

Gender Gap in High-Growth Ventures: Evidence From a University Venture Mentoring Program

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In a pattern that starkly diverges from broader trends in women’s increasing labor-market participation and educational attainment, women today still have substantially lesser likelihood of entering entrepreneurship. This gap is particularly pronounced among high-growth ventures, where female founders are rare (Robb Coleman Stangler 2014). Uncovering the potential obstacles for female entrepreneurs, especially at the early-stages of venture founding, is a pathway to better understanding the performance drivers of high-growth ventures and the levers of successful entrepreneurial ecosystems. In this paper, we track a set of high-growth venture ideas, founded by entrepreneurs with high human capital, from idea stage to commercialization. We use the data to present several stylized facts about the patterns of the gender gap during the lifecycle of a high-growth venture.

1 Data and Variables

Our empirical setting is MIT’s Venture Mentoring Service (VMS), a free educational service that provides mentoring to MIT students, post-docs, and alumni who are interested in entrepreneurship and have a nascent business idea.¹ VMS matches each venture idea and the entrepreneur with a small team of volunteer mentors, who are experienced local practitioners with extensive experience in new business formation and development. At the entrepreneur’s request, VMS schedules ad hoc meetings where the mentors provide confidential venture advice to the entrepreneur. We collected data on 651 venture ideas and 627 entrepreneurs that came to VMS between 2005 and 2012.²

Column (1) of Table 1 reports the summary statistics of the ventures in our sample. We observe ventures spanning a range of high-growth sectors, including web/mobile (28.0 percent),

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¹See Scott, Shu, and Lubynsky (2016) for a more detailed description of VMS.

²For the purpose of this analysis, we exclude seven ventures that had already been funded before joining VMS since they had progressed further than the typical venture that affiliates with VMS at the idea stage. We also exclude ten ventures founded by MIT faculty and one venture where we do not observe the gender of the primary entrepreneur.

enterprise software (17.8 percent), hardware³ (14.6 percent), life sciences / medical devices (13.4 percent), and consumer products (13.2 percent). Around 25 percent of the venture ideas had documented intellectual assets when they joined VMS, meaning that they originated from academic research and/or had filed for intellectual property protection at entry. The ventures are typically in very early stages when they come to VMS; the vast majority of the ventures in our sample (83.1 percent) had not registered for a business entity when they joined VMS.

Table 1: Summary Statistics of Ventures

Sample	All Ventures	Ventures by Male Founders	Ventures by Female Founders	t
	(1)	(2)	(3)	(4)
Year the venture joined VMS	2009.9	2009.8	2010.4	3.15
Month the venture joined VMS	6.5	6.5	6.5	0.07
<i>Industry Sector</i>				
Consumer web/mobile	28.0%	28.3%	26.6%	0.37
Enterprise software	17.8%	18.4%	15.3%	0.81
Hardware	14.6%	15.0%	12.9%	0.59
Life sciences/medical devices	13.4%	14.8%	7.3%	2.23
Consumer products	13.2%	12.3%	16.9%	1.36
Energy	5.8%	6.5%	3.2%	1.38
Other	7.2%	4.7%	17.7%	5.12
<i>Entry Characteristics</i>				
Has intellectual assets at entry	24.7%	25.0%	23.4%	0.39
Has business entity at entry	16.9%	17.3%	15.3%	0.52
<i>VMS-Related Variables</i>				
Mentor interest (in percent)	4.44	4.44	4.46	0.08
Number of mentor meetings	3.21	3.27	2.95	1.02
Number of mentors met at least twice	1.72	1.76	1.53	1.22
<i>Venture Outcomes</i>				
Full-time entrepreneur	46.4%	48.0%	39.5%	1.71
Angel/VC funding	18.6%	19.4%	15.3%	1.04
Commercialization	22.3%	23.3%	17.7%	1.35
N	651	527	124	

The unique institutional setting of VMS allows us to construct a measure of the ex-ante perceived quality of the venture idea in its earliest form: the proportion of mentors—a pool of over 100 experts—that express interest in mentoring the venture based on an objective, standardized summary of the proposed venture. In Scott, Shu, and Lubynsky (2016), we show that aggregate mentor interest positively and significantly predicts a venture’s subsequent outcomes, particularly for ventures with intellectual assets in R&D-intensive sectors (i.e., hardware, energy, and life sciences / medical devices). We exclude the alternative explanations that aggregate mentor interest systematically influences a venture’s access to mentoring resources or the entrepreneurs’ effort. We also demonstrate that mentors are recognizing high-quality

³Defined as products that require large-scale manufacturing processes.

ideas as opposed to excluding non-serious ideas. Table 1 shows that the average venture idea receives interest from around 4.4 percent of the mentors. By the time we collected the data (August 2014), the average venture has had 3.2 meetings with VMS mentors and had repeated interactions with 1.7 mentors.

We combine the rich archival data of VMS with web searches to construct three outcome measures capturing the growth and development of a venture by August 2014. First, we consider a venture to be launched if at least one of the founding entrepreneurs has ever pursued the venture full-time. Around 46.4 percent of entrepreneurs decide to commit fully to their venture and, for most ventures in our sample, such commitment from entrepreneurs occurred after they came to VMS. Second, we measure the amount of funding the venture ever received from angel investors and/or venture capitalists.⁴ Around 19 percent of the ventures in our sample have raised angel and/or venture capital (VC) funding, collectively raising over \$700 million in venture financing. The third outcome is commercialization, defined as having recurring revenue and expenses associated with the sale of products and/or services in keeping with the company’s business objective.⁵ Nearly a quarter of the ventures (22.3 percent) in our sample commercialized and created products and/or services that have received validation from customers. Around 48% of commercialized ventures did so without raising Angel/VC funding.

Table 2: Summary Statistics of Founders at VMS Entry (Sub-sample)

Sample	All Founders	Male Founders	Female Founders	t
	(1)	(2)	(3)	(4)
Age	31.4	31.9	29.3	2.56
<i>Bachelor Field</i>				
Engineering and Computer Science	64.7%	67.7%	52.2%	2.82
Science	17.5%	16.5%	21.7%	1.18
Management	4.9%	4.8%	5.4%	0.24
Other	12.8%	10.9%	20.7%	2.52
<i>Highest Degree</i>				
Bachelors	20.6%	19.3%	26.1%	1.44
Non-MBA Masters	49.1%	50.4%	43.5%	1.19
MBA	30.9%	32.1%	26.1%	1.12
PhD	29.3%	29.5%	28.3%	0.24
N	485	393	92	

For a subsample of ventures, we are able to collect information on the primary entrepreneurs’ education when they joined VMS; summary statistics are reported in Column (1) of Table 2. At entry, the average founder is around 31 years-old. Around 65 percent of the founders majored in engineering (including computer science) during college; nearly 18 percent majored in science. Less than 21 percent of the founder do not have any graduate degrees at VMS entry.

⁴We exclude crowdfunding, government grants, and investments from friends and family in this definition, since the criteria and purposes of those funding channels vary widely.

⁵In rare cases where the business model is based on licensing, establishing technology licensing deal(s) is considered commercialization.

2 Gender Gap over the Venture Life-Cycle

Next, we contrast the ventures by the gender of their primary entrepreneur. During our sample period, 124 out of the 651 early-stage venture ideas were brought to VMS by female founders, growing from 11 percent of ventures in 2005 to 25 percent in 2012. By comparison, over the same sample period, the percentage of females enrolled in undergraduate and graduate programs at MIT grew from 35 percent to 37 percent.⁶ This variance suggests evidence of a gender gap among members of the MIT community seeking mentorship for their early-stage venture ideas. This rate, however, is higher than the female-founder rates reported in other samples of high-growth ventures, which are usually less than ten percent (Robb Coleman and Stangler 2014).

Columns (2) and (3) of Table 1 compare the characteristics of ventures by gender of their primary entrepreneurs;⁷ column (4) reports the t-statistics from a two-sample t-test for equal means. The primary distinction of these early-stage venture ideas is the target industry sector, not the prior development or quality of the venture idea nor the engagement of entrepreneurs with the mentorship program. Ventures by female founders are less likely to be in consumer web / mobile, enterprise software, hardware, life sciences / medical devices, and energy sectors than ventures by male founders; the difference is significant for the life sciences / medical devices sector. In contrast, ventures by female founders are more likely to be located in the consumer products sector and significantly more likely to be founded in “other” industry sectors, a classification that is primarily composed of consulting and social entrepreneurship ventures. Ventures by male and female founders do not differ significantly at entry in whether they possess intellectual assets or have formed a business entity. They also received similar levels of interest from mentors and had similar degrees of interactions with mentors.⁸

Table 1 shows that on average, ventures with female founders are less likely to reach subsequent venture milestones but the differences are not significant. Once we include dummies for year joining VMS as controls, we find no evidence of a gender gap in the subsequent venture milestones: full-time commitment, angel/VC funding, and commercialization. This result, however, masks important venture heterogeneity in the sample. Figure 1 plots the estimated gender gap over the venture life-cycle for two different subsets of venture ideas, split by whether the ventures have intellectual assets at entry. For ventures with intellectual assets, we see that female founders are more likely to commit to the venture full-time conditional on venture age (measured by year and month joining VMS), venture characteristics at entry, industry sector, aggregate mentoring interest, and interactions with mentors. Their ventures are also more likely to raise Angel/VC funding and reach commercialization, but the differences are not statistically significant. However, for ventures without intellectual assets, which are the majority of ventures, female founders are less likely to reach all three milestones, and the gaps in full-time commitment and commercialization are statistically significant.

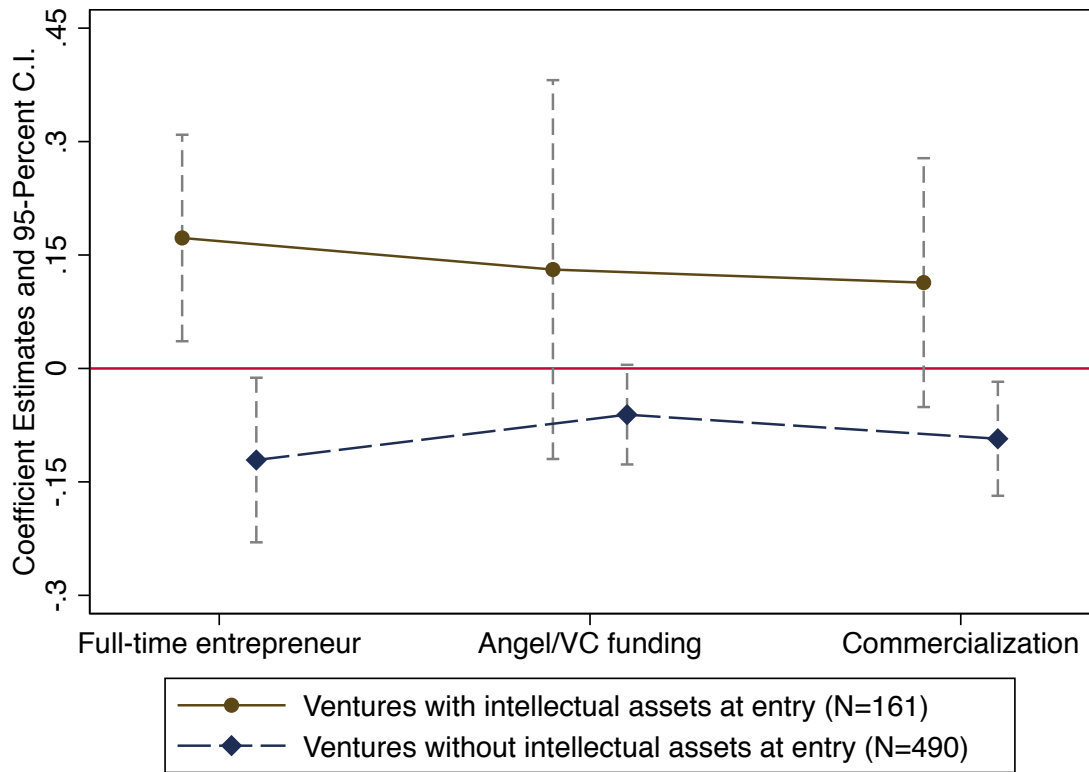
This distinction does not appear to be driven by specific industry sectors favoring intellectual assets or such assets capturing more established ventures at entry; similar exercises

⁶Source: MIT Registrar’s office.

⁷Some ventures with male primary entrepreneurs may have female cofounders, which we could not observe. These measurement errors could introduce attenuation bias in our estimation results of gender gaps.

⁸The name of the primary entrepreneur is included in the summary that mentors receive; it is therefore possible for mentors to infer the gender of the primary entrepreneur.

Figure 1: Estimated Gender Gap over the Venture Life-Cycle



Notes: This figure plots the marginal effects and 95-percent confidence intervals from Logit models with standard errors clustered by sector and year joined VMS. Each estimate plotted is from a separate regression where the dependent variable is whether the venture reaches a milestone and the independent variable is whether the primary entrepreneur is female. The sample consists of either ventures with intellectual assets at entry (solid line with dots) or ventures without intellectual assets at entry (dashed line with diamonds). All regressions include whether the venture has a business entity at entry, dummies for sector, quintile dummies for aggregate mentor interest (quintile defined within a sector), dummies for number of mentor meetings, and dummies for number of mentors met at least twice.

contrasting R&D-intensive and non-R&D-intensive sectors (Figure A1) as well as ventures with and without established business entities at entry (Figure A2) yielded no differences in attainment of venture milestones by gender.

Importantly, for ventures without intellectual assets, the gender gap appears in the earliest milestone—entrepreneurs’ decision to commit full-time to their venture, eschewing continued education or employment. Once we condition on this commitment decision, we see no significant differences in the probability of raising venture financing or the rate of commercialization by gender of the founder.

We further find that these patterns of the gender gap cannot be explained by the differences in the primary entrepreneurs’ education levels. Table 2 shows that, within the subsample of ventures where we observe more detailed characteristics of the primary entrepreneurs, female founders are on average few years younger than male founders; they are also less likely to have majored in engineering / computer science in college and more likely to have majored

in non-science and non-engineering fields. There are similar rates of overall graduate degree attainment across genders, including by graduate degree type. Including controls for age, bachelor degree type, and degree attainment at entry to VMS in the prior analysis yields similar evidence of a gender gap distinguished by lack of venture intellectual assets and founder commitment.

3 Conclusions

Differences across genders in entrepreneurial activity and performance have been attributed to variances in STEM education attainment rates, risk preferences, and network access of founders as well as the industry sector and quality of resulting ventures (e.g., Kacperczyk and Guzman, 2016). Using data from MIT Venture Mentoring Service, we find that the gender gap only emerges for ventures without documented intellectual assets at the earliest stage of founding, and that the gap occurs in founders' commitment. Conditional on founders' full-time commitment to the venture idea, we find no significant differences in the rates of professional venture financing or achievement of commercialization. Our results suggest that for entrepreneurs with high human capital, targeting resources at the earliest stages of a venture's lifecycle to encourage entry into entrepreneurship could be an effective way to narrow the gender gap in entrepreneurial outcomes.

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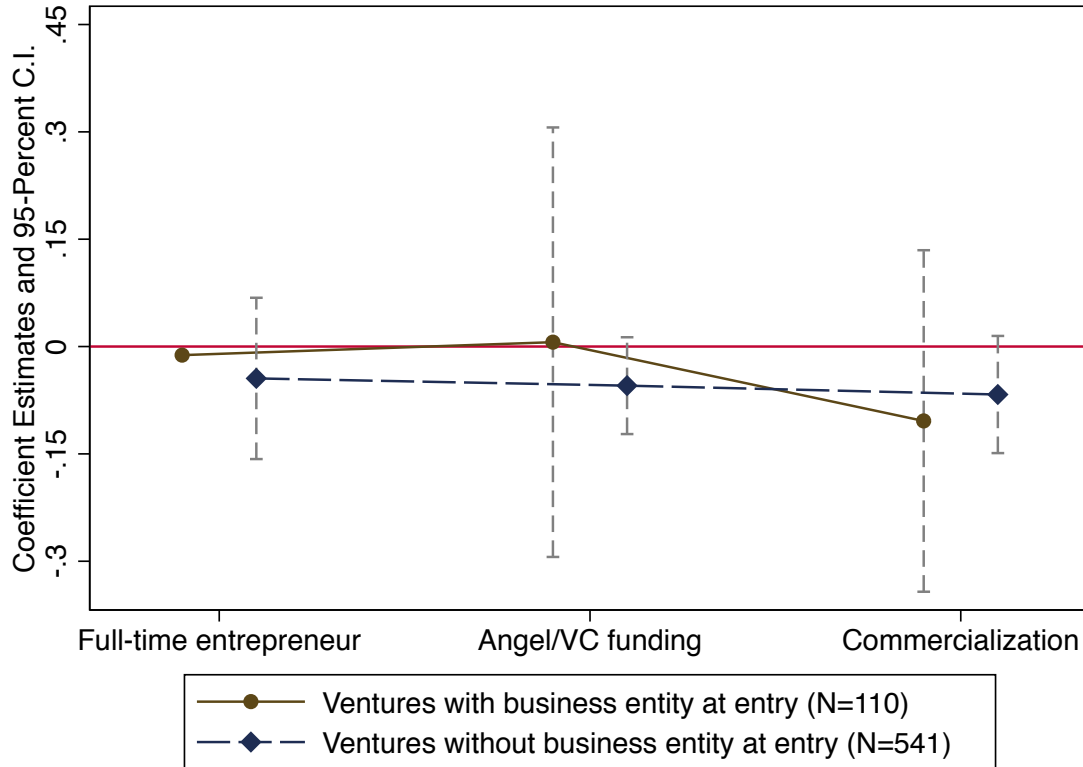
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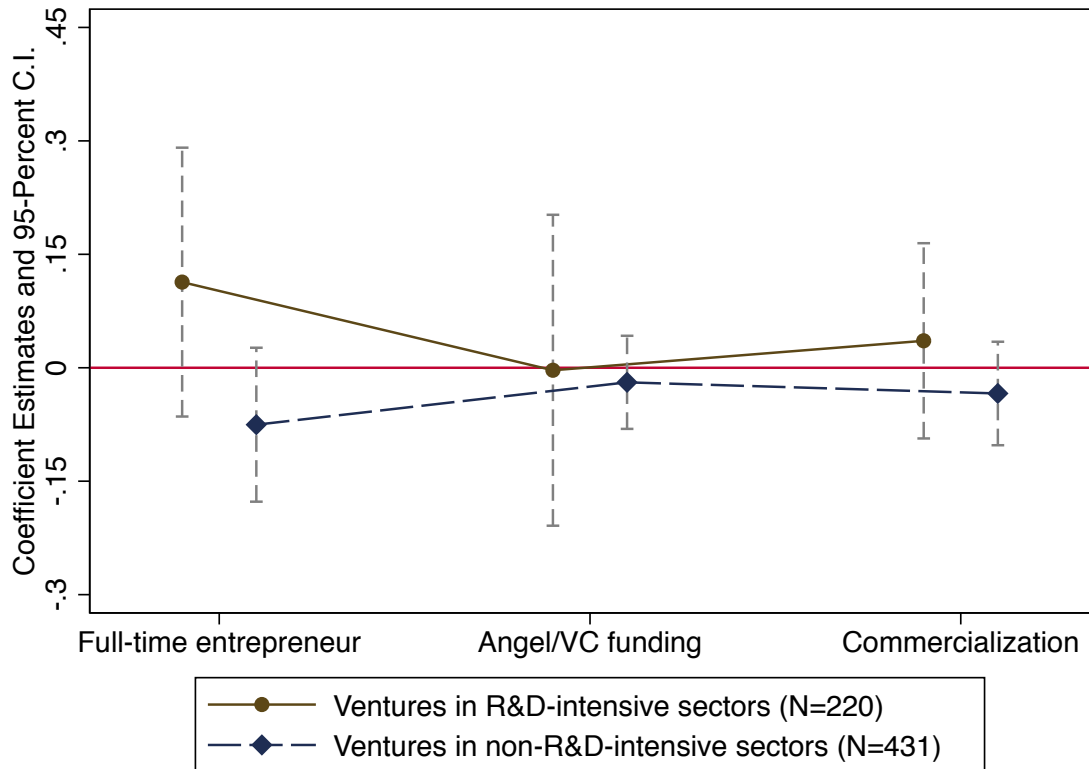
Appendix

Figure A.1: Estimated Gender Gap over the Venture Life-Cycle



Notes: This figure plots the marginal effects and 95-percent confidence intervals from Logit models with standard errors clustered by sector and year joined VMS. Each estimate plotted is from a separate regression where the dependent variable is whether the venture reaches a milestone and the independent variable is whether the primary entrepreneur is female. The sample consists of either ventures with business entity at entry (solid line with dots) or ventures without business entity at entry (dashed line with diamonds). All regressions include whether the venture has intellectual assets at entry, dummies for sector, quintile dummies for aggregate mentor interest (quintile defined within a sector), dummies for number of mentor meetings, and dummies for number of mentors met at least twice.

Figure A.2: Estimated Gender Gap over the Venture Life-Cycle



Notes: This figure plots the marginal effects and 95-percent confidence intervals from Logit models with standard errors clustered by sector and year joined VMS. Each estimate plotted is from a separate regression where the dependent variable is whether the venture reaches a milestone and the independent variable is whether the primary entrepreneur is female. The sample consists of either ventures in R&D-intensive sectors (solid line with dots) or ventures in non-R&D-intensive sectors (dashed line with diamonds). All regressions include whether the venture has intellectual assets at entry, whether the venture has a business entity at entry, dummies for sector, quintile dummies for aggregate mentor interest (quintile defined within a sector), dummies for number of mentor meetings, and dummies for number of mentors met at least twice.