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Gender Gaps in Venture Capital Performance

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Abstract

We explore gender differences in performance in a comprehensive sample of venture capital investments in the United States. Investments by female venture capital investors have significantly lower success rates than investments by their male colleagues when controlling for personal characteristics, including employment and educational history, and portfolio companies' characteristics. The gender differences in investment outcomes are not due to female investors being less skilled but, rather, are largely attributable to female investors receiving less benefit from the track records of their colleagues. Performance differences disappear in older, larger firms and firms with other female investors. This supports the view that formal feedback mechanisms and hierarchies are potentially useful in ameliorating the female performance gap.

I. Introduction

Gender differences in workplace performance have remained an important, if somewhat contentious, issue within the economic and management literature. Various researchers have ascribed the performance differential of females in the labor force to discrimination, differences in educational backgrounds and training, occupational choice, and differences in innate ability. We add to the literature by exploring gender performance differences in the venture capital (VC) industry, a setting that allows us to explore potential mechanisms at play. In particular, data on individual VC investments precisely measure performance (investment success) and are precisely associated with the individual responsible for the deal (the venture capitalist represented on the board of directors). Additionally, we gather a host of

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individual demographic and firm-level characteristics that help disentangle potential sources of the gender performance gap.

We explore investment performance for female venture capitalists once we control for individual, firm, and investment characteristics. Prior research on VC has shown that investment performance is a function of the individual's skill (as measured by his or her past track record) as well as the skill of a venture capitalist's colleagues within a firm (Ewens and Rhodes-Kropf (2015), Gompers, Mukharlyamov, and Xuan (2016)). In this article, we show that investment performance is also a function of the skill of a venture capitalist's co-investors (i.e., those investors in a portfolio company who may be from other VC firms).

Female venture capitalists have investment performance that is approximately 10%–15% lower than their male colleagues. We find that this performance gap is not a function of a female investor's skill; rather, it is largely attributable to a female venture capitalist receiving less benefit from the track records of her colleagues within her firm. Her investment success is affected by her prior investment track record (skill) as well as by that of her co-investment partners (i.e., venture investors in the portfolio company from other VC firms). The prior track record of a female venture capitalist's colleagues, however, does not affect her investment success. The opposite is true for male venture capitalists, whose investment performance improves in the presence of more successful colleagues. In other words, women venture capitalists do not benefit, on average, from having good colleagues in the firms in which they work. We find, however, that this lack of benefitting from colleagues' skill disappears in older, larger firms and in firms with other female VC investors.

The rest of the article is organized as follows: Section II provides an overview of the related literature, and Section III outlines our hypotheses. In Section IV, we introduce our large-sample data. Section V presents the analyses that explore the gender gap in investment performance. Section VI concludes.

II. Related Literature

Various articles have explored the differences in performance between men and women in the workplace. Much of this literature has been hampered by either small sample sizes or coarse, qualitative measures of performance. Similarly, large-scale demographic and firm-level information is typically unavailable. We utilize the VC industry to explore differences in the performance between male and female investors because of the availability of data that overcome many of these prior issues.

The VC industry has several attractive characteristics that make the study of gender differences in performance highly informative. First, data exist that allow a researcher to directly measure individual performance. Gorman and Sahlman (1989) show that most VC deals are individually sourced and that the venture capitalist who sources the investment is the one who serves on the board of directors. Sahlman (1990) shows, in a comprehensive study of VC, that the originating venture capitalist typically serves on the company's board of directors. In this way, we are able to tie individual companies to individual venture capitalists by identifying the specific individual at the VC firm who serves on the company's

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board of directors. Martel (2006) explores the investment decision process in VC firms via a survey, divides the process into stages, and identifies that deals are primarily sourced by individuals. After various stages of due diligence, an investment committee typically reviews and approves the investment. Gompers, Gornall, Kaplan, and Strebulaev (2020) survey nearly 1,000 VC investors and identify the importance of collaboration in the deal-evaluation and investment-decision-making stages of the deal funnel.

Second, we have a precise measure of individual performance. VC firms market their ability to make investments in private companies and to generate attractive returns for their investors. Additionally, venture capitalists' compensation is directly tied to investment returns because they earn a percentage (typically 20%) of the investment's profits. We are able to identify the eventual outcome of each investment. Because returns to VC investments are driven by high-value exits (initial public offerings (IPOs) and high-value acquisitions), we are able to precisely measure individual outcomes. Further, high-value exits deliver returns to VC fund participants (or outside investors in a venture fund) and attract future fund dollars. In this way, the outcome of individual VC portfolio investments is important to the total success of the venture firm and to fund participants.[1] Our results focus on two measures of successful investments: whether the investment eventually goes public in an IPO or, alternatively, whether it goes public in an IPO or gets acquired at a high value. Because both of these are objective measures of whether a venture capitalist makes money on the particular investment, they constitute a good measure of performance.

Finally, we have comprehensive demographic information on individual venture capitalists and the firms in which they work. We are therefore able to tabulate the education, work history, ethnicity, and gender of all venture capitalists. This allows us to not only evaluate the individual performance of a particular venture capitalist but also track the performance of her colleagues within the firm and her co-investors outside the firm. As a result, we can decompose the investment performance into three components measuring sensitivities to the individual track record, the track record of co-investors, and the track record of colleagues not involved in the deal under consideration.

Recent work on VC has used similar data to explore the micro-level foundations of investment success. VC firm and individual investment track records predict investment success, as does the degree of industry specialization (Gompers, Kovner, Lerner, and Scharfstein (2008), Gompers, Kovner, and Lerner (2009)). Performance is persistent at both the firm (Kaplan and Schoar (2005)) and individual levels (Gompers et al. (2008)). A higher degree of individual industry specialization is associated with greater investment success.

As is the case in many areas of the financial sector, VC remains a largely male-dominated industry. Although the number of female venture capitalists has increased over time, the subject of gender differences in performance remains a

[1]In many contexts, individual performance may not directly translate to total firm performance. The importance of high-value exits in the VC industry suggests that individual VC investor decisions can have a large impact on the total well-being of the firm. For a review of research on the relation between individual and firm performance, see DeNisi and Smith (2014).

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controversial issue. High-profile sexual discrimination lawsuits filed recently against Kleiner Perkins and CMEA Capital have drawn attention to gender workplace issues in VC firms (Geron (2013)). As such, the issues explored in this article are important not only from an academic perspective but also from a workplace and legal perspective.

The personal characteristics of venture capitalists also influence their investment performance (Gompers et al. (2016)). Gompers et al. find that venture capitalists who share similar backgrounds tend to invest together more often. They also show that the deals done because of high investor affinity perform substantially worse than other deals. In a similar manner, we use the gender and background of individual venture capitalists and their partners to disentangle performance differences between male and female venture capitalists.

Our article addresses issues related to the performance differential between men and women in the workplace. The literature on gender effects in the workplace covers a number of related areas that explore differences in performance.[2] One area of research explores differences between men and women in promotion rates to senior levels. Bertrand and Hollack (2001) find that between 1992 and 1997, women comprised only 2.5% of the top 5 highest-paid executive categories at public firms. Other work documents gender gaps in promotion rates and compensation for MBA graduates (Bertrand, Goldin, and Katz (2010)), lawyers (Wood, Corcoran, and Courant (1993), and university faculty (Barbezat (1987)).

Gender differences in observed characteristics, such as education and experience (Blau and Kahn (2000), (2006)) and differences in work preferences and human capital investment (Daymont and Andrisani (1984), Polachek (1981)) have also been studied. Most of this research finds that some (but not all) of the differences in workplace performance can be accounted for by different backgrounds. In our research, we include extensive controls for education and demographic characteristics to adjust for potential observable differences in male and female VC performance. The gender performance gap that remains is not directly attributable to gender differences in venture capitalists' backgrounds.

The sociology and organizational behavior literature have examined workplace performance as a function of historically gendered institutions and the gender biases of individuals (Ely (1995), Reskin and Bielby (2005)). For example, Budig (2002) finds that women are promoted at slower rates in traditionally male-dominated professions. Surveying women working in finance on Wall Street, Roth (2004) finds that women are gradually segregated into specific jobs with slower advancement opportunities after they are hired.

III. Hypotheses

Our primary focus is to first examine differences in the performance of male and female venture capitalists. Survey evidence from Gompers et al. (2020) shows

[2]Differences in gender outcomes may exist at many points in the career life cycle, including occupational choice, hiring, compensation, promotion, and firing. Our literature review focuses on the studies related to compensation because compensation is most directly related to investment performance outcomes in the VC industry.

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that most VC firms recruit and develop investment professionals. VC is often seen as an apprenticeship business in which junior investment professionals learn from seasoned partners. Women may not receive the same type and quality of support/mentorship as male partners in VC firms, which are typically male-dominated workplaces. Prior research in organizational behavior and social psychology has shown that women working in male-dominated fields may face a variety of challenges, such as lack of support (both career and psychological), lack of mentorship, and lack of voice, which can cause anxiety and self-doubt and negatively affect performance and career advancement (e.g., Noe (1988), Budig (2002), Roth (2004), Martin and Barnard (2013), Kim, Lee, and Kim (2015), and Beilock (2019)). Given this, our first hypothesis focuses on the performance differential between men and women in the VC industry:

Hypothesis 1. We expect that women will have lower investment returns than men, given the male-dominated nature of VC.

Prior research on gender performance differences has been limited because most studies cannot quantitatively attribute performance to individuals.[3] Some work accounts for observable differences in individuals, such as levels of education, experience, or job functions, but without direct measures of the production function and performance metrics for individuals, they cannot comprehensively compare individual performances by gender and instead focus on indirect measures of performance, such as compensation.

Prior work on VC (Gompers et al. (2008)) has shown that the skill (as measured by an individual's track record) of a venture capitalist's partners affects the investment performance of a venture capitalist. In this article, we control for the prior track records of all relevant investors in addition to the other demographic characteristics related to performance.

The venture capitalists who matter for the success of a deal originated by a female or male investor comprise three categories: the investor, his or her co-investors on this deal from other VC firms, and his or her colleagues within the firm not involved in this deal. The first two categories (the investor and co-investors) have a direct impact on performance because of their active involvement in the deal under consideration. The third category (the colleagues not involved in the deal under consideration) could indirectly influence performance by *assisting* the female or male investor and thus affecting her or his ability to create value on that deal.

By virtue of working at the same VC firm, colleagues may exert externalities on each other's ability to lead the portfolio company to a successful exit even when they are not involved in the same deal. This externality (or assistance) affects venture capitalists' ability to add value to their portfolio companies and could be accomplished through feedback, advice, contacts, analytical help, and so forth. Such interactions result in a track-record transfusion and make the performance of a deal sensitive to the skills of firm colleagues not involved in that deal. Because we

[3]A notable exception to the limitation of measuring individual performance on labor market outcomes is the article by Goldin and Rouse (2000), which examines the impact of blind auditions on orchestra hiring of male and female applicants.

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are not able to directly identify these actions in the data, we are not able to make causal claims, and other governance and internal mechanisms may play a role as well. For lack of a better term, however, we use the word *mentorship* to collectively refer to the different means by which venture capitalists transfer to their colleagues the ability to execute successful deals.

Our second hypothesis thus focuses on the different propensity of men and women to benefit through mentorship (defined broadly) from their successful colleagues:

Hypothesis 2. The gender gap in investment success is not driven by differences in individual capability or investment quality but is instead related to women receiving less value from their colleagues.

Research on performance differences in the workplace has found that women tend to perform better in firms that have more formal processes, greater structure, and higher bureaucratization (Reskin and McBrier (2000), Baron, Hannan, Hsu, and Kocak (2007)). Because data limitations make it virtually impossible to directly quantify the extent of bureaucracy in an organization, our analysis relies on proxies (firm age and firm size), which are chosen for two reasons. First, a long sociological literature, going back to seminal work on bureaucracy by Max Weber, connects an organization's age and size to greater formalization and bureaucracy (Weber (1968)).[4] Second, in their survey of VC investment practices, Gompers et al. (2020) find that older and larger VC firms are more likely to formally vote on investments, and formal votes are more likely to lead to formal mentoring and feedback. Similarly, larger and older VC organizations tend to have greater bureaucracy with more layers of professionals (i.e., more distinct titles) within the firm.

In this way, we would expect that performance differences between male and female venture capitalists might concentrate in smaller and/or newer VC firms. Such firms are likely to have insufficient formalized systems implemented, whereas larger, older VC firms are more likely to have formal mentoring and feedback mechanisms, formal investment-decision-making processes (e.g., investment recommendation memos and votes), and formal review procedures. Gender-uneven mentorship and support are thus more likely to occur in smaller, younger VC firms, which can hinder female venture capitalists' performance. Our third hypothesis, therefore, focuses on the role of VC firm age and size in mediating the gender difference in performance:

Hypothesis 3. We expect gender differences in performance to be higher in smaller, younger VC firms.

[4]For example, Aldrich and Auster (1986) suggest that information acquisition and communication channels become more formalized in larger and older firms. Baron, Burton, and Hannan (1999) examine the evolution of bureaucracy in a sample of Silicon Valley startups and show that the amount and rate of formalization are strongly affected by scale, growth, and organizational aging. Dobrev and Barnett (2005) argue that greater bureaucratization in older and larger firms and, as a consequence, higher role differentiation and routinization explain why employees of such companies are less likely to quit. Sorensen (2007) uses firm size and age to measure an organization's degree of bureaucratization in a study on how the social context affects entrepreneurial activity.

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Limited access to mentorship has been shown to play an important role in explaining gender differences in performance. Mentorship of women by women is more broadly related to the finding that gender inequality is a function of the sex composition of a firm and its managers (Ely and Padavic (2007)). Recent research using administrative data in Norway finds that women in the private sector are more likely to be promoted when they have a female boss, a result that may be attributable to mentoring (Kunze and Miller (2017)). Likewise, Matsa and Miller (2011) find that women on corporate boards increase promotions and hiring of female executives in public companies, and Ibarra (1992) finds that the availability of same-sex ties in the advertising industry is important for female success. In the academic context, a recent randomized controlled trial found that when senior female economists mentored young female economists, the younger scholars obtained more federal grant funding and had higher-quality publications (Blau, Currie, Croson, and Ginther (2010)). Research has also found that female undergraduate students who take classes with female professors are more likely to continue to study in these fields due to both role model and mentorship effects (Carrell, Page, and West (2010), Bettinger and Long (2005)). Further, Ulku-Steiner, Kurtz-Costes, and Kinlaw (2000) find that mentor support is lower for women in male-dominated versus gender-balanced graduate programs, and this helps to explain gender differences in doctoral student success.

Mentorship is important in VC because most VC firms are small and informally organized. Mentorship may not be well structured or reported in most VC firms. Similarly, firms that are "friendly" toward women may support women in other ways than mentorship (specific benefits, working from home, etc.). Our fourth hypothesis thus focuses on the presence of other female venture capitalists and its impact on the gender differences in VC performance:

Hypothesis 4. We expect that the presence of female colleagues should reduce gender performance differences in the VC industry.

IV. Data

A. Sources of Data

The data used in this article are derived from several sources. We start with VentureSource, a database that contains comprehensive information on VC investments. We obtained a data set of VC investments via a one-time data-dump purchase from VentureSource in 2003. The observations in the data set date from 1975 to 2003 (with incomplete coverage for 2001–2003).[5] We impose three conditions on the data to construct the sample used in the article. First, we retain only investments made by traditional VC firms. This means that investments made by entities such as hedge funds, mutual funds, investment banks, angel groups, individual investors, and universities are excluded. Second, to be retained in the sample, a portfolio company must have at least one board member listed who is affiliated

[5]Our results are qualitatively and quantitatively similar if we restrict the sample to the post-1990 period, during which VentureSource has better data coverage.

with a VC firm in the data set from which the startup receives funding. Third, we require that board members' names be nonmissing so that we can trace the biographic details of the individual venture capitalists.

For each portfolio company, VentureSource reports the identities of the VC firms and individual venture capitalists represented on a portfolio company's board of directors. We construct a data set with an observation for every venture capitalist board seat in each portfolio company. Board seats are indexed to the date the individual joined the board, which typically coincides with a new investment in the portfolio company.[6] Additionally, we have information on the date of each investment, the amount invested in each round of financing, the company's industry and location, and the portfolio company's ultimate outcome. Where data on the investment outcome were missing, it was hand-collected via a variety of Internet sources.

For each individual venture capitalist in the data, we hand-collect a broad range of biographic information, including past work experience, educational history, ethnicity, and gender, through Web searches, U.S. Securities and Exchange Commission (SEC) filings, news articles, and online résumé databases. For prior-employment histories, we record companies at which an individual had worked in the past and their prior positions. The education background includes data on the academic institutions at which individuals obtained their academic degrees as well as the types of degrees: undergraduate, postgraduate nonbusiness (PhD, MS, JD, and MD), or postgraduate business (MBA).[7] To determine whether an individual holds a degree from a top academic institution, we classify top universities as the Ivy League schools (Brown University, Columbia University, Cornell University, Dartmouth College, Harvard University, Princeton University, University of Pennsylvania, and Yale University) as well as other top U.S. schools (Amherst College, California Institute of Technology, Duke University, Massachusetts Institute of Technology, Northwestern University, Stanford University, University of California–Berkeley, University of Chicago, and Williams College).[8]

Venture capitalists' genders are determined based on visually inspecting first names. In the cases of unisex names, we determine gender by reading news articles and Web pages mentioning or containing pictures of the individual venture

[6]If VentureSource does not contain information on exactly when an individual investor from a given VC firm joined the board of a specific startup, we use the date of the first investment by this VC firm in the startup under consideration. The results in the article are robust to randomly assigning joining dates within an interval from the VC firm's first investment until 1 (2, 3, 4, and 5) year(s) later or the IPO date, if it happens sooner. As such, the imputation of dates does not drive out results.

[7]For a minority of venture capitalists, information on past employment and education cannot be located despite our best effort. In such cases (12.1% of the individual venture capitalists who are missing education information and 12.0% who are missing job employment information), we categorize the job and education variables as "unknown," thus allowing us not to discard these observations so that our sample is not constrained by the availability of biographical information online. We have also confirmed that the results are robust to dropping these observations from the analysis and to controlling for the missing biographical data with a separate dummy-variable regressor.

[8]The results presented in the article are robust to classifying only the Ivy League universities as top schools as well as to adding top European universities (Cambridge University, INSEAD, London Business School, London School of Economics, and Oxford University) to the list of top schools.

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capitalists.[9] To discern ethnic background, we use the name-matching algorithm developed by Kerr and Lincoln (2010) to determine the most likely ethnicities of venture capitalists based on their last names. Individual venture capitalists are classified into five nonoverlapping ethnic groups: East Asian, Indian, Jewish, Middle Eastern, and all others. Although the limitation of the name-matching algorithm does not allow us to identify all possible ethnicities, such as African American, the groups that the algorithm has been shown to successfully identify capture the most active ethnic minorities in the VC industry, and all have a strong sense of cultural identity.[10]

We determine investment outcomes using VentureSource and Thomson Financial's SDC database, supplemented by Thomson Financial's VentureXpert database. We supplement the data with information from Capital IQ. We consider an investment to be successful if it results in the IPO of the portfolio company because public floatation of a portfolio company is the cleanest signal of investment success, which brings the investing VC firms not only substantial returns but also significant name recognition.[11] All of our results are robust to defining success as either an IPO or an IPO plus high-value acquisitions.[12]

Because portfolio firm quality influences investment performance, we supplement our analysis with four ex ante measures related to a venture's success (Gompers et al. (2016)). First, we check whether the portfolio company was founded by a successful serial entrepreneur by tracking the careers of founders and identifying those who had already established a VC-backed business. An entrepreneur with a track record of success is more likely to succeed than a first-time entrepreneur (Gompers, Kovner, Lerner, and Scharfstein (2010)). We also capture the stage (e.g., startup/seed, early stage, expansion, later stage, and buyout/acquisition) at the time of fundraising and the financing round, respectively, keeping in mind that earlier stages and rounds involve more risks and hence are less likely to result in a successful outcome. Finally, we account for the amount of attention that the media paid to the portfolio company at the time of investment. Media attention may proxy for market sentiment at the time of investment, and therefore deals with more media presence prior to the first VC investment may be of higher quality and thus have higher success rates. We use Dow Jones Factiva to identify portfolio companies that had news stories about them released prior to or at the time of financing. Specifically, we search for publications with the portfolio company name and the phrase "venture capital" in the time frame from 6 months before the investment until 1 month after. We then define a dummy

[9]Despite our best effort, we cannot determine the gender of 26 venture capitalists in our sample. These individuals' observations are excluded from the sample.

[10]We take into account the information on the country/geographic region of a venture capitalist's undergraduate academic institution to determine ethnicity when the name-matching algorithm fails to do so.

[11]Although there are examples of successful investments that result in acquisitions instead of IPOs, the return to VC investing is primarily driven by the small fraction of investments that go public (Venture Economics (1988)). Moreover, the ambiguity of an acquisition as an indicator of success is evidenced by the 40% of investments that exited via acquisition in our sample.

[12]A high-value acquisition is defined as an acquisition exit with a transaction value exceeding a threshold of $25 million (or alternatively, $50 million or $100 million).

variable capturing high media coverage, which equals 1 if the number of news articles covering the investment is greater than the median number of news articles for investments covered by at least one news article in that year, and 0 otherwise.

The person-level investment data allow us to track and control not only for the individual performance of a particular venture capitalist but also for the performance of his or her colleagues within the firm and his or her co-investors outside the firm. We construct three distinct variables to capture these track records. SUCCESS_PERSON measures the past investment performance of the individual venture capitalist; it is simply the fraction of an individual's prior investments that have gone public.[13] SUCCESS_FIRM is a similar measure of past track record but is computed at the VC-firm level.[14] In particular, we calculate the fraction of the firm's prior investments (excluding those by the investor in question) that were successful prior to the current investment. Because most VC-backed companies receive investments from more than one VC firm, we also examine the quality of the syndicate partners involved in a given investment. SUCCESS_SYNDICATE measures the success rate of co-investment partners from other VC firms. We look at the collective prior investments for the individual's co-investors only (there may be multiple co-investors from multiple firms on a given deal), not the prior track record of all of the partners at the co-investors' firms.[15]

B. Summary Statistics

In Table 1, we summarize information on the individual VC investors in our data set. We have information on 3,264 male venture capitalists and 219 female venture capitalists. Females represent just 6.3% of the sample. Women represent an even smaller fraction of total deals and successful deals (IPOs): 5.5% (1,457 of 26,328) of all investments and only 4.7% (222 of 4,675) of IPOs have a female VC investor.

We also tabulate the personal characteristics of male and female VC investors. There do not appear to be substantial differences in the rate of attendance at top undergraduate or graduate schools between men and women. Roughly half of all venture capitalists (both men and women) have at least one degree from a top university. Women do, however, appear to have shorter careers (likely indicating that women are more heavily represented in recent years) and are more likely to join older and larger firms.[16] As we show later, this is likely due to women sorting into firms that have more structure and more formal processes. The lack of these structures, as we show later, is central to performance gaps between men and women. Finally, we tabulate the deal characteristics for male versus female

[13]Gompers et al. (2008) show that an individual's prior investment experience is useful for predicting his or her investment success. In our models, if an individual or firm has no prior investments, the prior investment success rate is set to 0.

[14]For deals where the investment is the first investment at a firm or there are no additional partners at the firm, this prior firm investment success rate is set to 0.

[15]For deals where there is a single investor on the board, the SUCCESS_SYNDICATE measure is 0.

[16]It should be noted that these firms may also have greater interest in hiring women to increase diversity.

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TABLE 1

Venture Capital Investor Summary Statistics

Table 1 summarizes the distribution of venture capitalists' personal characteristics. Covariates are summarized at the person level. Standard deviations are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Total	Male	Female	
People	3,264	219	
Deals	24,871	1,457	
Initial public offerings	4,453	222	
By Person Average	**Male**	**Female**	***p*-Value of Difference**
TOP_COLLEGE	0.316	0.269	0.154
	(0.465)	(0.445)	
TOP_BUSINESS_SCHOOL	0.377	0.352	0.450
	(0.485)	(0.479)	
TOP_GRAD_SCHOOL	0.136	0.105	0.196
	(0.343)	(0.307)	
TOP_SCHOOL	0.539	0.489	0.146
	(0.499)	(0.501)	
CAREER_LENGTH (years)	8.524	6.831	0.000***
	(6.068)	(4.949)	
TOTAL_NUMBER_OF_DEALS	6.614	5.644	0.018**
	(5.913)	(4.922)	
AGE_OF_FIRM_AT_JOIN (years)	8.214	9.543	0.006***
	(6.901)	(7.198)	
DEALS_COMPLETED_BY_FIRM_AT_JOIN	13.713	18.690	0.008***
	(26.299)	(31.932)	
MAX_NUMBER_OF_PARTNERS_AT_FIRM	4.124	5.014	0.002***
	(4.032)	(4.598)	
SUCCESS_PERSON	0.179	0.152	0.010***
	(0.383)	(0.360)	
ROUND_NUMBER	1.843	1.954	0.032**
	(0.736)	(0.768)	
INVESTMENT_STAGE	2.338	2.381	0.181
	(0.456)	(0.471)	
HIGH_MEDIA_COVERAGE	0.138	0.153	0.228
	(0.181)	(0.198)	
SERIAL_ENTREPRENEUR	0.252	0.252	0.988
	(0.266)	(0.264)	

venture capitalists. The investment success ratio (SUCCESS_PERSON), defined as the fraction of deals that have gone public, is significantly lower for women than it is for men.[17] Deal characteristics and observable quality measures, including the investment stage, whether the deal has high media coverage, and whether the portfolio company is founded by a serial entrepreneur, do not differ significantly by gender, except for the round number. Investments involving female venture capitalists are on average at a later investment round. We will examine these deal characteristics closely to see if any performance differential can be explained by differences in observable deal quality.

We are also interested in understanding whether women come into VC through different career paths than men. We collect biographical information from VC firm websites and the Capital IQ database that allows us to characterize prior employment history for all VC investors. We have up to three prior jobs for each individual.

[17]These results define success as a firm that files for an IPO. The results are qualitatively identical if we define success as a firm that either undertakes an IPO or has a high-value acquisition.

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TABLE 2

Prior Career Histories of Male and Female Venture Capitalists

Table 2 summarizes the career histories of male and female venture capitalists. Job categories cover up to three prior jobs for each investor before the investor worked in the observed venture capital firm. Covariates are tabulated at the person level. Standard deviations are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Prior Job Type	Male	Female	*p*-Value of Difference
Venture capital	0.262 (0.440)	0.269 (0.445)	0.800
Entrepreneur	0.168 (0.374)	0.078 (0.268)	0.001***
Operational manager	0.283 (0.451)	0.311 (0.464)	0.390
Banking/Finance	0.225 (0.418)	0.292 (0.456)	0.023**
Sales/Marketing	0.086 (0.281)	0.091 (0.289)	0.802
Product development/research and development	0.110 (0.313)	0.059 (0.237)	0.019**
CEO	0.192 (0.394)	0.110 (0.313)	0.003***
Chief operating officer	0.107 (0.309)	0.078 (0.268)	0.171
Chief financial officer	0.027 (0.161)	0.032 (0.176)	0.639
Chief technology officer	0.010 (0.100)	0.000 (0.000)	0.135
Consulting	0.133 (0.340)	0.132 (0.340)	0.982
Accounting	0.024 (0.152)	0.041 (0.199)	0.106
Lawyer	0.028 (0.165)	0.032 (0.176)	0.724
Doctor	0.006 (0.076)	0.000 (0.000)	0.258
Academia	0.027 (0.162)	0.027 (0.164)	0.969
Government	0.036 (0.187)	0.055 (0.228)	0.161

In Table 2, we tabulate career histories for men and women.[18] Nearly 30% of both men and women have prior experience as a venture capitalist before they join the firm in which we identify their investment. Many individuals start off as associates or principals at another firm before being recruited as investment professionals at a second VC firm. When we compare male and female venture capitalists, we find that men are far more likely to have been an entrepreneur (16.8% vs. 7.8%). Similarly, women are less likely to have been a CEO (19.2% vs. 11.0%) or to have been employed in product development (11.0% vs. 5.9%). It is also worth noting that women are more likely to come from banking/finance backgrounds (29% vs. 23%.) These patterns may influence the performance of female venture capitalists. Many entrepreneurs often speak of the advice that they can receive from a

[18]An individual's career history can enter the table more than one time. For example, if we have two prior jobs listed for an individual (e.g., an entrepreneur and a lawyer), then the individual will show up in both classifications. The patterns shown in this table are robust to tabulating only the single most recent job held.

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seasoned CEO, technology executive, or former entrepreneur. If fewer female venture capitalists have these backgrounds, then better entrepreneurs may be less likely to take money from a female venture capitalist.

In Table 3, we provide some additional information on the VC firms in the sample. For example, 79% of firms have never had a female VC investor. Of those that have had a female VC investor, the vast majority (126 out of 169) have only had one. This highlights that if a firm has a female venture capitalist, it most likely has only one. It is also important to note that we do not capture junior professionals at VC firms because they typically do not sit on boards.

Finally, in Table 4, we present the industry distribution of deals in our sample, broken down by gender. Relatively speaking, female venture capitalists have the most presence in the biotechnology/healthcare and consumer industries and the least presence in the industrial and energy sectors. The average IPO success ratio is lower for female venture capitalists' deals in most industries, except for industrial and financial services. In all of our analyses, we control for industry and year fixed effects to account for possible industry factors that contribute to deal success.

TABLE 3

Women at Venture Capital Firms

Table 3 summarizes the distribution of women at venture capital firms. Firms are tabulated by the number of women who were ever investment professionals at the firm. Additionally, the number of deals with a female investor is tabulated. The number of women (225) exceeds the total number of women in Table 1 (219) because 6 women worked at more than one firm in the sample.

No. of Women in a Firm	No. of Firms	% Firms	% Firms with Women	Total No. of Women at Firms	% Women	No. of Female Deals	% Female Deals	No. o Female Deals After 2nd Woman Joins	% Female Deals After 2nd Woman Joins
0	644	79%							
1	126	15%	75%	126	56%	768	53%	0	0%
2	31	4%	18%	62	28%	437	30%	417	63%
3	11	1%	7%	33	15%	226	16%	215	33%
4	1	0%	1%	4	2%	26	2%	25	4%
Total	813	100%	100%	225	100%	1,457	100%	657	100%

TABLE 4

Industry Distribution of Deals

Table 4 presents the distribution of deals across industries in our sample.

	All Deals					
	Male			Female		
Industry Name	Count	IPO	% IPO	Count	IPO	% IPO
Biotechnology and healthcare	5,129	1,372	26.75%	530	106	20.00%
Business services	2,531	174	6.87%	138	7	5.07%
Industrial	330	57	17.27%	5	1	20.00%
Communications	3,771	678	17.98%	98	10	10.20%
Computers	10,836	1,729	15.96%	552	77	13.95%
Consumer	1,006	191	18.99%	76	12	15.79%
Energy	43	17	39.53%	1	0	0.00%
Financial services	499	62	12.42%	18	4	22.22%
Other	726	173	23.83%	39	5	12.82%

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V. Estimation and Results

A. Gender and Venture Capital Investments

In this section, we test Hypothesis 1, documenting gender performance differences in the VC industry, as well as begin evaluating Hypothesis 2 to understand the source of these differences. Our first set of analyses attempts to control for a variety of observable demographic and investment characteristics. This analysis demonstrates that female venture capitalists have investment success rates that are significantly lower than those of their male colleagues when controlling for observable characteristics, consistent with our first prediction. We then explore a variety of explanations for this lower performance.

In Table 5, we start by testing whether female investment performance is lower than the performance of similar male colleagues. The dependent variable is our measure of investment success, a dummy variable that equals 1 if the underlying portfolio company went public.[19] In all specifications, we include year and industry fixed effects to control for time- and sector-varying opportunities, and we cluster standard errors at the VC-firm level.[20] In all of our regressions, we utilize OLS specifications to make the interpretation of the coefficients easier. The qualitative results are identical if we estimate the regressions using probit specifications.

In column 1 of Table 5, we include only a dummy variable equal to 1 if the investor is female, and 0 otherwise. Column 1 shows that when controlling for industry and year effects, investments made by females are 2.1% less likely to go public. Given an unconditional average probability of going public of 14.3%, this difference is economically significant, representing roughly 15% (= 2.1%/14.3%) lower performance.[21]

We next ask whether demographic factors can explain the difference. In column 2 of Table 5, we include dummy variables that capture whether the venture capitalist has a degree from a top school and whether the venture capitalist belongs to an ethnic minority group, as well as the prior job categories of the investor.[22] Venture capitalists with degrees from top schools perform significantly better. Controlling for all these personal characteristics, the magnitude and significance of the performance gap remain unchanged.

In column 3 of Table 5, we expand our independent variables to control for observable deal quality that could potentially affect investment performance. The regression estimates show that all four ex ante quality proxies (serial entrepreneur, investment stage, financing round, and media coverage) display statistical and economic significance in predicting the future investment outcome. However, female venture capitalists still significantly underperform even after controlling for ex ante deal quality.

[19]Table A1 in the Supplementary Material establishes that the results reported in Table 5 are robust to defining success as IPOs or high-value acquisitions.

[20]All results are robust to clustering standard errors at the portfolio-company level.

[21]Our results are robust to conducting the analysis at the portfolio-company level.

[22]Gompers et al. (2016) show that investors of the same ethnicity tend to co-invest and that when investors co-invest for affinity reasons, investment performance is lower.

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TABLE 5

Gender and Venture Capital Investments

Table 5 reports the results of OLS regressions for the probability of success of an investment made by a venture capitalist. The data observations are at the person-deal level. The dependent variable is a dummy variable that takes the value of 1 if the investment resulted in an initial public offering (IPO), and 0 otherwise. Independent variables include the success and personal (gender, education, ethnicity, and job history) characteristics of a venture capitalist as well as ex ante deal-quality measures. SUCCESS_PERSON is the venture capitalist's success ratio up to the current deal. SUCCESS_FIRM is the success ratio up to the current deal for the other investment partners at the venture capitalist's firm. SUCCESS_SYNDICATE is the success ratio up to the current deal for the co-investor in the portfolio company. TOP_SCHOOL is a dummy variable that takes the value of 1 if a venture capitalist holds a degree from a top university, and 0 otherwise. ETHNIC_MINORITY is a dummy variable that equals 1 if the individual is East Asian, Indian, Jewish, or Middle Eastern, and 0 otherwise. CEO, PRODUCT_DEVELOPMENT, ENTREPRENEUR, and BANKING_FINANCE are dummy variables indicating the venture capitalist's prior job history. SERIAL_ENTREPRENEUR is a dummy variable equal to 1 if the founder of a portfolio company had previously founded another venture-backed company, and 0 otherwise. INVESTMENT_STAGE is a variable with integer values from 1 to 5 corresponding to startup/seed, early stage, later stage, expansion, and buyout/acquisition, respectively. ROUND_NUMBER indicates the round at which the investment was made in the portfolio company. HIGH_MEDIA_COVERAGE is a dummy variable that equals 1 if the number of news articles covering the investment is greater than the median number of news articles for investments covered by at least one news article in that year, and 0 otherwise. Portfolio-company-industry and year-of-investment fixed effects are included in all specifications. Robust standard errors clustered at the venture-capital-firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	1	2	3	4	5	6
FEMALE	0.02096**	0.01956*	0.02987***	0.01850**	0.01422	0.01111
	(0.010)	(0.010)	(0.011)	(0.008)	(0.018)	(0.021)
SUCCESS_PERSON				0.11388***	0.11091***	0.10268***
				(0.015)	(0.015)	(0.017)
SUCCESS_SYNDICATE				0.24253***	0.24472***	0.20798***
				(0.016)	(0.017)	(0.021)
SUCCESS_FIRM				0.09154***	0.09848***	0.09888***
				(0.020)	(0.020)	(0.025)
FEMALE × SUCCESS_PERSON					0.03113	0.01354
					(0.053)	(0.056)
FEMALE × SUCCESS_SYNDICATE					0.03399	0.04402
					(0.068)	(0.080)
FEMALE × SUCCESS_FIRM					0.13459**	0.09943
					(0.059)	(0.075)
TOP_SCHOOL		0.03089***	0.01479**	0.00921*	0.00917*	0.00016
		(0.006)	(0.007)	(0.005)	(0.005)	(0.007)
ETHNIC_MINORITY		0.00674	0.01224*	0.00279	0.00293	0.00802
		(0.006)	(0.007)	(0.005)	(0.005)	(0.006)
CEO		0.00681	0.00168	0.00265	0.00280	0.00484
		(0.007)	(0.009)	(0.006)	(0.006)	(0.008)
PRODUCT_DEVELOPMENT		0.00837	0.00932	0.00443	0.00434	0.00667
		(0.009)	(0.009)	(0.007)	(0.007)	(0.008)
ENTREPRENEUR		0.01472*	0.01044	0.01328**	0.01341**	0.00801
		(0.008)	(0.009)	(0.007)	(0.007)	(0.008)
BANKING_FINANCE		0.00241	0.00527	0.00700	0.00732	0.00054
		(0.007)	(0.008)	(0.006)	(0.006)	(0.007)
ROUND_NUMBER			0.02165***			0.01661***
			(0.003)			(0.003)
INVESTMENT_STAGE			0.01920***			0.01990***
			(0.004)			(0.004)
HIGH_MEDIA_COVERAGE			0.04006***			0.03496***
			(0.008)			(0.008)
SERIAL_ENTREPRENEUR			0.04203***			0.03096***
			(0.007)			(0.007)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	26,328	26,328	17,379	26,328	26,328	17,379
Adj. R^2	0.134	0.136	0.162	0.157	0.158	0.176

In column 4 of Table 5, in addition to venture capitalists' personal characteristics, we introduce and control for three different track-record measures: SUCCESS_PERSON, SUCCESS_FIRM, and SUCCESS_SYNDICATE. Consistent with the performance persistence found in Kaplan and Schoar (2005) and

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Gompers et al. (2008), we find that an individual's track record (SUCCESS_PERSON) is positively related to the investment outcome for the current investment. Perhaps somewhat more surprising, however, is that we find that the prior track record of a venture capitalist's partners (SUCCESS_FIRM) and the prior track record of co-investors (SUCCESS_SYNDICATE) are both positively related to investment outcomes. When a venture capitalist has more successful co-investors or firm colleagues, the venture capitalist's current investment is more likely to be successful.[23] This indicates that either screening is more efficient or that more value is added when a venture capitalist surrounds him- or herself with smarter and better investors. Controlling for past performance at the individual, syndicate, and firm levels, we see that the gender gap remains statistically and economically significant. It is not the case that the prior track record of the individual, the firm, or the co-investors can explain away the lower female investment performance found in this sample. Columns 1–4 are consistent with Hypothesis 1: Female venture capitalists appear to have lower investment returns when controlling for a host of relevant observable characteristics.

The three success measures allow us to separately identify the sensitivity of the ultimate investment performance to the track record of each of the three parties: the individual venture capitalist, the venture capitalist's colleagues within the firm, and the venture capitalist's co-investors. In column 5 of Table 5, in addition to putting the various success measures in the regression, we also interact them with FEMALE to estimate whether the track-record impact of an investor's partners and co-investors varies depending on the gender of the investor. In this way, we are able to closely examine the factors that might explain the lower performance of female venture capitalists. We find that once we include the interactions, the coefficient on FEMALE declines and is no longer significant. Interestingly, the only interaction term that is significant is the interaction between FEMALE and SUCCESS_FIRM, which is negative. The coefficient on this interaction term is of greater magnitude compared with the positive and significant coefficient on SUCCESS_FIRM, which captures the positive impact of firm success on individual performance for male venture capitalists. Consistent with Hypothesis 2, this indicates that whereas for

[23]The spillover from successful VCs onto their colleagues can, in principle, be studied directly using departures of investors from one firm to another. Two potential issues, however, may hamper this analysis. First, job switches are infrequent (only 147 out of 3,483 venture capitalists in our sample move firms), and the number of movers identified is a lower bound for the true number because the data set may not track the full job histories (Ewens and Rhodes-Kropf (2015)). Second, moving firms is endogenous to both the characteristics of firms and the individuals who choose to leave. Keeping these caveats in mind, we find suggestive evidence (unreported for brevity) consistent with the spillover mechanism. On the one hand, the departure of a more prominent venture capitalist from a firm is associated with a lower future investment performance of their former colleagues. This finding is consistent with the notion that successful colleagues are a valuable resource. They may provide feedback, advice, contacts, analytical help, and other actions that we collectively refer to with the catchall term *mentorship.* Losing a successful colleague to a different firm effectively reduces the amount of resources at venture capitalists' disposal and limits their ability to add value to portfolio companies, thus impairing their future success rates. On the other hand, VCs do not experience a boost to their success rate when a prominent investor joins their firm. Possibly, it takes time for the prominent newcomer to get integrated into the new firm and begin mentoring or contributing to the deals of his or her new colleagues, and that is why we fail to find an effect. We thank the anonymous referee for suggesting this analysis.

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males, having partners within the firm with good track records significantly enhances investment performance, the incremental benefit to a female venture capitalist from having colleagues with good investment track records is essentially 0. And importantly, the lower performance of female investors does not stem from them having lower skills, as captured by the FEMALE dummy and its point estimate, indistinguishable from 0 in a fully specified model.

In column 6 of Table 5, we further add deal quality controls. In this specification, the coefficient on FEMALE is again insignificant. The coefficient on SUCCESS_FIRM interacted with FEMALE remains negative and is of similar magnitude compared with the positive coefficient on SUCCESS_FIRM. Male venture capitalists' individual investment performance benefits significantly from firm performance, whereas firm success has virtually no impact on female venture capitalists' individual performance. These results seem to indicate that a substantial portion of the gender difference in investment outcomes comes from the fact that female investors do not benefit from the track record of their colleagues within the firm.

In further tests, we rule out the alternative explanation based on the premise that female entrepreneurs seek less capital and are more likely to match with female investors (Ewens and Townsend (2020), Gafni, Marom, Robb, and Sade (2016)) and that peers may provide less support to those colleagues who deploy less capital.[24] First, we show that the baseline results reported in Table 5 hold in the presence of an investment amount control (see Table A2 in the Supplementary Material).

Second, we create an indicator variable, SMALL, equal to 1 for individual venture capitalists accountable for the smallest fraction of VC firm's investments, and 0 otherwise.[25] We then replicate Table 5 using the variable SMALL in lieu of the variable FEMALE; Table A3 in the Supplementary Material presents these results. The point estimate of the key interaction term, SMALL × SUCCESS_FIRM, is not statistically significant and is an order of magnitude less than the point estimate on FEMALE × SUCCESS_FIRM in Table 5, which suggests that the Table 5 results are not driven by women investing a smaller fraction of their funds.

B. Potential Selection on Observables

Our results so far show that the investment success rates of female venture capitalists are lower than those of their male colleagues and that this relationship persists after controlling for a wide range of personal and deal characteristics. Although the gender gap in investment outcomes cannot be explained away by the ex ante deal-quality controls in a regression setting, one potential concern is the gender-based quality sorting of deals. If female venture capitalists in general are involved with low-quality deals to start with, deal quality might be the underlying driver of the gender gap, and simply controlling for deal-quality measures in our

[24]We thank the anonymous referee for suggesting this analysis.

[25]Importantly, the ranking is done among venture capitalists with an above-median number of transactions at each firm. Without this filter, the variable SMALL would pick up investors entering the sample close to its end and not having time to contribute on more than one deal.

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regressions may not adequately address the issue. To alleviate this concern, we perform several additional tests.

First, as we note in the summary statistics, a comparison of ex ante measures for observable deal quality by gender suggests that deals done by female venture capitalists are not inferior in quality compared with deals done by male venture capitalists. In a regression setting, we relate deal quality directly to the gender of the investor in regressions with the ex ante measures of observable deal quality as dependent variables. The results, reported in Panel A of Table 6, indicate that gender largely does not correlate with proxies for investment quality. In particular, female venture capitalists do not seem to be associated with deals of lower observable quality, based on our ex ante proxies, compared with their male colleagues. Men and women appear to invest in portfolio companies of comparable observable quality as measured by investment stage, media coverage, and an entrepreneur's serial status. If anything, female venture capitalists have a higher tendency to invest in later investment rounds, which are typically associated with a higher probability of success. Because the data do not suggest that female venture capitalists are sorted into deals inferior to those of men based on objective, observable characteristics, other investment-quality-control variables, including unobservable ones, may matter little as well.

Moreover, we produce a kernel density graph of predicted IPO probabilities by gender using our full regression model excluding gender interactions and indicators. Figure 1 shows that the densities plotted for women and men are similar and trace each other almost across the entire domain. In the region with low predicted probabilities (under 0.2), however, the density for deals by female investors is shifted to the right of the male venture capitalist density. In other words, in that region, women are selected into higher-quality deals based on observable characteristics. This is consistent with the higher tendency of female venture capitalists to invest in later rounds (and likely higher-quality companies), as Panel A of Table 6 and the summary statistics in Table 1 suggest. Because our gender performance gap goes in the opposite direction of the selection patterns of female investor success and the densities are largely similar across gender, we are reassured that our result is not likely to be driven by selection issues.

We further address the selection concern in a more general manner by employing the propensity score matching (PSM) method (Rosenbaum and Rubin (1983), (1984)). We first run a probit regression to estimate the probability of a deal being conducted by a female venture capitalist based on various personal and deal characteristics. We then use the predicted probabilities (i.e., propensity scores) from this estimation and match investments made by female venture capitalists to those originated by men. We apply three different matching procedures (nearest neighbor, kernel, and radius matching) to make sure our results are not driven by the choice of a matching estimator.

Panel B of Table 6 presents the results of this estimation. Consistent across different sets of predictive controls and matching procedures, the PSM difference estimator indicates lower performance by female venture capitalists, as measured by IPO success ratio, compared with male venture capitalists. The magnitudes and significance levels of the estimates are similar to those of the main regression results in Table 5, further alleviating the concern that gender-based deal-quality sorting

TABLE 6

Potential Selection on Observables

Table 6 shows that the documented gender performance gap is unlikely to be driven by female venture capitalists being matched to inferior deals. Panel A regresses several characteristics of investment deals on the demographic characteristics of venture capital investors. SERIAL_ENTREPRENEUR is a dummy equal to 1 if the founder of a portfolio company had previously founded another venture-backed company. INVESTMENT_STAGE is a variable with integer values from 1 to 5 corresponding to startup/seed, early stage, later stage, expansion, and buyout/acquisition, respectively. ROUND_NUMBER indicates the round at which the investment was made in the portfolio company. HIGH_MEDIA_COVERAGE is a dummy variable that equals 1 if the number of news articles covering the investment is greater than the median number of news articles for investments covered by at least one news article in that year, and 0 otherwise. Robust standard errors clustered at the venture-capital-firm level are reported in parentheses. Panel B presents the propensity-score-matching estimates of differences in investment performance measured by the initial public offering (IPO) rate between the treatment group (investments by women) and the control group (investments by men). The matched sample is constructed using nearest-neighbor (columns 1–3), kernel (columns 4–6), and radius (columns 7–9) matching procedures. Propensity scores are estimated using different combinations of predictors, as each column in the table indicates. Standard errors, reported in parentheses, are obtained using 200 bootstrap replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Investment Quality and Venture Capitalist Demographic

	SERIAL_ENTREPRENEUR			INVESTMENT_STAGE			ROUND_NUMBER			HIGH_MEDIA_COVERAGE		
Variables	1	2	3	4	5	6	7	8	9	10	11	12
FEMALE	0.003	0.010	0.018	0.035	0.040	0.019	0.064	0.108**	0.103**	0.016	0.016	0.015
	(0.021)	(0.017)	(0.017)	(0.034)	(0.032)	(0.032)	(0.050)	(0.042)	(0.041)	(0.012)	(0.012)	(0.012)
TOP_SCHOOL			0.056***			0.050***			0.119***			0.015***
			(0.009)			(0.017)			(0.023)			(0.005)
ETHNIC_MINORITY			0.011			0.055***			0.017			0.010
			(0.009)			(0.020)			(0.024)			(0.006)
CEO			0.003			0.010			0.006			0.005
			(0.009)			(0.020)			(0.026)			(0.007)
PRODUCT_DEVELOPMENT			0.002			0.059**			0.001			0.002
			(0.012)			(0.026)			(0.036)			(0.008)
ENTREPRENEUR			0.019*			0.106***			0.085***			0.025***
			(0.010)			(0.021)			(0.029)			(0.007)
BANKING_FINANCE			0.024**			0.105***			0.049**			0.001
			(0.009)			(0.022)			(0.025)			(0.008)
Year and industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
No. of obs.	18,273	18,273	18,273	25,670	25,670	25,670	24,766	24,766	24,766	25,348	25,348	25,348
Adj. R^2	0.0000	0.1357	0.1392	0.0001	0.0302	0.0381	0.0001	0.1672	0.1702	0.0001	0.0520	0.0531

(continued on next page)

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TABLE 6 (continued)

Potential Selection on Observables

Panel B. Propensity Score Matching

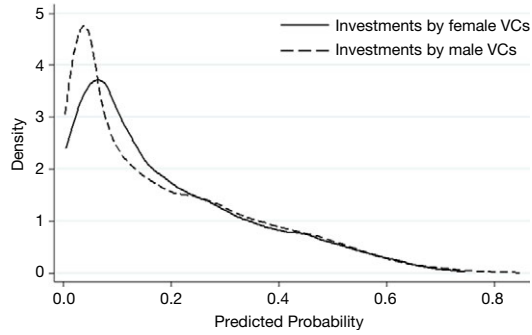
	Nearest-Neighbor Matching			Kernel Matching			Radius Matching		
Variables	1	2	3	4	5	6	7	8	9
FEMALE	0.0329**	0.0507***	0.0388***	0.0343***	0.0500***	0.0432***	0.0373**	0.0435***	0.0388***
	(0.0149)	(0.0135)	(0.0140)	(0.0126)	(0.0134)	(0.0132)	(0.0147)	(0.0138)	(0.0135)
Covariates Used in Estimation									
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal-quality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics		Yes	Yes		Yes	Yes		Yes	Yes
Past success measures			Yes			Yes			Yes
No. of obs.	17,234	17,234	17,234	17,234	17,234	17,234	17,234	17,234	17,234

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FIGURE 1

Kernel Density Graph of Predicted IPO Probability: By Investor Gender

Figure 1 plots predicted initial public offering (IPO) probability by venture capitalist gender. Predicted IPO probabilities are calculated using a model that excludes gender and treats this variable as missing. These models include all controls in the model except gender, including industry and year fixed effects, deal quality, past success, and personal demographic characteristics.



could account for our findings. Because the estimated gender gap is insensitive to the inclusion of the available precisely measured deal-quality variables, other portfolio company characteristics, including unobservable ones, might matter little as well. Overall, these results suggest that ex ante deal quality is unlikely to be a key factor that drives the female underperformance in our sample, thus giving additional support to Hypothesis 2.

C. Firm Age, Firm Size, and the Presence of Other Women as Mitigating Factors for the Female Performance Differential

We move to testing hypotheses on the sources of the differences in gender performance as well as mitigating factors. In our first set of results, we test Hypothesis 3, whether larger and older firms reduce differences in the performance of male and female venture capitalists. Various research studies have found that bureaucracy positively affects female performance in business. If the gender performance gap is driven, as hypothesized, by women receiving less benefit from the track records of their colleagues, then it should be less pronounced or even absent in larger, older VC firms. Larger, older VC firms are more likely to have formal mentoring and investment-decision-making processes as well as formal feedback mechanisms. Investment decisions may be more likely to be governed by formal investment recommendation memos and formal votes. Formal review processes are more likely to be implemented. As such, comparing these larger, older VC firms to their smaller, younger counterparts should help us understand the gender performance gap.

In Table 7, we examine whether VC firm age affects the gender differential in VC performance. In each year, we rank firms based on their age and classify firms that are in the top 2 quintiles of firm age as old firms and the others as young firms.[26] In columns 1–3, we include observations categorized as old firms only; in

[26]Our results are robust to splitting firms into young and old based on the sample median firm age.

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TABLE 7

Gender and Venture Capital Investments: By Firm Age

Table 7 reports the results of OLS regressions for the probability of success of an investment made by a venture capitalist in two subsamples broken down by firm age. The data observations are at the person-deal level. The dependent variable is a dummy variable that takes the value of 1 if the investment is successful, and 0 otherwise. Independent variables are the success and gender characteristics of a venture capitalist, as well as ex ante deal-quality measures. The subsample of old (young) firms consists of firms that are in the fourth or fifth (first, second, or third) quintile of venture capital firms in terms of firm age. Portfolio-company-industry and year-of-investment fixed effects are included in all specifications. Robust standard errors clustered at the venture capital level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Old Firms			Young Firms		
Variables	1	2	3	4	5	6
FEMALE	0.01373	0.01141	0.01173	0.03848***	0.03160**	0.01316
	(0.017)	(0.015)	(0.045)	(0.014)	(0.013)	(0.023)
SUCCESS_PERSON		0.09212***	0.09919***		0.10573***	0.09955***
		(0.028)	(0.028)		(0.021)	(0.022)
FEMALE × SUCCESS_PERSON			0.12362			0.07293
			(0.082)			(0.082)
SUCCESS_SYNDICATE		0.18405***	0.17992***		0.22347***	0.22260***
		(0.029)	(0.030)		(0.026)	(0.027)
FEMALE × SUCCESS_SYNDICATE			0.08090			0.01250
			(0.108)			(0.102)
SUCCESS_FIRM		0.10712**	0.10510**		0.07259***	0.08371***
		(0.048)	(0.049)		(0.028)	(0.028)
FEMALE × SUCCESS_FIRM			0.00071			0.16624*
			(0.160)			(0.085)
TOP_SCHOOL	0.00322	0.00571	0.00551	0.01830**	0.00290	0.00310
	(0.013)	(0.012)	(0.012)	(0.008)	(0.008)	(0.008)
ETHNIC_MINORITY	0.01312	0.00966	0.00989	0.00874	0.00616	0.00584
	(0.010)	(0.009)	(0.009)	(0.008)	(0.007)	(0.007)
CEO	0.00548	0.00248	0.00259	0.01028	0.01208	0.01147
	(0.015)	(0.013)	(0.013)	(0.012)	(0.011)	(0.010)
PRODUCT_DEVELOPMENT	0.00455	0.00164	0.00153	0.01951	0.01463	0.01454
	(0.011)	(0.010)	(0.010)	(0.016)	(0.013)	(0.013)
ENTREPRENEUR	0.02396*	0.01872	0.01825	0.00213	0.00003	0.00033
	(0.014)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
BANKING_FINANCE	0.00648	0.00505	0.00450	0.00253	0.00191	0.00233
	(0.013)	(0.011)	(0.011)	(0.009)	(0.008)	(0.008)
ROUND_NUMBER	0.01904***	0.01530***	0.01523***	0.02280***	0.01707***	0.01709***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
INVESTMENT_STAGE	0.03811***	0.03803***	0.03805***	0.00505	0.00610	0.00608
	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)
HIGH_MEDIA_COVERAGE	0.03561***	0.03139**	0.03139**	0.04390***	0.03897***	0.03928***
	(0.013)	(0.012)	(0.012)	(0.010)	(0.010)	(0.010)
SERIAL_ENTREPRENEUR	0.04493***	0.03668***	0.03657***	0.03655***	0.02553***	0.02529***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	7,431	7,431	7,431	9,948	9,948	9,948
Adj. R^2	0.169	0.179	0.179	0.162	0.177	0.177

columns 4–6, we include young firms only. We run our main regressions from Table 5 for these two subgroups of firms separately. A comparison of the estimates for old versus young firms in Table 7 indicates that female underperformance is more prominent in young firms. Moreover, although firm success has a significant and positive impact on individual performance for male venture capitalists in either type of firm (as indicated by the positive coefficient on SUCCESS_FIRM), its impact on female success differs significantly by firm age. The coefficient on SUCCESS_FIRM interacted with FEMALE is negative and significant for young firms, whereas it is essentially 0 for old firms. This difference indicates that in old firms, female

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TABLE 8

Gender and Venture Capital Investments: By Firm Size

Table 8 reports the results of OLS regressions for the probability of success of an investment made by a venture capitalist in two subsamples broken down by firm size. The data observations are at the person-deal level. The dependent variable is a dummy variable that takes the value of 1 if the investment is successful, and 0 otherwise. Independent variables are the success and gender characteristics of a venture capitalist, as well as ex ante deal-quality measures. The subsample of large (small) firms consists of firms that are in the fourth or fifth (first, second, or third) quintile of venture capital firms in terms of firm size. Portfolio-company-industry and year-of-investment fixed effects are included in all specifications. Robust standard errors clustered at the venture capital level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Large Firms			Small Firms		
Variables	1	2	3	4	5	6
FEMALE	0.01514	0.01441	0.03212	0.04223***	0.03398***	0.00348
	(0.018)	(0.015)	(0.044)	(0.013)	(0.012)	(0.024)
SUCCESS_PERSON		0.08552***	0.09048***		0.11158***	0.10780***
		(0.025)	(0.025)		(0.023)	(0.024)
FEMALE × SUCCESS_PERSON			0.06890			0.00397
			(0.085)			(0.081)
SUCCESS_SYNDICATE		0.17997***	0.17710***		0.22949***	0.22824***
		(0.030)	(0.030)		(0.026)	(0.027)
FEMALE × SUCCESS_SYNDICATE			0.04657			0.02292
			(0.105)			(0.105)
SUCCESS_FIRM		0.11153**	0.10678**		0.06446**	0.07770***
		(0.048)	(0.051)		(0.026)	(0.027)
FEMALE × SUCCESS_FIRM			0.05769			0.24784***
			(0.150)			(0.087)
TOP_SCHOOL	0.01464	0.00374	0.00389	0.00820	0.00505	0.00529
	(0.012)	(0.012)	(0.012)	(0.008)	(0.008)	(0.008)
ETHNIC_MINORITY	0.00608	0.00337	0.00343	0.01345	0.01037	0.01031
	(0.011)	(0.010)	(0.010)	(0.009)	(0.007)	(0.008)
CEO	0.00721	0.01093	0.01044	0.00110	0.00278	0.00214
	(0.015)	(0.014)	(0.014)	(0.011)	(0.010)	(0.010)
PRODUCT_DEVELOPMENT	0.00963	0.00623	0.00617	0.02288	0.01681	0.01609
	(0.011)	(0.010)	(0.010)	(0.015)	(0.013)	(0.013)
ENTREPRENEUR	0.01403	0.01116	0.01128	0.00300	0.00378	0.00395
	(0.014)	(0.012)	(0.012)	(0.012)	(0.010)	(0.010)
BANKING_FINANCE	0.02083*	0.01627	0.01626	0.00661	0.00942	0.01001
	(0.012)	(0.011)	(0.011)	(0.009)	(0.008)	(0.008)
ROUND_NUMBER	0.02067***	0.01761***	0.01763***	0.02192***	0.01588***	0.01589***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
INVESTMENT_STAGE	0.03080***	0.03105***	0.03113***	0.01130**	0.01194**	0.01198**
	(0.007)	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)
HIGH_MEDIA_COVERAGE	0.04102***	0.03728***	0.03724***	0.03721***	0.03220***	0.03266***
	(0.013)	(0.013)	(0.013)	(0.010)	(0.010)	(0.010)
SERIAL_ENTREPRENEUR	0.05075***	0.04354***	0.04351***	0.03097***	0.01935**	0.01910**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	7,455	7,455	7,455	9,924	9,924	9,924
Adj. R^2	0.167	0.176	0.176	0.163	0.179	0.179

venture capitalists benefit from their colleagues' skill as much as male investors, whereas in young firms, female venture capitalists enjoy no such benefits at all.

A similar result can be seen in Table 8, which explores the gender performance gap in larger VC firms. In each year, we rank firms based on their size in terms of total capital raised in prior funds and classify firms that are in the top two quintiles of firm size as large firms.[27] The results in Table 8 contrasting the

[27]The results are robust to using classifications based on the sample median firm size or using the number of partners at the firm to proxy for firm size.

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subsample of large firms versus the subsample of small firms are qualitatively similar to those in Table 7 that separate firms by age. We observe the performance gap of female venture capitalists that stems from women receiving less benefit from the track records of their colleagues in smaller firms but not in their larger counterparts. Tables 7 and 8 thus corroborate Hypothesis 3.

Our next set of analyses examines Hypothesis 4, which predicts that the presence of female colleagues mitigates performance differences. In Table 9, we present results classifying firms by the presence of additional female venture

TABLE 9

Gender and Venture Capital Investments: By Presence of Other Women

Table 9 reports the results of OLS regressions for the probability of success of an investment made by a venture capitalist in two subsamples broken down by the presence of women in venture capital firms. The data observations are at the person-deal level. The dependent variable is a dummy variable that takes the value of 1 if the investment is successful, and 0 otherwise. Independent variables are the success and gender characteristics of a venture capitalist, as well as ex ante deal-quality measures. Firms with other women are venture capital firms that have at least one other female investment professional prior to the current investment. Portfolio-company-industry and year-of-investment fixed effects are included in all specifications. Robust standard errors clustered at the venture capital level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Firms with Other Women			Firms with No Other Women		
Variables	1	2	3	4	5	6
FEMALE	0.03145**	0.02614*	0.05790	0.03371**	0.02703*	0.00704
	(0.015)	(0.015)	(0.042)	(0.016)	(0.014)	(0.020)
SUCCESS_PERSON		0.05873	0.07324*		0.10851***	0.10632***
		(0.039)	(0.042)		(0.018)	(0.018)
FEMALE × SUCCESS_PERSON			0.05709			0.02121
			(0.071)			(0.085)
SUCCESS_SYNDICATE		0.19810***	0.20013***		0.21212***	0.20923***
		(0.051)	(0.050)		(0.022)	(0.022)
FEMALE × SUCCESS_SYNDICATE			0.00625			0.09384
			(0.140)			(0.091)
SUCCESS_FIRM		0.05258	0.00283		0.09701***	0.10511***
		(0.101)	(0.112)		(0.024)	(0.025)
FEMALE × SUCCESS_FIRM			0.16323			0.21589**
			(0.124)			(0.091)
TOP_SCHOOL	0.01853	0.01040	0.01184	0.01425*	0.00140	0.00139
	(0.017)	(0.017)	(0.018)	(0.008)	(0.007)	(0.007)
ETHNIC_MINORITY	0.01138	0.00656	0.00596	0.01151	0.00743	0.00724
	(0.018)	(0.016)	(0.017)	(0.007)	(0.006)	(0.006)
CEO	0.01774	0.01167	0.01059	0.00435	0.00713	0.00683
	(0.027)	(0.025)	(0.025)	(0.009)	(0.008)	(0.008)
PRODUCT_DEVELOPMENT	0.02155	0.02234	0.02217	0.01343	0.01053	0.01032
	(0.021)	(0.020)	(0.020)	(0.010)	(0.008)	(0.008)
ENTREPRENEUR	0.00411	0.00341	0.00434	0.01089	0.00845	0.00845
	(0.023)	(0.020)	(0.020)	(0.010)	(0.008)	(0.008)
BANKING_FINANCE	0.00650	0.00564	0.00702	0.00509	0.00040	0.00059
	(0.017)	(0.016)	(0.016)	(0.009)	(0.007)	(0.007)
ROUND_NUMBER	0.02709***	0.02363***	0.02345***	0.02100***	0.01571***	0.01569***
	(0.008)	(0.008)	(0.008)	(0.003)	(0.003)	(0.003)
INVESTMENT_STAGE	0.04256***	0.04291***	0.04326***	0.01586***	0.01669***	0.01665***
	(0.015)	(0.015)	(0.015)	(0.004)	(0.004)	(0.004)
HIGH_MEDIA_COVERAGE	0.02543	0.02137	0.02239	0.04161***	0.03663***	0.03691***
	(0.019)	(0.018)	(0.018)	(0.009)	(0.009)	(0.009)
SERIAL_ENTREPRENEUR	0.02892	0.01992	0.02021	0.04381***	0.03265***	0.03246***
	(0.018)	(0.018)	(0.018)	(0.007)	(0.007)	(0.007)
Year and industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	2,202	2,202	2,202	15,177	15,177	15,177
Adj. R^2	0.157	0.165	0.164	0.163	0.178	0.178

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capitalists within a firm. The subsample of firms with other women consists of VC firms that have at least one other female investment professional prior to the current investment. We then undertake an analysis similar to that in Tables 7 and 8. The results confirm Hypothesis 4. We see that the decoupling of female performance from the firm-level success track record is concentrated in firms with no other female presence, indicating the importance of the presence of other female venture capitalists to performance.[28] Overall, our results on firm age, firm size, and the presence of other women as mitigating factors are consistent with the hypothesis that the gender performance gap is affected by the features of firms (e.g., greater bureaucracy, formal feedback mechanisms, hierarchies, and mentorship) that affect the extent to which venture capitalists benefit from their successful colleagues.

A potential concern, however, is that there may be other interpretations, and the differences across firm subgroups could be attributable to other mechanisms. In particular, larger and older VC firms may also have better reputations, allowing females at these firms to leverage firm reputation to gain access to better deals and thus minimize the gender performance gap in these settings. To examine this alternative hypothesis, we conduct several additional tests. First, we compare deal quality along with our ex ante observable deal-quality measures within subsamples of firms (young vs. old and small vs. large) and find no significant difference in deal quality between those done by female venture capitalists versus those done by male venture capitalists (see Table A4 in the Supplementary Material).

Second, we construct measures proxying for firm reputation, including firm ranking based on past performance (success ratio) and firm network position (centrality), and confirm that the gender performance gap that we observe in our results continues to hold after explicitly controlling for these reputation and status measures. Table A5 in the Supplementary Material adds reputation controls to Table 5 and shows the robustness of the baseline result; Table A6 in the Supplementary Material demonstrates that the fully specified models from the subsample analysis in Tables 7–9 are also robust to the inclusion of reputation controls. The interaction term FEMALE × SUCCESS_FIRM stays negative and significant only in the subsamples of young firms, small firms, and firms with no other female investors.

Third, we analyze the subsample of firms in which we see the most pronounced gender performance gap (i.e., small firms, young firms, and firms with no other female investors) to see if, within these subgroups, firms with a better reputation (based on past performance and network centrality) have smaller gender gaps in performance.[29] Table A7 in the Supplementary Material documents that firms with a better reputation do not have smaller gender gaps in performance, captured by the key interaction term FEMALE × SUCCESS_FIRM.

Lastly, we test the alternative hypothesis based on reputation more directly by replicating our subsample tests with high- versus low-reputation subsamples based on past performance and network centrality, rather than with subsamples

[28] An increase in the number of female investors may also support the entry of more female entrepreneurs (Ewens and Townsend (2020)).

[29] We determine "good reputation" within this firm set by taking the top 2 quintiles of firms ranked in each year of our data. Our results are robust to using the median as the cutoff.

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broken down by firm age, size, or the presence of other women venture capitalists. If it is reputation that is driving our subsample, we would expect to see similar patterns of the gender gap in performance across these reputation subsamples. However, as Table A8 in the Supplementary Material illustrates, dividing the sample by reputation produces no significant pattern of differences in the gender performance gap across subsamples, indicating that firm reputation does not drive our subsample results.

Overall, these additional tests suggest that reputation is unlikely a driving mechanism for our findings. In other words, the better reputation of older and larger VC firms, as well as of firms with at least two female investors, does not explain why women are less successful and benefit less from their colleagues in younger firms (Table 7), smaller firms (Table 8), and firms with no other women (Table 9). Such firms, as established in the survey of VC investment practices (Gompers et al. (2020)) and in the sociological literature discussed earlier, exhibit less formalization and bureaucracy. As such, our findings are consistent with the notion that in the structured environments of older, larger, and gender-diverse firms, women are more likely to succeed by virtue of not being excluded from *mentorship*, a broadly defined catchall term that includes feedback, advice, contact, analytical help, and other actions that allow investors to benefit from their colleagues and, as a consequence, add more value to their portfolio companies and enjoy higher investment success rates.

VI. Conclusions

In this article, we explore the performance of female venture capitalists in a comprehensive sample of VC investors in the United States. The VC industry is a particularly attractive setting in which to measure individual performance because, first, investment decisions are discrete, objective, and identifiable. We are able to match individual investors to companies through their service on the board of a startup company. Second, performance is easy to measure. Investment outcomes can be tracked on individual deals. When we analyze performance, we document a substantially lower investment performance for female venture capitalists even after controlling for individual, firm, and investment characteristics. Within this setting, we find support for our first hypothesis, namely, that female venture capitalists have investment performance that is approximately 15% lower than their male colleagues, all else equal.[30]

We find that this performance difference is largely attributable to female venture capitalists receiving less benefit from the experience and skill of their colleagues within their firms, consistent with our second hypothesis. Gompers

[30]This result generalizes outside of our sample period. Using the data from CrunchBase for the period of 2004–2013, we estimate the difference in performance between male and female venture capitalists. Controlling for industry and year effects, we find that the gender gap in VC performance continues in the more recent period, although the magnitude is only approximately 75% as large as in our earlier sample. The effect being smaller is consistent with the notion that the industry has taken a step in the direction of a level playing field for men and women in VC.

et al. (2020) show that within most VC firms, investment decision making is a collaborative process, with investors receiving input and advice from their colleagues. The prior experience of a female venture capitalist (as proxied by her investment track record) and prior experience of her co-investment partners outside her firm (i.e., her co-investors) are positively related to her investment success. The experience of a female venture capitalist's male colleagues within her firm, however, does not affect her performance. In other words, women venture capitalists do not benefit, on average, from having good colleagues in the firm in which they work. Male venture capitalists, in contrast, benefit significantly from having good colleagues within their firms.

The results also support our third hypothesis: The failure to benefit from colleagues' skill disappears in older and larger firms. This result is consistent with the notion that women benefit from greater bureaucracy, formal feedback mechanisms, and hierarchies. Gompers et al. (2020) show that older and larger VC organizations are likely to have more layers of professionals and are more likely to use formal investment-decision-making processes. Many small, young VC firms are likely to have only informal systems in place, reducing the extent to which women benefit from their successful colleagues through mentorship.

We also find that the presence of a senior female partner in the firm mitigates any performance gap, confirming our fourth hypothesis. Gompers et al. (2016) find that there is a strong attraction based on shared demographics in the VC industry. They find that co-investments are driven heavily by shared gender, ethnicity, work, and school experience. Women are more likely to mentor women. Hence, the presence of a female senior partner is likely to provide greater mentoring to other women in the VC firm.

We take a broad view of what mentorship entails. It could be feedback and advice that colleagues give on particular deals. It could also be help with contacts for new hires within a portfolio company or help in recruiting outside board members. Additionally, it could be analytical or technical help on particular aspects of the deal that require critical decisions in the future. Finally, there may even be other governance or cultural aspects within the VC firm that influence venture capitalists' ability to add value to their portfolio companies. Although we demonstrate quite clearly that investment success in VC is a joint-production process in which the outcome of an investment relies on the abilities of individual investors combined with the abilities of their partners within the firm and the co-investors outside the firm, our large sample does not allow us to explore which of these mechanisms is the greatest contributor to the gender differences we observe in the data. We provide suggestive evidence on the settings in which the gender differences are most severe, and we believe that distinguishing these alternatives and identifying effective ways to ameliorate gender gaps in VC performance are important topics for future research.

Supplementary Material

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S0022109020000988.

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