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Why Are Some States More Generous in Offering R&D Tax Credits than Others? An Empirical Answer

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This article examines political cost factors that affect a state's propensity to adopt a corporate income tax credit to encourage research and development (R&D) activities in the United States. Assuming state elected officials are vote-maximizers, this article hypothesizes that politicians' consideration of potential revenue losses and influence from organized interests are critical in a state's decision to provide a R&D tax credit. To test the hypothesis, two statistical models are specified. With a dichotomous dependent variable of whether or not a R&D tax credit is offered, a Logit regression model is utilized. For the interval level dependent variable of effective R&D credit rates, this article specifies a Tobit model. The results show that politicians' concerns about revenue losses loom much larger than private organized interests.

Keywords: research and development, tax credit, political cost, revenue loss, organized interests

STATE R&D TAX CREDITS AT THE CONFLUENCE OF CONFLICTING INTERESTS

The American states present a very unique set of *a posteriori* policy laboratories where analytical experiments are actively sought after such that "some important variables can be held constant while others are varied" (Dawson & Robinson, 1963, 265). The laboratory could be of economic development policy and of tax policy as well. For state policy makers, tax policy has been the key to incentivize economic development (Brunori, 2001). According to a survey of state incentives for business (IDRC, 2004), 41 states have corporate income tax exemptions of one sort or another and 45 states provide tax incentives for job creation and industrial investment.

There is a wide range of variations in the types of tax incentives that are utilized and in how they are designed. Although two states might have research and development (R&D) tax credits, their design features could be very different, as summarized by Wilson (2005a). Immediately after the federal research and experiment (R&E) tax credit was first established on a temporary basis by the Economic Recovery Tax Act of 1981, states began adopting this policy innovation to encourage in-state R&D, which, it is assumed, would lead linearly to economic development in the states. As early as 1982 the state of Minnesota adopted a state R&D tax credit (Wilson, 2005b)[1] and until the mid-1990s 24 states followed suit (SSTI, 1997). As of 2005, R&D credits are being administered in 34 states (72%) out of the 47 states that collect corporate income taxes.

Why are some states more innovative than the others in adopting a R&D tax credit? Why are some states more generous in their credit rates than others? Why did the state of New Hampshire repeal its policy in 1995? What factors are involved in the decisions of providing such a credit? Is it a function of the tax structure or of organized interests? The decisions about offering R&D tax credits may depend on both a state's context of the overall tax structures and the policy objectives that its government seeks to achieve.

While most studies of R&D tax credits focus on those at the national level, little serious attention has been paid to credits at the state level regardless of whether they are about effectiveness or about design features, with some notable exceptions (SSTI, 1997; Wilson, 2005a,b; Wu, 2005, 2008). As at the national level, the state tax structures and other state fiscal features could factor in the provision of state R&D tax credits. In addition, targeted tax incentives such as R&D credits have built-in political bias (Brunori, 2002) since they entail interstate competition of attracting firms

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[1]This author owes special thanks to Dr. Dan Wilson, who graciously allowed the author through personal communication to use his data on the state R&D tax credit availability and the effective credit rates.

into the states. Therefore, the rich diversity in design features as well as whether or not a credit is offered present a test bed of how and which states utilize this federal innovation in supporting industrial R&D within the state boundaries.

Building upon the literature of state policy studies, which have examined factors involved in the likelihood that a state would adopt a policy (Berry & Berry, 2007; Blomquist, 2007), this study aims to empirically investigate political factors that may affect a state's decisions on adopting and designing, if offered, a corporate income tax R&D credit. Specifically, utilizing the model developed by Hettich and Winer (1984) where a tax structure is determined by politicians' incentives to maximize re-election possibilities, this study addresses the question with the assumption that, in choosing among different tax structures, elected officials pursue vote maximization, essentially trying to strike a balance between marginal political costs and benefits.

Since politicians will weigh benefits and costs of a R&D tax credit in terms of their re-electability, they are concerned more about revenue losses relative to the expected benefits in deciding whether to offer a credit. Placed at the antipode of this consideration is the interest of resourceful organized groups—in this case, R&D-intensive large manufacturing companies. State politicians are theorized to strike a balance between revenue losses and industrial demand of R&D tax credits.

In the comparative state policy literature, a wide range of policy areas such as lotteries, hate crime legislation, social services, education, energy, health, juvenile corrections (Berry & Berry, 2007; Miller, 2004), and abortion policy (Oakley, 2009) has been dealt with, but it has not included much about tax credits. Therefore, this study is an addition to the literature because it contributes a new finding to the studies of state R&D tax credits and extends comparative state policy studies to a new policy area. Examining the relative importance of politicians' revenue loss considerations vis-à-vis organized interests' pursuit of a more generous credit rate, this study finds that the politicians who are concerned about revenue losses dominate business interests seeking a R&D credit.

The remainder of this article is organized as follows: Section II briefly reviews the current literature on R&D credits. In sections III and IV, a theoretical discussion is provided to explain the conflicting interests of politicians and state manufacturing industries with high R&D intensity, with two statistical models specified to examine the relationship between the provision of R&D credits and political costs. Sections V and VI report and discuss the analytical findings.

EFFICIENCY AND DESIGN ISSUES OF R&D TAX CREDITS

The most critical rationale for R&D tax credits is that they will encourage firms to invest more in R&D by lowering marginal costs of industrial R&D. Mansfield and Switzer (1985) first reported a 2 percent increase in R&D expenditures in Canada that was attributed to tax credits. More recently, Czarnitzski, Hanel, and Rosa (2005) found that without the credits one-third of the firms that claimed credits might not have conducted R&D. It is also reported that a state R&D credit has a positive impact on the number of its high-tech firms (Wu, 2008).

Another rationale is that increased R&D expenditures in a state benefit the state's economy. It is well established in the research policy literature that the knowledge/technology transfer from one knowledge producer to another is geographically differentiated or sticky, benefiting some neighboring regions more than others (Hedge, 2005; Jaffe et al., 1992;). The knowledge transfer in life sciences is a typical example (Zucker et al., 1998; Zucker & Darby, 1999). From the state's perspective, this is the very reason that it introduces a R&D tax credit in addition to the federal R&E credit.[2]

However, neither the state tax policy literature nor the policy innovation and diffusion literature pay serious attention to state R&D credits. The literature on R&D tax credits centers on the evaluation of their effectiveness and efficiency from the economics perspective. However, the empirical evidence generated from the studies is not conclusive. While some researchers report failures in finding statistically significant evidence that tax credits increase R&D expenditures (GAO, 1995; Mansfield, 1986), others find substantially positive evidence (Czarnitzski et al., 2005; Hall & Reenan, 2000; Russo, 2004; Wu, 2005, 2008). For example, Mansfield (1986) reported that the increased R&D expenditures caused by the credit seem to be substantially less than the revenue loss from the credits. Bloom et al. (2002) estimate that a 10 percent fall in the cost of R&D does not lead to a comparable increase in R&D expenditures even in the long run. On the other hand, Hall and Reenan (2000), Mamuneas and Nadriri (1996), and Hall (1993) found at least a unitary price elasticity of R&D credits.

Another theoretical interest is in the design features of the credit program. This focus is related to both the administration of R&D credits and specific policy objectives. In the policy tools approach (Peters, 2000; Salamon, 2002), R&D tax credits represent a policy tool with low coerciveness and visibility and high indirectness. While direct funding of industrial R&D gives the government the advantage of controlling the nature of R&D through which it can pursue pubic missions (OECD, 2002), R&D credits also allow firms to do whatever research they regard as improving their bottom line. R&D credits are less visible in the legislative decision-making process because, once enacted, they are only on the agenda when it's time for renewal.

[2]However, Wilson (2005a) questions the assumptions of the cost differentials between in-state and out-of-state firms. According to him, "the external-cost elasticity is positive and significant, raising concerns as to whether having state-level R&D tax credits on top of federal credits is socially desirable" (p. 2).

The R&D requires less interference by the government regarding the behavior of the firms, allowing them to retain autonomy in the decisions of R&D investment (Bozeman & Link, 1984). It entails less bureaucratic paperwork and lower administrative costs. Moreover, there is also an issue concerning whether the credit is superior to general tax relief or lowering corporate taxes. From the tools approach, how a country or a state chooses both between direct grants and an indirect tax credit and between a tax credit and less targeted tax relief becomes a relevant question.

The design features of the credit determine how beneficial tax credits are to the firms; such features include credit rates, volume-based versus increment-based calculation of the credit, base periods, and specific limits. These design features are a result of what policy objectives the government pursues other than encouraging industrial R&D in general. The distinction between volume-based and increment-based credit relates to the policy objective to subsidize new expenditures rather than expenditures that would have been done without the credit.

In calculating the amount of incremental increase, the base can be defined in terms of rolling-average, inflation-adjusted fixed amount or a ratio of R&D to a firm's sales (OECD, 2002). R&D credits can also be designed to encourage small business R&D: a volume-based credit generally benefits small firms rather than larger ones, while an increment-based credit works better for more R&D-intensive firms. Additionally, the total amount of the credit can be limited.

THEORETICAL CONSIDERATIONS AND STUDY HYOTHESIS

To address the question of how and which states utilize a R&D tax credit for economic development, this study anchors itself in the debate of functional and legislative theories of federalism, whose main focus is on economic and political factors of the state. Peterson (1995) advised dealing with both types of factors in explaining the likelihood of a state's adoption of specific policies. Paying heed to Peterson's advice, this study examines internal political determinants, assuming that the diffusion factors such as geographical proximities and interstate competitions are constant.

Whether to offer a R&D credit is a matter of the decisions by state elected officials given that functional (economic) factors may condition the decisions. Holding those factors constant, it is assumed in pubic choice theories that elected officials, as self-interested political agents, tend to maximize the expected net gain in votes. According to this approach (Hettich & Winer, 1984), a state's tax structure is a function of politicians' efforts to minimize political costs. While both the cost and benefit aspects need to be addressed in a more general model, Hettich and Winer's model focuses only on politicians' incentives in determination of specific tax structures, holding the benefit (expenditure) side constant. Building upon Hettich and Winer (1984), this study identifies seven indicator variables of politicians' political costs, which are grouped into two categories: revenue loss factors and influence from organized interests.

Revenue Loss Factors

First of all, the implementation of the R&D tax credit may lead to a large revenue loss. The State Science and Technology Institute 1996 survey reported that the credit cost the California government as much as $120 million, Illinois $16.5 million, and Minnesota $11 million. The amount of the credits claimed in California in 1996 took up about 2 percent of the state's total corporate income tax revenue. In 2002, the credit cost Connecticut about $20 million, which is 13.4 percent of its corporate income tax revenue. If the size of the revenue loss caused by the R&D credit is relatively large, this issue will tend to be a considerable burden to politicians[3] in the short term, given that the benefits from the credit would be realized in a longer run. The fact that the timeframes of costs and benefits are separate may pose a serious concern to politicians whose time discount rate is high. Theoretically, they are assumed to prefer a minimization of short-run costs at the expense of longer-run benefits (Downs, 1957, 1960).

In this article, the size of the potential revenue loss is measured by three indicators: the proportion of corporate income tax in the state's total tax revenues, per capita government debt, and per capita industrial R&D investment. The proportion of corporate income tax revenue is hypothesized to be positively associated with political costs from the R&D credit. *Ceteris paribus*, the larger the per capita government debt, the more constrained the politicians are in offering a tax credit. The larger the per capita industrial R&D, which represents the base of R&D credit claims, the more revenue loss the state would experience. Therefore, it is hypothesized that all of these three revenue loss factors are negatively associated with both the state propensity to offer a R&D credit and the state's effective credit rate.

Hypothesis 1-1: A higher revenue loss potential from the R&D tax credit of a state lowers its probability of providing a R&D tax credit.

Hypothesis 1-2: If a state offers a R&D tax credit, a higher revenue loss potential from the R&D tax credit lowers its effective credit rate.

[3]For example, faced with the increasing number of corporate income credits and the amounts claimed, Advocates for Connecticut's Children and Youth argues that more aggressive measures for disclosing the information on tax credits are required (ACCY, 2004).

Organized Interests

The primary beneficiaries of R&D tax credits are high-tech companies and large manufacturing firms (OTA, 1995) since they conduct most of the private R&D activities. If larger firms represent a higher proportion of all firms in a state, the R&D tax credit could benefit more firms than if they do not. This may be an advantage for politicians because the adoption of the credit could provide the politicians with support from a wider range of constituents.

On the other hand, if the benefits from R&D credits are concentrated on larger manufacturing firms while their costs are diffused among taxpayers of different tax bases, the firms may have incentives to organize themselves to seek credits from the state (Wilson, 1974). Therefore, it does make sense for larger firms to lobby legislatures to secure a R&D credit in a collective action perspective. Simply, larger firms have more resources than smaller ones to exert lobbying. If adopted in this manner, the credit will benefit mainly those who have lobbied for it.

This study measures the potential influence of organized interests with a set of variables including the proportion of firms with employments over 100, the proportion of manufacturing jobs, the proportion of employments by technology employers and generators, and the length of time a state has offered the credit. According to the prevailing definition, large firms are those that have at least 500 employees. However, since there is no substantial across-state variation in the percentage of firms with employments over 500, for this study we alternatively utilize the proportion of firms with employments over 100. Given that two-thirds of the beneficiaries of R&D tax credits are manufacturing firms (OTA, 1995), this study uses the proportion of manufacturing jobs as another indicator of organized interests. Considering that R&D-related workers would be more attentive to changes in state R&D policies, this study includes the proportion of employments by technology employers (high-tech firms) in the model specified in the following section.

The last indicator of organized interests, the length of time with a R&D credit, needs further elaboration. It is well established that if a policy is implemented, it nurtures its own interest groups, to which the R&D tax credit is not an exception. To renew the federal R&D credit, which was due to expire at the end of 1988, 152 companies, colleges and universities, trade associations, and other groups formed the Council on Research and Technology (CORETECH). The National Association of Manufacturers (NAM), which serves as the Executive Secretary of the R&D Credit Coalition, mobilized a lobbying effort to revive and strengthen the federal R&D credit that was expired in 2005.

It is usual for the R&D credit to be enacted on a temporary basis with the effect that interested parties are given opportunities to strengthen their effort to renew the credit on a regular basis. Therefore, as time goes on from the adoption of a R&D credit, it is likely that the policy process of renewing or terminating the credit involves better organized and experienced interest groups. There is no reason that the state politics with regard to R&D tax credit renewal would be waged differently from the federal experience. With more engagement with the policy process of the R&D tax credit offering, the organized interest groups within a state tend to seek more generous tax treatment of R&D, as exemplified by NAM. The longer a state has the credit, the more likely the states have higher effective credit rates.

Hypothesis 2-1: A state with better organized R&D interests has a higher probability of providing a R&D tax credit.

Hypothesis 2-2: If a state offers the R&D credit, better organized R&D interests will increase its effective credit rate.

MODEL SPECIFICATIONS

To test these hypotheses, this article develops two statistical models: one with the dichotomous variable of whether or not the state provides a R&D tax credit, and the other with the interval level dependent variable of effective R&D tax credit rates of 2002.

Model I

The first model predicts whether or not a state adopts the R&D tax credit policy tool depending on the independent variables of this study's interests. Since the adoption of the credit spans between 1982 and 2004, a Logit model with one year data could be misleading. In such a case, for example, the independent variables for 2002 would mistakenly be used to predict the adoption of the credit in 1982. Thus, if a state adopted a credit in 1997, the observed values of the independent variables are to be of 1996. Because there is no available data on the proportion of employments by tech employers, this variable is absent from model I. Moreover, the length of time with a R&D credit is irrelevant in model I. The model is specified as follows. The variables and their definitions are provided in Table 1.

$$\begin{aligned} \mathrm{P}(rdcredit = 1 \mid \mathrm{x}) = \mathrm{G}(&\beta_0 + \beta_1 p\_citx_{\mathrm{i}} \\ &+ \beta_2 pc\_debt_{\mathrm{i}} + \beta_3 c\_inrd_{\mathrm{i}} \\ &+ \beta_4 firm100_{\mathrm{i}} + \beta_5 manujob_{\mathrm{i}} \\ &+ \beta_{6\mathrm{m}} controls_{\mathrm{i}}) \end{aligned}$$

G: the logistic function

$$\mathrm{G(z)} = \exp(\mathrm{z}) / [1 + \exp(\mathrm{z})]$$

i: each of the states

m: each of the three controls

Model II

The second model predicts the effective R&D credit rates in 2002. Since the interval level dependent variable is only observable if the state has a R&D tax credit, a dummy value of 0 credit rate is assigned to states without a R&D credit. An ordinary least squares (OLS) regression based on a linear model would provide negative fitted values for states without the credit. To get non-negative predicted values for the effective credit rate, a Tobit model is utilized, as follows.

$$\begin{aligned} \text{creditrate}_i &= x\beta_i + \varepsilon_i \quad \text{if } (x\beta_i + \varepsilon_i) > 0 \\ &= 0 \qquad\quad \text{if } (x\beta_i + \varepsilon_i) \le 0 \\ x\beta_i &= \beta_1 p\_citx_i + \beta_2 pc\_debt_i + \beta_3 c\_inrd_i \\ &\quad + \beta_4 firm100_i \\ &\quad + \beta_5 manujob_i + \beta_6 techjob_i \\ &\quad + \beta_7 year_i + \beta_{7m} controls_i \end{aligned}$$

As pointed out above, the dependent variable is effective credit rates, which may be different from statutory rates due to their design features. First, taxpayers can deduct federal corporate income tax from their state corporate income liability. Second, if the credit is volume-based, the credit rate is simply the statutory rate. If it is based on increments, how the base is defined determines the effective credit rate. The moving-average formula dampens the value of the credit since the more a firm invests in R&D in a year, the more difficult it is for the firm to secure credit-eligible R&D expenditures in future years (Wilson, 2005b). Therefore, the effective credit rate is a direct result of its design features which may reflect politicians' cost considerations. In model II, the proportion of employments by technology employers and generators is included. In addition, the number of years with the credit, which ranged from 0 to 24, is included, which is absent from the first model.

Other Considerations

Every state commands its own profile of economic conditions and political controls. Concerning economic factors, per capita income and 5-year average of economic growth rate are controlled. It is possible for them to either stimulate or delay the introduction of the credit. On the other hand, Republicans in general prefer less government and more private initiative. Republican-controlled states may be more likely to provide a R&D tax credit than states controlled by Democrats. Political control is measured by the number of

TABLE 1
Variables and their Sources[1,2]

Variable	*Description*	*Model*	*Data Source*
Dependent Variable			
rdcredit	1 for states with credit, 0 for the others	I	Author's search and Wilson (2005b)
creditrate	Effective R&D credit rate	II	Wilson (2005b)
Revenue Loss Factors			
p_citx	Proportion of corporate income tax[3] in the state tax revenue	I, II	The U.S. Census Bureau (www.census.gov)
pc_debt	Per capita government debt	I, II	The U.S. Census Bureau (www.census.gov)
pc_inrd	Per capita industrial R&D	I, II	National Science Foundation (www.nsf.gov)
Organized Interests			
firm100	Proportion of firms with employments over 100	I, II	The U.S. Census Bureau (www.census.gov)
manujob	Proportion of manufacturing employments, full-time and part-time	I, II	The U.S. Bureau of Economic Analysis (www.bea.gov)
techjob	Proportion of employments by technology employers and generators in 2002	II	SSTI (www.ssti.org/Digest/Tables/032904t.htm)
year	Number of years that the credit has been effective in the state	II	Author's search and Wilson (2005)
Controls			
income	Per capita income	I, II	The U.S. Bureau of Economic Analysis (www.bea.gov)
econgrowth	Five-year average of growth of Gross State Product	I, II	The U.S. Bureau of Economic Analysis (www.bea.gov)
polcontrol	3 points assigned according to how many of the state governorship, the House and the Senate are controlled by Republicans.	I, II	State Directory: Directory I – Elective Officials (1982–2004) Gubernatorial Elections 1789–1997

[1]For model I, each of the observations of the independent variables is of one year prior to the adoption of the credit for states with the credit and of 2003 for those without the credit. For model II, most of the observations are for 2002, while the proportion of firms with employment over 100 is for 2001.

[2]In cases where some of the data for the 1980s are not available, the least recent available data are used. For example, for Minnesota, per capita industrial R&D in 1993 is used instead of 1982 data.

[3]While Texas does not impose a corporate income tax, it administers a business franchise tax against which the state provides a R&D credit. For this state, business franchise tax data are used.

state institutions of the governorship and the legislatures controlled by the two key political parties. If all three institutions are controlled by Republicans, the value of political control should be 3; the opposite, 0. The dependent and independent variables and their data sources are provided in Table 1.

POLITICAL COSTS AND R&D TAX CREDITS: ANALYTICAL FINDINGS

A brief description of the data and their sources is presented in Table 1, and a summary of descriptive statistics is shown in Table 2. Differences in the mean values between states with and without a credit are statistically significant for the variables such as proportion of corporate income tax revenues in the state's total tax revenues and the proportion of manufacturing jobs. This is consistent with the hypotheses. On the other hand, there is no significant difference between the two groups of states for the variables per capita government debt, per capita industrial R&D, and proportion of firms with employments over 100. This is not consistent with the hypotheses. The results are mixed, which leads us to the analysis with Logit and Tobit regressions.

The regression results are reported in Table 3. With the logistic model (model I), the negativity of a coefficient indicates that the odds-ratio is less than 1, meaning that a state's probability of adopting a R&D credit decreases as the independent variable increases. States with a higher proportion of corporate income tax revenues in the total state tax revenues are less likely to have a R&D credit. At the same time, as the proportion increases by one percentage point, the effective credit rate decreases by about 0.7 percent. It is predicted that with the heavy dependency on corporate income tax, a R&D credit may result in the state's revenue loss of a significant amount. This loss could be a political concern since benefits from the credits are realized only over a longer period of time. Politicians would not be able to harvest benefits from the credit, yet they have to bear its political costs at the next election.

On the other hand, the effects from the per capita government debt are also substantial in the decision to provide the credit, but not in the effective credit rate. In model I, per capita government debt is positively associated with the probability of a state's having a R&D credit. Given that per capita government debt is measured in units of dollars, its small coefficient is misleading. In the second model, this indicator has no utility in predicting the effective credit rate of a state. The opposite applies to the interpretation of the coefficients on per capita industrial R&D. While it is marginally useful in predicting effective credit rates, per capita industrial R&D does not have a causal impact on the probability of a state's having the R&D credit. This finding indicates that with regard to industrial R&D, the amount of revenue loss could be taken into account through credit designs, particularly in the definition of the base.

Regarding the indicators of organized interests, the proportion of firms with employments over 100 is negatively associated with the probability of a state's having a R&D

TABLE 2
Summary Descriptive Statistics

Variables	*Mean*		*Significance of Difference (t-Test)*
	States with Credit	*States Without Credit*	
Proportion of corporate income tax	3.42	7.47	0.01
Per capita debt	2,243.9	2,524.6	0.62
Per capita industrial R&D	552.6	317.5	0.15
Proportion of firms with 100+ employees	.04	.05	0.15
Proportion of manufacturing employments	0.15	0.11	0.02
Proportion of technology employment	10.23	9.46	0.51
Number of years with R&D tax credit	7.2	0	
Per capita income	27,478	30,483	0.06
Five-year average of economic growth	25.5	21.4	0.21
Political control of state institutions	1.32	1.54	0.26

TABLE 3
Regression Coefficient Estimates

Variable	*Model 1: Dependent Variable: Provision of R&D Credit*	*Model 2: Dependent Variable: Effective Credit Rate*
Constant	11.68**	30.61**
Proportion of corporate income tax	–.39***	–.71*
Per capita debt	.001**	0.001
Per capita industrial R&D	0.003	.01*
Proportion of firms with 100+ employees	–148.7**	–110
Proportion of manufacturing employments	11.52	–55.3*
Proportion of technology employment		–0.39
Number of years with R&D tax credit		.46***
Per capita income	–.0003**	–.0008**
Five-year average of economic growth	0.14	10.55
Political control of state institutions	–0.61	0.61
Model summary	Number of obs = 43 Wald $chi^2(8) = 17.66$ Prob > $chi^2 = 0.0239$ Pseudo $R^2 = 0.4099$	Number of obs = 45 Wald $chi^2(8) = 29.00$ Prob > $chi^2 = 0.0012$ Pseudo $R^2 = 0.1274$

*** p < .01, ** p < .05, * p < .1.

credit. A higher proportion of manufacturing jobs leads to a lower credit rate. These are the opposite of the stated hypotheses. How can these findings be interpreted? Larger firms tend to pay more corporate income tax, which motivates them to lower effective tax prices. A R&D credit is in the interest of larger firms because of this. However, this reasoning is in the firm's perspective. In the policy-maker's perspective, a R&D credit in the context of a higher proportion of big firms poses a potential for revenue loss, which is evidenced by empirical studies (OTA, 1995). Given that revenue loss considerations negatively affect both the probability of providing the R&D tax credit and its effective rates, this finding indicates that the policy process of providing and designing the state R&D tax credit is dominated by politicians, not by organized interest groups.

The length of years with the credit is positively associated with effective credit rates, as predicted. A one-year increase in the presence of the R&D tax credit in a state raises the effective credit rate 0.46 percentage points. Although the credit is in effect on a temporary basis, it provides the firms conducting R&D with benefits that may be taken for granted by the firms. In such a case, the expiration of the credit might be perceived as a cost or loss to the firms. Firms have an incentive to organize to renew and strengthen the credit. The longer the state has a credit, the more likely the state industrial interests are to be attentive to the fate of the credit.

On the other hand, the proportion of technology employments cannot predict the effective levels of the credit. Without systematic data on an organization of technology workers, it is difficult to decide whether or not technology workers command a significant presence in American state politics. However, according to the finding in model II, it is relatively clear that they are not a voice carrying significant influence regarding R&D credits.

The coefficients on per capita income indicate that the states with lower income are more likely to offer a R&D tax credit of high effective rates than their higher-income counterparts. For example, a $1,000 difference in per capita state income makes about a 0.8 percentage point difference in the state R&D tax credit rate. This result indicates that the states with lower incomes pursue policy innovation more aggressively to boost in-state economic development. On the other hand, the economic growth rate in itself does not affect the state's propensity to provide a R&D tax credit, and the political control of the political institutions is largely irrelevant in the R&D tax credit provision and its designs. The results seem to verify the wisdom of Dawson and Robinson (1963): economic factors are important, but political factors provide only a marginal presence.

However, this interpretation needs to be qualified. A comparison of the effects from revenue loss potentials and from organized interests reveals that the political cost consideration of politicians dominates the policy process regarding the R&D tax credit provision. The states with a higher proportion of large firms are less likely to offer a credit. That is, R&D credits are largely dependent upon politicians' concerns about revenue loss but are still conditioned by the economic factors.

DISCUSSIONS AND CONCLUSION

The analytical results imply that some factors critically affect the decisions about whether to provide the credit and, if provided, its design features, while others do not. The proportion of corporate income tax in state tax revenues has predictive power with regard to both the R&D credit provision and the effective credit rate. A higher proportion of firms with employment over 100 results in a lower probability of adopting the credit, while this does not affect the effective credit rate. The opposite is true of the proportion of manufacturing jobs: it contributes to the prediction of the effective credit rate but not to the prediction of whether or not the R&D credit incentive is offered.

Politicians' revenue loss concerns are comparable to the political costs incurred when cutting expenditures (Sobel, 1998). For ideological reasons, Republicans tend to prefer smaller taxes, and Democrats are afraid of cutting expenditures. If there is a realistic potential of significant revenue loss, then state politicians are found to decide against R&D tax credits. Moreover and most notably, politicians' concerns about revenue loss dominate organized interests in the decision of the R&D tax credit offering and its design features. It is indicated that state politicians consider the proportion of large firms and manufacturing jobs as revenue loss sources rather than as organized influences in the decisions of whether to adopt the credit and of effective credit rates. This finding is consistent with Hunter's (1999) argument that while important, interest group lobbying is only one among many factors in the decisions of state economic development policies.

However, this dominance of politicians' cost consideration should be qualified. That is, this study suffers from some limitations. Given that tax credits for businesses are driven primarily by economic development purposes, the politics surrounding state tax credits are inevitably waged in the context of competition among states. As mentioned in the section on theoretical consideration, the competition from a neighboring state would pose constraints on the state level policy options and their magnitudes.

Both movements of firms to neighboring states and the voter recognition that the neighboring state provides a more supportive tax treatment may push politicians into uncomfortable decisions. The first factor may shrink the corporate income tax base of the state, undermining the fiscal health of the state and inflicting political costs on the politicians. The second factor militates against politicians in the election since voters in the state may feel unsatisfied with their incumbent officials (Besley & Case, 1995). This might hold

true in the case of R&D tax credits. However, without a valid operationalization scheme, the present study could not incorporate competition among states into its two models.

The R&D tax credit is just one type of tax incentive provided to stimulate state economic development. As such, the analysis based on political cost considerations could be applied to the other types of tax credits such as investment credits and jobs creation credits. In application to these tax credits, the indicator variables of revenue loss factors, organized interests, and other control variables may be different, but the essential insight about politicians' political cost considerations can still be effective guidance.

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