Effects of Venture Capital Network Centrality on Earnings Management During an IPO Lockup: Evidence from the US Market

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Abstract

This study investigates the effects of the network centrality of a venture capital firm (VC) on the earnings management level of portfolio companies, focusing on the IPO lock-up period. The results suggest that companies backed by VCs with higher network centrality are more likely to use accrual-based earnings management during the lock-up period. In contrast, this same relationship does not exist with real earnings management. Furthermore, we do not see the same connection in periods other than the lock-up. The lock-up period is unique, as its expiration is the first opportunity for VCs to sell shares to public investors; thus, there is an incentive for VCs and managers to manage earnings just before the expiration of the IPO lock-up period. This study contributes to our understanding of how entrepreneurs seek investment. It suggests that engaging with a more centralized VC may not be preferable, given that the degree of earning management is higher. For limited partners looking to invest in VC funds, due diligence should focus on the financial performance and transparency of VCs with higher network centrality, especially during the lock-up period. Finally, this study provides guidelines for designing a more effective policy to address earnings management problems at IPO for VC-backed companies.

Keywords: Venture Capital; Earnings Management; Network Centrality

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Introduction

Venture capital (VC) is one of the best ways to fund startups because it helps companies commercialize and succeed financially (Da Rin, Hellmann, & Puri, 2013). Chemmanur, Krishnan, and Nandy (2011) have demonstrated that VC-backed firms are more efficient and perform better. Meanwhile, information asymmetry exists between outside investors and insiders during an IPO (DuCharme, Malatesta, & Sefcik, 2001; Rao, 1993; Teoh, Wong, & Rao, 1998). Specifically, Jenkinson, Ljungqvist, and Ljungqvist (2001) have pointed to evidence that insider investors manipulate financial data to boost stock prices through "earnings management." This practice constitutes a principal-agent conflict of interest between public market investors and insiders.

VC funds prepare firms to go public by deploying various commitments to protect their investments (Barry, Muscarella, Peavy Iii, & Vetsuypens, 1990). Their presence tends to suppress earnings management and promote company governance (Brau & Johnson, 2009; Morsfield & Tan, 2006). However, as members of a syndicate, VC firms come under pressure from their syndicate members (Bruton, Filatotchev, Chahine, & Wright, 2010). Goal misalignment can lead to principal–principal conflicts of interest, thereby impacting VC firms' monitoring role (Hochberg, Ljungqvist, & Lu, 2007). The grandstanding hypothesis (Gompers, 1996) suggests that some syndicate members actively seek to apply earnings management strategies.

Insiders can time their exit strategy by managing earnings during an IPO lock-up, which is a period that prohibits insiders from selling shares for an agreed-upon time after the IPO. Studies have revealed a 25 to 40% increase in the average trading volume post-lockup (Bradley, Jordan, Yi, & Roten, 2001; Brav & Gompers, 2003; Field & Hanka, 2001). In this vein, Aggarwal, Krigman, and Womack (2002) show that investors can maximize their wealth by underpricing IPOs and subsequently selling shares. However, investigating earnings management during lock-up and expiry can be more revealing than doing so at the time of the IPO. According to Wongsunwai (2013), some VCs relax their monitoring standards just before lock-up expiry to generate results that imply that the companies are financially more robust than they are.

Network centrality is a metric of a person's connections and their place and status within a network. Investors can use their channels to gather information from their networks and select which type and level of earnings management align with their firm's situation. Under conditions of solid trust, greater undetected earnings management can lead to certain advantages, such as higher returns for investors and reputational enhancement, as it enables portfolio companies to offer better returns to the public. Meanwhile, as well-connected investors are concerned about preserving their reputations, they may seek to avoid the adverse outcomes of risk-taking practices, such as earnings management. While stricter investors leverage interconnectivity to safeguard stockholders' best interests, well-connected investors attract lower levels of monitoring, leaving them free to practice risk-taking behaviors that cause long-term damage. The interconnection between VCs is key to the venture capital industry, as syndicated investments are preferred over single-VC investments (Lerner, 1994; Sahlman, 1990).

Considering the above, we focus this study to examine whether companies backed by VCs with higher network centrality are more likely to use earnings management during an IPO lock-up and to investigate further which type of earnings management is preferable. To achieve this aim, we focus on co-investment networks triggered by VC syndication, not only because

such networks are simple to observe but also because they can impact the principal driver of VCs' performance. We examine the relationship between VC network centrality and earnings management during the lock-up period of the VC-backed companies that went public from 2006 to 2017 using three measures of centrality: (1) degree, which measures how many connections a player has within their network; (2) closeness, which addresses network quality and is measured by "eigenvector centrality" developed by Bonacich (1972, 1987); and (3) betweenness, which is a proxy for the extent to which one VC can mediate between others. We use a cross-sectional version of the Jones model (Dechow, Sloan, & Sweeney, 1995; Francis & Yu, 2009; Jones, 1991; Kothari, Leone, & Wasley, 2005) and the real-earnings management model (Roychowdhury, 2006), in line with the findings of other studies (Cohen, Dey, & Lys, 2008; Dechow et al., 1995; Roychowdhury, 2006), to create variables for accrual-based earnings management and real earnings management evaluation. Our study focuses on the period immediately before the IPO lock-up expiration, which is a particular time because it is the first time VCs can sell shares to public investors.

Literature Review

The reputation of a VC is key to ensuring that it can source data and pass on competitive benefits (Kreps & Wilson, 1982; Milgrom & Roberts, 1990; Shapiro, 1983). Studies have shown that reputation is as crucial as fund performance for a VC's ability to raise capital. According to Gompers (1996), emerging VC firms are likely to incur costs by prematurely taking companies public. In light of this, Neus and Walz (2005) suggest that emerging VCs should seek to establish themselves by taking companies public and deploying an underpricing approach. Given the problem of observing how capable VCs are at choosing and supporting companies, their abilities are best revealed by an IPO. Most of the returns for limited partners (LPs) come from companies that go public (Sahlman, 1990). Potential LPs base their investment decisions on believing highly skilled VCs will choose startups that can eventually go public.

In IPOs in the United States (US), owners typically offer 15–20% of the total shares, with the remainder locked up for a set period (Ofek & Richardson, 2000); any deviation from this period may raise investors' concerns about the firm's value. Bradley, Cooney, Jordan, and Singh (2004) found that 80–90% of US IPOs have an average lock-up period of 180 days. Lock-up agreements between management and pre-IPO investors are "voluntary," with two motives being suggested: to serve as a signaling device and to ensure a commitment to checking for and controlling moral hazards (Leland & Pyle, 1977).

As investments are frequently syndicated, it can be challenging to identify the effect of a single-VC firm on the earnings management of a company going public (Lerner, 1994). The benefit of multiple and varied syndicate members is that their reputations are safeguarded, making it difficult to identify each member's contribution (Sorenson & Stuart, 2008). While syndication is valuable for each VC to diversify its company-specific risks and leverage complementary competencies, it can generate further agency conflicts, especially in the run-up to the IPO. Cumming (2006) claims that, as ownership is less concentrated, each syndicate member has less incentive to carry out monitoring roles, leading to free-riding. Greater network diversity makes it more difficult for individual VCs to stamp out opportunism among fellow syndicate members and firm insiders. Higher coordination costs are another possible outcome of syndication, undermining the collective monitoring of managerial behaviors and hampering coordinated responses to instances of managerial opportunism. Due to principal–principal

conflicts of interest, opportunistic managers may seize the opportunity to deploy earnings management at the IPO. Coordination difficulties also weaken time and effective decision-making (Cumming, Siegel, & Wright, 2007). Conflicts of interest can arise due to information asymmetry between syndicate members (Cumming, 2006). If VCs feel compelled to grandstand, they may collude with the firm's management, resulting in earnings management. The earlier the company goes public, the better the VC firms' reputation.

Network centrality is measured by the extent to which one actor participates in connections with others and can be illustrated using graph theory. In graph theory, an adjacency matrix is used to demonstrate the relationship between the actors in the network. In the case of the VC investment study, two VCs investing in a single portfolio company were coded as "tied" (Hochberg et al., 2007). Two types of adjacency metrics are "directed" and "undirected," and only the "directed" one can distinguish the actor originating a tie from the actor receiving the same. As this study focuses only on undirected metrics, VC firms that co-invest are represented as ties. Networks are not static, and centrality can continuously change; thus, this study is based on adjacency matrices depicting five-year periods and three centrality measures: degree, closeness, and betweenness. The degree counts the unique links connecting each VC and is expressed as the number of single VCs co-investing with others. Closeness, a quality measure, is determined by the "eigenvector" (Bonacich, 1972, 1987), which is based on the critical level of other players to which the actors are linked. Betweenness measures the influence of the players, which is relied upon by multiple other actors to forge network ties.

Many studies find the connection between the network centrality of company sponsors and performance together with the corporate governance of the company. Lin, Lu, Michaely, and Qin (2021) discovered through research of SPAC IPOs that the sponsor's network centrality explains a large percentage of the return variation and that a one-standard-deviation improvement in the sponsor's network centrality adds to a nearly four percent greater M&A success probability. Griffin, Hong, Liu, and Ryou (2021) find that more centralized CEOs link with a higher level of earnings management of the company.

Although earnings are considered the essential item in financial reporting (Degeorge, Patel, & Zeckhauser, 1999), management of the company usually engages in earnings management, which is not in the best interest of other stakeholders (Degeorge et al., 1999). As earnings management is an internal process, an appropriate indicator is needed to measure the level of earnings manipulation. The most widely used approach is to measure earnings management related to investigating for abnormal accruals on the company's financial reports as accruals can be manipulated easier than cash flows (DuCharme et al., 2001; Morsfield & Tan, 2006; Teoh et al., 1998). Several models can be used to assess accrual-based earnings management (DeAngelo, 1986; Healy, 1985; Jones, 1991). The well-accepted and most frequently used are the Jones model (Jones, 1991) and the Modified Jones model (Dechow et al., 1995). Aside from accrual-based earnings management, a body of research investigates the practice of real activity manipulation to deceive earnings. Roychowdhury (2006) research shed light on many manipulation tactics companies use to manage earnings upward, specifically, sales manipulation, overproduction to reflect the lower cost of goods sold, and cutting discretionary expenditures. The papers from Cohen and Zarowin (2010) and Zang (2012) find that companies engage in two categories of earnings management. Furthermore, Nam, Park, and Arthurs (2014) finds from the study of 160 new IPO companies that earnings management is more aggressive in IPO companies backed by VCs and that respectable VCs are less likely to engage in earnings management.

Information asymmetry and agency costs are related to the outcome of VC-backed companies. Cumming and Johan (2008) discover that when VCs can mitigate information asymmetry and agency costs experienced by new firm owners, the VC-backed company has a superior exit outcome. Diversified networks offer more opportunities for IPO insiders and syndicate members to exhibit opportunistic behaviors. The greater the diversity, the more complex the VC's tasks. Diversity among VC firms within a syndicate, with different objectives, can trigger principal–principal conflicts of interest. This conflict of interest offers opportunistic managers a window to deploy earnings management strategies in the run-up to the IPO, which affects the quality of monitoring of the VCs on portfolio companies (Hochberg et al., 2007). Consequently, we posited the existence of a relationship between firm earnings management and VC network centrality. Our first hypothesis was formulated as follows:

Hypothesis 1 (H1): Accrual-based earnings management is more aggressive in companies backed by VCs with higher network centrality during the lock-up period

The "window dressing" method is termed accrual-based earnings management, while the strategy of accelerating revenue or postponing day-to-day expenses is called real earnings management. The literature suggests that real earnings management is often substituted for accrual-based earnings management, as it is more difficult to detect (Black, Christensen, Taylor Joo, & Schmardebeck, 2017; Chan, Chen, Chen, & Yu, 2015; Zang, 2012). Nevertheless, firms can still incur long-term costs from real earnings management due to the modification of operational activities (Griffin, Hong, Liu, & Ryou, 2017; Gunny, 2005). Due to possible long-lasting adverse effects from real earnings management, we thus posited that VCs with greater network centrality would prefer accrual-based earnings management to real earnings management during the lock-up period. We formulated the following hypothesis:

Hypothesis 2 (H2): Accrual-based earnings management is preferred to real-earnings management in companies backed by VCs with higher network centrality during the lock-up period.

Research Methodology

Sample construction

The data were extracted from the Thomson-Reuters-Eikon database. Variables were Winsorized at 5% and 95% to eliminate the effects of extreme values. We listed all 421US IPO companies that went public between 2006 and 2017 in which VCs invested between 2005 and 2020. We focus on the US market as it has unique characteristics for a lock-up study. A lock-up provision in the US is voluntary; however, between 80% and 90% of US IPOs enter lock-up agreements. The average lock-up period of 180 days is standard for most firms (Bradley et al., 2004).

Regarding undirected network centrality variables, the focus was on relationships between VCs forged by co-investing in a single portfolio company. Therefore, we considered a syndicate to be formed company by company and to consist of all VCs with investment in each portfolio company.

We calculate abnormal accruals utilizing a cross-sectional version of the Jones model (Dechow et al., 1995; Francis & Yu, 2009; Jones, 1991; Kothari et al., 2005) in which the residual from the cross-sectional model is used to estimate the discretionary accruals. The following formula is used to calculate the model:

Equation 1. *Discretionary accruals*

$$\frac{TACC_t}{A_{\tau-1}} = \alpha_1\left(\frac{1}{A_{\tau-1}}\right) + \alpha_2\left(\frac{\Delta REV_\tau - \Delta REC_\tau}{A_{\tau-1}}\right) + \alpha_3\left(\frac{PPE_\tau}{A_{\tau-1}}\right) + \varepsilon$$

where ΔREV_τ is revenue in year t less revenue in year *t-1*, ΔREC_τ is the change in account receivables, and PPE_τ is the gross property, plant, and equipment at year *t*. $TACC_t$ is total accrual for year *t*, determined by subtracting the change in current assets (non-cash) from the change in current liabilities (excluding the current debt and current-portion of long-term debt). To normalize the variables, they were all divided by lagged total assets.

To capture the lock-up period, we delineated four periods in the lifecycle of IPO companies (Wongsunwai, 2013):

Phase 1. Four fiscal quarters ending on the date immediately before the IPO.

Phase 2. Four fiscal quarters starting from the fiscal quarter immediately before the lock-up expiry date. During this phase, insiders practice earnings management to boost share prices and enhance prices post-lockup expiry.

Phase 3. Four fiscal quarters following *Phase 2*.

Phase 4. Four fiscal quarters following *Phase 3*.

A dummy variable for phase 2, the period of our interest, is added to the regression analysis.

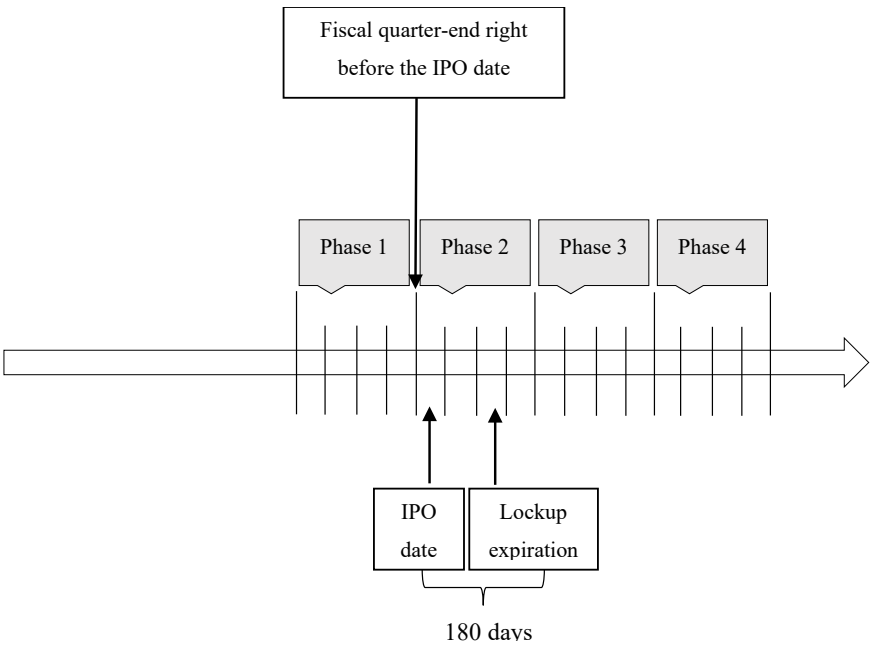

Figure 1: Timeline for VC-backed Companies That Went Public

There are multiple ways to measure real earnings management. This study focuses on abnormal cash flow from operations (CFO) and abnormal discretionary expenditures, based on Roychowdhury (2006). We exclude abnormal production costs since IPO firms are still in their early stages, and most VC-backed IPO companies are concentrated in the information-related industry. To estimate abnormal CFO, we further followed Roychowdhury (2006) by subtracting the ordinary CFO, which was calculated using estimated coefficients from the cross-sectional regression for every industry and year, from the actual CFO using the following formula:

Equation 2. *Abnormal Cash Flow from Operation*

$$abnCFO_t = \frac{CFO_t}{A_{t-1}} - \left[\propto_0 + \beta_1 \left(\frac{1}{A_{t-1}}\right) + \beta_1 \left(\frac{S_t}{A_{t-1}}\right) + \beta_2 \left(\frac{\Delta S_t}{A_{t-1}}\right) \right]$$

where CFO_t is cash flow from operating activities in year *t*, S_t is revenue from sales at year *t*, and ΔS_t is a change in sales revenue from *t* and the year before. All variables were scaled at lagged total assets.

Next, we calculated the discretionary expenses ($DISEXP_t$), which can be calculated from the variables of research and development expenses ($R\&D_t$); advertising expenses (ADV_t); and selling, general, and administrative expenses ($SG\&A_t$). To estimate the abnormal discretionary expenses model, we subtract actual DISEXP from normal DISEXP, which was calculated using estimated coefficients from the cross-sectional regression for every industry and year, using the following model:

Equation 3. *Abnormal Discretionary Expenses*

$$abnDISEXP_t = \frac{DISEXP_t}{A_{t-1}} - \left[\propto_0 + \beta_1 \left(\frac{1}{A_{t-t}}\right) + \beta_2 \left(\frac{S_t}{A_{t-1}}\right) \right]$$

where variable $DISEXP_t$ is discretionary expenses in year *t*, and variable S_t is sales revenue in year *t*. Both variables were scaled by lagged total assets, which is variable A_{t-t}. The same four-phase methodology was applied pre- and post-IPO within the real earnings management model outlined above.

VC Network Centrality

We detail how each VC's network centrality is determined in the next section. Based on the data from the Thomson-Reuters-Eikon database, we find 220,821 investment deals in 30,527 US-based companies performed by 9,081 VC firms between 2005 and 2020. Among this group, 4,342 VC firms are co-investing in 14,571 portfolio companies, one VC firm invests in 8.18 companies on average, and one portfolio company receives funding from 2.43 VC firms on average.

For each year t, we build a new network based on syndications from the 5-year ending in t. We make no differentiation between relationships exhibited in earlier or later syndicates within these 5-year time frames. The generated adjacency metrics are then utilized to create the three network centrality measurements described below. To relate the VC network centralities with IPO companies, we measure the VC firm's network centrality over the 5-year window preceding the year of each IPO.

There are three network centrality measures we calculate for this study. *Degree* refers to the number of other VCs with which one VC has formed unique ties. The *eigenvector* measured the closeness of one VC to all other VCs. *Betweenness* was gauged by measuring the paths connecting the VC to the other VCs in the network. Once all of these network measures were calculated, they were normalized by applying the theoretical maximum to calculate three centrality variables:

$$\textit{Degree} \text{ for } VC_i = \sum_j p_{ij}$$

$$\textit{Closeness} \text{ for } VC_i = ev_i = \sum_j p_{ij} ev_j$$

$$\textit{Betweenness} \text{ for } VC_i = \sum b_{jk} \forall i \neq j \neq k$$

where p_{ij} equals one if a connection is present between VC_i and VC_j, ev_i equals the *eigenvector* centrality of VC_i, and b_{jk} equals the share of all paths connecting players j and k through VC_i.

Empirical model

As Qiu (2019) recommended, a regression analysis was run on VC network centrality and earnings management variables with the other controlled variables. We outline the empirical model for each hypothesis as follows:

Empirical model for H1

$$\begin{aligned} Abnormal\ Accrual_{it} &= \beta_0 + \beta_1 Phase2Dummy_i + \beta_2 ToptierCentrality_i + \beta_3 Phase2Dummy_i \\ &* ToptierCentrality_i + \beta_4 ReturnOnAsset_{it} + \beta_5 RevenueGrowth_{it} \\ &+ \beta_6 Leverage_{it} + \beta_7 FirmSize_{it} + \ DummyforBig4auditor_{it} \\ &+ \ VCnumberofDeals_i + Independent\ Board_i \end{aligned}$$

Empirical model for H2

$$\begin{aligned} Real\ Earnings\ Management_{it} &= \beta_0 + \beta_1 Phase2Dummy_i + \beta_2 ToptierCentrality_i + \beta_3 Phase2Dummy_i \\ &* ToptierCentrality_i + \beta_4 ReturnOnAsset_{it} + \beta_5 RevenueGrowth_{it} \\ &+ \beta_6 Leverage_{it} + \beta_7 FirmSize_{it} + \ DummyforBig4auditor_{it} \\ &+ \ VCnumberofDeals_i + Independent\ Board_i \end{aligned}$$

where abnormal accruals equal for a company *i* at year *t* is a proxy for accrual-based earnings management, and real earnings management for a company *i* at year *t* indicates the real-activities manipulation. Centrality is a measure of network centrality. To mitigate the multicollinearity problem, we add one network centrality variable per each regression model. The interaction terms between the phase 2 dummy variable and dummy variable indicate that companies backed by VC with top-tier network centrality are added to capture the effect of network centrality during the lock-up period. It was essential to include the following control variables firm *return-on-asset*, *revenue growth*, *leverage*, and *company size*. These variables identified in previous research may be connected to earnings management in the context of an IPO firm (Cohen et al., 2008; Kothari et al., 2005). We also add a VC-specific variable, *number of deals* that each VC engaged*,* to capture the VC-specific effect on the dependent variable, and a *dummy for Big4 auditor, and percentage of independent board of director,* corporate governance variables to the model. The regressions are run using cluster standard error.

Research Findings

We investigate the quality of financial reporting of the IPO companies through abnormal accrual and real earnings management during the lock-up period.

Table 1 displays the descriptive statistics of the VC network centrality measures, abnormal accruals, real earnings management variables, and control variables. The average VCs funded IPOs have a normalized degree of 0.0578, an eigenvector of 0.0685, and a betweenness of 0.0057, indicating that they have co-investment connections with slightly more than 5 percent of the other VCs. This low degree centrality shows that, on average, VCs co-invest with a minimal number of additional VCs or that co-investing ties are somewhat exclusive. The average eigenvector and betweenness scores follow the same pattern as these low values echo the exclusive relationship of VC syndication. For the earnings management variables, the average abnormal accrual of -0.0323 suggests that VC-backed IPO companies do not engage in accrual-based earnings management on average. In contrast, positive average real earnings management of 0.0135 shows that on average VC-backed IPO companies practice real earnings management. The skewness in the distribution of these two earnings management variables is also pronounced as the figures range from -0.527 to 0.919 and -0.920 to 0.952 for abnormal accruals and real earnings management, respectively.

Table 2 shows the mean abnormal accruals and real earnings management in each phase of the companies that went public. A positive abnormal accrual during phase 2, which is the period immediately before the lock-up expiration, suggests that accrual-based earnings management is more prevalent during the lock-up period. On the other hand, positive figures for real earnings management can be seen in phase 3 and phase 4, suggesting that IPO companies engage in real-activity manipulation even after the lock-up expiration. Table 3 reports pairwise correlations of key variables. The result demonstrates a high degree of correlation among all network centrality measures.

Table 1: Descriptive Statistics of Accrual-based and Real Earnings Management Analysis

	No.	Mean	Std. Dev.	Min	Max
VC network centrality					
Degree	1,404	0.058	0.050	0	0.171
Eigenvector	1,404	0.069	0.064	0	0.213
Betweenness	1,404	0.006	0.008	0	0.032
Abnormal accruals	1,404	-0.032	0.330	-0.527	0.919
Real earnings management	1,404	0.014	0.475	-0.920	0.952
Abnormal CFO	1,404	-0.006	0.258	-0.635	0.477
Abnormal DISEXP	1,404	-0.013	0.495	-0.949	1.059
ROA	1,404	-0.160	0.305	-0.959	0.191
Sales Growth	1,404	0.513	0.522	-0.058	2.054
Leverage	1,404	0.916	2.345	-4.334	7.026
Revenue	1,404	202.5	301.4	1.167	1,230
VC number of deals	1,404	946.9	891.4	43	3,057
Independent Board of Director	1,404	79.3	11.3	30	100

Notes: This table presents mean descriptive statistics for 421 VC-backed IPO companies that received VC funding between 2005 and 2020 and went public.

Table 2: Mean Abnormal Accruals and Real Earnings Management in Each Phase for IPO Company Backed by VC

Phase	1	2	3	4
Abnormal accruals	-0.167	0.122	-0.018	-0.061
Real earnings management	-0.002	-0.098	0.062	0.112

Table 3: Pairwise Correlations

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Abnormal accruals	1					
(2) Abnormal CFO	-0.199*	1				
(3) Abnormal DISEXP	0.069	-0.215**	1			
(4) Degree	0.072	0.015	0.160*	1		
(5) Eigenvector	0.042	-0.042	0.191*	0.846***	1	
(6) Betweenness	0.033	-0.143	0.189*	0.765***	0.834***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 reports univariate comparisons of mean abnormal accruals and real earnings management in phase 2 and other periods for IPO companies backed by VC across two groups: (1) VC in top-quartile network centralities and (2) VC in lower-tier network centralities. Companies backed by VCs in all top-quartile network centralities have abnormal accruals that are largely positive and statistically significant from zero in the phase 2 period, suggesting evidence of accruals-based earnings management during the lock-up period. Those companies backed by VCs in lower-tier network centralities also have positive and significant abnormal accruals; however, the magnitudes are much lower than those in the top-quartile group. For real earnings management, companies backed by VCs in the top-quartile network centralities and lower-tier network centralities for the phase 2 period show negative and insignificantly different from zero, except those in the top-quartile *eigenvector*. These results suggest no real-activities manipulation for both groups during the lock-up period.

Table 5 displays t-statistics for differences in the mean abnormal accruals and real earnings management between two groups in phase 2 and other periods. For abnormal accruals, phase 2 is the only period that reports a significant difference in the mean level for companies backed by lower-tier and top-quartile network centralities. The significant negative difference in mean, which is the mean of the lower-tier group minus the mean of the top-quartile group, suggests a higher level of mean abnormal accruals in the top-quartile group, hence confirming the result in Table 4. However, data on real earnings management shows the opposite results, with a positive and significantly different mean of real earnings management in the lower-tier group compared with the top-quartile group.

Table 4: Univariate Analysis of Mean Abnormal Accruals and Real Earnings Management in Phase 2 and Other Periods for IPO Companies Backed by VC with Top-quartile Network Centralities and Backed by VC with Lower-tier Network Centralities

Phase	Phase 2 period	Other periods
Abnormal accruals		
Top-quartile Degree	0.303***	-0.085**
Test of zero mean (t-stat)	3.734	-2.511
Top-quartile Eigenvector	0.299**	-0.099**
Test of zero mean (t-stat)	3.424	-2.630
Top-quartile Betweenness	0.315***	-0.111
Test of zero mean (t-stat)	3.972	-3.291**
Lower-tier Degree	0.089***	-0.092***
Test of zero mean (t-stat)	3.112	-8.086
Lower-tier Eigenvector	0.089***	-0.090***
Test of zero mean (t-stat)	3.176	-8.106
Lower-tier Betweenness	0.087***	-0.088***
Test of zero mean (t-stat)	3.029	-7.697
Real Earnings Management		
Top-quartile Degree	-0.260	-0.094
Test of zero mean (t-stat)	-1.490	-1.365
Top-quartile Eigenvector	-0.356**	-0.134*
Test of zero mean (t-stat)	-2.383	-1.982
Top-quartile Betweenness	-0.308	-0.103
Test of zero mean (t-stat)	-1.527	-1.344
Lower-tier Degree	-0.073	0.081**
Test of zero mean (t-stat)	-1.049	2.277
Lower-tier Eigenvector	-0.049	0.090**
Test of zero mean (t-stat)	-0.689	2.538
Lower-tier Betweenness	-0.070	0.079**
Test of zero mean (t-stat)	-1.025	2.270

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Univariate Comparisons of Mean Abnormal Accruals and Real Earnings Management in Phase 2 and Other Periods between IPO Companies Backed by VC with Top-quartile Network Centralities and Backed by VC with Lower-tier Network Centralities

Phase	Phase 2 period	Other periods
Abnormal accruals		
Lower-tier Degree vs. Top-quartile Degree (t-stat)	-2.483**	-0.183
Lower-tier Eigenvector vs. Top-quartile Eigenvector (t-stat)	-2.287**	0.239
Lower-tier Betweenness vs. Top-quartile Betweenness (t-stat)	-2.699**	0.656
Real Earnings Management		
Lower-tier Degree vs. Top-quartile Degree (t-stat)	0.990	2.257**
Lower-tier Eigenvector vs. Top-quartile Eigenvector (t-stat)	1.860*	2.931***
Lower-tier Betweenness vs Top-quartile Betweenness (t-stat)	1.117	2.164**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The observed characteristics in abnormal accruals and real earnings management persist in regression scenarios that account for additional control variables that explain the observed pattern. To prevent the problem of multicollinearity, we run separate regressions for each of the network centrality measures and compare them side-by-side. Table 6 displays the regression results for the effects of VC network centrality, the phase 2 period, and the controls on abnormal accruals, which is the proxy for accrual-based earnings management. Standard errors are clustered by company in all the regressions. We perform variance inflation factor (VIF) to check for multicollinearity and find no issue for all the regression models. In the regression results displayed in columns (1) to (3) of table 6, the output suggests that abnormal accrual is positively correlated with phase 2, the period immediately preceding the lock-up expiration, as the coefficients in front of phase 2 dummies are positive and statistically significant. The result suggests more aggressive accrual-based earnings management in the lock-up period, which is in line with the result from descriptive statistics.

Furthermore, the interaction terms between the phase 2 dummy variable and top-quartile network centralities have statistically significant positive coefficients for all centrality measures. The result also suggests that accrual-based earnings management of IPO companies backed by top-quartile network centrality groups is more aggressive than those of lower-tier groups during the lock-up period with a meaningful magnitude of coefficients close to one standard deviation increase in accrual-based earnings management between two groups. These results confirm our hypothesis H1 that accrual-based earnings management is more aggressive in companies backed by VCs with higher network centrality during the lock-up period.

Regarding the effect of each network centrality measures on the abnormal accrual, of the three centralities, *degree* has the largest effect, followed by *betweenness* and *eigenvector*. Hence, the accrual-based earnings management is more aggressive during the lock-up when the company is backed by a VC with many ties in the network *(degree),* followed by the company backed by VC, that acts as a broker between other VCs *(betweenness)*. The effect is smaller when the VC's ties connect to other well-connected VCs (*eigenvector*).

Table 7 reports the regression results of the analysis of real earnings management. From the results in columns (1) to (3), the coefficients of the dummy variable in the lock-up period are not statistically significant, with only weakly significant in column (1), suggesting that the lock-up period is not correlated with the level of real earnings management. Also, the interaction terms of top-quartile network centralities and phase 2 dummy variables are not statistically significant for all models. This result demonstrates that, in contrast with accrual-based earnings management, the level of network centralities of VCs that back IPO companies does not correlate with the level of real earnings management during the lock-up period.

To investigate further, we run regression on the component of real earnings management, which are abnormal cash flow from operation and abnormal discretionary expenses, as displayed in Table 8 and Table 9, respectively. The regression results in table 8 are consistent with Table 7. The coefficients of phase 2 dummy variables and interaction terms between top-quartile network centrality and phase 2 are not statistically significant. The results of the interaction term from table 9 are also in-line with previous results. However, the result of phase 2 dummy variables in Table 9 with a weakly significant and positive coefficient highlight that the level of abnormal discretionary expenses is less aggressive in the lock-up period.

Table 6: Regression Analysis of Abnormal Accruals on Network Centrality, Phase Period, and Controls

Dependent variable:	OLS Regression		
Abnormal accruals	(1)	(2)	(3)
Dummy for Phase 2	0.190***	0.181***	0.183***
	(0.046)	(0.046)	(0.047)
Top-quartile Degree	0.0455		
	(0.054)		
Top-quartile Eigenvector		-0.002	
		(0.057)	
Top-quartile Betweenness			0.001
			(0.050)
Interaction terms:			
Phase 2 x Top-quartile Degree	0.230**		
	(0.108)		
Phase 2 x Top-quartile Eigenvector		0.236**	
		(0.105)	
Phase 2 x Top-quartile Betweenness			0.243**
			(0.103)
Dummy for healthcare industry	0.144***	0.139**	0.130**
	(0.054)	(0.054)	(0.055)
Dummy for biotech industry	0.256***	0.263***	0.257***
	(0.063)	(0.062)	(0.064)
Dummy for software industry	-0.011	-0.005	-0.003
	(0.037)	(0.038)	(0.038)
ROA	0.309***	0.301***	0.302***
	(0.094)	(0.095)	(0.094)
Sales Growth	0.064*	0.060	0.060
	(0.038)	(0.038)	(0.038)
Leverage	-0.004	-0.004	-0.004
	(0.008)	(0.008)	(0.008)
Size (sales)	9.66e-05	-0.000815	-0.000490
	(0.017)	(0.017)	(0.0175)
Dummy for Big 4 auditor	-0.006	0.004	-0.001
	(0.033)	(0.033)	(0.033)
VC number of deals	-3.81e-05*	-3.29e-05	-3.02e-05
	(2.29e-05)	(2.63e-05)	(2.41e-05)
Independent Board of Director	0.0018	0.002	0.002
	(0.002)	(0.002)	(0.002)
Constant	-0.234	-0.214	-0.221
	(0.181)	(0.185)	(0.180)
Observations	1,404	1,404	1,404
R-squared	0.217	0.210	0.212

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The above regression results reveal that the higher the network centrality of the VC that backs the IPO company, the more aggressive accrual-based earnings management during the lock-up period. However, a similar pattern is not evident in the case of real earnings management in all scenarios. The IPO companies backed by top-quartile VCs may not prefer

to engage in real-activities manipulation, which requires the company's business and operation to be altered in some way, causing long-term adverse effects to the companies. The results confirm hypothesis H2 that accrual-based earnings management is preferable to real earnings management for an IPO company that a VC with higher network centrality backs during the lock-up period.

Table 7: Regression Analysis of Real Earnings Management on Network Centrality, Phase Period, and Controls

Dependent variable:	**OLS Regression**		
Real Earnings Management	**(1)**	**(2)**	**(3)**
Dummy for Phase 2	-0.176*	-0.145	-0.168*
	(0.099)	(0.103)	(0.096)
Top-quartile Degree	0.020		
	(0.108)		
Top-quartile Eigenvector		-0.093	
		(0.134)	
Top-quartile Betweenness			0.017
			(0.134)
Interaction terms:			
Phase 2 x Top-quartile Degree	-0.022		
	(0.185)		
Phase 2 x Top-quartile Eigenvector		-0.140	
		(0.174)	
Phase 2 x Top-quartile Betweenness			-0.066
			(0.207)
Dummy for healthcare industry	0.205	0.197	0.208
	(0.183)	(0.174)	(0.182)
Dummy for biotech industry	-0.021	0.003	-0.013
	(0.183)	(0.191)	(0.191)
Dummy for software industry	-0.172*	-0.176*	-0.169*
	(0.099)	(0.091)	(0.099)
ROA	0.429	0.411	0.428
	(0.308)	(0.302)	(0.306)
Sales Growth	-0.092	-0.109	-0.095
	(0.106)	(0.106)	(0.106)
Leverage	0.012	0.0124	0.013
	(0.015)	(0.015)	(0.015)
Size (sales)	-0.075	-0.068	-0.074
	(0.056)	(0.055)	(0.056)
Dummy for Big 4 auditor	-0.196*	-0.192*	-0.194*
	(0.106)	(0.098)	(0.102)
VC number of deals	-0.000103**	-5.10e-05	-0.000100
	(4.87e-05)	(6.21e-05)	(6.22e-05)
Independent Board of Director	-0.004	-0.004	-0.004
	(0.005)	(0.005)	(0.005)
Constant	1.105**	1.063**	1.102**
	(0.498)	(0.512)	(0.507)
Observations	1,404	1,404	1,404
R-squared	0.181	0.193	0.181

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Regression Analysis of Abnormal Cash Flow from Operation on Network Centrality, Phase Period, and Controls

Dependent variable:	OLS Regression		
Abnormal CFO	(1)	(2)	(3)
Dummy for Phase 2	-0.015	-0.024	-0.007
	(0.040)	(0.041)	(0.039)
Top-quartile Degree	0.033		
	(0.043)		
Top-quartile Eigenvector		-0.061	
		(0.064)	
Top-quartile Betweenness			-0.049
			(0.048)
Interaction terms:			
Phase 2 x Top-quartile Degree	-0.081		
	(0.098)		
Phase 2 x Top-quartile Eigenvector		-0.046	
		(0.090)	
Phase 2 x Top-quartile Betweenness			-0.049
			(0.048)
Dummy for healthcare industry	0.139**	0.141**	0.166***
	(0.066)	(0.064)	(0.062)
Dummy for biotech industry	-0.012	-0.005	0.016
	(0.073)	(0.070)	(0.070)
Dummy for software industry	-0.003	-0.002	0.014
	(0.043)	(0.045)	(0.044)
ROA	0.349***	0.338***	0.332***
	(0.092)	(0.085)	(0.087)
Sales Growth	-0.037	-0.043	-0.049
	(0.049)	(0.050)	(0.048)
Leverage	-0.003	-0.002	-0.002
	(0.005)	(0.005)	(0.005)
Size (sales)	-0.048**	-0.044**	-0.044**
	(0.020)	(0.020)	(0.020)
Dummy for Big 4 auditor	0.088*	0.087*	0.089*
	(0.052)	(0.052)	(0.052)
VC number of deals	9.76e-06	4.08e-05	4.14e-05
	(2.67e-05)	(3.66e-05)	(2.87e-05)
Independent Board of Director	-0.000857	-0.00109	-0.00119
	(0.003)	(0.003)	(0.003)
Constant	0.277	0.271	0.264
	(0.242)	(0.243)	(0.246)
Observations	1,404	1,404	1,404
R-squared	0.164	0.170	0.185

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Regression Analysis of Abnormal Discretionary Expenses on Network Centrality, Phase Period, and Controls

Dependent variable:	OLS Regression		
Abnormal DISEXP	(1)	(2)	(3)
Dummy for Phase 2	0.249**	0.226*	0.225**
	(0.112)	(0.116)	(0.108)
Top-quartile Degree	-0.030		
	(0.114)		
Top-quartile Eigenvector		0.156	
		(0.156)	
Top-quartile Betweenness			0.039
			(0.138)
Interaction terms:			
Phase 2 x Top-quartile Degree	-0.021		
	(0.202)		
Phase 2 x Top-quartile Eigenvector		0.077	
		(0.191)	
Phase 2 x Top-quartile Betweenness			0.111
			(0.221)
Dummy for healthcare industry	-0.189	-0.176	-0.199*
	(0.117)	(0.113)	(0.115)
Dummy for biotech industry	0.091	0.055	0.041
	(0.195)	(0.196)	(0.211)
Dummy for software industry	0.200**	0.196**	0.180*
	(0.096)	(0.094)	(0.097)
ROA	-0.648**	-0.619**	-0.640*
	(0.321)	(0.309)	(0.320)
Sales Growth	0.089	0.112	0.113
	(0.116)	(0.114)	(0.116)
Leverage	-0.009	-0.011	-0.011
	(0.016)	(0.016)	(0.016)
Size (sales)	0.104*	0.094*	0.097*
	(0.054)	(0.053)	(0.054)
Dummy for Big 4 auditor	0.093	0.087	0.087
	(0.108)	(0.099)	(0.103)
VC number of deals	0.000110**	3.74e-05	8.38e-05
	(4.92e-05)	(7.24e-05)	(6.18e-05)
Independent Board of Director	0.003	0.003	0.003
	(0.005)	(0.005)	(0.005)
Constant	-1.165**	-1.108**	-1.131**
	(0.473)	(0.490)	(0.485)
Observations	1,404	1,404	1,404
R-squared	0.197	0.211	0.200

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Discussion

Theoretical Implications

To the best of the authors' knowledge, this study is the first to demonstrate the relationship between VC network centrality and firms' earnings management strategies during an IPO lock-up period. It extends the boundaries of knowledge obtained from network studies and VC research. Second, this study supports the proposition that VCs with higher network centrality are likely to choose accrual-based earnings management in the lock-up period, which contradicts the common perception that companies incur higher costs from accrual-based earnings management (Black et al., 2017; Chan et al., 2015; Griffin et al., 2017; Zang, 2012). However, we find there is no relationship between VCs network centrality and real earnings management as real activity manipulation, which involves altering company operations, that is likely to impact the business negatively.

Managerial Implications

The results of this study are of significant value to the players in the VC ecosystem in many ways. For entrepreneurs seeking investment, this finding suggests that a more centralized VC may be less preferable, as such a VC tends to be subject to more severe exit considerations regardless of the readiness of the portfolio company. Also, for LPs looking to invest in VC funds, thorough due diligence should focus on the financial performance and transparency of a VC with higher network centrality, especially during the lock-up period, as earnings management is more likely in such a case. Lastly, for the regulator, this study provides guidelines for the design of more effective policies to address earnings management problems at the IPO for VC-backed companies.

Conclusion

Brief Summary

This study examined the relationship between VC network centrality and firms' earnings management strategies during the lock-up period. The results confirm the hypothesis that accrual-based earnings management will likely occur in companies backed by VCs with higher network centrality only in the lock-up period; however, we did not see a similar effect in the other periods. This result is in line with past studies, which have suggested that the more complex and extensive the network, the more challenges players face in monitoring and controling due to principal–principal conflict. We also discovered that this relationship is only present during the lock-up period, which is the period when the incentives of firm management and the insider investor align. The results also indicate that accrual-based earnings management is likely to be chosen during lock-up by companies supported by VCs with higher network centrality than real earnings management.

This study offers insight into the hitherto unknown nature of the relationship between network centrality and multiple forms of earnings management during the specific lock-up period. It is possible to glean from this study that companies backed by well-connected VCs engage more in earnings management, as they believe that the benefit of such a practice outweighs the risk of a negative impact on the company's reputation. This relationship only occurs during the lock-up period. The study shows that accrual-based earnings management is preferable for the choice of earnings management. Although many scholars generally believe that accrual-based earnings management generates specific problems, these can be minimized

if the method is applied within certain limits. Nevertheless, firms utilizing real earnings management use cash inefficiently because real earnings management negatively alters a firm's operations. Thus, real earnings management could generate more problems for firms than accrual-based earnings management within specific parameters.

Limitations and Directions of Future Research

It is essential to acknowledge the limitations of this study. Although the findings suggest a relation between higher VC network centrality and a preference for a particular type of earnings management, testing the frequency with which each earnings management method is used falls outside the scope of the present work. Thus, this question can be an area of future research. Furthermore, the sample period for which empirical tests were carried out was limited to 2005-2020; hence, the results cannot be generalized outside this timeframe. Lastly, multiple methods can be used to estimate earnings management, and the findings of this study are derived from those most frequently used methods in the literature.

References

Aggarwal, R. K., Krigman, L., & Womack, K. L. (2002). Strategic IPO underpricing, information momentum, and lockup expiration selling. *Journal of Financial Economics, 66*(1), 105-137.

Barry, C. B., Muscarella, C. J., Peavy Iii, J. W., & Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies: Evidence from the going-public process. *Journal of Financial Economics, 27*(2), 447-471.

Black, E. L., Christensen, T. E., Taylor Joo, T., & Schmardebeck, R. (2017). The relation between earnings management and non-GAAP reporting. *Contemporary Accounting Research, 34*(2), 750-782.

Bonacich, P. (1972). Factoring and weighting approaches to status scores and clique identification. *Journal of mathematical sociology, 2*(1), 113-120.

Bonacich, P. (1987). Power and centrality: A family of measures. *American journal of sociology, 92*(5), 1170-1182.

Bradley, D. J., Cooney, J. W., Jordan, B. D., & Singh, A. K. (2004). Negotiation and the IPO offer price: A comparison of integer vs. non-integer IPOs. *Journal of Financial and Quantitative Analysis, 39*(3), 517-540.

Bradley, D. J., Jordan, B. D., Yi, H. C., & Roten, I. C. (2001). Venture capital and IPO lockup expiration: An empirical analysis. *Journal of financial Research, 24*(4), 465-493.

Brau, J. C., & Johnson, P. M. (2009). Earnings management in IPOs: Post-engagement third-party mitigation or issuer signaling?. *Advances in Accounting, 25*(2), 125-135.

Brav, A., & Gompers, P. A. (2003). The role of lockups in initial public offerings. *The Review of Financial Studies, 16*(1), 1-29.

Bruton, G. D., Filatotchev, I., Chahine, S., & Wright, M. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. *Strategic Management Journal, 31*(5), 491-509.

Chan, L. H., Chen, K. C., Chen, T. Y., & Yu, Y. (2015). Substitution between real and accruals-based earnings management after voluntary adoption of compensation clawback provisions. *The Accounting Review, 90*(1), 147-174.

Chemmanur, T. J., Krishnan, K., & Nandy, D. K. (2011). How does venture capital financing improve efficiency in private firms? A look beneath the surface. *The Review of Financial Studies, 24*(12), 4037-4090.

Cohen, D. A., Dey, A., & Lys, T. Z. (2008). Real and accrual-based earnings management in the pre-and post-Sarbanes-Oxley periods. *The Accounting Review, 83*(3), 757-787.

Cohen, D. A., & Zarowin, P. (2010). Accrual-based and real earnings management activities around seasoned equity offerings. *Journal of Accounting and Economics, 50*(1), 2-19.

Cumming, D. (2006). The determinants of venture capital portfolio size: empirical evidence. *The Journal of Business, 79*(3), 1083-1126.

Cumming, D., & Johan, S. (2008). Information asymmetries, agency costs and venture capital exit outcomes. *Venture Capital, 10*(3), 197-231.

Cumming, D., Siegel, D. S., & Wright, M. (2007). Private equity, leveraged buyouts and governance. *Journal of Corporate Finance, 13*(4), 439-460.

Da Rin, M., Hellmann, T., & Puri, M. (2013). A survey of venture capital research. In *Handbook of the Economics of Finance* (Vol. 2, pp. 573-648): Elsevier.

DeAngelo, L. E. (1986). Accounting numbers as market valuation substitutes: A study of management buyouts of public stockholders. *Accounting Review*, 400-420.

Dechow, P. M., Sloan, R. G., & Sweeney, A. P. (1995). Detecting earnings management. *Accounting Review*, 193-225.

Degeorge, F., Patel, J., & Zeckhauser, R. (1999). Earnings management to exceed thresholds. *The Journal of Business, 72*(1), 1-33.

DuCharme, L. L., Malatesta, P. H., & Sefcik, S. E. (2001). Earnings management: IPO valuation and subsequent performance. *Journal of Accounting, Auditing & Finance, 16*(4), 369-396.

Field, L. C., & Hanka, G. (2001). The expiration of IPO share lockups. *The Journal of Finance, 56*(2), 471-500.

Francis, J. R., & Yu, M. D. (2009). Big 4 office size and audit quality. *The Accounting Review, 84*(5), 1521-1552.

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics, 42*(1), 133-156.

Griffin, P. A., Hong, H. A., Liu, Y., & Ryou, J. W. (2017). *CEO network size and earnings management*. http://www.nzfc.ac.nz/archives/2017/papers/updated/80.pdf

Griffin, P. A., Hong, H. A., Liu, Y., & Ryou, J. W. (2021). The dark side of CEO social capital: Evidence from real earnings management and future operating performance. *Journal of Corporate Finance, 68*, 101920.

Gunny, K. A. (2005). What are the consequences of real earnings management?. In: Citeseer.

Healy, P. (1985). The impact of bonus schemes on the selection of accounting principles. *Journal of Accounting and Economics, 7*(1-3), 85-107.

Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *The Journal of Finance, 62*(1), 251-301.

Jenkinson, T., Ljungqvist, A., & Ljungqvist, A. P. (2001). *Going public: The theory and evidence on how companies raise equity finance*: Oxford University Press on Demand.

Jones, J. J. (1991). Earnings management during import relief investigations. *Journal of Accounting Research, 29*(2), 193-228.

Kothari, S. P., Leone, A. J., & Wasley, C. E. (2005). Performance matched discretionary accrual measures. *Journal of Accounting and Economics, 39*(1), 163-197.

Kreps, D. M., & Wilson, R. (1982). Reputation and imperfect information. *Journal of Economic Theory, 27*(2), 253-279.

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *The Journal of Finance, 32*(2), 371-387.

Lerner, J. (1994). The syndication of venture capital investments. *Financial Management*, 16-27.

Lin, C., Lu, F., Michaely, R., & Qin, S. (2021). SPAC IPOs and sponsor network centrality. *Available at SSRN 3856181*.

Milgrom, P., & Roberts, J. (1990). The economics of modern manufacturing: Technology, strategy, and organization. *The American Economic Review, 80*(3), 511-528.

Morsfield, S. G., & Tan, C. E. (2006). Do venture capitalists influence the decision to manage earnings in initial public offerings?. *The Accounting Review, 81*(5), 1119-1150.

Nam, D. i., Park, H. D., & Arthurs, J. D. (2014). Looking attractive until you sell: Earnings management, lockup expiration, and venture capitalists. *Journal of Management Studies, 51*(8), 1286-1310.

Neus, W., & Walz, U. (2005). Exit timing of venture capitalists in the course of an initial public offering. *Journal of Financial Intermediation, 14*(2), 253-277.

Ofek, E., & Richardson, M. P. (2000). Large the IPO lock-up period: Implications for market efficiency and downward sloping demand curves. *Available at SSRN 207908*.

Qiu, H. (2019). *CEO Network Centrality and Earnings Management.* [Doctoral dissertation, Louisiana Tech University, Ruston, Louisiana].

Rao, G. R. (1993). *The relation between stock returns and earnings: A study of newly-public firms*. Working Paper, Kidder Peabody and Company.

Roychowdhury, S. (2006). Earnings management through real activities manipulation. *Journal of Accounting and Economics, 42*(3), 335-370.

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics, 27*(2), 473-521.

Shapiro, C. (1983). Premiums for high quality products as returns to reputations. *The Quarterly journal of Economics, 98*(4), 659-679.

Sorenson, O., & Stuart, T. E. (2008). 12 Entrepreneurship: A field of dreams? *Academy of Management Annals, 2*(1), 517-543.

Teoh, S. H., Wong, T. J., & Rao, G. R. (1998). Are accruals during initial public offerings opportunistic?. *Review of Accounting Studies, 3*(1-2), 175-208.

Wongsunwai, W. (2013). The effect of external monitoring on accrual-based and real earnings management: Evidence from venture-backed initial public offerings. *Contemporary Accounting Research, 30*(1), 296-324.

Zang, A. Y. (2012). Evidence on the trade-off between real activities manipulation and accrual-based earnings management. *The Accounting Review, 87*(2), 675-703.