described below) to estimate the welfare effects of LIL service. The rest of this section describes the methodology that we employed.[24]

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 in DMAs 71-210 predicted by the simulation (net of the predicted price changes following the merger). 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 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* (DIRECTV or EchoStar) provides LIL service. Then, the

[24] [

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increase in mean utility from LIL equals β^L. The corresponding dollar value of LIL per subscriber per month is $\beta^L/(-\alpha)$.[25] Since we know α, all we need to value LIL per subscriber is β^L, the coefficient on x_{jl}. 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,

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

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 $-\ln(\frac{S_A^1 - S_A^0}{S_A^0} + 1)$ is zero. (This assumption under-estimates the value of LIL because $-\ln(\frac{S_A^1 - S_A^0}{S_A^0} + 1) > 0$ 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. For that purpose, we employ a monthly frequency, zip-code level dataset, which provides a more accurate measure of the share effects of LIL introduction. These data allow us to compare the change in DBS shares following LIL introduction with shares prior to LIL, while controlling for general trends in the growth of

[25] This measure can be thought of as the drop in price that would result in consumer benefit equal to the benefit provided by the introduction of LIL.

DBS market share.[26] Using monthly zip code level data from January 1998 to March 2002 on the number of DIRECTV and EchoStar subscribers and local service introduction, we estimate the following two panel regression models (one for EchoStar and one for DIRECTV) in the spirit of the "difference-in-differences" literature:

$$\Delta Sh^{j}_{i,t} = \lambda^{j} LIL^{ES}_{i,t} + \theta^{j} LIL^{DTV}_{i,t} + \gamma^{j} UR_{i,t} + D_i + D_t + u^{j}_{i,t}$$

where j represents product (EchoStar, DIRECTV), i represents franchise area, t represents month, $\Delta Sh^{j}_{i,t}$ is the percentage point monthly change in share of j, $LIL^{j}_{i,t}$ 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 ratio of the state where the zip code is located. Results from estimating the model on the monthly-frequency data are displayed in Table 2.[27] Based on the results in Table 2 (which show the monthly increase in DIRECTV and EchoStar shares from new LIL service), introducing LIL service increases EchoStar share by [ ] percentage points and DIRECTV share by [ ] percentage points over three years.[28] The combined share of DBS in these areas has thus increased by [ ] percent following LIL expansion relative to the initial share of DBS.

[26] Another alternative is to estimate the LIL effect on DBS shares by estimating Equation (2) above on cable franchise-area data. However, this approach is unlikely to produce accurate estimates of the effects of LIL on DBS share. Cable franchise area data 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 where LIL has already been introduced. 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.

[27] 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. The underlying data were produced on July 25th.

[28] [ ]

Before using the resulting share lifts to calculate β_i^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_i^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 appear to have reduced fees (relative to what they would otherwise have been) in response to LIL introduction by DBS. (Since we do not have monthly and zip code level cable price data, we could not include a cable price variable in the regression and thereby control for cable price changes.) 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,

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

where Δp_c is the average change in cable price in cable franchise areas where LIL was introduced by at least one 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 [ ] 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 right-hand side of this equation, we can solve for β_D^L. We can similarly solve for the corresponding parameter for EchoStar. Dividing the resulting β_i^L by α produces the monthly dollar value of LIL to EchoStar and DIRECTV subscribers. Specifically, we find that the value of LIL to the average DIRECTV subscriber is $[ ] per month; the corresponding value for EchoStar is $[ ] per month.[29]

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 [ ] (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 DBS gains the same *percentage point* lift to share from a new introduction of LIL as a result of the merger as it has historically.[30]

In other words, using the results in Table 2, we project that the DIRECTV share in DMAs [ ] increases by [ ] percentage points following LIL introduction in those DMAs. This share lift is calculated as [ ], where [ ] is the average monthly lift in DIRECTV share from DIRECTV introducing LIL and [ ] is the average monthly drop in DIRECTV share from EchoStar introducing LIL. A similar calculation for EchoStar produces a [ ] percentage point increase in EchoStar share.[31] 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).

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[29] 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 LIL and those who don't take LIL) of having LIL included as an available option for DBS service.

[30] Since historically LIL was introduced in cable franchise areas with lower DBS market shares, and since DBS market shares grew over time, this is much more conservative than assuming that the future *percentage* change is the same as the historical one.

[31] Share gains are lower than those noted earlier since we now allow for cross effects from both firms introducing LIL service following the merger.

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.[32] 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, inasmuch as these new subscribers are likely to value LIL more 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.

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 $[ ] in the first year and by $[ ] 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

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[32] 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. This is conservative - if anything, the consumer adopting DBS because of LIL introduction values LIL more than the consumer who had become a DBS subscriber already despite the absence of LIL. 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.

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.[33]

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 significant 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.*,$[ ]). This yields 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.

[33] 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. The underlying data were produced on July 25th.

SECTION 4: WELFARE EFFECTS OF THE MERGER

In this paper, we have explicated a methodology that allows us to calculate the impact of the proposed merger on consumer welfare. We include in that calculation the effects of merger-specific efficiencies such as expanded LIL service and marginal cost savings as well as the direct effect of the merger on competition. This section lists the results from this analysis.[34]

[ ]

[ ][35] [ ].[36] [

[34] Certain of the estimates of the welfare and price effects of the merger described here differ slightly from the numbers presented at the competitive effects presentations at the DOJ and the FCC. This is due to a few refinements in our analysis since the presentations. The differences in particular estimates are in both directions and have an immaterial net effect on our conclusions.

[35] [ ]

[36] [ ]

][37] [

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We note that the nested logit model under-estimates merger benefits in that it over-states the diversion ratio from EchoStar to DIRECTV. Model limitations prevent us from calibrating the model so that diversion ratios in both directions in the model are consistent with diversion ratios observed in the survey data. We calibrate the model to the diversion ratio from DIRECTV to EchoStar because DIRECTV survey data are more comprehensive.

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[37] [

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Nonetheless, available EchoStar churn survey data show that the diversion ratio from EchoStar to DIRECTV since August 2001 has been about [ ] percent. This is less than the [ ] percent, [ ] percent, and [ ] percent predicted by our model if we were to assume that the diversion ratio from DIRECTV were, respectively, [ ], [ ], and [] percent. By over-estimating this diversion ratio, the model we use here under-estimates the benefits of the merger.

Cable franchise area shares of DBS products in our data are very close to their national shares in 2002, but the share of cable in our data is less than its national share. To check the sensitivity of our results to increased cable market share, we constructed a cable franchise area-level dataset using a different approach. Our baseline dataset (used to produce the results in Tables 4.1-4.2) calculates the number of households in each cable franchise area by rolling-up zip-code level household counts. That is, we have no direct measures of cable-area level household counts. Instead, we begin with household counts in each zip code, and then by allocating zip codes to franchise areas, we calculate the number of households in each franchise area. As an alternative, we calculated the number of households in each cable franchise area by starting with census block population data, and allocating each census block to a cable area.

This method produces market shares that are close to the true national shares. It also produces in the nested logit a price coefficient α that is almost identical to the α obtained using zip code population data, as well as simulation results that are very similar to those presented here. We did not use these data as our primary data since it yields a smaller dataset for the regressions than the zip-code based dataset.

As a further robustness check, we rescaled our data to produce cable and antenna shares more in line with the national shares. We assigned weights to the cable franchise areas in our sample so that the weighted average shares of all products equal their national shares. The details of the rescaling process that was used are presented in ADDENDUM 5.[38]

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[38] The new weights attached to each cable franchise area are listed in the **_Output_MC_*.csv* files.

The results presented in Tables 4.3-4.4 reproduce the information in Tables 4.1-4.2 using the rescaled data.[39]

This rescaling process has only a small impact on the predicted effects of the merger on price changes. For example, the scaled analysis produces EchoStar and DIRECTV price increases that are within a tenth of a percentage point of the price increases predicted by a simulation based on data that are not rescaled. For cable, the difference is within [ ] percentage points.

Similarly, scaling has a relatively small impact on the predicted changes in consumer welfare. The model's prediction as to whether or not consumers' benefit from the merger (*i.e.*, the sign of the net change in welfare) is the same regardless of whether or not the data are scaled. Moreover, rescaling does not consistently under-state or over-state the benefits of the merger. In scenarios with lower marginal cost changes following the merger, the rescaled simulation produces slightly smaller welfare increases than the unscaled simulation. But in scenarios with higher marginal cost changes, the rescaled simulation produces slightly greater welfare increases following the merger than the unscaled simulation.

Finally, in order to measure the true welfare gains from the merger, one must add the consumer benefits from the expansion of products such as VOD and HDTV following the merger. Such benefits are hard to quantify since we lack the data needed to estimate the elasticity of demand for these products. However, we can estimate the benefit from these products by relying on share gains to DBS due to these products as projected by the parties. Based on their business judgment, the parties project a [ ] increase in DBS subscribers due to new products introduced following the merger (not including expanded

[39] Re-estimating the logit regressions for cable shares with these new cable franchise area weights does not affect the price coefficient and therefore the simulation results.

LIL service).[40] Using this share lift in the same way that we quantified the direct welfare gains from expanded LIL service, we estimate that consumers benefit by $663 million a year because of improved DBS service following the merger.[41] Adding these benefits to those stemming from expanded LIL service and cost savings, we find that the merger produces annual consumer welfare gains up to $1.66 billion. This estimate does *not* take into account the cable operators' response to the introduction of these services by New EchoStar. That response would likely result in further consumer benefits.

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41 We calculated the value of new services using an approach very similar to that used to calculate the value of LIL (as described in Section 3). Specifically, in the logit context, the utility of new services can be inferred from the increase in DBS share due to such services. Using the same notation as in the discussion regarding LIL valuation, let $\frac{S^1_{DBS} - S^0_{DBS}}{S^0_{DBS}}$ denote the increase in DBS share due to new services, where S^0_{DBS} is the market share of DBS without new services, and S^1_{DBS} is the DBS share with such new products. Then, as discussed in the context of valuing LIL, the average DBS subscriber's monthly dollar value of new services equals the absolute value of $\ln(\frac{S^1_{DBS} - S^0_{DBS}}{S^0_{DBS}} + 1) / \alpha$.

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ADDENDUM 1: ESTIMATION RESULTS

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		
Channels in use (for 2001-2002)		
Premium channels		
Year fixed effects		
MSO size fixed effects		
DMA size fixed effects		
% of singles in population		
Average household income		
% of single unit dwellings		
% of housing units that are rented		
Average household size		
Log of population density		
No. of observations		
R squared		
Auxiliary adj. R Squared		
Auxiliary coefficient on average MSO price		
Auxiliary coefficient on average DMA price		

*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. R squared for the first regression was not provided by the software.*

Table 2: Effect of Local Service Introduction on DBS Shares

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

Note:
All effects of LIL introduction are significant at 0.01 level.

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)		
Year Three Dummy (=1 if 2002)		
Number of Cable Channels in Use (2000)		
Number of Cable Channels in Use (2001 and 2002)		
DBS Short Term Local Service Dummy		
DBS Long Term Local Service Dummy		
Franchise area fixed effects		

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

ADDENDUM 2: NOTES ON CALCULATING σ

In Section 1 of this paper, we describe how we derive the nest parameter value, σ, for a given diversion ratio in the case where there is a single geographical area. However, our data consist of several thousand cable franchise areas with an *average* diversion ratio indicated by the churn surveys. In this addendum, we describe how we adapt the single-area approach detailed in Section 1 to the case where there are several geographical areas, thereby deriving a value of σ that is consistent with a given national average diversion ratio.

The spreadsheet used to calculate the revised σ is in the file *Sigma_Calculator.xls*. This file includes a worksheet that has instructions on how to use the workbook.

Notation:

- Upper case letters denote national figures, lower case letters denote individual cable franchise area figures
- Subscripts: E subscript indicates EchoStar, and D subscript indicates DIRECTV
- E_{ij} / e_{ij}: national/ cable area elasticity of i with respect to the price of j
- Q_i / q_i: national/ cable area subscribers of product i
- P_i: price of product i
- S_i / s_i : national / cable area share of product i
- HH / hh: national / cable area number of households
- DIV_{ED}: diversion ratio from DIRECTV to EchoStar after DIRECTV price changes
- σ: DBS nest parameter
- Summations are across all individual cable areas. The area subscript in the summation operator is dropped for convenience.

Using the above notation, together with the definition of diversion ratios and the formulas for demand elasticities in the context of a nested logit model as described in Section 1 of the paper, we detail below how we solve for σ as a function of a diversion ratio as well as EchoStar and DIRECTV shares in all cable franchise areas.

$$DIV_{ED} = -\frac{E_{ED}\cdot S_E}{E_{DD}\cdot S_D} = -\frac{\frac{dQ_E}{dP_D}\cdot\frac{P_D}{Q_E}\cdot\frac{Q_E}{HH}}{\frac{dQ_D}{dP_D}\cdot\frac{P_D}{Q_D}\cdot\frac{Q_D}{HH}} = -\frac{\frac{d\sum q_E}{dP_D}}{\frac{d\sum q_D}{dP_D}} =$$

$$= -\frac{\sum\frac{dq_E}{dP_D}}{\sum\frac{dq_D}{dP_D}} = -\frac{\sum\frac{dq_E}{dP_D}\cdot\frac{P_D}{q_E}\cdot\frac{q_E}{P_D}}{\sum\frac{dq_D}{dP_D}\cdot\frac{P_D}{q_D}\cdot\frac{q_D}{P_D}} = -\frac{\sum e_{ED}\cdot q_E}{\sum e_{DD}\cdot q_D}$$

Substituting the formulas for logit demand elasticities (listed in Section 1) into the above expression, we get:

$$DIV_{ED} = -\frac{\sum e_{ED} \cdot q_E}{\sum e_{DD} \cdot q_D} =$$

$$= -\frac{\sum \alpha P_D \cdot \left[s_D + \frac{\sigma}{1-\sigma} \cdot \frac{s_D}{s_D + s_E} \right] \cdot s_E \cdot hh}{\sum \alpha P_D \cdot \left[s_D - \frac{1}{1-\sigma} + \frac{\sigma}{1-\sigma} \cdot \frac{s_D}{s_D + s_E} \right] \cdot s_D \cdot hh} =$$

$$= -\frac{\overbrace{\sum s_D \cdot s_E \cdot hh}^{a} + \frac{\sigma}{1-\sigma} \overbrace{\sum \frac{s_D \cdot s_E}{s_D + s_E} \cdot hh}^{b}}{\underbrace{\sum s_D^2 \cdot hh}_{c} - \frac{1}{1-\sigma} \underbrace{\sum s_D \cdot hh}_{d} + \frac{\sigma}{1-\sigma} \underbrace{\sum \frac{s_D^2}{s_D + s_E} \cdot hh}_{e}}$$

$$\Rightarrow \sigma = \frac{a + c \cdot DIV_{ED} - d \cdot DIV_{ED}}{a - b + c \cdot DIV_{ED} - e \cdot DIV_{ED}}$$

ADDENDUM 3: SIMULATION RESULTS

ADDENDUM 4: INSTRUCTIONS ON HOW TO EXECUTE THE COMPUTER PROGRAMS USED TO SIMULATE THE ECHOSTAR-DIRECTV MERGER

This addendum provides instructions on how to use the Excel Workbooks and Mathematica Notebooks in order to produce the simulation results in Addendum 3. To calculate the effects of the merger, we employ the following files in the sequence of steps described below. We demonstrate this for the scaled [ ] diversion ratio case.

<u>*Stage 1: Create input data file for simulation.*</u>

Relevant files: *Stata_Output.xls*[42], *Scaled_div[ ]_Input.csv*

This file contains the data that we input into the Mathematica notebook (*Scaled_div[ ]_Simulation.nb*) that simulates the price and welfare effects of the merger. The *Scaled_div[ ]_Input.csv* file contains data on 4985 cable franchise areas (the first of which being the market added to represent non-cabled areas – see discussion above). The data are as of January 2002.

<u>Variables contained in *Scaled_div[ ]_Input.csv*</u>

Variable name	Description	Source	Notes
ica	Cable area franchise code	*Stata_Output.xls*	Not used in simulation
reweighted hhs*	Cable franchise area size used for simulations	Calculated using *DataScaling_Spreadsheet.xls*	Weights used to reweight data to mimic national cable franchise area shares, using method described in Addendum 5.
anten_share	Antenna share in cable franchise area	*Stata_Output.xls*	
cable_share	Cable share in cable franchise area	*Stata_Output.xls*	
es_share	EchoStar share in cable franchise area	*Stata_Output.xls*	
dtv_share	DIRECTV share in cable franchise area	*Stata_Output.xls*	
cable_price	Cable ARPU	*Stata_Output.xls*	Basic cable price was adjusted to average an ARPU

42 This file is generated by running *3_year_mvpd_data_prep.do* and *logit_regression.do* sequentially on the data contained in *3_year_mvpd_data.dta*. The *do* files were produced to the FCC on July 12th; the data file was produced on July 25th.

			of $[ ]
es_price	Monthly EchoStar ARPU in 2001 + av. equipment cost/12 months	EchoStar 2001 Annual Report; equipment price is from direct sales data from EchoStar	$[ ] for all cable franchise areas
dtv_price	Monthly DIRECTV ARPU+ av. equipment cost/12 months	DIRECTV 2001 10-K; equipment price is from interviews with DIRECTV businesspersons.	$[ ] for all cable franchise areas
alpha	Logit price coefficient	From the logit regression	[ ] for all cable franchise areas
sigma	DBS nest strength parameter	Calculated using *Sigma_Calculator.xls*	Calculated using formula in Addendum 2
adj_hh	Household counts before rescaling.	*Stata_Output.xls*	Not used in simulation. Used only in post merger calculations.
dma_rank	DMA size rank	*Stata_Output.xls*	Not used in simulation. Used only in post merger calculations.

* In the *unscaled* simulations this column includes a variable called *hhs*: the number of households in each cable franchise area without rescaling.

Stage 2: Use input data to simulate the price effects of the merger.

Relevant files: *Scaled_div[ ]_Simulation.nb, div[ ]_Output_MC_**

The second step in the simulation calculation is to input the data in *Scaled_div[ ]_Input.csv* into a Mathematica notebook, *Scaled_div[ ]_Simulation.nb*. The Mathematica program first uses the input data in *Scaled_div[ ]_Input.csv* to calibrate the $\delta + \xi$ parameter in the nested logit demand model, as well as the marginal costs of cable firms, EchoStar and DIRECTV. Given the calibrated values of these parameters, and given a marginal cost scenario (which is specified in *§1* of the program), the *Scaled_div[*

]_Simulation.nb solves the system of equations described in Section 2 of the Technical Notes to calculate post-merger prices.[43]

To implement this Notebook, the user needs to execute the following steps: (Before implementing the steps below, the user needs to execute Module [0], which loads the core Mathematica programs that are used later in the notebook.)

1. *§1 Model* Data, *Steps A-B:* Executing this block of commands inputs data by specifying the input file name and directory where the input file is located. In addition to specifying the input file name and directory, the user also needs to specify in Step A the dollar value of marginal cost reductions following the merger.[44] The user should input the directory names in a number of places. For each of the five marginal cost scenarios, the directory must be entered in §1, Step A (for the imported data) and in § 4, Step B (for the exported data). (Note that directory names do not end in a "\". Follow the template directory name in the program). Step B is a module that allows the user to check if the data are read in correctly.

2. *§2 Perform Intermediate Calculations:* This module calibrates $\delta + \xi$ and cable marginal costs in each franchise area as well as DIRECTV and EchoStar marginal costs nationwide. Note that no user input is needed here other than executing the block. If the program produces a "beep" and a message at this stage just press "don't show again" and ignore. The message is produced by the fact that, although the marginal cost for the average cable area is positive, at least one cable franchise area is calibrated to have negative marginal costs. The program proceeds as normal. Such negative costs in a few instances may arise due to mismeasurement and hence over-estimates of cable shares or due to the sale of complement products (such as premium cable services) by cable operators.

3. *§3 Compute Post-Merger Equilibrium:* Executing this block produces post-merger prices, shares, etc. The output produced are national results in that they are

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[43] A note regarding memory usage when running this program. The calculation of the post-merger equilibrium may require substantial computational time, ranging from a few minutes to a number of hours on memory-constrained machines. During the computation, the program prints out numbers (from one to eight) indicating its status. Given the recursive nature of the algorithm, the numbers may repeat (e.g., 1,2,3,4,5,6,7,5,6,7,8). Further, the program uses a number of convergence criteria to ensure that the equilibrium is properly calculated. In some situations, the program may indicate a failure to converge. This is normal as the program will automatically attempt different starting conditions and robustness checks, and continue execution as normal.

[44] The marginal cost reductions from merger-specific efficiencies that we used are listed in Section 3 of the Technical Notes.

averages of the cable franchise area -level results, weighted by households counts. For example, this module produces the change in the average cable fee (averaged across all cable franchise areas) following the merger.

4. *§4 Export Individual Cable franchise area Data:* These modules generate a CSV spreadsheet with cable area-level data on post-merger prices (titled post_price_C, post_price_D and post_price_E for cable, DIRECTV, and EchoStar, respectively), post-merger shares (titled post_*_share), and consumer welfare changes in dollars per area (titled consumer_welfare_change). In addition, this spreadsheet contains values of cable franchise area-level marginal costs and $\delta + \xi$ parameters (which are labeled delta_C, delta_E, and delta_D for cable, EchoStar and DIRECTV, respectively). Finally, the file produced by this module also contains all the data fields in the input file.

   Note that the user needs to specify the output file name and directory when executing this module.

   We simulate the merger under five scenarios for marginal cost changes for DIRECTV and EchoStar. Hence, the Mathematica program generates five output files with the above fields. They are:

   - *Scaled_div[ ]_Output_MC_no.csv* contains the cable area-level output from simulating the merger under the assumption that marginal costs of DIRECTV, EchoStar and cable remain unchanged following the merger.
   - *Scaled_div[ ]_Output_MC_A.csv* file contains the cable area-level output from simulating the merger under the assumption that marginal cost of DIRECTV drops by $[ ], EchoStar's by $[ ], and cable marginal cost remains unchanged following the merger.
   - *Scaled_div[ ]_Output_MC_B.csv* contains the cable area-level output from simulating the merger under the assumption that marginal cost of DIRECTV drops by $[ ], EchoStar's by $[ ], and cable marginal cost remains unchanged following the merger.
   - *Scaled_div[ ]_Output_MC_C.csv* contains cable area-level output from simulating the merger under the assumption that marginal cost of DIRECTV drops by $[ ], EchoStar's by $[ ], and cable marginal cost remains unchanged following the merger.

- *Scaled_div[ ]_Output_MC_D.csv* contains cable area-level output from simulating the merger under the assumption that marginal cost of DIRECTV drops by $[ ], EchoStar's by $[ ], and cable marginal cost remains unchanged following the merger.

Stage 3: Calculate the total welfare effects of the merger

*Relevant file: div[ ]*worksheet in the *Scaled_Welfare_Spreadsheet.xls* file.

The final step of the merger simulation analysis is to calculate the effects of the EchoStar-Hughes merger on consumer welfare. The net welfare effect is the sum of three components: First, the initial welfare changes stemming from the price effects of the merger. Second, the welfare effects of introducing LIL service (the "direct effect" as described in Section 3 of the Technical Notes). Third, the welfare effects of cable fee reductions in response to LIL introduction by DBS (the "indirect effect" as described in Section 3 of the Technical Notes). The sum of these three components equals the measured consumer welfare change from the merger. (The merger will create other forms of welfare improvements such as those stemming from expanded VOD, HDTV and other new products. We do not measure such effects in these files.)

The *Scaled_Welfare_Spreadsheet.xls* file calculates the welfare effects of the merger by adding the three components listed above. Again, using the div [ ] tab as an example, this file can be understood to consist of three parts:

a. *Input Fields (with numbers in bold font)*

These fields list data imported from various sources. Sources used in the input data are listed in the *Sources Tab* worksheet of this file. Key input data fields include the following:

- "Monthly consumer welfare change before LIL introduction": This field (which is located in the "Welfare Changes: Consumer Welfare Changes Before LIL Introduction" table in the div[ ] tab of *Scaled_Welfare_Spreadsheet.xls*) measures the initial national welfare change from the price changes following the merger (with no adjustment for LIL introduction post merger). This value is taken from the *Scaled_div[ ]_Output_MC_*.csv* output files. It is calculated by summing across consumer welfare changes in the individual cable franchise areas. (These welfare changes are in the "consumer_welfare_change" field in the *Scaled_div[ ]_Output_MC_*.csv* output files.)