The gender gap in federal and private support for entrepreneurship

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Abstract:

The role of gender in entrepreneurship has been thoroughly investigated. However, less is known about gender differences in access to private investment when attempting to develop a new technology. In this paper, we use data collected by the National Research Council of the National Academies to estimate differences between the probability that a female-owned firm and a male-owned firm, both conducting research funded by the Small Business Innovation Research program, will receive private investment funding to help to commercialize the funded technology. We find that female-owned firms are disadvantaged in their access to private investment, especially in the West and Northeast regions of the USA.

Keywords: private investments | entrepreneurship | gender | technology | innovation

Article:

1. Introduction

There is a growing literature on gender differences in labor market outcomes, such as competition and business performance. However, research related to gender differences in financing market outcomes, especially technology-based market outcomes, is limited. In this paper, we quantify gender differences in access to private investment funding by small, technology-based companies to support the development of a new technology.

The role of gender in entrepreneurship has been thoroughly investigated. For example, Blanchflower and Meyer (1994), Reynolds (1997), and Blanchflower and Oswald (1998) showed that women are less likely to start a new business or to be self-employed than men. However, less is known about gender differences in access to private investment when attempting to develop a new technology. A preliminary investigation by Gicheva and Link (2013) suggested that women are less likely to attract private investments to support technology developed from a Small Business Innovation Research (SBIR) award from the National Institutes of Health (NIH). This paper extends Gicheva and Link's earlier work on this topic by expanding both the sample of awards to all relevant agencies and the structure of the empirical model.

2. Analytical model

Based on project and firm information from the National Research Council (NRC) database of randomly selected SBIR-funded projects, we estimated[1]: *Private Investment*$_i$ = f($X_i'\beta$), where *Private Investment* measures the ability of a firm to attract private investment support for an ith SBIR-funded project and **X** is a vector of project and firm characteristics.

Data on 1027 completed Phase II projects were available in the NRC database on all relevant variables considered. These projects were funded through an SBIR award at some point from 1992 through 2001 by one of five agencies: Departments of Defense (DoD) and Energy (DOE), NIH, National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF).[2]

Phase I awards assist firms to assess the feasibility of an idea's scientific and commercial potential in response to the funding agency's objectives; they currently provide up to $150,000 for a 6-month period. A subset of Phase I recipients is invited to apply for a Phase II award to develop further the proposed research, ideally leading to a commercializable product, process, or service. Phase II awards are up to $1,000,000 for a 2-year period.

The Small Business Reauthorization Act of 2000 mandated that, among other things, the NRC of the National Academies conducts: ''an evaluation of the economic benefits achieved by the SBIR program….'' In its evaluation, the NRC conducted an extensive and balanced survey in 2005 from a population of 11,214 completed from Phase II projects. The total number of projects surveyed by the NRC was 6408; 1916 projects responded, and of those, 1027 were completed before the survey date and reported all of the information needed for this study.[3]

Private Investment was measured dichotomously (PI) as well as by the ratio of the amount of private investment to the amount of the SBIR award ($PI/$Award). On the NRC survey, ''private investment'' includes funding from: US venture capital, foreign investments, other private equity investments (e.g., angel funding), and investments from other US businesses.

Included in **X** is a variable for female-owned firms (Female), if the firm was the first firm founded by the owner (Nascent), the age of the firm (Age), the census region in which the firm is located (Northeast, Midwest, and South, with West being the excluded category),[4] and the funding agency (DOE, DoD, NASA, and NIH, with NSF being the excluded category). Some of the models also include interactions of Female with Nascent and each of the four census regions. A description of the variables is given in Table 1.

Female is the focal variable. Nascent is held constant to account for the business experience of the owner of the firm, and Age controls for the firm's research and technology experience. Regional effects not only account for the availability of private investment funds, venture capital in particular (Chen et al. 2010; NVCA 2012), but also account for differences in entrepreneurial cultures (Chinitz 1961).[5] Finally, to approximate the nature and characteristics of the technology being developed through SBIR funding, funding agency effects are also held constant.

3 Results

The results from the estimation of our model are given in Table 2. The probit results in columns (1) and (2) show that female-owned firms are less likely to receive private investment funding compared with male-owned firms.[6] The variables Nascent and Age proxy the firm's overall experience. Our results suggest that private investors favor younger firms with experienced

Table 1 Definition of the variables

Variables	Definition	Mean	Standard deviation	Range
PI	If owner of firm received any private investment funding for the development of the SBIR-funded technology (1 = yes)	0.2707	0.4445	0/1
$PI/$Award	Ratio of the amount of private investment received to the amount of the SBIR award	1.215	9.91	0/207.1
Female	If owner of firm is a woman (1 = yes)	0.1285	0.3348	0/1
Nascent	If firm receiving the SBIR award is the first firm the owner ever founded (1 = yes)	0.4606	0.4987	0/1
Age	Age of firm measured as (2005—year founded)	17.5	11.13	5/105
West	Census region (= 1)	0.333	0.4715	0/1
Northeast	Census region (= 1)	0.2795	0.4489	0/1
Midwest	Census region (= 1)	0.149	0.3562	0/1
South	Census region (= 1)	0.2386	0.4264	0/1
DOE	Agency funding the SBIR project (= 1)	0.0798	0.2712	0/1
DoD	Agency funding the SBIR project (= 1)	0.4674	0.4992	0/1
NASA	Agency funding the SBIR project (= 1)	0.0857	0.28	0/1
NIH	Agency funding the SBIR project (= 1)	0.2775	0.448	0/1
NSF	Agency funding the SBIR project (= 1)	0.0896	0.2857	0/1

Table 2 Regression results (robust standard errors in parentheses, n = 1027)

	PI (probit estimates)			$PI/$Award (Tobit estimates)	
	(1)	(2)	(3)	(4)	(5)
Female	-0.3125**	-0.4693**	-	-6.1954**	-
	(0.1371)	(0.2021)		(2.9780)	
Nascent	-0.1742**	-0.2078**	-0.1722**	-2.0486	-1.9275
	(0.0868)	(0.0926)	(0.0871)	(1.7296)	(1.7215)
Age	-0.0192***	-0.0192***	-0.0192***	-0.2917***	-0.2934***
	(0.0048)	(0.0049)	(0.0048)	(0.0949)	(0.0955)
Northeast	-0.2820**	-0.2822**	-0.3162***	-4.6692**	-4.9180**
	(0.1106)	(0.1107)	(0.1161)	(2.3656)	(2.4746)
Midwest	-0.1016	-0.0950	-0.1400	-2.9854	-4.0832
	(0.1289)	(0.1291)	(0.1365)	(2.4126)	(2.5629)
South	-0.2940**	-0.2936**	-0.4021***	-5.1938*	-6.7785**
	(0.1169)	(0.1169)	(0.1274)	(2.7049)	(3.1540)
DOE	-0.5156***	-0.5192***	-0.5167***	-7.4135**	-7.2775**
	(0.1990)	(0.1992)	(0.1993)	(3.4910)	(3.4660)
DoD	-0.5074***	-0.5041***	-0.5049***	-6.8809**	-6.7061**
	(0.1486)	(0.1487)	(0.1481)	(2.7136)	(2.6791)
NASA	-0.7818***	-0.7862***	-0.7892***	-12.6608***	-12.6378***
	(0.2062)	(0.2063)	(0.2053)	(4.2760)	(4.2522)

NIH	-0.7574***	-0.7624***	-0.7672***	-7.9388***	-7.7947***
	(0.1595)	(0.1597)	(0.1608)	(2.4208)	(2.4085)
Female x Nascent	-	0.2972	-	-	-
		(0.2756)			
Female x West	-	-	-0.7662***	-	-13.8370**
			(0.2768)		(5.8068)
Female x Northeast	-	-	-0.3517	-	-9.9594
			(0.3006)		(6.3370)
Female x Midwest	-	-	-0.3005	-	-1.7260
			(0.3312)		(6.2734)
Female x South	-	-	0.0792	-	-0.5105
			(0.2276)		(3.7633)
Constant	-0.5262***	-0.5403***	-0.5652***	-0.3878	-0.0333
	(0.1742)	(0.1748)	(0.1756)	(2.9695)	(2.9667)
Wald ratio X^2	59.02	60.63	64.95	-	-
F statistic	-	-	-	2.24	1.76
Pseudo-R^2	0.0538	0.0548	0.0586	0.0115	0.0128
Log likelihood	-567.43	-566.85	-564.55	-1515.02	-1512.98

*** Significant at .01 level; ** significant at .05 level; * significant at .10 level

Table 3 Predicted probability of receiving private investment funding (standard error of prediction in parenthesis)

	Female	Male	Total	*P* value (female = male)
West	0.1402	0.3532	0.3308	0.0052
	(0.0616)	(0.0449)	(0.0466)	
	N = 36	N = 306	N = 342	
Northeast	0.1277	0.2375	0.2260	0.1239
	(0.0587)	(0.0405)	(0.0424)	
	N = 30	N = 257	N = 287	
Midwest	0.2499	0.3057	0.2984	0.6165
	(0.0989)	(0.0507)	(0.0570)	
	N = 20	N = 133	N = 153	
South	0.2372	0.2176	0.2213	0.7996
	(0.0667)	(0.0394)	(0.0445)	
	N = 46	N = 199	N = 245	
Total	0.1878	0.2828	0.2706	0.2405
	(0.0684)	(0.0433)	(0.0465)	
	N = 132	N = 895	N = 1027	

founders (i.e., Nascent = 0), a finding that has not previously been reported. There is no statistical evidence that the age effect is nonlinear and thus higher-order terms were not included in the model. Finally, firms located in the Northeast, Midwest, and South are less likely to receive private investment funding than firms in the West. Similar results for experience and location are seen from column (3). The Tobit results in column (4) suggest that female-owned firms receive less private investment funding relative to the award amount, as do older firms.

The predicted probabilities of receiving private investment funding, based on the Probit results in column (3), are given in Table 3.[7] The finding that female-owned firms are less likely to receive private investment funding is a regional phenomenon, perhaps reflecting differences in the entrepreneurial culture of the region. Female-owned firms in the West are 21 % points less likely to receive such funding compared with male-owned firms in the same region—a similar directional result for the West is given in column (5) of Table 2 with respect to the ratio of private investment to the award amount—and the gender difference in the Northeast is 11 % points. Differences in the predicted probabilities are not close to significance in the Midwest or South.

4. Discussion

Our findings are compelling that female-owned firms are disadvantaged in their access to private investment funding to bring SBIR-funded technologies to commercialization. Established in 1982, the SBIR program was reauthorized in 1986 and then in 1992. The latter reauthorization broadened the objectives of the program to provide for enhanced outreach efforts to female-owned firms. There are not data to test the effectiveness of this new objective. However, our findings suggest that if private investment funding is critical to commercialization, then whether or not more female-owned firms are receiving awards in general, those located in the West and Northeast, are less likely than male-owned firms to achieve the program's objective of commercializing SBIR-funded technology.

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