

**Women & Early-Stage Entrepreneurship:
Examining the Impact of the Venture Funding Crisis on
Male and Female-Led Technology Start-Ups**

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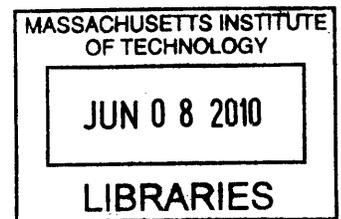
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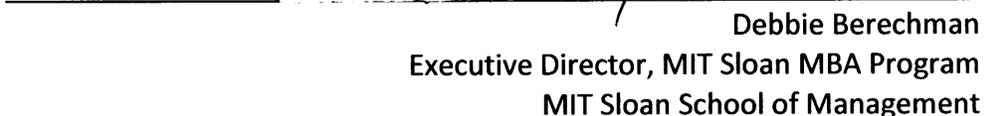
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ABSTRACT

Women in technology have always been a minority and the number of women who are founders of venture backed start-ups is even lower. This research empirically investigates venture capital funding received by entrepreneurs along the twin dimensions of gender and geography. The ideal experiment would have been to study the numbers of entrepreneurs who pitch their ideas to venture capitalists by gender, and correlate that number with attrition rates during each stage, and finally study the funding outcome, fully accounting for survivor bias. This data could not be accessed. Therefore, we decided to use the financial crisis of 2008 which resulted in illiquid capital markets as a proxy, and studied pre- and post-crisis funding outcomes. The study assumes Q3'08 as date of crisis. The results indicate that gender does not affect the chances of receiving follow-on funding.

The key factors that affected funding were the participation of reputed investors in the pre-crisis funding event, and geographic location of the venture. Men founders were more likely to receive follow-on funding in Massachusetts compared to women founders, while women had a significantly better chance of receiving funding in California compared to their male counterparts.

We then investigated the cause of the surprising results. Our analysis indicated that the majority of the women founders who received pre-crisis funding in California were either experienced entrepreneurs with prior founding experience, or possessed an advanced technical degree (Ph.D.). This was in sharp contrast to the women who founded technology companies in Massachusetts who were mostly first time founders, and the majority did not possess advanced technical degrees.

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INTRODUCTION

For technology entrepreneurs, venture capital is an important source of funding for ongoing operations of their enterprise. Repeated studies have shown that gender diversity at the highest levels yields improved outcomes for the company. Yet, most venture backed technology companies are founded solely by men, and only a small minority of venture backed companies are founded by women (Padnos, 2010).

Reasons for the paucity of women receiving venture capital (VC) have been hypothesized. These range from a lack of sufficiently qualified women, to a lack of sufficient social capital and an innate preference for “female-typed” industries such as retail and service industries (Du Rietz & Henrekson, 2000) that preclude venture investment. Each of these theories have either been debunked over time, or the statistics show a gradual improvement. For instance, women constituted 40% of Science and Engineering graduates in 2006, 27% of the science and engineering workforce in 2007 (NSF, 2010). Yet, they received less than 10% of venture funding (Padnos, 2010). Other studies have shown that there are increasingly larger numbers of qualified women (Goldin, 2006), with increasing social capital who are interested in building technology product companies. Yet, the rate of venture funding has not kept pace with the rate of improvement in the statistics.

A recent study (Mayer, 2008) showed that women-owned technology firms have a higher representation in California (Silicon Valley), and that Massachusetts (Boston) has the least representation of the four metro areas studied (Silicon Valley, Boston, Washington DC and Portland, Oregon). We investigate whether this trend has been sustained two years later, and whether there are any contributing factors that can potentially explain this trend.

Further, empirical studies on this topic of women-founded technology companies have suffered from survivor bias as they studied only surviving companies.

This research attempts to answer the following core questions eliminating survivor bias:

- Do similarly qualified founders of technology companies have the same continuing access to venture capital regardless of gender?
- Does the location of the venture affect founding outcomes and how does this vary by gender?
- What could be potential causes for any differentials observed?

We use the financial crisis of 2008 as a pivotal time to examine the differential impact of illiquid capital markets across two primary dimensions – gender and geography. The

study employs a dataset of 560 technology companies that received early stage funding in California and Massachusetts between 2006 and 2008 as data points.

The empirical analysis highlights three sets of results. The first set of results indicate whether or not a start-up received follow-on funding is independent of the founder's gender.

The second set of results indicate that the key factors that affect funding outcomes is the participation of reputed investors in the pre-crisis funding rounds, the time elapsed between the pre-crisis round and the crisis, and the geographic location of the venture. There is a strong positive correlation between the reputation of the investors participating in the early rounds and the probability that the venture received follow-on funding post-crisis. Also, greater the time elapsed between the pre-crisis round and the occurrence of the financial crisis, higher the probability of receiving follow-on funding.

Both of these findings are consistent with common observation – reputed VCs are more selective and have deeper pockets to fund their portfolio companies. The greater the time lapse between a funding event and crisis date (Q3'08), higher the probability that a venture will seek (and receive) a subsequent round of funding post crisis. A venture located in California has a higher likelihood of receiving follow-on funding, and is consistent with the observation that California is home to five times as many ventures as Massachusetts and twice as many venture capital firms.

The third set of results indicate that men founders are more likely to receive follow-on funding in Massachusetts compared to women founders, while women have a better chance of receiving funding in California compared to their male counterparts. This finding is unusual and we therefore examine potential reasons.

The remainder of this thesis presents a survey of literature, and a derivation of empirical predictions of the probability of receiving a follow-on round of funding post-crisis, controlling for different variables. These empirical results are followed by an exposition of the data. A final discussion section concludes the thesis.

PRIOR LITERATURE AND HYPOTHESIS DEVELOPMENT

This section surveys the literature on financing strategies adopted by women founded technology companies, findings on key variables such as education levels and geographic location, and other literature that has already addressed the commonly perceived reasons for why there are fewer women founding technology companies. It also surveys literature that suggests social and human capital and prior founding experience contribute to venture performance and thereby funding outcomes.

There are only a few studies to date that examine the financing strategies of women-founded technology firms. A recent study (Robb & Coleman, 2009) cited earlier literature review done by Brierley from 2001. The Robb and Coleman study describes striking differences between women- and men-owned high-tech firms in terms of firm characteristics and financing strategy. They report that women-owned high-tech firms are more likely to be sole proprietorships or partnerships, home-based, less likely to have employees or own intellectual property, and smaller than men-owned firms in their first year of operations in terms of average total assets, revenues and profits. They further report that over time, women-owned firms made progress in terms of developing intellectual property, which can be a competitive advantage and in raising substantial amounts of capital to sustain their firms. Despite this development, women-owned firms continue to lag men-owned firms in developing external sources of equity capital that could be used to fund future growth. It is therefore important to study whether this discrepancy persists once the women founders have succeeded in raising an early round of funding, and are seeking a follow-on round to grow their ventures.

A study by Carter, et al, (Brush, Carter, Gatewood, Greene, & Hart, 2002) highlighted and dispelled eight myths about women and equity capital. The eight myths are:

1. Women don't want to own high growth businesses
2. Women don't have the right educational backgrounds to build large ventures
3. Women don't have the right types of experience to build large ventures
4. Women aren't in the network and lack social contacts to build a credible venture
5. Women don't have the financial savvy or resources to start high growth businesses
6. Women don't submit business plans to equity capital providers
7. Women-owned ventures are in industries unattractive to Venture Capitalists
8. Women are not a force in the Venture Capital industry

This outcome is supported by conclusions in the Padnos study (Padnos, 2010). It is fair to assume that women who have founded ventures which have received an early round of funding have already overcome any lingering biases. It then becomes interesting to study whether there is an observable difference in follow-on funding outcomes in the absence of these gender-based biases.

A Kauffman Foundation study (Wadhwa, Freeman, & Rissing, 2008) showed that 47% of U.S.-born technology company founders hold advanced degrees. A NSF study (NSF, 2008) reported that 45.7% of Master's degrees in Science and Engineering were awarded to women. Another study (Carter, Brush, Greene, Gatewood, & Hart, 2003) showed that only graduate education significantly influenced the odds of women using outside equity financing. Given these findings, it is particularly noteworthy that a study (Hsu, 2007) confirms that founding teams with a doctoral degree holder are more likely to be funded via a direct VC tie and receive higher firm valuations, suggesting a signaling effect to external resource providers. This paper also suggested that prior

entrepreneurial founding experience is positively related to VC valuation and therefore funding outcomes.

There is also earlier literature that relates educational and management experience to receiving financial resources. In a 1994 study (Robinson & Sexton, 1994), the educational attainment is correlated with the munificence of received financial resources in entrepreneurial ventures. Education and work experience are also linked with venture growth (Colombo & Grilli, 2005) and opportunity costs, which in turn shape entrepreneurial thresholds for staying in business. We therefore thought it important to study whether education levels and prior founding experience also affect follow-on funding outcomes.

A 2004 study (Hanson & M., 2004) suggests that women-owned firms in high tech. that are not located in core areas of the industry might encounter problems getting support, gaining access to market and gaining access to important business information. A study by Mayer (Mayer, 2008) concludes that sectoral and spatial segmentation are powerful dynamics that shape business ownership by women in high technology. An individual's prior experience and skills directly affect the type of firm an entrepreneur starts (sectoral segmentation). Further, she points out that a locality's social structure and gender culture are important place-based determinants of women's ability to function as business owners (spatial segmentation). The paper reports that women-owned firms are best represented in Silicon Valley (15.14% of all firms surveyed) and least represented in Boston (9.34% of all firms surveyed). Given these findings, we thought it very important to understand if this trend persists, and whether it strengthened or weakened in follow-on funding rounds.

Hypothesis 1

Ventures will have better chances of raising a post-crisis follow-on round in California than Massachusetts. Our reasoning is as follows:

There are more than twice as many investors in California (N=174) compared to Massachusetts (N=77). Therefore it follows that the odds of raising a follow-on round in California is higher than the odds of raising follow-on funding in Massachusetts regardless of gender.

Hypothesis 2

Having a reputed investor in an early round affects the chances of a venture receiving follow-on funding. Our reasoning is as follows:

Reputed investors see a higher quality as well as quantity of deal flow, and are therefore more selective. They have deeper pockets to finance their portfolio companies. Therefore, the participation of a reputed investor in an early round should improve the odds of receiving follow-on funding for portfolio companies.

Hypothesis 3

Once a founder has successfully raised an early round of funding, gender should be irrelevant when attempting to raise follow-on rounds. Our reasoning is as follows:

Since all the traditional reasons why women receive venture funding at lower rates have already been accounted for, there should be no difference in follow-on funding outcomes based on gender.

DATA

The ideal experiment to test these hypotheses would have been to study the number of entrepreneurs who pitch their ideas to venture capitalists sorted by gender, geography and industry sub-sector, analyze the attrition rates during each stage of the funding process, before studying the final funding outcome. A study of this nature would have completely accounted for survivor bias. VC firms were unwilling to share data on the nature of their deal flow, and we were therefore unable to use this approach.

Therefore, we decided to use the financial crisis of 2008 which resulted in illiquid capital markets as a proxy, and studied pre- and post-crisis funding outcomes. Specifically, we took the third quarter of 2008 as the pivotal point in time, and define the time prior to Q3'08 as "pre-crisis" and the time period Q4'08 and later as "post-crisis".

A sample of early stage start-ups was required to test these hypotheses. To gather this data, we queried the Thomson Reuters VentureXpert database. The database was queried for all startups founded in Massachusetts and California that received their first round or early stage of funding from a Venture Capital Investor between January 1, 2006 and January 1, 2008. The resulting data set consisted of 560 high technology startups that were founded in California and Massachusetts.

Only those startups classified under the Venture Economics Industry Classification (VEIC) code of 1000 which lists all companies classified as "Information Technology" were counted. The following sub-categories were listed under VEIC code 1000: Communications (1000), Computer Hardware (2100), Computer Software (2700), Internet Specific (2800), Other Computer (2900) and Semiconductor/Electronics (3000).

We then defined an industry subsector labeled “Software” which comprised of all companies that were listed under VEIC 2700 and 2800 codes.

For each startup in the data set, the Capital IQ database was used to identify the names of the company’s founders since VentureXpert data frequently listed only some of the founders of the venture. In those instances when Capital IQ did not have any records for the management team, a Google search was the next resort. The ventures whose founders could not be identified at this stage were listed as “Founder Unknown”.

The companies whose founders were unknown were classified as male- or female-founded depending on probability of occurrence in the overall population. There were 53 women-founded companies and 507 men-founded companies in our sample. Therefore every tenth company whose founder was unknown was classified as a woman-founded company.

Once the founders were identified, each company was coded by hand as a “male-founded” or “female-founded” startup. A startup was classified as female-founded if even one of the co-founders in a venture with multiple co-founders was a woman. There were a total of 53 female-founded start-ups and 507 male-founded start-ups in our study.

We then went back to the Thomson Reuters VentureXpert database to identify those ventures from our list of 560 companies that had received follow-on round of funding between January 1, 2008 and March 22, 2010. The companies were further classified as having received funding before Q3’08 (pre-crisis) and Q4’08 and later (post-crisis). There were a total of 369 funding events between Q1’08 and Q3’08, and 237 funding events Q4’08 and later.

It is important to note that number of funding events do not have a one-to-one mapping with the number of companies funded – a venture could have potentially received multiple rounds of funding within the time period studied, and each round of funding was counted as a unique funding event.

For every female-founded startup, male-founded peer companies were identified and added to the “control group” in a two step process:

First, the VEIC codes (1000, 2100, 2700, 2800, 2900, 3000) for the female-founded company were identified and used to index all male-founded companies listed under the same VEIC code. These indexed companies were a subset of the original superset of all male-founded companies.

Second, we identified those companies in the subset that shared at least one of the same investors as the female-founded startup. This much smaller subset of male-

founded startups comprised the control group for our study. There was a total of 148 male-founded start-ups in the control group for 53 female-founded start-ups.

The follow-on funding outcomes of every company in the dataset was also studied to generate population level statistics for California and Massachusetts. Table 1 provides summary statistics and variable definitions.

The remainder of this section contains a description of the variables used in the empirical analysis.

Table 1
Summary Statistics and Variable Definitions

Variable	Definition	Mean	Standard Deviation
Dependent Variables			
(1) Post-crisis funding Q1'08	Dummy = 1 if start-up received funding between Q1'08 and Q3'08	0.659	0.474
(2) Post-crisis funding Q4'08	Dummy = 1 if start-up received funding between Q4'08 and Q1'10	0.423	0.495
Independent Variables			
(3) Gender	Dummy = 1 if start-up has at least one woman on the founding team	0.095	0.293
(4) Geography	Dummy = 1 if start-up was founded in California	0.834	0.372
(5) Software	Dummy = 1, if start-up was classified under VEIC codes 2700 or 2800	0.663	0.473
(6) Reputed Venture Capital Investor	Dummy = 1, if start-up received pre-crisis funding from a highly rated VC	0.488	0.500
(7) Dollars Raised	Money raised in the last funding event prior to Q3'08 (\$M)	6.214	6.780
(8) Time Elapsed	Time elapsed in months between last funding event and Q3'08	11.188	7.777

Dependent Variables

The variable *post-crisis funding Q1'08* indicates whether a start-up received a follow-on round of funding between Q1'08 and Q3'08. 65.9% of the start-ups in our sample received follow-on funding during this period.

The second dependent variable *post-crisis funding Q4'08* indicates whether a start-up received a follow-on round of funding between Q4'08 and Q1'10. 42.3% of start-ups in our sample received follow-on funding during this period.

Independent Variables

The variable *gender* is a dummy variable that is set equal to 1 if the company had at least one woman on the founding team. 9.5% of the companies in the sample qualified as a female-founded ventures using this criterion. Of a total of 53 female-founded ventures, 11 were founded in Massachusetts and 42 were founded in California.

The variable *geography* is a dummy variable that is set equal to 1 if the company was physically located in California. A value of 0 was assigned to those start-ups that were located in Massachusetts. 83.4% of the ventures studied were founded in California. Of the 560 companies in our sample, 93 were founded in Massachusetts and 467 were founded in California.

The variable *software* is a dummy variable that is set equal to 1 if the venture was classified under VEIC codes of 2700 or 2800 in the Thomson Reuters VentureXpert database. There were 371 companies categorized under “software” and 66.3% of all the companies in our sample were “software” ventures.

The variable *reputed venture capital investor* is a dummy variable that is set equal to 1 if any of the investors in the pre-crisis round for a venture satisfied specific criteria. 48.8% of the ventures in our sample received funding from a reputed venture capital investor in at least one of their pre-crisis funding events.

Prior literature (Hsu, 2004) uses investment experience, age (Gompers, 1996) and the VC's information network (Sorenson & Stuart, 2001) as a proxy for a VC's reputation. In accordance with prior literature, we decided to designate investors with a ranking greater than 3.0 (out of 5.0) on TheFunded.com as of April 2010 as a reputed investor. Since the reviews on TheFunded.com are provided by entrepreneurs who reflect upon their fundraising experience, and established investors have more reviews than newcomers, we believe this is an excellent proxy for investor reputation. The list of investors who invested in our sample companies and were classified using the above method as “reputed investors” is provided in the appendix.

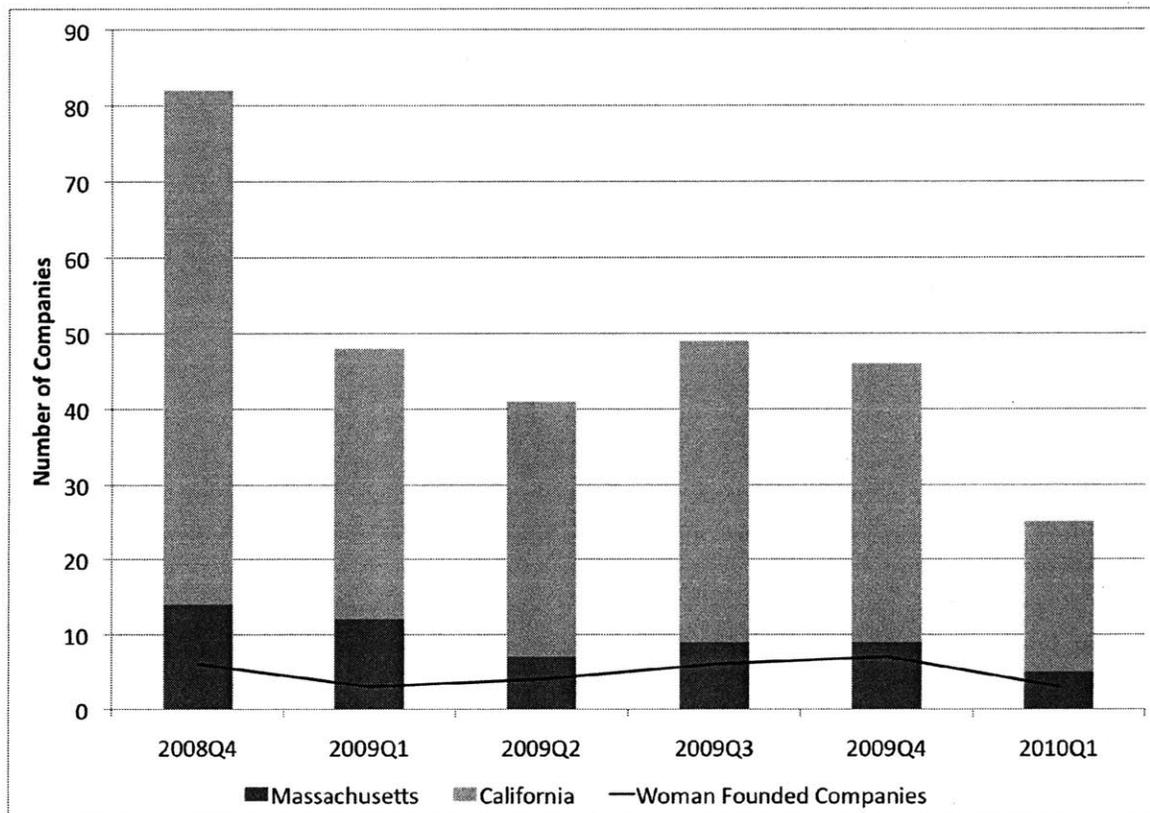
The variable *dollars raised* indicates the amount of money raised in the last funding event for a given venture, prior to the crisis date (Q3'08). The average amount raised was \$6.214M.

The variable *time elapsed* indicates the time between the last round of funding a venture received before Q3'08 and the crisis date of Q3'08. An average of 11.2 months elapsed between the last funding event and date of crisis.

EMPIRICAL RESULTS

Figure 1 summarizes funding events per quarter after the financial crisis from Q4'08 to Q1'10.

Figure 1 Plot of Follow-on Funding Outcomes After Q3'08



We started by examining simple univariate comparisons of ventures founded by women in Massachusetts and California (N=53), against the larger sample of ventures founded by all-male founding teams in both geographies (N=507).

Panel A in Table 2 reports conditional means and tests of differences for women-founded ventures in each geography versus men-founded ventures for any follow-on funding received between Q1'08 and Q3'08. The data shows that women-founded ventures in Massachusetts had a lower probability of receiving follow-on funding after Q1'08 at a significance level of 18.1%.

There is no statistically significant difference in means for entrepreneurs of either gender who received follow-on funding in Q1'08 in California.

There is also no statistically significant difference between the genders of entrepreneurs who sought follow-on funding after Q3'08 for the overall sample of 560 companies.

Panel B in Table 2 reports conditional means and tests of differences for women founded ventures in each geography versus men founded companies for any follow-on funding received after Q3'08, the date of crisis. Female founders in Massachusetts were significantly less likely to receive follow-on funding when raising money after Q3'08. This is statistically significant at a level of 12.1%. There is no statistically significant difference between the genders when raising follow-on funding in California.

Considering the entire sample of 560 companies regardless of geography, there is no statistically significant difference between the genders when seeking follow-on funding after Q3'08.

Table 2
Univariate Difference in Means Tests: Women-Founded Ventures vs. Male-Founded Ventures

	Women-Founded Start-ups	Men-Founded start-ups	Significance Level
(Panel A) Women-Founded vs. Men-Founded (Q1'08)			
MA	0.909 (N=11)	0.720 (N=82)	<u>18.10%</u>
CA	0.691 (N=42)	0.638 (N=425)	49.70%
CA + MA	0.736 (N=53)	0.651(N=507)	21.52%
(Panel B) Women-Founded vs. Men-Founded (Q4'08)			
MA	0.3 (N=11)	0.561 (N=82)	<u>12.10%</u>
CA	0.476 (N=42)	0.393 (N=425)	29.50%
CA + MA	0.453 (N=53)	0.420(N=507)	64.70%

We then examined univariate comparisons of ventures founded by women in Massachusetts and California against a narrow control group.

Panel A in Table 3 reports conditional means and tests of differences for women-founded ventures in each geography versus the control group for any follow-on funding received between Q1'08 and Q3'08. The data shows there is no statistically significant difference based on gender of founders in either location when raising a follow-on round in this period.

Panel B in Table 3 reports conditional means and tests of differences for women-founded ventures in each geography versus the control group for any follow-on funding received after Q3'08, the date of crisis. Female founders in Massachusetts were significantly less likely to receive follow-on funding when raising money after Q3'08. This was statistically significant at a level of 13.6%. There is no statistically significant difference between the genders when raising follow-on funding in California.

Considering the entire sample of 560 companies regardless of geography, there is no statistically significant difference between the genders when seeking follow-on funding.

Table 3
Univariate Difference in Means Tests: Women-Founded Ventures vs. Control Group

	Women-Founded Start-ups	Control Group	Significance Level
(Panel A) Women-Founded vs. Control Group (Q1'08)			
MA	0.909 (N=11)	0.727 (N=11)	29.10%
CA	0.691 (N=42)	0.723 (N=137)	68.80%
CA + MA	0.736 (N=53)	0.723(N=148)	85.77%
(Panel B) Women-Founded vs. Control Group (Q4'08)			
MA	0.3 (N=11)	0.636 (N=11)	<u>13.60%</u>
CA	0.476 (N=42)	0.467 (N=137)	91.88%
CA + MA	0.453 (N=53)	0.479(N=148)	73.80%

However, since these descriptive results do not control for a variety of factors, the remaining empirical analysis focuses on a more systematic analysis performed using logistic regressions. A logistic regression model allowed us to establish a relationship

between a binary outcome variable and the independent variables. We modeled the logistic-transformed probability as a linear relationship with the independent variables.

Since the descriptive results indicated that gender is not a factor in receiving follow-on funding, we decided to focus on other contributing factors. Table 4 examines the odds ratios of different independent variables affecting follow-on funding outcome after Q3'08, and their levels of significance.

Prior literature (Mayer, 2008) shows that women-owned technology firms have a higher representation in California than in Massachusetts. We therefore decided to study if geography is a significant variable that affects follow-on funding outcomes.

The first column Model (4-1) reports the baseline case where only *geography*, *software* and *gender* are evaluated against the odds of receiving follow-on funding after Q3'08. Only the *geography* variable is statistically significant at the 98% level and indicates that the odds of receiving follow-on funding is 74.1% higher if the venture were founded in California. *Gender* and *Software* are statistically insignificant.

This finding confirms Hypothesis 1.

Table 4
Q4 Follow-on Funding Logistic Regression

Independent Variables	Dependent Variable = P(Getting follow on funding post Q3'08)			
	Entire Sample N=560			
	Odds ratio for Model (4-1)	Odds ratio for Model (4-2)	Odds ratio for Model (4-3)	Odds ratio for Model (4-4)
Gender	1.178 (P=0.579)	1.027 (P=0.929)		0.964 (P=0.908)
Dollars raised in last pre-crisis funding event				1.003 (P=0.815)
Software	0.753 (P=0.120)			0.777 (P=0.191)
Time elapsed since last pre-crisis funding event			1.036 (P=0.002)	1.034 (P=0.005)
Reputed Venture Capital Investor		1.672 (P=0.003)	1.584 (P=0.009)	1.417 (P=0.064)
Geography	1.741 (P=0.02)		1.529 (P=0.07)	1.597 (P=0.053)

Since reputed venture capital investors have a better deal flow on both quantitative and qualitative dimensions, we decided to next investigate whether the variable *reputed venture capital investor* was a significant factor in follow-on funding outcomes.

The second column Model (4-2) reports a different baseline case where only *reputed venture capital investor* and *gender* are evaluated against the odds of receiving follow-on funding after Q3'08. Only the *reputed venture capital investor* variable is statistically significant at the 99% level and indicates that the odds of receiving follow-on funding is 67.2% higher if the venture was backed by a reputed investor in its pre-crisis rounds. *Gender* is statistically insignificant as suggested by our descriptive results.

This finding confirms Hypothesis 2.

The third column Model (4-3) adds key control variables of *geography* and *time elapsed since last pre-crisis funding event* to the *reputed venture capital investor* variable. This reports that the time elapsed since last pre-crisis funding event improves the odds of getting follow-on funding 3.6% and that having a reputed investor improves the odds 58.4% while being located in California improves the odds 52.9%. This data was significant at the 99% level.

These findings are consistent with our prior findings and it is to be expected that greater the time lapse between pre-crisis funding event and funding date, greater the odds of a venture seeking (and therefore receiving) a follow-on funding round post-crisis.

Finally, the fourth column Model (4-4) describes the full set of independent variables. This reports results that are consistent with our earlier findings. The key factors influencing whether a start-up receives follow-on funding after the financial crisis are where the start-up is located, whether a reputed investor participated in the pre-crisis funding rounds, and marginally, the time elapsed between pre-crisis funding event and date of crisis.

A start-up located in California improved its odds 59.7%, the participation of a reputed investor improved the odds by 41.7% and the time elapsed improved the odds by 3.4%. These results were significant at the 99% level. Further, it reports that gender is irrelevant when attempting to raise follow-on funding.

This confirms Hypothesis 3.

DISCUSSION AND CONCLUSION

This study has examined the following questions:

- Do similarly qualified founders of technology companies have the same continued access to venture capital regardless of gender?
- Does the location of the venture affect founding outcomes and how does this vary by gender?

We have concluded that similarly qualified founders have ongoing access to venture capital at similar rates, and that there is no statistically significant difference between the genders.

Further, we confirmed that location of the venture does affect funding outcomes and it is easier to raise follow-on funding if the venture is located in California.

However, interestingly, the descriptive statistics in Tables 2 and 3 point to a counter-intuitive trend. It appears that women founders have an advantage even if the difference in means is statistically insignificant, when it comes to raising money in California compared to male founders. This surprising result caused us to investigate the cause further.

Prior literature (Hsu, 2007) and (Colombo & Grilli, 2005) indicates that prior entrepreneurial experience and education level of the founders has a significant effect on venture outcomes and thereby more likely to be funded. There is also literature (Shane & Stuart, 2002) that suggests social capital affects funding outcomes by facilitating access to financial resources. We therefore decided to use the size of women founders' networks on LinkedIn as a proxy for social capital, and coded a dummy variable that correspond to the education level of the female founders and prior entrepreneurial experience. This variable was set equal to 1 if the woman founder had a Ph.D. in an area related to the venture she founded, or had founded or co-founded ventures in the past.

We found that while the social capital for women founders in Massachusetts and California were similar, there is a significant difference in prior entrepreneurial experience and education levels.

Female founders in Massachusetts have an average of 161 LinkedIn connections while the average is 187 in California. The difference in means is statistically insignificant.

58% of female founders in California (N=42) had either founded or co-founded start-up ventures prior to their current venture, or else possessed a Ph.D. degree in an area related to their current venture. By contrast, only 33.33% of female founders in Massachusetts (N=11) had prior entrepreneurial experience or an advanced degree.

We believe this difference in the backgrounds of the women founders in the two geographies we studied explains why California appears to favor female founders more than male founders. Future studies should explore this further, and compare prior

entrepreneurial experience, education and social capital for male founders in each location against those of the female founders.

This study contributes in two ways to literature. First, it indicates the importance of a venture capital investor's reputation for start-ups seeking to raise early stage money. The implication is straightforward – having reputed investors participate in early rounds of funding greatly improves the odds of raising capital under adverse circumstances in the future.

Second, once female-founders successfully manage to raise an initial round of venture capital funding, their gender no longer affects them adversely when seeking follow-on rounds of funding. In fact, there appears to be a positive bias towards women founders seeking follow-on funding since the women who succeeded in raising early stage capital were extremely well qualified in terms of both education and prior entrepreneurial experience.

The following interpretational issues need to be kept in mind while considering these contributions:

First, the primary focus of this study is start-ups receiving early stage funding from venture capital investors. Angel investors are a very common source of early stage funding for technology companies, and the effects of receiving investment from angel investors is a topic for a future study.

Second, the data for this study for the pre-crisis period was drawn between January 1, 2006 and January 1, 2008, a period of 24 months. The date of the financial crisis used for this study was Q3'08, coinciding with the declaration of bankruptcy by Lehman brothers. As a result, the time period available post-crisis for this study was only 18 months. It would be worthwhile repeating this study after sufficient time has passed post-crisis to include more data points.

Third, this study does not control for the fact that founders who raised money shortly before the crisis may have had sufficient financial reserves, and therefore were not seeking to raise money in the 18 months post-crisis. This is reflected simply as a negative follow-on funding outcome in this study. A more nuanced study will control for this, and perhaps include a dummy variable to indicate whether or not the founders were seeking to raise a follow-on round.

Fourth, this study does not control for the fact that while there are slightly more than twice as many investors in California compared to Massachusetts, there were five times as many start-ups founded in California compared to Massachusetts. It would be worthwhile to study the capital distribution (size of VC funds versus amount disbursed to start-ups) and control for this in future studies.

Fifth, prior entrepreneurial experience and education levels were only tracked for the female founders. It would be interesting to study whether the funding outcomes are consistent with similarly qualified male founders, and whether there is any difference in the case of mixed-gender founding teams where only the male co-founder has an advanced degree or prior entrepreneurial experience.

Finally, it would be interesting to study the role of prior successful versus unsuccessful exits for experienced entrepreneurs of each gender in future studies. Each of these studies would further deepen our understanding of the role of gender, prior experiences of the entrepreneur, the type of investor, and geography in venture funding outcomes.

APPENDIX

List of reputed VCs from TheFunded.com, April 2010

.406 Ventures
Aberdare Ventures
Accel Partners
Alsop Louie Partners
Altos Ventures
Apex Venture Partners
Ascent Venture Partners
Atlas Ventures
Bain Capital Ventures
Banexi Venture
Benchmark Capital
Bessemer Venture Partners
Bloomberg Capital
BlueRun Ventures
Canaan Partners
Charles River Ventures
Clearstone Venture Partners
Commonwealth Capital Ventures
DAG ventures
De Novo Ventures
Draper Fisher Jurvetson
Edison Venture Fund
Emergence Capital Partners
Fairhaven Capital
First Round Capital
Flagship Ventures
Flybridge Capital
Foundation Capital
General Catalyst Partners
Genesis Partners
Globespan Capital Partners
GRP Partners
Greylock Partners
Highland Capital Partners
Hummer Winblad
HLM Venture Partners
Index Ventures

Inflexion Partners
Intel Capital
InterWest Partners
Javelin Venture Partners
Kepha Partners
Khosla Ventures
Kleiner Perkins Caufield & Byers
Leapfrog Ventures
MTDC
Maples Investments
Masthead Venture Partners
Mayfield Fund
Menlo Ventures
Momentum Venture Management
Morgenthaler Ventures
North Bridge Venture Partners
New Atlantic Ventures
New Enterprise Associates
Partech International
Polaris Venture Partners
Psilos Group
RRE Ventures
Rustic Canyon Ventures
Sequoia Capital
Sigma Partners
Spark Capital
Steamboat Ventures
Storm Ventures Inc.
SV Angel
Trident Capital
Trinity Ventures
True Ventures
Tudor Ventures
Union Square Ventures
Venrock
Versant Ventures
Village Ventures
Vista Ventures
Voyager Capital
Wellington Partners

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