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Venture Capital Directors and Corporate Debt Structure: An Empirical Analysis of Newly Listed Companies

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Abstract

We investigate how venture capitalists (VCs) serving as directors on corporate boards affect portfolio companies' debt structure after initial public offerings (IPOs). Using hand-collected data, we find that companies with a higher fraction of VC directors on their boards use significantly fewer types of debt. The impact of VC directorships on debt concentration is more pronounced in companies facing greater expected bankruptcy costs or higher degrees of uncertainty. We further explore the benefits of debt concentration and find that a highly concentrated debt structure is associated with better corporate performance in companies with VC directors. Taken together, our evidence suggests that VC directors influence newly listed companies to adopt a concentrated debt structure, thus minimizing the risk of distress and enhancing company value. Our results are robust to accounting for endogeneity and sample selection bias.

Keywords: Venture capital; board of directors; debt structure; IPO.

JEL Classification: G24; G32; G33.

1. Introduction

The question of how companies choose their capital structure has attracted considerable academic attention since the seminal work of Modigliani and Miller (1958). A large body of the literature has identified various factors that explain variations in financial leverage and debt structure; see, for example, Graham and Leary (2011) and Colla et al. (2020) for excellent surveys of research on capital structure and debt choices, respectively. Nevertheless, previous studies of capital structure focus mainly on large and well-established companies that are listed on the stock market. In the context of initial public offerings (IPOs), only a few studies examine debt financing.[1]

Before going public, companies may raise capital in various ways, and venture capital (VC) is often considered one of the most important sources of funding available for private companies (Cassar, 2004; Lukas et al., 2016). It is common for VC firms to take an equity position in their portfolio companies, provide advisory services to the companies they finance (Krishnan et al., 2011), and help them time their listings on the stock market (Levis, 2011).[2] However, the involvement of VCs with portfolio companies continues beyond the IPO (Arthurs and Busenitz, 2006; Jeppsson, 2018; Iliev and Lowry, 2020). Lock-up agreements, performance incentives, and liquidity considerations often encourage VCs to engage with newly listed companies for a considerable period post-listing. These activities facilitate closer VC monitoring, reduce information asymmetries, and resolve potential conflicts with other stakeholders (Levis, 2011). Several studies document that VC firms receive extensive control rights and actively influence the decision-making process of their portfolio companies, post-

[1] For example, Brav (2009) examines the use of debt financing for public companies post listing, compared to their privately held counterparts.

[2] In this study, we use the terms 'VCs', 'VC involvement', 'VC directorship(s)', or 'VC directors' interchangeably to mean VC directors on a portfolio company's board.

investment (Hellmann, 1998; Bottazzi et al., 2008; Ewens and Marx, 2018). Indeed, it is well documented that VCs typically serve on portfolio companies' boards of directors and are involved in these companies' strategic decisions (MacMillan et al., 1989; Rosenstein et al., 1993; Fried et al., 1998). As the result of their active involvement and board representation, VCs can play a significant role in shaping corporate policies such as those on investments (e.g., Celikyurt et al., 2014). However, to the best of our knowledge, no study examines how VCs affect portfolio companies' debt structure decisions, although such decisions are important for corporate operations and performance (Colla et al., 2020). Our paper aims to fill this void.

Although VCs may not be the only capital provider of IPO companies and other major institutional investors may play a role, in our empirical analysis we focus on VC directors because VC involvement in portfolio companies is highly pertinent and differs from that of other institutional investors. First, VCs are known to specialize by sector and tend to have more specialist knowledge and understanding of the business activities of their portfolio companies (e.g., Gompers et al., 2008). Moreover, VC involvements typically begin at the early stage of companies' life cycles, with VC directors sitting on these companies' boards and having control rights to affect major corporate decisions, unlike other institutional investors who are generally associated with mature companies, or those companies close to going public (e.g., Kwon et al., 2020).[3] Recent evidence shows that institutional investors like mutual funds tend to prioritize liquidity and thus have fewer control rights. Therefore, they are less likely to vote on major company decisions and exert monitoring through board representation (Chernenko et al., 2021). Empirically, our focus on VCs is also motivated by several recent studies of newly listed companies that have explored the various roles played by VC firms in reducing the risk

[3] While recent research suggests that some institutional investors like mutual funds have started to invest in private companies, it also shows that these institutional investors are more likely to invest in private companies backed by VC firms (Kwon et al., 2020). The reason is that VCs involvements with portfolio companies are often seen as a positive signal, providing a certification effect.

of corporate failure (Lukas et al., 2016; Megginson et al., 2019), shaping corporate investment (Celikyurt et al., 2014; Aldatmaz and Celikyurt, 2021), and affecting dividend policies (Amini et al., 2022).[4]

To investigate the effect of VC involvement on corporate debt structure, we develop two competing predictions, building on prior literature on capital structure, debt structure, and VCs. On the one hand, we argue that VC involvement can influence corporate decisions by increasing portfolio companies' debt concentration. Recent evidence suggests that companies simultaneously rely on multiple types and sources of debt (Colla et al., 2013). Rauh and Sufi (2010) show that 70% of the companies in their sample use at least two types of debt. However, a dispersed debt structure complicates debt renegotiations and aggravates coordination problems among creditors of different debt types (Asquith et al., 1994; Berglöf and Von Thadden, 1994; Bolton and Scharfstein, 1996). This is because different sources of debt tend to have different types of cash flow claims, control provisions, collateral, and seniority, and the lenders of these debt types may have different investment horizons or objectives (Lou and Otto, 2020; Li et al., 2021). Since coordination failure across debt types is likely to increase the costs of financial distress, lenders will respond by increasing the costs of debt financing for corporate borrowers (Giammarino, 1989; Hoshi et al., 1990; Wruck, 1990; Gertner and Scharfstein, 1991; Bris and Welch, 2005). Furthermore, the coordination problems in a dispersed debt structure make it difficult for companies to restructure their debt (Ivashina et al., 2016), thus reducing the expected liquidation value of their assets. In short, these problems may cause an inefficient liquidation and increase the expected costs of default (e.g., Hoshi et al., 1990; Colla et al., 2013;

[4] Although VC directors play an important and distinct role in determining IPO companies' financing decisions, we do not rule out the role of other institutional investors. In Section 4.3.3, we examine the impact of VC directors and that of other major institutional directors. We thank an anonymous referee for this helpful suggestion.

Lou and Otto, 2020; Li et al., 2021), exerting a negative impact on VCs and their reputation.[5] To the extent that VC firms as residual claimants wish to reduce the costs of financial distress associated with portfolio companies to protect their reputation and ability to raise subsequent funds from their investors (e.g., Krishnan et al., 2011; Huang et al., 2016; Ersahin et al., 2023), they have a strong incentive to encourage their portfolio companies to adopt a concentrated debt structure.

On the other hand, one might argue that VC directorships are not necessarily associated with higher debt concentration as VCs create opportunities for portfolio companies to use a dispersed debt structure. The main reason is that VCs can mitigate the coordination problems associated with debt heterogeneity. Recent literature documents that VC involvement improves companies' accounting quality by creating a more efficient internal control environment and improving financial reporting practices (Wongsunwai, 2013; Nam et al., 2014; Cumming et al., 2022). Better accounting quality, in turn, reduces asymmetric information and facilitates coordination among creditors, thus mitigating the downside risk of debt heterogeneity (Li et al., 2021). Accordingly, portfolio companies backed by VCs can benefit from a dispersed debt structure, which helps deter strategic defaults (e.g., Bolton and Scharfstein, 1996). In sum, if VC directors serving on corporate boards already helps reduce creditor coordination costs and lowers the expected costs of default, they may have less incentive to influence their portfolio companies to use concentrated debt structures. In short, VC involvement may be associated with a higher degree of debt dispersion.

[5] One prominent example is the case of Energy Future Holdings Corp.'s bankruptcy. Li et al. (2021) discuss this case in length and highlight the coordination problems among private lenders and bondholders. Although venture capital/private equity fund providers agreed on a restructuring plan, bondholders challenged the plan and threatened to take the plan to court.

To test the above competing hypotheses, we manually collect data on the number and proportion of VC directors on each IPO company's board from the company's 10-K filings, focusing on the five-year period after the IPO. We use a five-year test window because existing evidence suggests that typically VC firms continue to provide support for VC-backed IPOs in the five years post-listing (Iliev and Lowry, 2020) before they start to exit their investments (Krishnan et al., 2011). Overall, using the five-year window allows us to best capture how VCs influence company debt structure decisions (see also Huang et al., 2016).[6] We use the VentureXpert database to identify companies that have been involved with VC firms before, or at the time of, their listing on the stock market. The sample of IPOs is gathered from J. Ritter's website for the period between 2001 and 2019.

Following Colla et al. (2013), we proxy for a company's debt structure using the degree of debt concentration. To calculate this measure, we collect data on debt types from the Capital IQ database, which include: (i) drawn credit lines (i.e., revolving credit), (ii) term loans, (iii) commercial papers, (iv) senior bonds and notes, (v) subordinated bonds and notes, (vi) capital lease, and (vii) other debt. Based on these different types of debt, we compute the Herfindahl-Hirschman index (*HHI*) for each IPO company in our sample over the five years post-listing. The index ranges from zero to one; a value of one indicates that the company's debt is concentrated, while a zero value suggests that the company uses various types of debt (i.e., simultaneously using all seven debt types in equal proportion). As in Colla et al. (2013) and Castro et al. (2020), we also use a dummy variable $Excl90_{i,t}$ as an alternative measure of debt concentration, which takes one if at least 90% of the company's debt is one debt type, and zero otherwise.

[6] We also use a three-year window post-IPO, and the findings are qualitatively unchanged. The results are not reported here but are available upon request.

Using *HHI* as our main measure of debt structure, we find that VC involvement is significantly associated with greater debt concentration. One standard deviation increase in the proportion of VC directors serving on a company's board leads to an increase of 4.6% in the degree of debt concentration, controlling for the company's characteristics. Consistent with our first hypothesis discussed above, this finding suggests that VC directors play an important role in encouraging their portfolio companies to adopt a desirable debt structure, with a higher degree of debt concentration that reduces the likelihood and costs of bankruptcy.

We alleviate potential concerns associated with endogeneity and sample selection in several ways. First, we use an instrumental variable (IV) Tobit model to address the possible endogeneity associated with VC directors on corporate boards, using the returns to Limited Partners (LPs) following the existing literature (Samila and Sorenson, 2011). Next, we use propensity score matching (PSM) and entropy balancing to mitigate the concern that the choice of debt concentration is driven by company characteristics rather than VC involvement. We then use the Heckman (1979) two-step model to correct for possible sample selection bias. Finally, we include various fixed effects to alleviate heterogeneity bias. Following these endogeneity tests and other robustness checks, including an analysis that controls for the role of other major institutional investors and tests that examine the dynamic effects in longer time horizons up to three years post-IPO, our baseline results are qualitatively unchanged, suggesting that our inference is unlikely to be affected by endogeneity concerns.

In our additional analysis, we first examine the impact of VC involvement on debt structure in portfolio companies associated with varying degrees of (expected) bankruptcy costs. Our results show that, consistent with our first conjecture, VC directors encourage the use of concentrated debt structures in portfolio companies that face high expected bankruptcy costs or greater uncertainty. Further, the positive effect of VC directorships on debt

concentration is more pronounced when VCs have debt dispersion experience or greater reputations, hence stronger incentives to influence portfolio companies' debt structures. In the final test, we examine the value implications of debt structure decisions for companies associated with VC directors. Our findings show that the influence of VC directors on IPO companies' debt structure adds value to these companies.

Our paper contributes to three strands of literature on capital structure, VCs, and IPOs, respectively. Following Jensen and Meckling (1976) and Myers (1977), several studies in the former literature focus on the conflict of interest between shareholders and debt holders and their impact on capital structure (see Graham and Leary, 2011). In this paper, we show that VC directors have a positive influence on the degree of debt concentration and help mitigate the risk of debt financing, which has implications for corporate financial policies and performance. We add to recent research on debt heterogeneity (e.g., Colla et al., 2013; Li et al., 2021) by demonstrating a new and important determinant of debt structure, namely, VC directors on companies' boards. Lukas et al. (2016) show that renegotiation leads to higher control rights for VC firms, and this reduces the risk of failure, while Megginson et al. (2019) document that VCs help reduce distress risk for IPO companies. Our research complements these recent studies by showing that VC involvement reduces companies' risk by influencing their decisions to use fewer debt types. Celikyurt et al. (2014) and Aldatmaz and Celikyurt (2021) have suggested that VC directors on companies' boards may affect corporate investment decisions. Our study adds to this strand of research by focusing on corporate financing policies and showing that VC directorships also influence the debt structure of newly listed companies.

The existing literature on VCs and IPO companies shows that VC-backed IPOs outperform non-VC-backed IPOs (e.g., Megginson and Weiss, 1991; Brav and Gompers, 1997; Gompers and Lerner, 2000; Jain and Kini, 2000; Gompers and Lerner, 2001; Gompers et al.,

2010; Chemmanur et al., 2021). Our study complements these studies by demonstrating that VC directors on company boards mitigate the risk associated with debt financing by influencing IPO companies' debt choices. We further provide evidence showing that such debt structure decisions have value implications, namely, higher debt concentration as the result of VC involvement improves the performance of VC-backed companies. This evidence suggests that VC directorships in newly listed companies not only benefit the VC firms (Hasan et al., 2018), but also the IPO companies and their shareholders. Our finding adds to the existing evidence of how VCs can add value to companies, including start-ups and entrepreneurs (e.g., Jelic et al., 2005; Ewens and Marx, 2018; Ewens et al., 2022), by showing that VC involvement affects newly listed companies' debt structure, which, in turn, reduces the risk of bankruptcy and costs of financing and thus has value consequences. Collectively, our findings provide important implications for IPO investors, entrepreneurs seeking VC financing, and VC investors who receive shares instead of cash from the VC firms when these VC firms exit the IPO companies.

The rest of the paper is organized as follows. Section 2 provides a theoretical framework and develops the main hypotheses. Section 3 discusses data and methodology, while the empirical results are presented and interpreted in Section 4. We conclude in Section 5.

2. Theory and hypothesis development

2.1. Theoretical framework

Existing research highlights the importance of VCs in the financing and growth of small and private companies, including newly listed companies (Celikyurt et al., 2014; Aldatmaz and Celikyurt, 2021). VC firms generally provide advice and support to their portfolio companies (Gompers, 1995; Lerner, 1995), professionalize the management team (Hellmann and Puri, 2002), exercise monitoring and corporate governance (Kaplan and Stromberg, 2003, 2004;

Lerner, 1994), and improve productivity (Chemmanur et al., 2011). They are known to take an active role in monitoring and intervening in portfolio companies' strategic decisions by serving on companies' boards of directors and taking extensive control rights (i.e., board control) (Rosenstein et al., 1993; MacMillan et al., 1988; Fried et al., 1998; Hellmann, 1998; Bottazzi et al., 2008; Ewens and Marx, 2018). Existing literature also shows that VC involvement with a company continues after the company's IPO due to lock-up agreements, performance incentives, and liquidity considerations (Arthurs and Busenitz, 2006; Jeppsson, 2018; Iliev and Lowry, 2020). Baker and Gompers (2003) analyze the role of VCs at the time of listing and find that VC-backed companies have better-performing boards of directors and tend to improve their performance post-IPO. Given the expertise and experience of VC firms, they can bring in specific expertise that is valuable to a portfolio company. Recent evidence shows that VCs indeed play an important role in driving their backed companies' investment decisions on research and development, innovation output, and mergers and acquisitions (Celikyurt et al., 2014; Aldatmaz and Celikyurt, 2021). Hence, it is expected that VC directors on a company's board will be valuable for the company when the latter makes debt financing decisions.

It is well documented that the use of different debt types simultaneously is a critical factor in corporate capital structure decisions. For instance, Rauh and Sufi (2010) find that most companies tend to rely on more than two different types of debt. However, previous theoretical and empirical studies reveal both the benefits and costs of using heterogeneous debt types. A dispersed debt structure makes debt renegotiation more difficult as multiple creditors are unlikely to coordinate and agree on the debt restructuring procedures when the borrower defaults (e.g., Gertner and Scharfstein, 1991; Asquith et al., 1994; Berglöf and von Thadden, 1994; Bolton and Scharfstein, 1996; Colla et al., 2013; Ivashina et al., 2016). Hence, using multiple debt types simultaneously can potentially increase creditor coordination costs due to

debt contracts, which include cross-acceleration or cross-default provisions (Beatty et al., 2012). Specifically, in the event of a default, creditors need to coordinate not only within but also across debt types (Li et al., 2021), leading to coordination problems. These problems arise as different debt types have different cash flow claims, control provisions, collateral, or seniority, while lenders often have different investment horizons or objectives (Ayotte and Morrison, 2009; Lou and Otto, 2020). Such problems lengthen the debt renegotiation process as they make it more difficult for companies to restructure their debt (Ivashina et al., 2016). Bargaining with the owners of different debt types deters potential buyers from learning about the borrower's assets, which reduces the expected value at which the borrower's assets can be sold in case of a default (Bolton and Scharfstein, 1996). In sum, debt heterogeneity can reduce the expected liquidation value and cause an inefficient liquidation, thus increasing the expected costs of default and costs of future debt financing (Hoshi et al., 1990; Colla et al., 2013; Bris and Welch, 2005; Lou and Otto, 2020; Li et al., 2021).

However, the upside of debt heterogeneity is that the costs of the coordination problems can reduce the borrower's benefits from defaulting strategically and weaken their incentives to do so (Bolton and Scharfstein, 1996).[7] Debt heterogeneity can also alleviate holdup problems between lenders and borrowers (Rajan, 1992) and reduce the risk that individual lenders can fail when these borrowers require debt financing (Detragiache et al. 2000). Overall, the extant literature argues that debt structure decisions are highly important for companies. However, there is an upside (i.e., deterring strategic default) and downside (i.e., higher costs of default) risk of debt heterogeneity for companies when choosing between a dispersed or concentrated debt structure.[8] To the extent that VCs can play an important role in influencing their portfolio

[7] In a strategic default (i.e., defaulting despite being able to service the debt), expected repayments to creditors are lower, which, in turn, reduces the borrower's borrowing capacity and hence its ability to finance new projects.
[8] Given the advantages and disadvantages of debt heterogeneity, it is unclear whether ex-ante the managers of a company prefer a concentrated or dispersed debt structure, prior to VC involvement.

companies' financing decisions, it would be of interest to empirically examine how VC involvement affects these companies' debt structure choices.

2.2. Hypothesis development

Debt financing might be more attractive than equity for recently listed companies, because of the negative market reaction associated with equity financing (Myers and Majluf, 1984; Bilinski and Mohamed, 2015). Moreover, when raising debt, having a suitable debt structure is critical for IPO companies as it may have implications for their performance and viability. As discussed, a dispersed debt structure deters strategic defaults because of the coordination problems across debt types (Asquith et al., 1994; Berglöf and Von Thadden, 1994; Bolton and Scharfstein, 1996). However, the disadvantage of debt dispersion is that these coordination problems increase the expected costs of default by making debt restructuring more difficult (Ivashina et al., 2016), reducing the expected liquidation value of the company's assets, and causing inefficient liquidation (Hoshi et al., 1990; Colla et al., 2013; Lou and Otto, 2020; Li et al., 2021). In addition, debt heterogeneity is likely to diminish the company's ability to invest due to the lengthy debt renegotiations, reducing the company's performance. Bris and Welch's (2005) model further suggests that using a dispersed debt structure from multiple lenders sends a negative signal to creditors that management is likely to expropriate creditors in the case of bankruptcy, and hence creditors are likely to impose higher financing costs. In a similar vein, creditors are likely to perceive a low level of commitment from management in mitigating liquidation risk and a higher likelihood of default when the company's debt is dispersed (Colla et al., 2013; Li et al., 2021). Overall, there is strong evidence that debt dispersion (concentration) is associated with a higher (lower) probability and costs of financial distress.

As articulated in the above sections, VC firms maintain their involvement with their portfolio companies not only during the IPO but also in the period post-listing (e.g., Levis, 2011; Iliev and Lowry, 2020). While previous studies document the superior performance of IPOs associated with VC firms relative to their peers (Megginson and Weiss, 1991; Brav and Gompers, 1997; Gompers and Lerner, 2000), recent evidence further suggests that continued VC involvement after IPOs may have important implications for corporate behavior post-listing (e.g., Celikyurt et al., 2014). Typically, VCs have an incentive to protect their reputations, and in doing so, they are likely to help their portfolio companies to avoid high (expected) bankruptcy costs. For instance, Huang et al. (2016) document the importance of reputational concerns for VC and private equity firms, by demonstrating actions taken by these firms to protect their portfolio companies from being involved in costly bankruptcies. To the extent that a more concentrated debt structure helps reduce the costs of financial distress, we predict that VC directorship is associated with a higher degree of debt concentration. We summarize our first hypothesis as follows:

H1: All else being equal, VC involvement increases the degree of debt concentration of IPO companies.

Higher bankruptcy costs and a greater degree of uncertainty increase the risk for a company's equity holders, including VC firms (Ferreira and Pereira, 2021). Despite VCs being more actively involved in corporate decisions, they rank below debt holders in the payment "food chain" (i.e., debt holders are paid ahead of VC firms). Therefore, the higher the likelihood of liquidation, the higher the risk for residual claimants. Moreover, a high level of liquidation risk and uncertainty associated with market or economic uncertainties, which affect VC firms' ability to exit from their portfolio companies, have an adverse impact on the VCs' reputation and their ability to raise subsequent funds from their capital providers (e.g., Krishnan et al.,

2011; Ersahin et al., 2023). This uncertainty is likely to affect VC firms more than other equity holders since VCs have a time restriction on their involvement with portfolio companies and are required to return capital to their investors over a specified period (Pearce and Barnes, 2006; Cumming and Johan, 2007). Overall, when portfolio companies face greater expected bankruptcy costs or uncertainty, VC firms are likely to exert a greater influence on those companies' debt choices, that is, they have more incentive to mitigate the costs of bankruptcy or uncertainty risk by encouraging those companies to concentrate their debt structure. This argument leads to our second hypothesis:

H2: All else being equal, the positive influence of VC involvement on the debt concentration of IPO companies is stronger when these companies face high expected bankruptcy costs or a high degree of uncertainty.

Credit quality is an important factor determining a company's debt structure (e.g., Diamond 1991; and Bolton and Freixas 2000). Rauh and Sufi (2010) document that high-credit quality companies rely exclusively on fewer debt types (e.g., unsecured debt) than low-credit quality companies. Although the latter may have limited access to arm's-length (short-term) sources of debt, they could still adopt a multi-tiered debt structure, including secured bank debt, secured non-bank debt, and subordinated bonds and convertibles. Colla et al. (2013) show that, excluding companies with the lowest ratings, debt concentration is associated with credit quality in a nonmonotonic fashion. While companies with medium credit quality exhibit the highest degree of debt concentration, those with low or high credit quality maintain less concentrated debt structures. Based on these findings, it is plausible that credit quality may

play an important role in influencing the relationship between VCs and debt concentration.[9] Specifically, for companies that rely on multiple debt types, such as those with low credit quality (Rauh and Sufi, 2010), VC directors could have a stronger incentive to encourage those companies to restrict the use of debt heterogeneity. On the other hand, if companies with very low credit quality, such as those with no credit ratings, do specialize in a few debt types (Colla et al., 2013), the role of VC involvement could become less important, as these companies already have limited access to some segments of the debt markets.[10] Overall, based on the above arguments, we develop the following hypothesis:

H3: All else being equal, the positive effect of VC involvement on the degree of debt concentration of IPO companies varies with these companies' credit quality.

The alternative argument to the above hypotheses is that VC involvement is associated with a lower degree of debt concentration because VC directorships help create opportunities for portfolio companies to use different debt types. VC firms not only provide financial backing to their portfolio companies, but also assist these companies in recruiting talented managers, formulating new strategies, and gathering resources through the VC networks (Leiblein and Reuer, 2004; Gompers and Lerner, 2004; Arthurs and Busenitz, 2006; Arikan and Capron, 2010). Accordingly, VC involvement in a company may send a powerful signal about the company's quality to investors (e.g., Carter and Manaster, 1990; Brav and Gompers, 1997; Stuart et al., 1999). Hence, companies with VCs are likely to face lower costs of debt (e.g.,

[9] The role of VC debt may also be relevant as another related proxy for credit quality. Some creditors may be less willing to lend to companies that do not attract VC debt, and the lack of VC debt could affect their debt structures. In further analysis, we consider the impact of VC debt. However, we refrain from reporting the results given the small sample size and lack of statistical power. Future research, with better data coverage, would be necessary to shed further light on the role of VC debt.

[10] This argument may also lead to the question of whether VCs actively encourage companies to use a concentrated debt structure or whether debt concentration is mainly driven by (low) credit quality. In our test of *Hypothesis 3*, we address this issue in more detail.

Huang et al., 2016) and can attract different types of lenders more easily, leading to higher debt heterogeneity. More importantly, VC directors are likely to enhance the likelihood of successful coordination among the creditors, thus mitigating the downside of debt dispersion. Recent evidence suggests that VC firms help improve their portfolio companies' financial reporting practices (e.g., Wongsunwai, 2013; Nam et al., 2014; Cumming et al., 2022), which, in turn, enables creditors to resolve disagreements and find a resolution for a more efficient default more easily (Senbet and Wang, 2012; Ayotte and Skeel, 2013; Li et al., 2021). Additionally, even if coordination among creditors fails and the company enters a Chapter 7 liquidation, VC involvement may help the company achieve a higher liquidation value. For instance, Masulis and Nahata (2011) show that in the context of takeovers, acquirers pay a premium when the target company is associated with VC firms. Overall, the above discussion leads to the following hypothesis:

H4: All else being equal, VC involvement decreases the degree of debt concentration of IPO companies.

As discussed above, VC involvement helps improve portfolio companies' internal control environment and accounting quality. Li et al. (2021) show that higher accounting quality reduces the degree of debt concentration by increasing the probability of effective creditor coordination and reducing the costs of coordination failure for borrowers. To the extent that VC firms help improve the accounting quality of their portfolio companies and enable these companies to rely on a more dispersed debt structure, the impact of VC involvement on debt heterogeneity may be more pronounced for companies with relatively lower accounting quality, namely, companies that will benefit most from VC involvement. In sum, this argument leads to our final hypothesis:

H5: All else being equal, the negative effect of VC involvement on the degree of debt concentration of IPO companies is stronger when the accounting quality of these companies is relatively lower.

3. Empirical model and data

3.1. Empirical model

We use the normalized Herfindahl-Hirschman Index (*HHI*) as a proxy for debt concentration, following Colla et al. (2013), Castro et al. (2020), and Li et al. (2021). To compute this index, we first calculate the following:

$$SS_{i,t} = \left(\frac{DC_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{TL_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{CP_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{SBN_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{SUB_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{CL_{i,t}}{TD_{i,t}}\right)^2 + \left(\frac{Other_{i,t}}{TD_{i,t}}\right)^2 \quad (1)$$

where *SS* refers to the sum of the squared debt type ratios based on Capital IQ data for company *i* in year *t*, while *TD* is the total debt. *DC* (drawn credit lines), *TL* (term loans), *CP* (commercial paper), *SBN* (senior bonds and notes), *SUB* (subordinated bonds and notes), *CL* (capital leases), and *Other* (other debt) represent different debt components. Next, we calculate the *HHI* index as follows:

$$HHI_{i,t} = \frac{SS_{i,t} - 1/7}{1 - 1/7} \quad (2)$$

The values of *HHI* range from zero to one, with a higher value indicating a lack of borrowing diversity (i.e., a tendency to concentrate on fewer debt types) for company *i* in year *t*. For instance, the value of one indicates that the company uses only one debt type, whereas the value zero suggests that the company uses various debt types (i.e., simultaneously using all seven debt types in equal proportion). As an alternative measure of debt concentration, we also use a dummy variable $Excl90_{i,t}$ for company *i* in year *t,* which takes one if at least 90% of the

company's debt is one debt type and zero otherwise; see also Colla et al. (2013) and Castro et al. (2020).

To investigate the effect of VC involvement on corporate debt structure, we use pooled Tobit regressions to accommodate the censoring nature of *HHI* (e.g., Colla et al. 2013; Castro et al. 2020):

$$HHI_{i,t} = a_1 VCdirector\%_{i,t} + a_2 MB_{i,t-1} + a_3 Profitability_{i,t-1} + a_4 Size_{i,t-1}$$
$$+a_5 Tangibility_{i,t-1} + a_6 RD_{i,t-1} + a_7 CFVol_{i,t-1} + a_8 Dividend_{i,t-1}$$
$$+a_9 Unrated_{i,t-1} + a_{10} CompanyAge_{i,t-1} + a_{11} BookLev_{i,t-1} + n_j + d_t + e_{i,t} \quad (3)$$

where $VCdirector\%$ is the fraction of VC firm directors on the board of company i (i.e., the number of VC directors on the company's board divided by the total number of board members) in year t.[11] Consistent with previous studies (see, for instance, Castro et al., 2020), we include the following control variables: market-to-book (*MB*), profitability (*Profitability*), company size (*Size*), tangibility (*Tangibility*), research and development expenses (*RD*), cash flow volatility (*CFVol*), dividend payments (*Dividend*), credit ratings (*Unrated*), company age (*CompanyAge*), and book leverage (*BookLev*). Except for *Size*, *Dividend*, and *CompanyAge*, all the variables are scaled by total assets. In our model, we further control for industry fixed effects (n_j) and year fixed effects (d_t).[12] Standard errors are clustered at the company level. Table 1 provides the detailed definitions of the variables used in our analysis.

In line with previous studies (e.g., Colla et al., 2013; Castro et al., 2020), we also examine whether the choice of the estimator or dependent variable affects our results. We use

[11] To examine the robustness of our results, in Section 4.3, we also measure VC involvement using the number of VC directors.

[12] We do not include company fixed effects because our main independent variable, *VCdirector%*, is highly persistent over the test window.

ordinary least squares (OLS) as an alternative estimation method to the Tobit model. We also use the Probit model, where the dependent variable is equal to one if at least 90% of the company's debt is one debt type, and zero otherwise.

3.2. Data and sample construction

We study a sample of IPO companies listed between 2001 and 2019; the list of these companies is collected from J. Ritter's data library. We use the VentureXpert database to identify companies that have been involved with VCs at the time of listing. We manually collect information on the number and fraction of VC directors on the IPO companies' boards from the prospectuses at the time of listing and from companies' 10-K filings up to a five-year window post-listing. Next, we use the Capital IQ database to collect data on debt types, while we retrieve accounting information and market data from Compustat and CRSP, respectively. Information on debt structure from Capital IQ is available only from 2001 and hence this is the first year of our sample period. Consistent with the previous IPO literature (e.g., Megginson and Weiss, 1991; Brav and Gompers, 1997), we exclude IPOs in regulated (SIC codes 4900-4999) and financial (SIC codes 6000-6999) industries, cross-listed IPOs, spin-offs private placements, closed-end funds, right-offerings, and unit-offerings. We merge the Capital IQ data with the Compustat accounting data. Since *HHI* is our variable of interest, we include in our sample only IPOs with available data to compute this index.[13] As the result of the above restrictions, our final sample is an unbalanced panel consisting of 6,434 company-year observations for 1,719 unique IPOs. We winsorize all continuous variables at the 1st and 99th percentiles to alleviate the potential impact of outliers.

[13] In Section 4.2.3, we use the (two-stage) Heckman sample selection model to correct for the possible bias associated with this restriction.

3.3. Summary statistics

Table 2 reports the descriptive statistics for *HHI,* various types of debts/loans, and company characteristics by their mean, median, and standard deviation. The mean value of *HHI* is 79.7%, while the median value is 88.5%. The statistics suggest that debt is fairly concentrated on average, but negatively skewed, as shown by the higher median than the mean value. The variable VC dummy shows that VCs are involved in 22.6% of the IPOs in our sample. The average proportion of VC directors on boards is 31.6%, with a median of 28.6%. The mean term loans are 33.3% of the total debt in our sample, compared to the mean of 30.2% and 18.4% for senior bonds and notes as well as drawn credit lines, respectively. Commercial papers are the least used loan type compared with the other debt types, with a mean of 0.1%.[14]

Regarding company characteristics, the mean (median) market-to-book ratio for our sample is 2.231 (1.416). On average, the IPO companies in our sample are not profitable with a mean of -11.3% and a median of 6.9%. The mean (median) logarithm of company size is 5.533 (5.62) and the ratio of tangible assets to total assets is 27.4% (15.6%). On average, research and development expenses represent 9.5% of total assets, while the mean value of cash flow volatility (i.e., the standard deviation of operating cash flow) is 39%. The statistics show that 18% of the companies pay dividends during our sample period, while 48.2% are not rated by the S&P credit rating agency. The mean (median) logarithm of company age is 0.893 (1.099), while the mean leverage ratio is 31% (23.7%). Overall, the summary statistics of the

[14] Our measure of the *HHI* index is consistent with that used in previous studies (e.g., Colla et al., 2020). However, there is a difference in the statistics of *HHI* between our paper and previous studies. The reason is that we focus on newly listed companies, while those studies typically examine all listed companies. In an additional robustness test, we recalculate the *HHI* index for non-IPO companies and find that the statistics are indeed similar to those reported in previous research (e.g., Colla et al., 2020).

control variables in our sample are consistent with those in Colla et al. (2013) and Castro et al. (2020).

Table A1 in the appendix reports the correlation matrix for the different debt types and control variables. The degree of correlation is low among the control variables, suggesting that multicollinearity is unlikely to be an issue in our regression analysis.[15]

[TABLE 2 HERE]

4. Empirical tests

4.1. Baseline analysis

In our empirical analysis, we first examine the impact of VC involvement on corporate debt concentration, as measured by *HHI* in multivariate settings. Table 3 reports the results from both the Tobit and OLS regressions. In column 1, the coefficient on the variable *VC director %* is 0.244 and statistically significant, indicating that VC directors on company boards are significantly and positively associated with the degree of debt concentration. In column 2, we include IPO companies' characteristics and find that the relation between VC involvement and debt structure remains to be statistically significant at the 1% level. Based on the coefficient estimate of 0.204, the degree of debt concentration (*HHI*) increases by 4.6% (=0.204*0.181/0.797) relative to its sample mean for one standard deviation increase in the proportion of VC directors on corporate boards, indicating that our finding is also economically meaningful. In columns 3 and 4, we re-run the analysis using OLS instead of the Tobit model. Column 3 shows the result of including only the fraction of VC directors, while column 4 reports the estimates after controlling for company characteristics as in column 2. We find the

[15] We also examine the Variance Inflation Factors (VIFs) for the control variables in our regression and all the values are less than 5, alleviating the concern of potential multicollinearity.

magnitudes of the coefficients on *VC director %* are smaller than those reported in columns 1 and 2. Nevertheless, the main finding persists as VC involvement remains significantly associated with greater debt concentration. Overall, our results suggest that VC directors on companies' boards are associated with more concentrated debt structures in portfolio companies, consistent with *Hypothesis 1* that VC firms encourage those companies to lower the likelihood and costs of default and to protect their reputation. However, these results do not support *Hypotheses 4* and *5* that VC involvement enables firms to use a more dispersed debt structure.

[TABLE 3 HERE]

4.2. Addressing endogeneity and sample selection issues

4.2.1. Instrumental variable analysis

So far, our regression analysis has assumed that the proportion of VC directors on company boards exogenously determines corporate debt concentration. However, our results may be subject to endogeneity bias due to the presence of omitted variables, which may affect both the appointment of VCs as directors and portfolio companies' debt structure choices. In such a scenario, VC directorship might not exogenously influence corporate debt concentration, leading to biased results. To empirically address this endogeneity concern, we estimate an instrumental variable (IV) Tobit model in two stages (via maximum likelihood).

Based on Samila and Sorenson (2011), we use the returns to VC limited partners (LP) as the instrument. The IV, *LP returns*, is likely to satisfy both the relevance and exclusion restrictions.[16] LPs are the main capital providers to VC firms (Espenlaub et al., 2015), typically allocating 60% of their assets to equity, 30% to fixed income, and the remainder to alternative

[16] We thank an anonymous referee for suggesting the use of LP returns as an IV.

assets (Samila and Sorenson, 2011). These LPs generally rebalance their portfolios to maintain capital allocations close to these optimal mixes, where higher returns are invested in VC firms (Samila and Sorenson, 2011). Hence, the higher the returns to LPs, the greater the supply of VC capital, and the higher the likelihood of VCs making investments and serving on company boards. That is, LP returns are likely to have a significant impact on VC involvement and directorship in portfolio companies (i.e., the relevance condition). On the other hand, LPs mainly consist of local endowment funds of universities and colleges, and so their returns are primarily determined by macro and local economic conditions. Thus, LP returns are less likely to be correlated with VC characteristics, such as the relationship with lenders, that could have a direct effect on the IPO companies' debt structure decisions (i.e., the exclusion restriction). We compute our IV, LP returns, as the three-year cumulative lagged annual returns for college and university endowments, following Samila and Sorenson (2011).[17]

Table 4 reports our IV results. The first-stage results show that, as expected, the IV has a significant and positive impact on the likelihood of VC directors serving on company boards. Also, the first-stage *F*-test rejects the null hypothesis that the IV is weak. Importantly, the second-stage results show that the effect of VC directors on debt concentration is significant and positive, consistent with the baseline results.[18] Overall, although there is no perfect way to ensure the validity of the instrument used, our IV analysis offers some assurances that endogeneity is unlikely to bias our evidence of a positive relationship between VC directorships and companies' debt structure.[19]

[17] Following the literature, we use the three-year cumulative lagged returns because VCs do not immediately invest the fund committed to them.

[18] The coefficient on the *VC director %* in the baseline analysis (i.e., 0.204) is similar to that in the IV model (0.201). Jiang (2017) refers to such an outcome as "unclear endogeneity", which typically happens when there are opposing forces that respectively cause an overestimation or underestimation in the baseline regressions, ultimately canceling each other out.

[19] As in previous studies (e.g., Saretto and Tookes, 2013), we also perform the Hausman test. Failure to reject the test suggests that endogeneity is unlikely a concern.

[TABLE 4 HERE]

4.2.2. Matching analysis

A further potential concern is that our baseline analysis may ignore the possible effect of VC firms selecting companies with certain characteristics, which are associated with a more concentrated debt structure, such that VC directors on boards might not be the main driver of such decisions. To address this concern, we use propensity score matching (PSM) and report the results in Table 5. We match companies in the treatment group (i.e., those with at least one VC director) with companies in the control group (i.e., those with no VC director) based on the control variables, which include the market-to-book ratio, profitability, company size, tangibility, research and development, operating cash flow volatility, an indicator of whether a company pays dividends, credit rating, company age, and book leverage. Our matched sample is based on one-to-one matching with the nearest neighbor, without replacement.

Panel B of Table 5 shows the mean differences in the matched variables between the treated and control groups. The results show that those differences are not statistically different at any conventional significance level following the matching, suggesting that the matching procedure is reliable.[20] Panel A of Table 5 reports the multivariate results for the matched sample. Columns 1 and 2 show the results from the Tobit and OLS regressions, respectively. In both columns, the coefficients on *VC director %* are similar to our baseline results in terms of economic and statistical significance. In further analysis, we document qualitatively similar results using entropy balancing instead of PSM; see Table A2 for more details. Overall, the results of Table 5 and Table A2 provide support for our main finding that VC involvement

[20] In unreported analysis, we find that the control variables do not predict VC involvement for the matched sample, providing further evidence to validate our matching exercise.

significantly influences companies' debt concentration decisions. Importantly, these results are unlikely to be driven by the selection effect or heterogeneous company characteristics.[21]

[TABLE 5 HERE]

4.2.3. Heckman two-step sample selection

Sample selection could be yet another concern for our empirical analysis. For instance, the positive effect of VC involvement on debt structure may be driven by sample selection bias, whereby companies with VC directorship have certain unobserved characteristics that are correlated with debt structure. To address this concern, we use the Heckman (1979) two-step model. In the first stage, we use the Probit model to estimate the likelihood of a company having a VC on its board of directors. The dependent variable takes the value of one if the IPO company has at least one VC director on its board and zero otherwise. The control variables are similar to those reported in Equation (3). In the second stage, we estimate the effect of VC involvement (i.e., the proportion of VC directors on boards) on debt concentration for only a sample of IPO companies with VC director(s). We include the Mills ratio estimated from the first stage to control for sample selection in this regression. The results in Table 6 show that the impact of *VC director %* on debt concentration remains similar to our baseline results. Moreover, the coefficient on the inverse Mills ratio is not statistically significant at any conventional level, suggesting that sample selection bias is unlikely to drive our main results.

[TABLE 6 HERE]

[21] We further use the Heckman two-step model to examine the bias of excluding companies with no data from Capital IQ to calculate *HHI*. We find no evidence of sample selection bias; the results are not reported for brevity but are available from the authors.

4.3. Robustness checks

4.3.1. Alternative measure of debt concentration

As discussed above, following Colla et al. (2013) and Castro et al. (2020), we construct a dummy variable ($Excl90_{i,t}$) as an alternative measure of debt concentration, which takes the value of one for a company-year observation if at least 90% of the total debt is sourced from one type of debt and zero otherwise. We use this alternative measure to estimate the probability of debt concentration using the Probit model. Panel A of Table 7 reports the results of the Probit model for the full sample (column 1) and the matched sample from PSM (column 2). Columns 1 and 2 show that the probability of debt concentration increases by 13.3% and 12.8% points, respectively, for one standard deviation increase in the fraction of VC directors on a company's board. Taken together, the results in Panel A of Table 7 show that VC involvement significantly increases the likelihood of debt concentration, and this effect is insensitive to using the full and matched samples.

4.3.2. Alternative measure of VC involvement

Next, we examine the robustness of our finding to an alternative measure of VC involvement. In Panel B of Table 7, we show how debt concentration is affected by the number of VC directors (*Number of VC directors)* instead of the fraction of VC directors (*VC director %)*. We expect the proportion of VC directors to influence debt structure decisions more strongly than the number of VC directors. This is because having a higher number of VC directors on boards does not necessarily mean that VC firms are influential, especially when the board size is large. Simply put, the impact of the number of VC directors is affected by the companies' board size. By contrast, the proportion of VC directors already takes into account board size relative to the number of VC directors on boards. Panel B of Table 7 shows the effect of the *Number of VC directors* on debt concentration using the Tobit (column 1), OLS (column 2), and Probit

regressions (column 3). Consistent with our expectation, the coefficient on the number of VC directors is statistically significant, but as expected, its magnitude is smaller than that of *VC director %* in the baseline analysis. Yet, these findings provide additional support for the main result regarding the influence of VC involvement on debt concentration.

4.3.3. Further robustness checks

In the remainder of Table 7, we conduct further robustness tests. In Panel C, we exclude from our full sample company years where the difference between the sum of debt types from Capital IQ and total debt from the Compustat database exceeds 10% of the total debt. We conduct this test to assess whether our baseline results are affected by the inconsistent reporting between these two databases following previous studies (Colla et al., 2013; Castro et al., 2020; Lou and Otto, 2020). Column 1 shows that the impact of VC directors on debt concentration is similar to that reported for the full sample. In columns 2 and 3, we further use the Heckman selection model to account for the possible selection bias associated with the difference between the two databases.[22] Again, we find no evidence of sample selection bias and the results are consistent with our baseline findings.

In Panel D, we investigate the dynamic effects of VC directorships at the IPO on the degree of debt concentration over a longer time horizon, namely, one, two, and three years after the IPO. Our results show that VC involvement continues to exert a significant and positive effect on corporate debt concentration over the period one, two, or three years post-IPO. This finding provides further evidence of the causal effect of VC directorship on debt concentration.

[22] The dependent variable in the first stage takes 1 if the difference between the sum of the debt types from Capital IQ and total debt from Compustat exceeds 10% of the total debt, and 0 otherwise. The control variables are similar to those reported in Equation (3). In the second stage, we include the inverse Mills ratio estimated from the first stage to control for sample selection bias.

Next, we examine the impact of VC directors and other major institutional directors on corporate debt concentration. As discussed in the introduction, company financial decisions, and debt structures in particular, could be affected not only by VC directors but also by other major institutional investors (e.g., mutual funds and hedge funds). However, thanks to the distinct role of VC firms in newly listed companies, we expect the influence of VC directors on these companies' debt structures to remain highly significant, even in the presence of other institutional directors. To test this conjecture, in Panel E, we rerun our regressions while controlling for the directorship of other major institutional holders. We collect data on all other major institutional directors from BoardEx, Refinitiv 13F, and FactSet and create the variable *Other major institutional directors %*, which measures the fraction of the directors of other major institutional holders sitting on companies' boards.

In column 1 of Panel E, we replace our main independent variable, *VC director %*, with the new regressor, *Other major institutional directors %*. In column 2, we include both variables. In column 3, we study a matched sample of VC and non-VC backed companies. Importantly, we match these companies using the directorship of major institutional holders, together with several company characteristics. This matching exercise further allows us to investigate the effect of VC directors on corporate debt concentration for companies in which other major institutional directorships play a similar role. The results across the models show that the effect of VC directors on debt concentration is always significant and positive, even after accounting for the role of other institutional directors. We also find that, in models with or without VC directorship, other institutional directors do play a role, although their impact on newly listed companies' debt structure is marginally significant. Taken together, these findings provide evidence that the impact of VC involvement is above and beyond that of other major institutional directors' involvement. Moreover, VC directors exert a statistically

significant and possibly more important impact on portfolio companies' debt structure than other major institutional directors. These findings are consistent with the arguments that VC directors play an important and distinct role in determining IPO companies' financing decisions, further justifying our research focus on VC firms.

In Panel F, we address another potential concern that our results could be driven by unobservable time-invariant VC firm and portfolio company characteristics. To this end, we control for different combinations of fixed effects, namely, company, VC, and year fixed effects (columns 1 and 2) and VC, industry, and year fixed effects (columns 3 and 4). The results remain qualitatively similar to our baseline findings, suggesting that our main inference is not affected by heterogeneity bias.

[TABLE 7 HERE]

4.4. Cross-sectional analysis

4.4.1. Bankruptcy costs

In this section, we test *Hypothesis 2* by investigating whether and how the effect of VC involvement on corporate debt structure varies in companies with high versus low expected bankruptcy costs. As discussed, if mitigating financial distress and liquidation risks through adopting a concentrated debt structure is the driving force explaining the positive effect of VC involvement on debt concentration, we expect a stronger effect of VC directors on *HHI* when the expected bankruptcy costs are higher. This is because higher bankruptcy costs increase the risk of VC firms as equity holders (Ferreira and Pereira, 2021) and adversely affect their reputation (Krishnan et al., 2011).

We follow previous studies and use tangibility, cash flow volatility, and the modified Altman Z-score as proxies for expected bankruptcy costs (e.g., Colla et al., 2013; Castro et al.,

2020). Table 8 reports the results of the Tobit regressions for companies with high and low bankruptcy costs, using the median values of these proxies to split the full sample into those groups. In Table 8, low tangibility, high cash flow volatility, or a low Altman's Z-score represent high expected bankruptcy costs, whereas high tangibility, low cash flow volatility, or a high Altman's Z-score proxy for low expected bankruptcy costs. The results show that VC directors on corporate boards positively influence debt concentration when bankruptcy costs are high (columns 1, 3, and 5). Nevertheless, this effect fades away when bankruptcy costs are low (columns 2, 4, and 6). These results are consistent when using a matched sample based on PSM,[23] and continue to hold in IV regressions.[24] These findings indicate that the higher the (expected) costs of bankruptcy, the higher the effect of VCs on companies' debt concentration, which is consistent with *Hypothesis 2*.

[TABLE 8 HERE]

4.4.2. Uncertainty

Next, we study the impact of VC directorship on debt concentration for companies operating in an environment with varying degrees of uncertainty. Higher uncertainty intensifies the risks for equity holders, particularly VC firms. Previous studies document that VC firms are obliged through their contractual agreements to return the capital to their providers/investors within a certain period (Pearce and Barnes, 2006; Cumming and Johan, 2007). However, an environment with higher uncertainty could increase the risk for VC firms when liquidating

[23] In Tables A3 – A5, we rerun our cross-sectional tests using matched samples. For example, we match the treated and control groups after splitting IPO companies into subsamples with high or low expected bankruptcy costs. This method leads to different sizes in the matched subsamples. We further test the differences in the mean values of all the variables between the treated and control groups and find that they are not statistically significant, suggesting that our PSM is valid.

[24] As in Section 4.2.1, and using the same instrument (*LP returns*), we conduct IV regressions for all cross-sectional analyses reported in Table 8, as well as subsequent tests reported in Tables 9, 10, and 11. Overall, our results are robust to using IV estimations.

their investments in IPO companies. As a result, as in *Hypothesis 2*, we expect VC directors on boards to exert a stronger influence on debt concentration decisions for those companies associated with higher uncertainty.

Following Bloom et al. (2007), we measure the degree of uncertainty associated with companies using stock return volatilities estimated over a 12-month rolling window.[25] We also use the economic policy uncertainty (EPU) index developed by Baker et al. (2016) as an alternative, macro-level, proxy for the uncertainty related to the content, timing, and potential impact of policy decisions made by institutions and politicians (Litov et al., 2023).[26] Pastor and Veronesi (2013) find that heightened EPU increases company risks and leads to higher stock returns volatility, while Litov et al. (2023) show that EPU has a negative impact on VC investment and exit outcomes, suggesting a stronger incentive for VC intervention in portfolio companies.

The results in Table 9 show that VC directors on corporate boards positively influence debt concentration when there is a high degree of uncertainty, i.e., when the uncertainty measures used are higher than their median values (columns 2 and 4). However, this positive influence fades away in the presence of limited uncertainty, i.e., when the uncertainty measures are lower than their median values (columns 1 and 3). Overall, these findings indicate that VC firms have stronger incentives to reduce the risk associated with a higher degree of uncertainty by influencing companies' concentrated debt structures. They provide further empirical support for *Hypothesis H2*.

[TABLE 9 HERE]

[25] We also used a 3-month rolling window and our results remain qualitatively the same.
[26] This index is calculated as the weighted average of three components: (i) the frequency of newspaper coverage referring to policy-related economic uncertainties, the role of policy and federal tax code changes, (ii) forecasters' disagreements on future inflation, and (iii) government spending.

4.4.3. Credit quality

We next examine the effect of credit quality on the relationship between VC involvement and company debt structure. As stated in *Hypothesis 3*, for companies with multiple debt types, such as those with low credit quality (Rauh and Sufi, 2010), VC directors may have greater incentives to encourage those companies to adopt more concentrated debt structures. However, if companies with very low or no credit ratings already pursue debt specialization (Colla et al., 2013), the effect of VC involvement could become less important, given these companies' limited access to debt markets. Following the debt structure literature (Custodio et al., 2013), we use S&P credit ratings to measure credit quality. We further employ abnormal earnings as an alternative proxy for a related, and broader, concept of company quality.

In Table 10, columns 1 and 2, we split our sample into companies with high and low credit quality, using the presence of an S&P credit rating. In columns 3 and 4, we classify companies with high (low) quality as those with above-median (below-median) abnormal earnings. It is evident from columns 1 through 4 that VC directors positively affect companies' debt concentration, regardless of their credit quality. Specifically, the effect of VC involvement on companies' debt structures is significant for both high- and low-quality companies. These results suggest that VC directors play an active and important role in influencing the debt structures of different company types, supporting our central prediction (*Hypothesis 1*) and main finding.[27]

[TABLE 10 HERE]

[27] These results may help to alleviate the concern that our main finding is driven by credit quality, e.g., companies with low credit quality have limited access to debt markets and hence more debt concentration, rather than due to the active role of VC directors.

4.4.4. Accounting quality

In this analysis, we examine the role of the accounting quality of portfolio companies, as stated in *Hypothesis 5*. Recent literature shows that companies with lower accounting quality have a stronger incentive to concentrate their debt structures than those with higher accounting quality (Li et al., 2021), since lower accounting quality exacerbates creditor coordination problems. To the extent that VC directorship improves companies' internal control and accounting quality, companies with VC directors may have less incentive to adopt concentrated debt structures and the VC effect is more pronounced among companies with lower accounting quality, who will benefit more from VC involvement.

To test this prediction, we use a conventional measure of earnings management to proxy for accounting quality (Dechow et al., 1995). Typically, companies with high (accounting) quality have less incentive to manipulate their earnings than low-quality companies. In columns 5 and 6 of Table 10, we split our sample into companies with high and low degrees of earnings management. The results show that VC directorships positively affect the degree of debt concentration, and the effect is qualitatively similar for both high- and low-accounting quality companies. These results provide evidence against the predictions in *Hypotheses H4* and *H5* that VC involvement decreases the degree of debt concentration among portfolio companies, and the effect of VC directors is stronger for those with lower accounting quality.

4.5. Additional analysis

4.5.1. VC experience and reputation[28]

In this section, we examine whether VCs with previous experience investing in portfolio companies with dispersed debt structures are more likely to encourage IPO companies to

[28] We thank an anonymous reviewer for suggesting this line of enquiry.

concentrate their debt structure. We also investigate whether the impact of VC directorships on company debt concentration varies between more reputable and less reputable VCs. Based on the preceding discussions, we expect VC firms with a greater reputation to have a stronger incentive to influence IPO companies' debt concentration.

To measure VCs' experience with dispersed debt structures, we continue to use the Capital IQ database, which provides data on the debt structures of both public and private companies. We compute the *HHI*, our measure of debt concentration, for a sample of private companies (excluding the IPO companies in our analysis) associated with our sample VCs, before the IPO years of our sample companies. Using this new sample, we classify private companies with a dispersed debt structure as those companies with below-median *HHI* scores. Then, in our original sample, we define VC firms associated with such private companies as those with prior debt dispersion experience. Table 11, Panel A reports the results for the subsamples of VCs with and without such experience. The results show that the positive effect of VC directorships on debt concentration is significant for VCs with previous debt dispersion experience, whereas it is insignificant for VCs without such experience. This finding is consistent with the conjecture that when VC firms have a potential negative experience with debt dispersion, they have a stronger incentive to influence IPO companies' debt structures, by encouraging these companies to pursue debt concentration.

Next, to study whether the reputation of VCs plays a role in influencing their relation with portfolio companies' debt concentration, we follow Nahata (2008) and compute two measures of VC reputation, namely, (i) the cumulative market capitalization of VC-backed IPO companies associated with the VC firm, divided by the aggregate market value of all VC-backed IPOs and (ii) the sum of the VC firm's investments in portfolio companies divided by

the aggregate VC investments in the industry.[29] We consider VCs with above-median portfolio companies' (cumulative) market capitalizations or above-median investments in those companies to be more reputable. The results in Table 11, Panel B, show that more reputable VCs have a stronger impact on portfolio companies' debt concentration than less reputable VCs, consistent with theoretical expectations.

Overall, these findings are consistent with the argument that VCs prefer concentrated debt structure as a means of protecting their reputation and hence improving their abilities to attract funds from their investors (e.g., Krishnan et al., 2011; Huang et al., 2016; Ersahin et al., 2023). VC directors with dispersed debt experience or higher reputations exert a greater impact on portfolio companies' debt structure decisions.

[TABLE 11 HERE]

4.5.2. Impact of VCs on various debt types

Our analysis has examined the influence of VC involvement on corporate debt structure, which we have measured using *HHI*. In this section, we investigate the impact of VCs on each of the seven debt types, which are used to compute *HHI*. Table 12 reports the regression results based on the Tobit model. The negative and significant coefficients on senior bonds and notes (column 3) and other debt types (column 6) suggest that companies with higher VC involvement tend to use less risky debt financing, consistent with our argument. The coefficients on credit lines (column 1), term loans (column 2), and subordinated bonds and notes (column 4) are also negative, although they are statistically insignificant. However, in column 5, we document a positive and significant coefficient on capital leases, suggesting that

[29] Nahata (2008) uses VC age as a measure of VC industry experience, but he also argues that it is highly correlated with VC reputation. Hence, in our untabulated analysis, we employ VC age as an alternative measure of VC reputation. Our results remain qualitatively similar.

companies significantly rely more on capital leases when there is an increase in VC involvement. Specifically, one standard deviation increase in the fraction of VC directors on the boards is associated with an increase of 6.9% in the use of capital leases relative to their sample mean, suggesting that the VC impact is not only statistically significant but also economically important.[30]

Companies with VC directorships may have the incentive to rely more on capital leases to reduce the risk associated with debt financing since capital leases have several advantages over debt. The central argument is that leasing represents a financial alternative to borrowing. In a typical lease contract, the lessee (i.e., the party that leases the asset) takes the rights of the asset and uses it for an agreed period, and, in return, the lessee makes periodic payments to the lessor (i.e., the owner of the asset) (e.g., Gavazza, 2010). Therefore, by using capital leases, companies can free up their working capital and reduce the likelihood of bankruptcy.[31] Empirically, Krishnan and Moyer (1994) find that leasing is associated with lower bankruptcy costs than other debt types. Our finding is therefore in line with both previous theoretical and empirical research on capital leases.

Overall, in addition to our main evidence, the results in Table 12 suggest that companies with VC involvement concentrate their debt structure by using more capital leases while

[30] To check the types of assets leased by companies with VC involvement, we manually scan the 10-K files of a random sample of approximately 25% of the VC-backed sample companies that use capital leases. We find that these companies typically lease property (e.g., offices, store facilities, spaces for factory houses, warehouses, manufacturing facilities, service, and sales centers) and equipment (e.g., computer hardware and software, machinery, telecommunication and related equipment, furniture and fixtures, and automobile).

[31] Leasing allows companies to make investments without making substantial up-front payments. Moreover, through the leasing contractual agreement, both the lessor and lessee could exploit the tax deductibility features of interest obligations to shareholders. Sharpe and Nguyen (1995) find that companies with high costs of external funding could minimize financing costs through leasing, which is consistent with Eisfeldt and Rampini's (2009) finding that more financially constrained firms lease a larger portion of their capital. Generally, leasing minimizes transaction costs relative to other debt types (Flath, 1980; and Smith and Wakeman, 1985).

reducing their reliance on other debt types to reduce the risk of debt financing. They provide corroborating evidence in support of the main arguments underpinning *Hypotheses 1* and *2*.

[TABLE 12 HERE]

4.5.3. Company performance

Thus far, our results have demonstrated that VC directors on company boards influence portfolio companies' decisions to rely on fewer debt types. To the extent that higher debt concentration reduces the risk of bankruptcy and costs of financing, it should have value consequences for those portfolio companies. Put differently, a more concentrated debt structure as the result of VC involvement should have a positive impact on the company's performance.

To test this conjecture, in our final analysis, we examine the relationship between a company's debt concentration and its performance for a sample of IPOs with and without VCs on their boards of directors. If the effect of VC involvement on debt concentration creates value for the company, we expect a positive and significant relationship between debt concentration and company performance when VC directors serve on the company's board. In our model, we use two common measures of company performance: (i) industry-adjusted stock returns and (ii) industry-adjusted return on asset (ROA) (Bhagat and Bolton, 2008; Fresard, 2010). By using industry-adjusted measures, our analysis captures the performance of the company relative to that of its industry rivals. We also report the results without adjusting these measures for industry effects.

Table 13 reports the results for the sub-samples of IPOs with or without VC involvement. In columns 1–4, we use industry-adjusted stock returns and ROA without controlling for industry fixed effects, whereas in columns 5–8, we estimate models with unadjusted stock returns and ROA and with industry fixed effects. Across all models, we find

that debt concentration, as measured by *HHI*, positively influences company performance. Nevertheless, the effect is significant only for newly listed companies with VC directors serving on their boards of directors. This finding indicates that debt concentration enhances companies' performance as the result of VC involvement. Overall, our analysis suggests that the influence of VC directors on debt structure ultimately creates value for companies, as demonstrated by higher stock returns and better operating performance.

[TABLE 13 HERE]

5. Conclusion

This study investigates the influence of VC involvement on IPO companies' debt structure choices. Our results show that an increase in the proportion of VC directors on a company's board increases the degree of debt concentration. This evidence is robust to tests using instrumental variable regressions, propensity score matching, and entropy balancing, addressing sample selection bias, controlling for the role of other major institutional investors, and addressing heterogeneity bias. We also show that when newly listed companies' expected bankruptcy costs are high, the influence of VC involvement on their debt structure is stronger. Furthermore, the positive effect of VC involvement on debt concentration is more pronounced for IPO companies operating in an environment associated with a higher degree of uncertainty.

In additional analysis, we study various debt types used by IPO companies and show that heightened VC involvement significantly increases the use of capital leases, which reduces the risk of debt financing. We also find that VC directorship has a direct impact on their portfolio companies' debt structure decisions in different time horizons and our inference is unlikely to be driven by confounding factors and/or alternative explanations. VCs with debt dispersion experience or greater reputations exert a stronger impact on portfolio companies'

debt structure decisions. Overall, our results indicate that VC firms influence IPO companies' choice of debt concentration to mitigate the likelihood and costs of bankruptcy and the risk of debt financing as well as to protect their reputations. Such VC involvement ultimately creates value for these companies through enhanced corporate performance.

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Table 1: Variable definitions

Firm-level variables (source: Compustat and CRSP):	
VC director %	Fraction of VC firm directors on the board of the company (i.e., the number of VC directors on the company board divided by the total number of board members) at the time of IPO.
MB	Market to book ratio. It is measured as [MV equity, which is fiscal year closing price (199) times common shares used to calculate earnings per share (199), plus total debt plus preferred stock liquidating value (10) minus differed taxes and investment tax credit (35)] / Total assets (6)
Profitability	It is operating income before depreciation (13) / Total assets (6).
Size	Logarithm of total assets (6).
Tangibility	Net property, plant, and equipment (8) / Total assets (6).
RD	Research and development expenses (46) / Total assets (6). Missing observations are set to zero.
CFVol.	Cash flow volatility. Standard deviation of operating income before depreciation (13) divided by total assets (6). We require each company to have at least five data points in our sample period to compute the company-level cash flow volatility.
Dividend	A dummy variable equals 1 if common stock dividends (21) are positive, and 0 otherwise.
Unrated	A dummy variable equals 1 if a company does not have an S&P rating on long-term debt, and 0 otherwise.
Company Age	It is measured as the logarithm of 1 plus the number of years since a company appears in CRSP.
Book Lev	It is measured as total debt, which is the sum of long-term debt (9) and debt in current liabilities (34) / Total assets (6)
LP returns	Three-year cumulative lagged annual returns for college and university endowments
Other major institutional director %	Fraction of the directors of other major institutional holders (e.g., mutual funds and hedge funds) on the board of directors, i.e., the number of the directors of other major institutional holders on the company board divided by the total number of board members at the time of IPO.
High/Low bankruptcy costs	This dummy variable is used to split the sample into companies with high and low bankruptcy costs based on their tangibility, cash flow volatility, and Altman's Z score. Low tangibility, high CF volatility, or low Altman's Z score proxy for high bankruptcy costs, whereas high tangibility, low CF volatility, or high Altman's Z score proxy for low bankruptcy costs. The sample split is based on the annual median values of these proxies for bankruptcy costs.
High/Low uncertainty	This dummy variable is used to split the sample into companies facing high and low uncertainty, based on these companies' stock return volatility and the macro-level economic policy uncertainty (EPU) that they face. Stock return volatilities are estimated over a 12-month rolling window. Below-median values of stock return volatility or EPU proxy for low uncertainty, whereas above-median values of stock return volatility or EPU proxy for high uncertainty.
High/Low (credit) quality	This dummy variable is used to split the sample companies into those with high and low quality, based on those companies' S&P credit ratings and abnormal earnings or companies with high and low accounting quality, based on these companies' degrees of earnings management. Following the literature (e.g., Custodio et al.,

	2013), we compute abnormal earnings as the difference between the income before extraordinary items – adjusted for common stock equivalent – for time *t* and *t-1* divided by the market value of equity. We use Dechow et al.'s (1995) cross-sectional adaptation of the modified Jones model to estimate discretionary accruals earnings management.
VC experience with dispersed debt structure	This dummy variable is used to identify companies involved with VCs that have prior experience with private companies' dispersed debt structures. To measure such VC experience, we use the Capital IQ database, which provides the debt structure for both private and public companies. We calculate the *HHI* for a sample of private companies (excluding the IPO companies in our analysis) associated with our sample VCs, before the IPO years of the sample companies. Using this sample, we classify private companies with a dispersed debt structure as those companies with below-median *HHI* scores. In our original sample, we define VC firms associated with such private companies as those with prior debt dispersion experience.
High/Low reputation	This dummy variable is used to split the sample into companies with more or less reputable VCs. To measure a VC firm's reputation, we follow Nahata (2008) and use (i) the cumulative market capitalization of VC-backed IPO companies associated with the VC firm divided by the aggregate market value of all VC-backed IPOs and (ii) the sum of the VC's investments in portfolio companies divided by the aggregate VC investments in the industry. We split VC firms based on the above-median values of these VC reputation measures.
Debt structure (source: Capital IQ):	
DC/TD	Drawn credit lines / Total debt
TL/TD	Term loans / Total debt
CP/TD	Commercial paper / Total debt
SBN/TD	Senior bonds and notes / Total debt
SUB/TD	Subordinated bonds and notes / Total debt
CL/TD	Capital leases / Total debt
Other/TD	[Other debt plus total trust-preferred stock] / Total debt
Total adjustment	Total debt - (CP + DC + TL + SBN + SUB + CL + Other)
HHI	$[(CP/TD)^2 + (DC/TD)^2 + (TL/TD)^2 + (SBN/TD)^2 + (SUB/TD)^2 + (CL/TD)^2 + (Other/TD)^2 - 1/7] / (1 - 1/7)$
Excl90	A dummy variable equals 1 if at least 90% of a company's total debt is in one debt type in a given year and 0 otherwise.

Table 2: Summary statistics

This table shows the mean, median, standard deviations, and the number of observations for the debt structure, venture capital (VC) involvement, and control variables. The sample covers the period between 2001 and 2019.

Variables	**Mean**	**Median**	**Std. Dev.**
HHI	0.797	0.885	0.358
VC dummy	0.226	0.000	0.438
VC director %	0.316	0.286	0.181
Drawn Credit Lines	0.184	0.000	0.322
Term Loans	0.333	0.042	0.400
Commercial Papers	0.001	0.000	0.025
Senior Bonds & Notes	0.302	0.001	0.422
Sub. Bonds & Notes	0.043	0.000	0.158
Capital leases	0.120	0.000	0.270
Other debt	0.033	0.000	0.139
Excl90	0.560	1.000	0.496
Control variables			
Market to book	2.231	1.416	3.031
Profitability	-0.113	0.069	0.673
Company Size	5.533	5.620	1.955
Tangibility	0.274	0.156	0.273
RD	0.095	0.000	0.221
CF volatility	0.390	0.085	1.373
Dividend	0.180	0.000	0.384
Unrated	0.482	0.000	0.500
Company Age	0.893	1.099	0.566
Book Lev	0.310	0.237	0.414
Number of obs.	6,434		

Table 3: Baseline results

This table reports the coefficient estimates of Equation (3). The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of venture capital (VC) firm directors on a company's board at the time of IPO. Columns 1 and 2 report the results from the Tobit regressions, whereas columns 3 and 4 report the results from the OLS regressions. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Tobit		OLS	
HHI	(1)	(2)	(3)	(4)
VC director %	**0.244*** **	**0.204*** **	**0.113** **	**0.100** **
	[0.058]	**[0.055]**	**[0.048]**	**[0.047]**
MB		0.017***		0.011***
		[0.004]		[0.003]
Profitability		0.004		-0.028
		[0.020]		[0.027]
Size		-0.030***		-0.023***
		[0.005]		[0.004]
Tangibility		-0.154***		-0.107***
		[0.040]		[0.035]
RD		0.110**		0.006
		[0.048]		[0.052]
CF Vol.		-0.001		-0.003
		[0.007]		[0.006]
Dividend		-0.001		-0.017
		[0.019]		[0.015]
Unrated		0.019		0.016
		[0.017]		[0.015]
Company Age		0.005		0.012
		[0.010]		[0.008]
Book Lev		-0.196***		-0.123***
		[0.024]		[0.023]
Number of obs.	6,434	6,434	6,434	6,434
Adj-R^2			0.063	0.115
Pseudo R^2	0.075	0.146		
Industry & Year FE	Yes	Yes	Yes	Yes

Table 4: Instrumental variable analysis

This table reports the coefficient estimates from the instrumental variable (IV) Tobit model. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of venture capital (VC) firm directors on a company's board at the time of IPO. In the first stage of the IV analysis, we use the returns to Limited Partners (*LP returns*) as an IV for the probability of VC directors serving on a company's board. In the second stage of the IV regressions, we use the predicted *VC director %* from the first stage. The first-stage *F*-test is the joint test of the significance of coefficients, testing the strength of the instrument(s). Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	First Stage	Second Stage
Dependent variable:	VC director %	HHI
	(1)	(2)
LP returns	0.888***	
	[0.093]	
Predicted VC director %		**0.201*** **
		[0.057]
MB	0.001	0.017***
	[0.001]	[0.004]
Profitability	-0.003	0.004
	[0.007]	[0.020]
Size	0.008***	-0.028***
	[0.002]	[0.005]
Tangibility	-0.050***	-0.165***
	[0.015]	[0.039]
RD	0.063***	0.122**
	[0.022]	[0.048]
CF Vol.	-0.010***	-0.003
	[0.002]	[0.007]
Dividend	-0.038***	-0.008
	[0.007]	[0.019]
Unrated	0.001	0.019
	[0.008]	[0.017]
Company Age	0.017***	0.008
	[0.003]	[0.010]
Book Lev	-0.022***	-0.201***
	[0.006]	[0.024]
Number of obs.	6,434	6,434
First-stage F-test (p-value)	86.97 (0.000)	
Industry & Year FE	Yes	Yes

Table 5: Propensity score matching

Panel A of this table reports the coefficient estimates of Equation (3) from the Propensity Score Matching (PSM) sample. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of venture capital (VC) firm directors on a company's board at the time of IPO. Column 1 reports the results from the Tobit regression, whereas column 2 reports the results from the OLS regression. The treated group (companies with at least one VC firm director on their boards) and control group (companies with no VC director on their boards) are matched on propensity scores based on the control variables in Equation (3). We use one-to-one matching, with the nearest neighbor and without replacement. Panel B shows the mean value differences in the covariates between the treated and control groups. The statistically insignificant differences suggest that the matching procedure is reliable. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Tobit	OLS
Dependent variable: HHI	(1)	(2)
VC director %	**0.208*** **	**0.119** **
	[0.060]	**[0.055]**
MB	0.019***	0.016***
	[0.005]	[0.005]
Profitability	-0.042	-0.025
	[0.037]	[0.030]
Size	-0.030***	-0.026***
	[0.007]	[0.006]
Tangibility	-0.292***	-0.238***
	[0.055]	[0.049]
RD	0.057	0.037
	[0.068]	[0.049]
CF Vol.	0.011	-0.010
	[0.026]	[0.015]
Dividend	-0.003	-0.005
	[0.031]	[0.026]
Unrated	0.026	0.016
	[0.024]	[0.020]
Company Age	0.024*	0.036***
	[0.014]	[0.012]
Book Lev	-0.295***	-0.143***
	[0.041]	[0.032]
Number of obs.	2,902	2,902
Adj-R^2		0.155
Pseudo R^2	0.20	
Industry & Year FE	Yes	Yes

(*continued on next page*)

Table 5 (*continued*)

Panel B	Treated (N=1,451)	Control (N=1,451)	Differences	t-stats
p-score	0.314	0.310	0.004	0.75
MB	2.156	2.228	-0.072	-0.79
Profitability	-0.102	-0.128	0.026	1.26
Size	5.406	5.469	-0.063	-0.99
Tangibility	0.196	0.191	0.005	0.64
RD	0.140	0.139	0.000	0.04
CF Vol.	0.231	0.266	-0.035	-1.24
Dividend	0.055	0.054	0.001	0.08
Unrated	0.328	0.317	0.011	0.64
Company Age	0.906	0.909	-0.004	-0.17
Book Lev	0.215	0.230	-0.015	-1.26

Table 6: Heckman two-step analysis

This table reports the coefficient estimates from the first stage (column 2) and the second stage (column 1) of the Heckman two-step analysis for potential sample selection bias. In the first stage, we use a Probit model to estimate whether a company has a venture capital (VC) director. The dependent variable takes 1 if a firm has at least one VC director on its board at the time of IPO, and 0 otherwise. The control variables are based on Equation (3). We estimate the selection probability for each observation (the inverse Mills ratio) from the Probit model in the first stage. Then, in the second stage, we add the inverse Mills ratio derived from the first stage to Equation (3) and estimate the effect of VC involvement (i.e., the proportion of VC directors on company boards) on debt concentration for a sample of companies with VC director(s) on their boards. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Heckman-Second Stage	Heckman-First Stage
	(1)	(2)
VC director %	**0.165*** **	
	[0.056]	
MB	0.006	-0.002
	[0.005]	[0.012]
Profitability	0.050	0.106
	[0.046]	[0.153]
Size	-0.021	0.054**
	[0.017]	[0.022]
Tangibility	-0.439**	-0.703***
	[0.204]	[0.153]
RD	0.339	0.892***
	[0.242]	[0.344]
CF Vol.	-0.051	-0.091
	[0.034]	[0.060]
Dividend	-0.252	-0.755***
	[0.220]	[0.115]
Unrated	-0.160	-0.506***
	[0.136]	[0.076]
Company Age	0.013	0.004
	[0.014]	[0.022]
Book Lev	-0.278***	-0.368***
	[0.101]	[0.125]
Mills ratio	0.491	
	[0.363]	
Number of obs.	1,452	6,434
Adj- R^2	0.236	
Pseudo R^2		0.103
Industry & Year FE	Yes	Yes

Table 7: Robustness checks

This table shows the results of several robustness checks. Panel A shows the coefficient estimates from the Probit regressions after replacing the dependent variable *HHI* (the Herfindahl-Hirschman index of debt concentration) in Equation (3) with an alternative dependent variable, *Excl90*. The new dependent variable *Excl90* is a dummy variable that equals 1 if at least 90% of the total debt of a company is in one debt type in a given year, and 0 otherwise. The variable *VC director %* is the fraction of venture capital (VC) firm directors on a company's board at the time of IPO. In columns 1 and 2, we use the full sample and matched sample based on propensity score matching, respectively. Panel B shows the coefficient estimates from the Tobit, OLS, and Probit regressions after replacing the variable *VC director %* in Equation (3) with the variable *Number of VC director*. In columns 1 and 2, the dependent variable is *HHI*, whereas in column 3 the dependent variable is *Excl90*. Panel C shows the coefficient estimates of Equation (3) from further robustness checks. In column 1, we drop company-year observations where the difference between the sum of debt types from Capital IQ and total debt from Compustat exceeds 10% of the total debt. In columns 2 and 3, we use the Heckman selection model for the possible selection bias associated with this difference. Columns 2 and 3 of Panel C report the second and first stages of the Heckman two-step analysis, respectively. In the first stage, we use a Probit model to estimate whether the difference between the sum of the debt types and total debt from Compustat exceeds 10% of total debt. The dependent variable takes 1 if the difference is higher than 10%. The control variables are from Equation (3). We estimate the selection probability for each observation (inverse Mills ratio) from the Probit model in the first stage. Then, in the second stage, we add the inverse Mills ratio derived from the first stage to Equation (3). Panel D reports the results for the dynamic effects of VC involvement on debt concentration, that is, the effects of VC director % on debt concentration for one, two, and three years after IPO. Panel E reports the coefficient estimates after controlling for the fraction of directors from other institutional block holders on company boards (i.e., *Other major institutional director %*) in our Tobit model. Columns 1 and 2 report the results for the full sample, whereas column 3 reports the results for the propensity score-matched sample. Panel F shows the results after controlling for company, VC, and year fixed effects (columns 1 and 2) or industry, VC, and year fixed effects (columns 3 and 4) in our regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Alternative measure of debt concentration

Dependent variable: Excl90	Full Sample	Matched Sample
	(1)	(2)
VC director %	**0.731*** **	**0.709*** **
	[0.167]	**[0.204]**
Control variables	Yes	Yes
Number of obs.	6,434	2,902
Pseudo R^2	0.070	0.131
Industry & Year FE	Yes	Yes

Panel B: Alternative measure of VC involvement

Dependent variable: HHI	Tobit	OLS	Probit
	(1)	(2)	(3)
Number of VC directors	**0.014** **	**0.008** **	**0.057*** **
	[0.007]	**[0.004]**	**[0.020]**
Control variables	Yes	Yes	Yes
Number of obs.	6,434	6,434	6,434
Adj-R^2		0.120	
Pseudo R^2	0.143		0.068
Industry & Year FE	Yes	Yes	Yes

(continued on next page)

Table 7: (*continued*)

Panel C: Further robustness checks

Dependent variable: HHI	Drop if Leverage differences >10%	Heckman-Second Stage	Heckman-First Stage
	(1)	(2)	(3)
VC director %	**0.216*** **	**0.127*** **	
	[0.058]	**[0.034]**	
MB	0.014***	0.008***	-0.001
	[0.004]	[0.002]	[0.008]
Profitability	-0.005	-0.008	-0.078
	[0.022]	[0.012]	[0.051]
Size	-0.029***	-0.011**	-0.062***
	[0.005]	[0.005]	[0.018]
Tangibility	-0.159***	-0.077**	-0.364***
	[0.041]	[0.033]	[0.110]
RD	0.109**	0.052*	-0.135
	[0.052]	[0.028]	[0.123]
CF Vol.	-0.004	-0.002	0.014
	[0.008]	[0.005]	[0.020]
Dividend	0.020	0.059**	-0.317***
	[0.019]	[0.025]	[0.078]
Unrated	0.012	-0.003	0.129**
	[0.017]	[0.012]	[0.059]
Company Age	-0.002	-0.011	0.144***
	[0.010]	[0.009]	[0.026]
Book Lev	-0.199***	-0.124***	-0.054
	[0.027]	[0.019]	[0.053]
Mills ratio		-0.006	
		[0.004]	
Number of obs.	5,438	5,438	6,434
Adj-R^2		0.120	
Pseudo R^2	0.150		0.038
Industry & Year FE	Yes	Yes	Yes

Panel D: Dynamic effects of VC directors on debt concentration

Dependent variable: HHI	One year post-IPO	Two years post-IPO	Three years post-IPO
	(1)	(2)	(3)
VC director %	**0.150** **	**0.220*** **	**0.192** **
	[0.076]	**[0.076]**	**[0.076]**
Control variables	Yes	Yes	Yes
Number of obs.	1,432	1,479	1,344
Pseudo R^2	0.180	0.183	0.167
Industry & Year FE	Yes	Yes	Yes

(continued on next page)

Table 7 (*continued*)

Panel E: Controlling for the directors of major institutional shareholders

Dependent variable: HHI	Full sample		Matched sample
	(1)	(2)	(3)
VC director %		**0.205*** **	**0.218*** **
		[0.055]	**[0.061]**
Other major institutional director %	**0.040***	**0.040***	**0.064***
	[0.022]	**[0.022]**	**[0.037]**
Control variables	Yes	Yes	Yes
Number of obs.	6,434	6,434	2,902
Pseudo R^2	0.141	0.146	0.191
Industry & Year FE	Yes	Yes	Yes

Panel F: Controlling for unobservable time-invariant fixed effects

Dependent variable: HHI	Tobit (1)	OLS (2)	Tobit (3)	OLS (4)
VC director %	**0.151*** **	**0.110*** **	**0.297*** **	**0.202*** **
	[0.052]	**[0.045]**	**[0.091]**	**[0.073]**
Control variables	Yes	Yes	Yes	Yes
Number of obs.	6,434	6,434	6,434	6,434
Adj-R^2		0.088		0.114
Pseudo R^2	0.127		0.143	
Company & VC & Year FE	Yes	Yes		
Industry & VC & Year FE			Yes	Yes

Table 8: Bankruptcy costs

This table shows the coefficient estimates of Equation (3) from the Tobit regressions for subsamples of companies with high expected bankruptcy costs versus those with low expected bankruptcy costs. Low tangibility, high CF volatility, and low Altman's Z score in columns 1, 3, and 5, respectively, proxy for high bankruptcy costs, whereas high tangibility, low CF volatility, and high Altman's Z score in columns 2, 4, and 6, respectively, proxy for low bankruptcy costs. We split the full sample based on the annual median values of these proxies for bankruptcy costs. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on a company's board at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable HHI	High Bankruptcy Costs (Low Tangibility)	Low Bankruptcy Costs (High Tangibility)	High Bankruptcy Costs (High CF Volatility)	Low Bankruptcy Costs (Low CF Volatility)	High Bankruptcy Costs (Low Altman's Z Score)	Low Bankruptcy Costs (High Altman's Z Score)
	(1)	(2)	(3)	(4)	(5)	(6)
VC director %	**0.245*** **	**0.068**	**0.243*** **	**0.092**	**0.217*** **	**0.099**
	[0.072]	**[0.085]**	**[0.082]**	**[0.078]**	**[0.072]**	**[0.086]**
MB	0.021***	0.014***	0.013***	0.029***	0.009**	0.043***
	[0.006]	[0.004]	[0.004]	[0.010]	[0.004]	[0.008]
Profitability	0.018	-0.009	-0.014	0.124	-0.007	0.026
	[0.037]	[0.021]	[0.020]	[0.112]	[0.020]	[0.076]
Size	-0.022***	-0.036***	-0.006	-0.029***	-0.021***	-0.021***
	[0.008]	[0.006]	[0.008]	[0.008]	[0.008]	[0.007]
Tangibility	-0.893***	-0.012	-0.206***	-0.122**	-0.232***	-0.075
	[0.241]	[0.051]	[0.064]	[0.049]	[0.062]	[0.063]
RD	0.177**	0.026	0.045	0.198	0.041	0.565**
	[0.072]	[0.059]	[0.048]	[0.206]	[0.048]	[0.281]
CF Vol.	-0.002	-0.004	0.001	0.468	0.001	0.040
	[0.010]	[0.007]	[0.007]	[0.472]	[0.007]	[0.031]

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Table 8 (*continued*)

Dividend	-0.022	0.020	0.024	-0.003	-0.073**	0.006
	[0.033]	[0.021]	[0.039]	[0.020]	[0.036]	[0.024]
Unrated	0.022	0.010	0.036	0.019	0.021	0.022
	[0.027]	[0.020]	[0.025]	[0.022]	[0.025]	[0.025]
Company Age	0.021	-0.008	-0.022	0.029**	-0.007	0.023*
	[0.015]	[0.012]	[0.016]	[0.011]	[0.016]	[0.013]
Book Lev	-0.197***	-0.192***	-0.137***	-0.383***	-0.132***	-0.306***
	[0.038]	[0.028]	[0.025]	[0.046]	[0.024]	[0.067]
Number of obs.	3,222	3,212	3,212	3,222	2,980	2,971
Pseudo R^2	0.160	0.142	0.110	0.206	0.138	0.168
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Uncertainty

This table shows the coefficient estimates of Equation (3) for the companies with low uncertainty in columns 1 and 3 (with below-median values of stock return volatility or economic policy uncertainty (EPU)) and those companies with high uncertainty in columns 2 and 4 (with above-median values of stock return volatility or EPU). Stock return volatilities are estimated over a 12-month rolling window. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on a company's board at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: HHI	Low Uncertainty (Low Stock Ret. Volatility)	High Uncertainty (High Stock Ret. Volatility)	Low Uncertainty (Low EPU)	High Uncertainty (High EPU)
	(1)	(2)	(3)	(4)
VC director %	**0.120**	**0.183****	**0.250**	**0.225*****
	[0.185]	**[0.076]**	**[0.175]**	**[0.081]**
MB	0.035***	0.021***	0.013***	0.021***
	[0.007]	[0.005]	[0.005]	[0.006]
Profitability	0.151**	0.018	-0.003	0.006
	[0.073]	[0.043]	[0.024]	[0.028]
Size	-0.017**	-0.021**	-0.030***	-0.030***
	[0.007]	[0.009]	[0.006]	[0.006]
Tangibility	-0.144***	-0.275***	-0.132***	-0.179***
	[0.049]	[0.058]	[0.049]	[0.049]
RD	0.610***	0.194**	0.123**	0.093
	[0.192]	[0.081]	[0.059]	[0.060]
CF Vol.	0.074*	-0.008	0.000	-0.004
	[0.043]	[0.013]	[0.008]	[0.010]
Dividend	0.010	0.007	0.013	-0.008
	[0.021]	[0.036]	[0.025]	[0.022]
Unrated	0.077***	0.021	0.011	0.026
	[0.023]	[0.025]	[0.021]	[0.021]
Company Age	0.025**	0.007	0.009	-0.002
	[0.013]	[0.017]	[0.015]	[0.014]
Book Lev	-0.360***	-0.286***	-0.178***	-0.213***
	[0.054]	[0.043]	[0.030]	[0.032]
Number of obs.	2,741	2,731	2,832	3,602
Pseudo R^2	0.237	0.163	0.143	0.161
Industry & Year FE	Yes	Yes	Yes	Yes

Table 10: Credit and accounting quality

This table shows the coefficient estimates of Equation (3) for companies with high credit or accounting quality in columns 1, 3, and 5 and those with low credit or accounting quality in columns 2, 4, and 6. We use S&P credit ratings and abnormal earnings to proxy for company credit quality. We use earnings management to proxy for accounting quality. In the first two columns, we split the sample based on whether a company has an S&P credit rating or not. In the following columns, we split the sample based on the median values of abnormal earnings and earnings management. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on company boards at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: HHI	High Credit Quality (Rated)	Low Credit Quality (Unrated)	High Quality (High Abnormal Earnings)	Low Quality (Low Abnormal Earnings)	High Accounting Quality (Low Earnings Management)	Low Accounting Quality (High Earnings Management)
	(1)	(2)	(3)	(4)	(5)	(6)
VC director %	**0.210*** **	**0.211** **	**0.186*** **	**0.204*** **	**0.161** **	**0.227*** **
	[0.069]	**[0.096]**	**[0.063]**	**[0.065]**	**[0.079]**	**[0.074]**
MB	0.021***	0.013**	0.018***	0.015***	0.046***	0.004
	[0.005]	[0.005]	[0.005]	[0.005]	[0.009]	[0.005]
Profitability	0.016	-0.009	-0.01	0.023	-0.01	-0.014
	[0.028]	[0.026]	[0.025]	[0.028]	[0.060]	[0.021]
Size	-0.037***	-0.025***	-0.030***	-0.029***	-0.014**	-0.030***
	[0.007]	[0.007]	[0.006]	[0.006]	[0.007]	[0.007]
Tangibility	-0.179***	-0.144***	-0.214***	-0.088**	-0.162***	-0.129**
	[0.056]	[0.056]	[0.048]	[0.045]	[0.059]	[0.051]
RD	0.140**	0.076	0.033	0.278***	0.054	0.012
	[0.055]	[0.074]	[0.051]	[0.077]	[0.126]	[0.050]
CF Vol.	-0.002	0.001	0.000	-0.003	0.020	-0.009
	[0.006]	[0.011]	[0.008]	[0.008]	[0.015]	[0.009]
Dividend	0.026	-0.02	0.021	-0.023	-0.01	0.021
	[0.027]	[0.026]	[0.022]	[0.022]	[0.026]	[0.028]
Unrated			0.013	0.028	0.043*	-0.015
			[0.020]	[0.019]	[0.022]	[0.023]
Company Age	0.015	0.007	0.019	-0.005	0.051**	-0.035
	[0.013]	[0.015]	[0.013]	[0.013]	[0.022]	[0.025]
Book Lev	-0.204***	-0.189***	-0.215***	-0.170***	-0.301***	-0.112***
	[0.033]	[0.032]	[0.030]	[0.025]	[0.062]	[0.023]
Comparing coeff. on *VC director %* (p-value)	0.99		0.842		0.542	
Number of obs.	3,334	3,100	3,208	3,216	2,301	2,289
Pseudo R^2	0.158	0.170	0.153	0.164	0.170	0.173
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: VC experience with dispersed debt structure and VC reputation

Panel A in this table reports the coefficient estimates of Equation (3) for portfolio companies with VC firms that have prior dispersed debt structures and companies without such VC firms. Panel B reports the results for portfolio companies with highly reputable VC firms and companies without such VC firms. Following Nahata's (2008), we measure a VC firm's reputation as (i) the cumulative market capitalization of VC-backed portfolio companies associated with the VC firm, divided by the aggregate market value of all VC-backed IPOs (in columns 1 and 2) and (ii) the sum of the VC's investments in portfolio companies divided by the aggregate VC investments in the industry (columns 3 and 4). We consider VCs with above-median portfolio companies' (cumulative) market capitalizations or above-median investments in those companies to be more reputable. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on a company's board at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: VC prior experience with dispersed debt structure

Dependent variable: HHI	VC with dispersed debt experience	VC without dispersed debt experience
	(1)	(2)
VC director %	0.286***	0.139
	[0.093]	[0.103]
MB	0.012	0.017***
	[0.011]	[0.004]
Profitability	-0.005	0.007
	[0.068]	[0.020]
Size	-0.061***	-0.026***
	[0.018]	[0.005]
Tangibility	-0.286***	-0.117***
	[0.087]	[0.044]
RD	0.132	0.094*
	[0.120]	[0.052]
CF Vol.	-0.008	-0.001
	[0.052]	[0.007]
Dividend	0.015	-0.009
	[0.043]	[0.020]
Unrated	0.045	0.013
	[0.038]	[0.019]
Company Age	0.025	-0.004
	[0.023]	[0.011]
Book Lev	-0.241***	-0.180***
	[0.068]	[0.025]
Number of obs.	1,330	5,104
Pseudo R^2	0.276	0.131
Industry & Year FE	Yes	Yes

Table 11 *(continued)*

Panel B: VC reputation

Dependent variable: HHI	High Reputation (High Market Cap)	Low Reputation (Low Market Cap)	High Reputation (High VC Investment)	Low Reputation (Low VC Investment)
	(1)	(2)	(3)	(4)
VC director %	**0.314*** **	**0.041**	**0.317*** **	**0.121**
	[0.102]	**[0.228]**	**[0.102]**	**[0.238]**
MB	0.011	0.017***	0.010	0.017***
	[0.010]	[0.004]	[0.010]	[0.004]
Profitability	-0.035	0.012	-0.032	0.012
	[0.056]	[0.021]	[0.057]	[0.021]
Size	-0.052***	-0.026***	-0.054***	-0.026***
	[0.017]	[0.005]	[0.017]	[0.005]
Tangibility	-0.274***	-0.120***	-0.266***	-0.122***
	[0.085]	[0.045]	[0.087]	[0.044]
RD	0.116	0.103**	0.104	0.106**
	[0.112]	[0.052]	[0.112]	[0.053]
CF Vol.	-0.007	-0.001	-0.007	-0.001
	[0.048]	[0.007]	[0.048]	[0.007]
Dividend	0.036	-0.012	0.028	-0.011
	[0.044]	[0.020]	[0.045]	[0.020]
Unrated	0.037	0.009	0.033	0.011
	[0.036]	[0.019]	[0.036]	[0.019]
Company Age	0.019	-0.001	0.020	-0.002
	[0.022]	[0.011]	[0.022]	[0.011]
Book Lev	-0.261***	-0.178***	-0.254***	-0.179***
	[0.064]	[0.025]	[0.064]	[0.025]
Number of obs.	1,444	4,990	1,405	5,029
Pseudo R^2	0.261	0.131	0.255	0.131
Industry & Year FE	Yes	Yes	Yes	Yes

Table 12: Impact of VC on debt types

This table shows the coefficient estimates from Tobit regressions after replacing the dependent variable *HHI* in Equation (3) with individual debt types. From columns 1 to 6, the dependent variables are the ratios of drawn credit lines (DC/TD), term loans (TL/TD), senior bonds and notes (SBN/TD), subordinated bonds and notes (SUB/TD), capital leases (CL/TD), and other debt (Other/TD), respectively. TD stands for total debt. The variable *VC director %* is the fraction of VC firm directors on company boards at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	DC/TD	TL/TD	SBN/TD	SUB/TD	CL/TD	Other/TD
	(1)	(2)	(3)	(4)	(5)	(6)
VC director %	**-0.21**	**-0.101**	**-0.504*** **	**-0.273**	**0.302*** **	**-0.427*** **
	[0.132]	**[0.139]**	**[0.161]**	**[0.253]**	**[0.116]**	**[0.119]**
MB	-0.029***	-0.022***	0.014*	-0.068***	0.015**	-0.020**
	[0.008]	[0.008]	[0.008]	[0.019]	[0.006]	[0.009]
Profitability	0.028	0.063	-0.099**	0.078	0.031	-0.130***
	[0.044]	[0.043]	[0.044]	[0.085]	[0.039]	[0.038]
Size	-0.034***	0.026**	0.073***	0.012	-0.013	0.053***
	[0.011]	[0.012]	[0.012]	[0.022]	[0.009]	[0.010]
Tangibility	0.249***	-0.220**	0.246***	-0.551***	0.185***	-0.124
	[0.083]	[0.093]	[0.088]	[0.180]	[0.068]	[0.080]
RD	-0.549***	0.137	-0.194	-0.120	0.215**	-0.222**
	[0.197]	[0.114]	[0.129]	[0.206]	[0.098]	[0.089]
CF Vol.	-0.011	-0.023	0.013	-0.040	-0.024	0.011
	[0.020]	[0.018]	[0.017]	[0.030]	[0.019]	[0.011]
Dividend	0.176***	-0.087*	-0.036	-0.325***	-0.137***	0.019
	[0.040]	[0.047]	[0.045]	[0.079]	[0.036]	[0.036]
Unrated	-0.019	0.110***	0.039	-0.173**	0.016	-0.038
	[0.036]	[0.039]	[0.041]	[0.073]	[0.035]	[0.034]
Company Age	0.021	-0.076***	0.124***	0.016	-0.018	0.0001
	[0.019]	[0.019]	[0.023]	[0.035]	[0.017]	[0.019]
Book Lev	-0.024	0.328***	0.193***	0.701***	-0.355***	0.051
	[0.052]	[0.048]	[0.047]	[0.105]	[0.061]	[0.039]
Number of obs.	6,434	6,434	6,434	6,434	6,434	6,434
Pseudo R^2	0.122	0.054	0.061	0.138	0.101	0.106
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 13: Company performance

This table shows the effect of debt concentration on company performance for the companies with VCs and without VCs. We use stock returns and return on assets (ROA) to proxy for company performance. In columns 1–4, we use industry-adjusted stock returns and ROA in models without industry fixed effects, whereas in columns 5–8, we use unadjusted stock returns and ROA in models with industry fixed effects. We split the sample based on the median values of stock returns and ROA. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Ind-adjusted Stock Return without VC	Ind-adjusted Stock Return with VC	Ind-adjusted ROA without VC	Ind-adjusted ROA with VC	Stock Return without VC	Stock Return with VC	ROA without VC	ROA with VC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HHI	**-0.001**	**0.145****	**-0.009**	**0.120*****	**0.043**	**0.260*****	**-0.024**	**0.258***
	[0.038]	**[0.072]**	**[0.036]**	**[0.046]**	**[0.049]**	**[0.097]**	**[0.073]**	**[0.153]**
Size	0.002	-0.019	0.072***	0.098***	-0.014	-0.104*	0.172***	0.453**
	[0.008]	[0.029]	[0.007]	[0.030]	[0.011]	[0.063]	[0.028]	[0.201]
RD	0.107	0.292	-0.849***	-0.393***	0.120	0.440	-2.830***	0.009
	[0.101]	[0.222]	[0.071]	[0.141]	[0.136]	[0.277]	[0.741]	[0.906]
Company Age	0.072***	0.060*	-0.033*	-0.038	0.102***	0.102**	-0.115**	-0.161
	[0.021]	[0.036]	[0.017]	[0.027]	[0.030]	[0.046]	[0.049]	[0.100]
Book Lev	0.037	0.151*	-0.233***	-0.247***	0.073	0.115	-1.204***	-0.633*
	[0.028]	[0.087]	[0.039]	[0.068]	[0.045]	[0.141]	[0.287]	[0.330]
Number of obs.	4,982	1,452	4,982	1,452	4,982	1,452	4,982	1,452
Adj. R^2	0.012	0.032	0.382	0.244	0.073	0.132	0.338	0.377
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes	Yes	Yes

Appendix

Table A1: Correlation matrix

This table shows the correlations between the Herfindahl-Hirschman index (HHI) of debt concentration by debt type and control variables for the data from US companies over the period 2001-2019. ***, **, and * indicate statistical significance at the 1%, 5%, and 10%

Variables	HHI	VC director %	MB	Profitability	Size	Tangibility	RD	CF Vol.	Dividend	Unrated	Company Age
VC director %	0.079***	1.000									
MB	0.145***	0.005	1.000								
Profitability	-0.147***	-0.035***	-0.568***	1.000							
Size	-0.217***	-0.077***	-0.377***	0.535***	1.000						
Tangibility	-0.136***	-0.178***	-0.107***	0.116***	0.229***	1.000					
RD	0.179***	0.156***	0.316***	-0.603***	-0.395***	-0.224***	1.000				
CF Vol.	0.082***	-0.045***	0.402***	-0.526***	-0.393***	-0.073***	0.250***	1.000			
Dividend	-0.122***	-0.156***	-0.083***	0.177***	0.352***	0.236***	-0.184***	-0.110***	1.000		
Unrated	0.035***	-0.113***	0.026**	-0.024*	0.040***	-0.016	0.012	0.013	0.051***	1.000	
Company Age	0.005	0.003	-0.032**	-0.037***	0.050***	0.044***	0.016	0.018	-0.017	-0.103***	1.000
Book Lev	-0.102***	-0.131***	0.329***	-0.427***	-0.049***	0.141***	0.089***	0.256***	0.110***	0.056***	0.084***

Table A2: Entropy balancing

Panel A of this table reports the coefficient estimates of Equation (3) from the matched sample using entropy balancing that matches the balanced mean values of the company years in the treated group (companies with at least one VC firm director on their boards) and control groups (companies with no VC director on their boards). The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of venture capital (VC) firm directors on a company's board at the time of IPO. Columns 1, 2, and 3 report the results from Tobit, OLS, and Probit regressions, respectively. The treated group and control group are matched based on the control variables in Equation (3). Panel B shows the mean value differences in the covariates between the treated and control groups. The statistically insignificant differences suggest that the matching procedure is reliable. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A

	Tobit	OLS	Probit
Dependent variable	HHI	HHI	Excl90
	(1)	(2)	(3)
VC director %	**0.155****	**0.118****	**0.783*****
	[0.071]	**[0.056]**	**[0.211]**
MB	0.029***	0.000	0.044**
	[0.009]	[0.001]	[0.020]
Profitability	-0.067	-0.068*	-0.271**
	[0.077]	[0.037]	[0.120]
Size	0.001	-0.005	0.009
	[0.006]	[0.005]	[0.019]
Tangibility	-0.171**	-0.138**	-0.726***
	[0.068]	[0.055]	[0.225]
RD	0.077	0.021	-0.395***
	[0.090]	[0.045]	[0.125]
CF Vol.	0.104	0.023	0.219
	[0.083]	[0.022]	[0.216]
Dividend	-0.005	-0.049	-0.288
	[0.048]	[0.043]	[0.202]
Unrated	0.077**	0.031	0.150
	[0.033]	[0.025]	[0.092]
Company Age	0.049***	0.046***	0.051
	[0.017]	[0.013]	[0.057]
Book Lev	-0.482***	-0.202***	-0.725***
	[0.071]	[0.052]	[0.166]
Number of obs.	6,434	6,434	6,434
Adjusted R^2		0.08	
Pseudo R^2	0.125		0.06
Industry & Year FE	Yes	Yes	Yes

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Table A2: *(continued)*

Panel B	Treated (N=1,452)	Control (N=4,982)	Differences	t-stat
MB	2.156	2.159	-0.003	-0.077
Profitability	-0.104	-0.105	0.001	0.080
Size	5.404	5.403	0.001	0.034
Tangibility	0.196	0.196	0.000	0.000
RD	0.141	0.141	0.000	-0.043
CF Vol.	0.231	0.234	-0.003	-0.260
Dividend	0.055	0.055	0.000	-0.062
Unrated	0.328	0.328	0.000	-0.012
Company Age	0.906	0.906	0.000	0.000
Book Lev	0.215	0.215	0.000	-0.044

Table A3: Matched sample results for the bankruptcy cost results in Table 8

This table shows the coefficient estimates of Equation (3) from the Tobit regressions with the propensity score matched samples for the analyses in Table 8. The analyses are for the subsamples of companies with high expected bankruptcy costs versus those with low expected bankruptcy costs. Low tangibility, high CF volatility, and low Altman's Z score in columns 1, 3, and 5, respectively, proxy for high bankruptcy costs, whereas high tangibility, low CF volatility, and high Altman's Z score in columns 2, 4, and 6, respectively, proxy for low bankruptcy costs. We split the full sample based on the annual median value of these proxies for bankruptcy costs. The dependent variable is HHI, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on a company's board at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: HHI	High Bankruptcy Costs (Low Tangibility)	Low Bankruptcy Costs (High Tangibility)	High Bankruptcy Costs (High CF Volatility)	Low Bankruptcy Costs (Low CF Volatility)	High Bankruptcy Costs (Low Z-score)	Low Bankruptcy Costs (High Z-score)
	(1)	(2)	(3)	(4)	(5)	(6)
VC director %	**0.204*** **	**0.077**	**0.217** **	**0.124**	**0.288*** **	**0.102**
	[0.078]	**[0.097]**	**[0.095]**	**[0.083]**	**[0.080]**	**[0.089]**
MB	0.025***	0.013	0.022***	0.026*	0.013**	0.027**
	[0.007]	[0.009]	[0.007]	[0.014]	[0.006]	[0.012]
Profitability	0.047	0.041	-0.040	-0.022	0.070	-0.053
	[0.058]	[0.046]	[0.051]	[0.132]	[0.046]	[0.138]
Size	-0.026**	-0.027***	0.007	-0.033***	-0.021*	-0.017
	[0.011]	[0.009]	[0.013]	[0.012]	[0.012]	[0.011]
Tangibility	-1.235***	-0.110	-0.322***	-0.171**	-0.263***	-0.171**
	[0.308]	[0.082]	[0.113]	[0.071]	[0.087]	[0.078]
RD	0.168*	0.219**	0.065	0.128	0.168**	0.428
	[0.098]	[0.090]	[0.079]	[0.205]	[0.077]	[0.323]
CF Vol.	0.004	0.056	0.024	0.466	0.040	0.238
	[0.029]	[0.037]	[0.025]	[0.589]	[0.034]	[0.198]

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Table A3 (*continued)*

Dividend	0.001	-0.028	-0.107	0.015	-0.069	0.079**
	[0.051]	[0.035]	[0.075]	[0.035]	[0.052]	[0.040]
Unrated	0.032	0.026	0.067*	0.022	0.041	0.036
	[0.034]	[0.030]	[0.040]	[0.032]	[0.033]	[0.035]
Company Age	0.050**	-0.018	-0.026	0.065***	0.010	0.051**
	[0.020]	[0.020]	[0.025]	[0.018]	[0.022]	[0.020]
Book Lev	-0.252***	-0.279***	-0.221***	-0.408***	-0.187***	-0.423***
	[0.065]	[0.045]	[0.056]	[0.059]	[0.044]	[0.072]
Number of obs.	1,816	1,142	1,496	1,406	1,550	1,294
Pseudo R^2	0.192	0.240	0.143	0.266	0.164	0.224
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A4: Matched sample results for the uncertainty analyses in Table 9

This table shows the coefficient estimates of Equation (3) from the Tobit regressions with the propensity score matched samples for the analyses in Table 9. The analyses are for the companies with low uncertainty in columns 1 and 3 (with below-median values of stock return volatility or economic policy uncertainty (EPU)) and those companies with high uncertainty in columns 2 and 4 (with above-median values of stock return volatility or EPU). Stock return volatilities are estimated over a 12-month rolling window. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on company boards at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: HHI	Low Uncertainty (Low Stock Ret. Volatility)	High Uncertainty (High Stock Ret. Volatility)	Low Uncertainty (Low EPU)	High Uncertainty (High EPU)
	(1)	(2)	(3)	(4)
VC director %	**0.115**	**0.213****	**0.293**	**0.237*****
	[0.224]	**[0.084]**	**[0.202]**	**[0.089]**
MB	0.029**	0.015**	0.018***	0.029***
	[0.013]	[0.008]	[0.007]	[0.010]
Profitability	0.051	0.034	-0.010	-0.045
	[0.123]	[0.069]	[0.062]	[0.049]
Size	-0.014	-0.022*	-0.016	-0.036***
	[0.013]	[0.012]	[0.010]	[0.011]
Tangibility	-0.187**	-0.287***	-0.295***	-0.244***
	[0.077]	[0.080]	[0.080]	[0.073]
RD	0.503**	0.231**	0.095	0.070
	[0.214]	[0.110]	[0.095]	[0.102]
CF Vol.	0.060	0.125*	0.033	-0.005
	[0.080]	[0.067]	[0.039]	[0.027]
Dividend	0.014	0.070	0.010	0.012
	[0.044]	[0.060]	[0.044]	[0.044]
Unrated	0.116***	0.046	0.027	0.031
	[0.035]	[0.034]	[0.029]	[0.034]
Company Age	0.046**	0.012	0.021	0.006
	[0.022]	[0.024]	[0.021]	[0.024]
Book Lev	-0.381***	-0.348***	-0.362***	-0.281***
	[0.079]	[0.063]	[0.056]	[0.059]
Number of obs.	1,140	1,448	1,554	1,344
Pseudo R^2	0.238	0.182	0.192	0.209
Industry & Year FE	Yes	Yes	Yes	Yes

Table A5: Matched sample results for the credit and accounting quality analyses in Table 10

This table shows the coefficient estimates of Equation (3) from the Tobit regressions with the propensity score matched samples for the companies with high credit or accounting quality in columns 1, 3, and 5 and those with low credit or accounting quality in columns 2, 4, and 6. We split the sample based on the presence of S&P credit rating in the first two columns. The sample split for abnormal earnings and earning management in columns 3 to 6 are based on their median values. The dependent variable is *HHI*, which is the Herfindahl-Hirschman index of debt concentration by debt type. The variable *VC director %* is the fraction of VC firm directors on company boards at the time of IPO. We control for industry and year fixed effects in the regressions. Robust standard errors in brackets are clustered at the company level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: HHI	High Quality (Rated)	Low Quality (Rated)	High Quality (High Abnormal Earnings)	Low Quality (Low Abnormal Earnings)	High Quality (Low Earnings Management)	Low Quality (High Earnings Management)
	(1)	(2)	(3)	(4)	(5)	(6)
VC director %	**0.251*** **	**0.208** **	**0.157** **	**0.219*** **	**0.187** **	**0.161** **
	[0.071]	**[0.105]**	**[0.073]**	**[0.072]**	**[0.089]**	**[0.081]**
MB	0.015**	0.032***	0.017**	0.018**	0.032**	0.006
	[0.007]	[0.011]	[0.007]	[0.008]	[0.012]	[0.008]
Profitability	-0.024	0.053	0.006	-0.046	0.120	0.075*
	[0.060]	[0.048]	[0.047]	[0.084]	[0.076]	[0.045]
Size	-0.029***	-0.016	-0.032***	-0.005	-0.015	-0.039***
	[0.010]	[0.013]	[0.009]	[0.011]	[0.012]	[0.012]
Tangibility	-0.195***	-0.353***	-0.283***	-0.162**	-0.244***	-0.285***
	[0.070]	[0.101]	[0.077]	[0.064]	[0.093]	[0.087]
RD	0.167*	0.160	0.003	0.487***	-0.003	0.202**
	[0.100]	[0.105]	[0.078]	[0.131]	[0.148]	[0.089]
CF Vol.	0.015	0.014	0.020	0.017	-0.018	-0.010
	[0.049]	[0.030]	[0.025]	[0.033]	[0.075]	[0.025]
Dividend	-0.024	0.119**	0.020	0.032	-0.017	0.043
	[0.036]	[0.054]	[0.043]	[0.042]	[0.041]	[0.048]
Unrated			0.054*	0.036	0.052	0.034
			[0.031]	[0.029]	[0.034]	[0.037]
Company Age	0.028	-0.003	0.023	0.027	0.093**	-0.016
	[0.017]	[0.027]	[0.018]	[0.022]	[0.037]	[0.042]
Book Lev	-0.330***	-0.280***	-0.295***	-0.410***	-0.537***	-0.078*
	[0.060]	[0.057]	[0.053]	[0.060]	[0.070]	[0.046]
Comparing coeff. on VC director % (p-value)	0.73		0.55		0.82	
Number of obs.	1,948	952	1,496	1,400	924	839
Pseudo R^2	0.223	0.230	0.195	0.235	0.270	0.301
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes