Dynamics of Corporate Venture Capital:

Performance, Temporality, and Institution

by

Peiyuan Huang

Bachelor of Arts, Economics, Peking University, 2014

Master of Science, Economics, Peking University, 2016

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This dissertation was presented

by

Peiyuan Huang

It was defended on

March 9, 2021

and approved by

Ravindranath Madhavan (Dissertation advisor)
Professor of Business Administration, University of Pittsburgh

Sharon Alvarez
Thomas W. Olofson Chair in Entrepreneurship, University of Pittsburgh

Susan K. Cohen
Associate Professor of Business Administration, University of Pittsburgh

John E. Prescott
Thomas O'Brien Chair of Strategy, University of Pittsburgh

Gary Dushnitsky
Associate Professor of Strategy and Entrepreneurship, London Business School

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ABSTRACT

Along with effective knowledge search and technology portfolio management, financing is an important facet of innovation management for established corporations and new enterprises alike. I study the organization and process of innovation financing in corporate venture capital (CVC) context, which is a crucial form of interfirm equity relationship that facilitates corporate innovation by funding technological startups. This multi-method dissertation comprises three essays that jointly contribute to unpacking the dynamics and influence of resource interdependence between corporate investor and invested venture during the CVC investment life cycle. First, I conduct a meta-analysis to unveil the link between CVC investments and various performance objectives of corporate investors and new ventures. I integrate performance measures into different conceptual categories, after which I theorize and confirm that the magnitude of CVC impact systematically differs across these categories due to heterogeneity in dependence absorption. I also find that corporate financial performance is supplemented by corporate strategic performance but attenuated by venture performance. Second, I take a closer look at the longitudinal evolution of corporate strategic objective of technological learning, theorizing that it drives termination decisions in established CVC investments. I hypothesize that corporate strategic considerations co-evolve with the dynamics of interfirm technological dependency. In addition, this effect is conditional

on the aggregate resource dependence level that can be altered by corporate exploration breadth, venture new technology, and dyadic similarity. Third, I explore the emergence of the CVC ecosystem in China and introduce a new motivation, corporate political objective, to the CVC literature that has so far neglected non-market incentives. Based on 11 interviews with elite informants and archival data, I follow a mixed-method approach that identifies the primary stakeholders and their corresponding roles in China's CVC investment process, depicts the evolution of similarities and differences between US and China's CVC ecosystem, and articulates the existence and manifestation of the corporate political objective in CVC investments.

Together, my findings across the three studies suggest that market and non-market objectives coexist with, and influence, each other in the process of CVC investment life cycle, such that investment motivations and performance outcomes are based upon tradeoffs across interrelated objectives, time frames, and institutional contexts. This dissertation provides a conceptual framework and empirical foundation for the complex interaction between entrepreneurs and corporations in the CVC context to understand the interdependencies during innovation financing in a way that should prove meaningful to new venture funding, corporate entrepreneurship, investment for innovation, and resource dependency theory.

Keywords: Corporate venture capital, Strategic entrepreneurship, Resource dependency, Investment dynamics, Technological learning.

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Preface

Entrepreneurial success hinges on the resources provided by various stakeholders. As an academic entrepreneur, I have enormously benefited from a fabulous group of people who consistently provide unstinting help and support along this journey.

Let me start with expressing my overwhelming appreciation for my committee members, all of whom have illustrated a precious combination of excellent expertise and unreserved encouragement in the research area that I am pursuing. It is an absolute pleasure to have Ravi Madhavan as my chairperson. He is always available to provide a helping hand and always reliable to guide me on track in exploring promising directions, with his superb insights. Whatever academic achievements that I have fortunately made during these early years (and may well in the future) of my career, they are indebted to Ravi's all-around supports, both scholarly and emotionally. Being an academic mentor and life-long friend, Ravi (together with his wife, Kalpana) has filled many of the most cherished memories of these years. Susan K. Cohen had offered to host me at her house even before I arrived at Pittsburgh. During my doctoral experiences, she and her family have warmly looked after me in every means. Working with Sue on multiple research projects has largely helped me to smoothly transit my mindset from an economist to a management scholar. Sharon Alvarez's sharpness and brilliance make her an academic role model for me. Every time I discuss my premature research ideas with Sharon, she is able to point out the most valuable sparks within my verbose and vague explanations. I am constantly amazed by John E. Prescott's quick and detailed responses whenever I seek for help or feedback. John's grasp of the big picture and conceptual thinking have greatly led me to expand my comfort zones. It is a privilege to have Gary Dushnitsky on board. Despite his hectic schedule, Gary has invested

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1.0 Introduction

In the broad domain of innovation management, an important facet is how financial resources are effectively utilized to bring out innovative products. It involves a strategic allocation of financial capital via multiple organizational approaches, such as direct R&D investment or indirect interfirm technological collaborations. In the financing of innovation, one burgeoning form is corporate venture capital (CVC), which is an interfirm equity relationship that enables corporate innovation by funding technological startups.

CVC is defined as "minority equity investment by an established corporation in a privately held entrepreneurial venture" (Dushnitsky, 2012, p.157). Established corporations, such as Intel, Amazon, Google, or Johnson & Johnson, have played a pivotal role in startup fundraising in recent decades. It has been widely acknowledged that in addition to monetary investment, these CVC also facilitate new enterprises development by providing specific complementary assets that may be difficult to transfer via arm's-length market relationships. Instead of a one-shot resource commitment, investment decisions of venture capitalists can be seen as an intertemporal process—in which an investor sequentially funds a project in multiple rounds (e.g., Seed, Series A, Series B, etc.) of financing (Dixit et al., 1994; Guler, 2007). The traditional intertemporal perspective in economics addresses decisions in which "the timing of costs and benefits are spread out over time" (Loewenstein and Thaler, 1989). I use the term intertemporal more broadly to refer to how decisions at various points in time cross-influence each other, which brings into focus not only tradeoffs (e.g., short-term versus long-term benefits) but also interlinkages (e.g., how today's decision might constrain future decisions) and what changes between sequential decisions (e.g., how key considerations have

evolved since a previous decision). Time plays an important role in such intertemporal process. At the beginning of each new round, the venture receives an updated valuation, based on which existing investors may choose to exit and new investors may enter. The staged investment design provides corporate investors with chances to periodically reevaluate the prospects for different new enterprises, making it possible to both start funding new enterprises and discontinue undesirable investments in a timely manner. With the flexibility to quickly adjust their investment portfolios, CVC has therefore enabled corporation to seize new entrepreneurial opportunities and grants promising startups with essential resources for their development.

CVC represents an important context for understanding the entrepreneurship-innovation interface, corporate entrepreneurship, and entrepreneurial finance in business practices. It is not surprising that in 2020, the annual global CVC activity has reached over USD 73.1 billion in investment and is only second to independent venture capital (IVC) in funding new enterprises (CB insights, 2020). While corporate investors resemble IVC in terms of resource provision and return seeking, CVC also has critical differences, such as the simultaneous pursuit of multiple missions as well as distinctive governance and motivation schema. Instead of a purely financial return on investment, strategic goals such as exposure to new technologies and markets may dominate (Dushnitsky, 2012; Siegel et al., 1988). Complementing alliances, M&A, or open innovation, CVC is increasingly considered to be an important means for corporate investors to learn about nascent technologies and markets (Chesbrough, 2002; Dushnitsky and Lenox, 2005a,b; Lerner et al., 2012; Ozmel et al., 2017). With the parent firms' in-house expertise on related markets and technologies, CVC plays a unique role toward the development of invested ventures as well. On the one hand, despite the capital provision that could be fulfilled by traditional financial investors as well, the startup's return

includes gaining access to specialized industry networks and expertise (Alvarez-Garrido and Dushnitsky, 2016), as well as to complementary assets (Park and Steensma, 2012). Serving as a critical means by which entrepreneurs overcome resource constraints, CVC can be a key enabler of entrepreneurial resource mobilization (Florin et al., 2003; Clough et al., 2019). On the other hand, however, collaborating with corporate "sharks" also exposes the venture to appropriation threats (Katila et al., 2008).

The critical role that CVC plays in financing new enterprises and funding external innovation is reflected in the surging academic research that demonstrates an all-around exploration of decisions and performance outcomes in different stages of the CVC life cycle. Corporate strategy and entrepreneurship researchers have well advanced scholarly understanding in the formation, operation, and termination stages of CVC investments. First, in the formation stage, the key focus has been the antecedents that motivate the initiation of equity relationship between established corporations and new ventures. Corporate investors make deliberate evaluations on whether to engage in CVC activities, based on various corporate considerations (Ceccagnoli et al., 2018; Dokko and Gaba, 2012; Ma, 2020), external stakeholders (Belderbos et al., 2018; Dushnitsky and Lavie, 2010; Kim et al., 2019), and institutional factors (Gaba and Dokko, 2016; Hallen et al., 2014; Li and Chi, 2013). Meanwhile, new ventures also demonstrate a distinctive preference toward seeking funding from established corporations, mainly depending on the need for specialized complementary assets (Alvarez-Garrido and Dushnitsky, 2016; Park and Steensma, 2012) and the countervailing concern for technology misappropriation (Dushnitsky and Shaver, 2009; Katila et al., 2008). Second, in the operation stage, research has been centered around multiple types of performance objectives that CVCs are believed to simultaneously pursue. Instead of a purely financial return on investment, strategic goals such as exposure to new technologies

and markets may dominate (Dushnitsky, 2012; Siegel et al., 1988). Apart from balancing financial and strategic returns, the performance of CVC investments is further complicated by the need to account for the startup's performance (e.g., Ivanov and Xie, 2010; Park and Steensma, 2012). Third, in the termination stage, scholars have primarily theorized about and examined the factors that drive corporate investors to suspend their engagements in CVC that facilitate corporate entrepreneurship and new venture development (Dokko and Gaba, 2012; Gaba and Dokko, 2016; Ma, 2020).

Notwithstanding the extent of CVC activity and research, however, in general we lack an understanding of the dynamic processes regarding how different factors interdependently drive the CVC ecosystem toward its equilibrium. In each of the three stages throughout CVC life cycle, existing studies have well acknowledged the motivations and outcomes of CVC investments, but they have largely neglected the dynamic interplay across distinctive performance aspects, time frames, and institutional contexts. Regarding the formation of equity relationships between established corporations and new ventures, while previous studies have acknowledged that broader institutional factors affect CVC investment decisions, the extant CVC literature has predominantly focused on mechanisms pertaining to, and emerging from, the U.S. CVC market. Research is yet to address how investment incentives may manifest in heterogenous ways under different institutional contexts. In addition, during the operation period of CVC investment, though multiple objectives can be simultaneously pursued, achievement in one objective may not synchronize with that in other objectives. It is therefore important to further understand how different objectives interact with each other and how the involved firms balance their efforts across these objectives. Finally, among the few studies that drew attention to termination-related issues, the focus has been either on the termination of the entire CVC unit (Dokko and Gaba, 2012; Gaba and Dokko, 2016; Ma,

2020) or venture capital activity in general (Guler, 2007; Li and Chi, 2013). However, the motivation for terminating a specific investment may be systematically different from the entire CVC unit; nor does it fully resemble conventional venture capital (e.g., IVC) that rarely considers technology and innovation factors that are core in CVC investments (Dushnitsky and Lenox, 2005a,b; Narayanan et al., 2009).

To systematically address these gaps, this dissertation adopts a multi-method approach centered around the interactive relationships during the formation, operation, and termination stages of the CVC investment process. The dissertation unfolds in three inter-related chapters that combine a meta-analysis based on existing literature, an empirical analysis with archival data and a qualitative field study on the emergence of a developing CVC ecosystem.

First, I conduct a systematic review of CVC investment outcomes in Chapter 2. There has been consensus that corporate investors simultaneously pursue strategic and financial returns while ventures seek to enhance their own performance in CVC investments. However, ambiguity persists in how much value CVC creates in each performance category. In this chapter, I use the meta-analytical method that provides more valid overall patterns by synthesizing from a large number of existing studies. I first synthesize the literature regarding the heterogenous performance outcomes from CVC investments. Integrating extant measurement approaches into distinctive conceptual domains of performance, I focus on theorizing about the comparison and inter-relationships among them. It suggests how the magnitude of CVC impact systematically differs across performance domains due to heterogenous dependence absorption. Based on the nuanced mechanisms that lead to heterogenous performance outcomes in different domains, I further conduct a path analysis with meta-analytical structural equation modeling (MASEM) to show the potential complementarity or substitution among different domains of performance outcomes.

My findings in Chapter 2 unfold in three sequential steps. First, by decomposing CVC investment outcomes into more nuanced performance aspects, I show that involvement in CVC provides corporations with an advantageous product-market position and facilitate their technology advancement. Corporate investors also enjoy immediate financial returns, but these short-term monetary gains do not appear to translate into long-term firm value for the investing corporations. However, for the invested venture, while they do benefit financially and tend to experience successful exit due to the CVC provision of complementary resources, they appear to be compromised technologically, perhaps stemming from a lack of defenses against misappropriation. Second, I compare the magnitudes of CVC performance outcomes among different performance domains. Results indicate that while the achieved investment returns are similar between the dual financial and strategic objectives of corporate investors, ventures experience a significantly lower amount of value capture than both domains of corporate objectives. Third, this chapter depicts how the realization of one type of target objective in CVC investment is interrelated to that of other objectives. Corporate strategic performance is expected to prompt corporate financial gains as well as venture performance, but the overall venture performance is likely to jeopardize corporate financial returns, arguably because the corporate investors are willing to sacrifice some part of their financial returns to attract ventures that promise strategic value. These findings highlight the tradeoffs that both sides of a CVC coalition should be aware of when stepping into a potential partnership. It suggests that resource mobilization through CVC funding is not without cost. In deciding whether to engage with a CVC investor, startups therefore need to be especially cautious to evaluate the relative importance of corresponding benefits and costs in their own business settings.

Second, following the integration of findings from the extant CVC literature, Chapter

3 focuses on corporate investors' intertemporal decisions regarding the (dis)continuation of their existing investments. I use the term intertemporal more broadly to refer to how decisions at various points in time cross-influence each other, which brings into focus not only tradeoffs but also interlinkages and what changes between sequential decisions. Unlike pure financial investors, corporate investors base their decisions on achieving strategic goals as well as financial ones. Beyond extant literature that centers around financial considerations in investment termination decisions, this chapter explains how corporate strategic considerations co-evolve with the intertemporal dynamics of technological dependence on external firms, which affect the termination decision as well. I also theorize how the above effect is contingent on the aggregate resource dependence level in the CVC-venture tie, which can be altered by corporate exploration breadth, ventures' new technology, and dyadic similarity. In testing the hypothesized relationship, I gather CVC investment round and organizational patent information from multiple sources and use fuzzy-text matching to merge different databases. In this chapter, I employ standard survival regression techniques to investigate the influence of corporate achieved technological advancement on the time lag between the first and second (if the corporate investor continues to invest) rounds of CVC investment. I use the Cox proportional hazard model to estimate how the duration between two investment rounds is explained by technological factors that reside outside the financial aspects as studied in the traditional VC literature.

This chapter supports the hypothesized positive influence of investing corporation's achieved technological advancement, as reflected in newly granted patents, on subsequent CVC investment termination. The impact of corporate technology achievement is moderated by their overall technological dependence on the invested venture. I theorize and test that the main effect is intensified by the exploration scope of corporate patents and attenuated

by the venture's continuous patent filing and product market relatedness between corporate investor and invested venture. This study contributes to an understanding of investment termination, a critical yet overlooked phase of the CVC investment life cycle. Going beyond the current literature depicting venture capital termination as determined by venture financial potential, I focus on the technology aspect and explain how successful technology internalization also drives termination decisions. In addition, I also extend the applicable scope of resource dependency theory by theorizing the intertemporal dynamics of interfirm dependency and how the accumulation of dependence resolution gradually leads to corporate investors' investment termination decision.

Finally, I extend the research scope to the entire ecosystem in the Chapter 4 and study how interactions among multiple types of stakeholders jointly drive the emergence of CVC ecosystem outside the United States. This chapter focuses on exploring three key aspects to compare and contrast China's CVC ecosystem with the well-studied North America norms: who the involved stakeholders are, how the distinctiveness of investment characteristics manifests, and why established corporations are motivated to engage in CVC investments. Based on 11 interviews with elite informants and on archival data, I follow a mixed-method approach that focuses on how different types of core stakeholders jointly shape the ecosystem of CVC investments in China, which is the second largest and most rapidly evolving CVC market in the globe. This chapter identifies primary stakeholders in China's CVC ecosystem and theorizes about information flows among these stakeholders. I also propose potential mechanisms that explain distinctive CVC investment distributions between the U.S. and China. Based on the configuration of key players and the unique characteristics of CVC investment, the incentives in China's CVC context are also theorized, with an especial focus on conceptualizing the existence and manifestation of political incentives to which Chinese

corporate investors appear to be uniquely subjected.

Employing mixed-method analysis that combines field studies and archival data, this last chapter finds that government regulators act as a critical stakeholder that shapes the emergence and evolution of China's CVC ecosystem. The manifestation of strategic objectives shows noticeable differences in China's context. On the one hand, extant CVC literature's frequently mentioned core objective—technological incentive—appears to be a peripheral goal for both corporate investors and invested new ventures in China. The product-market incentive also shows subtle differences, such that Chinese corporate investors base their investment strategy on filling all niches and accessing highly regulated industries instead of avoiding market uncertainty. On the other hand, a non-market incentive that primarily seeks corporate political returns constitutes an important yet overlooked strategic objective in this process. Situated in a political-sensitive context, established corporations in China are motivated to leverage CVC investment to reduce policy-related uncertainty. Chinese corporations utilize CVC investments to co-opt political stakeholders and to internalize their resource dependency on institutional contexts. I used the Economic Policy Uncertainty (EPU) index (Baker et al., 2016) to show that there is a positive relationship between the trend of EPU and CVC investment volume. This study provides a systematic roadmap of China's CVC ecosystem, which operates distinctively from the institutional context in North America. More importantly, I extend the boundary of CVC investment objectives into the non-market strategy arena. This research into the stakeholders and incentives of CVC investments in Chinaserves as a first step to reveal how non-market considerations alter investment preferences and decision-making determinants of CVC investors.

Taken together, the three interdependent studies jointly explain how different participants in CVC investments interact with each other to progressively approach an equilibrium.

Accordingly, this multi-method dissertation unpacks the dynamics of the CVC investment processes and provides an in-depth exploration into the mechanisms of interdependencies among different players across different stages of CVC investments' life cycle. In doing so, this research extends our understanding of corporate entrepreneurship and new enterprise development in several ways. First, I explicate the theoretical mechanisms in the tradeoffs among the performance outcomes in different domains. Based on a large set of previous studies, multiple performance outcomes are incorporated simultaneously, a research goal hard to achieve within a single non-meta-analytic study. In addition, the meta-analysis contributes to an understanding of how different performance domains complement or substitute each other in CVC investments. Current CVC research tends to focus on one particular performance outcome at a time, and the first essay of this dissertation comprises an important attempt to understand the interplay of different constructs and players during their involvement in CVC investments. Second, this dissertation tackles a key source of heterogeneity in corporate investors' intertemporal investment decisions. With corporate investors' dual goals of strategic and financial returns, it mitigates the lack of focus on strategic factors that alter (dis)continuation of corporate investments in new enterprises. Drawing from the intertemporal dynamics of resource dependency, the second essay seeks to understand how technology learning and different features of the learned technology would lead to startups' distinctive attractiveness toward corporate investors. It also contributes to the Entrepreneurship area on how startups could continuously retain the corporate investors' interest and resource input. Third, my dissertation contributes to an understanding of the process during which a broad set of participants jointly establishes the second largest CVC investment market from the very beginning. Leveraging substantive primary information from field studies, this study describes how CVC actors, regulators and investment norms co-evolve in shaping

the current CVC ecosystem in China.

With a respective focus on the formation, operation, and termination phases, the three studies in this dissertation also facilitate a better understanding of CVC investments in business practices. Taking the investment process before the recent IPO of Lyft, Inc. as an example, it raised $5.1 billion in seven investment Series involving 10 CVCs and 34 independent venture capitals (IVCs). In the conference calls associated with each of these investments, IVCs are pretty consistent in emphasizing the prospect of financial returns while CVCs talk about diverging goals such as promoting innovation, accessing emerging markets, learning technology and forming alliances. Throughout the seven years' fund-raising process of Lyft, Inc., the duration of each corporate investor's engagement varies widely, with some firms investing only in one round while others make four rounds of continuous investment. Among Lyft's corporate investors, there are major U.S. corporations like General Motors as well as international CVCs such as Alibaba from China and Rakuten from Japan. The findings in this dissertation could shed light on making sense of the critical corporate decisions during the entire investment process. First, the study on the inter-relationships among multiple performance aspects helps to understand how the diverging goals of corporate investors could be simultaneously managed. Second, with the study on the strategic rationales of investment termination, it explains why different corporate investors largely vary in the decision on whether to make continuous investments in successive rounds, even though they are faced with the identical expectation of financial returns. Third, the exploration on the CVC ecosystem outside the United States would help the new enterprise to better interact with their international investors and to better understand the motivations and behaviors of these overseas corporations.

2.0 Meta-analytically Unpacking Corporate Venture Capital

2.1 Introduction

There has been an increasing number of studies in strategic entrepreneurship that raise the need for meta-analyses both to resolve controversy and to build new theory. In this study, I add to this steam with respect to Corporate Venture Capital (CVC), a topic that uniquely links strategy (on the corporate side) and entrepreneurship (on the startup side). CVC is commonly understood as "minority equity investment by an established corporation in a privately held entrepreneurial venture" (Dushnitsky, 2012, p.157). In 2019, global CVC activity reached new highs, with over USD 57.1 billion in investment (CB-Insights, 2019). Thus, CVC is a current context for understanding the entrepreneurship/innovation interface, corporate entrepreneurship, and entrepreneurial finance, all of which are ranked as top topics with academic and practical potential in a recent survey of entrepreneurship research (Kuckertz and Prochotta, 2018). Serving as a critical means by which entrepreneurs overcome resource constraints, CVC is a key enabler of entrepreneurial resource mobilization (Clough et al., 2019; Florin et al., 2003). Responding to the importance of CVC today, as well as facilitated by the emergence of databases such as VentureXpert, the academic literature on CVC has burgeoned in recent years.

Notwithstanding the extent of CVC activity and research, however, there has been controversy regarding its various performance impacts (see Table 1 and 2in the Theory and Hypotheses section). Extant theoretical and measurement approaches diverge greatly. This is partly because, unlike independent venture capital (IVC) firms, CVC investments simultaneously pursue multiple missions—corporate investors seek a balance between strategic

and financial returns while invested ventures look for their own growth and exit options (Dushnitsky, 2012; Ivanov and Xie, 2010; Park and Steensma, 2012). In addition to mixed findings, opportunities for improvement include inattention to the interaction of venturing activities (Dushnitsky and Birkinshaw, 2016), underspecified theoretical mechanisms and a lack of theorizing about distinctive performance aspects. An intriguing but unexplored nuance in the CVC literature regards what the relative magnitudes of distinctive performance outcomes are and how they are interrelated. While extant studies each offer an in-depth examination of a specific outcome, as a whole they are inconclusive on value distribution across different domains, nor do we know how value is manifested along different stages in the CVC investment chain. Reflecting these motivations, I ask: *How well does CVC investment perform in the corporate-financial, corporate-strategic, and venture performance domains? How interdependent are CVC performance outcomes across the three distinctive domains?*

To address these questions, I theorize about how the diverging performance outcomes may be viewed through the lens of heterogeneity in dependence absorption (Hillman et al., 2009). I then integrate the extant measures into the three major domains of corporate-financial, corporate-strategic, and venture performance, with a focus on theorizing about the comparison and inter-relationships among them. I explicate three mechanisms—learning, complementary asset and investment—to theorize about the tradeoffs among performance outcomes in different domains. I test my hypotheses via meta-analysis, an approach that has been widely used to offer a more accurate assessment of a relationship and is advantageous with regard to external validity (Combs et al., 2019; Crook et al., 2008; Hunter and Schmidt, 2004). The across-studies synthesis enables me to theorize about and test the distribution as well as the manifestation of value (in its separate dimensions) created in CVC investments, which are difficult goals for single empirical studies. Going beyond the analysis of

bi-variate relationships, I employ meta-analytic structural equation modeling (MASEM) to test the interdependent model as a nomological network that illuminates different theoretical pathways.

My results indicate that, across studies, both corporate investors and invested ventures benefit from CVC in general; however, there are noteworthy nuances. Besides intriguing differences regarding dependence absorption in distinctive aspects, there is heterogeneity in effect sizes as well. For example, despite the tendency to treat corporate strategic performance as the primary goal, its effect size is only marginally larger than for financial performance. Meanwhile, the effect sizes for corporate performance (both financial and strategic) are significantly greater than those for venture performance. In addition to the quantitative synthesis of the multifaceted performance outcomes, my path analysis indicates that corporate strategic performance is positively associated with both corporate financial and venture performance. However, there exists a potential conflict between the venture and corporate financial performance. Overall, my meta-analytic approach facilitates progress on the theory development and measurement heterogeneity noted earlier. Since CVC is a topic at the intersection of corporate strategy and entrepreneurship, this study will be of interest to scholars from both fields.

2.2 Theoretical background

In this section, I prepare the ground for the hypothesis development presented subsequently. First, I provide a short summary of CVC as an important element in entrepreneurship. Next, I propose that inconsistent findings and disparate measurement approaches in the literature call for meta-analytic integration. Finally, I suggest the need for a unifying

theoretical framework for integrating CVC performance using meta-analysis.

2.2.1 Background on CVC investments

Startups typically lack crucial assets and face uncertain prospects, motivating them to seek venture capitalists who are willing to accept high risk as a tradeoff for potentially high reward. Stimulated by the success of IVC firms, large corporations have stepped into the venture capital game. However, despite sharing the IVC goal of financial returns, CVC is critically different in both structure and motivation. Instead of forming independent partnership organizations, CVC units are often structured as corporate subsidiaries and may lack incentive-based compensation. Financial experts occasionally question if CVC is "dumb money" (Taber, 2017) because the lack of a traditional partnership structure may predispose CVC to distorted and unstable investments (Allen and Hevert, 2007).

Apart from financial returns, CVC investors also seek to align their investment focus with the corporate parent's strategic focus. Complementing alliances, M&A, or open innovation, CVC is increasingly an important means for corporate investors to learn about nascent technologies and markets (Chesbrough, 2002; Dushnitsky and Lenox, 2005a,b; Lerner et al., 2012; Ozmel et al., 2017). With the parent firms' in-house expertise on related markets and technologies, CVC can be attractive for the ventures as well. Beyond merely seeking capital, the startup's return includes gaining access to specialized industry networks and expertise (Alvarez-Garrido and Dushnitsky, 2016), as well as to complementary assets (Park and Steensma, 2012). However, collaborating with corporate "sharks" also exposes the venture to appropriation threats (Katila et al., 2008).

2.2.2 Motivation for meta-analysis

Given the importance of CVC in entrepreneurship, it is no surprise that the empirical literature on CVC performance has burgeoned in recent years. However, there is considerable ambiguity in the literature. For virtually every investigated performance dimension, some studies report positive outcomes while others report negative outcomes. To illustrate, consider corporate innovation outcomes, a topic of critical interest to CVC scholars. A glance at the literature shows that several studies report that CVC provides supplementary resources to corporate innovation (e.g. Dushnitsky and Lavie, 2010; Wadhwa and Basu, 2013). However, on the negative side, I also observe scholars reporting that passive CVC investments cannot promote technology input or outcome (e.g. Anokhin et al., 2016) and that technological performance is undermined by CVC's managerial and coordination complexities (Belderbos et al., 2018). Such equivocality of findings (see Table 1 and 2), while not unusual or unexpected in a growing field, points to the need (and opportunity) for meta-analytic integration.

Along with inconsistent findings, there is noticeable heterogeneity in measurements as well, perhaps not surprising given the scholarly consensus that CVC investments influence multiple aspects of corporate and venture performance. Table 1 and 2 also summarize the different outcome measurements that scholars have used to quantify the CVC effect and lists the representative studies that reveal bi-variate correlations in opposite directions. The detailed list of included empirical studies can be found in Appendix 1.

Table 1: Heterogeneous findings and measurements in CVC literature–Corporate side

Outcome Measurement	Positive Correlation	Negative Correlation	Performance Construct	
			First-order	Second-order
Investor JV, merger, or acquisition	Nahata & Mausulis, 2011; Dokko & Gaba, 2012; Wadhwa & Basu, 2013; Wadhwa & Kotha, 2016	Benson & Zeidonis, 2009	Corporate Product-Market Outcomes	Corporate Strategic Outcomes (strategic domain)
Investor alliance formation	Dushnitsky & Lavie, 2010; Gaba & Bhattacharya, 2012; Van de Vrande et al., 2013	Lorenzo & Van de Vrande, 2019		
Market power	Weber et al., 2016	Basu & Wadhwa, 2013; Chen et al., 2018		
Investor innovation (patent/new products)	Dushnitsky & Leonex, 2005a, 2005b; Keil et al., 2008; Fulghieri & Sevilir, 2009; Yang et al., 2009; Diestre & Rajagopalan, 2012; Ceccagnoli et al., 2018;	Wadhwa & Kotha, 2016; Belderbos et al., 2018**; Jeon, 2018;	Corporate Technological Outcomes	
Explorative learning	Schdilt et al., 2005*; Wadhwa & Basu, 2013; Lee et al, 2018;	Titus et al., 2017		
Exploitative learning	Lee et al, 2018	Titus et al., 2017		
Tech productivity		Anokhin et al., 2016		
R&D input	Schdilt et al, 2005; Dushnitsky & Lavie, 2010; Kim et al, 2011; Wadhwa & Basu, 2013	Van de Vrande et al., 2013; Yang et al., 2013; Anokhin et al., 2016; Kim et al., 2017; Titus et al., 2017;		

(Continued)

Revenue and Profitability	Schdilt et al, 2005; Kim et al, 2011; Anokhin et al., 2016; Gaba & Dokko, 2016	Wadhwa & Basu, 2013	Corporate Direct Financial Outcomes	Corporate Financial Outcomes (financial domain)
Investment success	Fulghieri & Sevilir, 2009; Tong & Li, 2011; Dokko & Gaba, 2012; Gaba & Dokko, 2016;	Guo et al., 2015		
Cash flow	Benson & Zeidonis, 2009; Dushnitsky & Lenox, 2005b	Allen & Hervert, 2007		
Liquidity (financial slack)	Ceccagnoli et al., 2018; Jeon, 2018	Dokko & Gaba, 2012; Gaba & Dokko, 2016; Belderbos et al., 2018; Chen et al., 2018	Corporate Longer-term Financial Value	
Tobin's Q	Dushnitsky & Lenox, 2005a; Titus & Anderson, 2016; Jeon, 2018;	Yang et al., 2013		
Growth potential	Tong & Li, 2011; Yang et al., 2014; Jeon, 2018	Titus & Anderson, 2018		
IRR	Hill & Birkinshaw, 2008	Allen & Hervert, 2007		

Notes: *Correlational effect size has been rounded as zero; **Correlational effect size shows a curvilinear relationship.

Table 2: Heterogeneous findings and measurements in CVC literature–Venture side

Outcome Measurement	Positive Correlation	Negative Correlation	Performance Construct	
			First-order	Second-order
Patent and new products	Chemmanur et al., 2014; Alvarez-Garrido & Dushnitsky, 2016; Ceccagnoli et al., 2018; Devarakonda & Reuer, 2019	Schdilt et al, 2005; Winston-Smith, 2009; Pahnke et al., 2015; Lorenzo & van de Vrande, 2019	Venture Technological Outcomes	Venture Outcomes (venture domain)
Tech Novelty	Balachandran, 2018	Lorenzo & Corredoira, 2018		
Technology Alliances	Dushnitsky & Lavie, 2010; Devarakonda & Reuer, 2019	Galloway et al., 2017		
IPO	Bottazzi et al, 2008; Park & Steensma, 2012, 2013; Balachandran, 2018	Yang et al., 2009	Venture Successful Exit	
Acquisition	Bottazzi et al, 2008	Dimitrova, 2013		
Successful exit	Dushnitsky & Shapira, 2010; Park & Steensma, 2013	Dai et al., 2012		
Survival	Park & Steensma, 2013	Hill & Birkinshaw, 2008; Arora & Nandkumar, 2011		
Revenue	Sahaym et al., 2016; Colombo & Shafi, 2016		Venture Financial Outcomes	
Profitability		Wang & Wan, 2013; Chemmanur et al., 2014		
Risk & sensitivity	Edward et al, 1991	Chemmanur et al., 2014; Galloway et al., 2017		
Valuation & Attraction	Yang et al., 2009; Wang & Wan, 2013; Sahaym et al., 2016; Chahine et al., 2019	Cumming, 2005; Hill & Birkinshaw, 2008		

As Table 1 and 2 demonstrate, the CVC literature spans a considerable array of performance measures, from learning and technological productivity to Tobin's Q (for the corporate investor) and from technological novelty to valuation and exit (for the startup venture). To bring some order to this welter of measures, I adopted an approach inspired by thematic coding (Strauss and Corbin, 1990), a procedure widely accepted in the grounded theory tradition of qualitative research. I first developed a set of first-order performance constructs to integrate measures that appear to "hang together". Thus, for example, I group outcome measures such as patents, learning and technology productivity into the first-order construct of Corporate Technological Outcome. In developing the seven first-order constructs laid out in Table 1 and 2, for corporate and venture sides respectively, I follow the guidelines of respecting convention, grouping by stakeholder, maintaining face validity and ensuring a sufficiency of primary studies in each grouping. I further aggregate the seven first-order constructs into three second-order performance constructs to facilitate meta-analytic synthesis within the key domains of corporate strategic performance, corporate financial performance and venture performance, as well as comparison across those domains. The aggregation logic in this step is "data reduction" by further abstracting the performance criteria. With respect to corporate investors, I cluster the various outcomes into strategic and financial domains–e.g., learning or cash flow, respectively. However, even within these domains, heterogeneity persists. In the strategic domain, for instance, prior studies have focused on two classes of outcomes-–some related to corporate product-market outcomes (e.g., acquisitions facilitated by CVC) and some related to technological outcomes (e.g., patents).

In the financial domain, prior studies have also focused on two classes of outcomes –some focusing on direct financial performance (e.g., revenue) and some on longer-term value (e.g., Tobin's Q). Such a view of CVC performance measures potentially allows one

to meta-analytically synthesize closely-related measures into meaningful performance constructs whose effect size can be investigated across studies. Thus, I divide corporate performance into four major constructs (Product-Market Outcome, Technological Outcome, Direct Financial Outcome and Longer-term Value) across the two domains (Strategic and Financial).

On the venture performance side, while heterogeneity persists, feasible categories are somewhat different because it is difficult to clearly delineate different types of objectives (Perry et al., 2012; Sarasvathy, 2001; Welter et al., 2016). Similar to the difference between a zygote and the complex organism it eventually gives rise to, the invested venture has much less differentiated performance outcomes as compared to the mature corporate investor with clear boundaries between strategic and financial objectives (and corresponding focused units -–e.g., R&D focused on patents and Marketing focused on revenue). Accordingly, I treat all venture performance constructs as reflecting a single domain, that of composite Venture Performance. Three clusters of venture performance constructs may be discerned in Table 1 and 2: Technological Outcome, Exit and Financial Outcome.

In the following pages, I first conceptualize the CVC effect as falling into performance constructs embedded in these three domains and then theorize the inter-relationships among domains. I explain how the inconsistent outcomes at least partly come from disparate mechanisms that underlie the effect of CVC investments in its distinctive aspects. I also predict differences in performance magnitude and interdependencies in structural correlation across these performance constructs.

2.2.3 Theoretical integration

Meta-analysis is conventionally undertaken as simply a quantitative summary of various underlying studies, and as such not necessarily demanding a theoretical orientation of its own. However, a recent promising development is the use of meta-analysis to advance theory. Combs et al. (2019, p.2) point out several ways in which meta-analysts can test and build new theory, including building new theory (e.g. Rauch et al., 2014; Vanneste et al., 2014), investigating conformity to complex systems of simultaneous predictions (Bergh et al., 2016; Jak, 2015), assessing competing predictions (e.g. Karam et al., 2019), and testing models that would be difficult to investigate in a single study (e.g. Carney et al., 2011). One example of meta-analytic theory testing is (Combs et al., 2006) use of strategic human resources management theory to explain across-studies performance outcomes resulting from high performance work practices. In this spirit, a call for papers for the meta-analysis special issue also emphasizes the need to "build and test new theory involving important phenomena involving opportunity- and advantage-seeking activities" (SEJ, 2019).

Accordingly, I undertake not only a quantitative summary of extant studies but also a theoretical integration by framing the expected effects across studies in light of a single unifying framework. The underlying studies present a variety of theoretical approaches: from little or no theory (as in many finance studies) to theories such as learning theory (Yang et al., 2009). I draw my unifying framework from resource dependence theory (RDT), which is especially appropriate for two reasons. One, to the best of my knowledge, RDT has not been employed so far in studying CVC. Two, given that CVC is a bilateral relationship involving the exchange of different types of resources, RDT appears to be the most general theory consistent with the specific features of the CVC context. The core proposition of RDT is that the organization's performance hinges on its capability to absorb critical resources

from the external environment, focusing attention on how interorganizational relationships help the organization to acquire such resources (Pfeffer and Salancik, 2003). In the CVC context, corporate investors seek innovation inputs from the startups, while the startups seek financial investment and complementary assets (e.g., market advice) for the CVC firm. This mutual dependence provides both sides with incentives to exchange critical resources and enhance performance. Further, the nature and level of dependency are not identical in all aspects, as startups and CVC firms have heterogenous capability to absorb technology and learning. Viewed thus, the RDT emphasis on resource exchange and evolving dependency subsumes themes such as learning and innovation that are key elements of the CVC story. Thus, RDT provides an appealing and novel theoretical framework for my purposes. In the next section, I summarize RDT and map it to CVC relationships.

2.3 Hypotheses

The RDT perspective explores how the formation of interorganizational relationships helps organizations acquire resources to reduce uncertainty (Drees and Heugens, 2013; Hillman et al., 2009; Pfeffer and Salancik, 2003). While CVC investment is a relatively nascent form of interorganizational relation, it fits in well with the RDT framework. CVC investments potentially enhance both members' performance by enabling them to overcome certain capability gaps. On the corporate side, they operate CVC investments to "fix the weaknesses" in their existing innovation capabilities (Ma, 2020, p.359); on the venture side, they depend on the corporate investor to overcome "the significant challenges" of developing complementary assets on their own (Park and Steensma, 2012, p.3) (Park and Steensma, 2012: 3). In other words, the dyad demonstrates bilateral dependency.

This mutual dependence provides both sides with incentives to exchange critical resources and enhance performance. The corporate investor depends on the venture to provide nascent technology, organizational renewal and growth opportunities. As a "window on technology" (Benson and Ziedonis, 2009), the invested venture reduces the investing corporation's resource constraint regarding limited access to nascent technology. Second, the dyad offers investing corporations with opportunities for boundary-spanning, which allows them to stimulate new demand, identify potential acquisition targets and provide access to foreign markets (Chesbrough, 2002; Dushnitsky and Lavie, 2010; Wadhwa et al., 2016). In addition, because of its innate optionality, the invested venture could help address the growth uncertainty faced by its corporate investor. On the other side of the dyad, studies have shown that via the CVC dyad, the venture expects to access critical resources including managerial expertise (Dushnitsky and Lenox, 2005a,b), legitimacy (Cumming et al., 2019), and specialized complementary assets (Alvarez-Garrido and Dushnitsky, 2016; Park and Steensma, 2012) to promote their product innovation and commercialization. The mutual dependence therefore enables both sides to acquire critical resources that are difficult to achieve from arm's length relationships with non-CVC collaborators. Below, I draw upon the RDT perspective to develop hypotheses related to CVC performance outcomes.

2.3.1 Baseline of CVC effects: The multifaceted performance outcomes

As depicted in the theoretical background section, the performance impact of CVC investment can be categorized into a set of interrelated yet different aspects. Resource availability and capability constraint also differ among these aspects. Therefore, I delve into each aspect and hypothesize how the CVC-startup dyad absorbs interdependence to heterogeneous degrees.

2.3.1.1 Corporate strategic domain

There is a general agreement in the literature that "firms mainly pursue such [CVC] investments for strategic reasons" (Dushnitsky and Lenox, 2005b, p.949), and that the two major strategic reasons are technological and product-market outcomes as I have categorized above. With respect to product-market outcomes, CVC investment enables access to critical external resources, the lack of which previously has constrained performance. First, it reduces external social, political and cultural constraints when the investing corporation taps into unfamiliar markets (Drover et al., 2017). Second, often holding seats in startups' board of directors (Chesbrough, 2002; Benson and Ziedonis, 2009), corporate investors are enabled to alleviate the constraint resulting from asymmetric information. For example, they could absorb dependencies on external information while identifying potential acquisition targets (Tong and Li, 2011). Third, CVC mostly invests in product markets that are related to its own products (Dushnitsky and Lavie, 2010). The CVC-startup relationship could cultivate demand for corporate products by removing their dependencies on complementary products.

Another critical aspect of resource provision contributes to corporate technological outcomes. The main constraint for corporate technological advancement is the innate lack of agility. Acting as a "window on technology" (Benson and Ziedonis, 2009), CVC investment enables constraint removal by gaining access to the venture's nascent technology. In addition, the equity relationship is characterized by a high level of new technology exploration that encourages greater resource commitment (Titus Jr et al., 2017). With such commitment, the openness between the investing corporation and venture is enhanced (Inkpen, 2000), which removes the constraints on inter-organizational knowledge transfer. Therefore, CVC investments are likely to enhance corporate technological outcomes by removing the constraints resulting from organizational inertia embedded in most established corporations.

It is also worth noting that achieving such constraint removal is not without challenges. First, the accessed knowledge might be nascent, inducing very high coordination costs in learning and leveraging it (Belderbos et al., 2018). Second, exploration is also associated with high risks that increase the uncertainty of innovation activities. However, while these obstacles might reduce the benefits that corporate technological performance benefits from CVC investment, they are unlikely to overturn the relationship, as they are internal to the corporate knowledge utilization processes without triggering new dependencies on external entities. Thus, I hypothesize that:

H1a. *CVC investments are positively related to corporate product-market outcomes.*

H1b. *CVC investments are positively related to corporate technological outcomes.*

2.3.1.2 Corporate financial domain

While the current literature predominantly addresses the strategic goals over financial goals (see Drover et al., 2017, for a review), there are still some studies that emphasize the salience of financial returns in a CVC relationship (e.g. Chesbrough, 2002; Hallen et al., 2014). Although the more recent literature tends to place the financial outcomes of CVC in a secondary position (Baldi et al., 2015; Dushnitsky and Lenox, 2006; Narayanan et al., 2009), early CVC studies have acknowledged the salience of financial returns (Rind, 1981; Sykes, 1986). There has been equivocality on whether the investors enjoy a superior financial performance as well. I propose that such inconsistency could be alleviated by differentiating corporate financial outcomes into short- to medium-term direct financial performance and longer-term (economic) value performance.

As elaborated above, CVC investments reduce dependencies on external technology or market access. With the corporate investors' high capability on technology commercializa-

tion, they could effectively turn the constraint absorption into enhanced financial performance. First, possessing a seat on the entrepreneurial board enables the corporate investor to reduce overpayments in subsequent transactions and influence the venture's decisions to be financially favorable to the investor (e.g., to accept a buyout). Second, corporate investors have substantial insight into the intended market and strong ties with lead users (Chesbrough, 2002). Their privileged knowledge of the industry can help to reduce the uncertainty associated with investment decisions. However, the innate characteristics of governing CVC also propose new constraints that inhibit the potential financial performance resulting from investments. Compared to conventional VC investors, corporate VC investors are constrained by competing objectives, inexperienced managers and inadequate compensation schema (Drover et al., 2017; Gompers et al., 2009; Meyer and Mathonet, 2005).

I expect that the relative dominance of the competing mechanisms differs in different time spans. While the absorbed technological superiority plays a dominant role in the short- to medium-term, it can be offset by newly triggered managerial constraints in the longer term. The technological life cycle has been widely accepted as showing an S-curve (Çetindamar et al., 2016). In the shorter term when the technology is in a "takeoff" phase, it promotes profits in an exponential way and therefore plays a dominant role in determining CVC financial returns. However, as the technology becomes mature, the potential profits start to stagnate or even to decline in the longer term (Haupt et al., 2007). Productivity growth, instead of physical capital accumulation per se, accounts for long-run economic growth (Jorgenson et al., 1995). The long-term value creation may therefore become less salient when the new technology fails to boost productivity continually. In addition, in emerging technology industries where CVC investments predominantly happen, there is an "era of ferment" (Anderson and Tushman, 1990) when existing technologies quickly become

obsolete. From the financial performance perspective, the positive effect of technological constraint absorption is likely to be gradually eroded by the negative effect of managerial constraint, with external environments drastically changing over time. Thus, I hypothesize that:

H2a. *CVC investments are positively related to corporate direct financial outcomes.*

H2b. *CVC investments are not related to corporate longer-term financial value.*

2.3.1.3 Venture domain

Apart from how CVC affects corporate performance, its impact on venture performance should also be taken into consideration. Different aspects of venture performance are distinctively affected by heterogeneous resources or constraints in the CVC relationship. I propose that ventures benefit in finance and successful exit resulting from removal of critical resource dependencies, but they are compromised technologically due to a lack of misappropriation defenses. CVC investments benefit invested ventures financially by reducing the ventures' dependencies on external environments while commercializing their entrepreneurial ideas. It provides specific complementary assets (Park and Steensma, 2012), such as critical customer access (e.g., beta sites), generic managerial expertise (Dushnitsky and Lenox, 2005b) and specialized industry networks (Alvarez-Garrido and Dushnitsky, 2016). These resources are constraining in arm's-length market relationships, but the equity relationship in CVC could absorb the dependencies that are otherwise critical in affecting the commercialization of venture products. In addition, the provided specialized complementary assets also bring critical external resources that facilitate ventures' successful exit (Park and Steensma, 2012). Highly respected and strongly networked investing corporations could signal the venture's legitimacy and quality (Cumming et al., 2019), which increases the venture's visibility to

potential acquirers.

However, despite benefitting ventures by removing their dependencies on complementary resources, the inter-organizational collaboration triggers a new constraint on potential technology misappropriation by corporate "sharks" (Katila et al., 2008). Without powerful defense mechanisms, invested ventures are constrained by their inability to prevent technology misappropriation during their collaboration with established corporations (De Clercq et al., 2006; Hallen et al., 2014). To attract CVC investors, ventures need to reveal their technological details, and such exposure increases the risk of knowledge leakage. Anecdotal evidence also suggests that some entrepreneurs worry about new constraints imposed by CVC, such as being unable to sell to rival ecosystems led by the corporate investor's competitors. Based on the above mechanisms corresponding to different performance outcomes, I hypothesize that:

H3a. *CVC investments are negatively related to venture technological outcomes.*

H3b. *CVC investments are positively related to successful venture exit.*

H3c. *CVC investments are positively related to venture financial outcomes.*

2.3.2 Comparison of CVC effects: The relative magnitude of each outcome

Along with aggregating outcomes from disparate measurements into meaningful aggregate performance constructs, a natural next step is to focus on relative magnitude. Unlike mergers, inter-organizational relationships such as CVC only function as partial constraint absorption, which has implications for their differential impact on each outcome.

2.3.2.1 Comparing corporate financial and strategic outcomes

Along with the dual focus in many CVC investments, the relative magnitude of returns in financial and strategic domains is still unclear. Especially given the fact that some strategic outcomes are long-term and hard to quantify (Gaba and Bhattacharya, 2012), it is not always feasible to directly compare the different types of investment returns. However, in a meta-analysis, the standardized effect sizes would allow me to obtain the magnitude of performance in different domains on a unified and comparable basis (Lipsey and Wilson, 2001).

Strategic performance has been regarded as the primary consideration for most CVC investments (Ceccagnoli et al., 2018; Dushnitsky and Lenox, 2005a,b; Gaba and Dokko, 2016), but this does not necessarily suggest a compromise on financial performance. In fact, among the handful of studies that tackle performance outcomes in both domains, the findings are equivocal. For example, Dushnitsky and Lenox (2006) emphasized that the structural deficiencies associated with CVC programs can erode financial gains. However, Hill and colleagues (2009) empirically found that the financial benefits from CVC investment are more pronounced than strategic returns. Although corporate financial and strategic outcomes are not mutually exclusive, I expect the latter will experience a higher degree of constraint absorption via three channels. First, the common measures for strategic performance, such as patents, are more proximate and directly linked as compared to financial returns. For example, the corporation's financial outcomes are dependent on a multitude of factors other than any learning from CVC, such as market conditions for current products. Second, CVC often syndicates with IVCs who exclusively focus on financial outcomes (Anokhin et al., 2011; Gaba and Dokko, 2016). In such syndications, financial dividends from the venture firm are shared with IVC investors, while the strategic gains are predominantly

enjoyed by the corporate investor. Third, financial returns are zero-sum. On the other hand, dependency absorption in strategic outcomes, which mainly include non-exclusive knowledge and information, allows the corporate and venture leaders to get more of the desired resources with less conflict.

Therefore, I hypothesize that:

H4a. *The correlation between CVC investments and corporate strategic performance is stronger than that between CVC investments and corporate financial performance.*

2.3.2.2 Comparing corporate and venture outcomes

Although CVC potentially absorbs constraints for both corporate and venture firms, the relative gains captured by each domain are still understudied in the current literature. I theorize about the underlying comparison from the perspective of mutual dependence absorption. On the one hand, the corporate investor relies on the new venture to provide resources on nascent technology, organizational renewal and growth potential. On the other hand, the new venture is dependent on the CVC's provision of managerial expertise, legitimacy and specific complementary assets. As the interdependency level is dynamic, the joint efforts become unstable once a partner has absorbed all critical resources (Hillman et al., 2009, p.1407). Each side's relative gain in CVC investment is dependent on how much dependency they have resolved and how quickly they can achieve the absorption.

Strategically, established corporations and entrepreneurial ventures have distinctive power advantages. Despite the relative benefits that new ventures obtain from technological turmoil and low entry barriers in nascent markets (Anderson and Tushman, 1990; Chen et al., 2017), I expect the invested ventures to be in a disadvantageous power position. During the dependence absorption process, while new ventures have difficulty in learning their investor's

complex organizational capabilities or assessing complementary assets (Pahnke et al., 2015), the knowledge transfer from venture to corporation is much easier (Argote and Ingram, 2000; Alvarez and Barney, 2001). In addition, to attract investors, new ventures have strong incentives to disclose their technological details (Alvarez and Barney, 2001), which further increases their corporate investors' dependence absorption efficiency and weakens the relative negotiation power of the ventures in CVC investments.

Financially, the demand for complementary assets cannot be determined ex-ante (Deken et al., 2018), so that the ventures' dependence on resource complementarity is not automatically relieved. Especially for new ventures that are characterized by high unpredictability and uncertainty, they may find it hard to effectively absorb corporate investors' complementary resources to achieve higher performance. Meanwhile, invested ventures are likely to lose operating control with corporate investors (De Clercq et al., 2006), which can further lead to a power imbalance that de-emphasizes the venture development and focuses on achieving corporate investors' return on investment. Therefore, I predict that:

H4b. *The correlation between CVC investments and corporate strategic performance is stronger than that between CVC investments and venture performance.*

H4c. *The correlation between CVC investments and corporate financial performance is stronger than that between CVC investments and venture performance.*

2.3.3 Manifestation of CVC effects: The interrelationship among performance

Apart from the question of how well CVC investments perform in different domains, an equally important question is how these performance outcomes are inter-related across domains. A final step in my endeavor to understand CVC performance is to assess those interrelationships. While corporate strategic outcomes have been widely regarded as the primary

focus for initiating CVC investment (Drover et al., 2017), I still have little knowledge on how corporate strategic returns are linked to other performance outcomes in CVC investments.

Following a temporal logic, I synthesize three mechanisms from the literature—learning, complementary assets, and investment—to theorize the transmission path of performance outcomes in CVC investments. Each of these mechanisms suggests a slightly different (although not mutually exclusive) path between outcomes in performance domains.

2.3.3.1 Learning mechanism

Although achieving superior strategic outcomes might motivate corporations to invest despite financial risk (Hill and Birkinshaw, 2008), learning benefits in the strategic domain could be salient enough to motivate CVC involvement. First, the capability to learn from invested ventures, i.e., the absorptive capacity of corporate investors (Benson and Ziedonis, 2009), contributes to an investor's financial revenue from CVC investments. The strength of externally generated knowledge and the ability to tap into valuable information indicate a high level of absorptive capacity, which improves corporate ability to drive growth and value (Zahra et al., 2009). Second, learning from CVC investments provides an advantageous position that could boost longer-term financial value. With their enhanced performance outcomes in either market or technology aspect of the strategic domain, corporations can leverage existing assets, capture investment opportunities and gain privileged access to specific deal flow (Hill and Birkinshaw, 2008; Park and Kim, 1997; Porter, 1980). The experience accumulated through the learning-by-doing process can also enhance corporate investors' valuation capability, which leads to better equity evaluation (Yang et al., 2009). I thus hypothesize that the benefits in corporate strategic outcomes will in turn enhance corporate financial gains from CVC investments:

H5a. *In CVC investments, there is a positive correlation between corporate strategic performance and corporate financial performance.*

2.3.3.2 Complementary asset mechanism

In terms of value manifestation from corporate strategic outcomes to venture outcomes, I focus on the provision of complementary assets from investing corporations. Early studies have shown that corporate acquired information can be leveraged into their invested venture (Burgelman, 1984; Galbraith, 1982; Rind, 1981; Siegel et al., 1988). More recently, corporate provision of specific complementary assets has been found to be particularly beneficial to new ventures (Park and Steensma, 2012). These specific complementary assets include corporations' superior knowledge of markets and technologies, reputation benefits, and better utilization of fuzzy information received from startups (Alvarez-Garrido and Dushnitsky, 2016; Chesbrough, 2002; Park and Steensma, 2012). When investing corporations have obtained a better understanding of the invested technologies and market, their expertise and infrastructure could accelerate the commercialization process and ultimately enhance performance in the venture domain. With investing corporations' innate industrial insights and relevant technology, the specific complementary assets provide ventures with benefits that cannot be accessed otherwise. Therefore, the venture domain would witness higher performance when corporate investors are better able to leverage the accessed information and technology in CVC investments. I also acknowledge that access to complementary assets does not come without costs. However, in general, I expect that the complementary assets provided by the corporate investors outweigh the potential cost, such that:

H5b. *In CVC investments, there is a positive correlation between corporate strategic performance and venture performance.*

2.3.3.3 Investment mechanism

Although incentives for engaging in CVC investment initially reside in the strategic domain, CVC by definition ultimately leads to performance outcomes in the financial domain. While influenced by corporate strategic performance, venture performance further determines corporate financial returns. Corporate investors receive financial returns through exit events such as initial public offerings and sale to third parties (Gompers et al., 2009). However, the returns that corporate firms obtain from high-performing entrepreneurial ventures are ambiguous in the current literature. Intuitively, the promoted venture performance outcome should boost corporate financial performance. However, the central role of strategic incentives could imply a lower financial expectation for corporate investors when the ventures have higher overall performance, demonstrating high strategic value.

First, there tends to be a price premium as corporate investors compete for better-performing ventures. CVC programs have long been criticized for overpricing their investments compared to those of IVCs (e.g. Benson and Ziedonis, 2009; Gompers et al., 2009). With the strategic outcome as the core goal of corporate investors, they may be willing to sacrifice some financial revenue to attract those ventures. Second, when the venture greatly benefits from its collaboration with CVC parent, it diminishes the interest of other potential acquirers. As CVC investors generally have strong incentives to support acquisitions of their portfolio ventures (Bottazzi et al., 2008; Masulis and Nahata, 2011), they may be willing to take a lower offered price even when it is not financially optimal. The frequent interactions within CVC investments adversely impact competitive bidding, resulting in a discounted price offered by potential acquirers of portfolio ventures. Third, high-performing ventures may create a nascent market that potentially disrupts corporate investors. At the technological frontier where corporate firms seek to nurture entrepreneurial ventures, intense

competition emerges as firms race to exploit new technologies (Anderson and Tushman, 1990; Chen et al., 2017). Taken together, the rationale of CVC investment indicates that corporate investors might be financially worse off when the venture shows higher performance.

Therefore, I propose the relationship within the final transmission path as:

H5c. *In CVC investments, there is a negative correlation between venture performance and corporate financial performance.*

2.4 Method

I collected relevant correlations from eligible studies to compute aggregated effect sizes on each performance construct. These aggregated effect sizes indicate the mean correlations for links between CVC investment and different performance constructs. I calculated the aggregated effect sizes for each performance construct and compared the relative magnitude of these bi-variate relationships. To test my hypotheses on the value manifestation path among distinctive performance domains, I constructed a MASEM model. MASEM has the advantage of being able to deal with higher level assessments with multiple permutations (Bergh et al., 2016), which is the appropriate method to conduct the meta-analytic path analysis. The details of the empirical methods are elaborated below. I also provide a Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) table in Appendix 2.

2.4.1 Study identification and sample

I identified empirical studies in the following manner. First, I searched for academic studies on a wide range of computerized databases and search engines, including *Wiley Online, JSTOR, ABI/INFORM, EBSCO*, and *Elsevier*. To tackle the potential "publication bias" (Rothstein et al., 2005), I searched databases of conference papers, online working papers (e.g., SSRN and NBER) and dissertations (e.g., *ProQuest Dissertation and Theses Global*). In the above searches, I used the following keywords to locate relevant studies: *corporate venture capital, CVC, CV unit, corporate venturing, portfolio, venture performance, corporate investment, equity*. Second, I examined each issue in top-tier management, entrepreneurship, finance and economics journals, as listed in *Financial Times Top 50 Journals Used in Business School Research*, from 2005 (the year when Dushnitsky and Lenox published their seminal article on CVC) to 2019. Third, I followed a two-way snowball method by manually backward-examining the reference lists of all identified articles from the first three steps and forward-tracing the articles that cited the original articles using Google Scholar. Finally, I applied the "ancestry" method (e.g. Lee et al., 2017) to trace reference lists in empirical studies, literature reviews (e.g. Narayanan et al., 2009) and previous meta-analyses on the venture capital (e.g. Rosenbusch et al., 2013).

The initial search yielded a set of 316 studies. Among them, 11 were excluded because of duplication resulting from the subsequent publication of working papers or dissertations. I further screened the remaining 305 studies and set the following inclusion criteria. First, the study must have reported a zero-order correlation (or other effect size that could be translated into a correlation) regarding one or more of the bi-variate relationships in my model. Second, the measure of CVC investment and outcome measurements should be in line with my foci of interest. It should be noted that as long as the measures are included

in the correlation matrix, meta-analysis does not require that CVC investment is the main research focus in an included study (e.g. Diestre and Rajagopalan, 2012). Third, I excluded studies that do not explicitly differentiate CVC from traditional VC or general corporate financing (e.g., internal venturing). Studies concerning corporate-entrepreneurial ties but without external equity investment (such as internal venturing or debt financing) were also excluded. The final sample contained 151 effect sizes from 68 studies covering 33,613 firms (corporate investors and invested ventures) over the time period 1969 to 2016. I provide a flow diagram of the study selection process in Figure 1.

2.4.2 Coding

After assembling the data set, I followed the widely accepted protocol by Lipsey and Wilson (2001) to extract information from each study, including effect sizes, types of performance constructs and sample sizes. The independent variable is the CVC investment. In studies where the sample is a combination of CVC and non-CVC involved firms (e.g., Park & Steensma, 2012; Alvarez-Garrido & Dushnitsky, 2016), I used the binary variable that indicates whether the sample firm engages in CVC investment; whereas in studies in which all observed firms are involved in CVC (e.g. Dushnitsky and Lenox, 2005b) I used the intensity of CVC investments as the independent variable. To capture the outcomes in each performance aspect, I used the measurements as shown in Table 1. For the variables that measure negative performance (e.g., risks and liquidation), I reverse-coded these correlations.

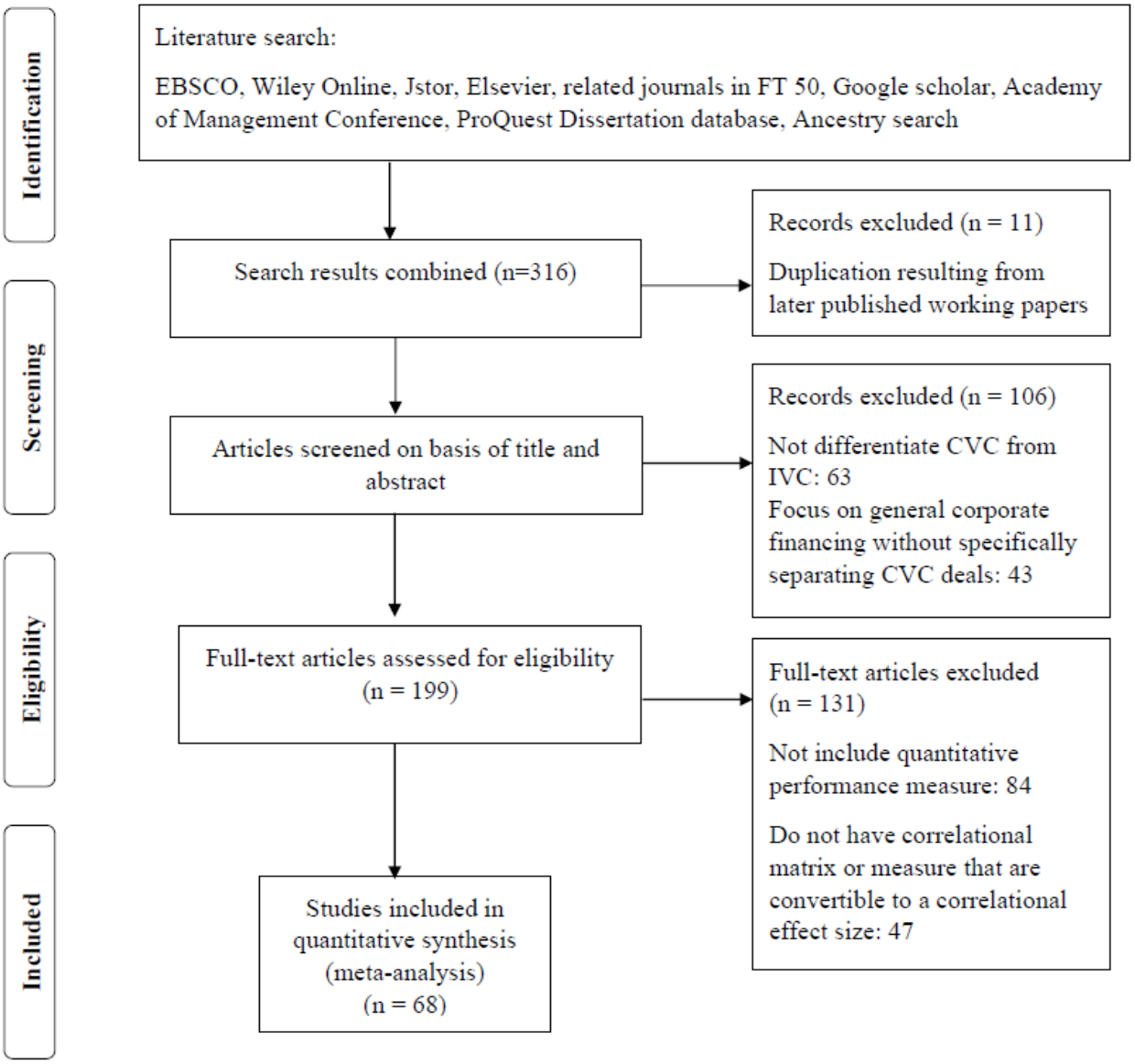

Figure 1: Flow diagram of study selection

Following common practice (Bergh et al., 2016; Lee et al., 2017; Samba et al., 2018), the coded effect sizes are based on the product-moment correlation of each study. I further collected the number of firms included in each study to weight the effect sizes during aggregation. In addition, the reliability level of the measurements was also coded when possible. I created a field for each of the first-order performance constructs as generalized in Table 1.

For studies that report correlations for more than one aspect, I separately put them into the respective fields (e.g. Hill et al., 2009). Meanwhile, I averaged the effect sizes if any study reported two or more correlations corresponding to a particular performance construct. For example, Kim (2014) had measures for both sales revenue and Return on Assets of investing firms. To reduce the concern of overlapping samples, for studies that selected samples on the same criteria—in terms of focal industry, geographic coverage, data source and sample period—I took the average of the correlations if they measured similar outcomes[1] (e.g. Dushnitsky and Lenox, 2005a,b; Park and Steensma, 2012, 2013).

After identifying eligible studies, with the assistance of two independent scholars, we each coded all the 68 included studies separately. The three separate coding results were then carefully cross-checked. The initial inter-rater consistency was 0.91, and all the discrepancies were resolved after discussion.

2.4.3 Meta-analytic procedures

First, I calculated the coded correlational effect sizes from each study in my sample. I transformed the sample correlation r using Fisher's z transformation, which provides a way to estimate the average of the sample correlation in an unbiased manner (Lipsey and Wilson, 2001). Although there is no absolute justification for preferring Fisher's z over the raw r in terms of estimation accuracy (Shadish and Haddock, 2009), the z-score follows a normal distribution and provides optimal weight with which to weight the correlations (Geyskens

[1]About 50 percent of studies used VentureXpert for at least part of their data. However, not all studies that use VentureXpert rely on the same sample, tending to diverge on one or more of three dimensions: focal industry, geographic coverage and sample period. There is no statistically significant difference between the results from samples based on VentrueXpert versus those from other sources, putting to rest concerns about single source bias.

et al., 2009)[2]. The weight used to compute the aggregate z value is n-3, where n represents the number of firms in each study. After standardization, I calculated the sample-size weighted mean correlation for each performance outcome.

Then, to delve into the inter-relationships among the three different domains, I calculated the conventional bi-variate mean correlations among CVC investments and each second-order performance construct, comparing the relative performance among these domains. Further, I integrated the bi-variate effect sizes into a correlation matrix and used it as the input for my path analysis with MASEM. Compared to traditional bi-variate analysis, MASEM is able to simultaneously include multiple factors and is advantageous in maximizing the external validity and integrating bi-variate relationships from different primary-level studies (Bergh et al., 2016; Shadish et al., 2002).

My MASEM procedure followed the guidelines provided by Bergh et al. (2016). As I did not encounter missing studies on any of the meta-analytic effects, I moved to calculate the sample size of MASEM. Each pair of variables has a different sample size to obtain the meta-analytically derived correlation, and I followed the tradition of preferring the harmonic mean (N=9,935) to compute the significance levels for the estimations (Bergh et al., 2016; Samba et al., 2018). For the studies that do not provide reliability information, I used a conservative reliability measure of 0.8 for the corresponding performance outcome (Jiang et al., 2012; Lee et al., 2017). However, I used 1.0 for measures on patents, new products

[2]The Fisher Z transformation possesses a variance-stabilizing property that is more efficient to approximate the variance. The variance of raw r is calculated as $(1-\rho^2)^2/(N-1)$, which needs to plug the sample correlation (r) to replace the population correlation (ρ), while the sampling variance associated with Fisher Z transformation does not depend on any unknown quantities. Therefore, especially for studies with small sample sizes, Fisher Z transformation relieves the concern that critical gaps between r and ρ could impose a bias on the estimated variance. However, the transformation is only unbiased when the magnitude of sample correlation r is not too high (with an absolute value smaller than 0.5). The z-score starts to deviate from the observed effect size once the correlation exceeds the range of $-0.5 < r < 0.5$. In this study, with many of the eligible studies having a small sample size and very few raw r greater than 0.5 (2 out of 151 coded effect sizes), I believe the Fisher's Z transformation should be preferred over the raw r. I also tested all hypotheses using raw r and found the results to be consistent.

and entrepreneurial exit because the majority of those data are verified by USPTO or SEC.

I selected the maximum likelihood[3] estimation approach and used AMOS 25 to conduct the corresponding analyses. Given the large sample size, the chi-square statistic may indicate a poor fit even with a low discrepancy between the hypothesized model and the empirically derived correlation matrix (Aguinis and Harden, 2009). I used some widely applied and recommended indices to examine the viability of my hypothesized model. Although the cutoff value for strong fit might be content-specific (Hu and Bentler, 1999), a general rule-of-thumb for a satisfactory model fit includes a *comparative fit index* (CFI) greater than 0.90, a *root-mean-square error of approximation* (RMSEA) less than or equal to 0.08, a *root-mean-square residual* (RMR) less than 0.10, and *goodness-of-fit index* (GFI) greater than 0.90 (Bergh et al., 2016; Jiang et al., 2012; Kline, 2015; Kirca et al., 2011).

2.5 Results

2.5.1 Analytical results

Table 3 presents bi-variate mean correlations and other descriptive statistics for the first-order performance constructs. First, the Q statistics show the heterogeneity level has been reduced significantly in my finer-grained performance aspects, compared to the one that aggregated all performance measure together. The salient decrease of Q statistics justifies my research motivation to understand the nuances within diverse performance outcomes of CVC investments. I return to this issue in the Discussion section.

Second, I find that CVC investments have a positive relationship with all aspects ex-

[3]I also tested the model based on generalized least squares estimates, and the results are consistent.

cept for the technological performance of the invested venture. Therefore, I have support for all hypotheses H1a-H3c except for H2b (which predicts that there is no effect on corporate longer-term financial value). However, despite its statistical significance, the mean population correlation for corporate longer-term financial value is very small—only about one-third of that for the direct financial outcomes, indicating a practical lack of substance. In addition, I can see the impacts of CVC investments varying across the different performance aspects. This again indicates the heterogeneous CVC effect on variables that tap into different performance constructs. The highest performance aspect corresponds to corporate product-market outcomes ($\hat{\rho} = 0.174, p < 0.001$), which is six times higher (in terms of the absolute value of mean population correlation) than the lowest aspect, which is venture technological performance ($\hat{\rho} = -0.028, p < 0.001$). Although the hypothesis for venture technological performance receives the weakest support in terms of its mean population correlation, I believe the practical implication is non-negligible. The venture technological performance is mostly measured by the number of new patents/citations, new products or technological alliance formation. Patents and technological products are likely to be the most valuable resource that ventures possess (Katila et al., 2008) and even a small change in its numbers could indicate very salient differences in the associated economic value. Likewise, the occurrence of technological alliances also represents significant value. The impact of merely one more (or less thereof) alliance could mean a lot to the venture. I also ran analysis using random-effects models and the results are consistent with the ones presented in Table 3.

Table 3: Baseline effects on different (first-order) performance constructs

	Q-stat	k	ρ	s.e.	95% C.I.
Aggregate	1326.8	151	0.099	0.012	[0.076, 0.122]
H1a. Corporate Product-Market Outcomes	120.53	11	0.174	0.018	[0.139, 0.210]
H1b. Corporate Technologic Outcomes	180.63	45	0.105	0.008	[0.090, 0.121]
H2a. Corporate Direct Financial Outcomes	111.22	32	0.117	0.010	[0.098, 0.136]
H2b. Corporate Financial Value	23.00	15	0.040	0.016	[0.008, 0.071]
H3a. Venture Technological Outcomes	342.55	22	-0.028	0.010	[-0.046, -0.010]
H3b. Venture Successful Exit	99.83	12	0.118	0.011	[0.097, 0.139]
H3c. Venture Financial Outcomes	217.74	14	0.159	0.012	[0.134, 0.183]

ρ: mean population (corrected) correlation; s.e: standard error; 95% C.I.: 95 percent confidence interval for ρ.

Table 4: Meta-analytic bivariate correlations for MASEM input

Meta-factor	1	2	3	4
1. CVC investment	1.00			
2. Corporate Strategic Performance		1.00		
ρ (s.e.)	0.116 (0.007)			
95% C.I.	[0.102, 0.130]			
k (N)	56 (20,320)			
3. Corporate Financial Performance			1.00	
ρ (s.e.)	0.096 (0.008)	0.188 (0.008)		
95% C.I.	[0.080, 0.113]	[0.173, 0.203]		
k (N)	47 (15,142)	49 (16,936)		
4. Venture Performance				1.00
ρ (s.e.)	0.062 (0.006)	0.152 (0.011)	-0.042 (0.018)	
95% C.I.	[0.051, 0.074]	[0.130, 0.174]	[-0.006, -0.077]	
k (N)	48 (25,738)	23 (7,999)	12 (3,079)	

ρ: mean population (corrected) correlation; s.e.: standard error; 95% C.I.: 95 percent confidence interval for ρ; k: number of effect sizes in computing ρ; N: sample size used in computing ρ.

To test my fourth and fifth sets of hypotheses, I integrated the mean population corre-

lations into the three major domains of corporate strategic performance, corporate financial performance, and venture performance. In Table 4, I provide the synthesized mean bi-variate correlation using classical methods. The information on confidence intervals and the number of studies included in each meta-analytic correlation are also provided in Table 4. In these bi-variate outcomes, all meta effect sizes have a 95 percent confidence interval that excludes zero. I then calculated Cohen's d value (Cohen, 2013) to indicate the standardized difference between group means in different domains' performance. First, using the aggregated performance outcomes in corporate strategic domain as the control group, the effect of their financial performance is 0.27 standard deviations lower. The direction of difference is consistent with the H4a, but it is not statistically significant. Thus, although corporate investors receive higher strategic performance compared to financial performance, the discrepancy is not significant. In addition, I tested the relative mean population correlation magnitude by setting venture performance as the benchmark. The Cohen's d statistics suggest that the corporate strategic and financial outcomes are 8.28 and 4.81 standard deviations higher than that for venture performance, respectively, evidence of significant and salient differences. The H4b and H4c are therefore supported.

Finally, I used the bi-variate correlations in Table 4 as the input for the subsequent MASEM analysis on the transmission path among outcomes in the three domains. Table 5 reports the estimation results. The direction and magnitude of MASEM estimates are consistent with the bi-variate analysis in classical models (as shown in Table 4), indicating that my results are robust across different models. For a more straightforward illustration of the MASEM results, the path model and corresponding MASEM estimates are shown in Figure 2. The results indicate that corporate strategic performance has a positive effect on corporate financial performance ($\hat{\beta} = 0.208, p < 0.001$), consistent with H5a that or-

ganizational learning in CVC investment is beneficial for boosting capital performance. In addition, corporate strategic performance is also found to be positively linked to venture performance ($\hat{\beta} = 0.158, p < 0.001$), which suggests less of a misappropriation concern compared to opportunities to obtain specific complementary assets. The estimation results also support H5c that high performance in the venture domain can actually harm the financial outcomes of corporate investors ($\hat{\beta} = -0.078, p < 0.0011$). My last set of hypotheses concerning the transmission path of CVC effects is thus supported. The chi-square is significant at $\chi^2 = 99.7$, which may be due to the large number of observations in MASEM (Bergh et al., 2016). Compared to a $\chi^2 = 474.4$ of the non-path model, my path model improves the model fit. Meanwhile, with RMR=0.027; GFI=0.995; CFI=0.905; AGFI=0.975; RMSEA=0.070, the fit indices are all acceptable in my path model (Bergh et al., 2016; Jiang et al., 2012; Samba et al., 2018).

Table 5: MASEM estimates of path model on the inter-relationship

	ρ	s.e.	95% C.I.
CVC Investment → Corporate Strategic Performance	0.116	0.010	[0.096, 0.136]
H5a. Corporate Strategic Performance → Corporate Financial Performance	0.208	0.009	[0.190, 0.226]
H5b. Corporate Strategic Performance → Venture Performance	0.158	0.009	[0.140, 0.176]
H5c. Venture Performance → Corporate Financial performance	-0.078	0.010	[-0.098, -0.058]

ρ: mean population (corrected) correlation, all the p-values here are smaller than 0.001; s.e: standard error; 95% C.I.: 95 percent confidence interval for ρ.

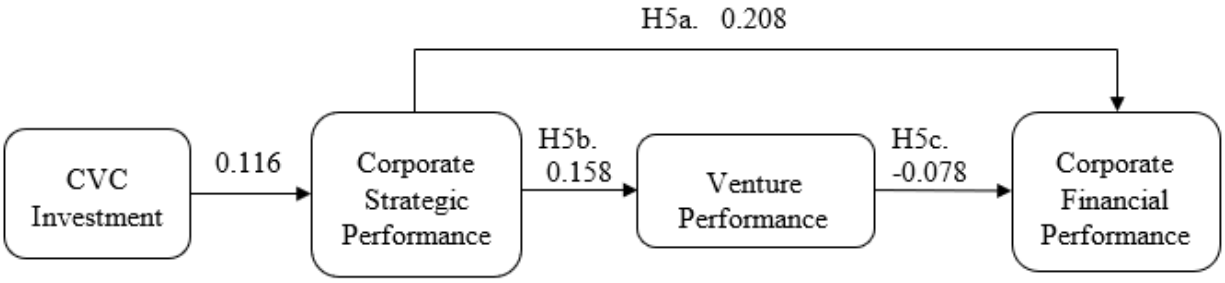

Figure 2: Transmission path model in MASEM

2.5.2 Robustness analyses

2.5.2.1 Alternative models

Results obtained in empirical studies have the implicit assumption that those are the best available estimates of focal effects. However, when there are methodological flaws (such as imperfect measurements), the estimated effect size is likely to be biased. For example, if there exists measurement error in one or both variables of interest, the observed correlation coefficients may be attenuated. Although I cannot trace the sources of endogeneity for each included study, a psychometric estimation approach can help estimate how much of the observed variance comes from measurement imperfections. Ideally, if one knows the measurement reliability values of the variables, they can easily calculate the magnitude of attenuation due to measurement error, and use it as the "artifact multiplier" to convert it back (Schmidt and Hunter, 2004). Unfortunately, the dataset does not contain those reliabilities, but I can illustrate the principle by generating some reasonable measurement reliability values. Comparing the results under the classical and psychometric approach, one could then determine how much of the observed variance is likely to come from the presumed measurement error level and see if the results would be radically changed by the

measurement error.

I followed the procedures in Hunter and Schmidt (2004) to calculate the psychometric effect sizes. The results with adjusted effect sizes are consistent with the findings reported above. Also, it is calculated that even under conservative reliability imputation, the potential artifacts of study designs account for less than 20 percent of the variance in effect sizes. This result lies below the 25 percent benchmark in variance decomposition (Hunter and Schmidt, 2004). It is also comparable to other meta-analyses in management research with artifact effect statistics ranging from 11 percent to 34 percent (Crook et al., 2008; Vanneste et al., 2014). Thus, it relieves the concern that the observed relationships merely result from diverse measurement approaches in included studies. Further, I undertook a two-stage SEM analysis following Jak (2015) to test fixed- and random-effects with the TSSEM setting; the results are consistent with the main results.

2.5.2.2 Sensitivity analysis for publication bias

Publication bias, also known as the "file drawer problem," is another issue to which meta-analysts should pay attention. As published studies may tend to report larger effect sizes than unpublished studies (Orlitzky et al., 2003), bias is present when the magnitude, direction, or significance of a study's results will affect the probability of the study's publication (Geyskens et al., 2009). I first compared the effect sizes on each performance dimension between published and unpublished studies in my sample and concluded that none of the comparisons showed systematic differences. I calculated the *fail-safe* N that estimates the number of unpublished studies with null results needed to reduce the cumulative effect size to non-significant or a specified criterion level (Orwin, 1983; Rosenthal, 1979). The results suggest that one needs 491 effect sizes that report the null effect to change the overall substantive

conclusion, and at least 55 effect sizes with a null effect to reduce the cumulative effect size to 0.05. I calculated *fail-safe* N for each performance domain and found that 417, 241 and 205 effect sizes with null effect are needed to overturn the significance for corporate strategic, corporate finance and venture performance respectively.

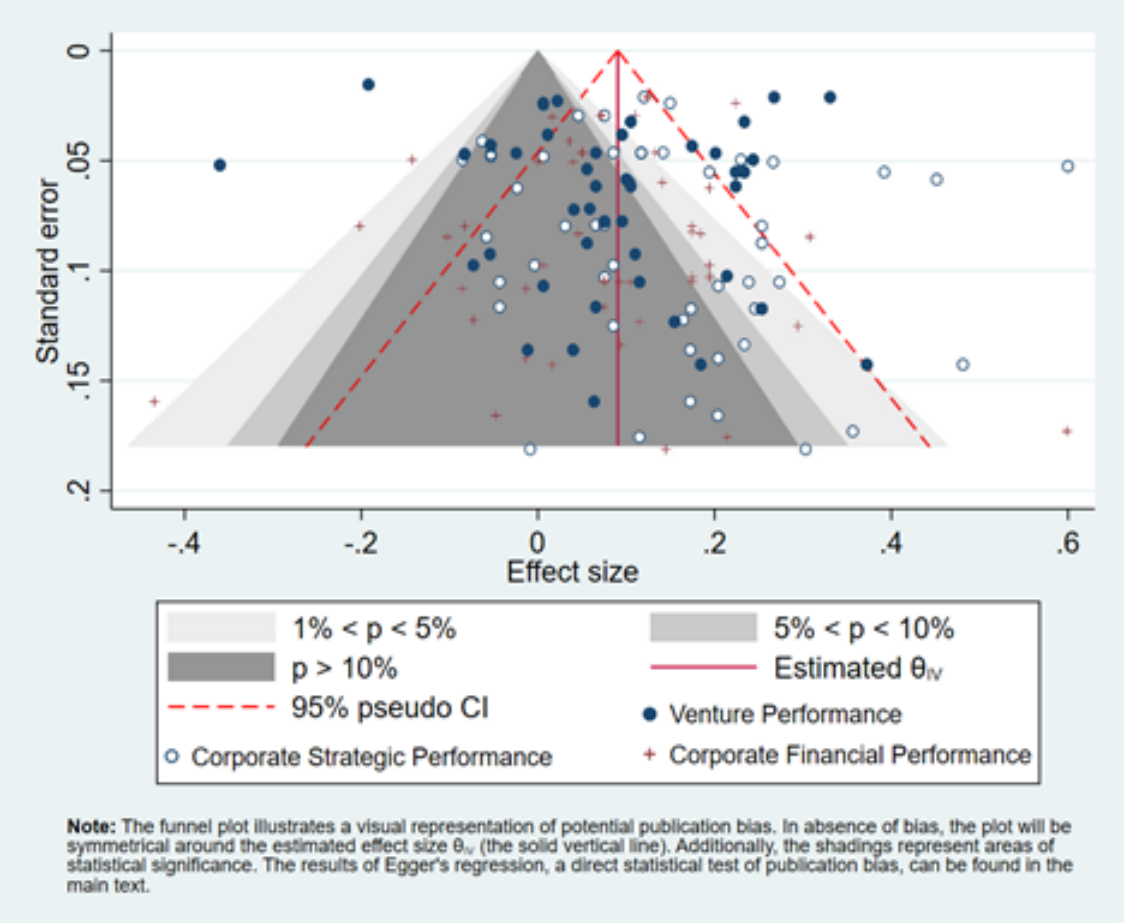

Figure 3: Contour-enhanced funnel plot of effect sizes (standardized)

Second, I present the contour-enhanced funnel plot for the coded effect sizes in Figure 3. In the absence of bias, the plot will resemble a symmetrical inverted funnel (Egger et al., 2008). A publication bias would be indicated if smaller studies (e.g., those with higher standard error) are missing in the non-significant regions of the overlaid contour-

zones. While the funnel plot represents an intuitive demonstration of potential publication bias, I also employ a direct test, i.e., Egger's regression (Egger et al., 1997). By regressing the standardized effect estimate (*effect/SE*) on a measure of precision (*1/SE*), a non-significant estimate would indicate a failure to detect publication bias. I separately regressed each type of performance measure in CVC and also tested the joint effect when I pooled all types of effect sizes together. None of the regressions show a significant result, suggesting that publication bias is not driving my results. Overall, the effect size comparison, fail-safe N analysis, the visual analysis and Egger's regression test combine to suggest that publication bias is not a serious threat to these results.

2.6 Discussion

In this study, I reported results from a quantitative synthesis of the CVC literature based on theorizing about CVC performance in its distinctive aspects. I found that in general CVC investments do enhance both strategic and financial performance for corporate investors, and the funded ventures benefit as well. My comparison indicated that corporate benefits are greater than venture benefits, but that the magnitudes of strategic and financial outcomes of corporate investors are qualitatively the same. I also examined how the outcomes manifest themselves along the value chain from corporate strategic performance to venture performance and then to corporate financial performance, showing that while CVC investments demonstrate a positive effect through the learning and complementary assets mechanisms, it imposes a negative influence through the investment mechanism. In this section, I outline the study's contributions to the field and its implications for future research.

2.6.1 Contributions

Beyond a quantitative summary, meta-analytic synthesis could also be a catalyst for re-evaluating established theories, developing new theory and surfacing measurement approaches appropriate to those new theories (Combs et al., 2006, 2011). In that spirit, I outline this study's contribution to the CVC literature in two broad pastures: to entrepreneurship research by enhancing scholarly understanding of CVC outcomes and then more broadly to corporate strategy.

2.6.1.1 Entrepreneurship

My contributions to the entrepreneurship field are threefold. First, I highlight a key constituent of entrepreneurial success by proposing a unified theoretical framework to explain heterogeneity in CVC investments. This meta-analysis also promotes measurement advances in understanding CVC outcomes. Quantitative syntheses illustrate the external validity of overall patterns (Hunter and Schmidt, 2004) by integrating similar measurements while mitigating unsystematic sampling errors to which single studies are prone. I utilize meta-analysis to highlight the performance nuances that are highlighted by information coming from different measurements. This approach of comparing the predictive value of different measurements has a long history of use in medical research (Critchley and Critchley, 1999) but is more recent in management (Carpenter et al., 2014).

Second, by highlighting the interdependence of performance dimensions, I point to the need for a more sophisticated conceptualization of CVC outcomes. While it is not surprising that CVC performance dimensions are interdependent, I contribute a more in-depth articulation on how dependence resolution is achieved through distinctive pathways and how the

interdependence absorption is heterogeneously manifested in each pathway. In addition, as various performance objectives may not align with each other, the dependence resolution in one aspect could complement or contradict performance outcomes from other objectives. My study takes a preliminary step to revealing the interrelationships across differentiated performance aspects while extant literature focuses on one performance aspect at a time. Additionally, my study also answers the call for explaining multiple performance outcomes in entrepreneurship literature (Shepherd et al., 2019).

Third, I contribute more broadly to the entrepreneurship field by shedding light on conflicting incentives implicit in entrepreneurial resource mobilization. Central to entrepreneurship is the resource mobilization process in which startups assemble financial, human, and social capital to execute on an opportunity (Clough et al., 2019; Florin et al., 2003). CVC offers not only financial capital, but also human capital through managerial expertise (Dushnitsky and Lenox, 2005b) and social capital including specialized industry networks (Alvarez-Garrido and Dushnitsky, 2016), customer access (e.g., beta sites), and legitimacy (Cumming et al., 2019). Yet, incentives are not necessarily aligned in this process, which is a common problem that entrepreneurs face (Sorenson and Stuart, 2008). I have pointed out several sources of friction when entrepreneurial firms (resource seeker) redeploy resources from corporate investor (resource holder) in the resource transfer stage. Indeed, such frictions may explain why the effect size on venture performance in my study is slightly smaller than the meta-correlation with IVC funding reported by Rosenbusch et al. (2013).

2.6.1.2 Corporate strategy

I believe this study also contributes to understanding corporate growth strategies through CVC investment. The scope of firms is a key component of corporate strategy (e.g. Bow-

man and Helfat, 2001), with the corporate boundary traditionally determined by M &A, divestiture and alliances. Drawing from corporate strategic objectives in CVC investment, I articulate how it serves as an additional tool to resolve established corporations' external dependence. I compared my results with meta-analyses that study the impact of other inter-organizational arrangements on corporate growth and/or revenue. These traditional corporate strategies have shown an average effect size of 0.02 for post-acquisition performance (King et al., 2004), 0.11 for divestiture performance (Lee and Madhavan, 2010) and 0.03 for non-equity-based alliance performance (Lee et al., 2017). Comparably, my synthesized effect sizes are 0.12 (for corporate strategic performance) and 0.10 (for corporate financial performance), reinforcing the significance of CVC investments as an additional corporate strategic move that extends firm boundaries.

2.6.1.3 Limitations

At this stage, I would also like to acknowledge a few limitations, most of which are inherent to meta-analytical designs. First, all meta-analysts face an "apples and oranges" problem, i.e., heterogeneity in measurement (Lipsey and Wilson, 2001). Specific to the case of this study, the comparisons of relative performance are based on aggregate effect sizes and should be interpreted as such. In other words, meta-analysis does not afford us a way to directly compare the performance dimensions per se but rather the magnitude of their correlations. Second, linking back to the Shepherd et al. (2019) categorization of the initiation, engagement and performing of entrepreneurial endeavors, my meta-analysis could only address the performing part by focusing on observable outcomes. The specific entrepreneurial objectives during initiation and engagement phases are more processual and beyond the reach of a meta-analysis. Third, the primary studies included in my analysis

demonstrate the dominance of VentureXpert as a data source in the field. While I am confident that this factor does not threaten my results because there is sufficient variation in industry, geography or time-frame (see related discussion in the Method section, Footnote 2), some included studies might still share common observations that I am unable to identify. Notwithstanding these limitations, the meta-analytic approach provides us with a bird's-eye-view of the mechanisms on which CVC effects rely. Further, my quantitative review has mapped out important future research avenues to throw light on nuances in CVC investments.

2.6.2 Implications for research and practice

2.6.2.1 Implications for research

I would like to point out four broad directions for future theoretical advancement. First, my synthesis of the distinctiveness and interrelationship among performance outcomes in CVC investment raises the need for further exploration. For example, the MASEM path analysis shows how value is manifested along different stages in the CVC investment chain, but it only captures correlational relationships and is unable to reveal causality (Cheung and Chan, 2005). I encourage future research to explicate the causal mechanisms underlying different performance aspects, such as how technological and venture outcomes lead to financial returns. Qualitative inquiry into how entrepreneurs and CVC managers view their own and their counterparts' actions as relating to the different outcomes may be a useful starting point. This endeavor could be even more valuable if it is coupled with new quantitative data, such as perceptual data, from alternate sources other than VentureXpert. Another related direction is to explore the interactions between CVC investment and other inter-firm relationships in achieving interdependence absorption. CVC investments often occur

simultaneously with other corporate moves such as acquisitions, alliances, or other sources of risk capital (e.g., IVC). It is important to further understand how the coexistence of other inter-organizational designs enhances or substitutes the motivation and effectiveness to utilize CVC investments in absorbing resource dependence.

Second, my systematic review has surfaced theoretical gaps in CVC research. My study utilizes the powerful resource dependence lens to explain performance outcomes in CVC investments, but the literature so far has been silent on how these interdependencies evolve over time during the investment process. Similar to IVC investments, corporate investors make incremental commitments to new ventures in sequential stages (e.g., Seed, Series A, Series B, etc.). Their motivation to absorb interdependence via CVC investment is therefore not static but periodically re-evaluated. This presents an opportunity to take the time dimension into consideration. Additionally, the importance of non-market strategy has been well established in corporate strategy (Mellahi et al., 2016), but the CVC field is still blank on the roles that non-market incentives play. Social responsibility and political activities both affect corporations' dependence on external resources (Sutton et al., 2021; Tang et al., 2015). It is worth scholarly attention to understand how non-market strategy affects decision making and performance outcomes of CVC investment.

Third, my findings imply significant opportunities for entrepreneurship research, especially in the domain of entrepreneurial resource mobilization. Particular to the venture side, the entrepreneurship literature has focused on how to ensure the benefit of resource mobilization in the search, access, and transfer phases (see Clough et al., 2019, for a review). However, my finding on the negative impact on venture technological performance implies that resource mobilization through CVC funding is not without cost. I call for attention to the "dark" side of entrepreneurial resource mobilization, which emphasizes the tradeoffs be-

tween conflicting motivations. For example, entrepreneurship scholars could further theorize how new ventures evaluate the relative importance of different motivations as they mobilize capital from corporate investors, and how they minimize the cost paid for such resource mobilization. Meanwhile, in the external financing process of new ventures, misalignment of incentives commonly exists (Sorenson and Stuart, 2008). It may be fruitful to explore how social structure becomes a substitute for legal controls to forestall opportunistic behaviors in CVC investments when contracts are hard to monitor. Corporate strategy scholars have theorized how ad hoc familiarity changes investor behavior (Guler, 2007), but much remains unknown about how trust and interfirm familiarity shape venture behavior in interaction with the corporate investor.

Fourth, my unpacking of CVC performance dimensions may have implications more broadly for management scholars as they think about the performance construct. Strategy and entrepreneurship research has come full circle from early divergent conceptualizations to more coherent constructs as the field evolved, and now back to an embrace of the multi-dimensionality of performance (e.g. Combs et al., 2006) — consider the appeal of constructs such as the Triple Bottom Line and shared value as well as scholarly interest in environmental performance and in social legitimacy constructs such as "earning the license to operate." A logical next step would be to apply this unpacking to more types of performance in more contexts, and more important, to methodically explore the interrelationships between performance dimensions in each context.

2.6.2.2 Implications for practice

I would also like to suggest briefly that the findings hint at practical implications for entrepreneurs and CVC managers. At its core, my findings suggest that CVC investments

operate in a nuanced performance landscape with likely hidden tradeoffs. An appreciation for such tradeoffs and interdependencies will help both parties become more adept in guarding their own self-interest as well as to structure better, more productive, partnerships.

2.6.3 Conclusion

Consistent with the goals of the Special Issue, my meta-analysis contributes a quantitative synthesis of the performance outcomes and value creation pathways in CVC. The accompanying logic promises to add further theoretical nuance and depth to the CVC literature, including insights into how such investment ties operate in the context of asymmetric partner incentives and performance goals. Addressing a topic at the intersection of corporate strategy and entrepreneurship, I hope that this study spurs a productive conversation about the complementarities and conflicts inherent in CVC.

3.0 Drivers of Investment Termination in Corporate Venture Capital

3.1 Introduction

In the innovation economy of the 21st century, Corporate Venture Capital (CVC) has become an important investment vehicle for established corporations as well as a key avenue for entrepreneurial ventures to access critical resources, such as nascent technology or specialized industry knowledge respectively (Alvarez-Garrido and Dushnitsky, 2016; Benson and Ziedonis, 2009; Park and Steensma, 2012). CVC is now the second largest source of global entrepreneurial financing, reaching an annual investment volume of over USD 73.1 billion in 2020, a 24 percent increase from the previous year despite the pandemic lockdowns (CB insights, 2020). Scholarly research has paid close attention to the processes and performance outcomes of CVC investments. Unlike independent venture capital (IVC), the CVC-venture seeks the dual objectives of strategic and financial returns (Drover et al., 2017; Dushnitsky and Lenox, 2005a,b), often with the primary pursuit of technology advancement (Benson and Ziedonis, 2009; Ceccagnoli et al., 2018). In addition to the incentives of tie-formation, CVC scholars have also depicted the multifaceted influences that this interfirm relationship has on both corporate and venture performance, for example, access to nascent technology (Alvarez-Garrido and Dushnitsky, 2016; Belderbos et al., 2018; Titus Jr et al., 2017), reduced uncertainty in unfamiliar markets (Drover et al., 2017; Tong and Li, 2011), and the provision of complementary assets (Cumming et al., 2019; Park and Steensma, 2012, 2013). On the basis of these prior studies, more recent studies have examined the interrelationship among various types of performance outcomes in CVC investment process (Huang and Madhavan, 2020) and the financial impact on ventures after the breakup of investment ties (Shafi et al.,

2020).

However, while extant CVC research has well studied the ex-ante considerations for tie formation and ex-post consequences of established ties (or a lack thereof), an equally important yet overlooked aspect is what happens between the formation and premature termination of corporate-venture ties. As CVC investment is a dynamic process that evolves over time (Ma, 2020), it is essential to ask what determines the intertemporal stability of an established tie. The traditional intertemporal perspective in economics addresses decisions in which "the timing of costs and benefits are spread out over time" (Loewenstein and Thaler, 1989). I use the term intertemporal more broadly to refer to how decisions at various points in time cross-influence each other, which brings into focus not only economic tradeoffs (e.g., short-term versus long-term benefits) but also interlinkages (e.g., how today's decision might constrain future decisions) and what changes between sequential decisions (e.g., how key considerations have evolved since a previous decision). Conventional venture capital studies (e.g., IVC) have portrayed investment termination as the intertemporal control of downside financial losses (Guler, 2007; Li and Chi, 2013). However, CVC additionally incorporates strategic considerations that prioritize the pursuit of technology advancements over financial returns, rendering generic VC termination studies insufficient to explain the intertemporal decision toward breakup of CVC-venture tie. Therefore, focusing on the dynamic changes of corporate technology in CVC investment process, I specifically ask: *after the CVC-venture tie formation, how does corporate achieved technological advancement influence the intertemporal decision toward termination of the dyadic relationship?*

To address this question, I start by highlighting the importance of an intertemporal perspective that emphasizes the ongoing process wherein organizations make a series of decisions that are interdependent across time. There are three mechanisms that potentially frame the

dynamic process of intertemporal choice, which correspond to different roles that time plays. First, classic economic and finance models emphasize that decision makers make tradeoffs between present and future when their decisions have consequences that play out over time (Loewenstein and Thaler, 1989; Vasudeva et al., 2020). Time functions as a discounting factor that facilitates the comparison of the net present value of different alternatives. Intertemporal decision making is therefore believed to be based on integrated information about the reward, uncertainty, and timing of each alternative (Leiblein et al., 2018; Li, 2008; Reeck et al., 2017; Scholten and Read, 2006, 2014). Second, the intertemporal sequence could also represent how today's decision may constrain or otherwise influence tomorrow's decision, as illustrated by path dependency and escalation of commitment over time (Guler, 2007; Podolny, 2010). Institutional forces, such as isomorphic pressure (Baker et al., 1998), are another source of constraint on future decisions. In both perspectives, economic value determines the optimal choice for intertemporal tradeoff and a tie-breakup implies a correction of a previous ineffective decision . However, from an organizational (as against economic) perspective, power could also shape and guide the stability of interorganizational ties absent any sort of financial failure (Baker et al., 1998; Cui et al., 2011; Hamel, 1991). Following calls by strategy scholars for understanding the role of learning in temporal interdependence (Leiblein et al., 2018), I propose a third mechanism in intertemporal decision making where the desirability of interfirm ties is affected by power dynamics associated with achieved learning. Rather than functioning as a discounting factor or a rigidity force, the importance of time is manifested in the evolution of power balance between two time points.

This evolution of intertemporal choice is especially important in the CVC context where the corporate investors often prioritize the strategic objective of accumulating technology and make sequential investment decisions in multiple rounds (such as Seed, Series A, Series

B, etc.). On the one hand, similar to other equity investments, corporate investors have the right to periodically reevaluate whether to terminate or continue a focal investment at the beginning of each round. Such multi-round investment design allows corporate investors to intertemporally update their beliefs and (at least partially) reverse previous commitments. On the other hand, unlike the mere pursuit of financial return in IVC where "the project does not generate intermediate payoffs until the investment is complete" (Guler, 2007, p.251), the strategic return concerning technological achievement can be achieved along the investment process. The achieved technological advancement can alter the intrinsic value of CVC-venture partnership over time, regardless of the evaluation of the venture's potential. Therefore, the mechanisms that drive CVC intertemporal decision making could go beyond extant studies that interpret termination as a reflection of failed partnerships.

As the evolutionary aspect of intertemporal decision making emphasizes the power dynamics of interfirm relationships, I draw on resource dependence theory (RDT) to understand the influence of achieved technological advancement on CVC investment termination. Empirical evidence has shown that the goal of CVC investment is more about "fixing the weaknesses" rather than "building on strength" (Ma, 2020, p.359). According to RDT, such internal weaknesses indicate a reliance on other players in the external environment (Pfeffer and Salancik, 2003). The focal corporation possesses the motivation to create and sustain interorganizational relationships, such as CVC-venture dyads, to absorb constraints and remove such dependency (Hillman et al., 2009; Pfeffer and Salancik, 2003; Rondinelli and London, 2003). Research has shown that both corporate investor and invested venture establish the equity tie to mitigate interdependence regarding innovation inputs (Hallen et al., 2014). However, the interdependency can evolve over time, "as one partner accumulates key resources from the other, the joint effort [of interorganizational coalition] becomes

less stable" (Hillman et al., 2009, p.1407). The achieved technological advancement, manifested in newly granted patents, reflects an intertemporal evolution of corporate investor's dependency on the venture's resources. I theorize that the corporate investor's achieved technological advancement leads to a higher likelihood of terminating the existing investment dyad by cumulatively reducing mutual dependence and increasing power imbalance between the partners. I also propose that the impact of dependency resolution is moderated by the level of corporate investor's overall dependence on the invested venture. I theorize how factors in invested venture, corporate investor and dyadic level respectively alter such dependence level. In particular, I suggest that the scope of corporate technological exploration reduces the overall dependence while the venture's innovation capability and product market similarity enhance the dependence. To test my hypotheses, I construct a sample of U.S. CVC investments at the CVC-venture dyadic level by integrating investment and patent data from VentureXpert, Crunchbase, and USPTO. Event history analysis is used to model the intertemporal evolution of the CVC-venture ties.

Based on the Makadok et al. (2018) taxonomy of theoretical contribution, I claim my contribution to both CVC and RDT literature by introducing a new causal mechanism and applying existing theory to a new phenomenon respectively. From the CVC perspective, I contribute to an understanding of investment termination, a critical yet overlooked part of the CVC investment life cycle. Going beyond the current literature depicting venture capital termination as determined by venture financial potential, I focus on the technology aspect and explain how corporate internalization considerations drive the termination decision. In addition, I also extend the applicable scope of resource dependency theory by theorizing how the resolution of resource constraint drives corporate investors' termination decision. RDT has been widely applied to conventional forms of interfirm collaboration such as M&A or

joint ventures (JV). My research extends the power of RDT to the more nascent but growing CVC field.

The rest of this chapter unfolds as follows. I provide a brief overview of extant research on VC investment termination and introduce the key features of CVC investment termination. Based on CVC characteristics and the RDT framework, I develop hypotheses regarding how the achieved technological advancement drives the termination decision, along with contingencies from venture, corporate and dyadic characteristics. I then describe my sample data, empirical measures and analytical approach. I conclude by discussing theoretical and practical implications.

3.2 Theory

In equity investments, investors typically adopt flexible funding policies to accommodate the inherent uncertainty and information asymmetry. Instead of a one-shot resource commitment, investment decisions of venture capitalists can be seen as an intertemporal process—in which an investor sequentially funds a project in multiple rounds (e.g., Seed, Series A, Series B, etc.) of financing (Dixit et al., 1994; Guler, 2007). Time plays an important role in such intertemporal process, which contrasts with theories of economic transaction (Baker et al., 1998; Williamson, 1991). At each new round, the venture receives an updated valuation, based on which existing investors may choose to exit and new investors may enter. The sequential model provides investors with chances to periodically reevaluate the prospects for the established investment, enabling them to discontinue undesirable investments, thus releasing resources for seizing new opportunities in a timely manner (Fulghieri and Sevilir, 2009; Jovanovic and Szentes, 2013; O'Connor et al., 2008; Tellis et al., 2009; Tian, 2011).

Via intertemporal decision making, equity investors successively acquire new information to update their beliefs about potential returns and decide whether to dissolute the focal investment tie. While the establishment of CVC investment is based on a two-sided mutual selection (cites), the longevity of the dyadic tie is predominantly determined by the investors' decisions (Zhelyazkov and Gulati, 2016). To protect investors, it is a general norm for equity investment deals to include a "right of first refusal" term sheet in the contract, meaning that an existing investor has the right to participate in future rounds as long as it so desires.

As the evaluation of focal interfirm relationship shifts over time, different stages of tie evolution is of paramount importance to understand CVC investment process. Extant literature on CVC has depicted the antecedents of tie formation (Drover et al., 2017). For example, based upon varying intensity of intellectual property protection, Dushnitsky and Shaver (2009) conceptualized the ventures' heterogenous attitudes toward forming relationship with corporate investor within the same industry. Likewise, Hallen et al. (2014) theorized how social defenses alleviate the misappropriation concerns in the establishment of CVC-venture coalition. More recently, scholars have started to examine the consequences of tie dissolution for both equity investors (Zhelyazkov and Gulati, 2016) and invested ventures (Shafi et al., 2020). Despite the fruitful research on pre-formation and post-termination stages in an investment life cycle, the dynamic process in between—how an existing CVC-venture tie evolute from its initial establishment to premature dissolution—remains overlooked. There are few studies tackling the antecedents of tie dissolution in generic venture capitalists, which premises on the expectation of financial returns. These financial driven venture capitalists terminate existing investment ties when faced with inclining uncertainty (Li and Chi, 2013), although socio-cognitive biases may escalate commitments despite an anticipated weak performance (Devigne et al., 2016; Guler, 2007). Nonetheless, these studies cannot

fully delineate the pathway to CVC tie dissolution because corporate investors possess dual objectives in pursuing both strategic and financial returns. Possessing a primary goal to exploit external innovative inputs (Dushnitsky and Lenox, 2005b), such strategic objective can provide additive evaluation criteria that fundamentally differ from financial rationales. With the corporate investors' deterministic power in terminating an investment tie and the inadequate studies on the role of strategic objectives in driving such termination, I theorize how power dynamics serve to explain the evolution process toward premature tie dissolution. In the following sections, I first focus on potential mechanisms that affect tie dissolution in intertemporal decisions. Depicting nuances between pursuing strategic and financial objectives, I then articulate how corporate achievements of strategic objective affect the pathway toward tie dissolution via altering power dynamics.

3.2.1 Intertemporal evolution toward tie dissolution

In the broad array of interfirm relationships, intertemporal process in tie continuity and dissolution is influenced by competition, power and institutional forces (Baker et al., 1998). Competition speaks to market forces where classic economic theories are applied to examine the rules by rivalry intensity and market structure (Schmalensee, 1981). The effect of product market competition can be manifested in agency costs and market uncertainty that govern the intertemporal usage of "exit option" (Fligstein, 1996). For power forces, they are rooted in resource dependence that counts on the ratio of resources given to recourses received in interorganizational exchanges (Cook, 1977). The stability of interfirm relationships is a dynamic reflection of interdependency level (Hillman et al., 2009; Pfeffer, 1987). Finally, institutional force refers to factors that impact isomorphic pressures to conform prevailing norms (DiMaggio and Powell 1983). In emphasizes the roles of network ties and social

embeddedness that determine the pressure of conformity. Among the three types of forces, market competition and bidder's power are expected to increase the risk of tie dissolution over time, while institutional force serves as a stabilizer that decreases dissolution risk (Baker et al., 1998).

Extant studies on intertemporal hazard of tie dissolution have concentrated on the dynamism of market and institutional forces. In the trajectory of market competition, the hazard of tie dissolution follows an economic pathway in which the focus is expected survival and profitability under interfirm and/or market rivalries. It is most adaptable to understand IVC investments where the dynamism of market landscape and capital returns are of paramount interest. For example, Li and Chi (2013) has conceptualized the role of venture capital portfolio configuration, which reflects the duplicity of investments and alters the option value of withdraw, on subsequent withdraw from existing projects. Relatedly, the entrepreneurial ventures are thus advised to design the contract in ways that prevent investors' opportunistic withdraw resulting from adverse selection and moral hazard in a competitive market (Andrieu and Groh, 2021). Beyond the traditional VC context, competition-based framework has also been applied to explicate alliance tie dissolution (Asgari et al., 2018; Greve et al., 2013). From the standpoint of institutional force, extant studies have depicted how general isomorphic pressure and social embeddedness alter the stability of interfirm ties (Bermiss and Greenbaum, 2016; Heidl et al., 2014; Uribe et al., 2020). The intertemporal choices between continuity and dissolution hinges on institutional isomorphism such as the pressures imposed by syndication partner (Devigne et al., 2016) and the need of conformity (Guler, 2007). Such perspective is mostly adopted to make sense of intertemporal evolution among alliance partners where the network effect is a key determinant to tie stability (Heidl et al., 2014; Garcia-Pont and Nohria, 2002; Polidoro Jr et al., 2011, e.g.,).

Apart from the fruitful studies on competition and institutional forces, the organizational force from power lenses is an equally important but less studied factor in current understanding of intertemporal tie dissolution. While power and resource dependence potentially function as an alternative logic that shapes the evolution of interorganizational ties (Bermiss and Greenbaum, 2016), examination on their intertemporal mechanism and boundary conditions remain scant. In the power dynamics of (dis)stabilizing existing interfirm ties, the motivation to exchange resources hinges on the magnitude and symmetry of resource dependencies (Casciaro and Piskorski, 2005). Intertemporal changes in these two dimensions affect the corporate investor's evaluation of continually benefiting from the existing tie, altering its tradeoff toward sustaining or dissoluting the focal investment tie in subsequent rounds. Mutual dependence is a core dimension of the dyadic power, which captures the existence of bilateral dependencies in the dyad. While the mutual dependence has not been absorbed, the involved organizations (i.e., corporate investor and invested venture in the CVC context) would be motivated to maintain the existing interorganizational tie and guarantee the continuation of the flow of critical resources. Power imbalance is the other force that affects the stability of interfirm relationship. In a bilateral interorganizational tie, the accumulation of power dominance would trigger reluctance to maintain resource exchanges with the power disadvantaged side. I propose that such power lens is suitable for the evolution of CVC ties where the power is unbalanced between involving firms and non-fungible strategic resource absorption is the ultimate objective.

3.2.2 Intertemporal power dynamism and corporate strategic objectives

Although CVC investment is a relatively nascent form of interorganizational arrangement, it constitute an attractive context to study the role of power dynamics in tie dissolu-

tion. Unlike conventional VC that premises solely on economic exchanges, CVC additionally possesses strategic objective to facilitate its innovation by accessing external information from the invested venture (Drover et al., 2017; Dushnitsky and Lenox, 2005a,b). Such strategic objective grants interdependency between corporate investor and invested venture. Both the participating organizations in CVC coalition depend on the interorganizational relation so formed to compensate for their lack of a respective capability, such as mitigating the interdependence for innovation inputs (Hallen et al., 2014). On the corporate side, they operate CVC investments to "fix the weaknesses" in their innovation capabilities (Ma, 2020, p.358); on the venture side, they depend on the corporate investors to overcome "the significant challenges" of developing complementary assets on their own (Park and Steensma, 2012, p.3). To manage the constraint imposed by investing corporation's limited knowledge in nascent fields, CVC could be leveraged as an effective corporate tool to absorb external technology and facilitate its own innovation. Compared to interfirm relationship in IVC that more resembles a principle-agent tie (Gompers, 1995; Bergemann and Hege, 1998; Cumming and Johan, 2008, 2010), the strategic interdependencies in CVC make power dynamics an additional force that affects the evolution of interfirm ties over time.

Among the strategic objectives that motivates the formation of CVC investment ties, a critical one is tapping into external information sources and the know-how to promote innovation (Benson and Ziedonis, 2009). Several fundamental differences exist between pursuing monetary return and technology advancement, which differentiate CVC from IVC in the evolution of intertemporal investment ties. While IVC largely follow economic theories (e.g., real option) to frame the during investment process, it is insufficient to explain the evolution of strategic interdependencies in CVC context. First, for the economic returns, the venture "does not generate intermediate payoffs until the investment is complete" (Guler, 2007,

p.251). The VC investors therefore has a strong tendency to sustain the investment ties until the final liquidation (via acquisition or IPO) of the venture (Dixit et al., 1994; Tellis et al., 2009; Tian, 2011). Strategic return that aims at technology advancement, on the contrary, can be achieved anytime along the investment process. The motivation to maintain the inter-firm relationship could fade away once the desired resource has been internalized (Cui et al., 2011; Hamel, 1991), Second, in the periodical revaluation of economic returns, the decisions are based on the dynamic balance of prospects and uncertainty (Cumming and Johan, 2008, 2010; Guler, 2007; Li and Chi, 2013; Sahlman, 1990). Along the investment process for these financial-focused ties, key determinants that influence intertemporal stability, such as competition intensity, market condition, institutional protection and emotional attachments (Devigne et al., 2016; Guler, 2007; Li, 2008; Zheng and Xia, 2018), are all directly linked to the intrinsic value of the investee. The effect of shifting technological capability, however, speaks more toward the changing demand of the investor. Such strategic objective can be independent of the venture characteristics and count on the opportunities that enhance the investing corporation's power in certain technological domain. Third, the price of exchanges is easier to negotiate when only economic considerations are included. Once the technological information is included in evaluating the subsequent deals, the negotiation process will be subject to a dilemma where "[the information] value for the purchaser is not known until he has the information, but then he has in effect acquired it without cost" (Arrow, 1970, p.615). To entice the corporate investor into maintaining the dyadic tie, the invested venture would disclose sufficient technological details to make the corporate investors willing to continue the investment. However, once the corporate investor has absorbed the desired technology, it no longer needs to continue paying for learning and is likely to dissolute the investment tie even absent any sort of investment failure (Cui et al., 2011; Hamel, 1991; Hyll and Pippel,

2016; Sadowski and Duysters, 2008).

Taking together, besides extant economic lens on venture characteristics, the power lens brings an additional angle to frame the driving forces of tie dissolution, which comes from the corporation's evolving dependency on portfolio ventures. Under the power lens, the intertemporal tie stability diminishes with decreased mutual dependence and increased power imbalance. Although the venture may continue to demonstrate indifferent operational prosperity, heterogeneity in interfirm tie stability could still exist due to dynamisms in corporate investor's key resource dependence in strategic domain on technology advancements.

3.3 Hypotheses

3.3.1 Corporate technology achievement and CVC tie dissolution

Organizational decision making could be affected by power dynamics (Pfeffer and Salancik, 2003). As the corporate fulfillment of main strategic objective—absorption of new technology—could evolve over time after the initial tie establishment, the removal of technological constraints on the corporate side could therefore influence corporate investor's motivation in dissoluting previous ties. Intertemporally, as corporate accumulates new technology, it indicates a resolution of dependence and enhancement of power over the invested venture.

Due to their corresponding constraints that cannot be resolved within firm, the CVC dyad initially possesses high bilateral dependence. The corporate investor depends on the venture to provide access to nascent technology, organizational renewal and growth opportunities during their endeavor in achieving new technology (Benson and Ziedonis, 2009; Huang and Madhavan, 2020). On the other side, studies have shown that via forming ties with

CVC investor, the venture expects to access critical resources including managerial expertise (Dushnitsky and Lenox, 2005a), legitimacy (Cumming et al., 2019), and specialized complementary assets (Alvarez-Garrido and Dushnitsky, 2016; Park and Steensma, 2012) to promote their product innovation and commercialization. The interdependence therefore enables both sides to acquire critical resources that are difficult to achieve from arm's length relationship with alternative collaborators. However, the mutual dependence within the dyadic tie is likely to diminish as corporate investor gradually achieve technology advancements that decreases its dependence on the venture. For the corporation, organizational rigidity is likely to constrain its ability to catch up the fast-changing innovation hotspot (McKinley et al., 2014). The newly achieved technologies could increase the corporate investor's mastery of knowledge in nascent domain, reducing its dependence on invested venture over time. Successful technological internalization indicates information absorption regarding the target technology, meaning that the nascent technology is less of a black box for the corporation. Additionally, achieved technological advancement enables the internalization of critical information that was previously outside the corporate boundary, via obtaining a more thorough understanding of the related stakeholders, technology and market knowledge.

In the CVC-venture dyad, the corporate investor possesses the power dominance due to slack resources (Katila et al., 2008; Maula et al., 2013), hierarchical controls over the venture (De Clercq et al., 2006), relative ease of knowledge absorption (Alvarez and Barney, 2001; Deken et al., 2018) and abundant capacity to defend proprietary resources (Kim et al., 2019). Such imbalance could be further enhanced with the corporate investor's new technology achievements. RDT has identified several sources of power dominance including complementary resource need and organizational ownership by other parties (Casciaro and Piskorski, 2005; Drees and Heugens, 2013; Ellstrand et al., 2002). CVC as a minority equity

investment, possessing equity ownership grants the corporate investor with dominant power over the venture. Besides, the new venture often has a higher demand for operational resources and lacks defense mechanisms against misappropriation (Alvarez and Barney, 2001; Katila et al., 2008). In the dynamic process of alleviating interdependence, while the corporate investor could relatively internalize technology dependence in interfirm ties (Alvarez and Barney, 2001), it is often very difficult for entrepreneurial firms to absorb complex organizational capabilities from the corporate investor (Pahnke et al., 2015). The main advantage of entrepreneurial firm over established corporation is its superior technology. Once the corporate investor removes the constraint via its newly learned technology, the only power advantage that invested venture possesses will subsequently vanish. Just as asymmetries in learning can alter the relative bargaining power of alliance partners (Hamel, 1991), corporate investor's technology advancements indicate an enlarged power gap, making corporate investor more likely to dissolute the tie with the focal venture in subsequent rounds.

Therefore, as the corporate investor have achieved new technology over time after the tie formation, interdependence between the dyadic tie is expected to be reduced due to a decreased mutual dependence and increased power imbalance. I thus propose that the corporate investor becomes less motivated to sustain commitment in the focal venture once it achieves the desired technological advancement.

H1. *CVC investor's achieved technological advancements subsequent to the initial investment will increase the future likelihood of tie dissolution.*

3.3.2 Moderating factors of aggregate interdependency

The main hypothesis depicts the relationship between the dependence absorption over time, which is reflected in corporate technology advancement after the coalition establish-

ment, and the tie dissolution over time. As partners tend to constantly evaluate anticipated interdependencies in the future (Bruyaka et al., 2018), absorbed dependency's impact on tie dissolution should be contingent on the magnitude of cohesive and disruptive power forces. I propose that the aggregate dependence level alters the equilibrium point as corporate investors seek to balance further knowledge internalization opportunity and resource commitment in the investment dyad. If the corporate investor envisions a higher overall dependence on the invested venture, a given amount of dependence absorption would impose a lesser motivation for the corporate investor to terminate the focal investment. As heterogeneity could exist at the venture, corporate or dyadic level of a CVC-venture coalition, I theorize how factors from each aspect moderates the baseline relationship.

3.3.2.1 Corporate exploration scope

From the corporate side, the exploration scope of its own knowledge search alters the firm's dependence on external sources to keep pace with the fast-changing technology landscape. Exploration scope reflects the breadth of the corporate knowledge stock (Ahuja and Katila, 2001), which represents complementary knowledge resources (Leiponen, 2005) and opportunities for effective knowledge utilization (Caner et al., 2017; Srivastava and Gnyawali, 2011). With a broader knowledge coverage on heterogenous technological segments, the corporate investor has an enriched pool of distinctive knowledge that provides new sources of variation. These variations have been long considered as valuable constituents of technological resources toward problem solving (March, 1991), technology commercialization (Hill and Rothaermel, 2003) and new technology discovery (Arora and Gambardella, 1990).

In addition to the provision of more technological resources, a broad exploration scope also demonstrates a higher dependence on internal knowledge sharing as compared to exter-

nal knowledge acquisition (Zhou and Li, 2012). The marginal benefits to maintain the interfirm coalition after successful technology advancement would decline with the exploration scope, as it enhances corporate existing technological capability and reduces the corporate motivation to proactively acquire ideas from external partners. First, corporate investors with a broader scope of knowledge base possess a stronger capability to utilize the technological advancement that the corporate investor has achieved in the investment coalition. Not only does the breadth of organizational knowledge stock indicates the recombinative opportunities to effectively utilize existing knowledge (Miller et al., 2007; Nelson and Winter, 1982; Caner et al., 2017), but also facilitates absorptive capacity by enabling novel linkages and assimilations (Cohen and Levinthal, 1990; Vasudeva and Anand, 2011; Zhang, 2016). The extensive knowledge exploration facilitates the accumulation of know-how and tacit knowledge from partners (Prabhu et al., 2005; Zhou and Li, 2012), enabling the corporate investor to more effectively fix its weaknesses with the newly achieved technology. Second, due to the bounded rationality, the corporate investor's cognitive attention is limited and the motivation to further pursue knowledge acquisition would be diminished with its broader exploration scope. Information overload concerns will enhance the corporate investor's reluctance to continually seek knowledge absorption opportunities from the invested venture after it has achieved a certain level of technology advancement.

Therefore, with the diminished need for external technological resources, corporate exploration scope during the knowledge search enhances the impact of the achieved resource absorption on investment tie dissolution decision. I thus hypothesize that:

H2. *Corporate exploration scope will enhance the positive relationship between CVC investor's intertemporal technological achievements and the future likelihood of tie dissolution.*

3.3.2.2 Venture new technology

At the venture level, the capacity to continue to innovate is expected to renew dependence and thus to entice the corporate investor to stay in the investment relationship, notwithstanding the dependence absorption that the corporate investor has achieved over time. The degree of interdependency is dynamic instead of static. The interfirm relationship can be stabilized if new dependencies are triggered (Hamel, 1991; Pfeffer and Salancik, 2003). The venture's continuous generation of new technology triggers new dependence and increases its relative power within the bilateral coalition, which is determined by the dynamic balance of existing "bargain" obsolescence and new "bargain" emergence. For ventures that only infrequently bring new technology to the CVC-venture coalition, the corporate investor can easily absorb the discrete technology and terminate the coalition with low cost. However, if a venture holds the promise of a stream of new technology in the future, it keeps the corporate investor interested by adding new sources of dependence. In addition, the signaling of high inventive capability also restricts corporate appropriation capacity because of the enhanced imitation difficulty (Alvarez and Barney, 2001) and venture bargaining power (Lavie, 2007). With such logic, I posit that:

H3. *Venture new technology introductions subsequent to the initial tie formation will attenuate the positive relationship between CVC investor's intertemporal technological advancements and the future likelihood of tie dissolution.*

3.3.2.3 Dyadic product market similarity

Beyond venture and investor level contingencies, relatedness in the dyad also tends to alter the equilibrium between dependence absorption dynamics and investment termination.

In general, high relatedness among collaborating partners indicate high mutual dependence level (Dutta and Beamish, 2013; Haunschild, 1993, 1994; Liu et al., 2018). Specific to the CVC investment context, this interdependency is likely to be manifested in the reputation concerns of the corporate investor. While the achieved technological advancement incentivizes an investment termination, its impact on corporate investor's reputation creates new constraints that contradict the motivation to terminate. The early interfirm relationship dissolution imposes a negative signal to future potential partners (Devigne et al., 2016; Guler, 2007; Zhelyazkov and Gulati, 2016), compromising the corporate investor's attractiveness as a reliable and desirable collaborator. I posit that the reputation effect matters more in CVC-venture coalitions where the product-market overlap is high, because the ventures are in markets that are more important to the corporate investor. Corporate investors terminating an investment outside their own product-market will have a more limited impact on their primary product-market reputation. The similarity in product-market may threaten future access to critical resources if the firm perceived as an unreliable partner (Podolny, 2010). While the failure to comply with the norms of "standing by your venture" (Guler, 2007, p.261) would restrict the corporate investor's future access to deal flow and syndicate partners, doing so in a distant product-market will impose more limited negative constraints on the investor. Therefore, investors may feel relatively safe terminating investments in product-markets that are distant from their own.

H4. *Product market similarity will attenuate the positive relationship between CVC investor's intertemporal technological advancements and the future likelihood of tie dissolution.*

3.4 Method

3.4.1 Sample

I tested my hypotheses on a sample of U.S. CVC investments occurring between 1990-2017. I cross-validated CVC investment information from VentureXpert and Crunchbase. While VentureXpert has been widely used in previous CVC research (Dushnitsky and Shaver, 2009; Ma, 2020; Park and Steensma, 2012, e.g.,), Crunchbase is a relatively new dataset with extensive coverage of startup activities and financing starting from 1990. Over the past few years, Crunchbase has been increasingly popular among VC scholars (Block et al., 2015; Colombo et al., 2017; Homburg et al., 2014) and the Kauffman foundation has described it as a premier data asset on the tech/startup world[1]. Technology related information was captured by patent data from the United States Patent and Trademark Office (USPTO). According to the American Inventor's Protection Act, all filed patents will be published promptly after eighteen months from the earliest filing date. I therefore closed the observation window on December 2017 to ensure that all the filed patents could be observed in USPTO dataset by December 2019.

To obtain the sample, I first identified the overlap between firms that are involved in CVC investments listed in VentureXpert and Crunchbase. The inclusion criteria for eligible CVC investments are: 1) the investor is included and identified as "corporate venture capital" fin both databases, 2) the venture is included in at least one CVC investment in both databases, 3) the fund is initiated by a non-financial corporation, and 4) the region for the fund headquarter or invested venture is within the United States. After obtaining the eligible list of firms that are identified as either corporate investor or invested venture in both

[1]https://www.kauffman.org/what-we-do/entrepreneurship/research/data-resources, last accessed date: 12/03/2019.

databases, I extracted all the investment rounds information for each CVC-venture dyad from both databases. For each dyad, I specify if an investment has been terminated once the corporate investor no longer invested in any subsequent rounds. Following the established identification approach in VC termination studies (Li and Chi, 2013), I assumed the CVC termination occurs at the earliest round date when the CVC no longer appears as an investor of the venture in the sample. An investment dyad is considered as censored instead of terminated if the CVC has invested in the venture until an exit event (venture IPO, acquisition or bankruptcy) or December 2017, whichever comes sooner. If no exit event or further investment has occurred by December 2017, I assumed the CVC-venture dyadic relationship has terminated if twenty-six months (a time span where 75 percent of the subsequent investment round occurs) has passed since the last investment round. Besides identifying round information from initiation to potential termination of eligible CVC-venture dyads, I collected detailed investment and product market categories information from the two databases as well.

Along with the investment related information, I tracked the CVC and venture patents granted by USPTO and merged it with the eligible investments identified above. I retrieved all the patents that have been applied by December 31, 2017. To combine the corporate investor's newly achieved technology and investment dyad information, I did a fuzzy text match between the patent assignee name and the CVC fund's affiliating corporation name. Following the matching procedures adopted in recent finance research (González-Uribe, 2020; Ma, 2020), I first standardized the corporate investor names by 1) capitalization; 2) removing common company prefixes and suffixes, and 3) stripping punctuation and white spaces. The same standardization procedures have been applied to the USPTO assignee names as well. After developing the standardized corporate investor (assignee) names, I used the token

method in string matching to compare the similarity between the standardized investor names in CVC-venture dyads and USPTO assignees. The similarity score was calculated based on the minsimple method which highlighted the matched text and I used 0.75 as the threshold for the lowest included similarity score. I then manually went through each of the resulting fuzzy-matched pairs and identified if it is a true match based on the full corporate investor (assignee) name and the corresponding geographic location. As a corporation could have applied for new patents under the name of different business units, a CVC investor name could be matched to multiple assignee names in USPTO. Following similar text matching approach, I then incorporated the ventures' patent information into my dataset.

The final sample includes 2,525 unique CVC-venture dyads of CVC investment by 129 corporate investors in 2,020 ventures. Within the sample, 77 CVC have at least once terminated their investment in an established CVC-venture dyad, with 351 ventures involved.

3.4.2 Measures

I have summarized detailed description of the dependent and explanatory variables in Table 1. The dependent variable is the likelihood of CVC investment terminating its coalition with a venture in the subsequent rounds. My dependent variable is the propensity to terminate, which is the hazard that a CVC terminates its investment in a venture before an exit event, conditional on the fact that the CVC-venture coalition has been established in previous investments. I use right-censoring if an investment termination has not happened by the end of year 2017.

Table 6: Variable Definitions

Variables	Description
Dependent variable:	
Investment termination	The hazard that a CVC terminates its investment in a venture before an exit event, conditional on the CVC-venture dyad establishment in prior financing round
Independent variables:	
Corp. tech advancement	The sum of corporate investor's successful patent application between the initiation of the focal CVC-venture dyad and the termination or censoring month
Venture new technology	The sum of venture's successful patent application between the initiation of the focal CVC-venture dyad and the termination or censoring month
Corporate technology breadth	The proportion of previously unused citations in the corporate investor's newly applied patents' list of citations, measured as $Scope_i = \frac{New\ Citations_i}{Total\ Citations_i}$
Product market similarity	The number of common product market keywords divided by the total number of corporate product keywords, measured as $Similarity_{ij} = \frac{Common\ Keywords_ij}{Total\ Keywords_i}$
Control variables:	
Technology stock	The total number of patents that the CVC fund's parent corporation has obtained prior to its initial equity investment in the focal venture
Capital usage	The ratio of the CVC's realized investment amount divided by the total fund amount
Leading investor	A dummy variable reflecting whether the CVC is a leading investor in the focal dyad
Leading experience	The total number of previous investments in which the corporate investor acts as a leading investor
Number of Exits	The total number of successful exits that the CVC has observed in its previous investments
Total Invested Amount	The natural logarithm of total amount (in thousand dollars) that has been previously raised by the venture
Venture age	The number of months between venture foundation and the focal CVC-venture coalition establishment

(Continued)

Total investors	The total number of investors that have involved in the venture's equity financing
Corporate investors	The total number of corporate investors that have involved in the venture's equity financing
Geographic proximity	Dummy variable that takes a value "1" if the CVC-venture dyad operates in the same region

3.4.2.1 Achieved technological advancement

Technological advancement includes potential internalization of both explicit and tacit knowledge (Argote, 2012; Argote and Ingram, 2000; Nonaka, 1991). Compared to tacit knowledge that is "unarticulated and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb" (Nonaka and Von Krogh, 2009, p.635), explicit knowledge refers to the uttered and formulated ones that have the capacity to act across contexts. Given my interest in understanding the effect of CVC acquired technological information, which is "universal" across organizations, I operationalize the technological achievement as successful internalization of explicit knowledge. I measure the achieved technological advancement as the demonstration of corporate new technology, namely the successful patents applications. Patent counts are a widely acknowledged indicator of technological output (Almeida et al., 2015; Magelssen, 2020). I sum up the number of corporate investor's patents that are newly applied between the month of the CVC-venture dyad establishment and the termination or censoring month of the dyad. The patents are matched to months based on the application date, which is closer to the time of new technology compared to the patent grant date. Given the skewed distribution regarding the number of the newly applied

patents, I take the natural logarithm term of the total number plus one.

3.4.2.2 Corporate exploration scope

Following established approach in the organizational search literature (e.g., Ahuja and Katila, 2004, etc.), I measure the exploration scope of the corporate technology breadth as the proportion of previously unused citations in the corporate investor's newly applied patents' list of citations. As knowledge typically loses significant value within approximately five years (Ahuja and Katila, 2004; Argote and Ingram, 2000), I identify a citation as "new" if it could not be found in the previous five years' list of patents and citations by the corporate investor. The values of corporate technological breadth is thus calculated as $Scope_i = \frac{New\ Citations_i}{Total\ Citations_i}$, which ranges from 0 to 1.

3.4.2.3 Venture new technology

I measure the venture new technology by the number of new patents that the invested venture has applied during the time span between the month of the CVC-venture dyad establishment and the termination or censoring month of the dyad. Similar to my operationalization of corporate new technology, I match the venture patent based on the application date and take the natural logarithm term of the total number plus one.

3.4.2.4 Product market similarity

Product similarity measures the relatedness of the CVC-venture dyad in product market space. As the Standard Industry Classification (SIC) code cannot fully capture the within industry difference nor provide a continuous representation of the pairwise similarity between

the coalition (Hoberg and Phillips, 2010), I construct a text-based measure of product similarity. To evaluate the similarity, I refer to the keywords of the organization's product market for both the corporate investor and the venture, as stated in VentureXpert. I start by listing a vector of keywords for CVC and venture respectively. Then I obtain the number of common keywords for each CVC-venture dyad by comparing the corresponding keyword vectors. The number of common keywords is then divided by total number of unique keywords in the CVC and venture descriptions. The calculation formula is: $Similarity_{ij} = \frac{CommonKeywords_{ij}}{TotalKeywords_i}$, where i, j represents the corporate investor and invested venture in the coalited dyad respectively. Such standardization avoids the bias toward a larger number of listed keywords. The product similarity measure is bounded within the [0,1] range, and a higher similarity is associated with CVC-venture sharing more common keywords.

3.4.2.5 Control variables

I include a set of variables to control for characteristics related to corporate investor, invested venture and dyadic connectivity. First, I account for factors pertaining to corporate investor's technology stock, capital availability and prior performance. I measure corporate *Technology Stock* by the number of patents that the CVC fund's parent corporation has obtained prior to its initial involvement in financing the focal venture. The existing knowledge stock determines how much resources the firm could leverage to support the further endeavor of technological advancement (Caner et al., 2017; Stuart, 2000). Therefore, the coefficient estimates for the independent variables reflect marginal contribution of the corporate investor's newly achieved technologies, regardless of its existing achievement in previous technological inventions. *Corporate Capital Usage* is captured as the ratio of total CVC fund amount that has already been invested in ventures. It potentially affects the CVC decision of terminating

an established investment coalition in two ways. Not only does the fund usage affects corporate investor's capacity in continuously investing, it also reflects CVC access to alternative learning sources that lead to the corporate investor's alleviated resource dependence on a specific venture. I included a dummy variable *Leading Investor* that measures whether the corporate investor is a leading investor in the focal CVC-venture dyad, and a continuous variable Leading Experience that measures the number of previous investments in which the corporate investor acts as a leading investor. Also, successful exit through IPO or acquisition is the major source of financial returns in a venture capital investment (Hochberg et al., 2007; Lerner et al., 2012; Sorenson and Stuart, 2008), which reflects the selection capability (Yang et al., 2009) and affects reputation of the investor (Masulis and Nahata, 2011). I thus control for *CVC Exit Performance*, measured as the total number of successful exits among the ventures that are previously nurtured by the corporate investor. In addition to the investor level controls, I also control for variables on the venture's side including its received total funding, age, and number of investors. Venture's *Cumulative Invested Amount* measures the natural logarithm of total amount (in thousand dollars) that has been raised by the venture before initiating the dyadic coalition with the focal CVC investor (Alvarez-Garrido and Dushnitsky, 2016; Guler, 2007). *Venture Age* measures the number of months between venture foundation and CVC-venture coalition establishment. I control for the number of *Total Investors* by summing up the number of unique investors involved in the venture's financing, irrespective of whether it is a CVC or an IVC, as a larger number of co-investors is likely to occur when the venture has a higher risk exposure (Brander et al., 2002; Dushnitsky and Shapira, 2010). Such uncertainty reflected by a large syndication size could render the CVC willingness to make subsequent investments. In addition, accounting for the systematic differences between CVC and IVC (see Drover et al., 2017, for a review), I separately control

for the *Number of Corporate Investors* as well. Last, I include the dyadic-level control of the *Geographic Proximity* of the CVC-venture dyad. When the CVC and venture are located in the same region, they tend to establish emotional links that make the corporate investor incline to escalate its investments to the venture (Devigne et al., 2016; Guler, 2007). I measure the geographic proximity on the regional level and the dummy variable takes a value "1" if the CVC-venture dyad operates in the same region.

3.4.3 Model specification

To test the impact of corporate investor's achieved technological advancement and the product market relatedness on the likelihood of investment termination, I adopted a survival analysis approach with semiparametric Cox proportional hazard (PH) models. Two reasons drove my model choice. First, the observation window is finite for each investment, either up to the month when the CVC is considered as terminating an existing investment or December 2017 when I close the observation window. The survival model could efficiently handle such censoring issue (Cleves et al., 2008; Chen et al., 2017). Second, with fixed hazard ratio over time, Cox PH model does not require specifying a particular hazard's probability distribution (Cleves et al., 2008; Cox and Oakes, 1984; Li and Chi, 2013). Also, I assume random effects in the Cox PH model because it addresses the autocorrelation resulted from repeated measures (Chen et al., 2017). My analysis is at the dyadic level with each CVC-venture coalition as the unit of analysis. The entry time is set as the investment date when the CVC-venture dyad is initiated, and a termination event is considered to have occurred when the CVC no longer invests in the focal venture despite the venture's continuing seek of investment. For all the estimations, I used robust standard error.

3.5 Results

Table 7 reports descriptive statistics and correlations for the variables. The variance inflation factors (VIF) are all well below 10 (the mean is 1.96), indicating that multicollinearity is not a threat to my model estimations.

Table 7: Descriptive Statistics and Correlation

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Corp. Tech Advancement	1													
2 Venture New Technology	0.06	1												
3 Technology Breadth	0.31	0.06	1											
4 Product Market Similarity	-0.04	0.06	0	1										
5 Technology Stock	0.44	0.07	0.56	-0.02	1									
6 Capital Usage	0.03	0.03	0.03	0	0.04	1								
7 Leading Investor	-0.04	0.01	-0.09	-0.07	0.02	-0.02	1							
8 Leading Experience	0.17	-0.03	-0.02	-0.15	0.24	0.06	0.09	1						
9 Number of Exits	0.15	-0.02	0	-0.15	0.19	0.05	0.07	0.92	1					
10 Total Invested Amount	-0.07	0.03	-0.07	-0.08	-0.05	-0.05	0.18	-0.21	-0.19	1				
11 Venture Age	0.02	0.08	0	0.01	0.06	0.02	0.04	-0.06	-0.08	0.03	1			
12 Number of Total Investors	-0.02	-0.01	-0.04	0.09	-0.13	0.01	-0.29	-0.12	-0.13	0.05	-0.05	1		
13 Number of Corp. Investors	0.01	0.06	0.06	0.08	-0.03	0.04	-0.14	-0.12	-0.11	-0.11	0.07	0.1	1	
14 Geographic Proximity	-0.05	0.03	-0.03	0.03	-0.08	0.02	-0.08	0.08	0.08	-0.07	-0.06	0.1	0.06	1
Mean	3.16	0.12	0.22	0.06	4.79	0.15	0.18	3.84	3.87	2.74	64.12	1.63	1.29	0.67
S.D.	3.38	0.46	0.25	0.09	4.19	2.51	0.39	1.64	1.52	0.23	46.88	0.39	0.47	0.47

Table 8 reports the estimation results from Cox PH model. Model 1 includes the control variables only. The estimated coefficients for some control variables provide some interesting insight into the termination of the current investment in subsequent rounds. First, the CVC parent corporation's knowledge stock is positively ($\hat{\beta} = 0.036, p < 0.001$) linked to the investment termination. I then convert the coefficient into hazard ratio by calculating $100[exp(\beta) - 1]$, which represents the percentage change in the hazard associated with one unit increase of the covariate. The calculation indicates that if the patent stock is increased by one unit, the likelihood of CVC termination the established CVC-venture dyad will increase 3.67 percent. Second, for the CVC fund's Capital Usage, it has a statistically significant but practically less salient effect considering the range of the variable ($\hat{\beta} = 0.019, p < 0.001$). I again compute the $100[exp(\beta) - 1]$ to have propensity of CVC-venture dyad termination conditional on the corporate roles as an leading investor. The negative coefficients for both the dummy ($\hat{\beta} = -0.267, p < 0.05$) and continuous variable ($\hat{\beta} = -0.311, p < 0.001$) indicate that the leading investment roles decrease the likelihood of CVC investment termination. It is calculated that being a Leading Investor in the focal dyad and one unit increase in Leading Experience decrease the termination propensity by 23.43 and 26.73 percent respectively. Meanwhile, the results indicate that none of the venture characteristics contributes significantly to the termination likelihood, suggesting that the venture side plays a minor role in the potential termination of the investment dyad. Finally, consistent with the escalation-commitment argument in previous studies (Devigne et al., 2016; Guler, 2007), I find that compared to CVC-venture dyad that locate in different regions, the co-location of CVC-venture dyad makes it 17.14 percent ($p < 0.05$) less likely to observe its CVC investor abandoning the coalition in subsequent financing.

Model 2 added my main effect variable: Achieved technological advancement of the

corporate investor. My main hypothesis predicted that the occurrence of corporate investor's achieved technological advancement will positively impact the propensity to terminate the investment. The result confirms my hypothesis—with one unit increase of corporate newly issued patent after the dyad establishment, the CVC is 14.91 percent ($p < 0.001$) more likely to stop making subsequent investments in the focal CVC-venture dyad. The results remain consistent when I add the moderators into the model. Considering the sample distribution, the propensity to investment termination increases 57.93 percent if the achieved technological advancement increases one standard deviation from the mean value, and vice versa. This offers support for my core prediction that the resolution of resource dependence makes the CVC-venture coalition unstable (Casciaro and Piskorski, 2005; Drees and Heugens, 2013; Hillman et al., 2009; Pfeffer and Salancik, 2003). In Models 3-5, I included the interaction term for each moderation variable to test how the equilibrium of resource dependency is bounded by the value of the resources. In Model 3, the negative estimated interaction term provides support for Hypothesis 2, indicating that the venture's continuous innovation attenuates the positive relationship between achieved technological advancement and the propensity of the corporate investor's investment termination. With an estimated interaction term coefficient as -0.057 ($p < 0.05$), the $100[exp(\beta) - 1]$ yields one unit increase of venture new technology alleviated the effect of achieved technological advancement by 5.54 percent.

Table 8: Regression Coefficient of Cox PH Model on CVC-venture dyad Termination

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Tech Advancement		0.139**	0.146**	-0.047	0.162**	-0.027
		(0.033)	(0.033)	(0.058)	(0.034)	(0.059)
Venture New Tech			0.231*			0.268*
			(0.125)			(0.115)
Tech Advance			**-0.057+**			**-0.070***
***Venture Tech**			**(0.028)**			**(0.028)**

(Continued)

Corp. Tech Breadth				0.535+		0.553+
				(0.314)		(0.321)
Tech Advance				**0.357****		**0.392****
***Tech Breadth**				**(0.109)**		**(0.115)**
Product Similarity					1.972*	2.196**
					(0.666)	(0.643)
Tech Advance					**-0.304***	**-0.404***
***Prod. Similarity**					**(0.155)**	**(0.161)**
Technology Stock	0.036*	-0.062+	-0.060*	-0.046	-0.065*	-0.045
	(0.013)	(0.027)	(0.027)	(0.029)	(0.027)	(0.029)
Capital Usage	0.019**	0.018**	0.019**	0.016**	0.018**	0.018**
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Leading Investor	-0.267*	-0.242	-0.250+	-0.206	-0.256	-0.231
	(0.160)	(0.165)	(0.166)	(0.165)	(0.166)	(0.167)
Leading Experience	-0.311**	-0.328**	-0.321**	-0.275**	-0.318**	-0.258**
	(0.073)	(0.073)	(0.073)	(0.077)	(0.073)	(0.075)
Number of Exits	0.186*	0.188*	0.183*	0.201*	0.182*	0.190*
	(0.075)	(0.075)	(0.074)	(0.080)	(0.074)	(0.077)
Invested Amount	-0.036	0.025	0.041	0.132	0.091	0.233
	(0.318)	(0.395)	(0.415)	(0.394)	(0.373)	(0.395)
Venture Age	-0.001	-0.001	-0.001	-0.000	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total Investors	-0.087	-0.114	-0.122	-0.136	-0.133	-0.167
	(0.161)	(0.170)	(0.171)	(0.169)	(0.171)	(0.171)
Corporate Investors	0.068	0.032	0.027	0.020	0.029	0.015
	(0.132)	(0.132)	(0.132)	(0.133)	(0.133)	(0.132)
Geographic Proximity	-0.188+	-0.179+	-0.193+	-0.186+	-0.181+	-0.206+
	(0.103)	(0.104)	(0.105)	(0.106)	(0.104)	(0.106)
Observations	2,525	2,525	2,525	2,525	2,525	2,525

Robust standard errors in parentheses.

$**p < 0.001, *p < 0.01, +p < 0.05$ based on one-tailed test

To better visualize the moderation effect, a graphic illustration of the relationships between investment termination and corporate achieved technological advancement, under high

and low level of venture innovation respectively, is shown in Figure 4. The "high" and "low" corresponds to one standard deviation above and below the sample mean of Venture Innovation. As the lowest possible value of venture's new technology is zero, which is less than one standard deviation from the mean value, I use zero (indicating the venture brings out no new technology after the coalition establishment) to indicate the lower bound of venture's new innovation.

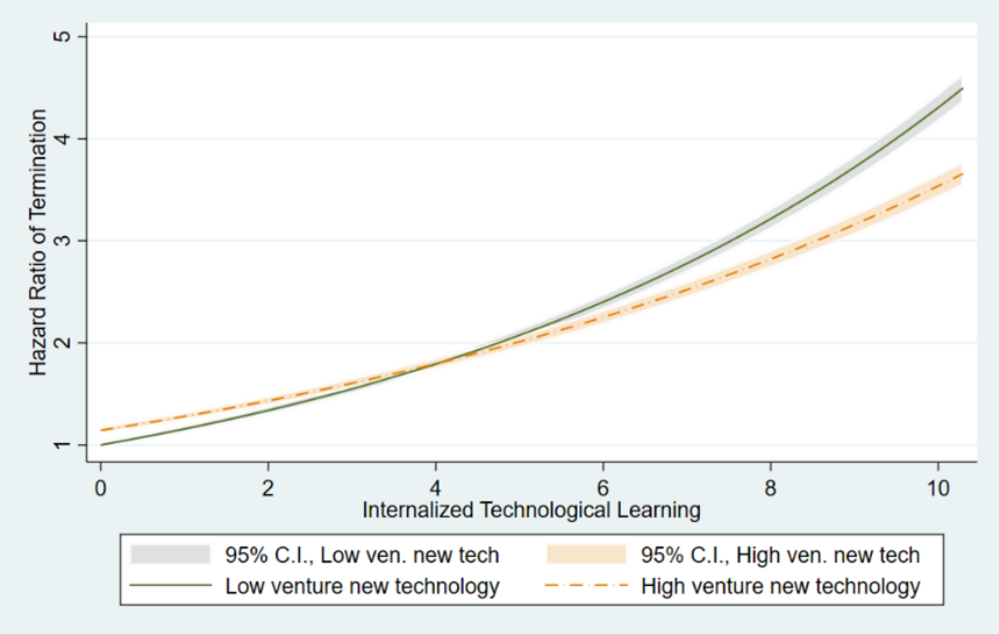

Figure 4: Moderation Effect of Venture New Technology

Similar to that of Model 3, the estimation results for the interaction term of exploration scope and achieved technological advancement are shown in Model 4. The estimated coefficient for interaction term is 0.357 ($p < 0.001$), suggesting that the unit change on the scope of exploring new technology enhances the impact of achieved technological advancement on the investment termination likelihood by 42.90 percent. It therefore supports Hypothesis

3. The graphic illustration of moderation effect coming from exploration scope is shown in Figure 5. Again, as the lowest possible value of corporate exploration scope is less than one standard deviation from the sample mean, I use zero as the value for "low exploration scope" and one standard deviation higher than the sample mean (which adds up to 0.473) to represent the "high exploration scope" condition. The results confirm my hypothesis that the main effect is enhanced by the magnitude of corporate investor's exploration scope.

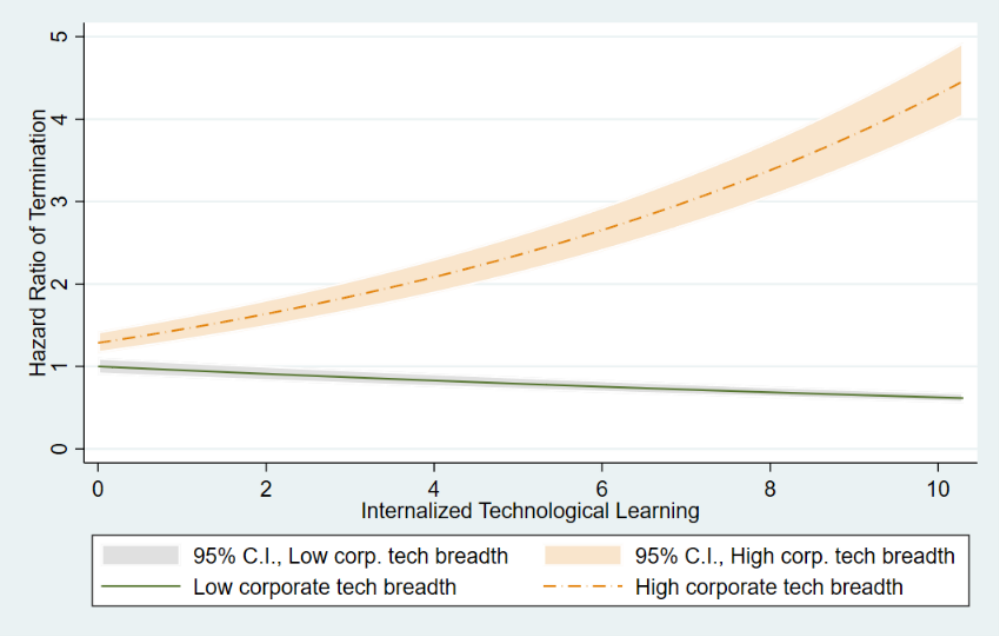

Figure 5: Moderation Effect of Corporate Technology Breadth

The Model 5 represents the moderation regarding the similarity between the corporate and venture's main products. Consistent with Hypothesis 4, the negative estimated coefficient ($\hat{\beta} = -0.304, p < 0.05$) demonstrates that the unit increase of Product Similarity between the involving CVC and venture reduces the main effect from achieved technological advancement by 26.21 percent. Figure 6 illustrates the relationships between investment

termination and achieved technological advancement, under high and low product market relatedness between the CVC-venture dyad respectively.

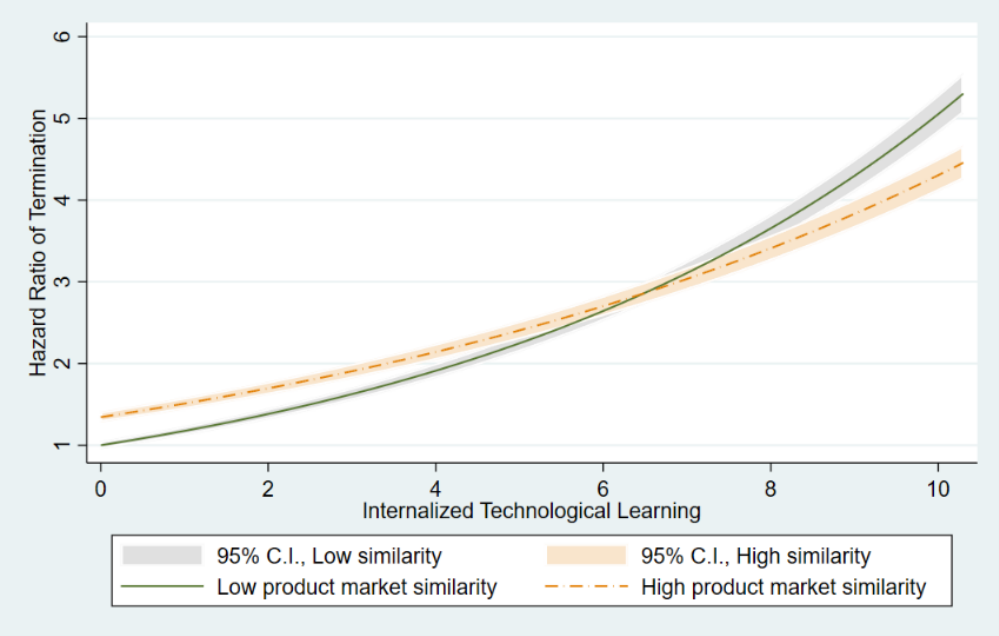

Figure 6: Moderation Effect of Product Market Similarity

Finally, in Model 6, I include all the moderating and control variables to estimate the full model. All the above results hold in support of all hypotheses. Jointly, these results imply that when the corporate investors have achieved technological advancement, a primary goal in CVC investment (Benson and Ziedonis, 2009; Dushnitsky and Lenox, 2005a,b; Drover et al., 2017), they are more likely to terminate capital inputs in future investment rounds. According to the predicted boundary conditions, which tap into the shifting value of the resources in specific circumstances, the achieved technological advancement will have a higher impact when the corporate investor has a broader scope of technological exploration. On the other hand, the impact will be attenuated when the venture demonstrates a high capability

of continuous innovation, or when there is a high product similarity between the firms in a CVC-venture dyad.

3.5.1 Robustness analysis

While I am still in the process to bring in more robustness analyses, I have found additional supports for my results in several avenues. First, considering that the value for different patents might diverge a lot, I weight the corporate and venture patents with the total number of forward citations. I use a three-year moving window to count the citations as the impact of a new patent starts to decline since the fourth year (Caner et al., 2017). Second, I have proposed that the dyadic similarity on product market attenuates the main effect due to an increased reputation concern. If this mechanism holds, the technological similarity should observe the same pattern. I calculate the Euclidean distance between the technology portfolio of corporate investor and invested venture. I use this as an alternative measure of dyadic similarity and find consistent results. Additionally, I admit that there might be unobservable omitted variables that would render my results endogenous. I argue that the American Inventors Protection Act (AIPA) functions as an exogeneous shock and the endogenous effects from omitted variables can be resolved via a difference-in-difference (DID) model. Since 2001, AIPA mandates the information disclosure after 18 months of patent application, even if it is not granted by USPTO. In the post-AIPA era, firms have an incentive to apply for patents only if commercial success is likely (Hoffmann et al., 2019). Accordingly, I expect post-AIPA patents to be a better proxy for corporate successful technology internalization and the hypothesized effect should only be observed in the post-AIPA period. The regression result from the DID model supports such speculation.

3.6 Discussion

In this study, I focused on the effect of corporate investor's achieved technological advancement on its termination decision with regard to an existing CVC-venture investment. I sought to mitigate the gap that while the field has thoroughly explained several rationales for VC termination in general, the focus has been exclusively financial and on whether the venture demonstrate sufficient potential to achieve specified milestones. However, for CVC investors who possess dual objectives in seeking both financial and strategic returns, the termination decision should also be explained by dynamics of their strategic needs. Especially given the fact that the most frequent motivation of making CVC investment is to gain access to technological resources (Benson and Ziedonis, 2009; Kim et al., 2019; Ma, 2020), it is critical to understand the role that technological factors play in driving corporate termination decision.

Based on RDT, I hypothesized that achieved technological advancement, as reflected in new patent application by the corporate investor after the initial investment, will increase corporate willingness to terminate its investment on the focal venture in subsequent rounds. In addition, with an alleviation of mutual dependence and an enhancement of power imbalance, the main effect is expected to be moderated by product-market relatedness and the usefulness of the internalized knowledge. I tested my hypotheses using a sample of CVC investments in US. Having matched multiple datasets on CVC investment and patent application, I conducted survival analysis to examine how the corporate investor's achieved technological advancement affects the likelihood of terminating its involvement in subsequent rounds after the initial establishment of the CVC-venture coalition. I have full support for my main effect hypothesis and moderation effect conditional on aggregate dependence.

Based on Makadok et al. (2018)'s taxonomy of theoretical contribution, I claim my contribution to both CVC and RDT literature by introducing a new mechanism and applying the existing theory to a different context respectively. First, I explicate the corporate investors' motivation for terminating an existing investment dyad via a new mechanism—technology assimilation. As Makadok et al. (2018) put in their level 4 of theoretical contribution, this is the "lever that defines why the theory's proposed relationships or effects occur" (p.1536). My study contributes to the CVC literature by theorizing and testing why the termination of CVC-venture coalition would occur under the condition of realized technological internalization on corporate side. While relationship termination has been widely regarded as a negative event attributed by default to the venture's declining prospects (Guler, 2007; Li and Chi, 2013; Zhelyazkov and Gulati, 2016), I propose the additional mechanism that termination is also a deliberate choice after successful knowledge internalization. Beyond existing studies that focus on the general financial mechanism, this study differentiates the idiosyncratic motivation of CVC investors from the IVC investors. Acknowledging the fact that most corporate investors possess strategic objective to fix their weaknesses (i.e., knowledge gaps), I theorize that the realization of the technological internalization goal leads to the termination of an established investment dyad.

Meanwhile, I also contribute to the scholarly world by extending RDT to a new context. As categorized by Makadok et al. (2018), the third level of theoretical contribution is defined as extending "where my theory is relevant, that is, the context of the theory" (p.1536). Traditional RDT scholars look at the interfirm collaboration that absorbs interdependency and resolve constraints. While current RDT studies mainly refer to joint ventures (JV) and M&A to portray the dynamics of interorganizational relationships (Casciaro and Piskorski, 2005; Hill et al., 2009; Tolbert and Hall, 2015), the phenomenon of relationship

termination in the CVC context is equally well suited to the RDT framework. Similar to JV and M&A, CVC functions as an increasingly prevalent interorganizational relationship, which links the corporate investor and invested startup to co-create value that is unlikely to be achieved on their own. An RDT perspective explores how the formation of interorganizational relationships helps organizations to acquire resources to reduce uncertainty (Drees and Heugens, 2013; Hillman et al., 2004; Pfeffer and Salancik, 2003). Despite the fact that CVC investment is a relatively nascent form of interorganizational arrangement, it fits well with the RDT framework to understand the performance outcomes of such interorganizational relationship between corporate investor and invested venture. Although Hallen et al. (2014) applied RDT to explain tie formation in CVC investment, it is still not known how the dynamics of resource dependence subsequently drive the termination decision. My study focuses on how the corporate investor's internalized technology learning absorbs the existing dependency and leads to the termination of existing dyads.

In seeking to make these theoretical contributions, I also acknowledge several limitations of this study. First, there is an implicit assumption that each corporate new invention represents the same amount of achieved technological advancement from the invested venture. As my primary research focus is to understand how the strategic aspect drives the investment termination in general, I have not gone into the nuances of the technologies that the corporate investor has successfully internalized. Second, although I have controlled for several factors and considered the heterogeneity from knowledge usefulness and market similarity, there might be other unobserved factors that affect the investment continuity. For example, the level of trust could lead to an escalation of commitment that prevents a timely termination (Devigne et al., 2016). Third, with misappropriation concerns and limited defense mechanisms, the invested venture may also be heterogenous in their approach, which will

also differentiate their attractiveness while corporate investors decide on whether to continue or terminate the investment relationship. Last, in theory the dyadic relationship can be terminated by either the corporate or venture side decision. However, based on both my conversations with industry experts and existing research (Zhelyazkov and Gulati, 2016), it is very unlikely for a venture to kick out an existing investor who has already participated in previous rounds, at least not in the US context. At the outset, the venture would of course carefully screen the pool of potential partners and could decide not to form a coalition partnership with the corporate investor. But once the equity investment relationship has established, the contract "almost universally include(s) the right of a VC firm to participate in each future round at the rate of its prior stake in the company" (Zhelyazkov and Gulati, 2016, p.280), meaning that an investor cannot be excluded in later stages against its own wishes. CVC as a specific format of VC investment would likely enjoy the same right.

There are also several important avenues for further exploration of how the strategic considerations alter the termination likelihood of an established CVC-venture coalition. For example, the internalized knowledge could be explicit as well as tacit. This research focuses on the achieved technological advancement that is patentable, but there also exists the absorption of tacit knowledge in the dynamic process of a CVC investment. It is worth future scholarly attention to further examine the degree and consequences of the achieved tacit learning on corporate investors' termination decision. Meanwhile, it is also the case that established corporations differ in their primary objective of making CVC investments. Although there has been scholarly agreement about CVC's dual objectives in both finance and strategy (Drover et al., 2017; Yang et al., 2009), the relative emphasis could vary among firms. Some corporate investors are more similar to financial investors compared to others (Drover et al., 2017). Even within the strategic aspects, corporate investors take heteroge-

nous factors into account when they evaluate the strategic value of continuing the existing investment. For example, along with the goal of acquiring new knowledge, the CVC may also target new markets (Dushnitsky and Lenox, 2005b; Tong and Li, 2011), adapting to unpredictable environmental changes (Van de Vrande et al., 2011), and strategic diversification (Lee and Kang, 2015) via investing in a collection of new ventures.

Subsequent research could theorize the representative types of CVC investments and test how each type makes the termination decision under various contingencies. Another avenue worth future exploration is the ex-post consequences of CVC investment termination, to both corporate investor and invested ventures. Studies in the traditional VC segment have found that early termination harms future syndication with elite partners (Guler, 2007; Jovanovic and Szentes, 2013; Shin, 2019). It also sends out a negative signal regarding the invested venture's quality if it experiences an IVC investment termination (Shafi et al., 2020). However, as CVC and IVC pursue nuanced objectives, it is still unknown what signals have been sent out upon CVC investment termination before a successful termination. Based on my sample, preliminary analysis indicates that the early CVC termination has no substantial difference in the likelihood of having subsequent financing rounds by attracting equity investors. the successful exit rate has become significantly lower once the venture has a CVC investment termination. Finally, the existing literature has focused on the financial mechanism that drives the termination of a venture capital dyad, and I add the achieved technological advancement mechanism from the strategic perspective. However, it remains unknown how these two mechanisms interact with each other and lead to an integrated decision of terminating an existing dyad relationship in CVC investment. Future studies may help to understand how the corporate investors evaluate tradeoffs among different determinants and make termination decisions based on the interaction of multiple mechanisms.

4.0 New Maps for New Terrains: Stakeholder Composition and Investment Incentives in China's Corporate Venture Capital Emergence

4.1 Introduction

Corporate venture capital (CVC) investment has increasingly become an irreplaceable tool for corporate resource accumulation and entrepreneurial finance. Through CVC investments, established corporations are able to achieve multiple performance goals that facilitate their market competitiveness (Benson and Ziedonis, 2009; Drover et al., 2017; Dushnitsky and Lenox, 2005b, 2006; Huang and Madhavan, 2020). To decide whether to engage in CVC activities, corporate investors make deliberate evaluations various organizational determinants (Basu et al., 2011; Ceccagnoli et al., 2018; Drover et al., 2017; Ma, 2020; Narayanan et al., 2009; Titus Jr et al., 2017). Beyond the corporate level factors, institutional context is also critical to CVC investment decisions. On the one hand, corporate interactions with external stakeholders (such as syndication partners, invested ventures, and alliance networks) directly influence CVC investment process and performance outcomes (Balachandran, 2019; Belderbos et al., 2018; Dushnitsky and Lavie, 2010; Kim et al., 2019; Noyes et al., 2014; Wadhwa and Basu, 2013). On the other hand, macro institutional factors cast influence on the motivations for establishing CVC investment ties, by altering conditions of market uncertainty, intellectual property regime, and industrial dynamics (Dushnitsky and Shaver, 2009; Gaba and Dokko, 2016; Hallen et al., 2014; Li and Chi, 2013; Vanacker et al., 2014).

While previous studies have acknowledged that broader institutional factors affect CVC investment decisions, they have predominantly focused on mechanisms pertaining to the U.S. CVC market. Though a few studies feature empirical settings in Asia or Europe (Belderbos

et al., 2018; Dai et al., 2012), they are treated as if there is no sign of systematic differences from the corresponding mechanisms in the North America. CVC ecosystem components such as stakeholders, characteristics of investment distribution, and investment objectives have been assumed to be homogenous across countries. However, the pursuit of both financial and strategic goals is subject to the institutional socioeconomic contexts in which the focal companies are embedded (Aldrich and Fiol, 1994; Rosenbusch et al., 2019; Sigmund et al., 2015; Vanacker et al., 2017). The CVC field is yet to address how these market related incentives may manifest in heterogenous ways under different institutional contexts. This gap becomes even more salient when one takes non-market strategy into consideration, which is often critical to corporations in developing economies that are faced with "institutional costs" (see Dorobantu et al., 2017, for a review). Such a non-market perspective is necessary to understand the evolution and interactions of CVC investments in weak institutions. Yet, this consideration has been largely neglected in extant CVC literature that focuses exclusively on market-related incentives.

To understand the complex processes and interactions of CVC investments in a developing context, I delve into the composition and unique characteristics of the CVC ecosystem in China. China is an important and ideal context to explore such distinctiveness for several reasons. First, despite its weak intellectual property protection regime, which has been found to be a central factor that impedes establishment of CVC investments (Dushnitsky and Shaver, 2009; Hallen et al., 2014), China has grown to be the second largest CVC market across the globe. Figure 7 illustrates the increasing trend of China's CVC investment over the past decade. Second, the institutional context of China has been widely acknowledged to be distinctive compared to U.S. conditions, making it a representative one to compare potential differences within various dimensions. Third, anecdotal evidence has shown that

CVC investments in the U.S. and China follow idiosyncratic patterns. For example, while traditional VC is still the largest source of entrepreneurial finance in the U.S., China' CVC market cap has exceeded its IVC volume since 2018. In addition, Chinese corporations have been much more aggressive in investing activities in general. For major CVC investors in the U.S. and China, I calculated the cash flow percentage for each corporation's total investments by total operating activities, based on their financial statements through 2014-2019. In the US, the net cash outflow in investing activities accounts for 55 percent of Facebook's cash inflow generated by operations, while 54 percent for Google, 63 percent for Amazon, and 30 percent for Microsoft. In comparison, Alibaba has invested 82 percent of its cash inflow from operations and Tencent even has put all its operating cash inflows into CVC investments. As CVC is a critical component of corporate investments, it is not surprising that the investment heterogeneity has led to a broader scope of Chinese corporation's CVC empire. According to *Hurun 2020 Global Unicorn Index*, among the 586 unicorn startups throughout the globe, Chinese CVC investor Tencent has nurture 52 of them, a number that only second to Sequoia. Alibaba and its fully owned subsidiaries also have invested in 44 global unicorns. As a comparison, despite the U.S. having more unicorn startups than China, the most active U.S. CVCs are largely absent from funding these ventures, only except 7 unicorns receiving venture capital investment from Google Venture (CVC arm of Alphabet, Inc) and 2 from Alexa Fund (CVC arm of Amazon, Inc). Therefore, given the important role that CVC investment plays in China's context and the heterogeneity vis-a-vis the extant literature, an in-depth exploration into China's CVC ecosystem is worthwhile.

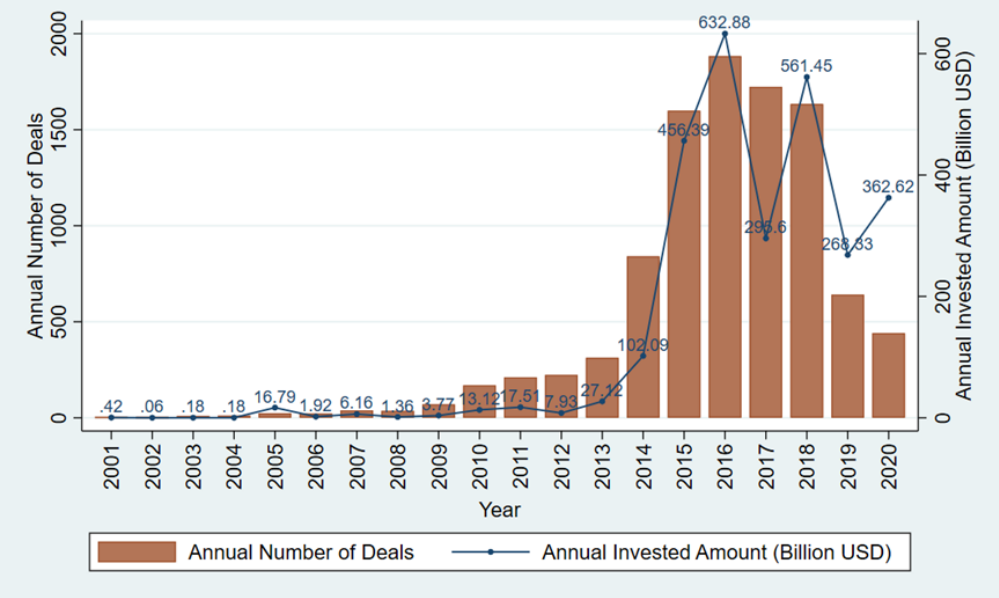

Figure 7: Annual volumes of China's CVC investments from 2001-2020

I employ a mixed method approach to uncover the complex organizational phenomena pertaining to the research question above. As the mixed-method is especially helpful for theories in their intermediate maturation stages (Molina-Azorin et al., 2017), I find it ideal to my research setting where I seek to extend my understanding of the CVC investment process, well understood in a mature context, into a distinctive and novel context. To obtain an overall understanding of China's CVC ecosystem and how it differs from the well-studied North America CVC investment norms, this study follows a simple framework around three key questions: who the involved stakeholders are; how the distinctiveness of investment characteristics manifests; and why established corporations are motivated to engage in CVC investments.

In the following sections, I first introduce the methodology and the sources of my qualitative and quantitative data respectively. Second, I depict the primary stakeholders in China's

CVC ecosystem and theorize about information flows among these stakeholders. I then compare and contrast the CVC investment distributions between the U.S. and China, and also propose potential mechanisms that explain such discrepancies. Based on the configuration of key players and the unique characteristics of CVC investment, I then theorize about the incentives in China's CVC context that are distinctive from the conventional North American wisdom. I especially focus on conceptualizing the existence and manifestation of political incentives to which Chinese corporate investors appear to be uniquely subjected.

This study mainly seeks to contribute to CVC literature in two pastures. First, I provide a systematic roadmap of China's CVC ecosystem, which operates distinctively from the institutional context in North America. My exploration strongly suggests that, when studying CVC investments in China, these idiosyncratic characteristics should be taken into consideration and reflected in the theorization. Second and more importantly, I extend the boundary of CVC investment objectives into the non-market strategy arena. By this in-depth research into the stakeholders and incentives of CVC investments in China, I take a first step to reveal how non-market considerations alter investment preferences and decision-making determinants of CVC investors.

4.2 Methods

I employ a mixed method approach in adaptation to uncover the complex organizational phenomena that comprise China's CVC ecosystem. By integrating qualitative and quantitative approaches together, the mixed method approach has been a growing methodological trend that can provide both empirical intricacy and rigor to match the complexities in focal phenomena (Creswell et al., 2007). While quantitative methods are perceived as more ap-

propriate for examining mature theories and qualitative methods are attributed most toward theories in the early stages, a combination of both can be especially applicable in fields where theories are in their intermediate maturation stages (Molina-Azorin et al., 2017). The core advantage of mixed methods is the triangulation of results which enhances validity (Creswell and Plano, 2007, Niglas, 2004). Meanwhile, such cross-validation becomes even more desirable when the generated understanding of the mechanisms underlying quantitative analyses results in new theoretical advances (Edmondson and McManus, 2007; Molina-Azorin et al., 2017).

My research goal to explore the phenomenon of China's CVC ecosystem satisfies all the above conditions and make the mixed method appropriate. First, while the theory development in the generic CVC field is relatively mature, its applicability and manifestation in China's context is still largely unknown. Second, the qualitative and quantitative parts can respectively serve an irreplaceable role to understand the characteristics and behavioral manifestations of the complex interactions between China's CVC stakeholders. The integrated methods jointly promote both insight and rigor of the research—while the qualitative interviews serve to elaborate the emerging phenomenon of emerging CVC investment ecosystem in China, the quantitative data provides preliminary evidence of its idiosyncratic characteristics. There has been a scholarly tradition (e.g., special issue on *Organization Science* in 2004) as well as recent advancements in using qualitative approach to uncover new dynamics of management theories in Chinese setting (Luo et al., 2019; Xing et al., 2021; Yang and Li, 2008). Third, with the triangulation provided by the method, I am therefore granted the flexibility to explore the novel yet complex elements in China's CVC ecosystem without compromising validity and reliability.

In delving into this complex phenomenon with mixed methods, I apply an inductive

approach associated with theory development to understand the patterned relationships among various stakeholders (Glaser and Strauss, 2017; Suddaby, 2006). Prior CVC theories overlook the evolution of its investment ecosystem in China, a context where CVC plays a critical role but quite likely follows distinctive logics. The inductive approach is thereby well suited because it is powerful in research questions where existing theory is underdeveloped or less applicable (McDonald and Gao, 2019).

4.2.1 Data sources

With the mixed methods design, I have drawn on multiple sources of both first-hand and archival data to conduct the study: (1) semi-structured interview with insider informants in both CVC divisions and funded startups; (2) interviews with closely related stakeholders including independent venture capitalists (IVCs), top corporate executives who may not be directly in charge of investment functions, and government regulators; (3) archival data that reveal the investment round information for previous CVC investments in both China and the U.S.; (4) other archival materials, including industry reports, investment memos, proprietary surveys, and press releases.

My primary source of data consists of 11 interviews with key informants who are closely engaged in China's CVC ecosystems . I adopt a combination of theoretical and snowball sampling (Yin, 2002). I first identify target respondents in two categories: *insider informants* and *external informants* (McDonald and Gao, 2019). Insider informants are primary decision makers of their corresponding organization or investment division. I have interviewed directors of investment divisions, startup (co-)founder, CVC fund manager, and directors of strategy divisions. External informants include two groups: (1) people who are in arm's length distance to the corporate investment, such as IVC investors and top corporate execu-

tives; (2) government regulators of investments, especially representatives of the State-owned Assets Supervision and Administration Commission who are closely tracking state-owned enterprises' entrepreneurial investments. Table 9 demonstrates a summary on the composition of the 11 interviewed individuals.

Table 9: Composition of the Eleven Informants

Type	Category	Interviewee description
Insider informants*	Corporate investment representative	One in traditional industry (SOE firm);
		One in high-tech industry (private firm)
		One invested in more than 20 unicorns (public firm)
	Startup (co)founder	Two in technology-intensive industry (one with and one without CVC funding)
		One in business innovation (CVC funding in Series B)
External informants	Corporate general executive	Two fortune 500 company executives (one engages in and one opt-outs for CVC investment)
	Independent investor	One in early-stage investments;
		One in late-stage investments
	Government regulator	One in central government supervision council;
		One in local government finance bureau

*One interviewee contributes to both categories of "insider informants", who has initially enacted their role as a startup founder and later as a corporate investment executive once their startup has matured

The interviews are semi-structured but center around the CVC investment incentives in China and their perceived differences from the U.S. CVC investment ecosystem. The interviews are typically face-to-face and last between 30 minutes to three hours in duration.

I decide not to tape record the interviews because of sensitivity issues. Instead, I follow the conventional 24-hour rule (Eisenhardt, 1989; Miles and Huberman, 1994) in writing down full case notes and document summary sheets within 24 hours of each interview. I also request my informants to review the interview report to ensure the validity and reliability of the documents (Crossan and Berdrow, 2003).

Beyond the qualitative sources of data collection, I have also gathered archival data on CVC investment in both the U.S. and China. The CVC investment round information has been collected from *Crunchbase* for the U.S. corporate investors, *CVSource* for Chinese corporate investors, and *VICO database from RISIS2* (Research Infrastructure for Science and Innovation Policy Studies 2) for European corporate investors. In addition, I have accessed *Cyzone*, an online entrepreneurial investment platform, which has initiated a "CVC Union" in China that share information among members. On the platform, I obtained access to industry analyses of CVC investments in China, such as analytical reports, investment commentaries, and videos on major investors.

I also refer to the Economic Political Uncertainty (EPU) index, as developed by Baker et al. (2016), to understand the relationship between political incentives and CVC investments. This index is based on newspaper coverage frequency that proxies for movements in policy-related economic uncertainty. It captures both near-term policy concerns (e.g., the policy adjustment rate of Fed) and longer term (e.g., the funding of entitlement programs) concerns that are reflected in newspaper articles. It has included the EPU in the U.S. and 12 other economies dating back to 1990s. It has been a widely applied index in financial economics research where scholars examine the impact of uncertainty on growth and investment (Doshi et al., 2018; Gulen and Ion, 2016; Jens, 2017; Kim and Kung, 2017; Kahle and Stulz, 2013). To examine the relationship between the trend of EPU and CVC investment volume,

I collected political uncertainty data from Baker et al. (2016), which provides monthly EPU information on the U.S., China, and nine major European countries, all of which have intensive CVC activities. For each of the involved countries, I collect corresponding information on each CVC investment round and aggregate the information into country-month level.

4.2.2 Qualitative research process on elite informants

Since the interview respondents are mostly upper echelon managers, the transparency and replicability in qualitative studies with elite informants should be particularly emphasized (Aguinis and Solarino, 2019). Elite informants are defined as "key decision makers who have extensive and exclusive information and the ability to influence important firm outcomes, either alone or jointly with others (e.g., on a board of directors)." (Aguinis and Solarino, 2019, p.1293). Serving as the upper echelon of organizations, these individuals are critical to theory building in strategic management research (Basu and Palazzo, 2008; Hambrick and Mason, 1984). These elite informants could offer valuable research opportunities in multiple ways. First, they provide useful insights on organizational narratives and enable the researcher to understand the micro-foundations of firm strategies (Felin et al., 2015; Foss and Pedersen, 2016). Second, by allowing the exploration of organization-wide processes, policies, and actions, elite informants offer insights into how the highest level of the organization shapes the lower operational levels (Aguinis and Molina-Azorín, 2015). As the qualitative part of this study mainly comprises interviews with corporate executives and venture founders, who are well-qualified as elite informants of the corresponding organization, I follow Aguinis and Solarino (2019) in revealing some additional information on the elite informants to comply with the transparency criteria that enable future replications.

First, this study follows a mixed method study with a theory-building orientation that

seeks to understand the complex interactions within China's CVC ecosystem. The research setting mainly resides in corporate investors and their portfolio ventures. Additionally, I also include other closely related stakeholders, such as IVC investors, government fund managers, and corporate executives. These second set of stakeholders are not directly involved in CVC investments, but their actions have a profound impact on the decision making of both CVC investors and invested ventures. As for the position of researchers along the insider-outsider continuum, I have an indirect relationship with most of the participants and the access to them is primarily based on a snow-ball approach. The sampling procedure has been elaborated in the subsection above and I do not repeat it here. Another criterion is the relative importance of the participants, which I perceive as high due to the fact that these informants jointly contribute to billions of dollars of CVC investment value. I follow the convention of defining data saturation point when the insights of respondents are linked and no new perspectives have been brought out (Bowen, 2008). The power imbalance is managed via endorsement from a prestigious individual or institution. For each of the key respondents, I reach them via the connection set by their direct supervisor or a corresponding government officer from regulatory commissions.

4.2.3 Data analysis

To generate insights from the mixed data , I focus on activities and themes documented in both types of data (Jick, 1979; McDonald and Gao, 2019). After consolidating all the qualitative and archival data into case histories, I follow the inductive study roadmap for multiple case studies (Eisenhardt, 1989; Yin, 2002). I adopt the theoretical sampling approach by identifying informants in representative types related to CVC investments, including corporate investor from public firms, corporate investor from state-owned enterprise (SOE),

private investor, and invested venture. To analyze the mixed data, I first apply open coding to understand how the elite informants reflect on CVC investment process. As the goal of this study is mainly to serve as a first step to unveil the characteristics and functionality of China's CVC ecosystem, the openly coded interview transcripts are suitable to retain all possible theoretical directions (Charmaz, 2006; Saldaña, 2013). In the second step, I further apply axial coding based on the openly coded transcripts. I integrate similar elements, i.e., those that have surfaced in multiple cases, into more abstract categories. Finally, I conceptualized the theoretical aspects that the second-order categories belong to. Table 10 illustrates representative examples of the coded interview quotes and how they are categorized into different theoretical aspects. For the reasons that the meetings have not been recorded in order to ensure maximum information revelation from the elite informants, and that the interviews were conducted in Chinese with transcripts later translated into English, I only present representative insights in the first order coding and do not duplicate the quote if the same idea appears multiple times throughout the interviews. Therefore, Table 10 serves more as an illustration that aims at revealing the critical aspects of CVC ecosystem in China.

Thereafter, to build internal validity and understand the "why" behind relationships, I perform a cross-case synthesis and apply the explanation building technique, which seeks to build a general explanation that fits all cases and identify associations among elements of the explanation (Eisenhardt, 1989; Yin, 2002). As the composition of stakeholders and their interrelationships gain clarity, I revisit extant CVC literature for comparative purposes. Integrating the insights that emerge from my research, I generate the analytical framework in three folds—the stakeholders, investing characteristics, and investment incentives of China's CVC ecosystem—to theorize the investment process, adding to the mechanisms that have been depicted in current CVC studies.

Table 10: Examples of semantic coding of first-round interviews

Informant type	First order coding–open coding quotes	Second order coding –axial coding	Third order coding–integrated conceptualization
Corporate investment representative	IVCs are just "dumb money" as they provide nothing other than monetary capital	Resources provided by IVC investors	Relationship with IVC
Independent investor	We have syndicated with many corporate investors in nurturing venture firms. These ventures have better insights in corresponding industries than we do. Now, [fund name] makes investment just by following our portfolio firms' expansion plan, without spearing our own efforts to search high-value investment opportunities.	IVC motivations for syndicating with CVC investors	

(Continued)

Startup (co)founder	As a startup, we need capital and complementary resources to develop. Financial capital is fungible but complementary resources can only be provided by certain strategic investors. In the AI + Robotics industry, the three most valued resources are: data, content, and ecosystem. Thus, an ideal investor needs to be a salient platform that has wide industrial coverage and enormous user traffic (the sum of IP, user view, and page view). This criterion has restricted the target investor to BAT (Baidu, Ali, Tencent), the three leading CVC investors in China.	Venture motivations for opting in CVC investors	Relationship with venture
Corporate investment representative	Because of [Company name]'s signaling effect, we are granted favorable terms compared to other strategic investors during the price negotiation process	Differences in dealing with IVC and CVC investors	

(Continued)

Corporate general executive	We possess the strategy to fill out the Go board, because you will never know which play will be the critical move We tend to explore and build new businesses based on our infrastructure [Company name] is revolving our ecosystem to prepare for future industrial landscape. It is not known whom the next disruptor will be, and therefore we need to build a "venture moat" to fence against any possible future disruptions	Investment motivation to fill all niche markets	Product-market incentive
Corporate investment representative	We make the investments for precautionary purposes; and we therefore do not spend much time in reviewing or reflecting on our failed investments The main objective is to build relationships with potential suppliers and customers in the business ecosystem that we [the ultimate corporate parent] establish Our main rationale is to prepare the industry layout that strengthens our competitiveness in future markets	Investment objective to connect with current and future complementors	

(Continued)

Corporate general executive	If we become interested in a certain technology, [company name] always seeks to fully own it through acquisitions. Making minority equity investment to access technology does not make sense to us. We need the full control of the focal technology if it has been proved vital	The lack of motivation in utilizing CVC to promote technological innovation, corporate executive perspective	Technological incentive
Corporate investment representative	Due to high uncertainty for this type of technology, the only feasible strategy is to have an industry coverage as wide as possible. It will be considered as a successful strategy as long as one-tenth of the invested projects take off The focus is indeed technology potentiality. The technology achievements that have already been met by ventures are not considered as an evaluation criterion in deciding targets In deciding whether to form a CVC investment relationship with a specific venture, we evaluate the industry trend, the founding team capability, the profit story, and the available resources... we are very cautious in fueling money into the seemingly fancy technologies. They are likely to be bottomless chasm	The lack of motivation in utilizing CVC to promote technological innovation, CVC division perspective	

(Continued)

Startup (co)founder	With our endeavor to develop cutting edge technology, we can obtain the government supportive funds with pretty favorable terms. Corporate investors are often concerned that they cannot get the investment return in a short- or medium-term, causing our business model [to be] unattractive to them.	The lack of motivation in utilizing CVC to promote technological innovation, venture perspective	
Government regulator	The newly released action plan regarding "building high-standard market system" is surely aiming at directly regulating the VC/PE market and lead the market capital to its most effective direction In China, the longevity of CVC resembles that in IVC (mostly 5+2 years and rarely exceeds 7+2), which is less than CVC funds in the US. For the technology fields that need continuous capital inflow for a prolonged time (e.g., semiconductor, intelligent robotics), startups hardly get steady capital from the market to accumulate R&D development. Therefore, these industries heavily rely on government's industrial fund to play a central role in guiding the private capital into these fields.	How the political institution in China shapes the landscape of CVC investments	Political incentive

(Continued)

Corporate investment representative	The initiative is to get an entry ticket into some specific fields There are areas and industries that have certain entry barrier. We cannot access these markets merely with its own resources. Therefore, to complete the strategic layout of our future industrial landscape, the only feasible strategy is to become shareholders of the ventures that have access to such regulated markets Our preferred industries and target ventures will be heavily influenced by investment-oriented policy making of the governments Of course, political connection of the startup founders constitutes a salient criterion in our evaluation	Political objectives that can be achieved via CVC investments	

4.3 Theoretical summary

My inductive exploration on the complex CVC ecosystem embedded in China consists of three progressive steps. A summary of the corresponding elements and their respective theoretical implications is illustrated in Table 11.

Table 11: Summary of the CVC ecosystem in China

Dimensions of Ecosystems		**Idiosyncratic features**	**Theoretical Implication**
Stakeholders	Corporate investor	Major corporate investors have formed a CVC union and developed an online platform to share exclusive information	1. The direction and type of information that flows among different stakeholders 2. The motivations and impacts of market players and non-market player (i.e., the government) syndicating together
	Invested venture	There is a "family tree" of CVC investment networks, where the invested ventures later turn into corporate investors themselves and the corporate parent follows its portfolio ventures' investment decision	
	Independent VC	IVC investors are regarded as "dumb money" in China, whose decisions usually depend on CVC investors' insights	
	Government fund	The industrial funds provided by local and central government play a critical role in supplementing the CVC ecosystem	

Features of investment distribution	Round distribution	Preference toward relatively early-stage ventures	1. Risk attitude of CVC investors in China 2. Deviation from the conventional wisdom in North American CVC investment practices
	Amount distribution	Excessively conservative in the amount of investment	
	Industry distribution	Inclined toward non-high-tech sectors such as consumption and entertainment, rather than technology-intensive ventures	
Manifestation of strategic objectives	Technology incentive	Corporate investors mainly seek business model innovation rather than technology breakthroughs	1. Peripheral emphasis on the technology incentives in China's CVC investments 2. Emphasize on breadth rather than depth of market access 3. Existence of non-market incentives in triggering investment
	Product market incentive	The major driving force is a relational incentive where the corporate investor seeks wider industry coverage	
	Political incentive	CVC investments serve as a special type of corporate political activity	

First, I depict the primary stakeholders in the CVC ecosystem under China's context. Based on the insights observed from interviews, I categorize them into one of the four stakeholder types in China's CVC ecosystem—i.e., the central players including the corporate investor and invested venture, as well as the arm's length players including the IVCs and government participants, including regulators. In addition, I also focus on the factors that shape the uniqueness of the relationship within different categories of stakeholders. Second, I look at the characteristics of CVC investment that result from complex interactions

among the various stakeholders that have been depicted in the first step. Specifically, I focus on archival data that reveal the distribution of three key decisions that a corporate investor faces, which are choices on the round, amount, and industry of an investment. I compare the distribution concerning each dimension under China and the U.S. contexts, respectively. I point out how China's CVC investments unfold in a way that deviates from the conventional wisdom that has been widely theorized and examined in North American CVC investment practices. Especially, I unveil the conservativeness of corporate venture investment in China. As a last step, drawing from the interactions among different stakeholders and the features of core distributions, I leverage interview responses to theorize the strategic incentives that motivate established Chinese corporations to engage in CVC investments. On the one hand, I elaborate how the incentives for technology advancement and product-market access, which are two primary types of returns that CVCs are (canonically) expected to pursue, manifest in a distinctive way under the institutional context of China. On the other hand, I also emphasize the existence of non-market incentives (mostly corporate political incentives in this research) in driving CVC investments. I theorize whether and how established corporations utilize the CVC investments as a corporate political activity and seek non-market political returns. From the in-depth field studies in China, I extend the theoretical boundary with regard to the strategic objectives of CVC investments.

4.4 Components of CVC ecosystem stakeholders in China

An ecosystem approach emphasizes identifying a set of actors who interact with each other to materialize a value proposition (Adner, 2013, 2017; Adner and Kapoor, 2010, 2016a,b). As the starting point of exploring my focal ecosystem on China's CVC invest-

ment, I first describe the composition of the actors and the interdependent value creation process among them. Similar to corporate stakeholders, who are defined as persons or groups with legitimate interests in substantive aspects of corporate activity (Donaldson and Preston, 1995), I set the boundary of CVC ecosystem stakeholders as the core entities that have salient impacts on CVC actions and outcomes. I first identify the relevant stakeholders and then theorize how they uniquely create value in China's CVC context.

4.4.1 Corporate investors

Undoubtedly, corporate investors are the central players in a CVC investment. They provide both monetary capital and specialized complementary assets that pervasively facilitate value creation in CVC activities (Drover et al., 2017; Park and Steensma, 2012). With a relatively short history of development, the design of the Chinese corporate investment process largely mimics that of the North American. Indeed, as mentioned by one respondent and validated by several others, the terms in widely adopted CVC investment contracts are translated scripts from standard U.S. deals. The corporate investors usually remove some terms that are not applicable to a specific investment, but rarely do they add new terms that go beyond the ones that appear in U.S. CVC contracts. In a typical CVC investment in China, corporate investors follow the incremental resource commitment rule and have the discretion to terminate an investment in subsequent rounds. Meanwhile, they enjoy a set of preference clauses, including convertible stocks, convertible debt, right of first refusal, veto power, and valuation adjustment mechanism (VAM) agreement. Compared to corporate investors in the U.S., Chinese corporate investors tend to be more conservative in each investment by emphasizing the investor protection clauses in the contract. For example, a VAM clause (also known as "bet-on terms") agrees upon conditions (mostly the future

financial performance indices of the invested venture) in which the investors have the option to exercise the right to adjust the valuation or retract the investment when the conditions are not satisfied. While in the U.S. it is almost exclusively used by private equity (PE) and IVC only, a VAM agreement is frequently applied by corporate investors in China.

Despite the similarity in investment process and terms, however, the uniqueness of Chinese corporate investors lies in the availability of information acquisition channels pertaining to potential and existing investments. The distribution of China's CVC funds follows a typical duopolistic pattern, where Tencent and Alibaba act as two major "aircraft carriers" at the head of the fleet. The remaining corporate investors therefore have a strong motivation to align together to compete with the two duopolies. In 2018, the major corporate investors in China other than Tencent and Alibaba have formed a CVC union where they focus on three core goals. First, they formed an exclusive online communication platform (i.e., cyzone) where the corporate investors share information and experiences. Second, they utilize the union as a channel using which members seek syndications and cross-participate in each other's portfolio ventures. Third, they coordinate in building a joint brand as a holistic union rather than as standalone investors, which has granted them a higher level of joint attractiveness against the duopolistic corporate investors.

4.4.2 Invested ventures

Another category of directly engaged players is the portfolio firms who receive resources inflow from CVC investments. Similar to startups in the U.S. context, the primary motivation that China's new ventures seek CVC investment is the need for complementary assets from target corporate investors. As a startup founder put it, *"we need capital and complementary resources to grow our business. While financial capital is fungible, complementary*

resources can only be provided by certain strategic investors." The choice among corporate investors is thereby centered around *"the match of our resource needs and the corporation's plausible resource provision."* Take the AI industry as an example, which is one of the fastest growing industries in China. Startup founders in AI industry unanimously reflect on three types of complementary resources from the corporate investor: data availability to train the machine learning model, content support to ensure value added, and a corresponding ecosystem that enables the startup to benefit from a positive spillover effect. Thus, an ideal investor is expected to hold a salient platform that has wide industrial coverage and enormous user traffic. Among these three types, data and contents are regarded as general strategic resources because most of the top corporate investors could provide them with similar quality. The ecosystem is a more specialized complementary resource and ventures seek to attract different platform owners that best match their demand. A venture founder has elaborated their reasoning on how they choose between Tencent and Alibaba, both of whom have owned a gigantic business empire in China —- *"From the ecosystem perspective, Alibaba focuses more on constructing a business-to-business ecosystem while Tencent targets on building a business-to-customer ecosystem. For XXX [the invested venture's name], our strategic positioning is to produce smart robots that provide services to households. Therefore, a business-to-customer ecosystem fits more with our strategic objectives."* This reflects that the fit of corporate investors is differentiated by distinctive platform ecosystems that they bring to the table.

Although the direction of resource flow is often viewed as unilateral from corporate investors to invested ventures, the flow of information can also follow an opposite direction. Portfolio ventures are expected to provide corporate investors with thorough insights into their specialized industries. A special feature I observed was that the invested venture later

turns into corporate investors themselves, under China's context. Once the mature ventures need a sizable amount of capital to invest in another nascent venture, they pitch to the parent fund and provide information to persuade the parent fund to collaborate in such CVC investment. The ultimate corporate parent often trusts in their ventures' judgements and makes investment decision by following its own portfolio firms' expansion plan, without taking its own efforts to find high value investment opportunities. This has formed a unique phenomenon of CVC investment "family tree" where the ultimate corporate parent becomes a more passive investor once the first generation of invested ventures start to make their own investments.

4.4.3 Independent venture capitalist

Although IVCs are not a direct player in a CVC investment, they are important syndication partners and salient complementors that contribute to value creation in the CVC ecosystem. The direction of information flow in China's CVC-IVC syndication is mostly from CVC to IVC partners. Unlike the common perception in the U.S. where "smart money" mostly refers to IVC investors and CVCs are considered as "dumb money" (Huang and Madhavan, 2020), IVCs are frequently observed to follow the investments led by CVC investors in China. CVC are perceived as better able to nurture the venture because *"[in China] the investment experience and so-called insights play a less important role than the industrial insider information and provision of access to established corporation's platform."* The IVCs are willing to give the leading role to CVCs due to the fact that *"a venture cannot [achieve] success [in China] if its products and services are not consolidated in a major corporation's platform, and the easiest way to get into a corporate platform is to become its investee."*

Indeed, there is a good alignment of investment objectives between CVC and IVC in-

vestors where the former open up customer access to the startups and the latter coach these ventures on governance related issues. In contrast, the within investor-type (i.e., CVC or IVC) syndication appears to be less appealing than between investor-type syndication. On the one hand, there might be conflict of interests within major CVC players; on the other hand, IVCs have found little additive value in merely forming coalitions with each other. To better illustrate this argument, I have delved into the pairwise investment relationships among two most active CVC investors (Tencent and Alibaba) and two most active IVC investors (Sequoia (China) and Hillhouse) in China's venture capital market. Table 12 presents the number and percentage of co-investments among each of these two investors. I do observe that CVC investors rarely syndicate with each other but they intensively syndicate with prestigious IVCs. In addition, while the two IVCs have a slightly higher proportion of investment overlap than the overlap with CVC investors, the IVCs also have a higher inclination to co-invest with a major CVC investor rather than another high-profile IVC. I also visualize the intensity of linkages among different investors in Figure 8.

Table 12: Co-investment deals among top IVC and CVC investors in China

	Total investment	Hillhouse	Sequoia	Alibaba	Tencent
Hillhouse (IVC)	256	-	42 (16.4%)	36 (14.1%)	90 (35.3%)
Sequoia (IVC)	1005	42 (4.2%)	-	29 (2.9%)	104 (10.3%)
Alibaba (CVC)	800	36 (13.1%)	29 (10.5%)	-	7 (2.5%)
Tencent (CVC)	275	90 (11.3%)	104 (13.0%)	7 (0.9%)	-

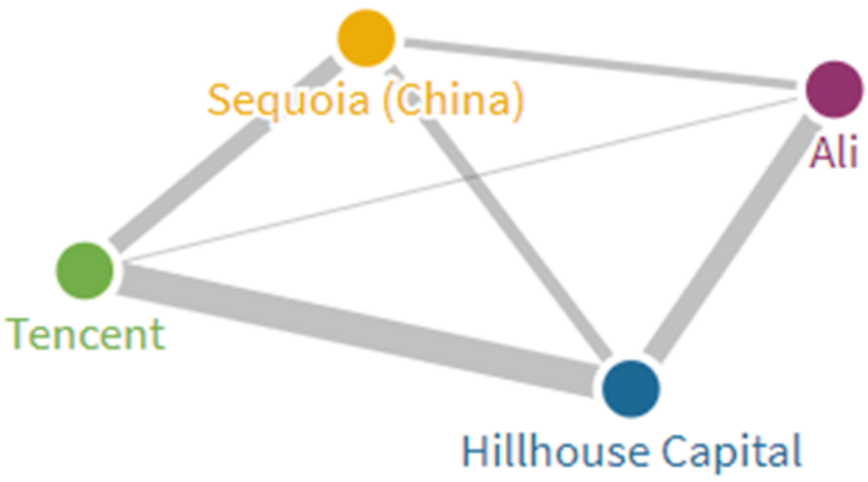

Figure 8: Co-investment intensity among top IVC and CVC investors in China

4.4.4 State governments

A unique and critical stakeholder in China's CVC ecosystem is the state governments. It shapes the value creation and distribution in CVC ecosystem via three aspects of influence.

First, a large chunk of corporate investors in China are state-owned-enterprises (SOE). Today's SOE are very different from their predecessors and tend to enjoy a greater amount of independence (Bruton et al., 2015). While these SOE investors do have flexibility to make investment decisions, their information access and evaluation matrix can differ greatly from those of private firms. SOEs have close connection to the government, such that they can benefit from regulatory influence (Hillman et al., 2004), enhanced legitimacy (Baum and Oliver, 1991), and exclusive information regarding state policies (Lester et al., 2008). Meanwhile, with government intervention (Okhmatovskiy, 2010) and the unique function of SOEs (Jensen, 2008), the main objective of SOEs is not necessarily maximizing profits (Bruton et al., 2015; Ghosh and Whalley, 2008). Instead, in SOE investments, they claim

the purpose as aligning with industrial policies and nurture ventures in critical industries that the government wishes to boost.

Second, beyond the proprietary information that potentially shape the investment behaviors of SOE investors, government information influences generic CVC investors with its industrial policies that are publicly available to everyone. Especially since China has a high-powered government, capital flow on the market is heavily directed to the industries that are favored by local or central governments. For example, on Jan 31st, 2021, the General Office of the CPC Central Committee and General Office of the State Council unveiled an action plan that aims at "building high-standard market system" (Xinhua News, 2021) [1]. This plan includes more than 50 specific measures about resource allocation and the market environment. Although this is a very recent plan for which I cannot observe its implementation yet, it is widely believed that this government plan will profoundly influence the CVC (and VC/PE in general) ecosystem, with items that enable the syndication of banks and equity funds, bring out detailed regulatory policies on VC investment, and encourage pension funds' engagement in equity investments. Such infusion of long-term capital could greatly mitigate the "impatience" (short-termism) in China's current investment ecosystem at large.

Third, in the past decade, there is a rapid growth of government industrial venture funds at all governmental levels that range from county to nation. The objective of these government funds is to guide private capital toward certain industries. As of 2019, there has been 2,090 industrial funds with a total volume of 1.78 trillion USD set by government. Among these funds, about 162.4 billion USD (9.1 percent of the total fund volume) are set with the goal to provide capital support to startups in the targeted industries. Although the investment efficiency of government funds is relatively low, it has successfully directed

[1] http://english.www.gov.cn/policies/latestreleases/202101/31/content_WS6016bb82c6d0f72576944dff.html

private capital to deeply engage in the industries that the governments support (Bank of China Report, 2019). In fact, all the interviewed private-market investors (i.e., both CVC and IVC) acknowledge their willingness to follow the government funds' investment, because it demonstrates a strong signal on the industries and ventures that have access to exclusive government resources.

4.5 Features of CVC investment distribution in China

The complex interactions among diverse stakeholders as discussed above could further affect the likelihood that a potential CVC investment relationship with different attributes materialize. In a typical CVC investment, venture's stage, committed capital amount, and industry coverage are the core dimensions upon which individual investors need to make decisions. Such individual preferences could add up to reflect the aggregate preferences on each dimension under China's CVC ecosystem, delineating characteristics of its investment distributions. I delved into the conceptual indication of each dimension and compared the nuances between these distributions in the U.S. and China.

4.5.1 Round distribution

Heterogeneous investors could have distinctive preferences regarding the development stage of the start-ups they finance (Dushnitsky and Shapira, 2010; Dokko and Gaba, 2012; Ivanov and Xie, 2010). Some firms prefer ventures that are in their early stages, where they can spread the available budget to more ventures (as early stages usually tend to be much smaller in size). Others may prefer to wait until later rounds, when the start-up already has

a product, or at least a prototype. Existing CVC studies have well reasoned that the pursuit of strategic objectives results in a preference toward later stage investments. For example, Dushnitsky and Shapira (2010) theorized that the lack of performance-based payment schema has propelled corporate investors to invest in early-stage ventures when the uncertainty level is excessively high. Similarly, (Dokko and Gaba, 2012). While this pattern holds true in the U.S. context, China's CVC investors appear to favor the early-stage investments instead.

Figure 9 summarizes the round distribution of CVC investment from U.S. investors since 1995-2020. In general, the round distribution in the U.S. is relatively even among different investment series, with the Series B investment takes the largest proportion. It observes a salient amount of investments occurred in late investment stages (beyond Series C). This pattern could steam from two underlying reasons, both of which are congruent with the dominant logics as depicted in existing literature. First, with the core objective being to achieve technology and market access via CVC investments (Belderbos et al., 2018; Benson and Ziedonis, 2009; Ceccagnoli et al., 2018; Dushnitsky and Lenox, 2005b, 2006), these investors are more likely to engage in an investment once the technology is proven and the market information is sufficient to resolve uncertainty. Second, the sequential investment design enables corporate investors to periodically reevaluate the ventures. Their investment returns (both financially and strategically) are expected to be positively linked to the venture's anticipated future performance (Guler, 2007; Li and Chi, 2013; Mohammadi et al., 2014). Therefore, typical CVC investors tend to engage in multiple rounds that last into late stages as long as the venture continually signals its future potential.

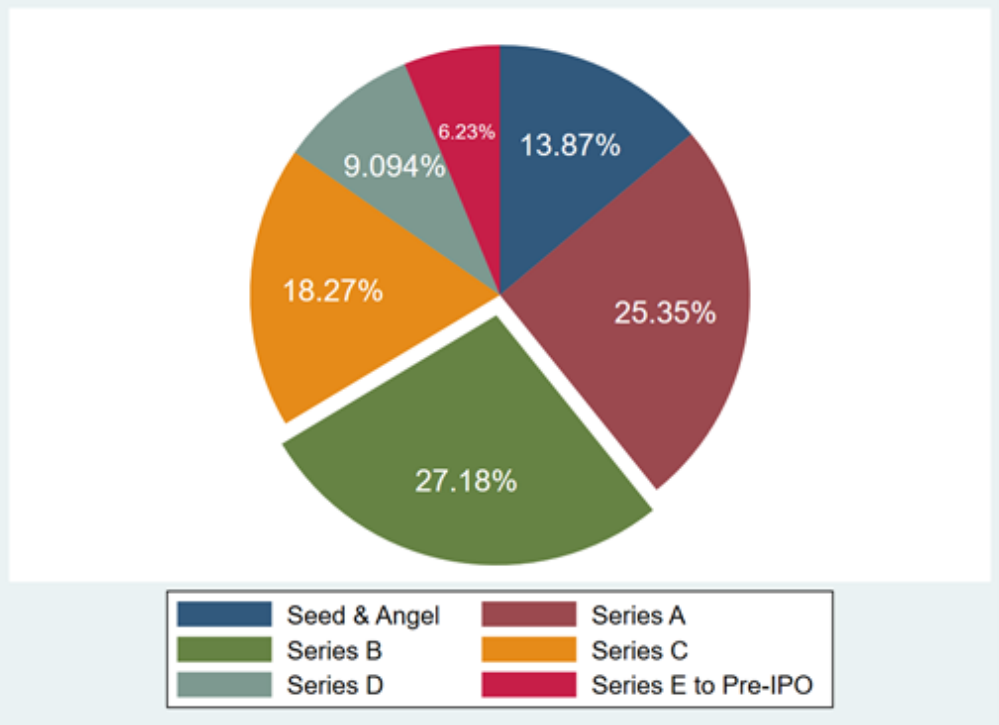

Figure 9: Round distribution of U.S. CVC investments, 1995-2020

In comparison, however, China's CVC investments are heavily inclined toward early-stage investments. As shown in Figure 10, corporate investors in China have more than 75 percent of the deals allocated to Series A or before, while CVC investors in the U.S. commit less than 40 percent of their investment rounds to these early series.

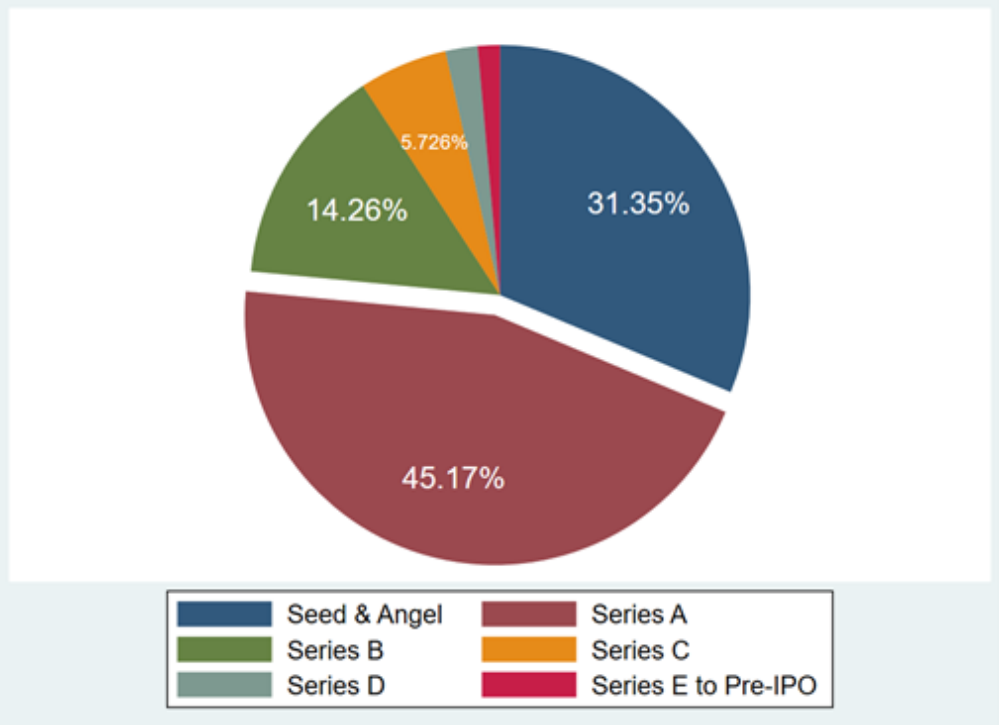

Figure 10: Round distribution of China CVC investments, 2001-2020

4.5.2 Investment amount distribution

Another important characteristic of the focal investment is the amount of capital commitment in each round. Corporate investors in western markets are supposed to be uniquely positioned to provide high amount of funding (Colombo and Shafi, 2016; Katila et al., 2008), causing the ventures more likely to engage a CVC investor when their funding needs are high. However, the investment amount in general appears to be more conservative in China's CVC market. The distributions of investment amount under the U.S. and China context are shown in Figure 11 and 12, respectively. With more than half of the investment rounds exceed 10 million dollars fund raising, it is obvious that corporate investors in the U.S. on average are committing a much higher volume to each deal. Only one-fourth of the deals are lower than

5 million USD by the U.S. CVC investments. As a sharp comparison, however, corporate investors in China most frequently commit only 1.5 to 5 million dollars in each of their investment rounds. The majority of CVC deals in China feature an investment amount that is less than 5 million USD while less than 30 percent of the deals exceed 10 million.

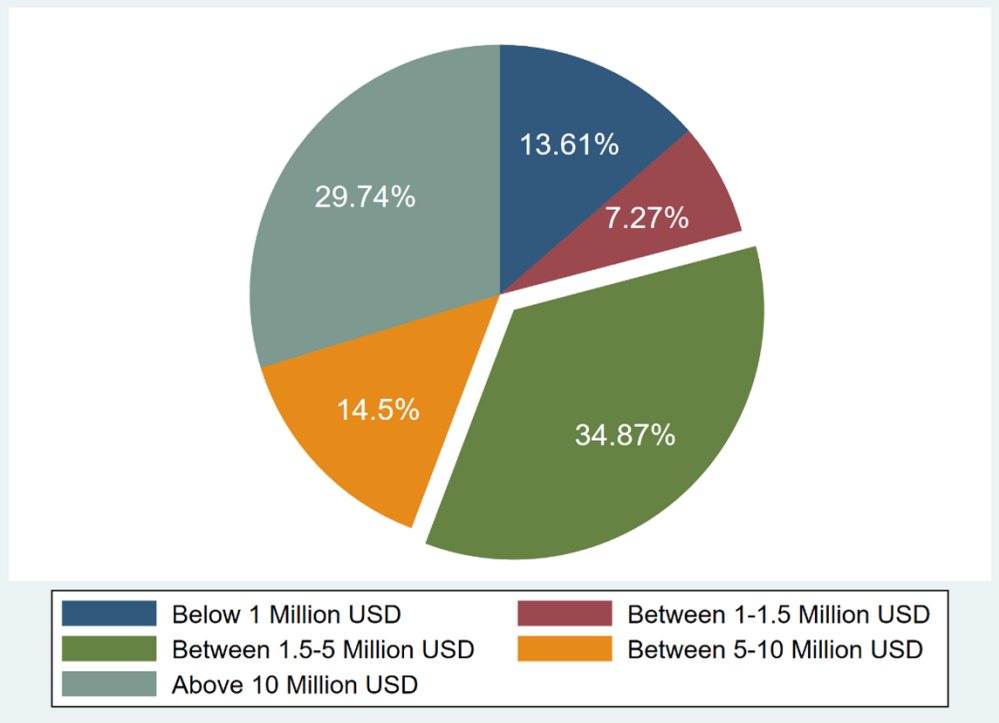

Figure 11: Per deal amount distribution of U.S. CVC investments, 1995-2020

The distinctions in the distribution of deal amount may partly come from differences in round distribution where China's corporate investors engage more in early stages when the capital requirement is generally lower. However, with a more skewed divergence regarding the investment amount between the two contexts, the enlarged discrepancy may not be fully explained by just the round differences. According to responses from corporate investors in China, such inclination to a smaller deal amount is at least partially due to Chinese cor-

porate investors' primary goal which differs from that of U.S. investors. The emergence of CVC investment in the U.S. largely comes from the need to facilitate and acquire critical technology. However, China's CVC investors are mainly driven by the guideline that *"we do not want to leave any blank area on the investment map,"* implying a market coverage consideration. In the next section, I will provide more details on the goal differences for CVC investments in respective context, but I wish to propose three aspects here that briefly depict how the differences in investment objective and deal amount can be linked together. First, corporate investors in the U.S. prioritize the depth of innovation that necessitates an intensive commitment to push the technology boundary. In contrast, China's CVC places greater emphasis on the breadth of market coverage in their portfolio ventures. Second, while nurturing nascent technology commonly consumes a salient amount of capital input, the pursuit of fulfilling market coverage is less capital intensive. The corporate investors in China only need an entry ticket for most of their investments to obtain a stake in the corresponding market. Third, without an incentive to "control" the ventures' strategic direction, a majority of CVC investors in China prefer to hold a relatively small amount of venture shares because *"a high equity ownership in a venture would trigger a mandatory consolidation of the venture's financial statement into the parent company, which we (as CVC investors) strongly wish to avoid."*

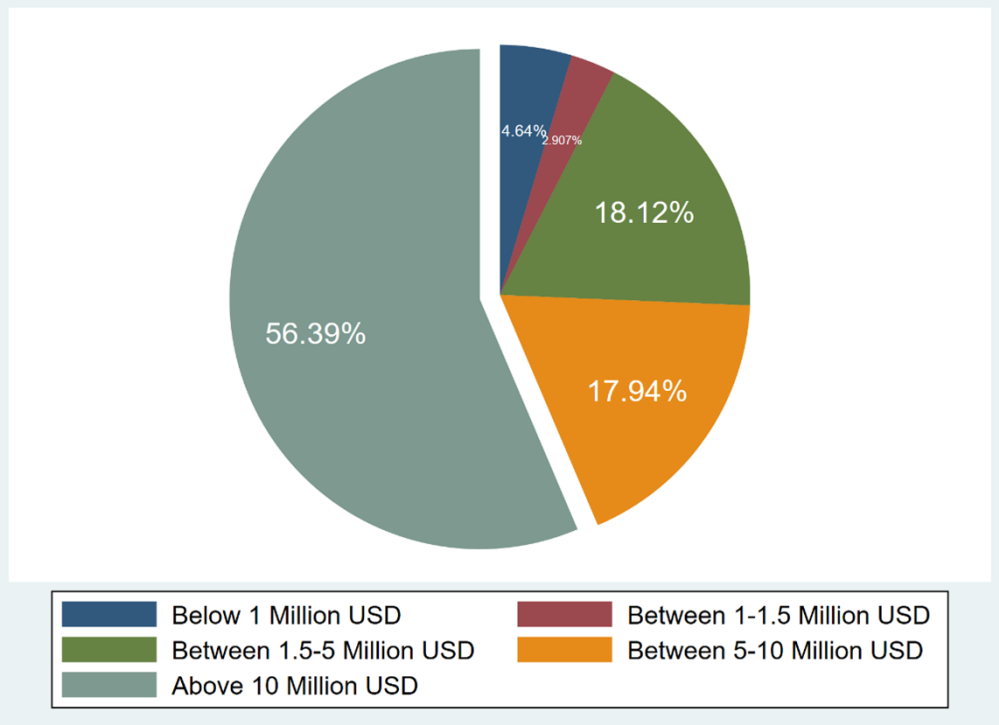

Figure 12: Per deal amount distribution of China CVC investments, 2001-2020

4.5.3 Industry distribution

The objective to fulfill strategic needs would imply that CVC focuses on a narrow range of industries to satisfy specific corporate goals (Dokko and Gaba, 2012). With a prevalent goal to advance technology and ensure intellectual property protection, corporate investments are expected to converge to technology-driven industries, where breakthrough innovations are likely to occur, and proprietary patent rights serve to protect the portfolio firm's knowledge. Indeed, I have seen major U.S. CVC investors explicitly favor those industries in their statements. For example, Wendell Brooks, Intel senior vice president and president of Intel Capital, commented on their investment philosophy that *"Each of our recent investments is pushing the boundaries in areas such as AI, data analytics, autonomous systems and semicon-*

ductor innovation."[2] China's corporate investors, however, seldom mention their inclination to hunt for next generation technology. Instead, as a corporate investment division chair in China explained, their screening of target industry is based on *"selecting the markets that [the corporate parent] cannot access with our own resources, or the ones where young talents reside in."* Especially with the fast growth of consumption and entertainment sectors, China's CVC appears to be rushing into capital-intensive rather than technology-intensive industries, which noticeably differs from the norm in U.S. CVC investments.

Figure 13 and 14 provide detailed illustrations of the corresponding industry distributions among existing CVC deals. Echoing the conventional logic on facilitating technology advancements via CVC investments, it is not surprising that the U.S. corporate investors are most active in innovation-driven industries, such as computer, internet, biopharma and telecommunications. The industry distribution of Chinese CVC investments follows a very different pattern. As an investment committee chair in a public Chinese corporation put it, "corporate investors in China are impatient and risk averse in general, who focus more on the ones with business model innovation rather than expecting high-tech innovation." Such reluctance to pursue long-term technology breakthroughs leads the primary outlet of Chinese CVC money flow to be the entertainment and business services sectors. Indeed, even for many deals originating within internet and computer related fields, most interviewees do not perceive their portfolio firms as exploring technological boundary-spanning. Quite a few of them have explicitly acknowledged that *"we (the corporate investors) just seek to find new scenarios where the existing technology capabilities are applicable."* As a result, China's CVC investments play a much more salient role in industries that provide daily services to individuals and businesses, while they have downplayed the involvement in industries where

[2]https://newsroom.intel.com/news/intel-capital-invests-132-million-11-disruptive-technology-startups/#gs.s72pb1

frontier technologies are likely to emerge.

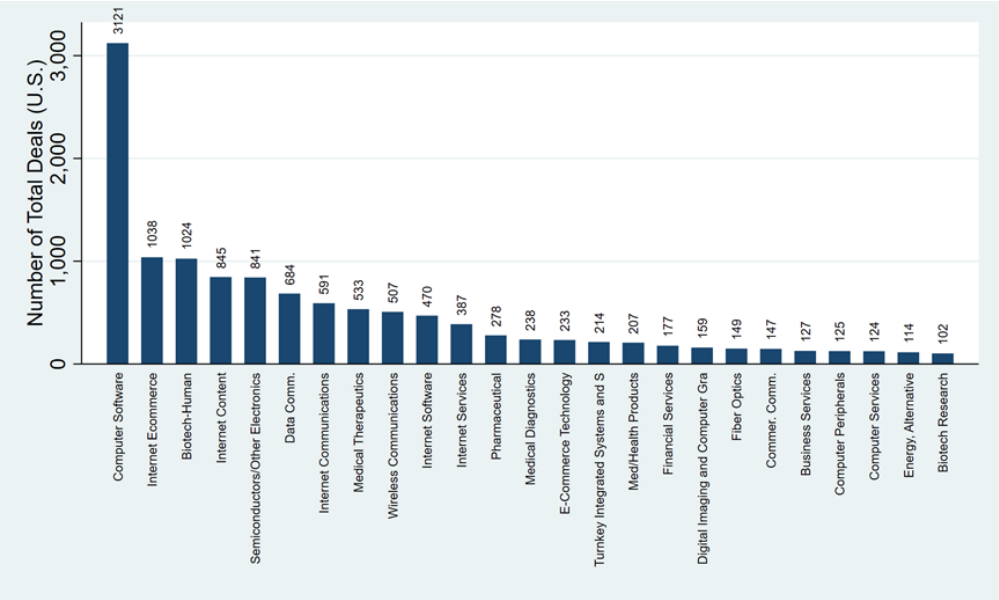

Figure 13: Industry distribution of U.S. CVC investments, 1995-2020

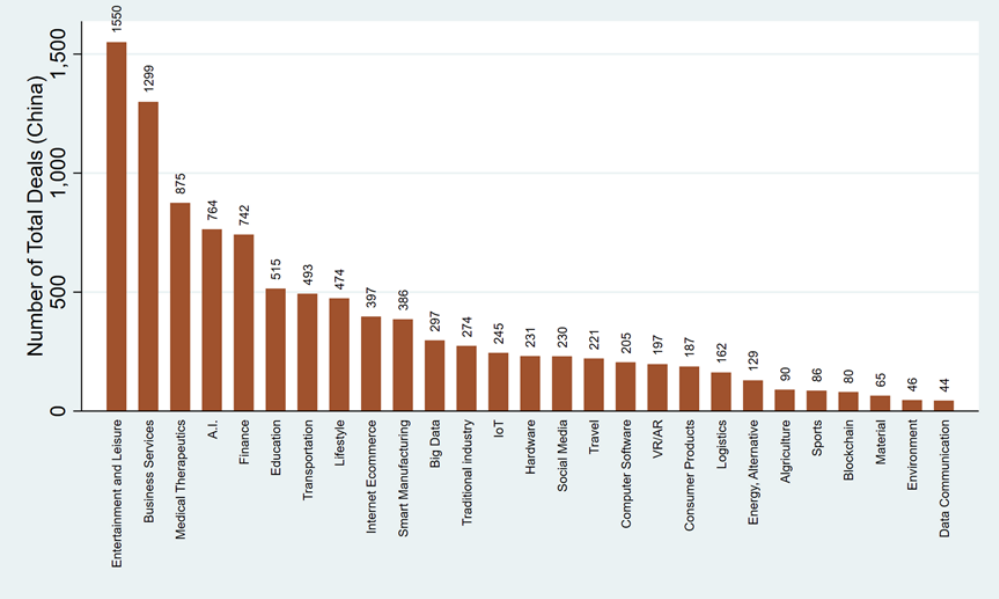

Figure 14: Industry distribution of China CVC investments, 2001-2020

4.6 Manifestation of CVC strategic objectives in China

The characteristics of China's CVC investment distributions, which are different from the patterns predicted by existing CVC studies, hints at heterogeneous incentives that motivate established corporations to initiate equity investments in diverse new ventures. It has been widely agreed that the possession of strategic objectives differentiate CVC investors from their IVC counterparts (Drover et al., 2017; Dushnitsky and Lenox, 2005b, 2006). Among the existing literature that is based on the U.S. CVC investment incentives, the core driving forces in strategic objectives are comprised of facilitating internal technology development and getting access to new technology markets (Belderbos et al., 2018; Benson and Ziedonis, 2009; Ceccagnoli et al., 2018). However, the manifestation of strategic objectives in China represents systematic differences compared to the established North American norm, which provides an explanation for the distinctive features of China's CVC investment distributions as well.

4.6.1 Technology incentives

The pursuit of access to breakthrough technology has been assumed as a primary incentive that drives CVC investment. However, according to a study of 96 corporate investment representatives in China, it surprisingly shows that "facilitate innovation within parent company" is regarded as the least important objective for CVC investments in China (Yu, 2021). They have also demonstrated interviewees highlighting an inclination against satisfying technology innovation via CVC investment. In the response of my 11 interviewees, the pattern is similar. From the corporate side, my respondents on the investor side acknowledge that *"Our investment philosophy is emphasizing business model innovation rather than technol-*

ogy innovation; we would be happy to buy new technologies on market once they have been mature, but we would not take the extremely high risk to nurture such technology by our own." They also follow the investment strategy that *"in deciding whether to form a CVC investment relationship with a specific venture, we evaluate the industry trend, the founding team capability, the profit story, and the available resources... we are very cautious in fueling money into the seemingly fancy technologies. They are likely to be bottomless chasm."* From the startup side, they have found it relatively easy to get corporate capital if they could differentiate themselves in terms of business model innovation, which is regarded as "easy money" compared to the uncertainty in committing to technology innovation. Even for those who do focus on exploring hard-core technologies, they do not perceive CVC as an ideal partner to collaborate with. As the founder of a semi-conductor venture stated , *"with our endeavor to develop cutting edge technology, we can obtain the government supportive funds with pretty favorable terms. Corporate investors are often concerned that they cannot get the investment return in a short- or medium-term, causing our business model [to be] unattractive to them."*

The key reasons for such discrepancy from the mainstream western CVC investment rationale are two-fold. First, there is a much smaller proportion of ventures focusing on bringing breakthrough technologies in China. The vast existence of government industrial funds could satisfy their capital needs. Especially given the fact that government funds are much more patient than the corporate funds, and that these technologies are often beneficial for the whole macro institutions, nurturing these technology-intensive ventures through government fund is considered as a Pareto improvement for all the involving stakeholders. Second, in most industries, China's technological development is not at the global frontier. In the "make or buy" trade-off, the corporate parents often find it much more efficient to

purchase the more advanced products on the international market, rather than investing a great amount of resources to develop the same product in-house through either internal R&D or nurturing external ventures.

Product-market incentives. Apart from the search for technological opportunities, CVC investments can also be driven by incentives to access nascent markets (Benson and Ziedonis, 2009; Drover et al., 2017). In developed economies where market conditions have been relatively stable, the corporate investors are expected to avoid market uncertainty in achieving their investment objectives (Li and Chi, 2013; Li and Mahoney, 2011). Industry volatility has been traditionally assumed as a negative signal that defers venture capital investments in the western context (Bygrave et al., 1989; Cochrane, 2005; Gompers, 1995; Ruhnka and Young, 1991). However, in China where the market uncertainty is inevitable because of the fast-changing business landscape, the corporations make investing strategies that adapt to such volatility rather than trying to avoid it. They mostly follow an ecosystem strategy of stepping into a wide array of interconnected product-markets, so that they build a business "aircraft carrier" that could withstand all the market turbulence and remain a top player no matter what new market emerges. Due to the high uncertainty associated with developing economies, corporate investors regard extensive industry coverage as "the only feasible strategy to keep up with market disruptions". Indeed, most corporate investors in China do not pay a lot of attention to reflect on their failed investments; instead, they become satisfied if one-tenth of the invested projects eventually take off. Such strategy that aims at covering every niche market has worked out well for China's CVC investors—according to *Hurun 2020 Global Unicorn Index*[3], among the 586 unicorn startups throughout the globe, Chinese CVC investor Tencent has nurture 52 of them, a number only second to that of Sequoia, the IVC

[3]https://www.hurun.net/en-us/rank/hsrankdetails?num=WE53FEER

firm. Alibaba and its fully owned subsidiaries also have invested in 44 global unicorns. As a comparison, despite the U.S. having more unicorn startups than China, the most active U.S. CVCs are largely absent from funding these ventures, only except 7 unicorns receiving venture capital investment from Google Venture (CVC arm of Alphabet, Inc) and 2 from Alexa Fund (CVC arm of Amazon, Inc).

Another typical component of CVC product-market incentive in China is to get into some highly regulated industries via their portfolio ventures who stay in close relationship with governments. As entry barrier exist in many of the industries due to regulations, companies are highly dependent on government connections. They are therefore motivated to engage political stakeholders into their market activities and buy influence with political incumbent (Hillman et al., 2004; Oliver and Holzinger, 2008; Sun et al., 2012). The interviewed corporate respondents who make investments in semiconductor and robotics industries, two fields that are considered as critical to national development strategy by the central government, have confirmed the existence of such investment motivation. They are quoted as saying *"one of our primary incentives to engage in CVC investments is that we could not get into some regulated product-markets merely with internal resources;"* and that *"get an entry ticket into some specific fields"*.

4.6.2 Political incentives

While the manifestation of technology and product-market incentives, the two typical strategic incentives that have been explored in extant CVC literature, another important yet overlooked type of incentive is the non-market incentives on seeking political returns. Non-market incentives are important to corporate decision makings because they impose profound impact on corporate efficiency as well as legitimacy (Lux et al., 2011; Jia, 2018;

Musacchio et al., 2015; Zhou et al., 2017).

There are two competing mechanisms on how political environment could potentially affect corporate investment decisions. On the one hand, the volatility of political environment could mute rent extraction opportunities and deter incentives for corporate investment. On the other hand, organizations situated in a political sensitive context possess the initiative to reduce policy-related uncertainty (Akey and Lewellen, 2017). As state government is as a critical stakeholder in CVC ecosystem, corporate investors could set connection with government via co-investing with government funds, investing in ventures who are affiliated with high-rank government officers, and infusing capital to ventures that are related to government preferred industries or political achievement projects. Rooted in the early work by Stigler (1971) and Zardkoohi (1985), corporations possess a resource dependence on the government. Governments in emerging economies play critical roles in affecting firms' competitive advantage (Lazzarini, 2015), fostering performance (Inoue et al., 2013; Musacchio et al., 2015), and facilitating innovation (Zhou et al., 2017). In emerging economies, institutional voids, such as shallow capital markets, shortages of skilled labor, weak legal enforcement, and a lack of independent financial intermediaries, could seriously hinder firms' operation and development (Khanna and Palepu, 1997; Hoskisson et al., 2000; Ramamurti, 2000). One way to address such institutional voids is to get connected with the government (Musacchio et al., 2015; Xu et al., 2014), which strongly influences business operations through policy making and resource allocation. Since political stakeholders are the most difficult environmental dependencies to control (Sun et al., 2012), corporations' optimal choice is to co-opt political stakeholders and CVC investment can be effective to achieve so.

In developed economies such as the U.S., CVC is purely perceived as a profit-generating tool, and political uncertainty reduces the profits that can be obtained from entrepreneurial

ventures (see Chinchwadkar, 2020, for a review). Therefore, corporate investors are expected to follow the rent extraction logic and be reactive in responding to political dynamics. The government mainly plays a regulatory role in affecting the institutional context and stability of such context is preferred to realize the rent extraction goal in developed economies. In emerging economies like China, however, the government is also a critical resource provider that the market players depend on. In the Chinese context, economic conditions have undoubtedly affected by national (and regional) politics, which is different from the Western democratic regimes (Guo, 2009). Corporate political environment casts critical influences on regulatory policies and control over scarce resources, profoundly shaping corporate competitive environment (Gao et al., 2010; Nee and Opper, 2012; Zhou et al., 2017). The state government role on financing goes beyond regulation and enforcement to which it is generally limited in the U.S. (Dinç, 2005). For example, banks are directly controlled by government in China. Government could therefore finance the projects that they wish, regardless of economic potential of these projects.

For a preliminary examination of the theoretical prediction above, I refer to the EPU index developed by Baker et al. (2016). I measure the trend of EPU and CVC investment volume as the regression estimate of the key variable over time, based on a three-month moving average[4]. According to the two competing mechanisms as theorized above, the political incentive to extract economic rent would lead to a negative correlation between the trend of EPU and that of CVC investment. In contrast, the political incentive to reduce political resource dependency would predict a positive correlation between the trend of EPU and that of CVC investment. Therefore, by examining the relationship under different institutional contexts, I could infer the dominant type of political incentive in CVC investments under

[4]I have also tested the moving window on 4, 5, 6 months respectively, and the direction and significant level of results remain the same.

diverse institutions.

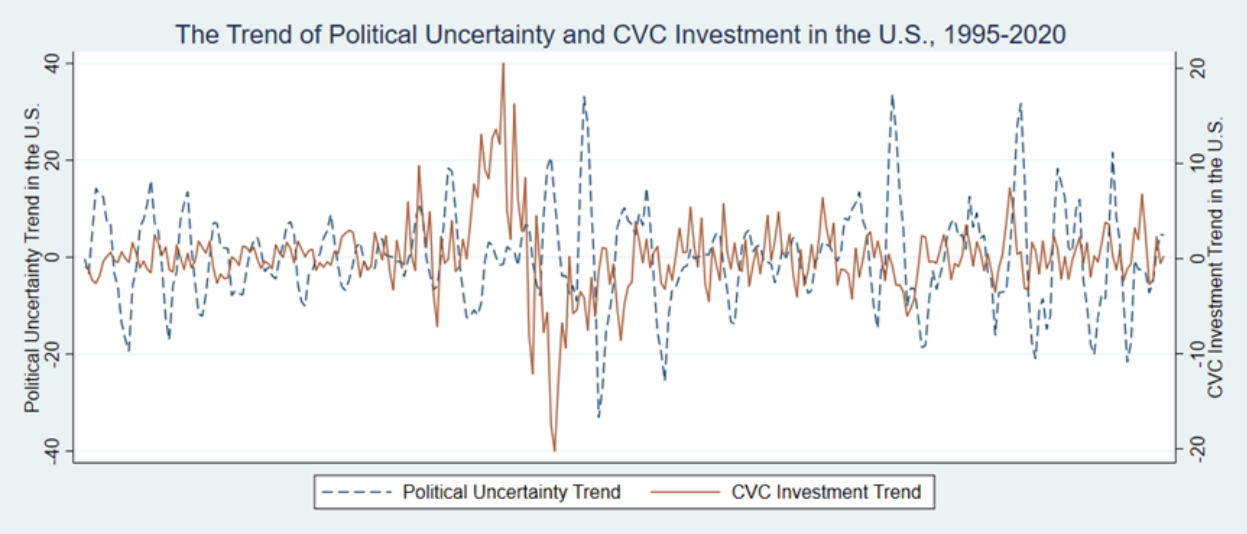

Figure 15: The relationship between the political uncertainty index and CVC investment deals in the U.S., 1995-2020

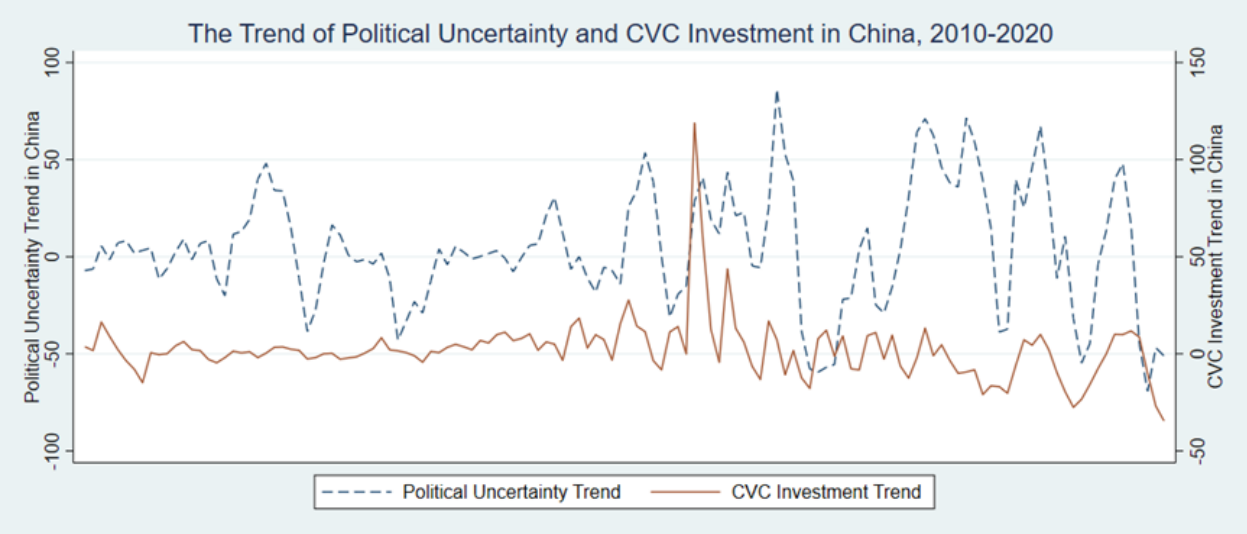

Figure 16: The relationship between the political uncertainty index and CVC investment deals in China, 2010-2020

Results in the Table 13 support the expected relationship under different institutional contexts. In the first two columns, both the U.S. and European countries have experienced a decreasing trend of CVC investment coupled with an increasing trend in EPU, in a three-month moving window. This relationship supports the theoretical prediction that in developed countries, political uncertainty deters corporate motivation to conduct investments due to the reduced opportunities of rent extraction. Interestingly, however, this relationship in China goes into reverse. In column 3 of Table 13, the positive coefficient suggests that the increasingly trend of EPU enhances the corporate incentives to seek political returns via their CVC engagement. For a more direct visualization, I graphed the fluctuation of monthly political uncertainty trend and CVC investments trend in the U.S. and China respectively. Figures 15 and 16 show that while the two curves diverge in the U.S. context, the trend of CVC investments synchronizes with the trend of political uncertainty in China.

Table 13: The relationship between EPU and CVC deals across countries

Trend of CVC investment over time in:	(1) U.S.	(2) Europe	(3) China
Fluctuation of political uncertainty over time	-0.121**	-0.072***	0.134**
	(0.058)	(0.025)	(0.063)
Constant	-0.000	0.000	-0.000
	(0.058)	(0.025)	(0.063)
Observations	295	1,644	247
Number of Country	1	9	1

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

I interpret the above relationship as demonstrating the existence of political incentives in CVC investments. According to the seminal work by Hill et al. (2009), there are three

dimensions of decisions that corporations make to realize their political strategy. I further draw on each of these dimensions and shed light on how corporations in China utilize CVC as part of their corporate political strategy. First, firms choose between transactional and relational approaches in their political strategy. While transactional approach refers to monitoring public interest and involves specific issues, the relational approach is more long-term oriented and proactively build relationships across issues (Hill et al., 2009). Corporate investors in China have pervasively practiced both approaches in their investment endeavors. They comply with government interests by investing in ventures that reside in industries preferred by government industrial funds. Meanwhile, corporate investors also build relational connections with critical individual policy makers via investing in ventures that have close relationships with these persons.

The second dimension speaks to the level of political participation, where the corporation chooses between solitary efforts and collaborative efforts among multiple firms. On the individual level, the corporate investors in China independently evaluate their dependence on political resources and adjust the goal for political returns accordingly. Meanwhile, the idiosyncratic existence of the CVC union also provides a platform such that the united corporate investors are able to collectively approach certain political resources. These two approaches enable value creation by demonstrating political compliance and actively influencing corporate political environment (Oliver and Holzinger, 2008). Finally, firms also make decisions on specific strategies and tactics to employ, which include information strategy, financial incentive strategy and constituency-building strategy. For the CVC investors in China, the predominant drivers are the first two strategies whereas the constituency-building is not applicable because public policies are not directly influenced by voters in China. From the information strategy aspect, Chinese corporate investors provide information to policy

makers to express their demand for government supportive funds and/or policies that are needed to co-nurture the new ventures. Such demand could be fulfilled via two channels. The corporate investors could either lobby policy makers during the national and regional People's Congress or convey specific industrial demands in high level forums and summits. For example, the Ant Finance Group called for preferential policies that loosen the regulations on fintech ventures during the Bund Summit in 2020. The financial incentive strategy of corporate investors is manifested in a more subtle way in China's context. Chinese policy makers have been strictly forbidden by law from obtaining direct financial benefits. However, corporate investors could provide financial incentives by investing in ventures that either pose conflict of interests to policy makers or are part of governments' "political achievement projects."

4.7 Discussion and conclusion

In this study, I focus on the CVC investment ecosystem in another context beyond the conventional Western wisdom, which is equally important but demonstrates plenty of unexplored idiosyncrasies. I have explored the core elements of China's CVC ecosystem and their unique manifestations along the stages of the investment process. This research seeks to contribute to CVC literature in two ways. First, current CVC theory is pretty much North America centric, tending to overlook the heterogeneous institutional conditions that distinctively drive the formation and evolution of the CVC ecosystem. Adopting a mixed-method approach to peer into China's CVC ecosystem, I provide an in-depth exploration into the composition, idiosyncrasy, and pursued objectives in the fast-developing economy. I have conceptualized the complex interactions among various stakeholders in China's CVC

evolution process and have articulated how they demonstrate potential theoretical differences as compared to the U.S. CVC market. Second, CVC investments have been widely recognized as having dual incentives that seek both financial and strategic returns. However, current studies on CVC investments exclusively focus on market- related strategic returns (e.g., technological and product-market) but have largely neglected non-market returns. I provide the first endeavor to integrate the notion of non-market returns, especially political incentives, into the CVC research framework.

I also acknowledge some limitations of this work. First, although all my interview respondents are qualified as elite informants, they are still relatively limited in number. In the next stage of this research, I will extend the coverage of relevant CVC stakeholders in China to surface further insights in how the focal ecosystem unfolds and evolves. Second, as a first endeavor into the non-market incentives of CVC investments, this study aims more at proposing the existence of political incentives and depicting its manifestation in less mature markets. More studies are needed to theorize about the aspects of political incentives in CVC investment in greater detail. For example, it is worthwhile to develop a typology on the approaches that corporate investors utilize CVC investment as an indirect tool of corporate political activity.

While I have extended the boundary of CVC research into less mature markets and into non-market strategy, there are some theoretically important avenues that worth future exploration, especially pertaining to the integration of corporate political incentives and CVC investments. First, this essay touches upon on how the CVC investment decision is affected by political objectives. A remaining gap is how the political connection and motivations affect the efficacy of its capital utilization. In other words, does the "political incentive" complement or substitute the more conventional technological and financial objectives? Sec-

ond, political strategy can be manifested in three typical types—passive reaction, positive anticipation, and public policy shaping (Hillman et al., 2004). However, how corporate investors make deliberate decisions among the three types of political strategy is important but yet understudied. Finally, the choice between foreign and domestic ownership has been identified as an important determinant of corporate political activities (Getz, 1997; Hillman et al., 2004; Jia, 2018). Delving into how and why corporate investors respond differently to fluctuations of political uncertainty under domestic and foreign investments offers the prospect of further theoretical advancement.

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Appendix B Modified PRISMA checklist

Section/topic	#	**Checklist item**	**Reported on page #**
Title	1	Identify the report as a systematic review, meta-analysis, or both.	12
Structured summary	2	Provide a structured summary, including: background; objectives; and synthesis methods; results; conclusions and implications of key findings.	12-14
Rationale	3	Describe the rationale for the review in the context of what is already known.	13-14
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions (not applicable), comparisons, outcomes, and study design (PICOS).	13-14
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address).	Not applicable
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	38-40
Information sources	7	Describe all information sources in the search.	38-40
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	38-40
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	39

(Continued)

Data collection process	10	Describe method of data extraction from reports and any processes for obtaining and confirming data from investigators.	40-42
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	44
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	47-50
Summary measures	13	State the principal summary measures.	Table 1
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency for each meta-analysis.	42-46
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	48-50
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	47-50
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period).	Appendix 2

(Continued)

Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Figure 3
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1, 2, Appendix 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Table 3, 4
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	48-50, Table 3
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	46-50
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	50-57
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	53-54
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	58

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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