

**Does Investor Gender Matter for the Success of Female Entrepreneurs?
The Signaling Effect of Gender Homophily in Entrepreneurial Finance**

KAISA SNELLMAN
INSEAD
Boulevard de Constance
Fontainebleau 77300
France

ISABELLE SOLAL
INSEAD
Boulevard de Constance
Fontainebleau 77300
France

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ABSTRACT

One proposed solution to closing the gender gap in venture capital is to encourage female investors to invest in female entrepreneurs. This paper explores how gender homophily affects the long-term success of male-founded and female-founded firms, defined as the continued ability to raise venture financing. Using longitudinal data on venture-backed firms in the United States and employing matching methods, we find that female-founded firms backed only by female investors are two times less likely to raise additional capital compared to those whose first-round investors include male venture capitalists. We find no equivalent effect for male-founded firms. We propose that when female entrepreneurs receive funding from female investors, the market interprets this as an expression of diversity activism, rather than as a signal of quality. We test this explanation in an experimental setting and show that a female-female investment relationship produces a competence discount for the female entrepreneur, leading to lower evaluations of quality for female, but not male founders.

Keywords: Diversity; Economic Sociology; Empirical: Quantitative

INTRODUCTION

Women are underrepresented in the technology industry and among funded entrepreneurs in particular (Gompers and Wang 2017). Less than three percent of venture capital funds go to ventures led by female CEOs (Brush et al. 2014), and female entrepreneurs are 63 percent less likely than men to obtain venture capital financing (Guzman and Kacperczyk 2019). One proposed solution to level the playing field is to increase female participation on the venture capital (VC) side, as research suggests women are far more likely than men to invest in female entrepreneurs (Ewens and Townsend 2019; Greenberg and Mollick 2017). However, little is known about how gender homophily affects startup outcomes, especially for female-led ventures. We address this gap by investigating how gender homophily influences the continued ability of startups to raise venture financing.

Raising funds from a VC investor reduces audience uncertainty about the entrepreneur and her firm by providing a signal of quality (Sorenson and Stuart 2008; Stuart, Hoang, and Hybels 1999). An affiliation with an investor effectively indicates to the market that the investor possesses some private information about the venture and allows observers to rely on the investor's evaluation of quality. Providing strong signals of quality is especially important for female entrepreneurs, as success in entrepreneurship is typically associated with male-typed traits (Bird and Brush 2002; Buttner and Rosen 1988; Gupta et al. 2009), and being female or exhibiting feminine characteristics tends to be associated with lower perceived quality, or the application of different standards of assessment (Balachandra et al. 2017; Bigelow et al. 2014; Brooks et al. 2014; Kanze et al. 2017; Malmström, Johansson, and Wincent 2017). Strong signals of quality can help women counteract competence stereotypes and reduce the gender gap in evaluation (Thébaud 2015; Tinkler et al. 2015).

When both the investor and the entrepreneur are female, however, venture capital financing may not possess the same signaling value. Observers might infer that the investment decision was not based purely on an assessment of quality but influenced by the female investors' desire to support female entrepreneurs. In other words, in the case of female-female investment relationships, the investment could be interpreted as an expression of diversity activism, rather than as a signal of quality. If that is the case, the venture is likely to be less successful in raising subsequent capital from other investors.

Using data on 2,136 venture-backed startups in the United States, we explore the relationship between the gender of first round investors and the likelihood that the firm is able to raise a second round of capital, for male and female-founded firms. We find that firms with female founders who received funding from female rather than male VC partners are two times less likely to raise additional financing. There is no investor gender effect for firms with all-male founding teams. We investigate alternative explanations based on differences in actual – rather than perceived – quality of the startup or of the investor by using matching techniques to compare equivalent male-founded and female-founded firms, and investments made by male and female investors. We also replicate our results in an experimental study with MBA students, where we vary entrepreneur and investor gender while keeping the quality of the business constant. We find that pitches by female-backed female entrepreneurs received lower evaluations compared to all other conditions, and that this was driven by lower perceptions of entrepreneur competence.

We contribute to the literature on gender homophily (Brass 1985; Burt 1998; Ibarra 1992, 1993; Ragins and Cotton 1999) by showing that gender homophily in endorsement relationships – specifically in the context of early-stage investments – has negative consequences for women. We extend prior work by proposing a new mechanism through which homophily may disadvantage women. Specifically, we argue that gender homophily in the investment relationship can lead to negative consequences for female entrepreneurs if it is seen as a signal of diversity activism rather than as a signal of quality. Moreover, our research builds on the signaling literature that examines how additional cues surrounding the signal affect its interpretation and consequences (Hubbard et al. 2018). We show that characteristics of the parties must be examined together rather than separately to determine their effect on the signaling value of social ties, and in this way also contribute to research on the symbolic role of affiliation (Bielby and Bielby 1999; Podolny 1994; Stuart et al. 1999).

We further speak to research on gender and entrepreneurship by highlighting an additional path through which gender-biased evaluations structure the market for entrepreneurial capital (Greenberg and Mollick 2017; Guzman and Kacperczyk 2019), and suggest that the source of capital can be a key factor in eliminating or exacerbating the gender funding gap. Finally, we provide insight into the relationship between female representation and outcomes for women (Cohen and Broschak 2013; Cohen

and Huffman 2007; Srivastava and Sherman 2015), suggesting that the presence of women among decision-makers can be harmful to other women not because women will not advocate for each other, but because when they do it will provoke negative reactions from observers. This may erect barriers to success not just for female advocates (Hekman et al. 2017) but, as we show, for those whom they champion.

This research has important policy implications. Our results show that placing the burden on women to reduce the gender gap in entrepreneurship or in any other context is counter-productive, given audiences' reactions when women advocate for other women. Female founders may indeed find it easier to raise capital from female investors. However, until they can convince a male investor to come on board, they will find it much harder to continue to grow their business. Female investors will likewise be disadvantaged if they are slotted into the role of investing primarily in female-founded businesses. Thus, while well-intentioned, initiatives aimed at increasing female investment in women-led firms may ultimately undermine the future success of women on both sides of the market. One potential solution, based on our research, would be to promote inclusive investing, where male and female investors are encouraged to join forces to support promising female entrepreneurs.

Gender homophily as a signal

When quality is difficult and costly to observe, evaluators tend to rely on external cues to make inferences about an individual or firm (Akerlof 1970; Spence 1973, 1974). An entrepreneur's most pressing concern is to access essential resources, notably financial capital, but this requires her to overcome information asymmetries that prevent prospective investors from assessing the quality of the business. One solution is to signal quality through human capital indicators, such as education credentials or the status of former employers (Beckman, Burton, and O'Reilly 2007; Burton, Sørensen, and Beckman 2002; Higgins and Gulati 2006). Affiliations with prominent partners (Baum and Oliver 1991; Gulati and Higgins 2003; Stuart et al. 1999), especially venture capital investors, are also important signals (Sorenson and Stuart 2008).

This signaling function is critical in the very early stages of new venture development, when entrepreneurs are actively raising capital. Because of the uncertainty and agency costs inherent in entrepreneurial financing, equity investments are structured in stages, or rounds (Gompers 1995).

Typically, entrepreneurs and existing investors seek to attract new investors for each round (Gompers 1995; Hallen and Eisenhardt 2012). Thus, the quality of early-stage ventures is constantly being re-evaluated, based on information that becomes available from one round to the next. But finding and selecting investment targets is difficult as nascent ventures lack hard assets, revenues, and reputation (Bernstein, Korteweg, and Laws 2017; Gompers et al. 2019). Investors will therefore look for signals that are indicative of quality. In very early rounds, the identity of the investor is one of the few signals that potential future investors can rely on when assessing the viability of the business (Davila et al. 2003; Lerner 1994).

A signal, to communicate quality, must not only be transmitted but also received and decoded by the intended audience (Plummer, Allison, and Connelly 2016; Pollock and Gulati 2007). The same signal may be interpreted differently depending on additional information available to the observer. For example, a signal may provide less information than it usually would because the timing of the signal or prevailing market conditions mean that the audience will find it less revealing of quality than would otherwise be the case (Gulati and Higgins 2003; Lee, Pollock, and Jin 2011). The existence of multiple signals can also make one of them redundant (Ozmel, Reuer, and Gulati 2013; Pollock et al. 2010). In other cases, signals may reinforce each other. One study found that venture capital investment could reduce audience uncertainty about other signals of quality, like the founder's prior managerial experience, by drawing attention to it and painting it in a positive light (Plummer et al. 2016).

Multiple, concurrent signals can give contradictory information about the individual or the firm, leaving the audience to make sense of them. In some cases, audiences may be able to reconcile conflicting signals. Someone who signals the experience of a generalist and the identity of a specialist may be able to leverage the benefits of both while avoiding their pitfalls (Kacperczyk and Younkin 2017). More often, though, observers will make sense of contradictory signals by prioritizing one over the other. Thus, social movement activists use protests to signal to corporate stakeholders that something about the firm is amiss, but that signal may have no effect if positive press coverage has already shaped investor beliefs (King and Soule 2007). Similarly, while the presence of female directors on a board usually signals that a firm cares about diversity, investors may look to the firm's relatively poor

performance on diversity issues and conclude that gender does not factor into its director selections (Solal and Snellman 2019).

Relatedly, while venture capital investments usually signal quality, observers may assume that when a female investor invests in a female entrepreneur, she is engaging in some form of diversity activism, whereby women are making a conscious choice to support other women in order to help them overcome traditional gender barriers (Greenberg and Mollick 2017). Female-female pairings occurring in male-typed contexts are more likely to be perceived as illegitimate expressions of favoritism stemming from a desire to create “female coalitions” (Ragins 1989:11; see also Loyd and Phillips 2006). Given the double standards of assessment that women are evaluated against in male-dominated fields (Correll et al. 2007; Foschi 1996, 2000), the female investor’s decision will be read less as a signal of the entrepreneur’s quality, and more as an indication of the investor’s inability to discern or unwillingness to uphold the proper standards (Duguid, Loyd, and Tolbert 2012). For male founders, however, gender homophily is not likely to affect the interpretation of the investment as a signal of the underlying quality of the firm. Most venture capitalists are men, as are most entrepreneurs. Thus, a male investing in a male is the norm in this context and should receive the standard interpretation.

Overview of studies

We first explore how the gender of an early backer affects outcomes for male and female entrepreneurs using data on first-round venture capital investments in the United States, and find that receiving financing only from female investors is associated with lower chances of successfully raising additional capital for female-founded, but not male-founded firms. We argue that this result illustrates differences in perceived quality for female-backed female founders, compared to other entrepreneur-investor pairings.

To separate sorting and treatment effects, we implement coarsened exact matching (CEM) methods on a sample of female-founded and male-founded firms and then on a sample of female-founded firms backed by either a male or a female VC. The first matched sample analysis helps us address the possibility that the female-female penalty we uncover could be due to differences in venture type or actual quality. That is, founder gender may be correlated with underlying differences in venture characteristics that predict fundraising outcomes. For example, female-founded firms may raise smaller

initial rounds, leading them to grow at a slower rate. They may also operate in industries that are less appealing to venture capital investors (Guzman and Kacperczyk 2019). The second matched sample, meanwhile, helps us deal with the concern that female investors may be less proficient in selecting ventures for investment, or less able to add value to their portfolio firms, which would account for differences in the ability of the firms they invest in to attract additional funding.

In our second study, we test the effect of investor gender on audience perceptions of entrepreneurs and their ventures directly, using an experimental design. We manipulate entrepreneur and investor gender while keeping quality constant, and ask MBA participants to evaluate fictional pitches. In this way, we are able to tease out the effect of gender on perceptions of the prior endorsement as a signal of quality, from the possible confounding effects of objective quality differences.

STUDY 1: INVESTOR GENDER AND FUNDRAISING OUTCOMES

Empirical setting and sample

We investigate the relationship between the gender of first round investors and the likelihood that male and female-founded firms are able to raise a second round of capital, using data on early-stage VC investments in the United States. We collected the data from Crunchbase, a database operated by the media company Tech Crunch that contains detailed information on startups, founders, and investors, collected from news publications, venture capital firms, executives, entrepreneurs, and investors. Since its founding in 2005, Crunchbase has become a leading provider of data on startups and investment activity in the United States. It is widely used by industry experts, and increasingly by academics (Hallen, Davis, and Yin 2017; Ter Wal et al. 2016).

To ensure that we had a large enough sample of female-founded firms, we started by sampling all female-founded firms that received their first round of financing between January 1, 2010, and April 13, 2018.¹ This yielded a total of 1,760 firms that we define as “female-founded.” We complemented this with a random sample of 10,000 firms with all-male teams. We then restricted the sample to firms for which an individual venture capital partner was identified as being involved in the first round of funding, to allow us to test investor gender effects on the firm’s fundraising outcomes. Firms for which

¹ We chose this time frame to exclude fundraising efforts affected by the financial crisis in 2008 and its aftershocks in 2009.

an individual partner was not listed raised capital from investors such as accelerators, angel investors, or corporate venture capital entities. Based on this approach, we identified 390 female-founded and 2,222 male-founded firms, which, after accounting for missing data, resulted in a final sample of 2,136 firms, of which 290 are female-founded.

Measures

Our key outcome variable is a dichotomous indicator of whether a venture raised a second round of financing. Second-round financing constitutes a more proximate measure of the impact of early-stage investors than exit outcomes such as initial public offering (IPO) or acquisition, and has been used in prior work on the role of venture capitalists (Ter Wal et al. 2016). Growth-oriented startups typically require several rounds of funding to sustain them prior to achieving profitability or a successful exit. At each round, investors re-evaluate the probability of the firm reaching a successful exit, and maintain the option to discontinue funding ventures with bleak prospects (Gompers 1995). Raising a second round of financing is a strong, positive signal that investors evaluate the venture's future prospects favorably (Bergemann, Hege, and Peng 2010; Gompers 1995). Moreover, being able to raise capital quickly is likely to have a beneficial impact on the nascent firm's development (Hallen, Bingham, and Cohen 2019). Of the 2,136 firms in our sample, 1521 (71.2 percent) raised a second round of financing within our observation window.

We created indicator variables for each founder-investor gender combination. We distinguish between female-founded and male-founded firms, and whether first round investors include female VC partners, male VC partners, or both. Financing is often provided through investment syndicates. Typically, a syndicated investment refers to instances when two or more investors invest in the same start-up within the same round (Bygrave 1987; Lerner 1994). We identify a firm as being backed by a syndicate with a female (or male) VC based on the gender of the investment partner directly involved in the deal. With respect to founder gender, we follow industry convention and classify firms with at least one female founder as "female-founded." As a robustness check, we perform the same analysis excluding mixed-gender founding teams.

We control for other factors that may affect fundraising success. We account for characteristics of the first investment round by including a measure of the *amount of capital raised*. Larger initial

rounds may provide a competitive advantage by giving the founders the resources needed to hire staff and invest in marketing, sales, and product development. We also include the *age of the firm* at the time of the first round, as older firms may have had more time to grow and may be better prepared to raise a second, larger round of capital.

At the investor-level, we control for the *number of venture capital partners* involved, as the presence of more partners may translate to a larger pool of resources and more extensive networks, which can affect the evaluation of a venture's prospects as well as the resources available to it (Lerner 1994). Affiliation with a prominent investor should lead to more favorable evaluations and facilitate access to additional capital (Hsu 2004; Stuart et al. 1999). We therefore include a binary measure of *investor prominence* based on his or her past performance, equal to one if at least one of the venture capital partners is listed on Forbes' Midas List of Top Tech Investors for that year.² This list identifies the 100 most prominent venture capital investors, based on aggregate deal performance over the past five years. Deals attributed to VC partners include exits (IPOs or acquisitions) worth over \$200 million, as well as private portfolio companies valued at more than \$400 million.

We include the *size of the founding team* as a founder-level control, as investors are heavily influenced by information about founders (Bernstein et al. 2017). Larger teams also give nascent ventures more human and social capital. We collected additional data on the *number of serial founders* within the founding team for a subset of firms, as a proxy for the team's experience with fundraising.

Gender-status beliefs may affect the evaluations of businesses led by male and female entrepreneurs. We therefore identified firms with activities that are *female-typed* (Tak, Correll, and Soule 2019). Trained coders reviewed brief descriptions of each business, provided by the company to Crunchbase, to identify those that specifically target female customers, or operate in industries typically associated with women (such as fashion, cosmetics, or early-childhood education). Discrepancies between coders were discussed and settled by the authors. Firm-level controls also include dummies for *business category*, as some industry sub-sectors may be more attractive to investors. We assigned each

² The Forbes Midas List is compiled in partnership with TrueBridge Capital Partners. Data is available from 2011 to 2019. For first rounds that occurred in 2010, we used the 2011 list results as a proxy. On average across the years for which data is available, 77 of the 100 partners appearing on the list in a specific year were present on the list the following year, making the 2011 data a reasonable proxy for 2010.

venture in our dataset to one of 10 business categories using hierarchical clustering analysis, based on the category-group labels associated with the venture in Crunchbase (see Appendix Table A1).

Finally, we include *location* dummies to account for the possibility that firms based in states with a high concentration of VC investors, such as California, New York, or Massachusetts, may find it easier to secure additional financing. Tables 1 and 2 provide key summary statistics and pairwise correlations for the main variables included in our analysis.

Insert Tables 1 and 2 here

Empirical Strategy

We use a Cox regression model to estimate the effect of investor gender on raising a second round, which takes the following form:

$$h(t) = h_0(t)\exp\{\beta'X(t)\},$$

where $h(t)$ is the hazard rate of securing a second round of funding at time t ; h_0 is the unspecified baseline hazard for ventures in the baseline category for each variable; $X(t)$ is a vector of covariates; and β' is a vector of coefficients. In our analysis, a venture enters the risk set on the date it receives its first funding round.

A particular advantage of the Cox model is that it does not require us to make any assumptions regarding the parametric shape of the baseline hazard. Instead it assumes that any changes to the baseline rate resulting from changes in the covariates are proportional and independent of time (Allison 2014). If a covariate violates this assumption, the standard errors will be biased and the significance tests decreased in their power (Box-Steffensmeier and Zorn 2001). We tested the proportional hazards assumption first with the Schoenfeld residual test, using both a statistical test and by plotting and examining the scaled Schoenfeld residuals (Grambsch and Thernau 1994; Park and Hendry 2015). Neither examination suggested any deviation from the proportional hazards assumption. We then re-estimated the models including interactions between our predictors and time, which are specified as time-dependent covariates using STATA's `tv` and `te` options in the `stcox` command (Allison 2014). The interactions were not significant, indicating that the proportional hazards assumption is not violated.

Distinguishing between selection and treatment effects is a common challenge when using observational data. For our analysis, it would be problematic if firms founded by men and women were not comparable in characteristics that affect the likelihood of raising capital, possibly producing a misleading correlation. Similarly, it would be problematic if the characteristics associated with raising a second round of financing interacted with investor gender. We address this problem by using two different matched samples.

We first define more closely-aligned samples of male and female-founded firms using the coarsened exact matching (CEM) procedure (Iacus, King, and Porro 2011). By doing so, we account for the fact that founder gender is not randomly assigned to firms and reduce bias by balancing covariates across treatment (female-founded) and control (male-founded) groups (Blackwell et al. 2009; King and Nielsen 2016; Stuart 2010). Firms with female founders may be more likely to operate in industries with lower capital requirements or growth potential (Guzman and Kacperczyk 2019). Similarly, female-founded firms may raise less capital in their first round, or raise at a different rate compared to male-founded firms. We therefore matched female-founded firms with equivalent male-founded firms based on industry cluster, the amount raised in the first round, and the age of the firm at the time of the first round.

Second, we address the non-random assignment of investor gender to firm by generating a matched sample of female-founded firms backed by either female or male investors. We match using the amount raised and the timing of the first fundraising round. Table A2 in the Appendix provides details on the outcome of the matching procedure.

Results

To test the prediction that female-founded ventures backed only by female investors will have more difficulty raising additional capital compared to other venture-backed firms, we estimate Cox proportional hazard models. Results of our analysis are presented in Table 3. Model 1 shows the main effect of the founder-investor combination on the full sample. The omitted category is *female-founded firm – only female VC partners*. Supporting our prediction, we find positive coefficients for all other founder-investor combinations.

Insert Table 3 here

We then estimate the same model using the matched sample of male and female-founded firms. Model 2 shows that that female-founded firms are more likely to raise a new round of capital when backed by at least one male VC partner, compared to those that receive funding from only female partners. The increased coefficients across founder-investor combinations – with the exception of mixed gender investment teams – suggest a larger effect on the matched sample. Model 3 introduces controls for investor, founder, and firm-level characteristics. Including these controls improves model fit and further increases the magnitude of the founder-investor gender effect. We continue to find support for our prediction, with female-founded firms backed by male investors twice as likely to raise a second round of funding compared to those backed by female investors. Firms backed by both male and female investors, meanwhile, are over 2.5 times more likely to raise additional capital. There is no significant difference in outcomes between female-founded ventures backed by only male partners and those backed by both men and women ($\chi^2=0.81$, $p=0.367$), however, suggesting that what is critical is the presence of at least one male investor to serve as a signal of quality for the female entrepreneur. Figure 1 graphs the cumulative likelihood of raising a second round by founder-investor combination based on the Cox proportional hazard estimation.

Insert Figure 1 here

Could it be that female investors have lower-quality firms in their portfolios? For example, male investors could simply be better at identifying high quality firms. If this were the case, however, we should see an impact of investor gender on fundraising outcomes for *all* ventures, regardless of founder gender. Our failure to find an investor gender effect for male-founded firms suggests that this is not what is driving our results.

A second possibility is that female-founded firms funded by female investors are qualitatively different from those funded by male investors. This could be the case if firms backed by male investors operate in industries that require more capital or accelerate faster. We therefore repeated our analysis using a matched sample of female-founded firms to account for the ways in which different observables might interact with investor gender. Table 4 shows the main effect of having a male investor, controlling for investment round characteristics and industry fixed effects. As expected, the coefficient for male investor is positive and significant, lending further support to our prediction.

Insert Table 4 here

It is also possible that our findings are driven by actual ingroup bias in a way that is not captured by the observables used to construct the matched samples. Female investors may apply less stringent criteria when evaluating female entrepreneurs, or may be less able or willing to monitor female-founded firms after the investment has been made. As a result, the quality of female-founded firms backed by female investors could be lower than those backed by male investors, accounting for the investor gender effect we uncover for female-founded (but not male-founded) firms. To explore this possibility, we estimate a Cox proportional hazard model with the IPO as the dependent variable. The rationale is that if female-founded firms backed by women are of lesser quality, they should be less likely to experience a successful exit. Table 5 shows the main effect of founder-investor gender on the hazard of going public. We find that, compared to male-founded firms with male investors, female-founded firms with female investors are three times more likely to go public, conditional on having received a second round of financing. In other words, female-founded firms with female investors have better long-term prospects than male-founded firms with male-investors, as long as they get enough financial support in the early stages.

Insert Table 5 here

In the analyses presented above, we made a methodological choice to follow industry convention and code all firms with a female co-founder as “female-founded.” To ensure that our findings are not driven by this choice, we replicated our analyses using a strict definition of “female-founded” as firms with only female founders. Table 6 presents the results. As in our earlier models, the reference category is *female-founded – female VC partner*. Coefficients for all other founder-investor combinations are significant and positive, confirming that our results are robust to our independent variable specification.

Insert Table 6 here

STUDY 2: INVESTOR GENDER AND PERCEPTIONS OF ENTREPRENEURS

The results of our first study show that female-founded ventures backed by a female are at a disadvantage compared to other VC-backed ventures. While our use of matched samples seeks to replicate random assignment to condition, we remain limited in our ability to draw causal inference from

observational data given the possibility that our results may still reflect underlying quality differences that are unaccounted for. Moreover, our data do not allow us to test our proposed mechanism directly. We therefore conducted an experimental study to confirm our findings, and test our prediction that investor gender impacts quality evaluations for female entrepreneurs.

Method

Participants, design, and procedure

We recruited 134 full-time MBA students from a top-tier business school to participate in our study, and asked them to help us screen pitch videos for an early-stage startup competition. Participants were randomly assigned to watch one of four versions of a pitch video in a two (male versus female entrepreneur) by two (male versus female investor) between-subject design. Each video is approximately 1 minute and 45 seconds long, and consists of a slide deck containing 5 slides, narrated by the founder and CEO of the fictional startup “Careerday.com,” an online platform where job seekers connect to company insiders in order to obtain information about companies they are interested in, and possible referrals. Each script provides an overview of the business as well as revenue projections. At the end of the pitch, the founder mentions that the startup is currently raising a \$600,000 seed round, and that an investor from the fictional VC firm “Pegasus Ventures Fund” has already invested in the business. The slides and narration script are identical across conditions, with the exception of the name of the founder (David vs Laura Anderson) and the name and the picture of the venture capital investor providing early stage financing (John vs Katherine Clark). We pre-tested the photographs for similarity in perceptions of age, attractiveness, and professionalism. The name pairs had been tested in prior research (Pedulla 2016; Thébaud 2015).

Measures

After watching the video, participants were asked to evaluate the quality of the pitch, as well as the competence of the entrepreneur. Both variables were composite measures adapted from prior research (Brooks et al. 2014) as well as scoring criteria from a business school pitch competition, aggregating ratings on 7-point Likert scales. We also asked participants to evaluate the investor. We made no prediction regarding participants’ perceptions of the investor, but included this measure to ensure that it did not drive our results. The specific items used are laid out in the Appendix. Scores were

aggregated across each set of items to obtain average measures of pitch quality (Cronbach's $\alpha = 0.82$), entrepreneur competence (Cronbach's $\alpha = 0.83$), and investor competence (Cronbach's $\alpha = 0.91$).

At the end of the survey, participants were asked if they experienced any technical difficulties while watching the video. They were also asked if they could recall the business idea being pitched. None of the 128 participants who completed all of the questions on the survey failed this attention check, and none experienced any technical difficulties. Finally, participants were asked to provide their gender (34% female).

Results

We estimate the effect of investor and entrepreneur gender on perceptions of pitch quality and entrepreneur competence using ordinary least squares regression (Table 7). We control for participant gender in all models.

Insert Table 7 here

We find no main effect of either entrepreneur or investor gender on perceptions of pitch quality and entrepreneur competence. However, consistent with the findings from our first study, the coefficient for the interaction term *female entrepreneur x female investor* is negative and statistically significant in the model predicting ratings of pitch quality as well as in the model predicting competence ratings. Results of a postestimation marginal analysis confirm that participants perceived the pitch as being of lower quality, and the entrepreneur as less competent, in the female-female condition, compared to all other conditions (Figure 2).

Insert Figure 2 here

We conduct a moderated mediation analysis to estimate the conditional indirect effect of investor gender on pitch quality through perceptions of entrepreneur competence, at different levels of our moderator (male or female entrepreneur). We use generalized structural equation modeling to measure coefficients as well as bias-corrected bootstrapped standard errors and confidence intervals (Hayes 2013; Preacher, Rucker, and Hayes 2007). We found that perceptions of competence significantly mediated the relationship between investor gender and pitch quality ratings, and that this effect occurred when the entrepreneur was female (bootstrap coefficient -0.439, 95% CI

[-0.852, -0.065]), but not when the entrepreneur was male (bootstrap coefficient 0.143, 95% CI [-0.177, 0.474]) (see Table 8)

Insert Table 8 here

Taken together, our results confirm our findings from Study 1. Female (but not male) entrepreneurs are evaluated less favorably when they receive early support from a female rather than a male investor. Our results also indicate that the female-female investment tie produces a competence discount for the female entrepreneur, supporting our argument that gender homophily negatively affects the interpretation of the investment as a signal of quality for the female founder and her firm.

DISCUSSION AND CONCLUSION

When new venture quality is difficult to observe, evaluators rely on signals such as VC funding to resolve informational asymmetries and identify the most promising investment opportunities. Strong signals of quality can be especially important for stereotyped minorities, helping to close race or gender gaps. Yet investor gender may change the interpretation of the signal. We predicted that female-female investment ties would affect attributions audience perceptions of the investment in a manner that causes observers to lose faith in the signal and leads to negative outcomes for the female entrepreneur.

We examined the effect of early-stage investor gender on fundraising outcomes using longitudinal data on entrepreneurial financing, and sought to account for underlying differences in quality with two different matched samples. Consistent with our predictions, we found that being backed only by female investors sharply decreased the hazard of raising additional capital for female-founded ventures, making them two times less likely to raise additional funding compared to those ventures with at least one male VC partner involved in their first round. We found no equivalent effect of investor gender for firms with all-male founding teams. Our results are consistent with our argument that female, but not male entrepreneurs, are perceived less favorably by an audience of potential future investors when they are backed by a woman.

We tested our proposed explanation in an experimental study wherein we kept entrepreneur and investor quality constant. We found that evaluations of pitch quality were lower for female-backed female entrepreneurs than for any other entrepreneur-investor pair. We further found that the effect of investor gender on assessments of quality was mediated by perceptions of entrepreneur competence.

Taken together, our findings suggest that same-gender endorsement relationships lead to less favorable outcomes for women than for men, as a result of audience perceptions.

Our findings contribute to the literature on gender and social capital. Previous work has suggested, as we do, that women may benefit more from affiliations with men than from affiliations with women. This literature has speculated that differential returns to homophily result from the disparity in resource distribution within and across organizations (Ibarra 1992, 1993). We suggest a complementary explanation for this phenomenon, namely the role of the audience in making sense of and responding to a woman's decision to advocate for other women.

Furthermore, we highlight an additional mechanism by which gender-biased evaluations structure the market for entrepreneurial capital. Much of the existing work in this area has focused on impediments women face in gaining access to financing. We show that, for those women able to overcome this initial hurdle, the source of investment capital has important implications for the survival of female-led ventures and determines their ability to continue to grow.

Finally, this paper speaks to the ongoing debate among scholars of organizational demography concerning the trickle-down effect of female representation among decision-makers. Research has yielded mixed findings, with some studies pointing to reduced gender disparities in terms of hiring, promotion, or pay (Cohen and Broschak 2013; Cohen, Broschak, and Haveman 1998; Cohen and Huffman 2007; Gorman 2005; Hultin and Szulkin 1999) and others finding either no effect or even a detrimental effect for female workers who reported to female managers (Duguid 2011; Penner, Toro-Tulla, and Huffman 2012; Srivastava and Sherman 2015). Our archival data on venture capital investments provides evidence of gender homophily consistent with other studies (Ewens and Townsend 2019; Greenberg and Mollick 2017), suggesting that the presence of more female investors could open up opportunities for female market participants. However, to the extent that women's actions in favor of other women are negatively interpreted by external constituents, increasing the numerical representation of female decision-makers may ultimately backfire. The negative effect of female representation that we uncover is not due to any so-called queen bee behavior, as has been suggested in prior work, but instead to the belief that a woman's endorsement of another woman is motivated primarily by gender.

This has critical practical implications, as calls have intensified for female investors to invest in female founders in order to close the gender gap. While well-intentioned, our results suggest that this form of gendered investment policy may undermine the future success of female-founded businesses, as well as placing an undue burden on female investors. Ultimately, women may benefit most from gender-diverse investment teams, allowing them to leverage the support and relatability of a female investor, as well as the strong signal of quality a male champion is more likely to bring.

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Affect Additional Board Appointments at U.S. Companies.” *Academy of Management Journal*
50(2):267–88.

Figure 1: Cumulative likelihood of raising second round (Cox proportional hazards estimation)

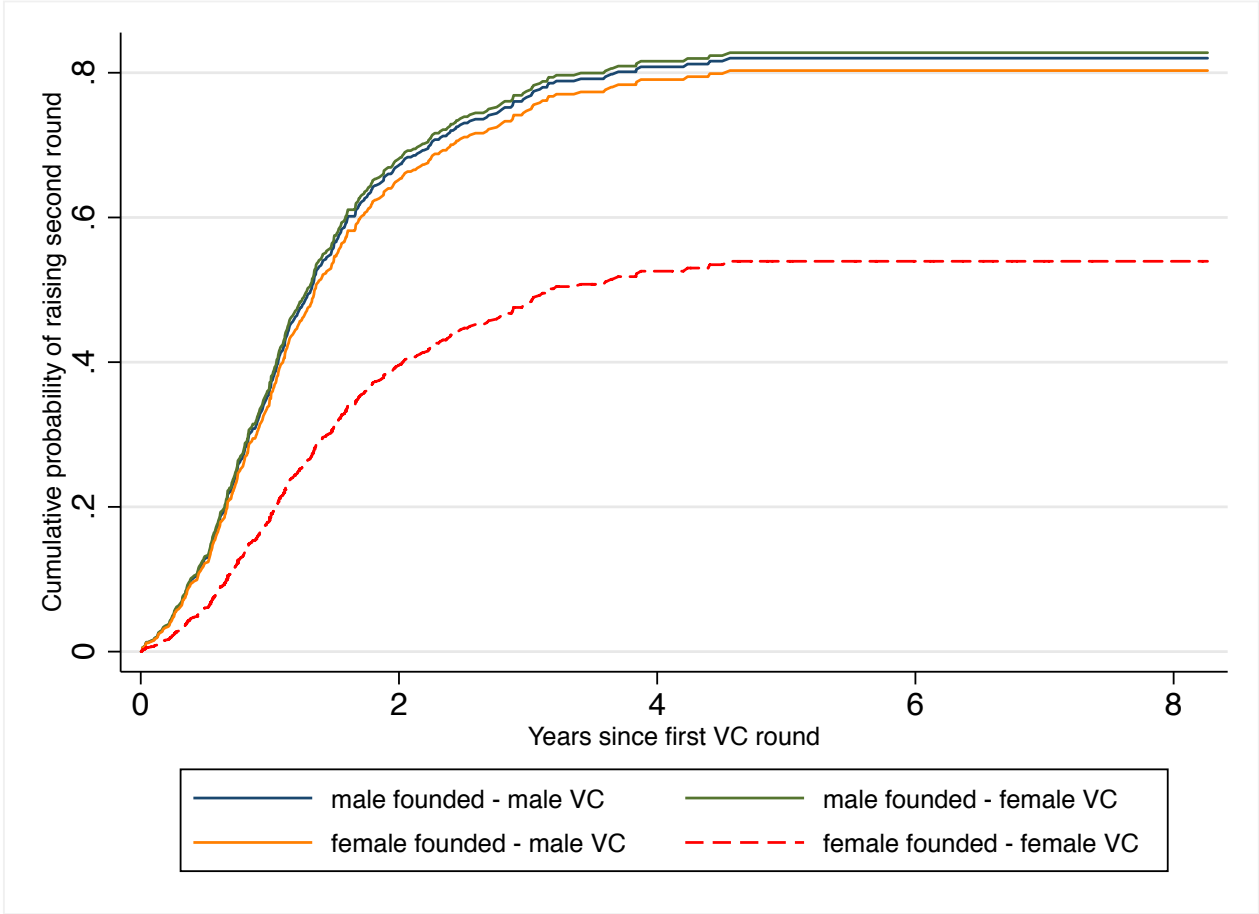


Figure 2: Adjusted predicted means of pitch quality and entrepreneur competence ratings

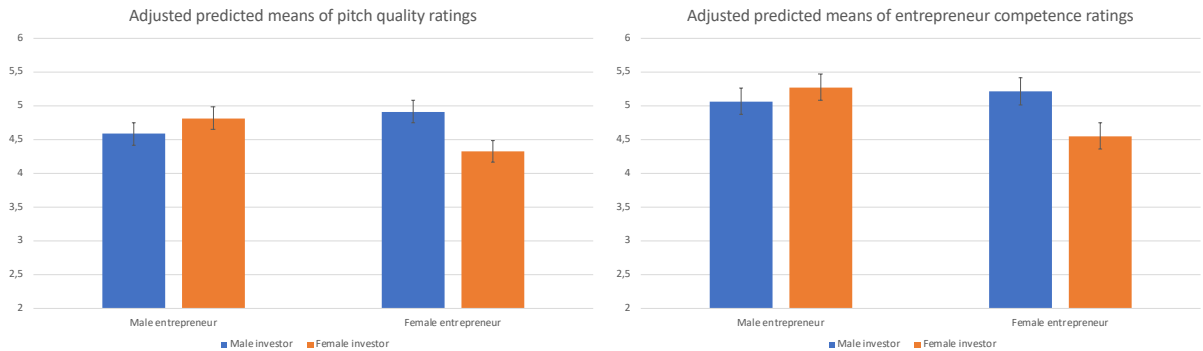


Table 1: Summary statistics, Study 1 (N= 2,136)

Variable	Mean	s.d.	Min	Max
Obtained round 2	0.71		0	1
Male founded – male VC	0.78		0	1
Male founded – female VC	0.03		0	1
Male founded – mixed VC team	0.05		0	1
Female founded – male VC	0.12		0	1
Female founded – female VC	0.01		0	1
Female founded – mixed VC team	0.01		0	1
Amount raised in R1 (logged)	3.10	1.53	-1.71	7.60
Age of firm at R1 (in days)	795	1253	1	36,604
Nb. of VC partners in round	1.65	1.09	1	11
Includes a prominent VC partner	0.08		0	1
Size of founding team	2.20	1.04	1	9
Female-typed business	0.05		0	1

Table 2: Correlations, Study 1

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Round 2	1											
2. Male founded – male VC	0.008	1										
3. Male founded – female VC	-0.008	-0.310***	1									
4. Male founded – mixed VC	0.002	-0.457***	-0.039†	1								
5. Female founded – male VC	0.003	-0.699***	-0.060**	-0.088***	1							
6. Female founded – female VC	-0.056**	-0.185***	-0.016	-0.023	-0.036†	1						
7. Female founded – mixed VC	0.022	-0.171***	-0.015	-0.022	-0.033	-0.009	1					
8. Amount raised in R1	0.010***	0.054*	0.006	-0.001	-0.068**	0.013	-0.024	1				
9. Age of firm at R1	-0.083***	0.051*	-0.012	-0.006	-0.039†	-0.021	-0.032	0.169***	1			
10. Nb. of VC partners in round	0.045*	-0.068**	-0.092***	0.258***	-0.062**	-0.041†	0.091***	0.098***	-0.062***	1		
11. Includes prominent VC	0.038†	0.012	-0.025	-0.000	-0.009	0.008	0.013	0.183***	-0.030	0.199***	1	
12. Size of founding team	0.085***	-0.074***	-0.045*	0.012	0.114***	-0.033	0.013	0.047*	0.141***	0.086***	0.081***	1
13. Female-typed business	-0.004	-0.253***	-0.026	-0.002	0.272***	0.128***	0.095***	0.074***	0.016	-0.012	-0.031	-0.047*

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10

Table 3: Cox proportional hazards models of time to second round

Dependent variable: Second round	(1) All firms	(2) Male and female-founded matched sample	(3)
Firm-investor combination			
Male-founded – male VC partner(s)	0.6757* (0.305)	0.7343* (0.309)	0.7943* (0.344)
Male-founded – female VC partner(s)	0.5645† (0.343)	0.6962† (0.370)	0.8190* (0.404)
Male-founded – male & female VC partners	0.7974* (0.323)	0.6448† (0.386)	0.6946† (0.415)
Female-founded – male VC partner(s)	0.6261* (0.313)	0.7064* (0.308)	0.7397* (0.339)
Female-founded – male & female VC partners	1.0712** (0.408)	0.9780* (0.404)	1.0023* (0.436)
Investment Round Controls	Yes	Yes	Yes
VC Controls	No	No	Yes
Founder Controls	No	No	Yes
Firm Controls	No	No	Yes
Industry FE	Yes	Yes	Yes
Observations	2,136	544	544
Wald χ^2	76.37	38.20	53.27

Notes. Estimates from a Cox proportional hazards model of receiving a second round. Omitted category is female-founded – female VC partner(s). The subsample of firms is constructed using the coarsened exact matching procedure to match female-founded and male-founded firms on industry category, amount raised in R1, and age of firm at R1. Investment round controls include amount raised in R1 (logged) and age of firm at R1; VC controls include total number of VC partners and presence of prominent VC partner; founder controls include size of founding team and number of serial founders; firm controls include firm location and whether business is female-typed. Robust standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10.

Table 4: Cox proportional hazards model of time to second round, on matched sample of female-founded firms

Dependent variable: Second round	(1)
Male VC partner(s)	1.0979* (0.545)
Investment Round Controls	Yes
Industry FE	Yes
Observations	40
Wald χ^2	20.01

Notes. Estimates from a Cox proportional hazards model of receiving a second round on a sample of female-founded firms. Firms that raised a first round from only female VC partners were matched with firms that raised a first round from only male VC partners based on the amount raised in R1 and age of the firm at R1, using the coarsened exact matching procedure. Investment round controls include amount raised in R1 (logged) and age of firm at R1. Robust standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10.

Table 5: Cox proportional hazards model of time to IPO

Dependent variable: IPO	(1)
Firm-investor combination	
Male-founded– male VC partner(s)	-1.0654* (0.499)
Male-founded– female VC partner(s)	-0.6625 (0.886)
Male-founded – male & female VC partners	-0.3235 (0.709)
Female-founded – male VC partner(s)	-0.9281 (0.659)
Female-founded – male & female VC partners	0.0450 (0.816)
Investment Round Controls	Yes
VC Controls	Yes
Founder Controls	Yes
Firm Controls	Yes
Industry FE	Yes
Observations	1,521
Wald χ^2	180.80

Notes. Estimates from a Cox proportional hazards model of experiencing an initial public offering (IPO) on a sample of firms that received a second round of financing. Omitted category is female-founded – female VC partner(s). Investment round controls include amount raised in R1 (logged) and age of firm at R1; VC controls include total number of VC partners and presence of prominent VC partner; founder controls include size of founding team; firm controls include firm location and whether business is female-typed. Robust standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10.

Table 6: Cox proportional hazards model of time to second round, excluding mixed gender founding teams

Dependent variable: Second round	(1)
Firm-investor combination	
Male-founded– male VC partner(s)	1.3133† (0.690)
Male-founded– female VC partner(s)	1.2779† (0.707)
Male-founded – male & female VC partners	1.3785* (0.699)
Female-founded – male VC partner(s)	1.5082* (0.696)
Female-founded – male & female VC partners	1.6274* (0.758)
Investment Round Controls	Yes
VC Controls	Yes
Founder Controls	Yes
Firm Controls	Yes
Industry FE	Yes
Observations	1,930
Wald χ^2	91.29

Notes. Estimates from a Cox proportional hazards model of receiving a second round on a sample of firms with either all-female or all-male founding teams. Omitted category is female-founded –female VC partner(s). Investment round controls include amount raised in R1 (logged) and age of firm at R1; VC controls include total number of VC partners and presence of prominent VC partner; founder controls include size of founding team; firm controls include firm location and whether business is female-typed. Robust standard errors in parentheses.

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10.

Table 7: Linear regression estimates of perceived quality

	(1) Pitch quality	(2) Entrepreneur competence
Female entrepreneur	0.335 (0.231)	0.151 (0.275)
Female investor	0.230 (0.234)	0.207 (0.253)
Female entrepreneur x female investor	-0.818* (0.329)	-0.869* (0.391)
Female participant	0.096 (0.175)	0.067 (0.245)
Constant	4.447*** (0.301)	4.968*** (0.368)
Observations	128	127
R-squared	0.061	0.064

Notes. Robust standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, † p<0.10.

Table 8: Conditional indirect effect of investor gender on pitch quality, by entrepreneur gender

Mediator	Entrepreneur gender	Effect	Bootstrap SE	Bootstrap CI
Competence	Female	-0.439	0.207	[-0.852, -0.065]
Competence	Male	0.143	0.167	[-0.177, 0.474]

Notes. N=127. Bootstrap sample = 1000.

APPENDIX

Industry clusters (Study 1)

Startups in Crunchbase are labeled using one or more industry category tags. A total of 45 unique tags appeared in our dataset. Startups were labeled with between 1 and 12 tags, for an average of 3.6 tags per firm. We assigned firms to one of 10 industry clusters based on these tags, using hierarchical clustering analysis, and linking observations according to Ward's method of clustering. We labeled each of the ten industry clusters obtained based on the most common tags appearing within that cluster (Table A1).

Table A1: Industry clusters

Industry cluster label	Nb. of firms in cluster
Design & fashion	44
Healthcare	572
Media & entertainment	143
Fintech	143
Mobile & apps	165
Sales & marketing	141
IT	323
Electronics	290
Analytics & A.I.	168
Biotech	147

Table A2: Covariate balance in full and matched samples, Study 1

Panel A: Full sample

Variables	<i>Male-founded</i>		<i>Female-founded</i>		Absolute difference of means
	Mean	s.d.	Mean	s.d.	
% obtained round 2	71.34	1.05	70.35	2.68	1.00
% male VC	90.74	0.67	87.24	1.96	3.50†
% female VC	2.98	0.40	6.90	1.49	3.92***
% mixed VC team	6.28	0.56	5.86	1.38	0.42
Amount raised in R1 (logged)	3.14	0.03	2.85	0.10	0.30**
Age of firm at R1 (in days)	820	31	632	45	189*
Nb. of VC partners in round	1.68	0.03	1.53	0.05	0.15*
% include prominent VC partner	7.80	0.62	7.59	1.56	0.21
Size of founding team	2.16	0.02	2.47	0.70	0.31***
% female-typed business	2.55	0.37	23.45	2.49	20.90***

Panel B: Matched sample of male and female-founded firms

Variables	<i>Male-founded</i>		<i>Female-founded</i>		Absolute difference of means
	Mean	s.d.	Mean	s.d.	
% obtained round 2	71.69	2.73	70.96	2.75	0.74
% male VC	88.24	1.95	87.13	2.03	1.10
% female VC	2.94	1.02	6.99	1.55	4.04*
% mixed VC team	8.82	1.72	5.88	1.42	2.94
<i>Controls used in CEM</i>					
Amount raised in R1 (logged)	2.82	0.10	2.82	0.10	0.00
Age of firm at R1 (in days)	610	34	575	36	35
<i>Other controls</i>					
Nb. of VC partners in round	1.69	0.07	1.53	0.05	0.15†
% include prominent VC partner	7.35	1.58	7.35	1.58	0
Size of founding team	2.23	0.06	2.50	0.07	0.27**
% female-typed business	4.04	1.19	21.32	2.48	17.28***

Panel C: Matched sample of female-founded firms (treatment = female VC)

Variables	<i>Control (male VC)</i>		<i>Treated (female VC)</i>		Absolute difference of means
	Mean	s.d.	Mean	s.d.	
% obtained round 2	70	10.25	45	11.12	25
<i>Controls used in CEM</i>					
Amount raised in R1 (logged)	3.17	0.40	3.31	0.37	0.14
Age of firm at R1 (in days)	512	71	521	74	10
<i>Other controls</i>					
Nb. of VC partners in round	1.6	0.28	1.2	0.16	0.4
% include prominent VC partner	0	0	10	6.71	10
Size of founding team	2.85	0.31	1.85	0.15	1**
% female-typed business	25	9.68	35	10.67	10

*** p<0.001, ** p<0.01, * p<0.05, † p<0.10

Experimental items (Study 2)

Pitch quality

“Please rate the competition entry along the following criteria:

- How original was the idea?
- How persuasive was the pitch?
- How fact-based was the pitch?
- How logical was the pitch?
- How clear was the description of the product or service?
- How solid were the financial forecasts and valuation?”

Participants answered each question using a 7-point Likert scale, from 1: Not at all, to 7: Extremely.

Entrepreneur competence

“Please rate [the founder] in terms of:

- Persuasiveness and credibility
- Industry knowledge
- Confidence.”

Investor competence

“Please rate [the investor] in terms of:

- Expected ability to help [the founder] identify and capture growth opportunities
- Expected ability to find additional capital for the business
- Expected ability to take this business to IPO/acquisition
- Expected ability to provide [the founder] with coaching and support.”

Questions pertaining to founder and investor competence were answered on a 7-point Likert scale, from 1: Extremely low, to 7: Extremely high.