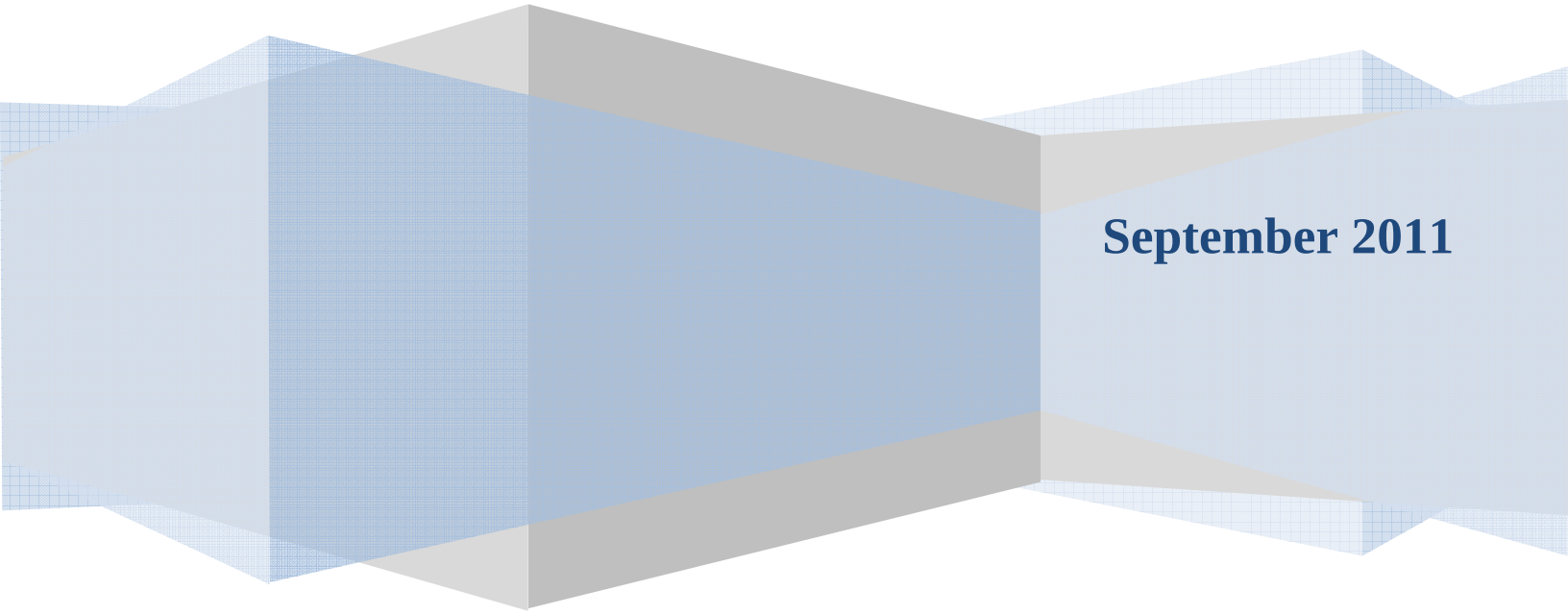
Operating Expense Study Sponsored by the Nebraska Rural Independent Companies

Update to Predicting the Operating Expenses of Rate-of-Return Telecommunications Companies



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I. The Task

In response to the Federal Communications Commission's (Commission) request for data on operating expenses,[1] the Nebraska Rural Independent Companies (Nebraska Companies)[2] undertook a statistical study designed to predict annual operating expenses of rate-of-return companies that operate voice and broadband-capable networks in rural areas. The goal of the analysis is to provide the Commission and other policy makers with data and methodologies that can be used to ensure that rate-of-return companies are utilizing federal universal service funding (USF) in an efficient manner. The Nebraska Companies filed the initial results of the analysis in May 2011[3] at the request of the Commission.

In this update to the original analysis, the Nebraska Companies will present an improved regression equation, provide a statistically valid method to calculate a cap on operating expenses, and propose a method of handling a statistically significant variable that might not be independent. Further analysis of the data and development of the updated regression equation was conducted by Edit Kranner of Consortia Consulting, Inc. with assistance from Peter Bluhm and Dr. Robert Loube of Rolka, Loube, Saltzer Associates.

II. Updated Regression Results

The Telergee Study supplied a variety of data on regulated and non-regulated operations of local exchange companies. For this study, the Nebraska Companies used the following types of data:

- Geographic (region, state, square miles served[4] and number of exchanges),
- Plant (remaining life of wireline plant, net regulated wireline plant and net non-regulated plant),

[1] After the Nebraska Companies presented the Capital Expenditure Study to the Commission on January 6, 2011, the Commission asked the Nebraska Companies to commence a similar regression analysis of the operating expenses of rate-of-return companies.

[2] The Nebraska Rural Independent Companies are comprised of the following: Arlington Telephone Company, The Blair Telephone Company, Cambridge Telephone Company, Clarks Telecommunications Co., Consolidated Telephone Company, Consolidated Telco, Inc., Consolidated Telecom, Inc., The Curtis Telephone Company, Eastern Nebraska Telephone Company, Great Plains Communications, Inc., Hamilton Telephone Company, Hartington Telecommunications Co., Inc., Hershey Cooperative Telephone Co., K. & M. Telephone Company, Inc., The Nebraska Central Telephone Company, Northeast Nebraska Telephone Company, Rock County Telephone Company, Stanton Telecom Inc., and Three River Telco.

[3] *Predicting the Operating Expenses of Rate- of-Return Telecommunication Companies*, Nebraska Rural Independent Companies' and Telergee Alliance of Public Accounting Firms, ex parte filed May 10, 2011. *In the Matter of Connect America Fund*, WC Docket No. 10-90. *A National Broadband Plan for Our Future*, GN Docket No. 09-51, *and High-Cost Universal Service Support, WC* Docket No. 05-337, *Establishing Just and Reasonable Rates for Local exchange Carriers*, Docket No. 07-135, *Developing Unified Intercarrier Compensation Regime*, Docket No. 01-92, *Lifeline and Link-Up*, Docket No. 03-109.

[4] In our study estimating capital expenditures costs, we found that customers per route mile, or linear density, was more significant than customers per square mile, or area density, in predicting capital expenditure costs. In this study, route mile data was not available, so area density was used instead.

- Customer and employee counts (employees by job type, broadband customers, ILEC access lines and CLEC access lines),
- Revenues (wireline operating revenues and non-regulated Internet revenues), and
- Expenses (plant-specific and plant non-specific expenses, customer expenses, corporate expenses, and property and other taxes). Expenses did not include depreciation or middle mile expenses.

In addition to the above data, the Nebraska Companies used public information sources to capture other cost of living differences related to housing, energy and food. The following state-specific variables were also tested as independent variables:

- Median Hourly Wages by State for May 2009—Source: Bureau of Labor Statistics, State Occupational Employment and Wage Estimates
- Mean Annual Wages by State for May 2009—Source: Bureau of Labor Statistics, State Occupational Employment and Wage Estimates
- Median Value of Owner Occupied Housing Units for 2000 and 2005—Source: Census Bureau. (Data that is more recent is significantly influenced by the nationwide housing crisis, so it was not tested.)
- State and Local Tax Burden per Capita for Fiscal year 2009—Source: Tax Foundation "2011 Facts and Figures: How Does Your State Compare?"
- State Average Population Density—Source: 2010 Census
- Federal Highway Miles per Capita—Source: Federal Highway Administration and 2010 Census

Equation 1 below describes the result of our preliminary regression study filed in May of 2001:

Equation 1. [5]

Operating Expense per Connection[6]=
A + B * Square Miles Served/Access Line + C * Access Lines
+ D * Employees/Connection + E * Median Home Value$_{2005}$
+ F * Net Wireline Plant/Access Line

After further testing, two minor changes were made to the regression equation. First, the independent variable, company size, was found to be inversely related to the dependent variable, operating expense per connection. In the preliminary regression analysis, the relationship was reported to be linear. As a result we substituted "1/Access Lines" for "Access Lines" as an independent variable. Second, the independent variable "net wireline plant per connection"

[5] Some variables are divided by access lines and others by connections. Generally, access lines are used when the variable is capturing the size or density of the service area. Connections are used when the variable is associated with costs or other monetary values, such as net plant or with employment. Both access lines and broadband connections are associated with higher plant values and costs.

[6] In thousands of dollars per year.

proved to be more significant than the original variable, "net wireline plant per access line." The updated equation, Equation 2, is as follows:

Equation 2.

Operating Expense per Connection[7]=
A + B * Square Miles Served/Access Line + C * 1/Access Lines
+ D * Employees/Connection + E * Median Home $Value_{2005}$
+ F * Net Wireline Plant/Connection

Each variable's regression coefficient, T-statistic and standard error are shown in Table 1:

Table 1. Updated Regression Coefficients

Factor	Coefficient Symbol	Coefficient	T-statistic	Standard Error
Constant	A	-.178286	-2.547630	0.069981
Square Miles Served per Access Line[8]	B	.078633	1.853306	0.042428
1/Access Lines	C	108.4469	2.683140	40.41789
Employees per Connection[9]	D	73.87333	8.694833	8.496233
2005 Median Home Value	E	1.28E-6	3.464459	3.69E-07
Net Wireline Plant per Connection	F	.068508	3.771949	0.018163

The recent changes improved the fit of the equation from an R-squared of 0.6522 to an R-squared of 0.6807. In other words, the independent variables in the final equation can explain 68% of the variation of company operating expenses.

III. Construction of a Cap Using the Regression Analysis Results

The regression equation is statistically designed to predict the most likely operating expenses per connection of any carrier. The prediction is not perfect, however. Some companies' operating expenses will be higher and some will be lower than the amount predicted by the regression equation. If the Commission were to establish a cap for operating expenses, the cap should reflect the scope of the uncertainty in the prediction, as measured by the variance, and should be higher than the mean value established by the regression equation.

There are several ways of creating such a cap. Simply increasing the coefficients by a fixed amount or percentage is not statistically correct because it does not consider the error in the estimate.[10] Instead, the Nebraska Companies recommend a cap be established that estimates an operating expense per connection that is one standard deviation above the expected value. This

[7] In thousands of dollars per year.
[8] The access line variable includes both CLEC and ILEC access lines.
[9] The connections variable includes CLEC and ILEC access lines, as well as broadband connections.
[10] Compare, Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking, Released February 9, 2011, ¶ 206.

method is accomplished by adding the standard error to the coefficient for each term in the regression equation. Applying the regression equation with these new coefficients produces an estimated expense per connection that is higher than the expected value, and appropriately reflects the variance of each variable. Each company's cap would be based on its individual input data, as shown in Equation 3 below:

Equation 3.

$$\text{Operating Expense Cap per Connection for Company}_i =$$
$$(A + SE_A) + (B + SE_B) * (\text{Square Miles Served}_i/\text{Access Lines}_i)$$
$$+ (C + SE_C) * (1/\text{Access Lines}_i) + (D + SE_D) * \text{Employees per Connection}_i$$
$$+ (E + SE_E) * \text{Median Home Value}_i + (F + SE_F) * \text{Net Wireline Plant per Connection}_i$$

Our study found coefficients and standard errors for each variable reported in Table 1. If the FCC were to reach the same finding, the cap for "Company i" is calculated in Equation 4:

Equation 4.

$$\text{Operating Expense Cap per Connection for Company}_i =$$
$$(-.178286 + 0.069981) + (.078633 + 0.042428) * (\text{Square Miles Served}_i/\text{Access Lines}_i)$$
$$+ (108.4469 + 40.41789) * (1/\text{Access Lines}_i)$$
$$+ (73.87333 + 8.496233) * \text{Employees per Connection}_i$$
$$+ (1.28E\text{-}6 + 3.69E\text{-}07) * \text{Median Home Value}_i$$
$$+ (.068508 + 0.018163) * \text{Net Wireline Plant per Connection}_i$$

The fourth term in the equation uses the variable Employees per Connection to calculate the cap on operating expense per connection. While it makes intuitive sense that the number of employees is related to company cost, in a regression equation created to limit allowable operations some companies might increase their employment numbers as a way to increase their expense cap and their universal service support. The validity of this concern could easily be verified or dismissed by performing a simple cost-benefit analysis that compares the cost of hiring an additional employee with the increase to a company's allowable expenses.

Standard statistical techniques can address the problem of nominally independent variables that are actually subject to manipulation. One such technique is to use a predetermined quantity for the independent variable, in this case Employees per Connection. Instead of using a company's actual employment counts, the FCC could calculate the company's cap using a surrogate employee count based on attributes of the geographic area served.[11] A table indicating the typical number of employees for companies could be constructed using variables such as the size of the geographic area served and the company's number of connections. That table could have several ranges for each independent variable. The table entries could be populated by a statistical analysis of industry data as well as other attributes that may influence a company's number of employees.[12]

[11] The prescribed number of employees would only be used for calculation of the cap. It would not be used for calculation of the regression equation itself.

[12] Another technique to limit the influence of variables that are not independent is to use a two-stage least squares regression. The first stage of the regression would predict the number of company employees. The independent variables considered in this stage would be the route miles served (or square miles served) and the number of connections in the study area. The second stage of the regression would predict operating expense per

Substituting a prescribed number of Employees per Connection in Equation 4 yields Equation 5 below.

Equation 5.

Operating Expense Cap per Connection for Company$_i$ =
(-.178286 + 0.069981) + (.078633 + 0.042428) * (Square Miles Served$_i$/Access Lines$_i$)
+ (108.4469 + 40.41789) * (1/Access Lines$_i$)
+ (73.87333 + 8.496233) * Prescribed Employees per Connection$_i$
+ (1.28E-6 + 3.69E-07) * Median Home Value$_i$
+ (.068508 + 0.018163) * Net Wireline Plant per Connection$_i$

The FCC should understand that depreciation and middle-mile costs were not included in the expenses used to calculate the regression equation, and thus should not be limited by the above equations. If the FCC decides to limit depreciation and middle-mile costs, those costs can be limited or capped in some other manner.

When a regression equation is used to set caps on expenses, it is important to periodically revise and update the equations with current data. In the period between updates, the estimates or caps need to be adjusted for inflation. The preceding method can easily be kept current on an annual basis using current input values from public sources and using standard statistical software.

IV. Consideration of Constraints on Rate-of-Return Companies

The Commission has expressed concerns about rate-of-return regulation not being an efficient use of public funding and although some disagree with this view, the Commission has made it clear that the concerns must be addressed. The Commission articulated concerns include the following:

- Rate-of-return regulation does not provide incentives for controlling capital and operating costs.[13]
- Support is not distributed among high-cost carriers in a way that maximizes overall consumer benefits.[14]
- More support is provided in some areas than a carrier needs to achieve the goal of reasonably comparable services at rates that are affordable and reasonably comparable to those in urban areas.[15]

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connection, using the predicted number of employees from the first stage analysis as an input (divided by the number of connections) along with other significant independent variables.

[13] *Id.* ¶ 162.

[14] *Id.*

[15] *Id.*

The Nebraska Companies strongly believe that if comparable and affordable broadband services are to be deployed and maintained in rural areas, rate-of-return regulation must be maintained for many (if not most) companies currently under that regulatory regime. Instead of abandoning rate-of-return regulation, the Commission can address the above concerns with reforms that limit on reimbursable operating and capital costs.[16] This is consistent with Commission's past proposals to continue rate-of-return regulation in the near term, and in the long term after establishment of the CAF.[17]

The results of the NRIC expense regression study provide conclusive evidence that rate-of-return companies' operating expense can be predicted with reasonable accuracy by a regression equation developed using actual company data. Using a regression equation to estimate aggregate operating expenses not only makes unnecessary limitations on any specific category of expenses, such as corporate operations, but it is preferable because it limits a company's ability to game a system that only addresses one type of expenditure. To test and improve regression results, it would be beneficial to expand the number and geographic distribution of the sample, as well as seek data over a series of years. Finally, while the high R-squared statistics show that regression analysis can accurately predict the level of operating expenses, unusual characteristics cannot be addressed by a regression equation. A streamlined waiver process is needed to address these unusual circumstances.

[16] *Id.* ¶¶ 201-206.

[17] *Id.* ¶¶ 448, 449.