SOCIAL SCIENCES

Evidence that investors penalize female founders for lack of industry fit

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Are female founding CEOs penalized when raising funds for their ventures based on industry served? Across an observational study conducted on ventures seeking funding ($N = 392$) and an experimental study conducted on investors allocating venture funding ($N = 130$), we find evidence for a "lack of fit" effect: Female-led ventures catering to male-dominated industries receive significantly less funding at significantly lower valuations than female-led ventures catering to female-dominated industries. In contrast, male-led ventures attain similar funding and valuation outcomes regardless of the gender dominance of the industries to which they cater. We confirm that this is because investors perceive lower degrees of fit between founding CEO and venture for female-led ventures catering to male- as opposed to female-dominated industries (with no perceived fit differences for male-led ventures across industries). Degree of investor sophistication emerges as a potential attenuating factor, appearing to help reduce gender bias from perceived lack of fit.

INTRODUCTION

Although efforts undertaken by public policymakers and practitioners show promising momentum, gender inequality persists worldwide, thwarting women's representation and earnings potential (*1*). The majority of labor markets today remain male dominated in terms of percentage employment (*2*), and women in industries marked by male dominance continue to experience a variety of adverse consequences in terms of compensation, promotion, retention, support, and opportunities for valued leadership (*3*–*8*). As one means to gain entry into industries where access is limited, women and other underrepresented groups may seek to employ themselves and others by founding entrepreneurial ventures (*9*–*11*).

Through entrepreneurship, female founders recognize a chance to sidestep institutionalized hiring and promotion processes operating inside organizations where bias is ingrained (*12*, *13*). As evidence, growth in business ownership has been largely driven by people of color and by women, with the biggest gains in businesses owned and operated by women emerging in male-dominated industries (*14*, *15*). The growth rate in businesses majority owned, operated, and controlled by one or more women between 2014 and 2019 was 21% versus 9% for all businesses, increasing the most in three industries that constitute male-dominated labor markets (*2*): utilities (160% growth), construction (68% growth), and information (36% growth). But what if women are also disadvantaged when entering male-dominated industries through entrepreneurship, despite the access that it provides?

Recently, Tak and colleagues found that a male-typed product—craft beer—was evaluated less favorably when described as produced by a woman rather than by a man, while men and women received similar evaluations for producing a female-typed product—cupcakes (*16*). This product-oriented finding represents the transference of an effect that has long been observed in the labor market; women are devalued when entering male-dominated work environments, while the same devaluation does not often extend to men in female-dominated work environments—in fact, men working in female-dominated industries at times even benefit (*17*–*20*). Although the literature has established biased evaluations that can diminish the outcomes of women (but not men) in gender-inconsistent contexts, it is unclear whether this gender interaction can transfer to male- versus female-led ventures.

As future directions for entrepreneurship, Tak and colleagues (*16*) encouraged researchers to explore whether this gender interaction effect generalizes beyond food and beverage products, whether a dollar amount allocated to male- versus female-typed products may emerge as significant in categories with larger price variations, and whether the effect also applies to relevant actors like investors and founders. Here, we set out to answer these calls by investigating whether investors are willing to allocate different amounts of funding to male versus female founders of ventures operating across industries with varying degrees of gender dominance. In terms of this phenomenon applying to venture funding efforts, Brooks and colleagues proposed that industry type is a productive avenue for future researchers to explore boundary conditions of the gendered funding effects they found, reasoning that "Heilman's lack-of-fit model suggests women may be more persuasive when they pitch female gender-typed ventures" [(*21*), p. 4429].

Supported by decades of research, the Lack of Fit model demonstrates that women face discrimination when there is a mismatch or "lack of fit" between the attributes perceived necessary for success in a male-typed domain and those that women are stereotypically believed to have (*22*–*26*). As a consequence, women are expected to be less capable than their male colleagues in male-dominated work contexts unless objective evidence of actual task performance proves otherwise (*27*). Venture funding allocations are particularly vulnerable to this gender bias that underlies the lack of fit phenomenon. That is because early-stage investment decisions are made under conditions of high uncertainty in the absence of historical track records within the entrepreneurship setting where gender is salient (*28*–*33*).

This context can induce an overreliance on heuristics like representativeness (*34*, *35*), where evaluators recall the most representative types as the basis for decision-making and neglect other key information at hand. For example, one data point relevant to investor decision-making is the low overall base rate of venture-funded chief executive officers (CEOs) that is likely to be neglected when

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recalling relative demographic frequencies such as those specific to gender (*36*). An investor's gender archetype of the "funded founding CEO" is likely to be male; when a female founding CEO seeks funding for a venture, perceptions of her "fit" are subject to several strikes. Women experience low representation in venture capital, with female-founded ventures receiving less than 3% of overall funding in the United States (*36*). At the same time, women also endure low representation in U.S. top management teams, accounting for only 6% of CEO positions across S&P 500 companies (*37*). According to the Lack of Fit model, founders who deviate from the archetype of a male venture–funded CEO are likely met with increased skepticism from investors, translating into a lower success rate in female founding CEO attempts to secure funding for their respective ventures.

The Lack of Fit model also suggests that women's attempts to raise capital would be particularly challenging when their ventures cater to male-dominated industries—or those where women represent a numerical minority of total employed (*2*)—constituting a third strike against female founding CEOs. Gendered expectations about the specific industries where male versus female leaders are likely to have subject matter expertise serve as an additional source of information that can potentially attenuate or exacerbate an investor's concerns over lack of fit. When female founding CEOs trespass into male-dominated industry territory where they are not considered a representative type, a perceived lack of industry fit is likely to confirm investor trepidation about the venture opportunity. On the other hand, when female founding CEOs address female-dominated labor markets where they are well represented and perceived to be a fit, industry information may act as a compensatory mechanism for raising capital. Men are unlikely to be affected by industry information; male founding CEOs are apt to be perceived as a natural fit when raising funds—both in terms of representation in venture capital and in an executive capacity—and therefore have no fit deficit for which to compensate through industry served or otherwise.

Together, we hypothesized that female founding CEOs are likely to experience significantly worse funding outcomes for their early-stage ventures than male founding CEOs, particularly in male-dominated industries where there is a perceived lack of fit (while male-led ventures will enjoy comparable funding outcomes regardless of industry served based on the Lack of Fit model).

Overview of the studies

To maximize both external and internal validity, we used a mixed methods approach offering correlational and causal evidence by coupling (i) an observational study of actual funding raised by comparable ventures led by female versus male founding CEOs across industries of varying gender dominance with (ii) an experimental study of funding allocated by investors to ventures led by female versus male founding CEOs catering to male- versus female-dominated industries. The latter study enabled us to capture an additional dependent variable of the valuation at which investors allocate funding, as well as to explore a potential mechanism and attenuating factor for the effect. Across the two studies, we report results both with and without controls and both as raw dollar amounts and as natural log ("ln" or "logged") amounts to account for skewness potential (*38*).

Study 1

We hypothesized that the interaction between founding CEO gender and industry gender dominance predicts venture funding performance. To test whether there is a correlational association among these variables, we first conducted an observational study by screening the Crunchbase venture database for all ventures with disclosed aggregate funding data that launched at the prestigious TechCrunch Disrupt "TCD" launch competition in the United States (N = 392; $\text{mean}_{\text{venture age}}$ = 5.58; SD = 2.35; 83.2% male led); see Table 1 for summary statistics. TCD enabled us to execute on our selection strategy: to conduct an apples-to-apples comparison of actual early-stage ventures with male versus female founding CEOs who actively engage in fundraising attempts.

When addressing the issue of the gender gap in venture funding, it is important to acknowledge that there are both demand- and supply-side factors at play (*31*). To isolate supply-side factors involving gender bias at the hands of investors supplying capital, researchers must make every effort to hold the demand for capital constant among the ventures examined. This involves not only subjecting statistical models to factors that can affect funding decisions but also, first and foremost, departing from a sample of comparable ventures in terms of baseline funding quality, intellectual property, scalability, and stage. To be accepted into the TCD competition, each founding CEO must demonstrate the venture's high degree of quality, need and desire for capital, as well as the ability to scale with the use of proceeds of that capital, while having a technological component (as the competition name suggests). At the same time, TCD features ventures that cater to a wide variety of end users. Hence, TCD allows for the technological consistency combined with the industry variance that is crucial to investigate our research question.

The resulting sample of U.S.-launched tech ventures of comparable quality, capital need, and stage thus enabled us to draw externally valid conclusions about the funding outcomes experienced by male versus female founders of U.S. tech ventures seeking capital across industries over time. We then captured and verified controls for each founding CEO and venture by using the full TCD sample with completeness of information. TCD participation facilitated key model adjustments, including a venture quality measure of competition performance for the entire sample, along with verifiable data on founding CEO gender and age, as well as venture launch location, launch year, and operating status. We then matched the Crunchbase industry classification for each TCD venture to that

Table 1. Study 1 summary statistics.

Venture funding raised average	$16,739,338
Male-led venture funding average	$18,509,448
Female-led venture funding average	$7,996,069
Operating count	214
Closed count	105
Acquired count	72
IPO count	1
SF launch count	201
NY launch count	191
Male founding CEO count	326
Female founding CEO count	66
TCD finalist distinction count	115

of the U.S. Bureau of Labor Statistics (BLS) (*2*), which provided the percentage of women employed by industry as our continuous measure of industry gender dominance. We also converted this measure into categories of gender dominance to enrich our comparisons.

See Materials and Methods and the Supplementary Materials for more details and Table 2 for descriptive statistics and correlations. Table 2 reveals a significant positive correlation of ln funding with venture quality [indicating whether the venture was a contestant versus a finalist at TCD, consistent with (*16*) findings on influence of status] and with operating status (indicating whether or not closed) but a significant negative correlation of ln funding with female founding CEO gender, as predicted. Notably, founding CEO gender does not have a significant correlation with key variables such as venture quality, helping to dismiss the alternative explanation that female-led ventures receive less funding because they are inferior to male-led ventures.

Study 2

We complemented these correlational results with a controlled experiment conducted on actual investors to determine whether there is a causal association between study 1's gender interaction and funding outcomes, as well as whether this effect is attributable to perceived lack of fit and whether the effect can somehow be reduced. To maximize external validity, we engaged leading survey and panel provider Qualtrics to recruit real-world investors (N = 130) who have made actual venture investments in the United States (see the Supplementary Materials for simulations conducted to determine sample size). Our participating investors are representative of U.S. angel investors in terms of key characteristics such as age, gender, ethnicity, education, experience, and industry focus (*39*), with mean age of 51.63 years (SD = 16.21), 67.7% male, 86.2% identifying with white ethnicity, 100.0% reporting to have a bachelor's or graduate degree, and mean years of investing experience of 9.01 (SD = 3.19), with 57.7% reporting to have 8 or more years of investing experience. Participants reported catering to a wide variety of industries, including financial services, healthcare, consumer goods or services, and education that are among the most common areas of focus for U.S. angels. We observed that the investing experience among our investor participants is professional in nature; 95% invested in seed, Series A and B (versus only pre-seed) stages, and 79% participated in angel, crowdfunding, and venture funding (as opposed to pure "friends and family") rounds.

In study 2, we desired to see whether fit (versus lack of fit) of founding CEO gender and industry gender dominance would cause investors to allocate more (versus less) funding to female- but not male-led ventures. We separately wanted to determine whether this effect also holds for venture valuations, the dollar amount at which investors allocate funding based on the venture's estimated worth. In doing so, we were likewise able to calculate the implied equity that each founding CEO would retain after the investor's stake is taken. Last, we sought to explore whether perceived fit serves as an explanatory mechanism for the effect and what—if any—attenuating factors can help to reduce it.

To maximize the ecological validity of a typical investor decision-making context, we used a within-subjects, counterbalanced design that exposed investor participants to fit versus lack of fit across four venture opportunities via a 2 (male versus female founding CEOs) × 2 (male-dominated versus female-dominated industries) procedure. In doing so, we manipulated actual Crunchbase venture profiles from study 1, all within the highest echelon of funding and quality based on competition performance and serving industries with comparable degrees of female versus male dominance. We held constant relevant information on both the ventures and the founders associated with each opportunity while maintaining the appearance of profile variation for authenticity of decision-making (see Materials and Methods for details and fig. S2 for profile visualization). This within-subjects design affords high internal validity, increased statistical power critical for difficult-to-obtain samples like investors, and high ecological validity for environments such as investing where the evaluator is likely to face a decision involving multiple choices; disadvantages of this design have been addressed by randomizing order of exposure using a counterbalancing procedure (*40*). Last, within-subjects design allowed us to embrace a more conservative approach by facilitating explicit comparative evaluations of multiple candidates' performance; separate evaluation enabled by between-subjects design is likely to have induced even greater reliance on gender stereotypes (*41*).

As outcome variables, we captured the U.S. dollar funding amounts allocated to each venture out of a total capped amount available for allocation across the four ventures (*31*), as well as uncapped U.S. dollar valuations for each venture. For our explanatory variable, we recognized that it is not only necessary to demonstrate that significant differences in perceived lack of fit drive our effect. It is also

Table 2. Study 1 descriptive statistics and correlations. Ln funding (logged aggregate funds raised); BLS percentage (percentage women employed); founder gender (female founding CEO = 1); founder age category (0 to 2); launch location (0, 1); launch year (2010 to 2018); venture quality (0, 1); venture industry (1 to 12); venture "operate" operating status (0, 1). $^{\dagger}P < 0.10$, $^{*}P < 0.05$, $^{**}P < 0.01$, and $^{***}P < 0.001$.

		M	SD	2	3	4	5	6	7	8	9
1	Ln funding	12.64	5.73	−0.02	−0.24***	0.11*	0.08	0.01	0.21***	0.05	0.28***
2	BLS percentage	44.32	17.85		0.27***	0.02	0.01	0.01	−0.12*	−0.05	−0.01
3	Founder gender	0.17	0.37			0.04	0.04	0.22***	−0.04	0.01	0.03
4	Founder age	0.84	0.70				0.16**	−0.06	−0.00	0.08	0.11*
5	Launch location	0.51	0.50					0.06	0.00	0.17***	0.09†
6	Launch year	2013	2.35						0.02	0.09†	0.29***
7	Venture quality	0.29	0.46							0.04	0.07
8	Venture industry	7.84	3.65								0.10*
9	Venture operate	0.73	0.44								

Table 3. Study 2 descriptive statistics and correlations. Founder "Entrep" gender, industry gender dominance, and investor gender (female = 1). Perceived fit (1 to 7 rating scale). Investor age (number of years old). Investor years of experience "Investor exper" (coded as 1 to 12, with 12 indicating "10+ years"). Investor accreditation status "Investor accred" (1 if accredited). *$P < 0.05$, **$P < 0.01$, and ***$P < 0.001$.

		M	SD	2	3	4	5	6	7	8	9	10
1	Condition	2.50	1.12	0.24***	0.20***	0.00	0.45***	0.12**	0.00	0.00	0.00	0.00
2	Ln funding	10.86	2.52		0.47***	−0.10*	0.17***	0.31***	−0.05	−0.02	−0.02	0.10*
3	Ln valuation	12.54	3.70			−0.13**	0.09*	0.17***	−0.02	−0.06	−0.04	−0.10*
4	Entrep gender	0.50	0.50				0.00	−0.05	0.00	0.00	0.00	0.00
5	Industry gender	0.50	0.50					0.07	0.00	0.00	0.00	0.00
6	Perceived fit	5.23	1.21						−0.14**	−0.28***	−0.22***	0.33***
7	Investor gender	0.32	0.47							0.03	0.09*	−0.23***
8	Investor age	51.63	16.21								0.58***	−0.42***
9	Investor exper	9.01	3.19									−0.27***
10	Investor accred	0.45	0.50									

imperative to demonstrate that the effect is not due to any differences in the perceptions of the standalone ventures and their respective founders. As such, we not only asked investors to report the extent to which each opportunity conveyed a sense of fit between the founding CEO and the venture served; we also asked them to report the extent to which each opportunity conveyed a sense of the venture's quality and trust in each founding CEO's ability to execute—factors deemed integral to investor decision-making when evaluating early-stage tech ventures (*30*–*32*, *42*–*47*). We report our results controlling for self-reported investor gender, age, years of investing experience, and accreditation status as a proxy for investor sophistication [accredited investors are those granted special status to invest in higher-risk securities due to their financial sophistication, as per SEC (Securities and Exchange Commission) Rule 501 under Regulation D of the Securities Act of 1933]. See Table 3 for descriptive and correlational statistics, which indicate that our key outcome measures of ln funding and ln valuation have a significant positive correlation with each other as well as with perceived fit and experimental condition, while each has a significant negative correlation with the gender of the founding CEO, as hypothesized.

RESULTS

Study 1

Consistent with prior scholarly findings (*31*) and overall industry statistics (*36*), founding CEO gender ($F = 1$) was a significant standalone predictor of logged funding [$B = -3.75$, SE = 0.75, $t(390) = -4.99$, $P < 0.001$] and remained a significant predictor when introducing our model adjustments (Table 4, models 1 to 3). On a raw dollar amount basis, male-led ventures received $18.5 million on average in funding, more than 2.3 times the $8.0 million raised on average by female-led ventures. As hypothesized, the influence of founding CEO gender on logged funding was moderated by the degree of industry gender dominance, for a significant founding CEO gender and industry gender dominance interaction of $B = 0.16$, SE = 0.04, $t(388) = 4.45$, $P < 0.001$. After adjusting our model for factors that can influence funding outcomes, the interaction remained significant: $B = 0.12$, SE = 0.04, $t(382) = 3.33$, $P < 0.001$, and our full model fit the data well: $F(9, 382) = 11.62$, adjusted $R^2 = 19.64$, $P < 0.001$ (Table 4, model 3).

We also converted the continuous measure of industry gender dominance into categories of female-dominated industries (i.e., 56% or higher women employed) versus male-dominated industries (i.e., 44% or lower women employed) versus gender-neutral industries (i.e., 45 to 55% women employed) to examine results both across and within gender. These categories correspond to robustness thresholds of recent work conducted on gender-dominated sectors (*48*); see the Supplementary Materials for sensitivity analyses confirming that interaction effects are consistent on the basis of alternative thresholds for industry categorization and a binary industry classification, as well as results of supplementary analyses conducted specifically on gender-neutral industries. When catering to male-dominated industries that represent a lack of fit for women, male-led ventures raised $21.8 million on average, over 10 times the $2.1 million raised on average by female-led ventures (with $\ln_{funding}$ diff = 7.84, $P < 0.001$, indicated by post hoc comparisons using Tukey's post hoc test). In contrast, the funding gap between male- and female-led ventures was nonsignificant in female-dominated industries where there is no lack of fit for women: $\ln_{funding}$ diff = 0.92, $P = 0.968$. See Fig. 1 comparisons. Comparisons of funding differences within founding CEO gender indicated that female founding CEOs are disadvantaged when raising funds for ventures in industries marked by lack of fit, raising 6.7 times more in raw funding when their ventures catered to female- rather than male-dominated industries: $\ln_{funding}$ diff = 6.47, $P < 0.001$. Conversely, industry fit did not matter for male founding CEOs: $\ln_{funding}$ diff = 0.44, $P = 0.992$. See Fig. 2 comparisons.

Study 2

Our results reinforced study 1's findings in a controlled environment and adjusting our linear mixed effects models for key investor characteristics: We observed a significant main effect of founding CEO gender ($F = 1$) on logged funding allocations [$B = -0.51$, SE = 0.22, $t(125) = -2.30$, $P = 0.022$], as well as on our additional dependent variable measure of logged venture valuations [$B = -1.00$, SE = 0.26, $t(125) = -3.85$, $P < 0.001$], with female founding CEOs receiving significantly lower amounts on both measures than male founding CEOs. Notably, we again observed a significant interaction effect of founding CEO gender and industry gender dominance on funding allocations [$B = 1.83$, SE = 0.43, $t(123) = 4.29$, $P < 0.001$]

Table 4. Study 1 regression results. ***$P < 0.001$. Robust standard errors clustered by venture in parentheses.

Effect on ln funding:	Model 1	Model 2	Model 3
Founding CEO gender	−3.75***	−12.44***	−10.16***
Female = 1	(0.75)	(2.05)	(1.97)
Industry gender dominance		−0.03	−0.01
Percentage women employed		(0.02)	(0.02)
Founder * Industry		**0.16*** **	**0.12*** **
Gender interaction		**(0.04)**	**(0.04)**
Founding CEO age			0.57
			(0.38)
Venture launch location			0.54
			(0.54)
Venture age			0.05
			(0.12)
Venture quality			2.24***
			(0.58)
Venture industry			0.01
			(0.07)
Venture operating status			3.17***
			(0.63)
Intercept	13.27***	14.33***	9.42***
	(0.31)	(0.84)	(1.40)
Multiple R^2	0.06	0.11	0.21
Adjusted R^2	0.06	0.10	0.20
F statistic	24.87***	15.63***	11.62***

as well as on our additional measure of venture valuations [$B = 2.68$, SE = 0.50, $t(123) = 5.40$, $P < 0.001$], whereby ventures led by female but not male founding CEOs were placed at a funding and valuation disadvantage for lack of industry fit. See Table 5 for linear mixed effect model results.

Examining the raw coefficient value, this gender interaction accounted for $61,068 in funding out of a $400,000 funding cap across all four ventures. Post hoc comparisons revealed that the female founding CEO of the venture targeting the female-dominated industry was allocated $50,137 more out of the $400,000 capped funding than the female founding CEO targeting the male-dominated industry ($\ln_{funding}$ diff = 1.76; $P < 0.001$), while the difference in funding allocations for male founding CEOs targeting male- versus female-dominated industries was not significant ($P = 0.997$), as per

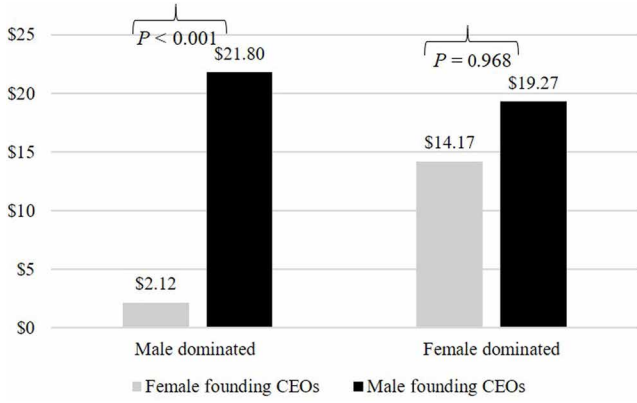

Fig. 1. Study 1 female founding CEO disadvantage by industry type. Figure reflects average raw funding amounts as U.S. dollars in millions; *P* values reflect natural log of funds raised "ln funding" to account for potential skewness (*38*). Figure indicates that female founding CEOs raise significantly less than male founding CEOs when serving male- but not female-dominated industries. See Fig. 2 for additional comparisons.

Fig. 3. Similar comparisons indicated that the female-led venture targeting the female-dominated industry received a $2.27 million higher valuation on average than the female-led venture targeting the male-dominated industry ($\ln_{valuation}$ diff = 2.00; $P < 0.001$), while the difference in valuations for male-led ventures targeting male- versus female-dominated industries was not significant ($P = 0.425$).

As to the driver of this interaction effect, our 1 to 7 rating scale measures revealed that investor participants rated the standalone quality of each venture and their trust in the standalone founding CEO of each venture similarly regardless of industry for both the female- and male-led ventures [all *P* values n.s. (not significant), enabling the elimination of these factors as drivers]. The only significant rating scale difference was identified in the degree of perceived fit predicted by an interaction between the founding CEO and the venture: $B = 0.48$, SE = 0.15, $t(123) = 3.17$, $P = 0.002$. Post hoc comparisons of our experimental conditions indicated that the female founding CEO of the venture in the female-dominated industry was perceived to have a significantly better venture fit than the female founding CEO of the venture in the male-dominated industry (fit diff = 0.40, $P = 0.038$); there was no significant difference in respondents' perceived fit for the male founding CEOs of ventures catering to male- versus female-dominated industries (fit diff = 0.08, $P = 0.956$). See Fig. 4 for details.

We then tested for perceived fit as a mediator to help explain the association between our experimental conditions and investment outcomes. The mediation models running the R mediation package on 10,000 bootstrapped samples were suggestive of mediation, with 95% confidence intervals (CIs) that did not include zero for indirect effects of the mediation path running from experimental condition through perceived fit to our outcome measures of logged funding and logged valuation; see Table 6 for full details.

Additional analyses

Using the study 2 response data on funding allocations and valuation amounts for each venture evaluated by our investor participants, we were also able to calculate an implied equity percentage remaining for each founding CEO based on the post-money valuation of each venture with the following formula:

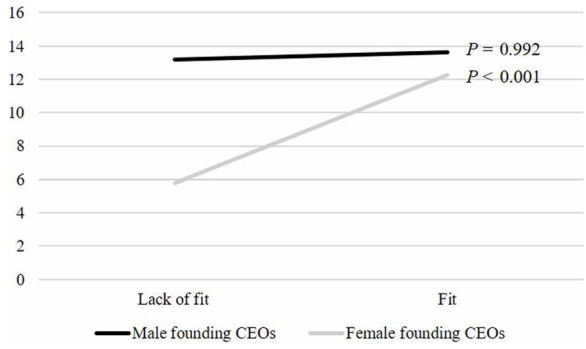

Fig. 2. Study 1 lack of fit disadvantage by founding CEO gender. Figure reflects natural log of funds raised (ln funding); it indicates that female founding CEOs raise significantly less funding when catering to male-dominated industries that represent a lack of fit, while male founding CEOs do not raise significantly less funding when catering to female-dominated industries that are a lack of fit for them.

100 * (1 – (investment amount / (investment amount + pre-money valuation)))

Consistent with our main analyses, we again found that female founding CEOs were disadvantaged, this time in terms of retained equity percentages, with $B = -0.06$, SE = 0.02, $t(125) = -3.33$, $P < 0.001$. Proposed investment amounts and estimated valuation figures provided for each opportunity implied that investors intended to take a significantly higher percentage of equity from the ventures led by female as opposed to male founding CEOs; as a result, male founding CEOs were left with approximately 74% equity on average, while female founding CEOs were only left with approximately 67% on average. Notably, this supplemental analysis enabled us to confirm that the interaction of founding CEO gender and industry gender dominance was again significant as well [$B = 0.12$, SE = 0.04, $t(123) = 3.37$, $P < 0.001$]. We achieved similar results when standardizing the numerator and denominator values for funding and valuation in the equation.

Post hoc comparisons of our experimental conditions using Tukey's post hoc tests confirmed that a male founding CEO targeting a male-dominated industry retains an average 76% equity, while a female founding CEO targeting a male-dominated industry retains 12% less on average for only 64% equity ($P = 0.006$). In contrast, a male founding CEO targeting a female-dominated industry retains an average of 71% equity—the same average percentage as that retained by a female founding CEO targeting a female-dominated industry. The equity that the female founding CEO is able to retain is not only on par with the amount that the male founding CEO retains when targeting a female-dominated industry, but the percentage is also roughly equivalent to the overall average retained equity for the entire experimental sample of 70.5%.

Aside from investigating this additional dependent variable of retained equity, we also explored what—if any—factor(s) can perhaps attenuate the effects we consistently found across all of our outcome measures. We sought to examine investor characteristics more closely as external evaluations of tech organizations have been found to vary according to different types of investors constituting the decision makers (*49*). Recent research indicates that the gap between interactions of male and female investors with early-stage female-led ventures may be reduced for more experienced investors (*50*). One of the key characteristics we captured on our investors serving as study 2 participants is whether they qualify as accredited. We were able to confirm that our results do, in fact, differ according to investor accreditation status or degree of financial sophistication.

Table 5. Study 2 linear mixed effects results. $^{\dagger}P < 0.10$, $^{*}P < 0.05$, $^{**}P < 0.01$, and $^{***}P < 0.001$. Standard errors in parentheses.

Effect on	Ln funding	Ln valuation	Perceived fit
Founding CEO gender	−1.42***	−2.34***	−0.37***
Female = 1	(0.30)	(0.35)	(0.11)
Industry gender dominance	−0.06	−0.68†	−0.08
Female dominated = 1	(0.30)	(0.35)	(0.11)
Entrepreneur * Industry	**1.83*** **	**2.68*** **	**0.48****
Gender interaction	**(0.43)**	**(0.50)**	**(0.15)**
Investor gender	−0.12	−0.42	−0.19
Female = 1	(0.24)	(0.51)	(0.16)
Investor age	0.00	−0.03	−0.01†
	(0.01)	(0.02)	(0.01)
Investor years of experience	−0.01	−0.01	−0.03
	(0.04)	(0.09)	(0.03)
Investor accreditation	0.52*	−1.20*	0.58***
	(0.24)	(0.52)	(0.17)
Intercept	10.78***	15.56***	5.91***
	(0.52)	(1.06)	(0.34)
Marginal R^2	0.08	0.08	0.16
Sample size	130	130	130

Welch's *t* tests indicated that female founding CEOs' disadvantage in lack of fit industries may be reduced (and even emerge as statistically nonsignificant for certain outcomes) with greater degrees of investor sophistication. For accredited (versus nonaccredited) investors, the gap between female founding CEOs of ventures catering to female- versus male-dominated industries tightened from an average funding gap of $62,406 when evaluated by nonaccredited investors to an average funding gap of only $35,373 when evaluated by accredited ones (with $t = 4.25$, $P < 0.001$ declining to $t = 2.80$, $P = 0.007$), from an average valuation gap of $5.0 million when evaluated by nonaccredited investors to an average valuation gap of only $1.1 million when evaluated by accredited ones (with $t = 3.74$, $P < 0.001$ declining to $t = 1.79$, $P = 0.077$), and from an average 11.5% founder equity gap when evaluated by nonaccredited investors to an average founder equity gap of only 2.8% when evaluated

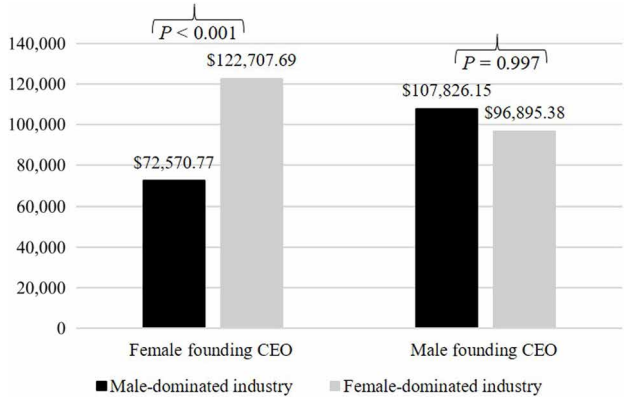

Fig. 3. Study 2 funding allocation comparisons by founding CEO type. Figure reflects average raw funding allocations based on $400,000 cap across all four conditions. It indicates that female founding CEOs are allocated significantly lower amounts of ln funding when catering to lack of fit male-dominated (versus female-dominated) industries, while male founding CEOs receive similar amounts regardless of industry fit. Note that female founding CEOs are also allocated significantly less than male founding CEOs for lack of fit ($P < 0.001$), while female founding CEOs do not receive significantly more than male founding CEOs for fit.

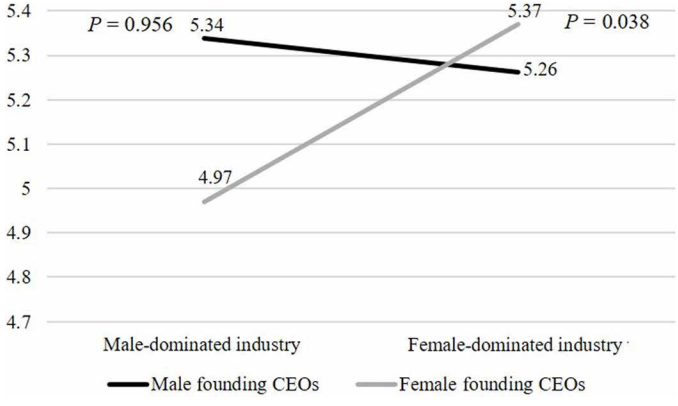

Fig. 4. Study 2 perceived fit differences by industry served. Perceived fit values reflect 1 to 7 rating scale measure responses provided by investors serving as experimental participants. Female founding CEOs catering to male-dominated (versus female-dominated) industries conveyed a significantly lower sense of venture-CEO fit, while perceived venture-CEO fit did not differ by industry served for male founding CEOs.

by accredited ones (with $t = 2.12$, $P = 0.036$ declining to $t = 0.52$, $P = 0.606$). These results help advance recent work, which found some support for the assertion that evaluators lacking product knowledge were more heavily influenced by gender status beliefs when evaluating craft beers (*16*).

DISCUSSION

Studies 1 and 2 make several contributions to recent research at the intersection of gender and venture funding (*31*, *48*, *50*–*53*). First, we not only document that a gender gap in the amount of funding raised persists across ventures of comparable quality and need but also help extend the gap to encompass the valuation at which funding is raised and the percentage of founder equity that is retained in the process. These three factors have key implications for successfully growing the venture, achieving a favorable exit for the venture, and subsequently starting a venture as a serial entrepreneur. Second, we uncover another means through which investor bias contributes to that gap, manifesting as a nuanced interplay of founding CEO and industry served that induces gendered perceptions of fit. We demonstrate how this perceived lack of fit operates to the detriment of female founding CEOs, revealing a new way in which women are prevented from advancing in male-dominated industries. Collectively, our findings indicate that only when catering to female-dominated industries are women able to somewhat offset the other strikes against them in terms of the ability to raise funding at an attractive valuation while retaining equity.

Rather than represent an escape from otherwise biased organizational contexts, we find that bias against women can persist even when seeking entrepreneurial employment opportunities, expressed in ways that are unique yet echo traditional employment contexts. In support of the Lack of Fit model (*22*–*26*), our studies jointly demonstrate that female, but not male, founders are disadvantaged for lack of industry fit in terms of both venture funding allocations and venture funding valuations. We offer new evidence that a continuous measure of U.S. dollars is affected by this gendered lack of fit, advancing recent scale and binary measure findings pertaining to product purchases (*16*) and to funding decisions (*48*). The gender interaction we identify for funding allocations, venture valuations, and equity percentages is not only perpetuating but also aggravating labor market inequality by impeding women's entry, advancement, and wealth accumulation as founders in male-dominated industries where they already suffer as employees.

In terms of practical implications, we help to dispel the misconception that women receive less funding because they start businesses in female-dominated industries that require less capital than male-dominated ones (*54*, *55*). Although female-led ventures were associated with less funding than comparable male-led ventures across both of our studies, we found that female founders raised significantly more (not less) funding when catering to female-dominated industries considered a fit for them. Interestingly—in male-dominated industries constituting the majority of the labor market (*2*)—recent evidence shows that female-led ventures not only report significantly higher profits (*54*) but are even able to outperform male-led ventures operating in those industries, conditional on receiving capital (*48*). Together, these findings suggest that investor bias thwarts otherwise high potential for labor market productivity and growth.

Our results can thus be conceptualized as a new type of double bind for women: Female founders can receive funding benefits from fit perceptions but only in female-dominated industries that represent the minority of overall labor markets (*2*) and are marked by lower earnings prospects (*54*, *56*). While men are afforded credibility across a broad range of industries, women are instead confined to effectively operate in a comparatively less lucrative subset of the labor market. Logic dictates that this market subset also tends to be relatively less familiar to male investors who represent the majority of decision makers in venture capital (*2*, *39*), creating a unique barrier for founders to overcome when serving female-dominated industries. Fortunately, our findings point to future research directions exploring conditions under which the gender gap can potentially be reduced by intervening based on perceptions of fit.

First, we hope to breed investor awareness for an opportunity misperception derived from the gender interaction we identify in our studies, which can inhibit portfolio optimization if investors

Table 6. Study 2 bootstrapped multiple mediation analyses. R package mediation models with 10,000 bootstrapped samples, adjusted for investor gender, age, years of investing experience, and accreditation status. $^{**}P < 0.01$ and $^{***}P < 0.001$. DV, dependent variables of logged funding and logged valuation; IV, independent variable of experimental condition.

Study 2 model outcome	Effect of IV on mediator	Effect of mediator on DV	Indirect effect of mediator	95% CI lower bound	95% CI upper bound
LnFunding	0.354**	0.653***	0.231***	0.11	0.37
LnValuation		0.974***	0.347***	0.17	0.55

neglect potentially viable ventures while favoring potentially undeserving ones. Second, the attenuating effect of financial sophistication we observe among accredited (versus nonaccredited) investors suggests the merits of earmarking support for investor education and other forms of financial literacy by public policymakers and investor groups going forward. Ultimately, this work underscores the need to reduce occupational segregation by gender and to promote women's cross-sector representation, not only in top management teams but across all levels of employment. Investors appear to gain some comfort in parting with their funds when female founders serve industries where they are well represented and have come to be regarded as subject matter experts or to otherwise embody the attributes compatible for success in those fields. Future researchers have an opportunity to delve into the specific role violations that contribute to female founding CEO disadvantage and determine which stereotypes are being activated so they can be addressed in turn.

MATERIALS AND METHODS

Study 1

We conducted study 1 using data from launch competition TCD, venture platform Crunchbase, and government platform U.S. Bureau of Labor Statistics "BLS" (*2*). Since the event's inception in 2010, we tracked and verified all ventures that launched at the U.S. TCD competition across the San Francisco and New York locations through the time of data collection, with $N = 392$ ventures disclosing funding outcomes. First, we gathered aggregate external capital raised (dilutive, not including grant, funding) from Crunchbase and converted raw dollar to natural log "ln funding" values to account for potential distribution skewness (*38*). See the Supplementary Materials for more details on data collection.

We then matched the Crunchbase industry classification for each venture to that of the BLS, which provided the most precise indication of gender dominance by industry as a continuous measure based on women's percentage of employment. We arrived at our continuous measure of BLS percentage (mean = 44.32, SD = 17.85) for the industry served by each venture using the "women as percentage of total employed by detailed industry category" obtained from the "2019 annual averages of employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity" available via the BLS. We then created industry categories (male dominated, gender neutral, and female dominated) to separately analyze the data in multiple ways. See the Supplementary Materials for supplemental analyses on each of these categories and alternates explored.

Crunchbase served as our primary data source for variable measures of founder gender (binary measure of female founding CEO = 1, male founding CEO = 0) and founder age category [ordinal values of 0, 1, and 2 indicating whether the founding CEO was younger than, roughly equivalent to, or older than the 43.2 average years old of tech entrepreneurs with high growth new ventures (*57*)], as well as for venture industry code (Crunchbase primary industry converted into numerical values from 1 to 12) and venture operating status (a binary measure of operating = 1 or not = 0). We separately obtained venture launch location (a binary measure of 0 or 1 for New York versus San Francisco) and launch year (2010 to 2018, also converted to venture age by subtracting launch year from current year) using TCD competition details, as well as venture quality using TCD competition performance [a binary measure of 0 or 1 indicating a TCD contestant versus a TCD selected finalist, runner-up, and winner, which also serves as a proxy for conferred status (*16*)]. Results reflect linear and multiple linear regressions, correlation tests, as well as one-way analysis of variance (ANOVA) with Tukey's post hoc test results for mean comparisons. We report regression results both with and without control measures for completeness of interpretation and as both raw and logged variables to account for any skewness (*38*). See the Supplementary Materials for additional analyses and details on alternate controls (e.g., serial entrepreneurship and years of experience) explored as well.

Study 2

Participating investors completed an online survey, each evaluating four venture opportunities in a counterbalanced order that included two founded by female CEOs and two by male CEOs, where one represented a fit and another a lack of fit with industry served for each CEO gender (e.g., cycling through male-dominated industries of financial services technology and automotive technology versus female-dominated industries of human resources technology and healthcare services technology). See the Supplementary Materials for full procedure, including specific instructions, as well as profile manipulations illustrated in fig. S2. We patterned each fictitious Crunchbase venture profile after actual ventures in study 1's sample. These were ventures that (i) were all designated as finalists in the TCD competitions and (ii) all raised hundreds of millions of dollars in funding, representing the top 3% of the study 1 venture sample.

Departing from this point of comparability, we varied the opportunities to maximize external and ecological validity whereby real-world investors typically evaluate multiple comparable yet distinct ventures at a given point in time (*31*). For the venture monikers, we created one-word names reflective of each venture that were standardized in terms of letter length; for the founding CEO names, we used the most identifiable tier of male versus female names in comparable socioeconomic and racial categories (*58*). Each profile included varied yet comparable venture depictions of founding year, location, number of employees, funding stage, year-over-year growth, as well as quality and status via performance at the TCD competition, all representing criteria for venture quality evaluation.

The Crunchbase profiles included three-line descriptions of the financial advisory, automotive sharing, employee benefits, and family healthcare platforms (across male- versus female-dominated industries comparable in terms of having 30 to 40% versus 70 to 80% employment of women), complete with comparable references to technology, to enabling everyday usage, and to successfully meeting user needs. The three lines of founder information included reinforcements of founding CEO role and name; references to successful serial entrepreneurship; years of industry experience; degree of passion, preparedness, and personal pain point for the offering's impact (*59*–*61*); and relevant industry certifications—all representative of criteria for venture founding team evaluation.

After reading each Crunchbase profile, participants were constrained to allocate funding out of a constant sum of $400,000 (*31*), as well as to provide an uncapped valuation at which they would invest in each venture. Each participant viewed these four ventures in random order before providing the requisite dollar funding and valuation amounts, as well as seven-point rating scale evaluations, indicating the extent to which each venture conveyed a sense of (i) venture quality, (ii) trust in the CEO's ability to execute, and (iii) fit between the CEO and the venture opportunity. As a testament to the comparability of our manipulated profiles, we observed nonsignificant results for rating scale response comparisons pertaining to the quality of each standalone venture and trust in each standalone CEO's ability to execute. Our participants thus confirmed that these ventures signaled comparable venture quality and CEO trust, but participants were nonetheless swayed by the industry fit and lack of industry fit derived from randomized entrepreneur-and-venture combinations that they assessed, as hypothesized.

Applying linear mixed effects modeling to test for our main and interaction effects, we nested the 520 venture evaluations within the 130 investor participants performing the evaluations (*62*–*63*). We kept the linear mixed models with all control variables intact and constructed a 1-1-1 mediation model for the funding and valuation amounts allocated to each startup, predicted by the experimental condition and a measured mediator of perceived fit associated with each venture opportunity (*64*). These 10,000 bootstrapped multiple mediation analyses tested whether the measured fit variable appeared to mediate the impact of the experimental conditions on funding allocations and valuation estimates while still accounting for multiple observations per subject and the personal attributes of each subject that could potentially affect investment judgments. As in study 1, we again performed all statistical analyses on both raw dollar values and natural log values to account for potential distribution skewness (*38*), as well as both with and without our control variables, finding consistency across all tests.

SUPPLEMENTARY MATERIALS

Supplementary material for this article is available at http://advances.sciencemag.org/cgi/content/full/6/48/eabd7664/DC1

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