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July 25, 2002

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Marlene H. Dortch
Secretary
Federal Communications Commission
The Portals
445 12th Street, S.W.
Washington, DC 20554

Re: Ex Parte - Consolidated Application of EchoStar Communications Corporation, Hughes Electronics Corporation, and General Motors Corporation for Authority to Transfer of Control (CS Docket No. 01-348)

Dear Ms. Dortch:

EchoStar Communications Corporation ("EchoStar"), Hughes Electronics Corporation ("Hughes") and General Motors Corporation ("GM") (collectively, the "Applicants") hereby submit certain additional back-up information for the July 2, 2002, presentation made to the Commission on competitive effects and national pricing. The additional information, set forth in the attached CD-Rom, includes the statistical data sets that were used for the econometric analyses in support of Slides 11, 19, 22 and 25 of the Technical Paper. The data sets are described in the documentation provided by the economists. The additional information filed herewith also includes a memorandum, in paper copy, describing in further detail certain methodologies used by the Applicants' economic experts to simulate the proposed merger.

The data sets include data obtained from Warren Communications ("Warren") under license, as well as highly confidential data of the Applicants, and has been designated as Highly Confidential under the Second Protective Order adopted by the Media Bureau on April 24, 2002. Warren has authorized submission of the Warren data to the Federal Communications Commission subject to the terms and conditions established by the Second Protective Order. The aforementioned memorandum has been designated as Confidential under the First Protective Order adopted by the Cable Services Bureau on January 9, 2002. The public versions of both submissions have been redacted accordingly.

The information being submitted is proprietary and competitively sensitive. Inadvertent disclosure of any of the materials being submitted could cause the Applicants significant competitive harm.

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An original and one copy of the public version of this submission and one copy of the confidential version of this submission are being filed with the Commission. If you have any questions concerning this filing, please contact the undersigned.

Respectfully submitted,

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Enclosures

HIGHLY CONFIDENTIAL

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ATTACHED CD-ROM IS HIGHLY CONFIDENTIAL AND IS BEING PROVIDED PURSUANT TO SECOND PROTECTIVE ORDER IN CS DOCKET NO. 01-348 BEFORE THE FEDERAL COMMUNICATIONS COMMISSION

SUPPLEMENTAL TECHNICAL APPENDIX TO THE PRESENTATION ON THE COMPETITIVE EFFECTS OF THE ECHOSTAR-DIRECTV MERGER

Dr. Robert Willig
Princeton University

July 25, 2002

INTRODUCTION

On July 2nd, we presented our analysis of the competitive effects associated with the EchoStar-DIRECTV merger. In conjunction with that presentation, we submitted a technical appendix providing additional information about our methodology.[1] The purpose of this paper is to delineate further the nested logit demand function methodology undertaken to simulate the proposed merger. We also use a flat logit demand model to simulate the merger. Since the flat logit is a special case of the nested logit, we focus on delineating the nested logit model here. We explain how the flat logit model relates to nested logit as we develop the nested logit model.

The simulation methodology can best be described as a sequence of three steps:

Step 1: We first specify a nested logit model of demand and estimate/calibrate the relevant parameters. Marginal costs are inferred from demand and past choice of prices. (Step 1 is described in Section 1 of this paper.)

Step 2: The demand and cost estimates produced in Step 1 are then used to simulate the price and welfare effects resulting from the merger. We simulate changes in DBS prices assuming that EchoStar and DIRECTV maximize joint profits in the context of a Bertrand-Nash equilibrium. We also simulate the equilibrium reactions by cable operators. (Step 2 is described in Section 2.)

Step 3: To calculate the true welfare effects of a merger, merger-specific efficiencies need to be modeled as well. Because the proposed merger will result in substantial merger-specific efficiencies, the final step in our analysis involved incorporating the consumer welfare benefits of such efficiency gains. Specifically, we estimate the welfare benefits of the merger-specific marginal cost reductions and the expansion of local service ("LIL") to all 210 Designated Market Areas (DMAs). (Step 3 is described in Section.)

[1] Competitive Effects Technical Appendix *ex parte* notice filed July 5, 2002 CS Docket 01-348

SECTION 1: ESTABLISHING DEMAND AND COST PARAMETERS

In this section, we first describe a standard, flexible model of consumer preferences, market demand, marginal costs, and firm conduct. We then delineate how we estimate/calibrate the appropriate demand and cost parameters to allow the model to capture the specifics of the markets at issue.

I. Model

Assumptions about Demand

Each consumer selects a single service from several options. Grouping (or "nesting") some of these products together allows us to test whether certain products are closer substitutes for each other than other products in the eyes of the consumer. Following the literature on discrete choice demand modeling (e.g., Berry (1994)), we assume that the utility of representative consumer k, from consuming choice j is $u_{kj} = \Delta_j + \eta_{kg} + (1-\sigma)\varepsilon_{kj}$. (For convenience, we suppress the subscript for geographical area.) Here, the mean utility of product j is $\Delta_j = x_j\beta + \alpha p_j + \xi_j$; the consumer and product specific variations in utilities, ε_{kj}, are modeled as *iid* extreme value error terms; η_{kg} is a group specific error that captures shocks common to choices within the same group (nest) g (*i.e.*, for consumer k, η_{kg} is common over all products in g, allowing a positive covariance in taste across products within group g); x_j is a vector of measured non-price characteristics of choice j; p_j is the price of choice j; and ξ_j may be interpreted as the utility associated with unmeasured product quality characteristics. The assumption that errors have an extreme value distribution gives rise to the familiar logit form of demand. Note that the parameter σ, which has values between 0 and 1, should be interpreted as measuring the strength of the nest (with higher values of σ corresponding to a stronger nest and hence higher correlation of consumer tastes within the nest). As $\sigma \to 0$, within group correlation goes to zero (shocks to utility become *iid*); when σ=0, the model reduces to a flat logit.[2]

We assume that consumers face the following choices: cable, EchoStar, DIRECTV and antenna (*i.e.*, not purchasing any MVPD product).[3] We allow for the possibility that consumers with a strong preference for DIRECTV may consider EchoStar to be their

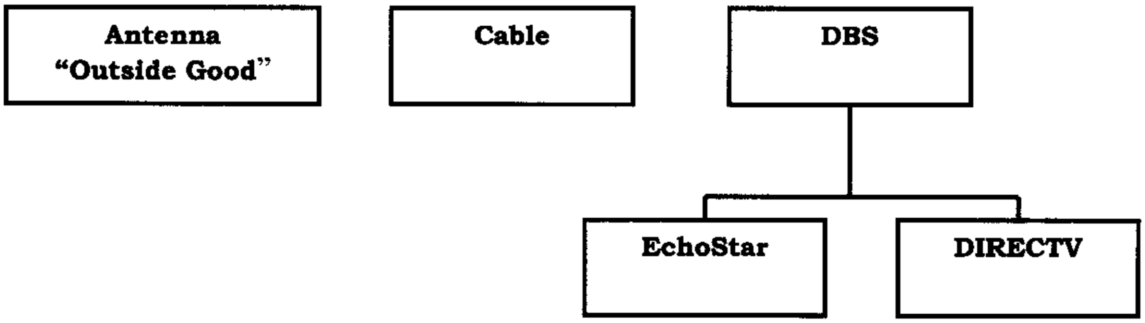
[2] See Cardell (1991) for a derivation of this result. Berry (1994) cites this conclusion as well.

[3] Note that specifying "antenna" as a choice does not imply that antenna is part of the "relevant market," in the sense of the Merger Guidelines. While the churn data from both EchoStar and DIRECTV suggest that more DBS consumers view antenna as a "second choice" than the other DBS provider, and thus that antenna should be included in the relevant product market, we do not take a position on this issue here. Instead, antenna should be understood as the numeraire good in this model (*i.e.*, it's the choice against which the utility of all inside goods is measured).

second choice (or vice-versa) by placing the two products in a "DBS nest."[4] Such an assumption is conservative in that it produces higher cross elasticities between the two DBS choices (and hence, higher price increases following the merger) than those that would be predicted by a flat logit model and other such models.

The choices facing consumers in our nested logit model are illustrated in Figure 1.[5]

Figure 1



The utility function described above implies the following demand system[6]:

For cable demand in geographical area *i*: Eq. (1):

$$\ln(CableShare / AntennaShare)_i = \delta_{ic} + \alpha P_{ic} + \xi_{ic}$$

For demand for DBS provider *j* in geographical area *i*: Eq. (2):[7]

$$\ln(Share_{ij} / AntennaShare_i) = \delta_{ij} + \alpha P_j + \sigma \ln(\frac{Share_{ij}}{EchoStarShare_i + DIRECTVShare_i}) + \xi_{ij}$$

where $Share_{ij}$ is the EchoStar or DIRECTV share of all households in geographical area *i*. $\frac{Share_{ij}}{EchoStarShare_i + DIRECTVShare_i}$ is the ratio of the share of EchoStar or DIRECTV in geographical area *i* to the sum of those two shares (*i.e.*, it's the within-DBS nest

[4] In fact, the churn data we have examined show that cable is by far the next best choice for subscribers to each DBS provider. The proportion of subscribers leaving one DBS provider to subscribe to the other is dwarfed by the proportion of subscribers leaving that DBS provider for cable.

[5] In a flat logit model, the DBS "nest" does not exist, and EchoStar and DIRECTV are choices at the same level as cable and antenna.

[6] See Berry (1994) for derivation.

[7] In a flat logit model, the DBS demand function is the same as in a nested logit model—except that the $\sigma \ln[\frac{Share_{ij}}{EchoStarShare_i + DIRECTVShare_i}]$ term drops out since $\sigma = 0$. The cable demand equation remains unchanged. The cable demand function in a flat logit context is the same as Eq. (1).

share of EchoStar or DIRECTV). σ measures the strength of the DBS nest, and α drives the price elasticity of demand for all inside goods. Further, δ can be interpreted as the mean utility associated with measured product characteristics (gross of price). (δ_j in the share equations are equivalent to $x_j\beta$ in the utility equations above.) ξ as before, may be interpreted as the utility associated with unmeasured product characteristics. (For convenience, we suppress time subscripts above.) We need to estimate or calibrate $\{\alpha, \sigma, \delta, \xi\}$ to describe the logit demand system.

Assumptions about Cost
Marginal costs of DBS providers change only with merger efficiencies. Otherwise, they are constant, as are the different marginal costs of the cable operators in the different geographical areas.

Assumptions about Competition and Conduct
Firms choose prices to maximize static profits in a Bertrand model of differentiated product competition. Each cable operator chooses price for each local franchise area. Each DBS provider chooses its price nationally

II. Estimation

Section I above specified a model of demand, cost, and conduct. The next step in the merger simulation process involved establishing the demand and cost parameters of the model by means of calibration and econometric estimation.

Estimating σ

Econometric determination of σ requires that we estimate the EchoStar and DIRECTV share equations (Eq. (2) above) with instruments for $\ln\left(\frac{Share_{ij}}{EchoStarShare_i + DIRECTVShare_i}\right)$ since this term is endogenous. Appropriate instruments would need to vary geographically such that they are correlated with $\ln\left(\frac{Share_{ij}}{EchoStarShare_i + DIRECTVShare_i}\right)$, but are not correlated with the error term, ξ_j. Following Berry (1994), measures of regional service quality of EchoStar (DIRECTV) constitute a potential set of instruments for the DIRECTV (EchoStar) share equation. However, both DBS firms offer national service with little (or no) geographical variation in service. One potential instrument – local-into-local ("LIL") service – was attempted. But since such LIL service covaries for EchoStar and DIRECTV – that is, they both offer LIL service in the biggest DMAs—this is not a very effective instrument. A two-stage least squares ("2SLS") estimation of Eq. (2) produced auxiliary regressions in which the instrument had an insignificant coefficient in the first stage of the 2SLS regression.

An alternative approach often used in merger simulation is to calibrate those parameters that cannot be estimated. The calibration can rely on direct observations that can be related to parameters. As described at the presentation on July 2nd, the parties conduct surveys that directly reveal the diversion ratio between the two DBS firms.[8] Starting from a known diversion ratio allows us to calibrate the nest parameter

[8] The "diversion ratio" from DIRECTV to EchoStar can defined as the derivative of EchoStar demand with respect to DIRECTV price divided by the derivative of DIRECTV demand with respect to DIRECTV price. (For further details, see Shapiro (1996).)

σ. Since the diversion ratio is a function of σ, inverting this function allows us to solve for σ as shown below.

The diversion ratio from DIRECTV to EchoStar is $\frac{\varepsilon_{ED} s_E}{\varepsilon_{DD} s_D}$, where ε_{ij} is the elasticity of demand for product *i* with respect to price of product *j*, s_i is the share of product *i*, and D and E signify DIRECTV and EchoStar, respectively.

Given the logit structure, the own and cross elasticities can be expressed as:[9]

$$\varepsilon_{ED} = \alpha P_D (s_D + (\frac{\sigma}{1-\sigma})(\frac{s_D}{s_D + s_E}))$$

$$\varepsilon_{DD} = \alpha P_D (s_D - (\frac{1}{1-\sigma}) + (\frac{\sigma}{1-\sigma})(\frac{s_D}{s_D + s_E}))$$

Substituting the above expressions for own and cross elasticities into the diversion ratio expression, $\frac{\varepsilon_{ED} s_E}{\varepsilon_{DD} s_D}$, yields the diversion ratio as a function of s_D, s_E, σ . We can invert this function to get σ as a function of s_D, s_E and the diversion ratio. We observe s_D, s_E . Hence, we can solve for the value of σ that produces a given diversion ratio.[10]

Note that the model overstates the strength of the nest (and therefore underestimates the benefits of the merger) in an important respect, as it implies a diversion rate from EchoStar to DIRECTV is higher by several percentage points than the diversion rate from DIRECTV to EchoStar. Adjusting the model to reflect the actual EchoStar-to-DIRECTV churn data in the record would make the benefits of the merger even larger.

Estimating α

Since there is limited cross-sectional and intertemporal variation in DBS prices and qualities, we cannot obtain estimates of α from the two DBS share equations (Eq. (2)). Instead, we estimate α using the cable share equation (Eq. (1)). We rely on cable price variation to estimate α because cable fees show substantial variation, since different cable operators levy different fees in different franchise areas.

We define the relevant cable "price" based on the monthly basic fee reported by cable operators to Warren Communications (for January 2000, January 2001, and January 2002). This fee has been scaled up to reflect the average cable ARPU.[11] A cable price

[9] Slade (2002) lists elasticity functions in a nested logit model.

[10] This solution for σ is correct for the case where there is only a single geographical area. When there are many local cable franchise areas (as is the case in our simulation), the above formula needs a slight modification in predicting a nationwide diversion ratio. This is because the national elasticities and national diversion ratios are non-linear aggregations of individual area elasticities and diversion ratios.

[11] We add a constant to each operating area's basic fee such that the average cable price equals the 2001 cable ARPU of $48.00. Note that adding a constant to the basic fee in each cable franchise area does not change the estimate of α.

"index" (*i.e.*, a weighted average of monthly basic fee, expanded basic fee and HBO *a la carte* fee) was also attempted, but we could not find effective instruments for this index.[12]

Unlike traditional logit estimation methods using individual data, our formulation of the demand system here (following Berry (1994)) allows us to use instruments for cable price. In turn, such instrumental methods allow us to produce consistent estimates of price elasticities. As Goolsbee and Petrin (2002) have shown, uninstrumented Ordinary Least Squares ("OLS") regressions produce cable price elasticity estimates that are biased toward zero. The bias arises from the endogeneity of the price variable – that is, areas with higher cable prices are likely to have higher service quality. (See Goolsbee and Petrin (2002) and Berry (1994).)

Following the widely used approach employed by Hausman, Leonard & Zona (1994) and Goolsbee and Petrin (2002), we use the average cable price charge in all other cable operating areas owned by the same MSO and the average price charged in all other operating areas in the same DMA as instruments for the cable price of a given operator. The idea is that cable areas owned by the same MSO and areas in the same DMA are likely to have common cost components.[13] These instruments perform well; they yield negative and significant values for the price coefficient, α, whereas the non-instrumented approach often yielded insignificant or even positive coefficients on price. They also perform well in the sense that they have strong predictive power in the first stage of the 2SLS estimations.

We estimate the following version of the cable share Equation 1 using cable franchise area level data reported by Warren Communications for January 2000, January 2001 and January 2002.[14] (For convenience, we suppress the time subscript below.)

Eq. (1.1):

$$ln(CableShare\,/\,AntennaShare)_i = x_{ic}\beta + \alpha p_{ic} + \xi_{ic}$$

where x_{ic} is a vector of cable and demographic characteristics of area *i*. We populate this vector with the following variables:

- Number of premium channels offered in each cable franchise area
- Number of channels in use (*i.e.*, total number of channels) in each cable franchise area
- Market demographics: percentage of singles in population, average income, percentage of single unit dwellings, percentage of houses that are rented, average household size, log of population density
- Year fixed effects
- DMA size fixed effects
- MSO size fixed effects

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[12] As instruments for this "index," we used similar variables as those that we used for the cable price based on the basic cable fee. However, despite these instruments, α does not have the correct sign in 2SLS estimations.

[13] These instruments may be correlated with common demand factors as well as common cost factors. In that case, our estimate of α is biased upward and our estimates of MVPD elasticities are too low. If so, we over-estimate price increases following the merger here.

[14] The STATA programs used to calculate the results in Table 1 (and the log files generated, which contain summary statistics of all variables) were produced to the FCC on July 12th as part of the backup materials to the competitive effects presentation.

Some cable franchise areas offer basic service with no expanded basic service. Others report offering both basic and expanded basic tiers. Since the definition of "basic fee" is different across these groups, we run regressions separately for both groups. The results from estimating the cable share equation (1.1) using a 2SLS estimation approach are described in Table 1. Based on the results displayed in Table 1, the weighted average coefficient on price (α) is –0.1269.

Calibrating δ and ξ

Finally, we extrapolate the model from observed market data to consumer demand by calibrating average utilities to shares and prices. The parameter δ specifies the average utility (gross of price) associated with measured product characteristics for each product in each cable franchise area. A higher δ for cable in a given cable franchise area, for example, implies a higher share, *ceteris paribus*. Likewise, ξ may be interpreted as the utility associated with unmeasured product quality characteristics. For the purpose of simulating the merger, we do not need to identify these two effects separately. Instead, since both terms enter a consumer's utility additively, it is sufficient to identify $\delta + \xi$ for each product in each market.

$\delta + \xi$ for each product in each cable franchise area is calibrated so that the share of each product in each area as predicted by the logit model equals the observed share. In other words, at this stage we have the values of all parameters and variables on both sides of Equations (1) and (2) for cable, DIRECTV and EchoStar for each area—except for $\delta + \xi$. We then set $\delta + \xi$ such that equations (1) and (2) are satisfied. This solution for $\delta + \xi$ is unique – given shares, prices and the estimates of the other parameters derived above.

Estimating marginal costs

We derive marginal costs from first order conditions of each firm. Since we now have a fully specified demand function, we can derive the own-price elasticity of demand for each product in each franchise area at current prices and shares. Assuming Bertrand-Nash competition, the Lerner Condition then implies firm-specific marginal costs. Such an approach also produces estimates of cable marginal costs for each cable franchise area.

SECTION 2: SIMULATING THE EFFECTS OF THE MERGER ON PRICES

The first section of this paper specifies our model of demand and competition, and details how the demand and cost parameters were estimated/calibrated. This section delineates how we simulate the price effects of the merger by solving for prices of EchoStar and DIRECTV that maximize the joint profits of the two firms (given the demand and cost parameters produced in Step 1 described in the previous section). Cable prices post merger are derived by calculating the cable price in each franchise area that maximizes cable profits given the national price of EchoStar and of DIRECTV. Thus, we solve for a vector of prices that simultaneously satisfy all the Bertrand-Nash equilibrium conditions.

We derive the equilibrium prices by solving a system of equations that consist of the First Order Conditions ("FOCs") of the inside goods. If there are N cable franchise areas, then following the merger, there are N+1 profit maximizations by N+1 firms and N+2 FOCs for the N+2 prices.

Specifically, let $p_i = \{p^{DTV}, p^{ECHO}, p_i^{CABLE}\}$ be a vector of prices in franchise area i. Define (logit) demand in area i to be $q_i^j(p_i, \delta_i, \xi_i, \sigma)$. Let $\{c^{DTV}, c^{ECHO}, c_i^{CABLE}\}$ be the marginal costs of each firm. Given N areas, we solve the following $N+1$ simultaneous profit-maximizations (for convenience, we suppress all argument of $q_i^j(p_i, \delta_i, \xi_i, \sigma)$ other than price):

$$\max_{p^{DTV}, p^{ECHO}} \sum_{i=1}^{N} [q_i^{DTV}(p_i)(p^{DTV} - c^{DTV}) + q_i^{ES}(p_i)(p^{ES} - c^{ES})]$$

$$\max_{p_i^{CABLE}} q_i^{CABLE}(p_i)(p_i^{CABLE} - c_i^{CABLE}) \text{ , } i \in \{1, \ldots, N\}$$

Solving the FOCs implied by the above profit maximizations yields post-merger prices.

We solve the system of FOC equations using January 2002 data on cable franchise areas. We have 4,984 cable operating areas with complete information as of January 2002. The cable franchises in our data account for approximately 75 percent of all households nationwide.[15] In addition, we account for the population in zip codes that are outside cable franchise areas by creating an additional "uncabled area." Our data show that uncabled zip codes have approximately 3.9 million households. We pool all these households into a single "uncabled area." Using these 4,985 areas, we solve the system of equations described above to derive post-merger prices and the welfare changes stemming from these price changes.[16]

SECTION 3: ESTIMATING THE EFFECTS OF MERGER-SPECIFIC EFFICIENCIES

In this section, we describe the final step in the merger simulation, *i.e.*, quantifying the consumer welfare effects of two types of merger-specific efficiencies: reduced DBS marginal costs and the expansion of local service following the merger.

I. Marginal Cost Reductions

As a result of the merger, marginal costs are expected to decrease. While the merger will likely produce other cost reductions, our analysis concentrates on the marginal cost

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[15] Market shares of products in our data do not exactly equal their national shares. To ensure that the merger simulation relies on correct national market shares, we assign weights to the cable franchise areas in our sample such that the weighted average shares equal their national shares.

[16] The system of equations was solved using a Mathematica program.

reductions due to reduced programming costs and subscriber acquisition costs (SAC). In our simulation analysis, we rely on a range of conservative cost reduction scenarios and simulate the effects of each scenario on consumer welfare. The specific dollar amounts of the marginal cost reductions that we use are listed in the table below. Any reduction in marginal costs generates consumer welfare improvements by reducing the equilibrium DIRECTV and EchoStar post-merger price. We incorporate the marginal cost reductions in our merger simulation by assuming that the marginal cost of each DBS firm drops by the dollar amount listed under each scenario, and then calculating the equilibrium post-merger prices given the new, lower marginal cost.

	Marginal Cost Reduction Scenarios			
	A	B	C	D
EchoStar	$0.96	$1.73	$2.94	$2.72
DIRECTV	$1.27	$2.35	$3.06	$3.34

The reasons for these marginal cost reductions were delineated at both the competitive effects presentation on July 2nd and the synergies presentation on July 3rd.

II. Welfare Effects of Expanded Local-into-Local Service

The merger will allow New EchoStar to expand LIL service to all 210 DMAs. We assume that absent the merger, DMAs ranked 71-210 would not receive LIL service, whereas with the merger, both DIRECTV and EchoStar introduce LIL in these DMAs.[17] Such an expansion of LIL service increases consumer welfare in these DMAs in at least two ways; first, by an increase in consumer utility derived from the improved service (the "direct effect"), and second by a reduction of cable prices in response to the improved DBS service (the "indirect effect"). Each of these components is described below.

A. The Direct Effect of LIL Expansion on Consumer Welfare

Existing DBS subscribers benefit from improved DBS service (*i.e.*, DBS service with the option to also receive LIL service). Additional subscribers attracted to DBS also gain from this service improvement.

To quantify the direct effect, we compute both the consumer welfare increase to existing (post-merger) DBS customers, and to new DBS subscribers who join in response to the local introduction. For existing customers, we estimate the average value (in $ per subscriber per month) of local service and multiply this by the number of DBS subscribers predicted by the simulation (net of the predicted equilibrium price changes). Similarly, for new DBS subscribers, an estimate of the average value of local service for these customers is multiplied by the expected number of such new adopters. The sum of the effects on existing and new DBS subscribers is the total direct effect of LIL expansion on consumer welfare.

The first step in calculating the direct effects of LIL expansion on consumer welfare is to calculate the dollar value of LIL service to DBS subscribers. The increase in utility from LIL can be derived using the random utility framework. Recall that the utility of a

[17] See Willig Reply Declaration, February 25, 2002, at ¶¶ 9-17.

representative consumer from consuming MVPD choice *j* is $u_{kj} = \Delta_j + \eta_{kg} + (1-\sigma)\varepsilon_{kj}$, where the mean utility of product *j* is $\Delta_j = x_j\beta - \alpha p_j + \xi_j$. Let x_j^L be a dummy indicator variable that equals 1 when product *j* (either DIRECTV or EchoStar) provides LIL service. Then, the increase in mean utility from LIL equals β^L. The corresponding dollar value of LIL per subscriber per month is $\beta^L/(-\alpha)$. (This measure can be thought of as the increase in DBS price that would just offset the increased utility stemming from LIL, or the drop in price that would result in consumer benefit equal to the benefit provided by the introduction of LIL.) Since we know α, all we need to value LIL per subscriber is β^L. We can derive the value of this parameter from the increase in DIRECTV and EchoStar shares in areas where they have introduced LIL. From Equation (2) we see that β^L equals the increase in DIRECTV (EchoStar) share relative to the antenna share in those areas where DIRECTV (EchoStar) has introduced LIL. That is,

$$\beta_D^L = \log(\frac{S_D^1}{S_A^1}) - \log(\frac{S_D^0}{S_A^0}) = \log(\frac{S_D^1 - S_D^0}{S_D^0} + 1) - \log(\frac{S_A^1 - S_A^0}{S_A^0} + 1)$$

where S_D^1 = DIRECTV share following LIL introduction by DIRECTV, S_D^0 =DIRECTV share before LIL introduction by DIRECTV, S_A^1 = antenna share following LIL introduction by DIRECTV, S_A^0 = antenna share before LIL introduction by DIRECTV.

For computational ease, we assume that $-\log(\frac{S_A^1 - S_A^0}{S_A^0} + 1)$ is zero. (This assumption under-estimates the value of LIL because $-\log(\frac{S_A^1 - S_A^0}{S_A^0} + 1) > 0$ since $(\frac{S_A^1 - S_A^0}{S_A^0} + 1) \in (0,1)$, and hence its log is negative. Therefore, this assumption produces an underestimate of the welfare improvement from the merger.)

We then proceed to estimate the first term; *i.e.*, the log of the increase in DIRECTV share from LIL introduction. One option is to estimate the LIL effect on DBS shares by estimating Equation (2) above on cable franchise-area data. However, such an estimate is unlikely to produce accurate estimates of the effects of LIL on DBS share. We need to use cable-area data to estimate Equation (2). These are essentially cross-sectional data. (Although we have three cross sections for three years, the cable data rely mainly on cross-sectional variation.) Any regression model of Equation (2) using such cross-sectional data would attempt to identify LIL effects on share by using a dummy indicator variable for whether or not a given cable area has LIL service. However, this LIL indicator variable equals 1 only in the bigger DMAs. As such, it may capture not just LIL effects on shares but also other systematic differences in DBS shares between big and small DMAs. (Historically, DBS has had relatively smaller shares in bigger DMAs.) Consequently, it is difficult to disentangle the effects of DMA size from LIL impact on DBS share using such an approach.

Hence, we employ a monthly frequency, zip-code level dataset which provides a more accurate measure of the share effects of LIL introduction since such data allow us to compare the change in DBS shares following LIL introduction with shares prior to LIL. Using monthly zip code level data from January 1998 to March 2002 on the number of DIRECTV/EchoStar subscribers and local service introduction, we estimate the following panel regression model in the spirit of the "difference-in-differences" literature:

$$\Delta Sh_{i,t}^{j} = \lambda^{j} LIL_{i,t}^{ES} + \theta^{j} LIL_{i,t}^{DTV} + \gamma^{j} UR_{i,t} + D_{i} + D_{t} + u_{i,t}^{j}$$

where j represents product (EchoStar, DIRECTV), i represents franchise area, t represents month, $\Delta Sh_{i,t}^{j}$ is the percentage point monthly change in share of j, $LIL_{i,t}^{j}$ is a dummy variable that equals 1 if DBS firm j offers local service in zip code i at month t, D_t, D_i are month and zip code fixed effects, respectively, and *UR* is the unemployment rate of the state where the zip code is located. Results from estimating the model on the monthly-frequency data separately for DIRECTV and EchoStar are displayed in Table 2.[18]

Before using the resulting share lifts to calculate β_j^L, we need to make a final adjustment for the fact that the DBS share gains noted in Table 2 are net of the cable price reductions in response to LIL introduction. (These cable price drops are discussed below.) To calculate β_j^L correctly, we need a measure of the increase in DBS share in response to LIL introduction *ceteris paribus*. However, as noted below, cable operators reduced fees in response to LIL introduction by DBS. Hence, the percentage point DBS share lift from LIL introduction noted above is net of cable price changes. Accordingly, we add to the increase in DBS shares noted in Table 2 the DBS market share lost due to the cable price drop. This produces an estimate of the increase in DBS share in response to LIL as if cable operators had not dropped their fees. Hence, for DIRECTV,

$$\beta_D^L = \log[\frac{S_D^1 - S_D^0}{S_D^0} + 1] = \log[\frac{(\Delta p_C / p_C)\varepsilon_{DC} S_D^0 + 0.0236}{S_D^0} + 1] = \log[\Delta p_C \cdot \alpha \cdot S_C + \frac{0.0236}{S_D^0} + 1]$$

where Δp_c is the change in cable price in response to LIL introduction by either DBS firm and ε_{DC} is the elasticity of DIRECTV demand with respect to cable price. (The second equality holds once we substitute for ε_{DC} the standard logit cross elasticity formula.) The term $[(\Delta p_C / p_C)\varepsilon_{DC} S_D^0]$ is the loss of DIRECTV share as a result of the cable price drop in response to LIL introduction. The 0.0236 term is the increase in DIRECTV share associated with DIRECTV's introduction of LIL—net of the cable price reaction. The sum of the two terms is the increase in DIRECTV share in response to DIRECTV introducing LIL—gross of the cable price reaction. Since we observe all parameters and variables on the RHS of this equation, we can solve for β_D^L. We can

[18] The STATA programs used to calculate the results in Table 2 (and the log files generated, which contain summary statistics of all variables) were produced to the FCC on July 12th as part of the backup materials to the competitive effects presentations.

similarly solve for the corresponding parameter for EchoStar. Dividing the resulting β_j^L by α produces the monthly dollar value of LIL to EchoStar and DIRECTV subscribers.[19]

Once we measure the value of LIL, we then multiply that value by the number of subscribers of each DBS firm after the merger in DMAs ranked 71-210 (as predicted by the simulation). This produces the welfare lift from LIL to those who are "current" DBS subscribers.

In addition, some consumers adopt DBS in response to LIL, and these new subscribers also gain from LIL introduction. We assume that the percentage point lift to DBS share from a new introduction of LIL as a result of the merger will be the same as its historical value. Since we assume that both DBS products will add LIL simultaneously after the merger, the share increase is the difference between the coefficient on the share gain from own local introduction, and the share loss due to introduction by the other DBS competitor. We then assume, consistent with the logit structure, that the new DBS subscribers will divert from cable and antenna in proportion to their pre-LIL shares (for a fixed cable price).

The value of LIL to those who switch to DBS in response to LIL cannot be measured exactly. We approximate the value of LIL to those people who switch from cable to DBS in response to LIL by taking the mid-point between the cable price drop in response to LIL (discussed below) and the average value of LIL to existing subscribers, a conservative estimate.[20] Similarly, we assume that the value of LIL to those who switch from antenna to DBS in response to LIL is half the value of LIL to existing DBS subscribers. (Again, in as much as these new subscribers are more likely to take LIL than existing subscribers, this is an under-estimate of the value of LIL to these subscribers.)

B. The Indirect Effect of LIL Expansion on Consumer Welfare

Based on historical experience in areas where DBS has introduced LIL, cable operators reduce fees (or do not increase fees as much as they would otherwise) in response to LIL introduction. This is a theoretically expected response to a quality improvement by a competitor. The fee reduction benefits both existing cable subscribers in the relevant DMAs as well as customers induced to subscribe to cable by the price reduction. This is an "indirect" effect of LIL expansion on consumer welfare.

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[19] Note that these valuations are net of the price at which LIL is offered to subscribers. Note also that these LIL valuations do not assume that all existing and new subscribers take LIL. Instead, the valuations should be interpreted as the value to the average DBS subscriber (averaged across those subscribers who take and those who don't take LIL) of having LIL included in DBS service.

[20] To see why this is a reasonable (yet conservative) assumption, consider for example a consumer switching from cable to EchoStar due to LIL introduction by EchoStar. This consumer cannot value EchoStar LIL any less than the cable price drop; if so, she would not have switched to DBS to begin with. For simplicity, we assume that she does not gain any more than the value of LIL to existing DBS subscribers. By taking the midpoint between these two bounds, we are underestimating the value of switching because the actual consumer who switches is likely to value LIL more than the average DBS consumer since she is probably much more likely to take LIL after switching to DBS.

Based on the experience of LIL introduction by DIRECTV and EchoStar since 1999, we estimate that cable operators reduced (or slowed the increase of) monthly expanded basic cable fees by $1.03 in the first year and by $1.57 after the first year in response to LIL introduction. The cable fee reduction estimate is based on data on annual cable franchise area cable fees as reported by Warren Communications for January 2000, January 2001, and January 2002. Table 3 summarizes the results from a regression analysis of the effects of LIL introduction by DBS on cable fees. The dependent variable is the Expanded Basic monthly cable fee. The independent variables are year dummies, count of channels in use, short term and long-term DBS local dummies, and franchise area fixed effects.[21]

Note that this model controls for systematic, time invariant differences across franchise areas (even if they are not included explicitly in the model as variables) because of the use of franchise-area fixed effects. For example, if certain areas have cable overbuilders over all three years, then that is accounted for via the franchise fixed effects. However, if overbuilding occurs at about the same time and in the same DMAs where DBS introduced LIL service, then the model does not fully control for overbuilding. However, this is unlikely to be a confounding factor given that most overbuilders appear to have scaled back expansion plans in 2000 and 2001.

To calculate the increased welfare to cable subscribers from cable operators' reaction to LIL expansion, we multiply the number of cable subscribers (and nearly all cable subscribers sign up for some sort of expanded basic service) predicted by the simulation (net of the number switching to DBS because of LIL) by the three-year average price reduction (*i.e.*,$1.39) to get the welfare gain to cable subscribers from cable operators' reactions to LIL. People who switch to cable in response to the cable price reduction are assumed to get half this value.

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[21] The STATA programs used to calculate the results in Table 3 (and the log files generated, which contain summary statistics of all variables) have been produced to the FCC on July 12th as part of the backup materials to the competitive effects presentations.

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TABLES

Table 1: Cable Share Regressions

	Dependent Variable: Log(cable share / antenna share)	
Explanatory Variables	**Population: Areas without Expanded Basic service**	**Population: Areas with Expanded Basic service**
Price	-0.1443***	-0.0829***
Channels in use (for 2001-2002)	0.0063**	0.0325***
Premium channels	-0.029	0.22***
Year dummies	Included	included
MSO size dummies	Included	included
DMA size dummies	included	included
% of singles in population	-0.2877	1.9196
average income	3.99e-06*	6.92E-07
% of single unit dwellings	1.2252**	2.5246***
% of housing units that are rented	-0.0337	1.394**
average household size	-0.1347	-0.6784***
log of density	0.0601	-0.2327***
Observations	6262	9073
R squared		0.178
Auxiliary adj. R Squared	0.0943	0.2053
Auxiliary coefficient on average MSO price	0.5421***	0.6652***
Auxiliary coefficient on average DMA price	0.0909***	0.15***

*Note: ***Significant at 0.01 level; ** Significant at 0.05 level; *Significant at 0.1 level. Employed robust standard errors, clustered by cable franchise area. Franchise areas were weighted by number of households using 2001 census data.*

Table 2: Effect of Local Service Introduction on DBS Shares

	Dependent Variable	
Explanatory Variables	EchoStar share change	DIRECTV share change
EchoStar local service dummy		
DIRECTV local service dummy		
Unemployment rate	included	included
Month fixed effects	included	included
Zip code fixed effects	included	included
Adj R-squared	0.35	0.0964
Number of observations	936802	936802
3 year % point share growth		

Note:
All effects of LIL introduction are significant at 1 percent.

Table 3: Effects of Local Service Introduction on Expanded Basic Cable Service Fees

Dependent Variable: Monthly Expanded Basic Cable Price		
Explanatory Variables	Coefficient Estimate	Standard Error
Year Two Dummy (=1 if 2001)	included	
Year Three Dummy (=1 if 2002)	included	
Number of Cable Channels in Use (2000)	0.03*	0.010
Number of Cable Channels in Use (2001 and 2002)	0.08**	0.012
DBS Short Term Local Service Dummy	-1.03**	0.334
DBS Long Term Local Service Dummy	-1.57**	0.476
Franchise area fixed effects	included	

*Notes: ** Significant at the .001 level* *n=19,748*
** Significant at the .01 level*