect for each network offered by any system is impractical. Instead, the following general strategy was pursued to parsimoniously measure the utility to consumers of programming. For each of the types of programming offered on cable, the networks provided by systems were separated into two classes. The first class contains those networks thought to provide an individual impact on the demand for cable. They are parameterized by dummy variables and enter the specification of X_s as separate regressors. The second class contains those networks thought to provide a common impact on demand for cable. They are counted and enter the specification of X_s as a single regressor.³⁵ The choice of the networks to enter the specification of X_s with separate or common impact depends on the type of programming considered and is described below.

We first allocated broadcast stations into one of the six principal types of broadcast networks

³²While there are over 11,000 systems in the sample, persistence in non-response over time as well as incomplete reporting of critical variables required imposing a large number of conditions in order for a system to be included in each sample. Missing information on prices, quantities, and reporting dates were responsible for the majority of the exclusions.

³³Systems in the sample tend to be smaller and in less urban areas than a representative system from the population of U.S. cable systems.

³⁴Variables associated with each service are indexed with letters as follows: b = basic, e = expanded basic one, f = expanded basic two, h = HBO, s = Showtime, d = Disney, c = Cinemax, and t = The Movie Channel.

³⁵The unequal treatment of some networks relative to others reflects the belief that there is significant heterogeneity in value to households of different networks; we try to permit individual effects where that heterogeneity is greatest.

available in local markets: ABC, NBC, CBS, FOX, Independent Stations and Public Stations.³⁶ For broadcast networks of each type available in any cable market, both over-the-air and on cable, we then distinguished between the 'first' such network and 'additional' such networks.³⁷ Given this structure, we measured both the number of first networks available over-the-air and on cable, respectively, in the market and the number of 'additional' networks available over-the-air and on cable. In the estimation, we include the number of first and additional networks offered over-the-air as well as the incremental number of first and additional networks offered on cable.³⁸

To accommodate differences in the value to consumers of different cable networks, we followed a similar strategy and distinguished between the benefit accruing to consumers from the 'most popular' versus 'additional' cable and premium programming networks offered on cable.³⁹ The most popular networks were permitted to impact the demand for cable on an individual basis, while additional networks were aggregated and permitted to impact demand on a common basis.

For each of cable and premium programming networks, the most popular networks are defined as those networks available to the greatest number of subscribers as of December, 1992.⁴⁰ The top-40 cable programming networks are given in Table 3; the top-5 premium programming networks are given in Table 4. The empirical specification presented here considers permitting individual impact to the top five and ten cable programming networks and the top five premium programming networks.⁴¹ The remaining networks not specifically indicated were then counted and their number permitted to enter the specification in levels.

The final category of programming provided by cable systems are Public, Educational, and Government (PEG) channels. The number of such channels is inferred from the utilized channel capacity less the total broadcast, cable, and premium programming networks provided by the system.⁴²

³⁶In the 1995 data reported in the 1996 Factbook, few stations were affiliated with either of the two fledgling networks, Warner Brothers and United Paramount Network.

³⁷The reason for this distinction stems from the widespread duplication of programming provided by stations of the same type. When this occurs, consumers will value on its merits the first available program network of a given type, but will not value as highly (or will simply value differently) each additional network of the same type. Systems often provide multiple networks of a given type due to Must-Carry requirements of existing cable regulations.

³⁸the incremental service provided by cable is defined by subtracting each of the over-the-air magnitudes from their cable counterparts.

³⁹As each of these networks is offered *only* on cable, we did not have to worry about forming differences in the variables as for the broadcast networks.

⁴⁰This is the most recent date for which a complete list is available. In future revisions, we intend to use the networks among the most popular in mid-1995, the vintage of most of the data.

⁴¹The top 10 cable programming networks were allocated to five different *groups* according to their content. While not necessary, grouping by content permits a more parsimonious specification of the nature of correlations permitted to unobserved tastes. The five groups are (1) Sports Networks (ESPN), (2) News Networks (CNN, CSPAN), (3) Adult General-Interest Networks (WTBS, USA, TNT), (4) Children's General-Interest Networks (Discovery, Nickelodeon, Family), and (5) Music Networks (MTV).

⁴²If, in addition, systems offered any pay-per-view (PPV) channels, these too would be allocated to the 'other' category.

Demographic variables included in the model are median income and population density. Median income impacts demand by permitting mean tastes to vary with income and population density by proxying for alternative entertainment options in the local market area.

Instrumental variables for price come from three variables thought to impact the marginal cost of providing cable television service(s). The first, homes passed, capture differences in marginal cost arising from potential scale economies in the provision of cable service. Noam (1985) found evidence of economies of scale in the number of homes passed by a cable system, channel capacity, and also in the density of homes per mile.⁴³ Another measure, the number of subscribers served by a Multiple System Operator (MSO) captures differences in marginal cost arising from heterogeneity in bargaining power in the input (programming) market. Chipty (1995), in an analysis of the impact of horizontal integration in the cable television industry, found evidence of such bargaining power. Along similar lines, we include a dummy variable if a system has vertical ties to programming networks. Both Chipty (1993) and Waterman and Weiss (1996) have found that systems tend to favor affiliated networks, at least in part because they can purchase programming from their affiliates at its true (and very low) marginal cost.

Tables 5 present sample statistics for each of the non-programming variables in the sample. Table 2 presented comparable information for individual programming networks.

6 Preliminary results: Estimates from several specifications

Table 6 presents the results for the simple logit specification of the demand model. The columns of Table 6 report, respectively, the parameter estimate, its standard error, the p-value of the test of the null hypothesis that the parameter equals 0. Also reported in Table 6 are the mean willingness-to-pay for each of the program variables estimated in the first column. These provide a convenient way to interpret the magnitude of the coefficient estimates provided in the first column.

Much of the demand for cable services is driven by Willingness-To-Pay for the cable and premium programming networks provided by systems.⁴⁴ Expected WTP estimates for these networks are largely reasonable: Expected WTP for ESPN is \$2.73, for CNN or CSPAN is \$0.91, and for WTBS, USA, or TNT is \$2.39.⁴⁵ Tastes for networks outside these ten are smaller, with an expected WTP not indistinguishable from \$0. Expected WTP for HBO, Showtime, The Disney Channel, Cinemax, and The Movie Channel, vary from a low of \$5.16 to a high of \$5.43.

⁴³As density and channel capacity have could also impact demand and therefore be correlated with the error, these are not used as instruments.

⁴⁴See Crawford (1999a) for a more detailed description of cable tastes for a slightly richer demand specification

⁴⁵Note that the expected WTP for MTV is -\$0.69, a finding *not* inconsistent with economic theory. For networks outside the most popular, it may be the case that mean tastes are negative; they can still be valuable bundle components as long as some households have tastes for them.

As the results presented here do not permit individual tastes to vary with market, as parameterized by Σ in Section 3, limited conclusions about the correlation in unobserved tastes for networks are available. Reported in Table 7, however, are the correlation in the *mean* tastes parameterized by β . This measure the degree to which these mean tastes vary *across* markets.⁴⁶

The findings provide weak indirect evidence for correlation among program groups. Three program group pairs show negative correlation: Sports and News Networks, News and Adult General-Interest Networks, and News and Music Networks. The remaining correlations are estimated to be positive. While firmer conclusions await identification of the structural parameters of interest, we explore the implications of these findings for regulation in cable television markets.

6.1 Implications of Preliminary Results

[PENDING]

1. A substantial theoretical literature identifies the distortions in product quality and number of products produced by multi-product monopolists. [Cites] No hard and fast conclusions are possible, however - conclusions depend on the structure of tastes and costs for the products produced by the monopolist.
2. In light of the failure of recent price-based cable regulations, one way to promote consumer welfare in cable markets may be to mandate the *unbundling* of networks.
3. Caveats: This paper can only suggest the maximum possible benefits of such a policy as unbundling implies forgoing cost savings arising from demand or cost complementarity. To adequately assess these competing costs and benefits requires a more detailed model of cable demand and supply.
4. In addition, there may be technical considerations: unbundling could impose substantial costs on some (esp. small and/or rural) systems.

7 Conclusion

The goal of this paper has been to assess the incentives of cable systems to bundle program networks into services for sale to consumers. In particular, we focus on a single possible determinant of bundling: the ability to sort consumers into groups in a manner similar to 2nd-degree price discrimination. In particular, the greater the negative correlation in unobserved tastes for the

⁴⁶ Σ measures the degree *individual* tastes vary *within* markets

networks that are bundled into services, the greater the profitability of bundling those networks. The preliminary estimates presented here indicate that tastes for *some*, but not all, groups of similar program networks may be negatively correlated. We then explore the implications of these preliminary findings for regulation in cable markets.

References

- ADAMS, W., AND J. YELLEN (1976): "Commodity Bundling and the Burden of Monopoly," *Quarterly Journal of Economics*, 90, 475–98.
- ARMSTRONG, M. (1996): "Multiproduct Non-Linear Pricing," *Econometrica*, 64(1), 51–75.
- BERRY, S. (1994): "Estimating Discrete Choice Models of Product Differentiation," *Rand Journal of Economics*, 25(2), 242–262.
- BERRY, S., J. LEVINSOHN, AND A. PAKES (1995): "Automobile Prices in Market Equilibrium," *Econometrica*, 63, 841–890.
- BRESNAHAN, T., S. STERN, AND M. TRAJTENBERG (1997): "Market Segmentation and the Sources of Rents from Innovation: Personal Computers in the late 1980s," *Rand Journal of Economics*, pp. S17–S44.
- CHIPTY, T. (1993): "Vertical Integration and its Effects on Unintegrated Rivals: Evidence from the Cable Television Industry," mimeo, Ohio State University.
- (1995): "Horizontal Integration for Bargaining Power: Evidence from the Cable Television Industry," *Journal of Economics and Management Strategy*, 4(2), 375–97.
- CRAWFORD, G. S. (1999a): "The Impact of the 1992 Cable Act on Household Demand and Welfare: A Discrete-Choice Differentiated Products Approach," mimeo, Duke University.
- (1999b): "The Incentives to Bundle: Evidence from the Cable Television Industry," mimeo, Duke University.
- GABEL, D., AND D. M. KENNET (1994): "Economies of Scope in the Local Telephone Exchange Market," *Journal of Regulatory Economics*, 6(4), 381–98.
- MCAFEE, R. P., J. McMILLAN, AND M. WHINSTON (1989): "Multiproduct Monopoly, Commodity Bundling, and Correlation of Values," *Quarterly Journal of Economics*, 103, 371–383.
- NEVO, A. (1997): "Measuring Market Power in the RTE Cereal Industry," University of California, Berkeley, mimeo.
- NOAM, E. M. (1985): "Economics of Scale in Cable Television: A Multiproduct Analysis," in *Video Media Competition: Regulation, Economics, and Technology*, ed. by E. M. Noam. Columbia University Press.
- PULLY, L. B., AND Y. M. BRAUNSTEIN (1992): "Composite Cost Function for Multiproduct Firms with an Application to Economies of Scope in Banking," *Review of Economics and Statistics*, 74(2), 221–230.
- SCHMALENSEE, R. (1984): "Gaussian Demand and Commodity Bundling," *Journal of Business*, 62, S211–S230.
- SPENCE, A. M. (1980): "Multi-Product Quantity-Dependent Prices and Profitability Constraints," *Review of Economic Studies*, 47, 821–41.

- SRINAGESH, P. (1991): “Mixed Linear-Nonlinear Pricing with Bundling,” *Journal of Regulatory Economics*, 3, 251–63.
- STIGLER, G. (1968): “A Note on Block Booking,” in *The Organization of Industry*, ed. by G. Stigler. Richard D. Irwin.
- WATERMAN, D. H., AND A. A. WEISS (1993): “Vertical Integration in Cable Television,” mimeo, American Enterprise Institute for Public Policy Research.
- (1996): “The Effects of Vertical Integration between Cable Television Systems and Pay Cable Networks,” *Journal of Econometrics*, 72, 357–95.
- WHOLY, D. (1996): “Scale and Scope Economies among Health Maintenance Organizations,” *Journal of Health Economics*, 15(6), 657–684.
- ZUPAN, M. A. (1989): “The Efficacy of Franchise Bidding Schemes in the Case of Cable Television : Some Systematic Evidence,” *Journal of Law and Economics*, 32, 401–36.

A Model Solution

Table 1: Service Heterogeneity

Mean	Expanded Services		Premium Services		Total Services	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	1.55	0.75	2.38	1.70	3.93	2.12
Frequency	Number	Percentage	Premium	Percentage	Services	Percentage
0	0	0	202	16.8	0	0
1	732	60.9	253	21.1	112	9.3
2	279	23.2	175	14.6	316	26.3
3	190	15.8	199	16.6	175	14.6
4	0	0	215	17.9	134	11.2
5	0	0	144	12	135	11.2
6	0	0	13	1.1	141	11.7
7	0	0	0	0	121	10.1
8	0	0	0	0	58	4.8
9	0	0	0	0	9	0.7

Table 2: Network Heterogeneity

Systems	All Systems	Systems Offering Basic Service	Systems Offering Basic + One Expanded Basic Service		Systems Offering Basic + Two Expanded Basic Services		
Services	All Services	Basic	Basic	Expanded Basic	Basic	Expanded Basic I	Expanded Basic II
Network	Mean	Mean	Mean	Mean	Mean	Mean	Mean
ESPN	0.98	0.98	0.30	0.68	0.77	0.19	0.04
CNN	0.96	0.95	0.17	0.78	0.26	0.46	0.28
WTBS	0.98	0.98	0.57	0.41	0.17	0.07	0.73
USA	0.87	0.82	0.19	0.72	0.26	0.62	0.10
Discovery	0.83	0.77	0.17	0.74	0.16	0.48	0.33
Nickelodeon	0.70	0.60	0.23	0.60	0.63	0.18	0.08
CSPAN	0.42	0.29	0.38	0.25	0.56	0.04	0.02
TNT	0.80	0.79	0.07	0.76	0.26	0.15	0.39
MTV	0.51	0.37	0.20	0.50	0.66	0.07	0.03
Family	0.92	0.90	0.22	0.73	0.52	0.16	0.28
Other	7.98	7.45	2.51	6.18	4.24	2.42	2.29
Total (by Service)	17.09	14.56	6.57	13.83	12.51	4.79	4.71
Total	17.09	14.56	20.40		22.02		
Observations	1,201	732	279		190		

Table 3: Top-40 Cable Programming Networks

Rank	Network	Subs (millions)	Launch Date	Rank	Network	Subs (millions)	Launch Date
1	ESPN	61.4	1979	21	Black Entertainment TV (BET)	34.3	
2	Cable News Network (CNN)	61.2	1980	22	Prevue Guide	29.7	
3	WTBS	60.0	1976	23	C-SPAN II	29.3	
4	USA Network	60.0	1980	24	EWTN: The Catholic Network	29.0	
5	The Discovery Channel	59.0	1985	25	Comedy Central	27.0	
6	Nickelodeon / Nick at Nite	58.7	1979	26	Mind Extension University	23.0	
7	The Nashville Network (TNN)	58.5	1979	27	E! Entertainment TV	21.5	
8	TNT	58.3	1988	28	Home Shopping Network I	21.0	
9	MTV: Music Television	57.3	1981	29	VISN/ACTS	19.0	
10	The Family Channel	57.2	1977	30	The Learning Channel	18.8	
11	C-SPAN-I	56.9	1983	31	Country Music Television	18.1	
12	Lifetime Television	56.7	1984	32	The Travel Channel	17.5	
13	Arts and Entertainment (A&E)	56.1	1984	33	TBN Cable Network	16.5	
14	The Weather Channel	53.3	1982	34	Nostalgia Television	14.7	
15	Headline News (HNN)	51.4	1982	35	WWOR	14.5	
16	CNBC	47.7	1989	36	The Box	14.0	
17	Video Hits One (VH-1)	47.1	1985	37	Home Shopping Network II	13.0	
18	QVC Network	44.5	1986	38	Sci-Fi Channel	11.0	
19	American Movie Classics (AMC)	43.0	1984	39	Telemundo	10.4	
20	WGN	38.1	1978	40	Bravo	10.0	

Source: Waterman and Weiss (1993)

Table 4: Top-5 Premium Programming Networks

Rank	Network	Subs (millions)	Launch Date
1	Home Box Office (HBO)	17.5	1972
2	Showtime	7.9	1976
3	The Disney Channel	7.1	1983
4	Cinemax	6.3	1980
5	The Movie Channel	2.9	1979

Source: Waterman and Weiss (1993)

Table 5: Sample Statistics - All but Individual Networks

Variable	Obs.	Mean	Std. Dev.	Min	Max
Year/Month	1201	95.05	0.02	95.01	95.08
Any Expanded Basic Services	1201	0.39	0.49	0	1
One Expanded Basic Service	1201	0.23	0.42	0	1
Two Expanded Basic Services	1201	0.16	0.37	0	1
HBO	1201	0.58	0.49	0	1
Showtime	1201	0.49	0.50	0	1
Disney	1201	0.50	0.50	0	1
Cinemax	1201	0.42	0.49	0	1
The Movie Channel	1201	0.30	0.46	0	1
w_{Basic}	1201	0.671	0.17	0.01	0.99
$w_{Expanded\ Basic\ 1}$	469	0.620	0.15	0.01	0.98
$w_{Expanded\ Basic\ 2}$	190	0.529	0.20	0.03	0.98
w_{HBO}	691	0.133	0.15	0.00	0.82
$w_{Showtime}$	583	0.156	0.18	0.00	0.97
w_{Disney}	597	0.144	0.17	0.00	0.95
$w_{Cinemax}$	504	0.149	0.18	0.01	0.91
w_{TMC}	363	0.137	0.16	0.01	0.98
$\log(w_b/w_{\bar{b}}) + \sum_r (1 + \log(w_r/w_{\bar{r}}))$	1201	-1.81	3.97	-19.00	4.59
$\log(w_e/w_{\bar{e}})$	469	3.17	1.52	-4.12	7.69
$\log(w_f/w_{\bar{f}})$	190	2.22	1.72	-3.01	5.57
$\log(w_h/w_{\bar{h}})$	691	-1.64	1.58	-5.11	5.69
$\log(w_s/w_{\bar{s}})$	583	-1.43	1.90	-5.63	5.57
$\log(w_d/w_{\bar{d}})$	597	-1.52	1.78	-5.15	5.76
$\log(w_c/w_{\bar{c}})$	504	-1.49	1.77	-4.60	6.07
$\log(w_t/w_{\bar{t}})$	363	-1.60	1.66	-4.68	5.22
p_{Basic}	1201	\$12.94	3.65	\$3.08	\$27.84
$p_{Expanded\ Basic\ 1}$	469	\$5.68	4.23	\$0.44	\$18.09
$p_{Expanded\ Basic\ 2}$	190	\$3.33	1.53	\$1.00	\$12.10
p_{HBO}	691	\$7.26	1.74	\$1.10	\$15.46
$p_{Showtime}$	583	\$7.22	2.07	\$0.79	\$16.84
p_{Disney}	597	\$7.19	1.97	\$0.56	\$14.53
$p_{Cinemax}$	504	\$7.33	2.00	\$1.12	\$17.91
p_{TMC}	363	\$7.18	1.80	\$1.33	\$13.97
Channel Capacity	1201	39.13	13.81	6.00	110.00
OTA Broadcast Networks	1201	2.60	1.41	0	8
First OTA	1201	2.37	1.13	0	5
Other than First OTA	1201	0.23	0.57	0	4
Cable Broadcast Networks	1201	5.84	2.02	0	13
First Cable	1201	4.73	1.00	0	6
Other than First Cable	1201	1.11	1.43	0	8
Comparative Broadcast Nets.	1201	3.25	1.60	0	10
First Comparative	1201	2.36	1.01	0	6
Other than First Comparative	1201	0.89	1.22	0	7
Cable Programming Nets.	1201	17.09	7.79	1	47
Top-5	1201	4.62	0.77	1	5
Top-10	1201	7.98	2.01	1	10
Top-20	1201	13.20	4.61	1	20
Other Channels	1201	13.82	10.40	0	56
Median Income (thousands)	1201	\$23.45	\$5.61	\$10.60	\$49.89
Population Density (ppkm2)	1201	45.60	144.79	0	2084.6
Homes Passed	1201	4986	17192	48	275394
MSO Subscribers (thousands)	1201	812970	1963913	33	12000000
Affiliated	1201	0.09	0.29	0	1

Table 6: Parameter Estimates and Mean Willingness-To-Pay

Parameter	Estimate	Std. Err	p-value	Mean WTP	Estimate
Constant - Basic Service	4.05	0.95	0.00	Constant - Basic Service	\$5.02
Constant - Exp. Basic I	1.25	0.15	0.00	Constant - Exp. Basic I	\$1.55
Constant - Exp. Basic II	3.06	0.21	0.00	Constant - Exp. Basic II	\$3.80
First Over-the-Air	-0.91	0.13	0.00	First Over-the-Air	-\$1.13
Dup. Over-the-Air	0.28	0.18	0.13	Dup. Over-the-Air	\$0.34
First on Basic	-0.52	0.13	0.00	First on Basic	-\$0.64
Dup. on Basic	-0.04	0.09	0.69	Dup. on Basic	-\$0.05
ESPN	2.20	0.38	0.00	ESPN	\$2.73
CNN, CSPAN	0.73	0.16	0.00	CNN, CSPAN	\$0.91
WTBS, USA, TNT	1.92	0.12	0.00	WTBS, USA, TNT	\$2.39
Discovery, Nickelodeon, Family	0.89	0.10	0.00	Discovery, Nickelodeon, Family	\$1.10
MTV	-0.56	0.26	0.03	MTV	-\$0.69
Other Satellite Programming	0.00	0.02	0.85	Other Satellite Programming	-\$0.01
Other Programming on Basic	0.03	0.01	0.00	Other Programming on Basic	\$0.04
Density (00s)	0.00	0.00	0.18		
Median Income (00s)	0.01	0.02	0.52		
HBO	4.17	0.58	0.00	HBO	\$5.16
Showtime	4.36	0.57	0.00	Showtime	\$5.41
The Disney Channel	4.28	0.57	0.00	The Disney Channel	\$5.31
Cinemax	4.38	0.58	0.00	Cinemax	\$5.43
The Movie Channel	4.18	0.57	0.00	The Movie Channel	\$5.18
Price	-0.81	0.08	0.00		
Number of Observations	1,201				

Table 7: Correlation in Program Dummies

	ESPN	CNN	WTBS USA	Discovery Nickelodeon	Family	MTV
ESPN	1.00	-0.14	0.30	0.17	0.05	
CNN						
CSPAN		1.00	-0.15	0.03	-0.02	
WTBS						
USA			1.00	0.01	0.16	
TNT						
Discovery						
Nickelodeon				1.00	0.05	
Family						
MTV						1.00