WHAT DETERMINES THE SUCCESS OF STATES IN ATTRACTING SBIR AWARDS?

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Abstract

This article analyzes the interstate distribution of per capita awards made through the Small Business Innovation Research (SBIR) program operated by the U.S. government from 1983 to 1993. The main finding is that after adjusting for population size, awards tend to be made to firms in centers of innovative activity, where knowledge is most easily created and spillovers between economic agents can occur most readily. State programs to assist prospective applicants for SBIR funding, on the other hand, appear to have had little effect in overcoming this seemingly powerful factor. Thus, the percentage distribution of per capita awards by state has remained roughly constant since the inception of the program.

WHAT DETERMINES THE SUCCESS OF STATES IN ATTRACTING SBIR AWARDS?

In 1982, the U.S. Congress created the Small Business Innovation Research (SBIR) program to reverse a perceived decline of American competitiveness in overseas markets. The program emphasizes technology development and provides applied research funding for small businesses throughout the United States to develop and ultimately commercialize results of this research. Funding for the program comes from a 4% set-aside from federal agency research budgets of 11 participating federal agencies and now provides about $1.2 billion annually from all agencies. The Department of Defense, the agency with the largest research and development budget, makes about half of all awards. Because of the length of time SBIR has existed and because of the magnitude of funding available, considerable interest has developed in evaluating the program. Prior studies of the SBIR program (Audretsch, Weigand, & Weigand, 2002; Lerner, 1999; Wallsten, 2000, 2001; and Wessner, 2000) have looked at the career choices of SBIR award recipients and the survival, growth rates, and spatial proximity of their firms. Also, the National Research Council, in conjunction with the National Academy of Sciences, is conducting studies to evaluate the program’s effectiveness as mandated by Congress.

This article examines why some states have received disproportionately more awards since the inception of the program, even after adjusting for state population size. For example, in 2001, Massachusetts received more than $26 per capita through the SBIR program while Mississippi received about $0.23 per capita. Two possible explanations for observed differences in state performance in the SBIR program are considered. The first explanation involves interstate differences in public policies and programs. Many states, noting that such firms as Apple Computer, Compaq, and Intel received early stage SBIR awards, promote this program and assist eligible companies with the application process as part of their economic and technology development programs.[1] Interstate differences in program size and effectiveness may account for at least part of the vast difference in observed per capita funding. A second explanation is that states with greater innovative activity, measured by the quality of higher education or the fraction of the population employed in high-technology manufacturing, have a competitive advantage in the program. Empirical findings presented in this article suggest that public initiatives to help firms attract funding through this program appear to have had little impact on per capita awards received and, thus, on the interstate pattern of awards. On the other hand, variables measuring states' capacity to conduct research and development appear to have substantial explanatory power. This outcome supports the idea that research and development activity tends to agglomerate to benefit from the local pool of specialized labor, venture capital, and business services (Herzog & Schlottmann, 1991).

The remainder of this article is organized into four sections. The first section describes the data used to estimate determinants of SBIR awards. The next section develops a fixed effects model for analyzing panel data on the extent to which public programs were effective in attracting SBIR awards from 1983 to 1993. This time period was selected to take advantage of Berglund and Coburn’s (1995) special compilation of data on state technology programs. The third section builds on this analysis to estimate the extent to which variables related to innovation capacity are associated with state

SBIR award levels over this same period. Implications for regional growth and development are briefly explored in the final section.

Data

The U.S. Small Business Administration, Office of Technology (1984 to 1994) compiles data on number and dollar value of SBIR awards made in each state in each year by 11 federal agencies.[2] States are used as the geographic unit of analysis. A study of cities would be interesting because cities are more spatially detailed units of observation and because agglomeration economies are generally thought to operate on a more localized scale than a state. However, a key aspect of this article is to look at the relationship between performance in the SBIR program and various public programs aimed at encouraging success and participation. These programs all operate at the state, rather than the city, level. This study also uses figures for the number and value of awards from both Phase I and Phase II of the program.[3] Nominal dollar values are converted to real (1987 dollars) values using the GDP price deflator. As shown in Table 1, all participating agencies combined made 688 awards in 1983, with a real value of $51.7 million, whereas 4,016 awards were made in 1993, totaling $567.5 million (in 1987 dollars). Thus, although the program has grown substantially over the years, it is not large in dollar terms. However, SBIR awards appear to play an important role in certifying firm quality to venture capitalists and other private investors (Lerner, 1999).

<Table 1 here>

Although the program has no explicit policy regarding the geographic distribution of participants, Table 2 shows that SBIR awards have been disproportionately concentrated among firms in a few states. This geographic pattern of awards holds year in and year out and is only partly explained by state size. Ordinary least squares regressions of the mean number of awards (A_j) and mean real value of awards (in thousands of dollars) (V_j) by state between 1983 and 1993 on mean state population (POP_j) over this same time period yields[4]:

$$\underset{}{A_j} = \underset{(-0.95)}{-14.21} + \underset{(6.55)}{0.014}POP_j + e_j \qquad R^2 = 0.478 \qquad (1)$$

$$V_j = \underset{(-0.93)}{-1857.6} + \underset{(6.30)}{1.74}POP_j + e_j \qquad R^2 = 0.458 \qquad (2)$$

Equations 1 and 2, show that although POP_j is positively and significantly (*t* statistics are presented beneath coefficient estimates) related to A_j and V_j, it explains less than half of the variation in both variables. In other words, the interstate distribution of awards is not simply coincident with the interstate distribution of people; thus, additional factors appear to be at work in determining a state's success in attracting SBIR funding. The next two sections identify some of these factors in a framework that accounts for persistence of award levels among states as well as the growth of the program over the sample period.

<Table 2 here>

A portion of the remaining geographic variation in SBIR awards might be explained by the fact that states operated programs over the sample period to identify prospective applicants and to assist them with the proposal process. These types of programs, which have been linked to research and development activity by Bania, Calkins, and Dalenberg (1992) fall into four categories: (a) university-industry cooperative research relationships, (b) SBIR assistance, (c) technology extension and deployment, and (d) the National Science Foundation's Experimental Program to Stimulate Competitive Research (EPSCoR). University-industry cooperative relationships are established to facilitate transfer of research results and personnel between academia and the private sector. By broadening communication between scientists and engineers, they may encourage innovation and therefore may lead to greater SBIR funding. State technology extension and deployment programs are aimed at encouraging the spread and application of the latest technology to aid economic development. These programs make technical information, including SBIR application materials, available through publications and computer databases. Also, staff members seek out potential adopters of existing technology and provide technical assistance. SBIR assistance programs make small businesses aware of opportunities for funding, provide help with proposal development, search for scientific and technical information, and facilitate contact with experts outside the firm. Rees (1991) and Berglund and Coburn (1995) provide a more complete description of these programs. Finally, EPSCoR seeks to enhance research and development capabilities in U.S. states and territories that historically have received disproportionately little federal R&D funding.[5] The program emphasizes developing science and engineering research capabilities in higher educational institutions as well as attracting funds for commercialization of research results through SBIR.

Information on the years in which states operated the first three types of programs is taken from a survey conducted by Berglund and Coburn (1995, pp. 54-56), which covered the period 1983 to 1993. Updating these data would be of interest but is beyond the scope of this article. Corresponding data for EPSCoR is taken from the National Science Foundation Web site (www.ehr.nsf.gov/epscor/). Also, data on expenditures by these programs are not available for the sample period so dummy variables were created to indicate whether a state operated a program in each of the four categories in each year.[6] The state of Washington did not provide information about its programs and was excluded from the analysis. In any event, data on program adoption show that the three types of state programs were relatively rare in 1983 but were widely available by the end of the sample period. In 1983, 14% of states had university-industry cooperative research programs, 4% had SBIR assistance programs, and 10% had technology extension and deployment programs. By 1993, these percentages were 47%, 53%, and 65%, respectively. Additionally, no states had adopted all three programs until 1987, but by 1993, 18% of states had done so. Finally, not all states are eligible for EPSCoR and states joined this program in different years (see Footnote 5).

Fixed Effects Analysis

A fixed effects model is used to analyze the connection between the four types of programs discussed and per capita attraction of SBIR awards by state. An advantage of this approach is that it is a simple way to control for unique aspects of states, as well as the effects of time. The model uses data on states over time and (in effect) includes dummy variables for each state and each period. Estimation is by ordinary least squares. The state dummy variables stand in place of all variables that vary by state but not over time (i.e., agglomeration economies and presence of high-tech industries) and the time dummies stand in place of all variables that vary over time by not across states (i.e., macroeconomic conditions and overall growth of the program).

The model to be estimated is:

$$AWARD_{jt}=\alpha+\mu_j+\lambda_t+\Sigma_k\beta_kX_{kjt}+\Sigma_k\gamma_kZ_{kj}+\varepsilon_{jt}. \tag{3}$$

In Equation 3, β_k and γ_k are coefficients to be estimated, μ_j and λ_t are state and time dummies, α is the constant term, and ε_{jt} is an error term.[7] $AWARD_{jt}$ is the natural logarithm of either the absolute number (*NUMBER*) or the real dollar value (*MONEY*) of SBIR awards (in thousands of 1987 dollars) received per thousand of population by state *j* in year *t*. The dependent variables are transformed to natural logarithms because changes in explanatory variables are more likely to exert a constant percentage increase in per capita awards across states than a constant absolute increase.[8] Also, scaling both award measures by population controls for state size, which already has been demonstrated to partly determine absolute levels of funding through the SBIR program.

In Equation 3, *X* denotes explanatory variables that vary over both states and time. In the estimates presented later, four such variables are considered. *EPSCoR* indicates whether a state participated in that program in a given year. *UI* indicates whether a state had a university-industry cooperative research program in a given year. *ASSISTANCE* indicates whether a state had an SBIR assistance program in a given year, and *EXTENSION* indicates whether a state operated a technology extension and deployment program in a given year. Also, *Z* denotes explanatory variables that measure state characteristics that do not vary or at least vary little over time. Variables such as the education level of the workforce, the proportion of scientists and engineers in the population, the percentage of the workforce in high technology manufacturing, the number of Research I universities, and other factors possibly related to per capita awards are treated as components of Z. Notice that including the state dummies (μ_j) in the regression sweeps out the Z_{kj}. Thus, effects of Z_{kj} on awards is recovered in a separate analysis.

Table 3 presents fixed effects estimates of Equation 3 for *NUMBER* and *MONEY* together with means for the four explanatory variables.[9] Estimates are based on 539 observations (49 states x 11 years). Both the state and time dummies are jointly significantly different from zero at the 1% level.[10] Values of R^2 are 0.923 in the *NUMBER* equation and 0.770 in the *MONEY* equation. Regression results suggest that state programs have no influence on per capita SBIR awards. Coefficients of the four program variables are negative and do not differ from zero at the 5% level under a two-tailed test. There is a simple explanation for this outcome. As previously noted, over the 1983-1993 period, states adopted technology development and assistance programs at a rapid pace. At the same time, as noted in the data section, real resources distributed through the SBIR program increased by a factor of 10. By including dummy variables for each time period, the estimates control for the effect of SBIR program growth. To reiterate, estimates in Table 3 suggest that state programs had no effect on the per capita number of awards that states received. Indeed, it is possible that these programs increase the overall number of applicants to the SBIR program and lead to an improvement in the overall quality of proposals. Yet, there is no evidence that they alter the per capita number or value of awards. In consequence, the next section turns to other possible explanations for the geographic distribution of SBIR awards.

<Table 3 here>

Analysis of State-Specific Effects

If state economic development programs do not appreciably affect the per capita attraction of SBIR awards, then what factors might represent a better explanation? The answer here rests on further analysis of the state-specific effects in Equation 3. These effects, presumably influenced by the level of innovative activity in a state, can be recovered by manipulating Equation 3 (see Henderson, 1996, for details) to obtain Equation 4:

$$W_j = c + \sum_k \gamma_k \mathrm{Z}_{kj} + v_j \,. \qquad (4)$$

In Equation 4, $W_j = \overline{AWARD}_{j\cdot} - \sum_k b_k \overline{X}_{kj\cdot}$, where $\overline{AWARD}_{j\cdot}$ denotes the time mean of either *NUMBER* or *MONEY* (expressed in logarithms per capita), $\overline{X}_{kj\cdot}$ denotes the time means of the state program variables, *c* is a constant equal to α plus the average of the $\lambda_t, v_j = \mu_j + \overline{e}_{j\cdot,}$ and the $\overline{e}_{j\cdot}$ are the time means of the residuals from the fixed effects estimates of Equation 3. The dependent variable in Equation 4, W_j, simply nets out the year-to-year effects of economic development programs on SBIR award levels from *NUMBER* and *MONEY*. Consistent estimates of the γ_k coefficients in Equation 4 can be obtained by a least squares regression of W_j on Z_{kj}, provided the *Z* variables are uncorrelated with the state fixed effects (Wooldridge, 2002, pp. 325-326). Notice, however, that in Equation 4, the error term, v_j, is a composite and would be expected to exhibit heteroskedasticity. In consequence, standard errors of the least squares estimates of γ_k are corrected using the method proposed by White (1980). Also, to reduce potential endogeneity problems, variables in Z_{jk} are drawn to the extent possible from a year just prior to the start of the sample period.

Table 4 presents results from estimating Equation 4. Five explanatory variables are used in the analysis to reflect different aspects of the level of innovative activity in a state. Similar variables have been used for this purpose in related studies (see, for example, Audretsch & Feldman, 1996). *HIGH-TECH* denotes employment of workers per thousand of population in six manufacturing sectors classified as having the highest R&D intensity (Organisation for Economic Co-operation and Development, 1995; see also the discussion of alternate classification schemes by Malecki, 1997). These sectors are drugs, office and computing machines, communications equipment, electronic components and accessories, guided missiles and space vehicle parts, and engineering and scientific instruments.[11] Notice that the level of employment in these sectors reflects the presence of industries oriented to national defense. Because of the U.S. Defense Department's prominent role in the SBIR program, *HIGH-TECH* is expected also to reflect the historical pattern of federal defense expenditures. *R&D* denotes research expenditures (in thousands of dollars) at doctorate-granting higher educational institutions in a state, per thousand of population, in 1982 (National Science Foundation, 1984). *SCIENTISTS* denotes the number of people employed as scientists and engineers per thousand of population in 1980 (U.S. Bureau of the Census, 1982). *RESEARCH I* denotes the number of universities in a state, per thousand of population, classified as

Carnegie Research I institutions in 1984 (Carnegie Foundation for the Advancement of Teaching, 1987). *COLLEGE* denotes the percentage of people with four or more years of college in each state's population in 1980 (U.S. Bureau of the Census).

<Table 4 here>

Means of explanatory variables are presented in the second column of Table 4, and regression results are presented in the third and fourth columns. Regressions use 49 observations because the state of Washington is again excluded. Values of R^2 were 0.682 and 0.567 in the *NUMBER* and *MONEY* equations, respectively. Coefficients of explanatory variables are positive and jointly significantly different from zero at the 1% level.

In Table 4, coefficients of *HIGH-TECH, SCIENTISTS,* and, *RESEARCH I* are positive and significantly different at the less than 5% level under a one-tailed test in the equation for *NUMBER*. Coefficients of *HIGH-TECH* and *RESEARCH I are* significantly different from zero at the 1% level using a one-tailed test in the equation for *MONEY*. The coefficient of *SCIENTISTS* is positive and (barely) significantly different from zero at the 5% level under a one-tailed test in the equation for *MONEY*. The coefficients of *R&D* and *COLLEGE* are not significantly different from zero at the 5% level in either equation. Thus, *R&D* and *COLLEGE*, although broadly measuring research capacity, do not appear to be indicators of where commercial technology is developed in the SBIR program. Coefficients are interpreted as the percentage change in per capita awards (*NUMBER* or *MONEY*) given a one-unit change in an explanatory variable. For example, if one more person per thousand of population is employed in a state's high-technology manufacturing sectors, the number of SBIR awards won per thousand of population would rise by 5.3%, and the amount of money attracted would rise by 12.8%.

Table 5 presents calculations using mean values of relevant variables to further illustrate the magnitude of these effects. In particular, the table presents effects of increasing *HIGH-TECH* and *SCIENTISTS* by one unit. For these variables, this calculation shows an increase of one such person in a state, per thousand of population. Table 5 also shows the effect on both *NUMBER* and *MONEY* of increasing the number of Research I universities in a state by one such university (not one such university per thousand people). Elasticity estimates are presented as well, although a caveat regarding interpretation of these values is that *RESEARCH I* is not a continuous variable.[12] Elasticity values are evaluated at the sample means of the relevant variables.

<Table 5 here>

These calculations show, for example, that the 5.3% increase in the per capita number of awards occasioned by an increase in high-technology employment by one person per thousand of population increases the absolute number of awards in a state with average population by about 2.8. The value of SBIR awards in a state with average population rises by about $772,000. Also, increasing the per capita number of scientists and engineers in a state appears to have a larger impact on SBIR funding than does increasing high technology manufacturing employment. In particular, the elasticities of both *NUMBER* and *MONEY* with respect to *SCIENTISTS* exceed those for *HIGH-TECH.* Also, an additional Research I university in a state increases the number of awards by 8.45 and increases the value of awards by $2.8 million. Overall, results presented in Tables 4 and 5 show that the number and value of SBIR awards respond to variables measuring innovative activity, after removing effects of population and publicly funded SBIR assistance programs.

Implications and Conclusions

This article has analyzed the geographic distribution of awards made through the SBIR program. This analysis began with an attempt to explain this distribution by estimating a fixed effects model for state-level data on per capita awards from 1983 to 1993. Measures of whether states participated in the National Science Foundation's EPSCoR or had adopted university-industry cooperative research programs, SBIR assistance programs, or technology extension programs were used as independent variables. Coefficients of these variables were not significantly different from zero, suggesting that publicly funded assistance programs were ineffective in altering the geographic distribution of awards. On the other hand, coefficients of variables measuring employment in high-technology manufacturing, the percentage of population employed as scientists and engineers, and the number of Carnegie Research I universities in a state were positively and significantly associated with mean per capita state SBIR awards for the sample period. Thus, after adjusting for population size, awards tend to be made to firms in centers of innovative activity. Again, state assistance programs do not appear to have been an effective tool in overcoming this seemingly powerful factor.

An implication of this result is that the SBIR program builds innovation capacity in states where it already is relatively well developed. This outcome suggests that there may be a conflict between the technology development goals of the federal government and the technology development goals of some states. From a national perspective, it might make sense to provide SBIR assistance in a manner that increases concentration of innovation capacity, particularly if the goal of the program is to increase global competitiveness of U.S manufacturing. Further concentration of innovation capacity may lead to external (agglomeration) economies that can lower production costs, not only of firms receiving SBIR awards, but also for neighboring firms. From the perspective of low-technology states, however, a national policy that increases innovation capacity in states that already have an advantage may not be entirely welcome, with those states instead likely preferring a greater spatial dispersion of SBIR awards. In any event, it is easy to see how differences in the interstate distribution of benefits may become a discussion point in the current evaluation of the SBIR program.

Notes

1. Another factor to consider along these lines is whether a state's political influence is used to intervene in the selection of awardees. Lerner (1999) contends that this possibility may not be important because the small size of awards, the fact that awards are made by 11 different agencies, and the scoring systems used to rank applicants largely focus on the technological merit of proposals.

2. It would also be of interest to analyze data on applications to the SBIR program to determine state success rates, but these data are available only for a few of the participating agencies in a few of the years studied.

3. Phase I awards are made for research projects to evaluate the scientific and technical merit of an idea. Phase II awards are made for further development of selected Phase I projects that demonstrate greatest potential. The program also includes a third phase in which commercialization occurs. However, no SBIR funding may be used for Phase III.

4. Mean values of these variables were computed for each state over the 1983-1993 period.

5. States and U.S. territories participating in EPSCoR, grouped by their year of entry, are: Arkansas, Maine, South Carolina, Montana, West Virginia (1980); Alabama, Kentucky, Nevada, North Dakota, Oklahoma, Puerto Rico, Wyoming (1985); Idaho, Louisiana, Mississippi, South Dakota (1987); Kansas, Nebraska (1992); Alaska (2000); Hawaii, New Mexico (2001); Virgin Islands (2002); Delaware (2003).

6. The survey attempted to obtain fiscal year 1994 expenditures for each program category in each state. However, in many cases, states were unable to provide

expenditure values because program activities were conducted by an economic development agency with a broader mission.

7. Simultaneity between SBIR funding and state programs to attract SBIR funding is a possible problem because program adoption may be influenced by the quantity of awards a state receives. However, this problem may not be serious for two reasons. First, as indicated previously, most states had adopted SBIR assistance programs by the end of the sample period. Second, the other two types of state programs have broader missions than simply to provide SBIR assistance (Berglund & Coburn, 1995). A complete analysis of simultaneity would be worthwhile, but it would require building a more complete model of the determinants of state technology program adoption.

8. A few states in some years received no awards. As a consequence, the dependent variables, *NUMBER* and *MONEY*, were created after adding one to each observation. This procedure permitted the transformation to logarithms and preserved the interstate differences in awards seen in the raw data.

9. Variables measuring interactions between programs also were tried in specifications not reported here. These interaction variables were significant determinants of both the number and value of awards in the one-way fixed effects models; however, their coefficients never were significantly different from zero at conventional levels in the two-way models. Thus, to economize on space, only the most parsimonious specifications are reported. Also, another issue investigated turns on whether state programs might lead or lag SBIR funding. In the specifications tried,

however, addition of time controls always destroyed the significance of the state program variables.

10. In the two-way fixed effects estimates of the *NUMBER* equation, the *F* statistic for testing the joint significance of time controls after removing state and program effects is $F(10,477) = 52.44$. The corresponding *F* statistic in the *MONEY* equation is $F(10,477) = 28.738$.

11. These are sectors 283, 357, 366, 367, 376, and 381 in the U.S. Bureau of the Census (1986).

12. Calculations of effects of *RESEARCH I* are based on the implicit assumption that all such universities are “perfectly divisible” in order to give partial derivatives with respect to this variable the usual interpretation.

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Table 1

Number and Value of SBIR Awards, 1983 to 1993

Fiscal Year	Total Number of SBIR Awards	Total Current $ Value of SBIR Awards (in millions)	Total Constant 1987 $ Value (in millions)
1983	688	45	51.7
1984	1,313	108	118.8
1985	1,804	199	211.0
1986	2,509	298	306.9
1987	2,955	351	351
1988	2,732	389	375.5
1989	2,866	432	399.3
1990	3,229	461	411.6
1991	3,313	483	413.9
1992	3,473	508	423.0
1993	4,016	698	567.5

U.S. Small Business Administration, Office of Technology (1984-1994) and Berglund & Coburn (1995).

Table 2

Distribution of SBIR Awards by State, 1983–1993

State	Total Number of SBIR Awards	Share in Total Number of SBIR Awards (in %)	Total 1987 $ Value of SBIR Awards (in thousands)	Share in Total $ Value of SBIR Awards (in %)
Alabama	442	1.44	53,121	1.6
Alaska	32	0.10	654	0.0
Arizona	370	1.21	39,573	1.2
Arkansas	47	0.15	3,741	0.1
California	6774	22.07	803,922	24.0
Colorado	1354	4.41	108,702	3.2
Connecticut	894	2.91	103,656	3.1
Delaware	87	0.28	9,763	0.3
Florida	653	2.13	75,903	2.3
Georgia	216	0.70	20,872	0.6
Hawaii	84	0.27	10,209	0.3
Idaho	29	0.09	2,846	0.1
Illinois	498	1.62	58,736	1.8
Indiana	177	0.58	20,045	0.6
Iowa	66	0.22	5,906	0.2
Kansas	57	0.19	4,610	0.1
Kentucky	39	0.13	3,727	0.1
Louisiana	105	0.34	8,585	0.3
Maine	333	1.09	9,888	0.3
Maryland	1652	5.38	175,362	5.2
Massachusetts	4571	14.89	555,506	16.6
Michigan	504	1.64	54,805	1.6
Minnesota	412	1.34	42,333	1.3
Mississippi	44	0.14	2,609	0.1
Missouri	133	0.43	13,438	0.4
Montana	55	0.18	4,977	0.1
Nebraska	77	0.25	5,935	0.2
Nevada	70	0.23	10,927	0.3
New Hampshire	296	0.96	38,076	1.1
New Jersey	849	2.77	96,132	2.9
New Mexico	650	2.12	74,231	2.2
New York	1365	4.45	137,978	4.1
North Carolina	335	1.09	41,757	1.2
North Dakota	86	0.28	1,607	0.0
Ohio	903	2.94	80,731	2.5
Oklahoma	103	0.34	10,126	0.3
Oregon	380	1.24	39,597	1.2
Pennsylvania	1161	3.78	130,257	3.9
Rhode Island	87	0.28	8,525	0.3
South Carolina	21	0.07	1,392	0.0
South Dakota	7	0.02	484	0.0
Tennessee	357	1.16	41,629	1.2
Texas	974	3.17	101,106	3.0
Utah	506	1.65	52,358	1.6
Vermont	172	0.56	6,677	0.2
Virginia	1611	5.25	169,035	5.0
Washington[a]	754	2.46	76,188	2.3
West Virginia	19	0.06	5,190	0.2
Wisconsin	157	0.51	17,990	0.5
Wyoming	5	0.02	355	0.0

U.S. Small Business Administration, Office of Technology (1984-1994) and Berglund & Coburn (1995).

a. State excluded from the regression analyses.

Table 3

State Programs and SBIR Awards

Explanatory Variable	Mean	*Number*	*Money*
CONSTANT	---	-5.184 (-156.23)	-0.903 (-8.77)
UI	0.32	-0.012 (-0.197)	-0.153 (-0.789)
ASSISTANCE	0.23	-0.036 (-0.646)	-0.040 (-0.229)
EXTENSION	0.33	-0.064 (-1.18)	-0.297 (-1.78)
EPSCOR	0.28	-0.023 (-0.667)	-0.026 (-0.247)
Summary Statistics			
NT		539	539
R^2		0.923	0.770

NOTE: The *t* statistics are shown in parentheses beneath coefficient estimates.

Table 4

Determinants of Adjusted Mean Awards

Explanatory Variable	Mean	*Number*	*Money*
CONSTANT	---	-7.820 (-13.96)	-3.145 (-3.00)
HIGH-TECH	5.64	0.053 (2.57)	0.128 (3.30)
R & D	32.88	0.003 (0.408)	-0.008 (-0.64)
SCIENTISTS	8.40	0.098 (2.19)	0.140 (1.68)
RESEARCH 1	0.250 E-03	742.73 (2.20)	2000.8 (3.16)
COLLEGE	16.03	0.077 (1.54)	0.007 (0.078)
Summary Statistics			
N		49	49
R^2		0.682	0.567

NOTE: The *t* statistics are shown in parentheses beneath coefficient estimates.

Table 5

Effects of Changes in Explanatory Variables

Explanatory Variable	*NUMBER* One Unit Increase	*NUMBER* Elasticity	*MONEY* One Unit Increase	*MONEY* Elasticity
HIGH-TECH[b]	2.82	0.30	$772,282	0.72
R & D	---[a]	---[a]	---[a]	---[a]
SCIENTISTS[b]	5.21	0.82	---[a]	---[a]
RESEARCH I[c]	8.45	0.19	$2,804,000	0.50
COLLEGE	---[a]	---[a]	---[a]	---[a]

a. Coefficients of variable are not significantly different from zero (see Table 4).

b. A one-unit increase represents a one-unit increase per thousand of population.

c. A one-unit increase represents an increase of one Research 1 university.