Science R&D Policy Experiments in the Laboratories of Democracy

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Abstract

While a sizeable literature examines federal investment in research and development (R&D) (David, Hall et al. 2000; Payne 2001; Santoro and Gopalakrishnan 2001; Ruegg, Feller et al. 2003; Feller 2007), we have a limited understanding of the impact of *state* government R&D initiatives as they relate to local innovation, entrepreneurship, and economic development. Improved understanding of state R&D investment complements the growing evidence that knowledge spillovers and agglomeration economies produced by R&D investments map out in a systematic manner over geographically concentrated and industry-focused trajectories (Jaffe, Trajtenberg et al. 1993; Audretsch and Feldman 2004; Greenstone, Hornbeck et al. 2010). State R&D investments have increased in magnitude and are targeted to promote local economic activity (Feldman, Lanahan et al. in press). Despite the resources devoted to state programs and their influence on national policy, the field has been dominated by descriptive overviews and case study analyses (Berglund and Coburn 1995; Combes and Todd 1996).

This paper employs a robust methodology to examine the effect of one specific program, state matching funds for the federal Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR). Many state programs are decentralized and fragmented, which presents methodological obstacles for robust state-level comparisons. The SBIR/STTR state match provides a uniform program with a direct measureable outcome—the receipt of Phase II funding—that provides a more immediate measure of firm progress towards commercialization[1]. Federal SBIR funding is competitively awarded in two phases: only successful Phase I recipients qualify to compete for the larger Phase II award. A recent report by the National Academies (2008) estimated that roughly 15% of applicants receive a Phase I award and approximately 40% of those that pursue additional funding for a Phase II grant receive support. To provide additional support for Phase I firm recipients as they compete for Phase II funding, 13[2] states have introduced an SBIR/STTR matching program. The temporal diffusion of this program is based on a belief that the state match for Phase I increases the likelihood that the recipient firms receives the follow-on Phase II award.

In this paper, we begin by providing an overview of state science policy. We specifically examine the effect of the SBIR matching program at the state-level and then estimate firm-level effects to assess if the matching programs increase the probability of receiving the Phase II funding. This approach offers a more comprehensive understanding of the policy highlighting both general trends and teasing apart the heterogeneity across the different states and for different types of firms. We hope that this approach may be used to study other state science policies. Moreover, while there is a growing body of scholarship revolving around the federal SBIR/STTR program (Lerner 1996; Wallsten 2000; Audretsch 2003; Toole and Czarnitzki 2007; Wessner 2008), there are no studies that examine the effect of the state SBIR/STTR matching program.

Methodology

The state matching SBIR/STTR program provides an advantageous opportunity to examine state-level R&D activity given that we are able to overcome common methodological hurdles faced with state-level analysis. While the amount of matched funding for the Phase I recipient varies by state, year, and firm, all of these state matching programs limit the program solely to those firms that have successfully secured a federal Phase I grant and only provide state matching funds with the explicit intention that the firm compete for federal Phase II funding. Thus, not only is the structure of the program uniform between states to allow for between state comparison, the methodological concern of selection bias is avoided given that the recipients of Phase I awards are determined by an external review process. The national

[1] The federal SBIR/STTR program was established in 1982 and comprises an interagency consortium of 11 federal agencies that provide competitive extramural R&D funds for small business proof-of-concept and development.

[2] These states include: CT, HI, IL, IN, KY, MI, MT, NE, NJ, MY, NC, OK, and VA.

level review conducted by the 11 participating federal agencies is centrally concerned with the scientific and technical merits of the Phase I proposal rather than where the firm in located. Moreover, with the intended goal of securing federal Phase II funding, the outcome of this state-level program is clearly defined allowing for a more straightforward interpretation of the results. This stands in contrast to many other analyses that seek to examine more intangible longer-term outcomes related to innovation and economic development (Salter and Martin 2001; Cerulli 2010).

To assess the effect of the state-level R&D program on spurring innovation through small firm activity, we conduct two sets of analyses. The first examines the state matching program on a broad, state-level scale with those states without the state matching program serving as the control group. Using data on the population of federal Phase I and Phase II recipients since the program's founding—made publicly available by the Small Business Administration—and data on the years that the 13 state's administered the state matching SBIR/STTR program, we have run descriptive and preliminary analyses (eq. [1]) using an OLS pooled cross-sectional analysis with state and year controls to examine whether the state matching program increases the rate of Phase II following on funding for those states with the matching program.

$$Weighted\ Moving\ Average\ of\ Phase\ II\ grants_{it} = \beta_0 + State\ Match_{it} + Internal\ Determinants_{it} + \beta_k X_k + \alpha_i + u_{it} \quad [1]$$

The second set of analyses examines the effect of the program on firms using an interrupted time series design by looking at within state variation for a selection of states with the matching program (eq. [2]). We match the state grant awards with the federal SBIR Phase I and Phase II firm level records to examine the marginal effect of the matching amount on securing a Phase II grant. The group of Phase I recipients in the state in the pre-period will serve as the control in this interrupted times series design.

$$Phase\ II_i = \beta_0 + State\ Match_i + \beta_k X_k + u_i \quad [2]$$

Current state of project

As mentioned above, we have run preliminary analyses for the state-level component of this project. Contrary to our expectations, the descriptive results indicate that there is considerable heterogeneity across the states in terms of the effect of the state matching program. For certain states—NC, KY, IN, and IL—there is strong evidence to suggest that the state matching program positively increased the yield of Phase II funding for firms in those respective states. This is what we expected from the state matching program. However, for select states—HI, MI, OK, and NY—the pattern of Phase II funding post policy fluctuates and does not suggest a distinct improvement in securing Phase II awards. Given this heterogeneity across states with the matching program, results from our preliminary regressions show that there is no overall effect of the state matching program on securing the follow on Phase II funding. We are exploring econometric specifications and also intend to include a set of state-level covariates (noted as internal determinants in eq. [1]) to control for potential confounding factors that affect the state adoption of the matching program in the first place.

Regarding the firm-level analyses, we currently have cleaned and matched data for NC and have preliminary estimates for the effect of the NC state matching funds towards increasing the probability that firms receive a Phase II award. In the interim, we intend to clean and match the firm-level data for additional states. Once this is complete, we intend to employ an interrupted time series design for a handful of states with the policy to examine within state variation of the state matching program.

We expect to have the analysis completed by June and intend to have a draft of the paper by August 2012.

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