Incentives for Cost Shifting and Misreporting: U.S. Rural Universal Service Subsidies, 1991-2002 *

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Abstract

The U.S. high cost loop support (HCLS) program, formerly referred to as the Universal Service Fund (USF), has been a key component of the Federal Communications Commission's (FCC) program to promote telephone access in rural, high cost areas. This study uses data from 1140 rural telecom firms in 50 states between 1991 and 2002 to test the impact of the HCLS subsidy system on reported costs. Our findings suggest that firms in higher reimbursement thresholds tend to report higher costs to the FCC in order to qualify for higher support payments. We also find that the capping of total available subsidy funds increased the incentive to overstate or misclassify costs. Overall, our results suggest that this billion-dollar program deserves closer scrutiny than it receives at present.

Keywords: Telecommunications, High Cost Subsidies, Universal Service
JEL codes: L96, H23, L51

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1. Introduction

The U.S. high cost loop support (HCLS) program, formerly referred to as the Universal Service Fund (USF), has been a key component of the Federal Communications Commission (FCC)'s program to promote telephone access in rural, high cost areas. The program reimburses a larger fraction of a firm's incremental costs as the level of the firm's costs rises above one of the identified thresholds i.e., "National Average Annual Loop Cost" ("NALC"). For example, firms are not eligible for reimbursement for their costs that are below 115% NALC; they are eligible for reimbursement of 65% of their costs that are between 115% NALC and 150% NALC; they are eligible for reimbursement of 75% of their costs that exceed 150% of the NALC level. Table 1 identifies each subsidy breakpoint.[1] This annual support program is targeted to small and medium-sized firms (with 200,000 or fewer loops). It is supposed to promote access to the telephone system by covering some of the higher loop costs [2] associated with less dense service territories. From 1986 to 2006, this amount of subsidy has increased dramatically from $56 million to over $1.2 billion,[3] but for the largest local telecommunications carriers in the United States, the gross book value of all assets has actually decreased in real terms during this period. [4] Since other telephone subscribers are footing the bill for the HCLS program, the mechanism warrants periodic review.

[Insert Table 1 Here]

A number of researchers have been critical of subsidies for universal service in practice.

[1] In Table 1, we use "*Ctg0*", "*Ctg65*" and "*Ctg75*" as dummy variables to denote the three thresholds; these three variables will be used in the statistical analysis.

[2] Loop costs refer to cost of investments in facilities (including outside wires and poles) that link the customer to the public switched telephone network.

[3] Data is from Table 3.1, *December 2005 Federal-State Joint Board Monitoring Reports*, Federal Communications Commission.

[4] See Table 4.8, *2004/2005 Statistics of Common Carriers*, Federal Communications Commission.

Earlier literature dates back to the work by Kaserman, Mayo, and Flynn (1990) and is summarized by Riordan (2002). More recently, researchers have addressed pricing issues associated with USF: Mirabel, Poudou, and M. Roland (2009) examine strategic links among markets served by USF providers and find that adding a unit subsidy in the compensation scheme of the universal service obligation helps to neutralize the inefficiencies caused by the strategic links; Rosston, Savage and Wimmer (2008) find that universal service payments to telecommunications suppliers in high-cost regions do not reduce the prices of telecommunications services in rural areas; Zolnierek and Clausen (2010) suggest the need to focus on reducing rates to people in high poverty area; and Hauge, Chiang, and Jamison (2009) find that universal service subsidies do not adequately target the preferences of low income customers.

However, few previous studies have researched the incentives for cost-containment associated with the existing subsidy allocation scheme, which is the main topic of this paper. Using data on 1,140 small and medium-sized rural telecom firms in 50 states from 1991 to 2002, we empirically examine how changes in per loop costs are influenced by cost thresholds utilized in the subsidy system. More specifically, we test whether companies in higher subsidy categories exhibit greater annual cost growth compared with companies in lower subsidy categories, where the greatest incremental incentive occurs when the 75% adjustment kicks in. To disentangle the effect of each categorical cutoff level on firms' per loop costs change, we use average schedule companies as comparison group. These companies receive compensation based on the industry average cost data instead of their reported loop costs, thus we believe they have little incentive to overstate their costs for reimbursement. In the model, we also control for other confounding factors, such as firm size, the policy determining the amount of available funds, and

macro environment conditions.

There is evidence that managers can categorize costs or shift them inter-temporally to stabilize earnings or achieve particular targets (Degeorge, Patel and Zeckhauser, 1999). In the case of rural telephone companies, the incentives for misreporting are substantial, while the ability of the FCC to detect such behavior is minimal. Berg, Jiang, and Lin (2010) describe the perverse incentives and associated cost patterns, but they do not present econometric evidence regarding the negative impacts of the HCLS program on cost-containment. In this study we find evidence suggesting that under the HCLS program, firms in higher reimbursement thresholds may overstate their costs because they have strong incentive to do so, in order to qualify for higher HCLS subsidies.

The remainder of the paper proceeds as follows. Section 2 describes the data and the determinants of loop cost change. Section 3 presents empirical model and regression results. Section 4 discusses robustness checks. Section 5 concludes.

2. Data and The Determinants of Loop Cost Change

Firms at higher reimbursement threshold have greater incentive to inflate reported costs since the marginal benefits of doing so is greater for such firms, i.e., the cost increment is expected to be more pronounced within higher cutoff firms. We will empirically test this proposition: the dependent variable is the change in per loop cost between one year and the prior year. We use a measure of the change in per loop cost instead of the level of per loop costs because the level of per loop cost determines the reimbursement category (as shown in Table 1)

to which the firm belongs.[5] After taking the difference, the dependent variable reflects only the change of the per loop cost, which does not depend on the firm's category *per se*. Therefore, we are able to test the effect of the subsidy threshold mechanism on the per loop cost change. After taking the difference, there are eleven relevant temporal observations for the dependent variable. Although we can also take the difference between more than one year period, we assume that the variation of one-year-per-loop-cost is a good measure of the firm's cost behavior in our sample.[6]

In addition to the key categorical dummy variables, we are also interested in the effects of the cap policy on total subsidy. In December 1993, the Commission, at the recommendation of the Federal-State Joint Board[7] in *CC Docket 80-286*, imposed a limit on HCLS payments. The limit (or "cap") was indexed to the rate of growth in total telephone lines in the country. The cap is implemented by adjusting the national average cost per loop from the true average value to whatever base value is required to achieve the cap. For rural carriers, the NALC is now frozen at $240.00 and the cap is indexed to the rate of growth in working lines of rural carriers plus the rate of inflation, as measured by the Gross Domestic Product Chained Price Index.[8] To capture the impact of HCLS subsidy cap on per loop cost change, we construct a dummy variable *Cap*. Although the FCC imposed a cap on USF payments in December 1993, it was not extended to rural carriers until July 1, 1999. We set *Cap*=0 to denote the period between 1991 and 1999 when the rural carriers are not subject to the USF payment cap, and *Cap*=1 to denote the period

[5] We have also used the percentage change - the log ratio of per loop cost - as the dependent variable to measure the growth rate of per loop cost for each firm. The results are consistent with those obtained using the change of per loop costs.

[6] We have also taken the difference between more than one year period. Those results are consistent with the one-year-period ratio.

[7] A Federal-State Joint Board is comprised of both federal and state commissioners. The Joint Board investigates issues that the FCC refers to it and makes recommendations to the FCC.

[8] The FCC froze the national average because they "do not anticipate a dramatic increase or decrease in the actual national average loop cost in the near future" FCC 01-157, 2001. Also see *Fourteen Report and Order, Twenty-second Order on Reconsideration, and Further Notice of Proposed Rulemaking* in CC Docket No. 96-45, and Report and Order in CC Docket No. 00-256.

from 2000 to 2002 when the cap was imposed on the fund subsidy. We expect that the cap policy should increase firms' incentives to exaggerate their costs due to greater competition for a more limited set of resources.

The FCC reimburses rural companies based on their reported loop costs. Data for the firms' true costs (let alone their potential costs) are unobservable. To test the effect of the HCLS subsidy program on reported costs, it would be ideal to find a control group that consists of similar firms but are not subject to the same program. However, this is extremely difficult as the HCLS program was launched throughout the nation at the same time. To find a comparison group that can be used to control for the firms' cost change, we note that firms in our dataset are under two accounting regimes – "cost schedule" companies and "average schedule" companies. They receive HCLS money in two different ways, reflecting the FCC cost reimbursement method. Cost schedule companies receive compensation based on their reported operating costs. By contrast, average schedule telephone companies receive subsidies that do not depend on their reported costs. Instead, the average schedule companies receive compensation on the basis of industry average cost data in the study area and formulas that are designed to simulate the reimbursement that would be received by a cost schedule company which is representative of average schedule companies.[9] Clearly, cost schedule companies can exert a more direct impact on subsidies received through cost manipulation and inflation, compared with average schedule companies. By including a dummy variable *Cmethod* with C*method*=1 representing cost schedule companies, we expect a positive coefficient for *Cmethod* as such firms will tend to shift or misreport costs to a greater extend.

In the analysis, we also control for several other factors that could affect per loop costs

[9] Please see http://www.neca.org/source/NECA_Home.asp for more details.

change. First, we include the natural logarithm of the total number of loops (*Loops*) as a proxy for firm size. Firms with different sizes may have different incentives to engage in misreporting or other forms of cost inflation: larger firms may have more flexibility to do so. For example, reporting fewer operating loops is relatively easy for larger firms since under-reporting is difficult to detect. This allows them to increase the per loop costs on the books without generating any actual costs. Therefore, we expect that larger firms have greater ability to overstate costs.

To isolate the effect of this subsidy mechanism, it is also important to control for state and industry level factors that may influence firm behavior in these markets (Ai and Sappington, 2002, 2004). These factors include: (1) demographic characteristics such as state population, population density, and the proportion of residents living in rural areas; (2) industry regulations that affect a firm's incentive to control its costs;[10] (3) industry technology, which can affect the firm's costs of delivering service; and (4) general economic conditions in the state such as unemployment rate, gross state productivity and personal income.

After accounting for all of these factors, some other relevant variation may still remain. To capture any systematic residual variation, we use the fixed-effects approach and use two types of dummy variables. First, we include the time-specific dummy variable to control for macroeconomic factors that vary over time but do not vary across firms or states; these would include interest rates, industry-wide technology advances, or unobserved quality of the network associated with higher costs. Second, we use the firm fixed effect to capture the unobserved and time-invariant features of rural LECs. These features can include factors such as investment style,

[10] We include a regulation term that measures whether the firm is under "rate-of-return" regulation or "price cap" regulation. However, because this term varies little over time, the term is dropped in the fixed-effects regression. We expect that firms operating under price cap regulation will have smaller cost increments due to the more pronounced incentives for cost control under such regulation (Donald and Sappington, 1997). However, when we split the sample and consider each group separately, we do not find that "price cap" firms have statistically significant less cost increments than "rate-of-return" firms.

management talent, customer base, corporate culture, and operating efficiency. The fixed-effects methodology helps mitigate potential endogeneity due to omitted variables and therefore the approach isolates the cost inflation effects.

3. Regression Model and Empirical Results

3.1 Model

The fixed-effects regression estimation can be expressed as follows. The standard errors are robust to heteroskedasticity and serial correlation in the error term. In addition, we allow for clustering by firms, recognizing possible correlation within firms across time periods.

$$CostDif_{it} = \beta_1 \cdot Ctg0_{it} + \beta_2 \cdot Ctg65_{it} + \beta_3 \cdot Ctg75_{it} + \beta_4 \cdot Loops_{it} + \beta_5 \cdot Cmethod_{it} + X_{it} + S_i + T_t + \varepsilon_{it} \qquad (1)$$

The dependent variable, $CostDif_{it} = Cost_{it} - Cost_{i,t-1}$, denotes the per loop cost change for firm *i* between year *t* and year *t-1*. X_{it} is a vector of state or industry level control variables. The S_i and T_t variables are firm-specific and time-specific dummy variables, respectively, and ε_{it} is the error term. The time period is from 1991 to 2002.

As noted above, the industry or state level variables are included in our estimating equations to reduce the likelihood of omitted variable bias. However, some of these potential explanatory variables lack time variance. After eliminating the time-invariant explanatory variables, four state-level explanatory variables remain: *Pop*, *Unemp, Inc* and *Gsp*. We assume that the firms' cost overstatement behavior is driven by the goal of profit (or at least, net cash-flow) maximization. The state's general economic activity provides a macro environment for a firm's investment activity and earnings prospects, which directly affects firms' decisions on cost reporting.

To summarize, the key independent variables control for a number of factors: *Ctg* for the three categorical dummies, *Loops* to reflect firm size, *Cmethod* to denote cost reimbursement

methods, *Cap* to capture the impact of HCLS subsidy cap on per loop cost change, *Pop* to reflect population density[11], and some variables reflecting state economic activity (*Inc, Gsp, Unemp*). All the variables are defined as below. The summary statistics are show in Table 2.

Cost	per loop cost for each firm, in US dollars
CostDif	per loop cost change by each firm in US dollars
Ctg0	categorical dummy if less than 115% of NALC (no subsidy)
Ctg65	if over 115% of NALC but less than 150% (eligible for 65% subsidy)
Ctg75	if firm is over 150% of NALC (eligible for 75% subsidy)
Cap=0	period between 1991 and 1999 when there was no USF payment cap
Cap=1	period from 2000 to 2002 when the cap was imposed on the fund subsidy
Loops	natural logarithm of total number of loops for each firm
C*method* = 1	if cost companies (subsidy based on their reported costs)
C*method* = 0	if average schedule companies (subsidy independent of reported costs)
Pop	state's population density (total population divided by the state area)
Inc	state's per capita income in natural logarithms
Gsp	gross state production in natural logarithms
Unemp	seasonally adjusted state's unemployment rate[12]

[Insert Table 2 Here]

3.2 Empirical Results

The regression models examine whether the cost increment is more pronounced for firms that are within the thresholds qualifying them for subsidies. The regression results are presented

[11] The data for the population density variable are obtained from the U.S. Census Bureau (2002).

[12] The data for the unemployment rate are obtained from the U.S. Department of Commerce, Bureau of Labor Statistics (2002).

in Table 3. The firm fixed effects and time dummies are included in the model, but to save space, the coefficients on these variables are not reported here. Column I presents the basic regression results. Column II shows the regression results for the whole dataset by including the cap regime variable. Column III focuses on the firms that changed their cutoff categories during the periods, which we will discuss later. The most important findings in Table 3 are the positive and significant coefficients of the categorical dummies, suggesting that firms in higher subsidy cutoff categories demonstrate a significantly higher level of annual per loop cost growth. Compared with the category *Ctg0* which does not receive any subsidy, group *Ctg65* has higher incremental costs of $15.85 more per loop each year, and group *Ctg75* has incremental cost inflation of $46.0 more per loop every year relative to those firms receiving no subsidies. Both of these estimated coefficients are significant at the 1% level. The coefficients for *Ctg75* are significantly larger than those of *Ctg65*, which suggests that companies in higher subsidy cutoff level have an incentive to overstate their loop costs more in order to qualify for additional subsidy funds.

[Insert Table 3 Here]

Of course, statistical significance does not necessarily imply economic importance. To better understand the cost inflation for those firms exhibiting particularly high cost overstatement, we focus on the firms which changed their cutoff categories during the same period and repeat the analysis. We expect that the firms that switched to higher subsidy categories may increase their per loop cost more rapidly and aggressively, compared to other firms. In our sample, 95% of the firms that switched their cutoff category moved to higher cutoff levels rather than lower.[13] This, in itself, suggests a one-way race to excessively high misreporting or excessive service quality improvements (gold-plating and the addition of high

[13] We removed the five percent of the sample that switch back and forth between different cut-off groups.

tech services). As can be seen in Table 3 Column III, we find that almost all of the estimated coefficients of the explanatory variables retain the same signs; furthermore, the magnitude for the coefficients of *Ctg65* and *Ctg75* is nearly three times for the entire sample, suggesting economically significant cost inflation for these firms.

In Table 3 Column II, we show the regression results for the whole dataset by including the cap regime variable. The impact of this constraint is positive but not statistically significant. As we discussed before, the cap imposed on the universal service fund may affect various types of firms differently. For example, the firms that qualify for the subsidy may respond to the cap imposition more aggressively than the other firms do. To capture these potential effects and explore the impact of subsidy cap imposition, we split our sample into two groups: pre-cap (1991-1999) and post-cap (2000-2002). The results are presented in Table 4.

[Insert Table 4 Here]

As can be seen, the impact of the categorical variables on cost inflation increases after the imposition of the cap, as indicated by the greater magnitude of the coefficients of *Ctg65* and *Ctg75* in the *Post-Cap* policy regressions (Column II). In particular, the coefficients of *Ctg65* in *Post-Cap* policy almost double those in the *Pre-Cap* regressions. We conduct a Chow test and find the differences statistically significant at 5% level. This confirms our hypothesis that firms at higher cutoffs have even stronger incentive to undertake cost inflation to compete for the limited resources after the imposition of the cap. To further test the robustness of the results, we also ran the OLS regression year by year. The results are generally consistent with our previous findings. For brevity, the results are not reported but available from the authors upon request.

As we discussed earlier, the state control variables may also yield some interesting findings. Consistent with our expectation, the population density is positively associated with per

loop cost change and the gross state production is negatively associated with per loop cost change. The impacts, however, are insignificant for unemployment rate and the per capita income. This result is probably due to state level indictors not capturing the regional macro environment for individual firms in rural areas.

As expected, the positive, significant coefficient on the cost settlement variable is consistent with companies in the cost reporting category submitting higher cost numbers due to their having more flexibility to shift costs inter-temporally or misreport information.

4. Robustness Tests

Confirming the causal effect of the subsidy mechanism on firm cost behavior is difficult due to the lack of a natural comparison group, which by itself could cause concern that the magnitude of firm cost increases are merely associated with firms' number of loops in the three categories. We argue that this is unlikely to be the case. First, as pointed before, the annual support provided by the HCLS has dramatically increased with the gross book value of all assets for the largest local telecommunications carriers actually decreased in the United States. [14] This suggests that the small and medium sized firms in our sample may have excessively increased outlays or shifted costs. Second, there are conspicuous kinks at the subsidy cut-off break points [15], reducing identification concerns (Berg, Jiang and Lin, 2010). [16] Third, the cost increment is concentrated in the subsample of firms that move to higher cutoff categories, and it is more pronounced once the cap policy is imposed. The split sample results are less susceptible

[14] See Table 4.8, *2004/2005 Statistics of Common Carriers*, Federal Communications Commission.

[15] An improbably small number of firms fall into the range just before the cut-off and an improbably large number of firms fall have costs just above the trigger of 115% of NALC.

[16] Saez (2010) captures tax evision by finding clear evidence of bunching around the first kink point of the US income tax schedule.

to identification concerns and support our economic argument that firms are more likely to overstate their costs when they approach the range making them qualified for the higher reimbursement rate.

We further address the issue by using a comparison group among the rural telecom firms. As was noted earlier, the average schedule firms, instead of reporting their costs, report revenues and receive the subsidies based on generalized industry cost data in the study area. Therefore, they may have less incentive to inflate (or shift) costs than the cost companies because it is very difficult to exert a direct impact on subsidies through cost manipulation. Thus they provide us a benchmark group to examine the cost inflation patterns within different types of firms.

In the model specification, we include the interactions of threshold dummy variables and the cost methods (*Cmethod*=1 represents a cost company). The results for the 1,140 companies are presented in Column I, Table 5. The two interaction terms are positive and statistically significant at the 1% level, suggesting that use of the cost method induces more cost inflation. Moreover, the coefficient for the *Ctg75* interaction is larger than the *Ctg65* interaction, which is consistent with our previous hypothesis that firms in the higher subsidy category have especially strong incentives to inflate the costs. We further split our sample based on cost policy. The results are shown in Column II for cost companies and Column III for average schedule companies in Table 5. We find that compared to cost companies, average schedule companies have smaller estimated coefficients on both *Ctg65* and *Ctg75* groups, which reinforces our findings when we used interaction terms. We also perform a Chow Test and find the difference of the two sample regressions is significant at the 5% level.

[Insert Table 5 Here]

It is worth noting that, in this paper we do not try to determine the magnitude of

difference on cost inflation between thresholds. Instead, we want to demonstrate that the cost inflation is more pronounced within higher cutoff firms due to the HCLS reimbursement mechanism. Our overall empirical analysis has provided evidence to support such conjecture.

5. Conclusion

These empirical results provide evidence of the perverse effect of current subsidy system for the U.S. high cost loop support (HCLS) program, as applied to small and medium-sized rural telephone companies. There are many factors affecting the change in reported costs, but the lack of cost-containment by firms meeting the subsidy cut-off thresholds suggests that managers are responding rationally to a system that encourages cost inflation. The econometric models attempt to control for endogeneity using a fixed effects model. In addition, firms choose whether to use the cost method or the average schedule method, which affects their ability to influence their eligibility for subsidies. That self-selection process reinforces our conclusions that the High Cost Loop Support program incentivizes small and medium-sized rural telephone companies to strategically shift and to misreport costs. This billion dollar program deserves closer scrutiny than it receives at present.

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Table 1. Embedded High-Cost Loop Fund Formulas

Cost Range as % of National Average	Expense adjustment within Range	Categorical Dummy Variables
Firms with 200,000 or Fewer Loops		
0% - 115%	0%	*"Ctg0"*
115%-150%	65%	*"Ctg65"*
150% and above	75%	*"Ctg75"*
Firms with Over 200,000 Loops		
0% - 115%	0%	
115%-160%	10%	
160% - 200%	30%	
200% - 250%	60%	
250% and above	75%	

Table 2. Description of Variables

Variable	Mean	Min	Max	Standard Deviation
Cost	393.4295	72.17	997.89	143.4016
CostDif	13.1571	-171.18	309.8	40.35813
Ctg0	0.2468	0	1	0.4312
Ctg65	0.2906	0	1	0.4541
Ctg75	0.4626	0	1	0.4986
Cap	0.2733	0	1	0.4457
Loops	8.0397	2.8904	12.1727	1.4116
Cmethod	0.5312	0	1	0.4990
Pop	4.1596	0.0289	7.0530	1.0752
Inc	10.0916	9.5860	10.6673	0.1707
Gsp	11.6550	0.9100	9.4563	14.0787
Unemp	4.6990	2.3000	11.0000	1.3796

Table 3. Determinants of Per Loop Cost Change

	Total Sample I	Total Sample with Price Cap Regime II	Subset Changing Cut-off Categories III
Ctg65	15.8450**	15.8450**	69.8755**
	[1.1646]	[1.1646]	[11.6032]
Ctg75	45.9751**	45.9751**	126.8767**
	[1.8848]	[1.8848]	[5.4821]
Cmethod	13.8341**	13.8341**	32.1766+
	[3.4155]	[3.4155]	[18.4898]
Loops	11.3879**	11.3879**	58.3953**
	[2.6504]	[2.6504]	[15.3213]
Pop	88.8175**	88.8175**	115.1704*
	[26.8555]	[26.8555]	[58.3148]
Unemp	-0.1359	-0.1359	1.051
	[0.8728]	[0.8728]	[2.0033]
Inc	28.1033	28.1033	59.8419
	[31.6475]	[31.6475]	[60.6316]
Gsp	-61.2979**	-61.2979**	-116.5975**
	[21.0696]	[21.0696]	[37.4217]
Cap		2.0643	
		[9.3480]	
Firm fixed effects	*yes*	*yes*	*yes*
Year dummies	*yes*	*yes*	*yes*
Obs.	12492	12492	3542
R-squared	0.1979	0.1979	0.1282

Notes: Regressions are based on firm fixed effect estimation. Robust standard errors are in brackets.

+ significant at 10%; * significant at 5%; ** significant at 1%.

Notes: The regressions examine whether the cost increment is more pronounced within higher cutoff firms. The dependent variable is the change in per loop cost between one year and the year before. The time period is from 1991 to 2002. We include the firm fixed effects and time dummies in the model. For brevity, the coefficients on these variables are not reported. Column 1 presents the basic regression results. Column III focuses on the firms that changed their cutoff categories during the periods. In our data, 95% of the firms that have switched their cutoff category moved to higher cutoff levels rather than lower. Column II shows the regression results for the whole dataset by including the cap regime variable.

The variable *Ctg0*, *Ctg65* and *Ctg75* are categorical dummies that represent three cutoffs. The variable *Loops* represents the natural logarithm of total number of loops. C*method* = 1 if cost companies; C*method* = 0 if average schedule companies. *Pop* measures the state's population density in natural logarithm; *Inc* is the state's per capital income; *Gsp*, measures the natural logarithm of gross state production; *Unemp* represents the seasonally adjusted state's unemployment rate.

Table 4. Pre-Cap and Post-Cap Regressions

	Pre-Cap Policy	**Post-Cap Policy**
	I	II
Ctg65	18.2174**	34.6259**
	[1.4048]	[7.1300]
Ctg75	55.3055**	64.9797**
	[2.7753]	[8.4213]
Cmethod	17.9791**	41.4852**
	[4.9036]	[16.0007]
Loops	14.6316**	107.4858**
	[3.4212]	[34.4891]
Pop	116.1542**	-284.4335+
	[41.5952]	[163.9128]
Unemp	0.4191	-2.5115
	[1.1137]	[4.0346]
Inc	39.2466	-109.128
	[41.2405]	[131.5245]
Gsp	-68.8412*	-12.9368
	[30.9686]	[76.8322]
Firm fixed effects	*yes*	*yes*
Year dummies	*yes*	*yes*
Observations	9078	3414
R-squared	0.2062	0.446

Notes: Regressions are based on firm fixed effect estimation. Robust standard errors are in brackets.

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes: This table shows the fixed-effects regression results by splitting the sample into two groups: pro-cap and post-cap. Pro-Cap is the period between 1991 and 1999 when the rural carriers are not subject to the USF payment cap; Post-Cap is the period from 2000 to 2002 when the cap has been imposed on the fund subsidy.

The variable *Ctg0*, *Ctg65* and *Ctg75* are categorical dummies that represent three cutoffs. The variable *Loops* represents the natural logarithm of total number of loops. C*method* = 1 if cost companies; C*method* = 0 if average schedule companies. *Pop* measures the state's population density in natural logarithm; *Inc* is the state's per capital income; *Gsp*, measures the natural logarithm of gross state production; *Unemp* represents the seasonally adjusted state's unemployment rate.

Table 5. Threshold Interactions

	Total Group I	Cost Method II	Average Schedule III
Ctg65	10.5016**	25.1553**	10.0193**
	[1.0139]	[2.6607]	[0.6265]
Ctg75	37.6463**	56.7611**	31.9428**
	[1.6873]	[3.4800]	[1.0745]
Cmethod	0.3127		
	[3.9836]		
Ctg65 × Cmethod	15.0695**		
	[2.6419]		
Ctg75 × Cmethod	19.9817**		
	[3.3249]		
Loops	11.0552**	22.1335**	7.0380**
	[2.6417]	[6.0509]	[2.6097]
Pop	78.8083**	96.3685*	22.9384
	[27.0223]	[39.2301]	[14.7228]
Unemp	-0.1311	-1.485	1.6012**
	[0.8778]	[1.4002]	[0.4198]
Inc	28.0409	-2.6536	60.1331**
	[31.7742]	[47.6513]	[19.1999]
Gsp	-60.5636**	-61.9018*	-28.3947*
	[21.2748]	[29.4895]	[13.1121]
Firm fixed effects	*yes*	*yes*	*yes*
Year dummies	*yes*	*yes*	*yes*
Observations	12492	6636	5856
R-squared	0.2006	0.2005	0.4409

Notes: Regressions are based on firm fixed effect estimation. Robust standard errors are in brackets.

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes: In the model specification, we include the interactions of threshold dummy variables and the cost methods (*Ctg65* × *Cmethod* and *Ctg75* × *Cmethod*). The results are presentable in Column I. The two interaction terms are positive and statistically at 1% level, suggesting that cost method induce more cost inflation for the firms qualified for the subsidiaries. We further split our sample based on cost policy. The results are shown in Column II for cost companies and Column III for average schedule companies.

The variable *Ctg0*, *Ctg65* and *Ctg75* are categorical dummies that represent three cutoffs. The variable *Loops* represents the natural logarithm of total number of loops. C*method* = 1 if cost companies; C*method* = 0 if average schedule companies. *Pop* measures the state's population density in natural logarithm; *Inc* is the state's per capital income; *Gsp*, measures the natural logarithm of gross state production; *Unemp* represents the seasonally adjusted state's unemployment rate.