## Appendix E: The Effect of Phase 2 Grants

Roughly a year after receiving a $150,000 Phase 1 award, a firm may apply for a $1 million Phase 2 grant. Successful applicants typically receive their Phase 2 money nearly two years after the Phase 1 award. Figure 1 shows all applicants by office and award status for Phase 2, which is much less competitive. Approximately 45% of applicants receive funding.

The short term nature of the Phase 1 effect on VC - recall that well over half the long term effect occurs within two years - suggests that Phase 2 does not cause the Phase 1 effect. In fact, I find that the Phase 2 grant has no consistently positive effect on subsequent VC. The first column of Table 1 uses the same specification as in the Phase 1 analysis, but estimates the Phase 2 treatment effect. Columns II and III use topic and year instead of competition fixed effects. The coefficients are small and positive, but imprecise. For example, the 95% confidence interval from the column III the coefficient of 4.4 pp ranges from -3 pp to 12 pp. I find smaller coefficients when the dependent variable is all private finance (Table 2).

I also estimate the effects of Phase 1 and 2 together by including an indicator for whether a firm won a Phase 2 award in my primary Phase 1 specification (Table 3). Across bandwidths and fixed effects, I find the same robust Phase 1 effects. Coefficients on Phase 2 range from -3.2 pp to -.1 pp, but have only slightly smaller standard errors than when I estimate Phase 2 alone. The narrowest 95% confidence interval ranges from -7.8 pp to 5.6 pp. I conclude that in contrast to Phase 1, any effect of Phase 2 is not consistently positive. That is, it may be useful for some firms, but is not for others. As with financing, I find no impact of the Phase 2 grant on revenue, survival, or exit, shown in Tables 4-6. The coefficients are small, often negative, and insignificant.

One reason for the absence of a strong measurable Phase 2 effect is adverse selection among Phase 1 winners in the decision to apply to Phase 2. Among Phase 1 winners, 37% *did not apply for Phase 2*. While 19% of the non-applyers received VC investment within two years of their initial award (column I), only 9%(8%) of firms who applied and lost(won) Phase 2 did (see Table 7). A t-test of the difference of means strongly rejects the hypothesis that non-appliers and appliers have the same mean probability of VC investment within two years, with a t-statistic of 5.44. In interviews, grantees told me that the grant application and reporting processes are so onerous that once they receive external private finance, it is often not worthwhile to apply for additional government funding. Similarly, Gans and Stern (2003) hypothesize that private funding is preferred to SBIR funding. For startup Oscilla

Power (introduced above), the Phase 2 grant of $1 million was significant in relation to what the firm sought to raise from private sources. Had Oscilla raised a $10 million VC round, CEO Shendure said, applying to Phase 2 would not have been worthwhile.

Now I turn to the set of firms that did apply to Phase 2. In the "Standard Sample" regressions (columns I-III of Table 1), there are only 410 observations, which is roughly half the total number of Phase 2 applicants. The other half are omitted because they are not first-time Phase 1 winners. The SBIR mills always apply to Phase 2, which is why the sample with only first-time winners is small. Column IV expands the sample to all firms, and finds a statistically insignificant effect of 0.2 pp. Column V considers only firms with more than one previous win, and finds a large negative coefficient, also insignificant.

The concentration of SBIR mills in the Phase 2 applicant sample may help explain the absence of a strong Phase 2 impact, but it does not cause the imprecision. The fraction of Phase 2 winners and losers who receive VC are quite similar, at 22% and 24% (columns II and IV of Table 7). These percentages are large; despite the SBIR mills, the Phase 2 applicants more broadly are only adversely selected relative to the population of Phase 1 winners.[1] It seems that the Phase 1 grant enables venture funding for high-quality firms whose prototyping reveals positive information. There is sufficient information about the firms at the Phase 2 stage that the grant no longer serves to mitigate information asymmetries.

It is natural to imagine that the very small Phase 1 grant enables access to VC finance because of the expected value of the Phase 2 effect. To the contrary, Table 8 shows that the Phase 1 grant effect on subsequent VC is *stronger* than in the whole sample both for Phase 1 winners who choose not to apply (Panel A), and for Phase 1 winners who lose Phase 2 or choose not to apply (Panel B). For firms who opt not to apply (Panel A), the long term effect of Phase 1 on VC is twice as large as in the whole sample within two years of winning the grant (i.e. before the firm could in theory have gotten a Phase 2 had they applied) and in the long term. Specifically, column II shows that the effect within two years is 14 pp, significant at the 1% level, whereas the effect in the whole sample from Table 7 in the main text is 7.5 pp. In the long term, column IV reveals an effect of 16.2 pp, also significant at the 1% level. This again is roughly twice the whole sample effect from Table 3 in the main

[1] One example of such a firm is FloDesign Wind Turbine, which received a Phase 2 award in 2010, and over the following two years raised money from Kleiner, Perkins Caufield and Byers, Goldman Sachs, Technology Partners and VantagePoint Venture Partners. A second example is American Superconductor, which received a Phase 2 award in 1996 after many rounds of VC investment from the likes of Bessemer Venture Partners and Venrock Associates. After the award, it received funding in 2012 from Hercules Technology Growth Capital. These two companies were at quite different stages when they won their Phase 2 grants and illustrate the variety underlying a "success" ($VC_i^{\text{Post}} = 1$) in my data.

text.

In contrast to the results thus far, I do find a positive effect of the Phase 2 grant on patenting *and* citations. The effect on patents is, however, much smaller than the Phase 1 effect. The Phase 2 award leads a firm to generate 1.5 times the patents it would otherwise (Table 9), about half the Phase 1 effect. The average patents for this sample is 2.2. Including applicants with previous DOE SBIR wins, I find the effect declines (columns II and III), suggesting decreasing returns in the number of Phase 2 grants to a firm. The same pattern occurs with citations (Table 10). The first stage indicates that for first-time winners (column Ia) the odds of positive citations for grantees are 85% higher than the odds for non-grantees, significant at the 5% level.[2] Among the Phase 2 applicants, the probability of positive subsequent citations is 0.31, so the population odds are 0.44. The second stage (regression within observations with positive citations, column Ib) finds small and insignificant coefficients. As with patents, the first stage effect declines substantially and becomes insignificant when firms have more than one previous win (column III).

Thus the Phase 2 grant acts on the extensive margin of innovation quality, but not the intensive margin. That is, among firms with positive citations and among firms with at least one previous win, the grant has no measurable effect. A policy implication is that if the government's objective is to generate R&D (measured by patents and more highly cited patents) rather than leverage private financing, then Phase 2 awards are beneficial when awarded to firms without previous patenting or citation histories.

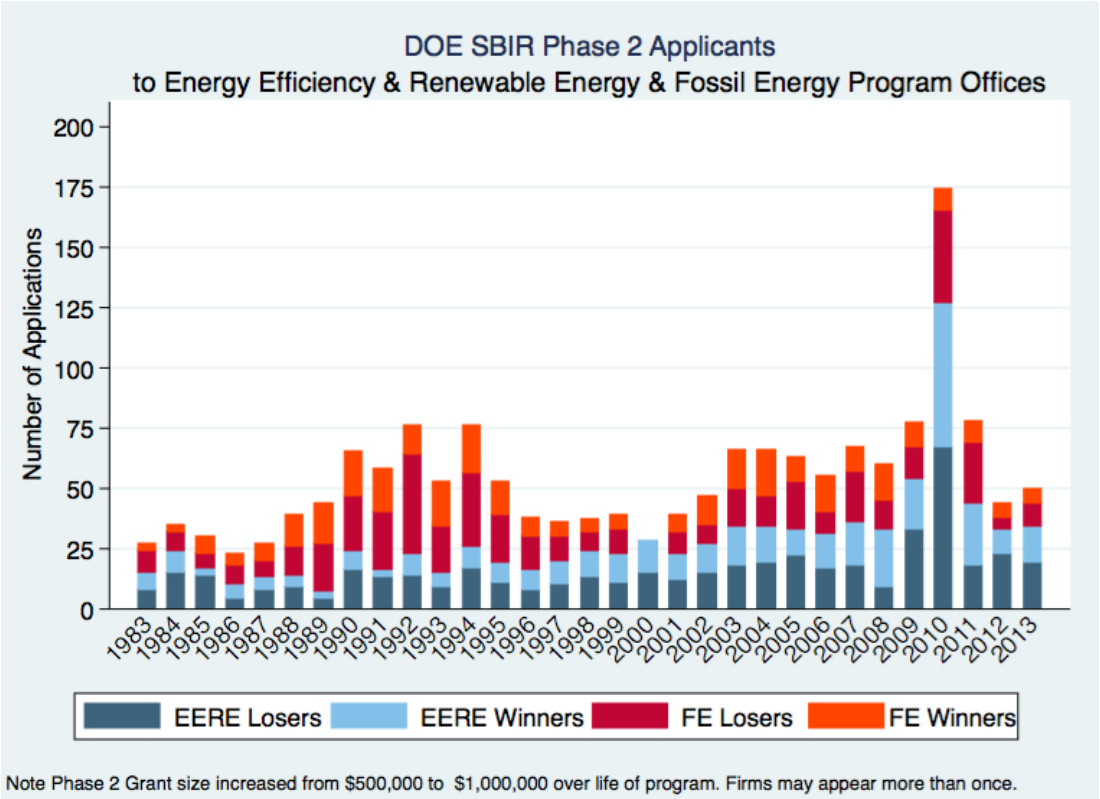
The principal research underlying the technology at the Phase 1 stage may have occurred before the firm applied for a grant. The Phase 1 award generates testing and demonstration (prototyping) which sometimes yields additional patents but generally does not represent a fundamental change to the firm's technology (thus no effect on citations). The Phase 2 grant, in contrast, allows the firm to undertake new inventive activity. This interpretation is consistent with previous literature that has found investment in R&D and patenting to occur simultaneously (Pakes 1985, Hall, Griliches and Hausman 1986; Gurmu and Pérez-Sebastián 2008). The large effect of Phase 2 on citations suggests that Phase 2 may affect the entrepreneur's technology quality ($\sigma_T^2$). This Phase 2 R&D work does not, however, likely generate the Phase 1 financing result, because (a) the impact of the award on VC is short term, mostly occurring between two and four years after the award; and (b)

[2]Logit coefficients give the change in the log odds of the outcome for a one unit increase in the predictor variable. This odds ratio is calculates as $OR = e^{\beta}$, where $\beta$ is the logit coefficient. Odds are the probability of success divided by probability of failure.

many firms who win Phase 1 and receive VC do not apply to Phase 2.

Since the SBIR program spends vastly more on Phase 2 than Phase 1, the absence of a consistently positive Phase 2 effect is important from a policy perspective. At the high end of the confidence intervals, the impact of Phase 2 is still much weaker per public dollar than Phase 1. For example, suppose that the true effect of Phase 2 on the likelihood of subsequent VC is 12 pp. Then the effect of Phase 1 per grant dollar is six times that of Phase 2.[3] Consider the following thought experiment. In 2012 DOE spent $111.9 million on 111 Phase 2 grants and $38.3 million on 257 Phase 1 grants. If all the Phase 2 money were reallocated to Phase 1, DOE could have provided 750 additional firms with Phase 1 grants, increasing by a factor of 2.5 the "return" in additional VC funding probability.[4]

Figure 1:




[3]Specifically, at this high end of the confidence interval, the effect of Phase 2 per $100,000 in grant money is 1.2 pp. My preferred estimate of 9 pp for Phase 1 corresponds to 6 pp per $100,000.

[4]The calculation is as follows, where all numbers are per $100,000 of grant spending: The effect of Phase 2 is 1.2 pp, andthe effect of Phase 1 is 6 pp. Actual Phase 2 2012 spending was 111.9, and actual Phase 1 spending was 383. The "return" in percentage points of increased VC funding probability was 3,640. If instead Phase 2 spending were 0, and Phase 1 spending were 1,502, then the counterfactual "return" would be 9,011, which is 2.48 times the actual "return."

Table 1: Impact of Phase 2 Grant on Subsequent VC

| Dependent Variable: $VC_i^{\text{Post}}$ | Standard sample | | | $\geq 1$ previous Ph. 1 Wins | $> 1$ previous Ph. 1 wins |
|---|---|---|---|---|---|
| | I. | II. | III | IV. | V |
| $\mathbf{1} \mid R_i^{Ph2} > 0$ | **0.0389** | **0.0255** | **0.0443** | **0.00220** | **-0.144** |
| | (0.141) | (0.0584) | (0.0363) | (0.0848) | (0.234) |
| $VC_i^{\text{Prev}}$ | 0.679*** | 0.505*** | 0.461*** | 0.396*** | 0.125 |
| | (0.217) | (0.128) | (0.0756) | (0.132) | (0.304) |
| $\#SBIR_i^{\text{Prev}}$ | 0.000115 | 0.000352 | 0.000520 | 0.000301 | 0.000337 |
| | (0.00105) | (0.000697) | (0.000429) | (0.000205) | (0.000374) |
| Competition f.e. | Y | N | N | Y | Y |
| Topic f.e. | N | Y | N | N | N |
| Year f.e. | N | N | Y | N | N |
| N | 410 | 410 | 410 | 868 | 460 |
| $R^2$ | 0.773 | 0.546 | 0.191 | 0.634 | 0.734 |

Note: This table is an RD estimating via OLS the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on subsequent VC using BW=1. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 2: Impact of Phase 2 Grant on Subsequent Private Financing

| | Standard sample | | | $\geq 1$ previous Ph. 1 Wins | $> 1$ previous Ph. 1 wins |
|---|---|---|---|---|---|
| Dep Var: $PF_i^{\text{Post}}$; BW=1 | I. | II. | III | IV. | V |
| $\mathbf{1} \mid R_i > 0$ | **-0.000950** | **-0.0000022** | **0.0279** | **-0.0295** | **-0.140** |
| | (0.174) | (0.0730) | (0.0403) | (0.0922) | (0.232) |
| $PF_i^{\text{Prev}}$ | 0.621*** | 0.484*** | 0.422*** | 0.401*** | 0.205 |
| | (0.173) | (0.121) | (0.0712) | (0.113) | (0.270) |
| $\#SBIR_i^{\text{Prev}}$ | 0.000195 | 0.000644 | 0.000450 | 0.000253 | 0.000323 |
| | (0.00109) | (0.000695) | (0.000405) | (0.000208) | (0.000370) |
| Competition f.e. | Y | N | N | Y | Y |
| Topic f.e. | N | Y | N | N | N |
| Year f.e. | N | N | Y | N | N |
| N | 410 | 410 | 410 | 868 | 460 |
| $R^2$ | 0.776 | 0.526 | 0.164 | 0.638 | 0.742 |

Note: This table is an RD estimating via OLS the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on all subsequent private finance. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 3: Impact of both Phase 1 and Phase 2 Grants on Subsquent Venture Capital Financing with No Rank Control and Varying Fixed Effects

| Dependent Variable : $VC_i^{\text{Post}}$ | Topic f.e. | | | | Competition f.e. | | Year f.e. | |
|---|---|---|---|---|---|---|---|---|
| | I. BW=1 | II. BW=2 | III. BW=3 | IV. BW=all | V. BW=3 | VI. BW=all | VII. BW=3 | VIII. BW=all |
| $\mathbf{1} \mid R_i^{Ph1} > 0$ | **0.106*** ** | **0.103*** ** | **0.113*** ** | **0.114*** ** | **0.110*** ** | **0.114*** ** | **0.111*** ** | **0.106*** ** |
| | (0.0272) | (0.0233) | (0.0236) | (0.0230) | (0.0274) | (0.0254) | (0.0213) | (0.0214) |
| $\mathbf{1} \mid R_i^{Ph2} > 0$ | **-0.0261** | **-0.0169** | **-0.0108** | **-0.0141** | **-0.0321** | **-0.0168** | **-0.0101** | **-0.0105** |
| | (0.0495) | (0.0399) | (0.0380) | (0.0369) | (0.0475) | (0.0428) | (0.0343) | (0.0342) |
| $VC_i^{\text{Prev}}$ | 0.305*** | 0.337*** | 0.322*** | 0.332*** | 0.307*** | 0.324*** | 0.335*** | 0.338*** |
| | (0.0472) | (0.0335) | (0.0312) | (0.0269) | (0.0363) | (0.0290) | (0.0283) | (0.0249) |
| $\#SBIR_i^{\text{Prev}}$ | 0.00117*** | 0.000989*** | 0.00100*** | 0.000895*** | 0.00105*** | 0.000871*** | 0.000987*** | 0.000897*** |
| | (0.000302) | (0.000253) | (0.000233) | (0.000207) | (0.000270) | (0.000236) | (0.000200) | (0.000186) |
| N | 1872 | 2836 | 3368 | 5021 | 3368 | 5021 | 3368 | 5021 |
| $R^2$ | 0.299 | 0.237 | 0.212 | 0.179 | 0.345 | 0.268 | 0.132 | 0.124 |

Note: This table is an RD estimating via OLS the both impact of the Phase 1 grant ($\mathbf{1} \mid R_i^{Ph1} > 0$) and Phase 2 grant ($\mathbf{1} \mid R_i^{Ph2} > 0$) on subsequent VC with no rank controls. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 4: Impact of Phase 2 Grant on Revenue

| Dependent Variable: $Revenue_i$ | | | | | |
|---|---|---|---|---|---|
| | Standard sample | | | $\geq 1$ previous Ph. 1 Wins | $> 1$ previous Ph. 1 wins |
| | I. | II. | III | IV. | V |
| $\mathbf{1} \mid R_i^{Ph2} > 0$ | **-0.00385** | **0.0292** | **0.0581** | **-0.0129** | **-0.0470** |
| | (0.165) | (0.0834) | (0.0464) | (0.0737) | (0.219) |
| $VC_i^{\text{Prev}}$ | 0.128 | 0.0932 | 0.189*** | 0.164* | 0.138 |
| | (0.200) | (0.0895) | (0.0543) | (0.0923) | (0.242) |
| $\#SBIR_i^{\text{Prev}}$ | 0.000619 | 0.000962 | 0.00103*** | -0.000583*** | -0.000728*** |
| | (0.00118) | (0.000731) | (0.000309) | (0.000149) | (0.000279) |
| Competition f.e. | Y | N | N | Y | Y |
| Topic f.e. | N | Y | N | N | N |
| Year f.e. | N | N | Y | N | N |
| N | 410 | 410 | 410 | 868 | 460 |
| $R^2$ | 0.785 | 0.522 | 0.118 | 0.678 | 0.770 |

Note: This table is an RD estimating via OLS the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on reaching revenue using BW=1. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 5: Impact of Phase 2 Grant on Survival

| Dependent Variable: $Survival_i$ | Standard sample | | | $\geq 1$ previous Ph. 1 Wins | $> 1$ previous Ph. 1 wins |
|---|---|---|---|---|---|
| | I. | II. | III | IV. | V |
| $\mathbf{1} \mid R_i^{Ph2} > 0$ | **-0.00240** | **0.0447** | **0.0668*** | **0.0374** | **0.0693** |
| | (0.139) | (0.0702) | (0.0372) | (0.0735) | (0.180) |
| $VC_i^{\text{Prev}}$ | 0.118 | -0.0122 | 0.0954** | -0.0213 | -0.106 |
| | (0.149) | (0.0714) | (0.0430) | (0.101) | (0.226) |
| $\#SBIR_i^{\text{Prev}}$ | 0.0000976 | 0.000571 | 0.000469** | 0.000276 | 0.000290 |
| | (0.000776) | (0.000581) | (0.000235) | (0.000314) | (0.000663) |
| Competition f.e. | Y | N | N | Y | Y |
| Topic f.e. | N | Y | N | N | N |
| Year f.e. | N | N | Y | N | N |
| N | 390 | 390 | 390 | 778 | 388 |
| $R^2$ | 0.776 | 0.528 | 0.099 | 0.692 | 0.799 |

Note: This table is an RD estimating via OLS the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on firm survival using BW=1. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 6: Impact of Phase 2 Grant on Exit (IPO or Acquisition)

| Dependent Variable: $Exit_i^{\text{Post}}$ | Standard sample | | | $\geq 1$ previous Ph. 1 Wins | $> 1$ previous Ph. 1 wins |
|---|---|---|---|---|---|
| | I. | II. | III | IV. | V |
| $\mathbf{1} \mid R_i^{Ph2} > 0$ | **-0.0275** | **-0.0282** | **0.00234** | **-0.0542** | **-0.122** |
| | (0.123) | (0.0519) | (0.0259) | (0.0526) | (0.106) |
| $VC_i^{\text{Prev}}$ | -0.112 | -0.106 | -0.133*** | -0.138 | -0.208 |
| | (0.172) | (0.0719) | (0.0416) | (0.0872) | (0.312) |
| $\#SBIR_i^{\text{Prev}}$ | 0.117 | 0.0864 | 0.128** | 0.241** | 0.314* |
| | (0.191) | (0.0719) | (0.0560) | (0.102) | (0.184) |
| Competition f.e. | 0.000556 | 0.000611 | 0.000165 | -0.0000217 | -0.000149 |
| Topic f.e. | (0.00102) | (0.000558) | (0.000335) | (0.000104) | (0.000134) |
| Year f.e. | Y | N | N | Y | Y |
| N | N | Y | N | N | N |
| $R^2$ | N | N | Y | N | N |

Note: This table is an RD estimating via OLS the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on exit using BW=1. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 7: Relationship between Phase 2 application and subsequent VC financing

| Phase 2 Status: | Number of Phase 1 winners (% of column) | | | |
|---|---|---|---|---|
| | I. Did not apply | II. Applied and lost | III. Applied and won | IV. Applied and won (VC from time of Ph 2 award) |
| $VC_i^{\text{Post}} = 0$ | 366 (69%) | 400 (78%) | 297 (73%) | 308 (76%) |
| $VC_i^{\text{Post}} = 1$ | 164 (31%) | 111 (22%) | 111 (27%) | 100 (24%) |
| $VC_i^{\text{0-2 yr Post}} = 1$ | 102 (19%) | 50 (9%) | 33 (8%) | 44 (11%) |

Note: This table uses all Phase 1 winners and analyzes the relationship between whether a firm did or did not apply for Phase 2 and VC financing status. Year$\geq$ 1995

Table 8: Impact of Grant on VC for Firms who did not Apply to or did not Win Phase 2

| Panel A: Firms who did not apply to Phase 2 | | | | |
|---|---|---|---|---|
| Dependent Variable: | $VC_i^{\text{0-2 yr Post}}$ | | $VC_i^{\text{Post}}$ | |
| | I. BW=2 | II. BW=3 | III. BW=2 | IV. BW=3 |
| $\mathbf{1} \mid R_i > 0$ | **0.122*** ** | **0.140*** ** | **0.142*** ** | **0.162*** ** |
| | (0.0334) | (0.0373) | (0.0417) | (0.0422) |
| $VC_i^{\text{Prev}}$ | 0.269*** | 0.273*** | 0.285*** | 0.281*** |
| | (0.0406) | (0.0371) | (0.0417) | (0.0398) |
| $\#SBIR_i^{\text{Prev}}$ | 0.0000192 | 0.0000465 | 0.00117*** | 0.00118*** |
| | (0.000263) | (0.000212) | (0.000333) | (0.000296) |
| Competition f.e. | Y | Y | Y | Y |
| N | 2460 | 2968 | 2460 | 2968 |
| $R^2$ | 0.468 | 0.400 | 0.419 | 0.364 |
| Panel B: Firms who lost Phase 2 or did not apply | | | | |
| Dependent Variable: | $VC_i^{\text{0-2 yr Post}}$ | | $VC_i^{\text{Post}}$ | |
| | V. BW=2 | VI. BW=3 | VII. BW=2 | VIII. BW=3 |
| $\mathbf{1} \mid R_i > 0$ | **0.0740*** ** | **0.0919*** ** | **0.103*** ** | **0.114*** ** |
| | (0.0225) | (0.0235) | (0.0279) | (0.0276) |
| $VC_i^{\text{Prev}}$ | 0.300*** | 0.294*** | 0.310*** | 0.292*** |
| | (0.0387) | (0.0351) | (0.0399) | (0.0381) |
| $\#SBIR_i^{\text{Prev}}$ | -0.0000802 | -0.0000423 | 0.00104*** | 0.00106*** |
| | (0.000261) | (0.000209) | (0.000330) | (0.000293) |
| Competition f.e. | Y | Y | Y | Y |
| N | 2670 | 3190 | 2670 | 3190 |
| $R^2$ | 0.450 | 0.395 | 0.408 | 0.353 |

Note: This table is an RD estimating via OLS the impact of the Phase 1 grant ($\mathbf{1} \mid R_i > 0$) on VC, where dependent variable $VC^{\text{Post}}{}_i = 1$ if the company ever received VC after the award. The bandwidth around the cutoff varies. Standard errors robust and clustered at topic-year level. *** $p < .01$. Year$\geq$ 1995

Table 9: Impact of Phase 2 Grant on Patenting (Negative Binomial)

| Dependent Variable: $\#Patent_i^{\text{Post}}$ | I. Standard sample | II. $\geq 1$ previous Ph. 1 Wins | III. $> 1$ previous Ph. 1 wins |
|---|---|---|---|
| $\mathbf{1} \mid R_i > 0$ | **0.417**** | **0.303**** | **0.189** |
| | (0.200) | (0.130) | (0.135) |
| $\#Patent_i^{\text{Prev}}$ | 0.735*** | 0.614*** | 0.666*** |
| | (0.110) | (0.0608) | (0.0654) |
| $VC_i^{\text{Prev}}$ | 0.689** | 0.576*** | -0.0194 |
| | (0.333) | (0.219) | (0.211) |
| $\#SBIR_i^{\text{Prev}}$ | 0.00320*** | 0.000803** | 0.000535** |
| | (0.00112) | (0.000313) | (0.000246) |
| Year f.e. | Y | Y | Y |
| N | 410 | 868 | 458 |
| Pseudo-$R^2$ | 0.077 | 0.073 | 0.098 |
| Log Likelihood | -794.7 | -2094.3 | -1241.3 |

This table is an RD estimating via a negative binomial model the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on the firm's patent count after award using BW=1. Columns I-III use the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column IV includes all Phase 2 applicants, while column V includes only firms with more multiple DOE Phase 1 wins. Note: Standard errors robust. *** $p < .01$. Year$\geq$ 1995

Table 10: Impact of Phase 2 Grant on Normalized Citations (Two-Part)

| Dependent Variable: $Citation_i^{\text{Post}}$ | I. Standard sample | | II. $\geq 1$ previous Ph. 1 wins | | III. $> 1$ previous Ph. 1 wins | |
|---|---|---|---|---|---|---|
| | Ia. Logit | Ib. Regress | IIa. Logit | IIb. Regress | IIIa. Logit | IIIb. Regress |
| $\mathbf{1} \mid R_i > 0$ | **0.627**** | **1.522** | **0.427***** | **2.723** | **0.347** | **4.800** |
| | (0.260) | (15.09) | (0.147) | (5.828) | (0.245) | (5.863) |
| $Citation_i^{\text{Prev}}$ | 0.0645 | 1.362 | 0.0136*** | 0.400*** | 0.0157*** | 0.393*** |
| | (0.0485) | (1.155) | (0.00459) | (0.0845) | (0.00538) | (0.0743) |
| $VC_i^{\text{Prev}}$ | -0.231 | 23.24 | 0.0222 | 11.63 | -0.334 | -0.968 |
| | (0.470) | (29.69) | (0.319) | (12.73) | (0.415) | (11.14) |
| $\#SBIR_i^{\text{Prev}}$ | 0.00521* | -0.0215 | 0.00312*** | 0.00458 | 0.00274*** | 0.0112 |
| | (0.00287) | (0.0340) | (0.000830) | (0.0135) | (0.000817) | (0.0127) |
| Year f.e. | Y | Y | Y | Y | Y | Y |
| N | 386 | 128 | 860 | 338 | 428 | 210 |
| Pseudo-$R^2$ Logit | 0.188 | | 0.223 | | 0.252 | |
| $R^2$ Regress | | 0.137 | | 0.142 | | 0.292 |
| Log lik. | -892.6 | | -2222.1 | | -1275.1 | |

Note: This table is an RD estimating via a two-part (logit plus regression) model the impact of the Phase 2 grant ($\mathbf{1} \mid R_i > 0$) on the firm's normalized citation count after award using BW=1. The logit portion of estimates zero vs. positive citations (extensive margin), and then the regress part estimates the impact of the grant on observations with positive citations (intensive margin). Column I uses the sample from the Phase 1 analysis, where no previous DOE winners are included (only the Phase 1 win that made the firm eligible to apply for Phase 2 is allowed). Column II includes all Phase 2 applicants, while column III includes only firms with more multiple DOE Phase 1 wins. Standard errors robust. *** $p < .01$. Year$\geq$ 1995