
Causes for Continuation of State Cost-Share Programs for Nonindustrial Private Forest Landowners

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ABSTRACT. State cost-share programs for nonindustrial private forest landowners are public assistance programs in the form of direct subsidy payments. A total of 18 states have such programs. This article presents a political economy model and empirical evidences of the factors that determine their presence and continuation. A logit regression is used in the empirical analysis, and the results suggest that the importance of forestry in a state's economy and healthy state finances are significant determinants. Furthermore, there is also evidence of significant regional differences within the United States and some effects of bureaucratic intent. Irrespective of the rationales or justifications for these programs, political pressure on the forest industry made them possible, and a healthy state economy made them a reality. *FOR. SCI.* 48(3):471–478.

Key Words: Political economy, financial assistance, substitution effect, timber.

NONINDUSTRIAL PRIVATE FOREST (NIPF) LANDS account for about 58% of forestland in the United States. As a result of timber harvesting reduction on public lands, timber supply from NIPF lands increased from 51% in 1987 to nearly 60% in 1997 (Smith et al. 2001). Because of their importance in the country's economy, NIPF landowners rightfully warrant attention from public policy makers. In the last few decades, many federal and state programs have been created to assist landowners in achieving their management goals. The nature of assistance ranges from technical assistance to exemption or deferred payment of taxes to direct payments or subsidies. Cost-share programs are a direct payment where the government shares a certain portion of NIPF management costs.

Many studies have been done on both state and federal forestry cost-share programs (e.g., Flick and Horton 1981, Royer and Moulton 1987, Romm et al. 1987, Bliss and Martin 1990, Lee et al. 1992). However, most of them deal with the nature and effectiveness of such programs, and none has focused on the political and economic factors that influence their presence and continuation.

Understanding the causes and impacts of governmental forestry programs such as the cost-share programs is a prerequisite for students in forest policy. However, the cause of such programs is a subject of much speculation but very little empirical evidence. Further, it has not received nearly the attention in forestry that it has received in other sectors, notably agriculture (e.g., Gardner 1983, 1987).

This article presents the results of an initial attempt to investigate the political and economic determinants of state cost-share programs for NIPF landowners. It differs from others insofar as it uses a political economy model and an econometric method to determine the direct cause for the continuation of these programs. Cross-sectional data from the mid-1990s are used to estimate the model. Since most of these programs were initiated in the 1970s and 1980s, justification for using data from the 1990s to investigate the causes and existence of these programs can understandably be questioned. However, given that the continuation of cost-share programs is an ongoing process, and that the states can repeal these programs at any time, we argue that using current data to understand the political process of cost-share pro-

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grams can reasonably be justified. This article starts, in the next section, with a review of the economics of public subsidy programs and a summary of all state cost-share programs in forestry. It is followed by a discussion on the hypothesis, model, and data used in this study. The remaining sections present empirical results and conclusions.

Literature Review

Economics of Public Subsidy Programs

Public subsidies are payments from governments designed to form a wedge between consumer's price and producer's cost so that the price is less than the marginal cost (Pearce 1992). Often subsidies are backed by arguments for the presence of market failure. The underlying reasoning is that the market either will not produce at the desired level or is not equipped to internalize the externalities of production (Lee et al. 1992). Therefore, subsidies are instituted in order to achieve one or more of the following: (1) to transfer wealth from taxpayers to the producers or consumers of certain goods, (2) to influence producer or consumer behavior, and (3) to keep prices of certain goods low or stable (Pearce 1992).

All these three objectives, directly or indirectly, have been used to justify financial incentive (cost-share) programs for forest landowners. Specific arguments in favor of these programs may vary but can be discussed within the realm of the three objectives mentioned earlier. It has been argued that productivity of NIPF lands is low. These lands, however, are becoming increasingly important in meeting the nation's demand for wood products given the rising demand and diminishing supply from public lands (de Steiguer 1984). Hence, a transfer of wealth to the landowners may help in maintaining the supply of wood fiber at a healthy level. The objective of changing behavioral patterns has also been addressed, and the underlying arguments are that NIPF landowners need to be encouraged to invest in long-term timber production and that these programs help minimize the externalities of timber production and maintain a socially desirable environmental quality (de Steiguer 1984). Finally, it has been argued that rising demand may exceed supply in the future, causing real prices of wood products to increase. A subsidy, therefore, may help keep the prices of wood reasonably low and stable.

Cost-share programs, however, are controversial and have drawn considerable criticisms. Researchers have so far chosen to concentrate on the second objective, mostly trying to estimate changes in landowner behavior due to cost-share funds. Except for Boyd and Hyde (1989), the price effects of cost-share programs have largely been ignored in the literature. While this study does not investigate the price effects, the findings stress the need for such research. Among the existing landowner behavior studies, Boyd (1984) and Boyd and Hyde (1989) find that landowners who would have invested on their land anyway use public funding instead. Bliss and Martin (1990) report that cost share does not change the level of management practiced by active forest managers, and Cohen (1983) concludes that the substitution effect of public for private funding in tree planting on NIPF lands is between 30 to 50%, while Zhang and Flick (2001) find a

smaller (17%) impact. On the other hand, both de Steiguer (1984) and Lee et al. (1992) find no evidence of such substitution in plantation investment on NIPF lands, while Lee et al. (1992) find the presence of an inducement effect where cost-share programs contribute to an increase in non-cost-shared plantations. It is also possible that landowners may delay reforestation in the absence of cost-share funds (Bullard and Straka 1988), but no empirical evidence has been found to support this hypothesis.

Although views and justifications for such programs differ, these programs result in a transfer of wealth from the taxpayers to a certain targeted group of landowners. Two obvious results from this transfer are deadweight loss and administrative cost.[1] Many economists have tried to measure the extent of the deadweight loss and quantify the efficiency of the redistribution of wealth in public subsidy programs. However, studies on the size of the deadweight loss created by forestry cost-share programs are virtually nonexistent, with the only notable exception Boyd and Hyde (1989).

Federal and State Financial Assistance Programs

Federal financial assistance programs started with the Clarke-McNary Act of 1924 and then evolved into several farm and forestry programs, including the Forestry Incentives Program (FIP), the Stewardship Incentive Program (SIP), and the Conservation Reserve Program (CRP) (Harrell 1989, Cabbage et al. 1993). Since most of these programs are often created in much larger legislation such as the Farm Bill, conducting empirical analysis aimed at identifying the causes of federal forestry cost-share programs is difficult, if not impossible. Most state forestry cost-share programs are stand-alone for forestry and hence offer a better opportunity for empirical analysis.

Table 1 provides a brief summary of currently available state cost-share programs. Characteristics of these programs vary widely, but all have a ceiling on cost-share (both proportional and absolute) and a limit on size of ownership, duration, and covered forestry practices. The cost-share rates vary from 40% to 90%, but usually they are about 50%. Funding comes mostly from timber yield taxes and other forms of state revenues, such as state appropriations and lottery revenues.

Most of state cost-share programs started in the 1970s and 1980s. In the early years, they were aimed at timber production. While timber still remains as the principal goal, various nontimber benefits have also been included in the programs. Management activities aimed at restoring and improving wildlife habitats, water quality, and wetlands are now covered by these programs (Haines 1995).

Hypothesis, Model, and Data

We could not rely on existing literature in order to build our model because of a lack of empirical research investigating the causes for continuation of forestry cost-share programs. However, we have attempted to construct a model based on the theories of political economy and similar research in areas other than forestry. Our hypothesis and model start with the demand and supply of such programs.

Table 1. Summary of state cost-share programs.

Program (yr established in parentheses)	Cost-share rate (%)	Max. payment (\$/yr)	Ownership limit (ac)*	Project area limit (ac)*	Min. project continuation (yr)
Alabama Agricultural and Conservation Development Program (1985)	60	3,500	min. 20	min. 1	10; 5 for timber stand improvement
Calif. Forest Improvement Program (1980)	75–90		20–5,000	min. 1–5 depends on practice	10
Florida Plant a Tree Program (1991)	50	10,000	10–1,000		2
Hawaii Forest Stewardship Program (1991)	50 max.		min. 5		10
Illinois Forestry Development Program (1983)	80		min. 5		10
Iowa Resource Enhancement and Protection Program (1989)	75	365/ac		min. 3–5 depends on practice	20
Kentucky Soil and Water Conservation Program (1994)	75	7,500			2
Maryland Woodland Incentives Program (1986)	50	5,000	10–500		15
Minnesota Forestry Improvement Program (1989)	50–65	15,000/3 yr 25/ac		min. 5–10 depends on practice	10
Mississippi Forest Resources Development Program (1974)	50–75	8,000			10
Missouri Soil and Water Conservation Program (1985)	up to 75				10
Missouri Streams for the Future Program (1992)	up to 75				
New Jersey Farmland Preservation Program (1981)	50	50,000/8 yr			8
North Carolina Forest Development Program (1978)	40–60			1–100	
Oregon Forest Resource Trust (1993)	up to 100	100,000/2 yr	10–5,000		Until harvest
South Carolina Forest Renewal Act (1981)	50		max. 100	max. 100	10
Tennessee Agricultural Non-Point Source Pollution Program (1993)	75 for BM	5,000			
Virginia Reforestation Timberlands Act (1970)	40	75/ac		min. 1–5 depends on practice max. 500	10

* 1 ac = 0.405 ha.

There are three groups on the demand side for the cost-share programs: the forest industry, NIPF landowners, and state forestry agencies. The forest industry and NIPF landowners must possess some political power to make the politicians respond to their demand. The acreage of NIPF ownership, the number of NIPF landowners, their geographical dispersion, the importance of timber economy in a state, and the size and stability of the forest industry are factors that may influence the political power of the demanders for such programs.

The larger the forest industry in a state, the more economic influence it has and the more political pressure it can generate. We therefore contend that the contribution of the forest industry to a state's gross domestic products, a proxy of forest industry's political power, is a positive factor influencing the chance of the state having a forestry cost-share program. Similar argument can be drawn for the proportion of timber supply from NIPF lands, which signifies the importance of the NIPF in a state. The total number of NIPF landowners and the relative size of NIPF land ownership in each state, two measures of the influence of NIPF landowners, should also be positive factors. However, the larger the number of NIPF landowners, the more costly for them to organize and to

control the free-riding problem. Therefore, the sign of this variable has to be determined empirically.

Although the use of three variables representing NIPF landowners may seem to be repetitive, these variables test the importance of landowners' influence from different perspectives. While proportion of timber supply from NIPF lands and the size of NIPF ownership in a state both measure the importance of nonindustrial private forestry, only the former emphasizes timber supply, which is still the primary focus of cost-share programs. Inclusion of the number of landowners captures the impact of NIPF landowners' political power and that of the possible organizational cost in lobbying.

The state forestry agencies, the third group on the demand side, are hypothesized to support the programs because they bring a bigger budget, more personnel, and greater influence to the agencies. As the size of a state forestry agency is probably related to its political power, we further hypothesize that the bigger the state forestry agency, the more likely that the state will have a forestry cost-share program.

Lawmakers are on the supply side of these programs. Theories of public choice indicate that lawmakers' deci-

sions to subsidize a certain group are based on several factors. Because the subsidy comes from taxing the rest of the citizens, the cost of such programs is a factor. In fact, deadweight losses resulting from subsidy can be viewed as the cost of redistribution (Stigler 1971, Peltzman 1976, Becker 1983, Gardner 1987). Therefore, the lower the cost, the more efficient the transfer. In the context of the timber market, the subsidy to NIPF landowners can be measured as producers' gains in economic rents at the expense of taxpayers' incomes and consumer surplus, and the deadweight loss is affected by the timber supply and demand elasticity. The greater the elasticity of supply and the less the elasticity of demand, the less costly the transfer (Gardner 1987). Unfortunately, state-specific estimates for timber supply and demand elasticity are rare. Although such estimates for a few states do exist (e.g., Daniels and Hyde 1986), there are not enough estimates in the literature upon which a dataset may be built for all of the states. Our effort to use regional estimates of stumpage supply and demand elasticity as a substitute was not successful as the variable was not significant. This led us to rethink the appropriateness of using this substitute, and we ultimately eliminated the variable from our empirical model.

Apart from the efficiency consideration, the health of a state's economy is relevant. If the state has a large amount of revenue and is debt-free, and its residents are relatively wealthy, there may be less opposition to cost-share programs in general. We therefore hypothesize that the health of state economy, measured as the per-capita state debt and per-capita state revenue, influences the likelihood of the state having a forestry cost-share program. Everything else being equal, the smaller the state debt and the larger the per capita state revenue, the more likely the state will have a cost-share program.

Now we have identified all important parties on both sides of the cost-share programs: the legislature which considers the status of state economy on the supply side and the forest industry, the NIPF landowners, and the state

forestry agencies on the demand side. Table 2 provides definitions and descriptive statistics for the variables used in the model. The dependent variable *CSP* takes the value of one if a state cost-share program is present and zero otherwise. The variable *GSP* is the percent of forest industry's contribution to

TIMBER measures the percent of timber supply from NIPF lands in 1996, while *SIZE* is the percentage of total state land area under NIPF control and *NUMBER* is the percent of NIPF landowners in state population. The expenditure by state forestry agencies in total state expenditures is measured by the variable *EXP*. The variables *DEBT* and *REVENUE* measure the health of the state economy. A binary dummy *SOUTH* represents the southern states. In addition, two other regional dummies *NORTH* and *WEST* were used for further analysis.

Theoretically, the supply and demand relations in the political market related to forestry cost-share programs can be represented as:

$$Demand_{csp} = f(P_{csp}, GSP, TIMBER, SIZE, NUMBER, EXP) \quad (1)$$

$$Supply_{csp} = f(P_{csp}, DEBT, REVENUE) \quad (2)$$

where P_{csp} is the price that a state has to pay by introducing a cost-share program. P_{csp} includes the amount of cost-share fund distributed to NIPF landowners, cost of administering the programs, and deadweight loss as a result of wealth redistribution.

P_{csp} and the outcome (*CSP*, if a cost-share program is present) are analogous to the equilibrium price and quantity in the usual supply and demand relations. Because P_{csp} and the outcome are simultaneously determined through interaction of the supply and demand equations, we use a reduced form equation in our econometric estimation. Deriving this equation requires some simple algebraic manipulation of the supply and demand equations. Because the outcome

Table 2. Definition and descriptive statistics for dependent and independent variables.

Variable	Description	Mean	SD
<i>CSP</i>	Cost-share program; binary variable, "1" if such a program is present, "0" otherwise.	0.36	
<i>GSP</i>	Percent contribution of forest industry in the 1996 gross state products. This includes lumber, paper, and wood furniture sectors.	2.01	1.80
<i>SIZE</i>	Percent of total state area under NIPF control.	24.14	19.91
<i>NUMBER</i>	Total number of NIPF owners as a proportion of total state population.	0.04	0.04
<i>TIMBER</i>	Percent of timber supply from NIPF lands.	64.83	24.54
<i>EXP</i>	Expenditures in 1996 by state forestry agencies, as a proportion of total state expenditures.	0.16	0.18
<i>DEBT</i>	Per capita state debt at the end of 1996 in thousands of dollars.	1.97	1.47
<i>REVENUE</i>	Per capita state revenue in thousands of dollars in 1996.	18.19	2.76
<i>SOUTH</i>	Whether or not the state is in the South; binary variable; "1" if the state is in the South, "0" otherwise. The southern states are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.	0.28	
<i>NORTH</i>	Whether or not the state is in the North region; binary variable; "1" if the state is in the North, "0" otherwise. The northern states are Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, West Virginia, and Wisconsin.	0.46	
<i>WEST</i>	Whether or not the state is in the WEST region; binary variable; "1" if the state is in the West, "0" otherwise. The western states are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.	0.26	

supplied equals the outcome demanded at the equilibrium, we set the equation equal

$$D_{csp}(P_{csp}, GSP, TIMBER, SIZE, NUMBER, EXP) = S_{csp}(P_{csp}, DEBT, REVENUE) \quad (3)$$

then solve for the price of cost-share program (P_{csp})

$$P_{csp} = f(GSP, TIMBER, SIZE, NUMBER, EXP, DEBT, REVENUE) \quad (4)$$

To get the outcome as a function of the other variables, we replace P_{csp} in the supply equation [Equation (1)] with Equation (4), resulting in an equation that we can use to estimate the outcome of cost-share program as a function of all of the independent variables. Specifically, the empirical model estimated is

$$CSP = f(GSP, TIMBER, SIZE, NUMBER, EXP, DEBT, REVENUE, SOUTH) \quad (5)$$

Single equation political economy models similar to Equation (5) have been widely used in the literature (e.g., Peltzman 1976, Becker 1983, Gardner 1987) since the publication of a seminal paper by Stigler (1971) on the theories of regulation. However, it should be noted here that there might be a simultaneity problem among expenditure, debt, and revenue variables. Furthermore, putting these three variables in one equation with the dependent variable CSP might create possible endogeneity problems. We performed Hausman tests for exogeneity as suggested by Grogger (1990) and Kennedy (1998, p. 151).[2] The test results are presented in Table 3. Our F-test failed to reject the null hypothesis that the coefficients of expenditure, debt, and revenue were equal to zero. In addition, we have used instrumental variables and tested each of these coefficients individually through t-tests and failed to reject the null hypothesis as well (Table 3).[3] These results suggested that expenditure, debt, and revenue could be treated as exogenous variables. Our efforts to use a two-stage model were also not successful possibly because of the additive errors introduced in the estimation process (i.e., the estimation errors in the first stage are added and magnified in the second stage).[4]

Although a total of 19 states had cost-share programs, the nature of the program in Texas contrasted with all other states as its cost-share funding is raised entirely from private sources. This presents a conflict with several hypotheses in the model. Therefore, the cost-share program in Texas was not considered, and the state was entered as one with no cost-

share program. We investigated the model's sensitivity to excluding Texas from the data set, and the results are almost identical.

All of the 50 U.S. states were included in the data set. Data for CSP were collected from Haines (1995). Data for GSP , $DEBT$, and $REVENUE$ are from the U.S. Department of Commerce. Data for $SIZE$ and $TIMBER$ were collected from Power et al. (1992), and data for $NUMBER$ were from by Birch (1996b, 1997a, 1997b). The 1996 State Forestry Statistics Report by the National Association of State Foresters was the data source for EXP .

Results and Discussion

Results from our initial estimation show that two variables— $SIZE$ and $NUMBER$ —are highly correlated. Therefore, we had to estimate Equation (5) with each of these two variables separately. Moreover, the variables $DEBT$ and $REVENUE$ were found to have a positive correlation coefficient of 0.61. A correlation of this magnitude is likely to affect the estimates. However, because both of these variables came out to be significant, and there is no theoretical reason to drop any one of them, we decided to keep them in the model. We have tried to use per capita personal income in place of revenue. The variable was also correlated with $DEBT$, and with two other variables GSP and $SOUTH$. We therefore decided to use the $REVENUE$ variable.

Equation (5) is estimated using the binomial logit model, and Table 4 presents the results.[5] Standard tests indicated that there are no serious heteroskedasticity problems. Columns 2 and 3 of Table 4 are the results using the variable $SIZE$ as the measure of NIPF influence, and Columns 4 and 5 are the results using the variable $NUMBER$. The log-likelihood tests in both cases are significant at the 1% level. The variables GSP , $TIMBER$, EXP , $DEBT$, $REVENUE$, and $SOUTH$ have the expected signs. The variables $SIZE$ and $NUMBER$ are negative, which is not unexpected.

The coefficient for GSP is positive and significant, although weakly at the 15% level. This implies that the more important the forestry sector to the state's economy, the more likely the state will have a forestry cost-share program. As expected, the variable $TIMBER$ is positive. The coefficient of $SIZE$ is negative but not significant. The coefficient of the substitute variable— $NUMBER$ —is negative as well (Column 4 of Table 4). This implies that, although large numbers give NIPF landowners more political power and influence, overcoming the free riding problem in lobbying is increasingly difficult and costly as the number of NIPF landowners increases. In other words, cost of lobbying is a significant factor in determining the existence and continuation of cost-share programs. Furthermore, NIPF landowners may have a

Table 3. Hausman tests for expenditure, debt, and revenue exogeneity.

Type of test	Computed value	Critical value (at the 5 % level)	Test result
F-test	2.19	4.08	Fail to reject H_0
t-test for			
<i>EXP</i>	-0.589	1.96	Fail to reject H_0
<i>DEBT</i>	-0.865	1.96	Fail to reject H_0
<i>REVENUE</i>	0.355	1.96	Fail to reject H_0

Table 4. Logit estimates of the model identifying the determinants of state cost-share provisions.

Variables	Coefficients (<i>t</i> -ratio)	Marginal effect						
Constant	-13.8404** (-2.6660)		-11.8276*** (-2.5540)		-12.4367** (-2.4500)		-11.5990** (-2.3280)	
<i>GSP</i>	0.4377* (1.4140)	0.8654	0.4141* (1.3820)	0.0833	0.5347* (1.5640)	0.8654	0.6152* (1.3647)	0.1213
<i>TIMBER</i>	0.0129 (0.6880)	0.0026	0.0076 (0.4190)	0.0015	0.0250 (0.9870)	0.0026	0.0246 (0.9430)	0.0048
<i>SIZE</i>	-0.0349 (-0.9790)	-0.0068			-0.0310 (-0.8670)	-0.0068		
<i>NUMBER</i>			-8.8629 (-0.4570)	-1.7836			-11.8480 (-0.5680)	-2.3359
<i>EXP</i>	9.3622 (0.0380)	1.8509	38.8133 (0.1530)	7.8111	-97.9045 (0.3360)	1.8509	-111.1686 (-0.3700)	-21.9175
<i>DEBT</i>	-0.7696** (-1.7320)	-0.1522	-0.8607** (-1.9130)	-0.1732	-0.8253** (-1.8000)	-0.1522	-0.8876** (-1.9470)	-0.1750
<i>REVENUE</i>	0.6940*** (2.6530)	0.1372	0.5992*** (2.5000)	0.1206	0.7323*** (2.7430)	0.1372	0.6612*** (2.6320)	0.1303
<i>SOUTH</i>	3.0066*** (2.4160)	0.5944	2.4795*** (2.3530)	0.4990				
<i>NORTH</i>					-3.3456*** (2.5531)	0.1372	-3.1035** (-2.3760)	-0.6119
<i>WEST</i>					-1.9951 (-1.1000)	0.1372	-1.3578 (-0.8680)	-0.2677
No. of observation	50		50		50		50	
Log-likelihood	-23.6256		-24.0261		-23.3529		-23.5749	
Restricted log-likelihood	-32.6709		-32.6709		-32.6709		-32.6709	
Chi-square value	18.0906**		18.2896***		18.6361***		18.1919**	

NOTE: * Significant at the 15% level.
 ** Significant at the 10% level.
 *** Significant at the 1% level.

comparative advantage in other economic activities such as agriculture, forest recreation, or other primary professional activities. If so, the negative and insignificant coefficient for *NUMBER* may mean that they do not have great interests in cost-share programs.

As expected, the coefficient for the *DEBT* variable is negative and significant at the 10% level. The presence of a large state debt is likely to be a negative deterrent to all subsidy payments and to provide incentives for lawmakers to manage state finances carefully and minimize transfer payments. The coefficient for the variable *REVENUE* is positive and significant at the 5% level. High per capita state revenue earnings imply a strong state economy and availability of funds for cost-share payments. Therefore, those states with high per capita revenue are more likely to have cost-share programs.

The coefficient for the expenditure variable for state forestry agencies is positive but not significant at any reasonable level. The variable representing the southern region is positive and highly significant at the 1% level, confirming that southern states are leading the nation in cost-share programs. Many communities in these southern states are rural and largely forestry dependent. Furthermore, compared to states in other regions, the southern states have a very small proportion of their land under public control, and NIPF lands are vital to the forest

industry in the South. Not surprisingly, these states provide financial support for NIPF landowners.[6]

Using just one regional dummy, *SOUTH*, separates the impacts of the southern states from other states. To further investigate the impacts of the other regions, two additional regional dummies *NORTH* and *WEST* were added, and the model was estimated without the variable *SOUTH*. These two estimates therefore capture the impacts of northern and western regions, normalizing on the *SOUTH*. As indicated in columns 6 and 8 of Table 4, the variable *NORTH* is negative and significant, implying northern states are less likely to have cost-share programs. The variable *WEST* is also negative, but not significant. Sign and significance of all the other variables are basically the same except *EXP*, which is still not significant, but ends up with a negative sign.

The marginal effects offer further evidence regarding the relative importance of the explanatory variables. Based on the marginal effects presented on Table 4, the forest industry appears to have the largest impact in determining the continuation of cost-share programs. Substantial regional differences exist, and the health of a state's economy is an important determinant of cost-share programs. Interestingly, although the coefficient of bureaucratic interests (*EXP*) is not significant, its marginal impact is the largest, suggesting that bureaucratic interests could play a significant role in determining the cost-share program in certain circumstance.

Table 5. Predictive abilities of the estimated models.

Model	Subcategory	Choice	% correct prediction	Pseudo R^2
Primary model (with <i>SOUTH</i>)	With <i>SIZE</i>	0	84	0.38
		1	67	
Model with <i>NORTH</i> and <i>WEST</i>	With <i>NUMBER</i>	0	88	0.38
		1	61	
		0	81	
<i>SOUTH</i> regional model	With <i>SIZE</i>	0	80	0.39
		1	61	
		0	84	
<i>SOUTH</i> regional model	With <i>NUMBER</i>	0	80	0.39
		1	61	
		0	80	
<i>NORTH</i> regional model	With <i>SIZE</i>	0	89	0.39
		1	89	
		0	80	
<i>NORTH</i> regional model	With <i>NUMBER</i>	0	94	0.39
		1	83	
		0	94	
<i>WEST</i> regional model	With <i>SIZE</i>	0	83	0.39
		1	100	
		0	100	
<i>WEST</i> regional model	With <i>NUMBER</i>	0	100	0.39
		1	100	
		0	100	

Table 5 presents measures of predictive abilities of the models. Column 4 lists the percent of times the models were correct in predicting the outcomes. This is a measure of the performance of the model in predicting the different outcomes correctly. The model performs quite well in predicting the absence of cost-share programs in a state (i.e., dependent variable equal to 0), correctly predicting 84% of the cases. In case of the presence of cost-share programs (i.e., dependent variable equal to 1), the model does not perform as well but still predicts correctly in 67% of the cases. For the model estimated by using the variable *NUMBER*, the predicted outcomes are identical and are subject to similar interpretation. Three additional models were also estimated using the three regional subsets of the data. The percentage of correct projection for these models is also listed in Table 5. However, the percentage for the regional models should be interpreted with caution since the degrees of freedom is small. Additionally, pseudo- R^2 values were also calculated, and the values for the first four models are presented in column 5. Pseudo- R^2 values for the three regional models lie outside of the 0 to 1 bounds and hence are not reported. This again indicates a problem due to insufficient degrees of freedom.

Conclusions

This article has identified the determinants of state cost-share programs. The importance of the forestry sector in a state's economy, cost of lobbying, and the characteristics of state finance are found to be significant factors. As more landowner assistance programs such as cost-share, tax deferral, technical assistance, and education continue to be promoted and debated at state and federal levels, the results of this study may be useful to policy makers, interest groups, and researchers for informed debate. Furthermore, this study shows that forest policy is at least partially driven by interest groups. Therefore, examining interest groups is an effective way to study forest policy. Third, the results from this study suggest that contrary to common wisdom, NIPF landowners may not be the primary stakeholders in cost share programs.

The negative and insignificant coefficients for the variables *SIZE* and *TIMBER*, and the positive and significant coefficient for *GSP* imply that cost-share programs may be more in the interest of forest industry. Whatever the explicit goals or justifications for these programs are, interest-group pressures makes the cost-share programs possible, and a healthy state economy made them a reality.

The extent to which cost-share programs actually help in NIPF land management and promote public goals is debatable. Understanding the explanatory power of the interests at stake is the first step towards promoting or eliminating them.

Endnotes

- [1] Deadweight loss refers to economic losses due to either market imperfections or market intervention. For market imperfections, deadweight loss is the additional consumer surplus and producer surplus that would have been gained had markets been perfect. For market interventions, deadweight loss is the social loss due to subsidy (or taxation).
- [2] This test involves running a model generally stated as $Y = X\beta + W\theta + \varepsilon$ where Y is the dependent variable (in our case *CSP*), while X and W represent the explanatory variables and a set of instrumental variables (i.e., predicted value of *DEBT*, *REVENUE*, and *EXP*), respectively. The F-test is performed to investigate whether θ is significantly different from zero. In this study, the predicted values for *DEBT*, *REVENUE*, and *EXP* are based on OLS regression of the following equations:
 $DEBT = f(\text{population density, poverty rate, percent of rural population, total capital expenditure})$,
 $REVENUE = f(\text{population density, poverty rate, percent of rural population, total income tax})$,
 $EXP = f(TIMBER, NUMBER, GSP)$.
- [3] The t -test involves regressing each of the three variables suspected of endogeneity on a set of independent variables and instruments (see endnote 2). The residuals from each of these regressions were then used as explanatory variables in our model. Conventional t -tests were then performed on their coefficients to test if they were significantly different from zero. See Kennedy (1998, p.151) for details on this procedure.
- [4] The two-stage process involves estimating the three variables (*DEBT*, *REVENUE*, and *EXP*) separately and using the estimated values of these variables in the Equation (5). The first attempt of this approach shows that the correlation between *DEBT* and *REVENUE* is extremely high. We then proceeded by using each of these two variables at a time. Still, insignificant and inconsistent signs of variables become apparent. A closer look at the estimated values for *DEBT*, *REVENUE*, and *EXP* from the first stage and their actual values shows that some of them were very different. Thus, it seems likely that the two-stage process suffers from an additive error problem.

[5] In logistical regression, the probabilities for each outcome are

$$P(Y_i = 1) = P_i = \frac{e^{X_i\beta}}{1 + e^{X_i\beta}}$$

$$P(Y_i = 0) = 1 - P_i = \frac{1}{1 + e^{X_i\beta}}$$

The likelihood function for the model is

$$L = \prod_{i=1}^n P_i^{Y_i} (1 - P_i)^{(1 - Y_i)}$$

The marginal effects for each independent variable can be calculated as

$$\frac{\delta P_i}{\delta X_i} = P_i(1 - P_i)\beta$$

where P_i and $(1 - P_i)$ are the probabilities that the dependent variable takes the value "1" and "0" respectively and β represents the coefficients.

- [6] Table 4 shows a difference in the *GSP* coefficients among models using different regional dummy variables. The coefficient where the *SOUTH* is used is smaller than that where other regional variables are used, suggesting that *SOUTH* might pick up some of the effects of the *GSP* variable.
- [7] The pseudo- R^2 values were calculated as

$$R^2 = \frac{-2 \log L_0 - (-2 \log L_1)}{-2 \log L_0}$$

where, L_0 and L_1 are unrestricted and restricted log-likelihood values respectively.

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