



Corporate Venture Capital and Green Innovation of New Ventures: The Empirical Evidence from Chinese Economy

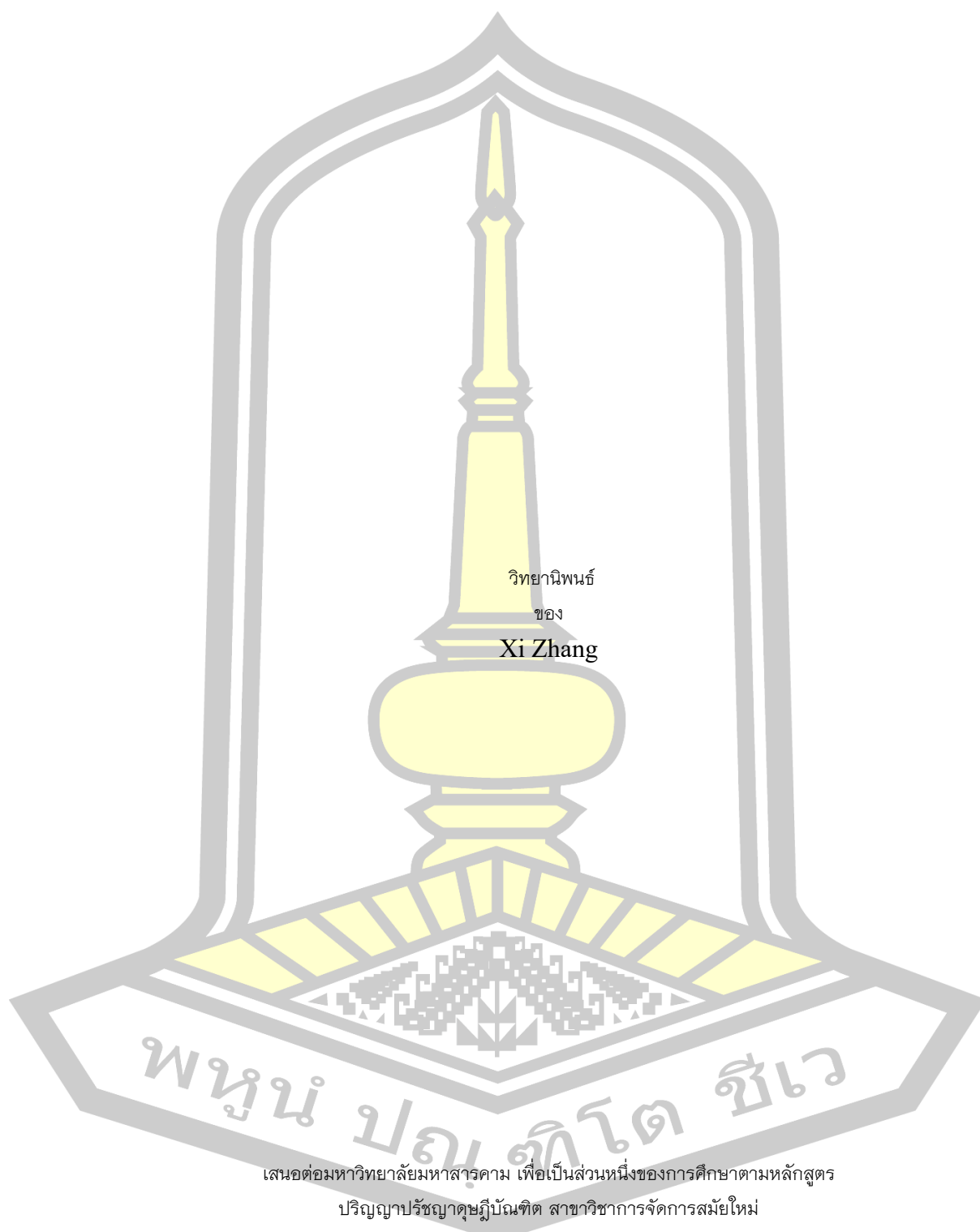
Xi Zhang

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in Modern Management

June 2025

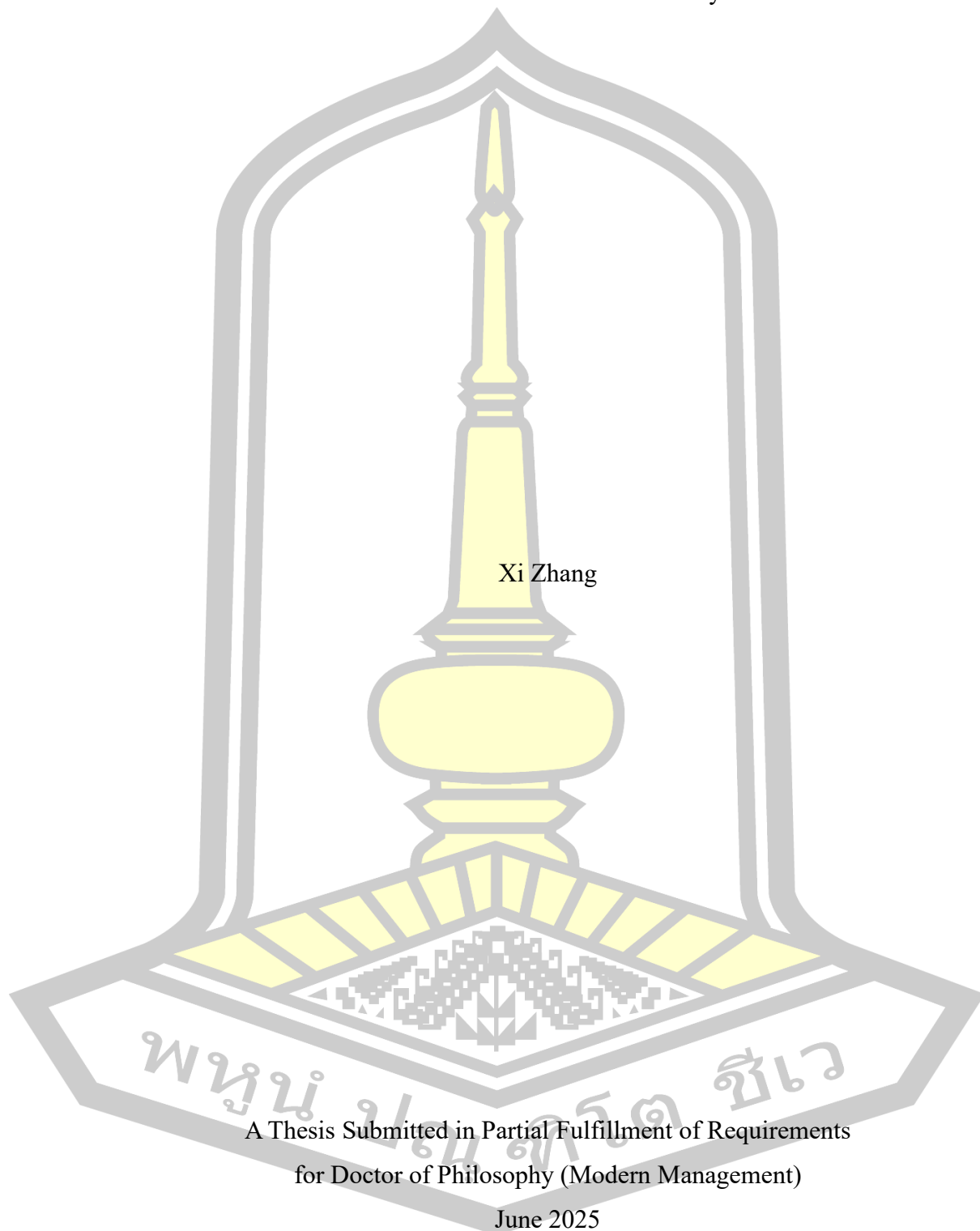
Copyright of Mahasarakham University

การร่วมลงทุนขององค์กรและนวัตกรรมสีเขียวของธุรกิจใหม่: หลักฐานเชิงประจักษ์จากระบบเศรษฐกิจของประเทศจีน



ลิขสิทธิ์เป็นของมหาวิทยาลัยมหาสารคาม

Corporate Venture Capital and Green Innovation of New Ventures: The Empirical
Evidence from Chinese Economy



Xi Zhang

A Thesis Submitted in Partial Fulfillment of Requirements
for Doctor of Philosophy (Modern Management)

June 2025

Copyright of Mahasarakham University



The examining committee has unanimously approved this Thesis, submitted by Ms. Xi Zhang , as a partial fulfillment of the requirements for the Doctor of Philosophy Modern Management at Maharakham University

Examining Committee

Chairman

(Associate Professor Pornlapas
Suwannarat , Ph.D.)

Advisor

(Assistant Professor Atthaphon
Mumi , Ph.D.)

Co-advisor

(Associate Professor Sujinda
Popaitoon , Ph.D.)

Committee

(Assistant Professor Sutana
Boonlua , Ph.D.)

External Committee

(Associate Professor Vissanu
Zumitzavan , Ph.D.)

Maharakham University has granted approval to accept this Thesis as a partial fulfillment of the requirements for the Doctor of Philosophy Modern Management

(Assoc. Prof. Charuay Savithi , Ph.D.) (Asst. Prof. Pondej Chaowarat , Ph.D.)
Dean of Maharakham Business School Dean of Graduate School

TITLE Corporate Venture Capital and Green Innovation of New Ventures:
The Empirical Evidence from Chinese Economy

AUTHOR Xi Zhang

ADVISORS Atthaphon Mumi , Ph.D.
Associate Professor Sujinda Popaitoon , Ph.D.

DEGREE Doctor of Philosophy **MAJOR** Modern Management

UNIVERSITY Mahasarakham **YEAR** 2025
University

ABSTRACT

In recent years, increasing attention to sustainable development has generated significant interest from governments, the public, and stakeholders regarding corporate green innovation. For venture capital-backed startups, a key question arises: Does Corporate Venture Capital (CVC) exert a greater impact on startups' green innovation compared to other types of venture capital? If so, through what mechanisms does this effect operate? Based on venture capital data from China's ChiNext and STAR Markets between 2009 and 2022, this study examines the impact of venture capital on startups' green innovation and its underlying mechanisms. The findings reveal three key insights: First, the type of venture capital background influences the level of green innovation in startups. While Independent Venture Capital (IVC) and Government Venture Capital (GVC) show no significant effect, CVC demonstrates a pronounced positive impact. Secondly, the environmental awareness of startup executives mediates the relationship between CVC investment and green innovation. Thirdly, startups' political connections, R&D investment, and ESG performance act as moderating factors in this relationship. This research contributes to the literature on green innovation by elucidating the role of CVC in promoting it and identifying key mediating and moderating variables.

Keyword : CVC Investment Green Innovation Green Awareness of Ececutives
Political Relations ESG Performance R&D Investment

พหุบัณฑิต ชีเว

ACKNOWLEDGEMENTS

Completing this doctoral dissertation would not have been possible without the unwavering support, guidance, and encouragement of many individuals to whom I owe my deepest gratitude.

First and foremost, I would like to express my sincerest appreciation to my supervisor, Professor's Atthaphon Mumi and Sujinda Popaitoon, for their invaluable mentorship, patience, and insightful feedback throughout my research journey. Their profound expertise, rigorous academic standards, and constant encouragement have shaped not only this dissertation but also my growth as a researcher. I am truly grateful for the opportunities they provided and the trust they placed in me.

My heartfelt thanks also go to my colleagues and fellow PhD students at Mahasarakan University Business School for their camaraderie, stimulating discussions, and moral support. The countless hours spent exchanging ideas, overcoming challenges, and celebrating small victories together made this journey far more meaningful and enjoyable. Special thanks to Lisa and Xia Li for their friendship and encouragement during both the highs and lows of this process.

I am forever indebted to my family—my parents, my spouse—for their unconditional love, understanding, and sacrifices. Their unwavering belief in me, even during moments of self-doubt, gave me the strength to persevere. This achievement is as much theirs as it is mine.

To all who have contributed in ways big and small, thank you for being part of this incredible chapter of my life.

Xi Zhang

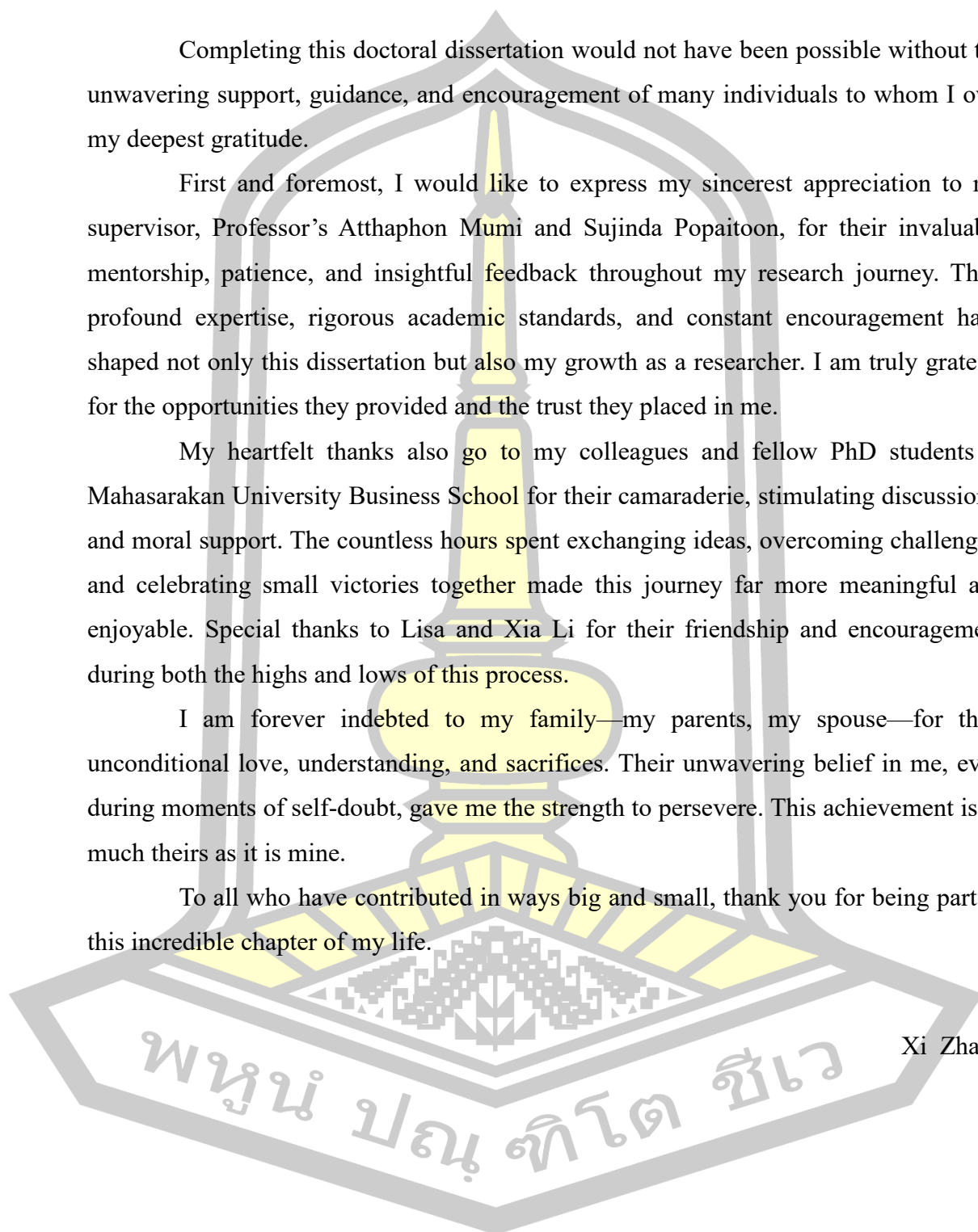
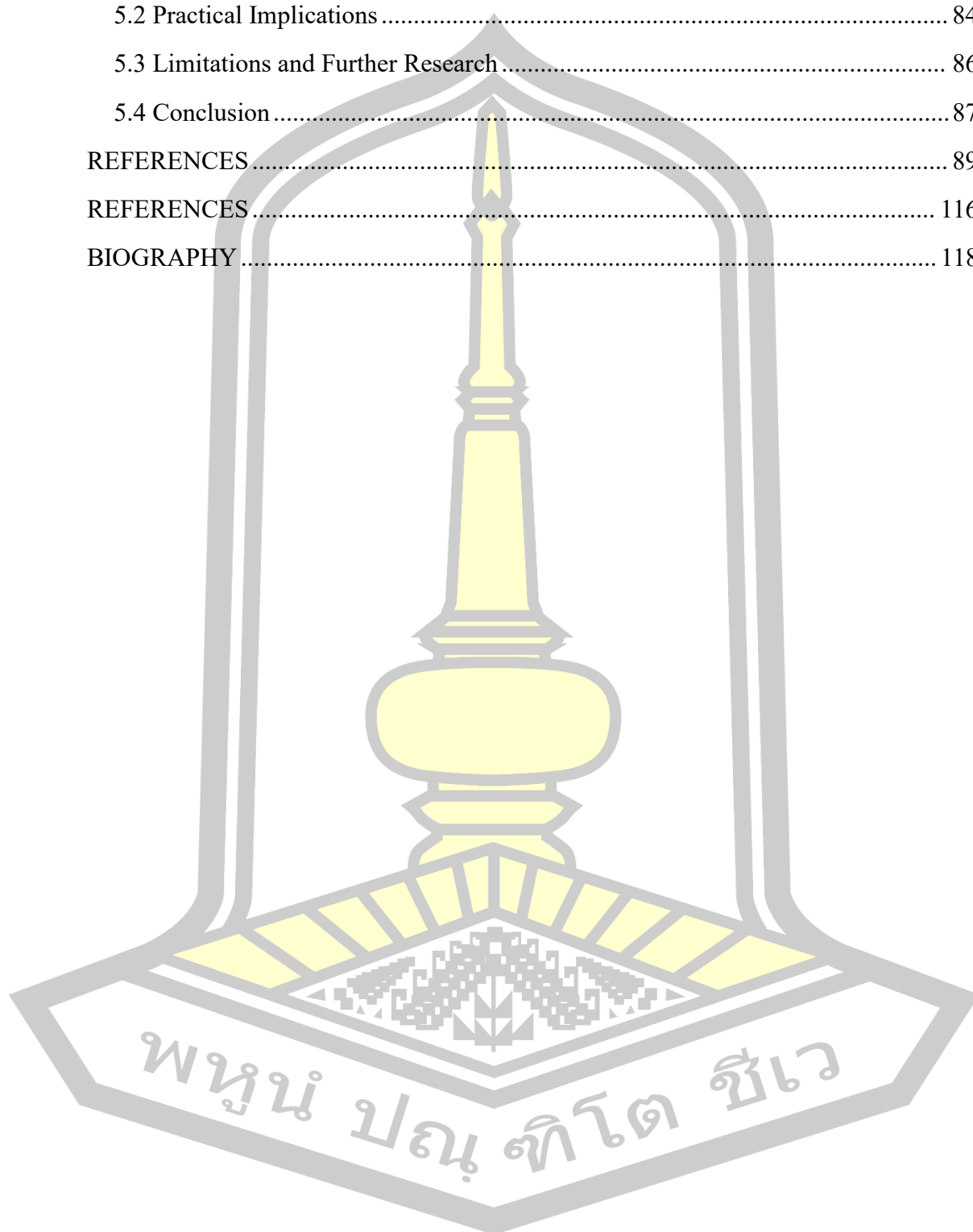


TABLE OF CONTENTS

	Page
ABSTRACT	D
ACKNOWLEDGEMENTS	E
TABLE OF CONTENTS	F
LIST OF TABLES	I
LIST OF FIGURES	J
CHAPTER 1	1
INTRODUCTION	1
1.1 Background and Rationale of the Study	1
1.2 Problem Statement	6
1.3 Research Questions	10
1.4 Objectives of the Study	10
1.5 Significance of the Study	11
1.6 Scope of the Study	11
1.7 Structure of the Study	11
CHAPTER 2	13
LITERATURE REVIEW	13
2.1 Theoretical Foundation	13
2.1.1 Resource-based Theory	13
2.1.2 Resource- dependence Theory	15
2.2 CVC investment company	20
2.2.1 The heterogeneity of VC investment	21
2.3 Green innovation	30
2.4 Executive's Green Cognitive/Awareness	32
2.5 Political Relations	35
2.6 Research and Development	38

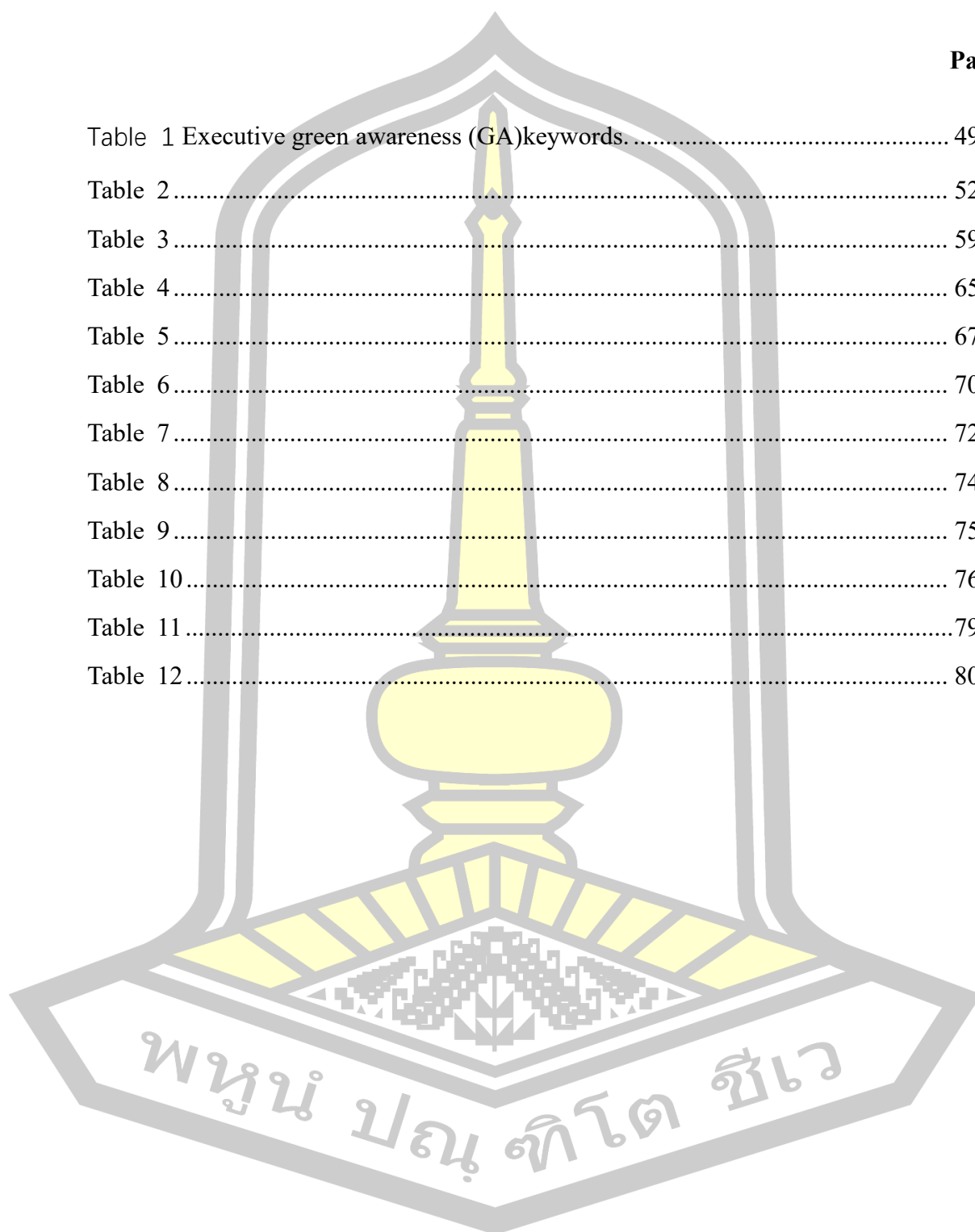
2.7 ESG performance	40
2.8 Conceptual Model and Propostion	43
CHAPTER 3	45
RESEARCH METHODOLOGY	45
3.1 The Research Paradigm	45
3.2 Sample Selection and Data Collection	46
3.2.1 Identifying CVCs	47
3.3 Measurement of the variable	48
3.3.1 Independent variables	48
3.3.2 Dependent variable	48
3.3.3 Other variables	49
3.3.4 Control variables	51
3.4 Methods	52
3.4.1 Hausman test	52
3.4.2 Python web data crawler	55
3.4.3 Instrumental variable method	56
3.5 Statistical Techniques	56
3.5.1 Descriptive statistics	56
3.5.2 Correlation analysis	57
3.5.3 Multiple regression analysis	57
3.5.4 Robustness check	58
CHAPTER 4	59
RESULTS AND ANALYSIS	59
4.1 Descriptive Statistics	59
4.2 Correlation Results	65
4.3 Hausman Test	67
4.4 Hypothesis Test	69
CHAPTER 5	81
DISCUSSION	81

5.1 Theoretical Implications	81
5.2 Practical Implications	84
5.3 Limitations and Further Research	86
5.4 Conclusion	87
REFERENCES	89
REFERENCES	116
BIOGRAPHY	118



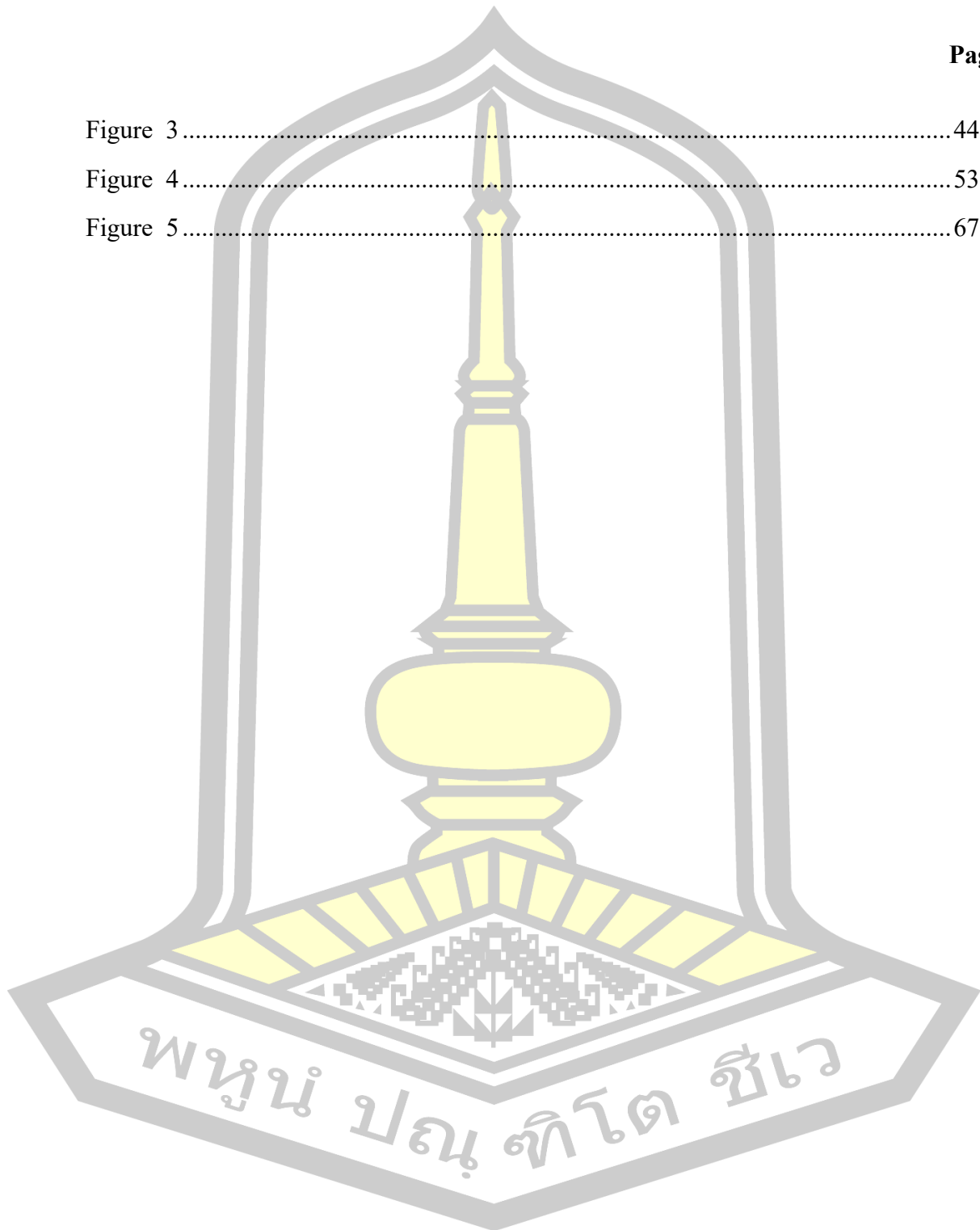
LIST OF TABLES

	Page
Table 1 Executive green awareness (GA)keywords.....	49
Table 2.....	52
Table 3.....	59
Table 4.....	65
Table 5.....	67
Table 6.....	70
Table 7.....	72
Table 8.....	74
Table 9.....	75
Table 10.....	76
Table 11.....	79
Table 12.....	80



LIST OF FIGURES

	Page
Figure 3.....	44
Figure 4.....	53
Figure 5.....	67



CHAPTER 1

INTRODUCTION

1.1 Background and Rationale of the Study

Venture capital investment is one of the most effective ways to finance newly established innovative firms, which hardly have access to other types of external investment. Practitioners and researchers suggest that venture capitalists (VCs) not only provide funds, but also exert intensive monitoring efforts and provide value-added support to projects with growth potential. Thus, VCs differentiate themselves from traditional financiers in terms of efficiently dealing with profound information and uncertainty issues associated with the investment (Sahlman, 1990; Gompers and Lerner, 2001). The impact of venture capital investment on entrepreneurial companies has attracted intensive interest from researchers in the past two decades. Kortum and Lerner (2000) find that based on industry-level data, venture capital activities significantly increase the propensity to patent inventions. Similarly, based on a survey of entrepreneurial firms in Silicon Valley, Hellmann and Puri (2000) report that more innovative firms have higher chances to be selected by VCs compared to imitators. Moreover, VC-backed firms introduce new products to the market faster than non-VC-backed firms do. Hellmann and Puri (2002) also reveal that VC intervention is important in the professionalization and development of young companies, particularly in the formulation of human resource policies and adoption of strategic management decisions.

The study of Chemmanur et al. (2011) was the first systematic analysis that dangles the screening and monitoring effects of VCs based on firm-level data. Using three different approaches to address the selection and identification issues, the authors confirm that in the United States, VCs not only choose to invest in firms with higher efficiency, but also help the firms to improve the efficiency after the investment is made. Moreover, the authors report that the improved efficiency is mainly contributed by the sales growth of the firms. Finally, the authors reveal that the efficiency improvement of the VC-backed firms is heterogeneous depending on the reputation of the VCs; that is, firms backed by VCs with higher reputation experience

significantly higher post-investment efficiency improvement than those backed by VCs with lower reputation.

Furthermore, Puri and Zarutskie (2012) find that VC-backed firms grow more rapidly in scale compared to their non-VC-backed counterparts. Additionally, the authors report that VC-backed firms are less likely to fail in the first four years after initially receiving venture investment.

With the rapid growth and maturation of the VC industry, scholars have extensively studied the positive role of VC in promoting enterprise innovation and business growth. These studies primarily focus on investment and financing decisions, corporate governance, ordinary technological innovation, and corporate financial performance. For example, Guo and Jiang (2013) discovered that firms' financial performance is improved after receiving VC. Song and Lee (2017) demonstrated that VC plays a crucial supervisory role in initial public offerings within the institutional environment of South Korea. Sun et al. (2018) conducted a study that suggested VC significantly enhances firms' innovation performance. Empirical evidence from Wang et al. (2022) revealed that VC could effectively restrain the good will bubble of mergers and acquisitions.

In recent years, several scholars have commenced examining the effect of VC on GI (Green Innovation), but the focus has been mainly on the theoretical and macro levels. For example, Maiti (2022) investigated the influence of VC on green growth using transnational panel data from 2007 to 2015, and the results suggested that VC promotes GI performance.

Similarly, Yang et al. (2022) analyzed panel data from 150 Chinese cities to evaluate the influence of VC on GI and investigate the moderating role of environmental regulations. However, it is only in recent times that a handful of studies have undertaken a micro level analysis to investigate the impact of VC on GI. For instance, Bendig et al. (2022) examined 97 US companies and empirically revealed that the impact of VC on GI is associated with the current GI output of firms. Jiang and Liu (2022) focused on electric car firms and explored the influence of VC on the GI performance of these enterprises.

This analysis attempts to extend the findings of Chemmanur et al. (2011) by examining the contribution of venture investment to entrepreneurial firms in China. Almost previous studies on venture capital investment are based on data from

developed economies. The issue of whether venture capital investment may also contribute to the innovation of entrepreneurial firms in developing countries such as China, where the institutions are complicated and different from those in industrialized countries, has attracted less scrutiny.

China, including Hong Kong, has been the second largest venture capital market in the world since 2006. Venture capital investment plays a major role in the startup of high-tech firms in China. Guo (2008) reports that over 62% of venture capital investment in China are in the hightech sectors.

CVC refers to venture capital investments made by established corporations in privately held entrepreneurial ventures, in other words, direct minority equity investments (Wadhwa et al., 2016). While many corporate investors face strong societal pressure from their stakeholders to reduce their ecological footprint, they can use CVC investments as a means of acquiring knowledge and technologies, allowing them to significantly improve their environmental performance and reduce their GHG emissions (Battisti et al., 2022). Typically, the aim of CVC investment is to acquire technological innovations (DaGbadjietal., 2015). A common reason for firms to invest in CVC is to gain knowledge and ideas to support their innovation efforts (Chemmanur et al., 2014; Shuwaikh and Dubocage, 2022) and improve their competitive position by developing those capabilities that enhance organizational performance (Dushnitsky and Lenox, 2006).

Faced with continuous and extreme changes in the environment (Antonioli and Mazzanti, 2017; Appolloni et al., 2022; Sun et al., 2022), CVC investments build linkages to improve environmental performance and pursue green innovation as part of their corporate performance strategies. CVC programs play a role in power building that could improve the performance of the firm (Dushnitsky and Lenox, 2005). Although reporting by CVC firms on their GHG emissions and green innovation efforts, especially over the last two decades, has greatly increased, little is known about the effect of these two factors on reputation of CVC parent company (ESG) and green innovation of investee companies. In developing hypotheses below, we build on these ideas to contribute to the substantive theory of CVC investments, environmental performance, green innovation and firm value.

CVC is embraced across many sectors and allows incumbent firms to achieve balance in their corporate strategy (Rossi et al., 2020a). Battisti et al. (2022)

demonstrate that corporate investors have exceptional access, compared to other firms, to social and ecological aspects through their investments. Second, CVC investment is a mechanism often used by firms to obtain a window into new technology and a channel through which it can gain knowledge (Maula et al., 2013). CVC develops unique strategies to lead innovation (Shuwaikh and Dubocage, 2022). Battisti et al. (2022) and Wadhwa et al. (2016) demonstrate that CVC investments are seen as an important source of knowledge and innovation by investors. Rossietal.(2020) show that CVC tend to invest in sectors related to their core business with strategic intent, applying knowledge management methods for the accumulation of intellectual capital. Third, scholars have explained the strong positive impact of CVC funding on corporate performance (Dushnitsky and Lenox, 2005). For example, Dushnitsky and Lenox (2006) with Wadhwa and Kotha (2006) find that CVC investment improves valuation performance through citations in addition to patent production and drives a higher market valuation. Research on CVC investments as tools for knowledge acquisition makes a positive contribution to innovation and financial performance in firms(Kangetal.,2022; Keiletal.,2008; Shuwaikh and Dubocage,2022;Wadhwa and Kotha,2006).

In the face of issues such as global warming, COVID-19, and international conflicts, the principles of protecting the environment and respecting people's interests are leading to major social changes (Garel & Petit-Romec, 2021; Nordhaus, 2019). Companies are exploring a more ethically responsible and sustainable way to conduct long-term business, and the integration of environment, society, and governance has become a focus of capital markets. As the largest manufacturing country in the world, China has a particularly prominent conflict between environmental pollution and economic development in the global market. The "2018 Environmental Performance Index", released by Yale University in 2018, ranks the ecological performance of 180 countries. China ranked 177th in terms of air quality indicators, indicating how China coordinates pollution and sustainable development is a long-term and critical topic. In fact, the Chinese government is trying to change that situation.

The Chinese government has officially committed to peaking carbon dioxide emissions by 2030 and achieving carbon neutralization by 2060. In the past, the Chinese market was more concerned about the financial performance of enterprises

without undertaking corresponding environmental and social responsibilities. Meanwhile, the regulatory system has not required to disclose the non-financial information on social responsibility as the pressure from market competition and nongovernmental social organizations is much lower than the one in other countries (Ong & Han, 2019). At present, the transformation of China's economy requires companies to undertake more environmental and social responsibilities, which means that all sectors of society will pay more attention to the ESG information of Chinese companies. Companies use the disclosure of non-financial information as a legalized tool. Transparent ESG information proves that companies are actively taking ecological and social responsibility, thereby enhancing their reputation with consumers and investors, accessing capital at a lower cost, and improving their competitive advantage (Ben-Porath, Dekel, & Lipman, 2018; Bofinger, Heyden, & Rock, 2022; Gillan, Koch, & Starks, 2021; Starks, 2021).

The rare experience of COVID-19 may lead investors to reexamine the expected effect of environmental and morality on business development (Garel & Petit-Romec, 2021). Research on ESG disclosure and corporate behavior in developed markets is abundant (Atif & Ali, 2021; Egginton & McBrayer, 2019; Huang, Li, Lin, & McBrayer, 2022; Lokuwaduge & Heenetigala, 2017; Pham & Tran, 2020; Qureshi, Kirkerud, Theresa, & Ahsan, 2020). However, compared with developed countries, China's financial market is less developed, and the financial activities of institutional investors in the capital markets are much less active. In 2007, the proportion of institutional investors in the United States reached about 70% (Boubaker, Chourou, Saadi, & Zhong, 2019), while in 2020, the proportion of institutional shares in Chinese A-share listed companies was only 40% or so. Do institutional investors with unique preferences also play a prominent role in China's capital market? Many companies thought corporate environmental management as an unnecessary investment, or even were misled that this would obstruct their development and growth. On the contrary, several previous studies thought that pollution was the concrete evidence of inefficient uses of resources, and companies that pioneer in green innovation will enjoy the 'first mover advantage,' which allow them to ask for a higher price for green products and, at the same time, improve their corporate images, develop environmental pollution. In order to eliminate the problems of environmental pollution, the concepts of environmental management, such as green management,

green marketing, green production and green innovation, etc. are now being pursued. The rise of international environmental regulations, such as Montreal Convention, Kyoto Protocol, Restriction of the Use of Certain Hazardous Substances in EE (RoHS), and Waste Electronics and Electrical Equipment (WEEE), and popular environmental consciousness of consumers would bring significant impacts to businesses in the world (Chen et al., 2016). Therefore, environmental management is gathering importance within organizations and it is increasingly becoming an important part of management agendas. Under the trends of strict international environmental regulations and popular environmental consciousness of consumers, there exist many changes and impacts for the rules and patterns of business competition. Therefore, corporate environmental management will play an important role, nowadays (Russo and Fouts, 1997). However, systematic analysis on this market remains very limited. In the context of China's carbon neutrality and peak carbon emissions goals, the development of green innovation in new startups under the investment of CVC capital has become increasingly significant. This trend is consistent with the global push towards sustainable development and green technologies in the face of environmental challenges. Understanding the impact mechanisms of CVC capital on green innovation in new startups is crucial for promoting sustainable economic development and achieving environmental goals.

1.2 Problem Statement

This research is conducted in the context of CVC investment. First, CVC applies to many sectors and allows incumbent firms to achieve balance in their corporate strategy (Rossi et al., 2020a). CVCs play an important role in funding digital technologies in new, pioneering, and groundbreaking firms, after assessment of the financial risk (Rossi et al., 2020a, 2020b). Battisti et al. (2022) demonstrate that corporate investors, through their investments, have more access to information on social and ecological aspects than other firms. Second, CVC investment is a mechanism often used by firms to obtain new technology and to gain specialized knowledge (Maula et al., 2013). CVC helps to develop unique strategies to lead innovation (Shuwaikh and Dubocage, 2022). Battisti et al. (2022) demonstrate that CVC investments are seen as an important source of knowledge and innovation by

investors. Third, scholars have established the strong positive impact of CVC funding on corporate performance (Dushnitsky and Lenox, 2005). For example, Dushnitsky and Lenox (2006) with Wadhwa and Kotha (2006) find that CVC investment improves market valuation through citations and patent production. Firms are more likely to pursue CVC activities as a part of their innovation strategy. Research on CVC investments as tools for knowledge acquisition makes a positive contribution to innovation in firms (Kang et al., 2022; Keil et al., 2008; Shuwaikh and Dubocage, 2022; van de Vrande et al., 2011; Wadhwa and Kotha, 2006). CVC helps firms to achieve balance in their corporate strategy (Rossi et al., 2020a) and to boost innovation (Wadhwa et al., 2016). CVC investment is a mechanism often used by firms to obtain new technology and specialized knowledge (Maula et al., 2013). CVC develops unique strategies to lead innovation (Shuwaikh and Dubocage, 2022). Battisti et al. (2022) demonstrate that CVC investments are seen as an important source of knowledge and innovation by investors. Dushnitsky and Lenox (2006) with Wadhwa and Kotha (2006) find that CVC investment improves valuation performance through citations in addition to patent production and drives a higher market valuation. A zero-pollution firm cannot exist as attaining net zero is impossible. Our work aims to assist firms in harnessing green innovation to reduce their pollution. Independent venture capital (IVC) investors are examples of financial firms that made important investments in innovation in targeted sectors subject to busts and booms (Chemmanur et al., 2014). CVC investment firms pursue a “hybrid” model that merges the capabilities of their own research laboratories with those of their funded start-ups “within a powerful system that consistently and efficiently produces new ideas” (Lerner, 2012). The goal of CVCs varies from that of other investors (Alvarez-Garrido and Dushnitsky, 2016), such as IVCs. Green innovation demands enormous corporate investment in clean technologies to decrease GHG emissions. Which firms are best positioned to achieve green innovation?

The influence of CVC capital on green innovation in new startups can be observed through various mechanisms. First, CVC capital provides financial support for research and development (R&D) activities related to green technologies, enabling startups to invest in environmentally friendly innovation and sustainable practices. Second, CVC investors often bring in expertise, industry knowledge, and networking opportunities, which can facilitate the integration of green innovation into the core

business strategies of startups. Additionally, CVC investors may also promote the adoption of green innovation by influencing the strategic direction and decision-making processes within startups.

The theoretical foundation for exploring the impact mechanisms of CVC capital on green innovation in new startups can be derived from the literature on venture capital, innovation, and sustainable development. The resource-based view (RBV) theory posits that access to valuable resources, such as financial capital and knowledge, can enhance a firm's innovative capabilities (Barney, 1991). This perspective can be applied to understand how CVC capital, as a valuable resource, influences the green innovation activities of startups. Additionally, the literature on technological innovation and environmental sustainability provides insights into the factors that drive firms to adopt green technologies and practices (Porter & van der Linde, 1995).

By integrating these theoretical perspectives, we can develop a framework for analyzing the mechanisms through which CVC capital influences green innovation in new startups.

Green innovation has become a focal point for many new startups as they aim to address pressing environmental concerns while also seeking to gain competitive advantage in the market. One area of interest in the literature is the relationship between corporate venture capital (CVC) investment and the green innovation mechanisms in new startups. Understanding this relationship is crucial in assessing how startups can leverage CVC investment to drive green innovation initiatives.

Resource dependence theory provides a theoretical foundation for understanding the dynamics of CVC investment and green innovation mechanisms in startups. According to resource dependence theory, organizations are influenced by the resources available to them and the organizations they depend on for those resources (Pfeffer & Salancik, 1978). In the context of startups, CVC investment can be seen as a critical resource that influences the ability of startups to drive green innovation. By drawing on the principles of resource dependence theory, this study seeks to explore the impact of CVC investment on the green innovation mechanisms in new startups.

Furthermore, the focus on government policy guidance is particularly pertinent in the context of Chinese startups. The Chinese government has placed significant emphasis on environmental sustainability and has implemented various policies to

incentivize green innovation in startups (Zheng & Liu, 2018). Understanding the interplay between CVC investment and government policy guidance in the context of green innovation is crucial for startups operating in China.

Domestically, the Chinese startup ecosystem is rapidly evolving, with a growing emphasis on sustainability and green innovation. Internationally, green innovation in startups has gained traction as environmental concerns continue to take center stage in global discussions. By examining the current situation both domestically and internationally, this study aims to provide a comprehensive understanding of the landscape in which startups are operating and the drivers influencing their green innovation initiatives.

Theoretically, the parent company's CVC investment is mainly to form synergy with its own interests, Yost M, Devlin K (1993), and its strategic intention is likely to have an important impact on new ventures. Block and MacMillan (1993) believed that parent companies may sacrifice the interests of new ventures for their own goals; Hellmann (2002) pointed out that investors with strategic intentions may have conflicts of interest with new ventures, and may also have conflicts with new ventures. Enterprises form a commercial complementarity. Chemmanur et al. (2014) compared CVC and IVC and found that CVC is more conducive to promoting innovation of new ventures, has a higher tolerance for failure, and is related to the technical fit between the parent company of CVC and new ventures. The research of Chemmanur et al. (2014) provides empirical evidence for the first time on how CVC affects new venture innovation, but their analysis of the relationship between the two is mainly based on the organizational characteristics of CVC and the resource support of the parent company.

Previous research believe that CVC has played an important role in the innovation of the parent company, but what impact does CVC have on the innovation of new ventures? Some studies believe that the CVC parent company can provide complementary resources such as industry experience and technical support that new start-ups lack, and has a high tolerance for failure, thus helping to promote the innovation of new start-ups; It is pointed out that based on its own interests, the parent company of CVC may compete with new ventures in the innovation resource or product market, and even infringe on its innovation achievements.

These studies have made useful explorations on the relationship between CVC and new venture innovation from the perspective of CVC's organizational characteristics and the parent company's resource support or conflict of interest, but they have not been based on the impact of CVC as its external exploration mechanism on the green innovation of start-ups. There are relatively few academic studies on how CVC investment affects the green innovation of start-ups, and no clear answer has yet been obtained.

1.3 Research Questions

As mentioned above, this study attempts to answer three specific questions:

1.3.1 Whether CVC investment participation affect green innovation in new ventures compared to other types of venture capital? To what extent does CVC investment affect green innovation in new ventures? If so, how is this mechanism achieved?

1.3.2 Do new ventures executive team's green awareness play a mediating role between CVC investment and new ventures' green innovation?

1.3.3 For new ventures, do external political relationships and internal ESG, and R&D investment moderator the relationship between CVC investment and new ventures' green innovation, and to what extent?

1.4 Objectives of the Study

The specific objectives of the study are:

1.4.1 Study CVC investment participation affect green innovation in new ventures compared to other types of venture capital? To what extent does CVC investment affect green innovation in new ventures? If so, how is this mechanism achieved?

1.4.2 Verify whether the environmental awareness of the internal management team affect CVC investment choices and their impact on the green innovation of their own enterprises;

1.4.3 Analyze the moderating effect of factors such as ESG performance and R&D investment, and external political relations on the relationship between CVC investment and green innovation of new ventures.

1.5 Significance of the Study

CVC is a venture capital institution established by mature enterprises for minority equity investment in new ventures, which organically combines industry and finance. A large number of studies have found that CVC encourages mature enterprises to pay attention to technological changes, respond to market changes, achieve continuous innovation, and maintain competitive advantages. However, there is still very little research on the impact of CVC on green innovation in new startups. On the basis of existing research, this article elaborates on the innovation incentive characteristics of CVC as a mechanism for mature enterprises to engage in external innovation, and uses empirical tests of listed companies on the Chinese ChiNext and Science and Technology Innovation Board from 2009 to 2022 to analyze the mechanism through which CVC affects green innovation in new ventures.

1.6 Scope of the Study

Essentially, the scope of this study is the secondary data level of companies listed on the GEM and Science and Technology Innovation Board of China's stock market. This study explores and collects the relationship between green innovation data of CVC-invested companies in the prospectuses of listed companies and CVC investment itself. The data was collected from companies going public from 2009-2022. This study only focuses on the aspects that affect the green innovation of newly listed companies, namely the number of green patents, the number of patent citations, the company's R&D investment, the number of green product labels, etc.

1.7 Structure of the Study

This paper consists of five chapters, as follows:

Chapter 1 is the introduction. It introduces the background and theoretical basis of the study, the problem statement and objectives, the significance of the study, the scope of the study, and the research structure.

Chapter 2 is the literature review. It is divided into six parts. This includes developing a conceptual framework for this study based on a review of the relevant literature on the three main constructs, the relationships between the key constructs, and the hypotheses. This paper conducts an in-depth and extensive review of the

literature in the following areas: (1) the characteristics of CVC investment; (2) a quantitative review of the concept and dimensions of green innovation and the relevant variables that affect this innovation capability; and (3) a quantitative review based on a review of the relevant literature on CVC investment and the green awareness and financing constraints of executives in emerging companies. Then, the relationship between the key constructs is explained from the perspective of the moderating role of political connections, R&D investment, ESG performance, and EM environmental management in the green innovation of new companies. Finally, this chapter proposes a conceptual model.

Chapter 3 describes how the actual validation design of this study is carried out, which is divided into four main parts. First, the selected empirical research paradigm is explained, that is, the use of quantitative research methods to guide the research design. Second, the definition of key core variables and the variable selection and data collection methods are given. Then the data preprocessing process and the data analysis methods used are introduced. Finally, the relevant statistical techniques for conducting quantitative empirical tests are introduced.

Chapter 4 uses the results of secondary data collection for descriptive statistics. This chapter also explains the inherent logic of the structural framework of this study, namely the correlation and preliminary analysis of CVC investment and green innovation of new start-ups, and then tests the hypotheses proposed in this study.

Chapter 5 introduces the data processing analysis. The results based on testing the hypotheses using hierarchical regression analysis are discussed, the data are robustly checked, and the implications of these findings for management practice are discussed. The interpretation of theoretical contributions and future research agenda summarizes the important findings of this study. The full text will be divided into four parts: theoretical significance, practical significance, limitations, and further research agenda and conclusions.

CHAPTER 2

LITERATURE REVIEW

This is a literature review. It is divided into eight parts. This includes developing a conceptual framework for this study based on a review of the relevant literature on the three main constructs, the relationships between the key constructs, and the hypotheses. This paper provides an in-depth and extensive review of the literature in the following areas: (1) the characteristics of CVC investments; (2) a quantitative review of the concepts and dimensions of green innovation and the relevant variables that affect this innovation capability; and (3) a quantitative review based on a review of the relevant literature on CVC investments and the green awareness of executives in emerging companies. The relationships between the key constructs are then explained from the perspective of the moderating role of political connections, R&D investment, ESG performance in green innovation in new startups. Finally, this chapter proposes a conceptual model.

2.1 Theoretical Foundation

2.1.1 Resource-based Theory

Resource-based theory (RBT) mainly studies the relationship between resources and corporate competitive advantage. It is also widely regarded as the most important and powerful theory to describe, explain and predict corporate performance and organizational relationships. Resource-based theory is mainly developed from the Resource-based view (RBV).

The notion of the RBV of firms was first described by Wernerfelt (1984) and Barney (1991). In its original form, it analyzes the impact of the heterogeneous resources used by firms on their performance over time. The concept of RBV helps to explain the role that a firm's resources play in creating sustained competitive advantage (Barney, 1991). According to Barney (1991), a firm's resources may therefore be viewed as a means of achieving its various strategies and goals. Given this background, RBV theory can be used to examine a company's social and environmental activities and, more specifically, their climate change policies. Companies can use the progress they make in these activities to establish a competitive advantage over their less ethical competitors. Environmental commitment

is seen as an important and beneficial aspect of the business strategy of these firms. Hart (1995) finds that enacting clean production methods can produce significant competitive advantage and environmental benefits.

Peteraf and Barney (2003) define this competitive advantage as the marginal economic value that a company enjoys over its competitors due to superior achievement in a particular area. By rethinking business models, processes, technologies, and products with a view to sustainability, environmental strategy can become a competitive resource. When discussing this concept, we should mention the first authors to empirically analyze this theory by applying firm-level data to environmental performance and financial profitability. Russo and Fouts (1997) and Sharma and Vredenburg (1998) find that companies achieve a better financial performance when they have an improved environmental performance. Sharma and Vredenburg (1998) suggest that corporate investment in pollution control as an environmental strategy improves firm-specific capabilities. According to Nidumolu et al. (2009), implementing an environmental strategy, particularly in firms committed to sustainability, leads to competitive advantage in the future. Notwithstanding corporate decisions to pursue environmental protection and sustainability, it is essential to realize that the primary aim of any firm is to maximize its profit (Friedman, 1962). One of the objectives of implementing environmental strategies is to obtain competitive advantage and ultimately to improve corporate performance.

At this point, the resource-based view began to enter a period of rapid development. Since then, scholars have continuously derived new correlation theories based on the resource-based view, such as knowledge-based view, Natural-resource-based view, Dynamic capability theory, Extended resource-based view and Entrepreneurship theory, etc. After nearly 30 years, supplemented by these theories, the resource-based view has increasingly developed into a mature resource-based theory.

Regarding the definition of resources, the conceptual definitions in different periods are slightly different. Early definitions were mainly based on the resources owned or controlled within the organization. They assumed that the only relationship between external resources and corporate performance was competitive. For example, Wernerfelt (1984) proposed that the so-called resources refer to “anything that can be

considered as an advantage or disadvantage of a certain company. More formally, A firm's resources at a given time can be defined as those assets (tangible and intangible) that are semi-permanently associated with the firm".

Barney (1991) expanded previous research and believed that resources are "all the forces that an enterprise can utilize when implementing its strategies" and "including all assets, capabilities, organizational processes, enterprise attributes, information, knowledge, etc. controlled by the enterprise. These Resources enable enterprises to conceive and implement strategies that improve their efficiency and effectiveness." Therefore, they are also called strategic resources. Later, scholars increasingly stepped out of the framework of internal ownership and control of the organization and began to emphasize the cooperative relationship between external resources and corporate performance, indicating that the resources of corporate partners can also contribute to corporate performance. These resources are called network resources by some scholars, and they expand the opportunity set for enterprise development.

For example, Lavie (2006) pointed out that the valuation of a company should be based on the resources owned or controlled by the company, as well as the resource endowments of its partners. To sum up, the super performance of an enterprise comes not only from the heterogeneous resources owned or controlled within the enterprise, but also from the resources that can be utilized outside the enterprise. Based on this, this article also advocates that the new product development of entrepreneurial enterprises not only depends on the internal resource advantages of the enterprise, but also depends on the resource endowment of its external partners such as venture capital.

Therefore, based on the research of Wernerfelt (1984), Barney (1991) and Lavie (2006), the resources in this article mainly refer to all the forces available to the enterprise, including all assets, capabilities, organizational processes, enterprise attributes, information, knowledge, etc.

2.1.2 Resource- dependence Theory

Resource Dependence Theory (RDT) is an important theoretical school in organizational theory research and originated in the fourth century of the 20th century

(Pfeffer & Gerald Salancik, 1978) .In the 1900s, the representative scholar in this field was Jeffrey, in 1978 Author of "External Control of Organizations: Resource Dependence" This theory is elaborated in the book "Analysis". This theory focuses on the study of relationships between organizations, organizational change activities, and the principles of interaction between organizations and the external environment.

The environment is the ecosystem in which an organization survives, providing it with resources and at the same time bringing opportunities and additional constraints for organizational development. Most social organizations are dependent on and affected by the environment. The organizational environment can refer to everything outside the boundaries of the organization. These things either affect the characteristics of its internal components or are changed by the organization itself. The organization needs to obtain resource input from the environment, go through a complex transformation process, and finally re-launch the products it produces into the environment.

In this interaction, all participating elements in the organization are subject to double constraints: first, from the technical core within the organization; second, even if the organization participates in the interaction in a positive or proactive manner, it is impossible to escape from the technical core. The influence and constraints of various factors in the environment. The restrictive force from the environment must not be underestimated. Scott (1984) even pointed out that "the open organization operating model emphasizes that the organization must maintain a mutually restrictive and interrelated reciprocal relationship with the various elements surrounding itself and the elements that penetrate it."

Moreover, it provides the organization with the resources to survive, the values to prove its existence, the management method for the healthy operation of the organization, and the organization's characteristics that are different from other organizations and different from other organizations. Competitive capital technology can even describe the historical trajectory of an organization from scratch. Organizations capture survival opportunities from the environment, but they also have to endure the constraints imposed on themselves by various factors in the environment. However, if an organization is to survive, it must adapt to its surrounding environment, and sometimes must undergo difficult reforms in order to adapt.

Resource dependence theory regards "the environment as a place where scarce

resources are obtained to achieve organizational tasks and operations." Resource dependence theory advocates that organizations and environmental resources have a competitive relationship with each other and coexist at the same time. "Dependence" (dependence) in resource dependence theory is understood by scholars as "the degree of demand for resources and the degree of resource availability (shortage or abundance) in the environment." To become an efficient organization, it must "Always complete the following three core tasks: achieving goals, maintaining internal independence, and adapting to the environment." Scott (1984) pointed out, "As open organizations, all organizations are incomplete and need to rely on communication with other organizations in the environment to survive." If an organization in a changing and turbulent environment wants to win in the competition for resources, it must adopt a completely different approach from that in a stable environment to meet the needs of planning, decision-making, and management.

Resource dependence theory had further development in the 1980s. Burt (1986) tried to point out the relationship between organizations and the environment from an economic perspective: "As long as the actors in the environment avoid dependence others, If it occupies a relatively weak competitive position in the social structure and is dependent on actors who are subject to stronger competitive pressures in the environment, then this actor will benefit in the environment." Coincidentally, Baker (Baker, 1992). A similar perspective illustrates the relationship between the organization and the environment. "When an organization becomes highly dependent on other organizations for funds, markets, information and other resources, the organization will maintain long-term and close relationships with them. Only when this degree of dependence is low can the relationship between them be temporary and relatively distant." It can be said that the dependence of organizations on the environment is an attribute of the interrelationships between organizations. It is precisely because of the interrelationships between organizations, and at the same time, organizations have a strong dependence on resources in the environment. Organizations and the environment Communication between other sisters occurs frequently.

In the financing process of developing new ventures with certain potential, the impact of CVC investment on the enterprise is also obvious, and it can bring a series of resources to it, but at the same time, this is also a two-way selection process.

Keilet al. (2010) point out that startups that establish strategic alliances with corporate partners, including CVC investors, can benefit from access to complementary resources and capabilities. Resource dependence theory helps to elucidate how startups manage relationships with corporate investors to obtain the various resources that drive their innovation process

Resource dependence theory (RDT) has been an important framework for understanding the relationship between organizations and their external environment (Drees & Heugens, 2013). It emphasizes the idea that organizations rely on external resources for survival and development (Hillman et al., 2009). RDT has been applied in a variety of contexts, such as multinational corporations (Cuervo-Cazurra et al., 2019), entrepreneurial ecosystems (Roundy & Bayer, 2019), humanitarian supply chain networks (Prasad et al., 2016), and corporate governance (Hillman and Dalziel, 2003). The theory predicts that organizations that control resources critical to the strategic process can have a significant influence on decision-making (Cuervo-Cazurra et al., 2019). Furthermore, it shows that organizations do not possess resources equally and their environments are not always reliable (Roundy & Bayer, 2019). RDT has also been used to explain the market-oriented strategies of nonprofit organizations (Prasad et al., 2016). In addition, RDT is combined with other theories to enhance its explanatory power. For example, it is combined with upper echelon theory to examine the impact of board composition on corporate decision-making (Marchini et al., 2021). Furthermore, RDT has been influential in exploring ways for firms to reduce or overcome resource vulnerabilities, particularly focusing on high-power actors (Shu & Lewin, 2016). The theory is also linked to institutional theory in the analysis of central government accounting reforms (Cohen & Karatzimas, 2018). Furthermore, RDT is also integrated with social and political theories (such as legitimacy and stakeholder theory) to understand corporate social responsibility disclosures (Branco & Rodrigues, 2008). RDT has also been used to understand the quality of relationships between logistics users and suppliers, emphasizing resource dependencies between involved parties (Van et al., 2020). It has been applied to analyze the decision-making processes of public organizations, particularly those related to the stakeholder resources that the organization seeks to own and use (Frączkiewicz-Wronka & Szymaniec, 2012).

Resource dependence theory (RDT) is a concept widely used to understand the

dynamics of organizational behavior and decision-making in the context of dependence on external resources. This theory emphasizes the impact of dependencies on the relationship between an organization and its environment, and how these dependencies influence strategic choices and actions (Pfeffer & Salancik, 1978). CVC investing involves established companies providing capital to startup or early-stage companies in exchange for equity. This type of investment enables corporate investors to gain access to new technologies, innovative business models and strategic partnerships, while providing financial resources and industry expertise to startups. RDT can reveal the motivations behind CVC investments and the dynamics of relationships between corporate investors and their portfolio companies.

Previous research has applied RDT to the study of CVC investments to understand the drivers of corporate investment decisions and the impact of these investments on corporate investors and startup performance (Gulati, 1995; Hagedoorn and Cloudt, 2003). These studies found that companies make CVC investments as a strategic response to their resource dependence, such as innovation needs, entry into new markets, or product diversification. RDT recommends that companies use CVC investments as a means to gain control over critical resources and reduce their vulnerability to environmental uncertainty.

In addition, RDT assumes that relationships between organizations are characterized by power asymmetry and interdependence, which can affect the outcomes of CVC investments. Corporate investors may use their resource dependence to exert influence and control over their portfolio companies, while startups may seek to leverage their innovative capabilities to negotiate favorable terms with corporate investors (Gomes Cassers, 1996; Park and Steensma, 2012). These power dynamics and interdependencies can influence strategic decisions and outcomes of CVC investments.

Resource dependence theory (RDT) has been widely used to analyze the interrelationship between an organization and its external environment. This theory holds that organizations depend on external resources and are affected by the power dynamics of their environment. In the context of new entrepreneurial firms, resource dependence theory provides a lens through which to understand the ways in which these firms seek and acquire resources from the external environment and how they navigate power dynamics to achieve innovation and growth.

Several studies have examined the relationship between corporate venture capital (CVC) investments and startup innovation mechanisms, and the literature has highlighted the relevance of resource dependence theory in understanding this relationship. For example, Ahlers et al. (2015) emphasize the importance of CVC investment as a means for startups to obtain key resources, such as financial capital, knowledge and networks, that are crucial for innovation and growth. This is consistent with the assertion of resource dependence theory that organizations seek resources from external sources to reduce dependence on specific resource providers and enhance their strategic position in the environment.

Dushnitsky and Lenox (2005) pointed out that start-up companies often face resource constraints and environmental uncertainty, which makes them more dependent on external resources. Resource dependence theory explains how startups adapt their strategies to obtain necessary resources and respond to power dynamics in the external environment. In the context of CVC investing, this theory can explain how startups navigate power dynamics with corporate investors and leverage the resources provided to drive innovation.

2.2 CVC investment company

The importance of venture capitalists (VCs) in providing funds for small and medium sized enterprises (SMEs) has been well documented (see, e.g., Black and Gilson 1998; Gompers and Lerner 1999; Kortum and Lerner 2000). VCs play a significant role in the development of entrepreneurial firms (e.g. Sahlman 1990; Sapienza et al. 1996; Gompers and Lerner 1999; Manigart et al. 2002, 2006; Leleux and Surlemont 2003; Wright et al. 2006). As such, many governments have mounted programs that seek to foster VC financing. Such programs have been the subject of previous scholarly examination.¹ Lerner (1999) evaluates the success of the US government's SBIR program. Lerner (1999, 2002), Cressy (2002), Leleux and Surlemont (2003) and Cumming and MacIntosh (2006, 2007), among others, discuss the appropriate role of governments in private equity markets,² and each argue that government programs ought to complement, and not compete with, private VC investments. Recent advances in the literature have considered the role of informed versus uninformed VCs and government policy towards VC (Kanniainen and Keuschnigg 2003, 2004; Keuschnigg 2004a, b; Keuschnigg and Nielsen 2001, 2003a,

b), and come to similar conclusions in regards to the role of complementarities between the public and private sector in the support of VC. In short, as the social rate of return to VC is greater than the private rate of return, VC markets warrant public subsidies if such subsidies facilitate and do not crowd out private investment.

2.2.1 The heterogeneity of VC investment

U.S. corporations started establishing CVC funds as early as the 1960s. Over the years, CVC investments accounted for on average 7% of the venture capital industry. According to the National Venture Capital Association. CVC subsidiaries are seen as an effective way to conduct R&D activities externally and to expose their management to new technologies and entrepreneurial mindsets (Chesbrough 2002; MacMillan et al. 2008). Not surprisingly, firms with CVC subsidiaries experience significant improvements in their own innovation productivity and higher firm value (Dushnitsky and Lenox 2005, 2006).

As of the end of 2021, there were 3,568 venture capital institutions in China (including 2,496 venture capital funds and 1,072 venture investment management institutions), an increase of 278 from 2020, an increase of 8.4%; the scale of venture capital under management reached 1.30353 billion yuan, an increase from 2020 The annual increase was 187.69 billion yuan, an increase of 16.8%.

Politicians likewise were quick to support the goal of a vigorous domestic venture capital industry based on a universal admiration of the Silicon Valley phenomenon (Kenney and Von Burg 1999). Importantly, the attraction of venture capital as a policy vehicle appeared to span the political spectrum. This growing policy awareness, evident from the early 1980s, had its intellectual foundations in academic research conducted in 1970s and 1980s on the significant economic contribution of young firms (Birch 1979; Storey et al. 1987.) Coincidentally, this period coincided with the early growth of VC industries in both the US and the UK (Coopey and Clarke 1995; Gompers 1994) although the first examples of the modern "classic" VC firm were created immediately after World War II (Bygrave and Timmons 1992).

At the start of the 21st Century, most national governments in the West had very little experience of VC activity. The USA and the United Kingdom were both outliers in having established important VC and PE industries from the early 1980s. As a

consequence of the immaturity of the VC industry, the majority of national policy makers were obliged to “learn by doing” and/or borrow from the limited, relevant experiences of equivalent public agencies in other countries. Apart from the dominant examples of the USA, the UK and possibly Israel, governments have had few illustrations of successful GVC programmes which they could study and adapt to their own purposes. And even the extant VC programmes in North America (Brander, Egan, and Hellmann 2008; Lerner 2002, 2010); Australia (Murray and Lingelbach 2010; Cumming and Johan 2014) and the UK (Cowling et al. 2012; Murray, Cowling, and Liu 2010) could still be viewed as “work in progress” with their final outcomes and long-run fund performance as yet unclear.

Government has essentially two choices as to how it wishes to intervene directly in the VC market. It may decide to act unilaterally and add to the existing pool of available risk capital by financing a new VC fund or programme exclusively from the public exchequer. Acting as both the “general partner” (GP) and the sole “limited partner” (LP), it assumes the full responsibility of investment selection, support and realization (exit). Conversely, the state may seek to encourage existing or new agents from existing capital markets to collaborate with it in the setting up of a co-investment scheme whereby both private and public parties are involved in raising the supply of venture capital. In this hybrid or indirect model, the state is a “special LP” providing investment finance on such terms that will attract both private investors to co-invest and incentivise a GP to manage the fund. The state is proscribed from involvement in the operational investment decisions after setting the parameters of the fund’s investment activities. This hybrid model, utilizing the skills and experience of the VC sector’s investment professionals who are incentivised to meet goals of mutual commercial interest to themselves and the state, has become the predominant conduit for public support. That hybrid funds have to be structured and managed in a commercial manner which will attract private LPs, while putting the operational onus on a GP normally identified in a competitive bidding process, has governance and efficiency benefits obvious to an accountable government. There are several variants in the structure and operational incentives of both the direct and hybrid models of state-supported VC activity. Nor are the two models mutually exclusive. In a number of countries, for example, the publicly funded Vaekstfonden agency in Denmark, the organisation makes both direct VC investments to Danish businesses while at the

same time supporting indirect VC investment via a hybrid fund structure (Damvad 2014).

However, to our knowledge, the impact of CVC financing on the green innovation productivity of the startups it supports has not been fully explored.

One of the purposes of this paper is to fill this gap in the literature by analyzing the relative effectiveness of CVCs, IVCs and GVCs in nurturing green innovation in the entrepreneurial ventures they support.

Prior studies suggest that government ownership of firms can have positive and negative impacts. Government intervention in state-owned enterprises (SOEs) can distort investment allocations, reduce investment efficiency, and destroy value (Shleifer, 1998), particularly in local government SOEs (Hao and Lu, 2018). Alternatively, government ownership conveys political connections, which can facilitate access to bank loans, government concessions, and favorable regulatory outcomes (Faccio, 2006; Claessens et al., 2008; Li et al., 2008). In venture capital, government ownership of VCs can confer certain advantages to entrepreneurial firms. Investment by government-owned VCs can imply government endorsement (Colombo et al., 2016) and can assist entrepreneurial firms in obtaining additional public support, such as R&D grants and partnerships (Colombo et al., 2016). The connections to government agencies provided by government-owned VCs are important for entrepreneurial firms in China, where exit through an initial public offering (IPO) requires prolonged government approval.

Despite the potential benefits of government-owned VCs, government ownership could lead to inefficiencies. This can occur both within entrepreneurial firms and the VC itself. Prior studies in developed markets suggest that government-owned VCs suffer from bureaucratic costs and political interest (Cumming et al., 2017), and can struggle to attract and retain talented managers (Jääskeläinen et al., 2007). These shortcomings can lead to less effective monitoring, nurturing, and mentoring of entrepreneurial firms by government-owned VCs (Colombo et al., 2016).

CVC and IVC funds share the same investment universe and many institutional characteristics, but have different organizational and corporate structures.

First, CVCs are typically independent subsidiaries of non-financial companies that invest in new ventures on behalf of their parent companies. The lifespan of a

CVC is almost infinite (at least initially). In contrast, an IVC is typically structured as a limited partnership with a contractual execution period of ten years (with the option to extend by up to two years). Additionally, a CVC is funded solely by its parent company, and its ability to withdraw capital from the parent company as needed is not contractually restricted. However, an IVC's capital withdrawals are limited by the amount of capital initially committed by its limited partners.

CVCs' longer investment horizons and relatively unconstrained capital supplies allow them to be more open to experimentation and exploration, and to invest in long-term innovative businesses that may not generate immediate financial returns but have high upside potential.

Second, CVC and IVC funds use different management compensation practices and incentive adjustment schemes (Dushnitsky and Shapira, 2010). According to a survey conducted by Frederic W. Cook & Co. in 2000, the vast majority of CVC funds (68% of respondents) did not enjoy the high-performance compensation plan (with interest incentives) that is standard for IVC funds. Instead, CVC fund managers are typically compensated through fixed salaries and annual bonuses tied to the performance of the parent company, as is traditional in the corporate world. The survey also shows that almost no CVC funds follow the traditional venture capital model and require employees to co-invest; they also do not allow voluntary reinvestment by CVC fund management members. Overall, this approach changes the incentives of CVC fund managers and is a double-edged sword in fostering innovation in the startups they invest in. On the one hand, the lack of strong compensation plans makes CVC fund managers more tolerant of failure (Manso 2011) and thus better able to foster innovation. On the other hand, CVC fund managers' compensation is tied to the performance of their parent companies, which may increase their incentives to promote the interests of their parent companies at the expense of the startups they support, which in turn may hinder innovation in these companies. In other words, this incentive to help the parent company may motivate CVCs to pursue an exploitative rather than a nurturing strategy for startups.

Third, unlike IVCs whose sole goal is to pursue financial returns, CVCs usually have a strategic mission to enhance the parent company's competitive advantage by bringing new ideas or technologies to the parent company (MacMillan et al., 2008). Therefore, CVC pursues strategic and financial objectives. Therefore, it is common

for CVCs to seek commonalities between their parent companies and the new ventures they support. A well-connected startup can leverage the CVC parent's manufacturing plants, distribution channels, technology, or brand, and adopt the CVC parent's business practices to manufacture, sell, or service its products. In return, the parent company receives from the startup a window into new technologies and markets that can improve its existing business (MacMillan et al., 2008). Therefore, the presence of a parent company provides a CVC with unique knowledge of the industries and technologies used by the startups it invests in. This technology match between the startup and CVC's parent company gives CVC superior industry and technology expertise and a better understanding of the startup's technology, which may help foster innovation at these portfolio companies. 6 The organizational form of a CVC may also allow the transfer of soft information relevant to innovative projects between the CVC parent and the startup, a fact that may be more difficult to achieve in the context of an IVC firm. In short, on the one hand, the unique characteristics of CVC, namely, longer investment horizon, less performance-driven compensation plan, and industry and technical support from the parent company, enable CVC to provide better technical support and support the financing of CVC. Startups are more tolerant, allowing them to foster innovation in these companies to a greater extent than IVCs. On the other hand, CVCs need to obtain resources from their parent companies and focus on improving the parent company's performance, which may hinder their incentives and reduce their effectiveness in nurturing innovation in these startups.

Overall, the relative capabilities of CVCs and IVCs in fostering green innovation is ultimately an empirical question. CVCs may be better than IVCs in cultivating green innovation because CVCs' unique organizational and compensation structures may make them more supportive of risky, positive green innovation activities. First, CVC funds are structured as subsidiaries of companies, while IVC funds are structured as limited partnerships and are subject to contractually enforceable ten-year terms. This means that CVC has a longer investment horizon than IVC. Secondly, as a corporate subsidiary, CVC pursues both the strategic goals and financial goals of the parent company, while IVC's only investment goal is to achieve high financial returns. Third, the performance-based compensation structure enjoyed by IVC fund managers (i.e. 2% management fee and 20% carried interest) is generally not found in CVC funds: CVC fund managers are paid a fixed salary and are closely related to the parent

company's financial Linked company bonuses.

The above three differences between CVCs and IVCs, namely longer investment horizons, not purely focused on financial returns, and lack of purely performance-driven compensation plans, may make CVCs more receptive to their portfolio companies compared to IVCs of experimentation and occasional failure (necessary to inspire successful innovation).

Additionally, the presence of a parent company may provide a CVC with unique knowledge of the industries and technologies used by its portfolio companies that is not present in an IVC. This superior industry and technology expertise of CVCs may enhance their ability to better exploit the soft information they receive about the R&D activities of their portfolio companies, thereby enabling them to better evaluate and nurture the potential of these new ventures. technology and products. Taken together, the above factors may make CVCs more effective than IVCs in fostering green innovation in their portfolio companies.

However, the unique organizational structure of CVCs may also adversely affect their ability to promote green innovation among portfolio companies compared with IVCs. A CVC is structured as a subsidiary of a company and must receive the amount invested in its portfolio companies from its parent company. This means that CVCs are subject to centralized resource allocation and associated corporate socialism (Rajan, Zingales, and Servaes 2000; Scharfstein and Stein 2000), which may promote mediocrity in R&D activities (Williamson 1985; Seru 2014). In addition, as a corporate subsidiary, CVC pursues the strategic goals of the parent company, and the compensation of its fund managers is linked to the financial performance of the parent company. As a result, CVCs may be incentivized to leverage the deep industry and technology expertise of their corporate parent companies to develop rather than nurture the startups they invest in, thereby hindering innovation in these companies. In contrast, IVCs may allocate resources more efficiently because they are limited partnerships and have full control over the capital committed by the limited partners. In addition, IVC pursues purely financial returns, and its fund managers are compensated based on financial performance. Furthermore, IVCs are known to make a significant contribution to the development of entrepreneurial firms: for example, they professionalize management teams (Hellmann and Puri, 2002) and promote collaborative relationships through strategic alliances between portfolio companies

Lindsey(2008). Finally, IVCs also tend to specialize to a large extent Gompers, Kovner, & Lerner (2009) and thus may possess the knowledge required to understand the innovation process in a specific industry. Overall, more efficient resource allocation, higher compensation packages, and specialized industry expertise may make IVCs better than CVCs in nurturing innovation.

To address my first research question, I first examine the green innovation output of CVC-backed initial public offering (IPO) firms versus IVC-backed firms. As is now standard in the existing innovation literature (e.g., Aghion et al. 2005; Kogan et al. 2012; and Seru 2014), the plan is to use the National Bureau of Economic Research (NBER) patent citation database to construct two measures: the number of patents a company generates, as our measure of the “quantity” of innovation, and the number of future citations per patent, as our measure of the impact, or “quality,” of innovation. For my research, I selected majors that showed green innovation. The green here mainly refers to the purpose of patented design, which tends to be energy-saving and environmentally friendly.

According to (Chemmanur et al. 2014), an empirical study using data from US listed companies shows the superior ability of CVC to cultivate innovation (therapeutic effect), as well as the superior ability of CVC to identify and select startups with higher innovation potential. To disentangle these two effects, they use an ideal experiment to evaluate the innovation output of entrepreneurial firms under random allocation of IVC and CVC investors. Since such an experiment is not feasible, they use a propensity score matching procedure, which enables minimizing differences in observable characteristics between the two types of firms and thus, to some extent, distinguishing treatment effects from selection effects.

They match these two types of firms in the IPO year using a range of dimensions known to influence innovation output. The results of their propensity score matching analysis show that CVC-backed firms are characterized by an average of 25%

Innovation output is higher before the IPO, and innovation output after the IPO is 45% higher on average. Although they cannot completely rule out selection effects, these differences are more likely attributable to treatment effects; that is, CVCs have a superior ability to foster innovation in their entrepreneurial venture.

Although the IPO sample enables effective control of a range of firm characteristics that influence innovation, it may be affected by survivor ship bias and

sample selection problems because compared to IVC, CVC may only allow the most innovative firms to go public. To address this question, they studied a sample of VC-backed startups. They hand-matched the patent information provided by the United States Patent and Trademark Office (USPTO) from the VentureXpert database based on the name and location of the startup. Using this sample, a difference-in-difference (DiD) analysis was conducted to examine the impact of the first round of IVC and CVC investment on the subsequent innovation output of entrepreneurial enterprises. They found that if startups receive first-round financing from CVCs rather than IVCs, their innovation output will experience greater long-term growth. Specifically, while both groups of firms showed similar levels of innovation output on the first round of funding, CVC-backed firms showed momentum in innovation output and outperformed five years after the first round of financing. IVC-backed businesses.

(Chemmanur et. al., 2013) analyze how corporate venture capital (CVC) differs from independent venture capital (IVC) in nurturing innovation in entrepreneurial firms. (Chemmanur et. al., 2013) present evidence consistent with two possible underlying mechanisms: CVC's greater industry knowledge due to the technological fit between their parent firms and entrepreneurial firms and CVC's greater tolerance for failure. The objective of Kumar (2015) is to explore green marketing innovations in small Indian firms which serve as decisive dimensions for developing green identity of small firms in the market. Findings Six categories of green marketing innovations are identified—marketing compliance, marketing strategic partnership, marketing environmental commitment, marketing green team, marketing benchmarking and marketing (environmental) ethical behavior. Dushnitsky et. al., (2016) examine the role of corporate venture capital (CVC) in enabling companies to gain access to innovations created by startups. Their analyses reveal that CVC investments are likely to occur where there is complementarity in the products of corporate investors and startups. Implementing green innovations represents a great challenge for non-green companies because it often requires the acquisition of new resources and competences that differ significantly from their existing competences. (Calza et. al., 2017) attempt to propose a theoretical framework that classifies green innovations according to their impact on company's competences and analyses how green innovations can be implemented.

Ozmel(2017) analyze the contingent benefits of receiving corporate venture

capital (CVC) investment on tech ventures' innovation outcome, show that ventures receiving CVC investment have higher innovation performance in comparison to ventures that have received independent VC (IVC) investment only. (Wang et. al., 2019) analyze the effects of corporate venture capital (CVC) and independent venture capital (IVC) backing on technological innovation and value creation in invested companies. Using data on Chinese listed companies, (Wang et. al., 2019) show that CVC investment can induce higher firm value than can IVC investment. (Du et. al., 2019) propose that policy and public intention to raising living standard rather than environment, as well as lacking complementary supporting from other related innovations, represent barriers to adopt green technology innovations in less developed economies. The findings in this paper also highlight policies for encouraging worldwide green technology cooperation, such as accelerating green technology transfer across economies. Examples of existing strategies for green economy are presented to demonstrate different policy options for incentivising the use of eco-innovations. (Engelmann et. al., 2019) argue that eco-innovations and sustainable business models are the pragmatic core in the transition to a green economy and must be represented in governmental policy strategies. Green technology innovation is an effective driving force to achieve the optimization and upgrading of industrial structure. Environmental regulations principally behave in guiding green technology innovation activities.

Other influential work includes (Burki, 2018). (Du et. al., 2019) propose that policy and public intention to raising living standard rather than environment, as well as lacking complementary supporting from other related innovations, represent barriers to adopt green technology innovations in less developed economies. The findings in this paper also highlight policies for encouraging worldwide green technology cooperation, such as accelerating green technology transfer across economies. (Du et. al., 2019) investigate the impact of green technology innovations on carbon dioxide (CO₂) emissions based on a data panel covering 71 economies from 1996 to 2012. It is found that the impact of green technology innovations exists a single threshold effect regarding the income level. (Corrocher et. al., 2019) investigate whether and how diversified firms in the Information and Communication Technology (ICT) sector innovate in green technologies and assess the potential impact of these innovations on firm performance. The results show also that the development of green

technologies is positively associated with firm performance: ICT firms involved in green patenting activity perform better than ICT firms with no green patents.

Based on the above literature review, we can conclude that CVC investment has a more significant impact on the innovation performance of new ventures than IVC or GVC, but there is no clear empirical verification process for the impact of green innovation. Based on this, I propose the purpose of this article. The first hypothesis proposes:

Hypothesis 1 There is a positive relationship between CVC investment and the green innovation capabilities of new ventures

2.3 Green innovation

Successful invention and innovation can increase profits in two principal ways: by widening the profit margin earned on a dollar of sales (or in the case of capital-saving changes, invested capital) and by opening up new opportunities for profitable sales growth. (Scherer, 1965) report the results of a study of inventive output, profitability, and sales growth in 448 firms appearing on Fortune's list of the 500 largest U.S. industrial corporations in. There is a debate as to whether this factor will affect R&D practices and product innovation in small and medium enterprises (SMEs). (Noci et. al., 1999) suggest a contingent framework to support SMEs in the analysis of the drivers of 'green' product innovation and in the choice of a proper R&D strategy that explicitly accounts for the eco-efficiency of product technologies. (Hall, 2001) propose a model describing why firms should invest in environmental supply chain innovation or 'green supply' activities. The model attempts to demonstrate that customer firms invest in environmental supply chain innovation because suppliers with poor environmental practices can expose the customer firm to high levels of environmental risk. Smith(2009) analyze corporate venture capital (CVC) investment and innovation performance in the medical device industry. (Smith, 2009) makes significant contributions to the understanding of project level dynamics and the innovation returns to CVC. Green innovation has been recognized as one of the key factors to achieve environmental and economic success in markets. (Lee et. al., 2011) aim to explore and understand the role of suppliers in enhancing the manufacturer's

ability to successfully carry out green innovation in product development. (Chemmanur et. al., 2013) analyze how corporate venture capital (CVC) differs from independent venture capital (IVC) in nurturing innovation in entrepreneurial firms. (Chemmanur et. al., 2013) present evidence consistent with two possible underlying mechanisms: CVC's greater industry knowledge due to the technological fit between their parent firms and entrepreneurial firms and CVC's greater tolerance for failure. (Saunila et. al., 2017) examine what drives green innovation investment and exploitation with regard to sustainability. The specific focus of (Saunila et. al., 2017) is on company valuations of different dimensions of sustainability and their relationships to green innovation. The social science literature on energy lacks much attention to private and semi-private energy companies and their efforts to reduce the impacts of the ongoing climate change. (Nilsen, 2017) explore one of the dominating energy companies in Europe, Statoil, and its strategic decisions that determine which type of energy technology multinational corporations choose to invest in or to acquire. By contrast, diversifying into the green energy path has the potential to close the gap between the black and green path, step-by-step. (Zhao et. al., 2020) conduct a theoretical analysis of the game mechanism between local governments and metal mining companies to study the factors that influence their strategies. Second, (Zhao et. al., 2020) list the utility of the company and local government under all game outcomes and analyse their behavioral tendencies. (Javad et. al., 2020) aim at selecting suppliers of Khouzestan Steel Company (KSC) based on their green innovation ability. In this research, the Company's alternative suppliers are identified and the most effective criteria for supplier selection based on the supplier's green innovation abilities is determined.

This study refers to the definition of "green innovation" proposed by (Chen et al., 2006), which is defined as hardware or software innovation related to green products or processes, including energy saving, pollution prevention, waste recycling, green product design or enterprise Technological innovation in environmental management (Chen et al., 2006). Green innovation is used to improve environmental management performance to meet the requirements of environmental protection (Chen et al., 2006). In addition, (Chen et al., 2006) divided "green innovation performance" into "green product innovation performance" and "green process innovation performance".

(Chan, 2000) proved that the green image of the source country has a significant

positive impact on the effectiveness of advertising and reminded marketers of the importance of green image. Furthermore, (Corrigan, 1996) points out that since Ireland was promoted as a European green center for quality products and services, Ireland's export industry has grown significantly, thus having the advantage of a green image. Furthermore, (Hu and Wall, 2005) proposed that the competitiveness of tourist attractions can be improved through sound environmental management practices.

2.4 Executive's Green Cognitive/Awareness

Since the introduction of cognitive theory, a rich body of literature has explored the composition of executive cognition and its economic consequences for business organizations from different perspectives. Early on, scholars attempted to analyze the composition and characteristics of executive cognition, thus introducing several important concepts such as attention (Cho and Hambrick, 2006; Cristofaro, 2020; Schunk and DiBenedetto, 2020), selective perception (Sutcliffe and Huber, 1998), and blind spots (Zajac and Bazerman, 1991). In subsequent studies, using textual analysis, scholars have built on this to analyze the factors influencing the cognitive complexity of executives (Graf-Vlachy et al., 2020). One study by Eftekhar et al. (2014) analyzed the link between Facebook users' photo-related activities and the "big five" personality traits and found that neuroticism and extraversion, among other connections, predicted more photo uploads. Obschonka and Fisch (2018) analyzed Trump's personality traits by means of computer linguistic text analysis using content posted by him on Twitter. Scholars have also focused on the impact that company executives' perceptions have on corporate organizational behavior and found that executives' perceptions can significantly influence firm performance (Kim et al., 2016; Ou et al., 2018; Park et al., 2018). The economic consequences of specific executive cognitions have also been examined; for example, Liu and Xi (2021) found that CEO entrepreneurial cognitive orientation affects firm performance by triggering middle managers' confidence in organizational prospects or workplace anxiety.

The corporate executive team, led by the chief executive officer, controls the entire company and directs the overall corporate actions (Javeed et al., 2021). The Upper Echelons Theory, introduced by Hambrick and Mason (1984), explains the complex decision-making behaviors of executive teams. Managers typically prioritize decisions based on their subjective perceptions and inherent values, which implies

that managers are inevitably influenced by their own past experiences, knowledge structures, cognitive biases, and attention focal points in receiving information, making decisions, and taking action. The Attention-Based View posits that business decision outcomes depend not only on the individual characteristics of decision-makers but are also influenced by their cognitive factors, such as attention. The attention levels of top management team members to redundant and complex information guide them in making crucial decisions for the company's development. Integrating psychological cognitive factors like the attention of top management team members into strategic decision-making processes helps in explaining a firm's behavior (Ocasio, 1997). Building upon the exposition of the attention-based perspective, executive green awareness can be defined as the level of attention and perception that executives allocate to environmental issues based on their unique experiences, knowledge structures, and values (Zhang et al., 2015). This encompasses the executive team's focus on the company's environmental footprint, resource management, sustainable operations, and social responsibility commitments, as well as their willingness and ability to incorporate these factors into business decisions and strategies (Wang et al., 2022).

Tan and Zhu (2022) argue that a management team with solid ecological risk awareness significantly propels corporate environmental information disclosure because a highly ecologically conscious management team regards minimizing adverse environmental impacts as an aspect of corporate responsibility. Additionally, Hussain et al. (2023) investigate the impact of CEO ability on corporate environmental sustainability information disclosure (CESID) in China. Grounded in upper echelons theory, their findings from a quantitative analysis of Chinese A-share listed companies show a positive association between CEO ability and CESID, with female CEOs strengthening this relationship. Their findings emphasize the crucial role of leadership quality in driving environmental transparency.

Overall, despite the many discussions in the literature on executive perceptions and corporate green innovation there are still several shortcomings. First, existing green research on innovation discusses more external factors, such as environmental regulation and stakeholder pressure, and is largely influenced by subjective factors of executive cognition. Second, most previous studies on executives' environmental perceptions have used cross-sectional data through questionnaire surveys, and less of

the listed medium- and long-term panel data companies have been used to verify their findings, which limits the relevance. The perceptions of corporate executives play an important role in influencing organizational behavioral decisions and economic performance and are a key element in explaining the different ways in which organizations respond to institutional pressures in the same environment Hambrick (2007). As decision-makers of corporate innovation strategies, executives identify and interpret opportunities and challenges. The external environment will be reflected in corporate behavior decisions, that is, executives' green environmental cognition intervenes and determines the company's behavioral choices.

Executive green cognition refers to the cognitive structure and cognitive process that corporate executives pay attention to. Faced with complex situations, they interpret and judge the internal and external environment of green environmental protection (ESG) policy signals and their application decisions in the enterprise. This article believes that executive green environmental awareness plays an important role in promoting corporate green innovation. First, companies are increasingly aware of the need to break the inherent production model through innovation. The stronger the corporate executives' awareness of green, the more likely they will gain original and unique leadership and technological innovation behaviors through green to achieve a win-win economy and environment. Liu et al. (2012) found that a company's environmental management practices are related to top management support. Zhang et al. (2015) concluded that managers' commitment to environmental sustainability has a significant impact on environmental strategy and company activities. The second is that under the current situation of increasingly stringent government regulations, company executives with green environmental protection (ESG) concepts will prompt them to interpret external environmental regulations and stakeholders' green needs as opportunities for corporate development. They will also be encouraged to take the initiative to assume corporate environmental responsibility, seize opportunities to transform to green innovation and transform market value, actively allocate organizational resources to adapt to corporate environmental strategies, and transform corporate production and operations to a green model. This will enable the company to shift production and Operate to a more environmentally friendly model to meet the expectations of green demand stakeholders and gain sustainable green competitive advantage. It is clear that corporate green behavior is directly driven by executives'

green environmental protection perceptions. Based on the above content analysis, this study believes that executives' green environmental protection cognitive level should play a mediating role in corporate green innovation.

Accordingly, here I propose that:

Hypothesis 2 : The environmental awareness of the entrepreneurial team plays a mediating role in the relationship between CVC investment and green innovation of new ventures

2.5 Political Relations

Shi et al. (2014) defined political relations as the relationship between enterprises and the central or local government. Wu, H. Q., Shi, Y., Xia, Q., & Zhu, W. D. (2014). Effectiveness of the policy of circular economy in China, but the authors argue that there are significant differences in government and business relationships across societies. The importance of such political relations in China and other transition economies has become one of the major debates in the management and international business (IB) literature. The question at the heart of the debate is whether political relations will lose their strategic value as political and economic liberalization advances. Although there is no clear empirical evidence, scholars differ on this issue (Siegel, 2007). For example, Nee (1989) and Guthrie (1998) argue that as China builds better legal and regulatory systems, the value of political relationships will decrease. This is because local firms are increasingly able to access key resources from NGOs, such as business networks that have developed as a result of economic liberalization (Keister, 2009). In other words, the role of the government is changing from a resource controller to a facilitator (Li & Zhang, 2007; Shi, Sun, & Peng, 2012).

In the management literature, Peng (2003) implicitly builds on these concepts by arguing that as transition economies such as China move towards more market-based competition, the costs of maintaining political relationships will eventually outweigh the benefits. When this happens, businesses are likely to shift toward rules-based, impersonal, market-based transactions, and the importance of political relationships declines. Following Peng (2003), Danis et al. (2010) recently found that the value of political connections does decrease over time, as exemplified by Hungary's institutional transformation.

Surprisingly, scholars who adopt a more fact-based inductive approach see a different picture (Kennedy, 2005). Kennedy's inductive approach suggests that political connections play an increasing role in China as interactions between business owners and state officials increase in formulating economic policy (Rittenberg, 2005). There are two reasons for this. First, history shows that the size of government, as a result of which GDP tends to increase rather than decrease after liberalization (La Porta, Lopez-de Silanes, & Shleifer, 1999).

Governments have the power to control resource allocation directly or indirectly by influencing government spending, industrial and antitrust policy, and financial regulation (Kroszner & Stratmann, 1998; Walder, 2003).

This view is consistent with Siegel's (2007) findings on the importance of political relations in South Korea after South Korea experienced a long period of liberalization. As Siegel points out, a key explanation for the continued importance of political linkages after liberalization is that liberalization does not necessarily mean the government withdraws from the economy.

Even in developed countries such as the United States, the state plays an important role in the financial industry and has a significant influence on which companies become M&A targets. This is especially true in emerging economies, such as China, where government actors play a key role in directing resource flows to politically connected firms (Li, Chen, Liu, & Peng, 2012; Lin, 2001).

In the context of China and similar transition economies, relevant formal institutions remain incomplete. The development of enterprises is restricted by government funds and policies. The political relationships of enterprises have become an important opportunity for enterprises to obtain information and gain development advantages. There are many studies on political relations, and scholars have approached them from different angles, mainly divided into political connections under the background of formal institutions and political connections under informal institutions.

In the context of emerging markets (especially in China), the importance of managerial relationships, especially political relationships, for innovation needs more attention. (Boisot and Child, 1996) research showed that as early as 1996, managerial relationships were ubiquitous in China's business environment. The boundaries and interpersonal relationships of senior managers provide a common means of

conducting business activities in China, and political connections cannot be underestimated.

(Peng & Luo, 2000) used Chinese companies as a database to directly link political connections to corporate performance, and confirmed through empirical research that there is a macro link between political connections, corporate performance, and innovation. (Peng & Luo, 2010) studied China's unique "guanxi" and combined it with business clusters and government departments to explore their impact on firm performance. (Wu & Leung, 2005) added another dimension of social capital trust when exploring the link between network ties and company performance, providing more thinking for subsequent researchers. With the deepening of research, scholars have conducted more research on political connections and corporate innovation performance, aiming to uncover relevant factors influencing this relationship and explore the black box of work from managerial relationships to corporate innovation performance. Li (2008) demonstrated that the link between the use of political ties and firm performance depends on ownership, competition, and structural uncertainty. Gao (2017) paid close attention to the influence of macro and micro institutions, particularly regarding market vitality as a micro institutional environment factor and combining the macro institutional environment factors of regional development to study the moderating role of management relationships on innovation performance. In the context of formal institutions, current studies mainly focus on government support, government control, and political connections. Government support emphasizes the support and encouragement of government departments in financial scientific research funding, while government control emphasizes the government's share of equity in the enterprise. However, most current research on political connections only focuses on the government background of corporate executives or the background of National People's Congress representatives (Guan & Chen, 2010). Guan and Chen believe that government funding is negatively related to innovation efficiency, and that the reduction of government intervention and the improvement of corporate entity status have a positive impact on the efficiency of technological innovation. Bai's research in 2011 shows that government R&D funding improves the efficiency of corporate technological innovation, although there is also negative evidence. For instance, Xiao (2015) found that government support, represented by the proportion of government funds in scientific research funding, has

a significant negative impact on the conversion efficiency of scientific and technological achievements and the overall innovation efficiency. Regarding the specific mechanism by which political connections work, Jia et al. (2010) believe that the political connections of corporate executives can strengthen the company's external public welfare behavior. However, when the external legal environment in the company's operating area is more complete, the role of political connections in promoting corporations' participation in charitable giving and increasing levels of giving will diminish. Su (2019) also conducted in-depth research based on political connections and found that it has a positive impact on corporate innovation willingness, further stimulating corporate innovation willingness through financial resources and government subsidies.

This leads to the third proposal of this article:

Hypothesis 3: Political relations moderate the relationship between CVC investment and the green innovation of new ventures

2.6 Research and Development

Research and Development (R&D) investment plays a pivotal role in the firm's GI activities (Ketata, Sofka, & Grimpe, 2015; Lee & Min, 2015; Parthasarthy & Hammond, 2002) and is considered as one of the most essential factors in promoting economic growth and business value (Chan, Martin, & Kensinger, 1990; Ghisetti & Pontoni, 2015). R&D investment seeks to generate innovation that increases the company's sales. Such innovation can be achieved by developing new products, improving existing products and gaining effectiveness and efficiency in production processes (Scarpellini et al., 2019). Thus, higher levels of R&D investment can contribute to the adoption and implementation of GI, making clean technologies more beneficial, with favourable and significant impact on growth of the firm's productivity (Wakelin, 2001). The NRBV suggests that companies should incorporate environmental issues into their strategic planning process (Hart, 1995), as such incorporation will favour firms' ability to handle uncertainties and help to develop valuable organizational capabilities (Hart, 1995). Managerial resources and capabilities are very important in the firm's ability to perform GI activities and play a pivotal role in increasing the level of resources allocated to GI activities (Kesidou &

Demirel, 2012). Laursen and Salter (2006) argue that companies must obtain resources from the external environment in order to innovate. Triguero, Moreno-Mondéjar, and Davia (2013) hold that having sufficient access to external knowledge correlates with the likelihood of developing GI activities (Bigliardi, Bertolini, Doran, & Ryan, 2012), and higher levels of R&D investment could help the firm to acquire such resources

Developing technological capabilities through R&D is crucial for firms to innovate and learn from external sources of information (Demirel & Kesidou, 2019). This external knowledge is essential for improving productivity and the efficiency of internal R&D activities, which is necessary to remain competitive in the fast-paced innovation landscape (Natalicchio et al., 2018; Teece et al., 1997). Firms that enhance their technological capabilities by investing in R&D are more likely to be aware of new environmental opportunities (Jové-Llopis & Segarra-Blasco, 2018). Growing R&D expenditures thereby demonstrates that firms have sufficient market information to reinforce technology opportunities and performance (Duque-Grisales et al., 2020) and is more likely a response to strict environmental regulations (Rennings, 2000). Also, it can contribute to the adoption of a GI strategy by supplying unique products that can encourage a firm's green development and bolster its environmental protection initiatives (Li et al., 2019). del Río et al. (2015) demonstrated that technological capabilities by R&D advance GI. Likewise, Demirel and Kesidou (2019) argued that a firm's performance effectively is improved by allocating resources via R&D and innovation. In this way, variances in applying GI activities reflect the level extent of R&D input (Horbach, 2016). Thus, R&D expenditures serve as a supportive motivator for firms to engage in GI (del Río et al., 2015), introduce clean technology, and thereby improve productivity (Duque-Grisales et al., 2020). Accordingly, raising R&D expenditures contributes to introducing higher degrees of technology transfer, acquiring new knowledge, and creating higher quality products. Thus, it can pave the way for new business and reduce the risk and uncertainty by enabling the commercialization of new technologies and innovative products (Samad & Manzoor, 2015).

Overall, Firms that invest in R&D expenditures are motivated to engage in GI, introduce clean technology, and improve productivity. Based on the reasoning above, we formulated the following hypothesis:

Hypothesis 4: R&D expenditures moderate the relationship between CVC investment and the green innovation of new ventures

2.7 ESG performance

The context of China's "double carbon", as the concept of sustainable development has become the consensus of today's social development, environmental, social and governance (ESG) factors have gradually become a topic of close concern for enterprises and their stakeholders. ESG is a key factor in measuring the level of sustainable development of a company. It is also one of the main manifestations of a company's good reputation. It is also an important driving force for companies to achieve green economic transformation.

ESG is the acronym for the three English words Environmental, Social and Governance. It is an important investment concept and corporate action guide that has emerged in the financial market in recent years. The origins of ESG can be traced back to the environmental movement and concepts such as corporate social responsibility, socially responsible investment, and green finance that emerged in the second half of the 20th century. In 2004, the report *Who Cares Wins* written by the United Nations Global Compact summarized and integrated many existing concepts in environmental, social and governance dimensions, formally proposed the ESG concept, and released the *Principles for Responsible Investment* in 2006. , to promote investment institutions to incorporate ESG indicators into investment decisions.

ESG maps out a firm's performance along its three dimensions and is used by investors, buyers, regulators, and other stakeholders. The S&P500, for instance, tracks high market-cap firms' ESG performance and conducts risk analysis. Asset managers, investors, financial institutions, and other stakeholders use ESG scores to make informed decisions, determine risk propensity, and assess the standing of a company compared to its peers (Lee et al., 2022; Capelle-Blancard and Petit, 2019; Barros et al., 2022). More than one-third of global investment worth \$35trn is monitored through ESG lenses (The Economist, 2022). The United States Securities and Exchange Commission (SEC) has resisted adopting ESG measures (Financial Times, 2020), though it has recently signaled a greater openness to greenhouse gas (GHG) emission

disclosures. The use of ESG in certain decision-making contexts is also criticized, e.g., in pension funds where managers' fiduciary duty requires acting in the best financial interest of their clients and providing a return sufficient to meet pension needs (The Wall Street Journal, 2019). Nonetheless, ESG remains a powerful tool for going beyond standard financial information and more and more companies are reporting their ESG performance. In general, ESG is different from the traditional pursuit of maximizing shareholder value. Instead, it pays more attention to the positive and negative externalities of corporate operations, emphasizing that companies should also take into account environmental and social benefits when creating economic benefits and other hidden values.

ESG builds on both internal and external data sources (Tamimi and Sebastianelli, 2017). Internal data sources include companies' environmental management systems, quarterly and annual financial, governance, and performance reports, corporate leadership reports, executive compensation disclosure, and press releases. External data sources include news, media reports analyzed through natural language processing, and social media. Third-party ESG evaluation firms (e.g., Bloomberg and MSCI) also participate in data collection, analysis, verification, benchmarking, grading, and preparing risk analysis reports (Eccles et al., 2020). Transforming raw data into ESG reports hinges on access to relevant data, accuracy of data, information processing capability of firms, and robustness of communication and disclosure structures (Hutton et al., 2001). These activities are increasingly grounded in the integrated use of emerging technologies.

(Eva.kriangkrai, M. et al. 2022) proposed for the first time the study of an integrated green governance framework for improving the performance of oil and gas companies, establishing the relationship between companies measuring corporate performance through shareholder value appreciation, and achieving simultaneous development of the economy and the environment. (Wang and Xu et al., 2021) believe that the core of green governance focuses on position coordination, strategic planning, sustainable development, public opinion guidance, etc. In recent years, both the world and the country are very keen on research on the relationship between green governance and financial performance based on the ESG concept. (Lee and Xie, 2022) believe that The positive effect of ESG disclosure on corporate financial performance is more pronounced in companies with ESG investors and companies

with longer inception, high media attention, and high agency costs.

By constructing a green governance structure evaluation system based on green concepts, values, strategies and organizational arrangements, and creating a green governance structure index, we conducted empirical analysis and found that green governance can impose financial constraints on enterprises. Enterprises with better green governance structures face financing constraints. Smaller it is, the easier it is to get support. Through research on the quantity and quality of innovations in multiple companies, it was found that ESG performance is positively correlated with corporate innovation, and can alleviate corporate financial constraints, reduce agency costs, and improve corporate financial performance.

(Halbritter et al., 2015) believe that in an ESG investment portfolio, the level of ESG performance will not affect its investment returns. (Auer et al. 2016) analyzed the performance of socially responsible investments in the Asia-Pacific region, the United States and Europe and found that regardless of geographical region, industry or ESG criteria, active selection of high- and low-rated stocks did not lead to better performance than passive stock market investment. Good risk-adjusted performance. (Velte 2017) used German data to empirically find that ESG has no impact on corporate value. Due to differences in social background and management characteristics, there may be significant differences in the ESG value creation effects between developed markets and emerging markets. The relationship between ESG performance and corporate value is still open to question. Whether the rich foreign research results on ESG are applicable to companies in China's emerging capital markets also needs to be further tested.

Wang et al. (2024) systematically reviewed how ESG practices create value for enterprises, noting that ESG contributes not only through traditional channels like reducing financing costs and enhancing brand reputation, but also by fostering innovation and long-term competitiveness. The development of digital finance has further strengthened this relationship. Mu et al. (2023) found that digital finance significantly amplifies the positive impact of corporate ESG performance on value by improving information transparency and financing efficiency.

The influence of ESG performance on enterprises is not homogeneous. Using factor analysis, Naffa and Fain (2022) revealed significant differences in financial performance between ESG leaders and laggards, with companies excelling in

environmental (E) dimensions particularly likely to gain market premiums. This finding aligns with earlier research by Galbreath (2013), whose Australian market evidence showed that firms with superior ESG performance demonstrate greater advantages in long-term stock prices and profitability.

As a representative emerging market, China exhibits unique characteristics in ESG practices. Shen et al. (2023) pointed out that while policy drivers and market transformation have accelerated ESG integration among Chinese enterprises, governance (G) deficiencies remain a key constraint on value creation. Future research should further explore how institutional environments and cultural factors moderate ESG effectiveness.

Based on the above research, a company's reputation affects its own innovation activities to a certain extent. However, in the field of green innovation, there are few authoritative studies and empirical tests. This study plans to abandon the use of the traditional corporate social responsibility reputation index and use ESG rankings to measure corporate green reputation.

Based on the above literature review, the last proposal of this study is derived:

Hypothesis 5 : ESG performance of new ventures moderates the relationship between CVC investment and green innovation of new ventures

2.8 Conceptual Model and Propostion

Based on the literature review and previously proposed hypotheses, this study focuses on the relationship between CVC investment and green innovation of new ventures, especially the mediating role of management team green cognition and the moderating role of political connections, ESG performance, and R&D investment. Figure 2.1 illustrates the conceptual framework and hypothesized relationships in this study.

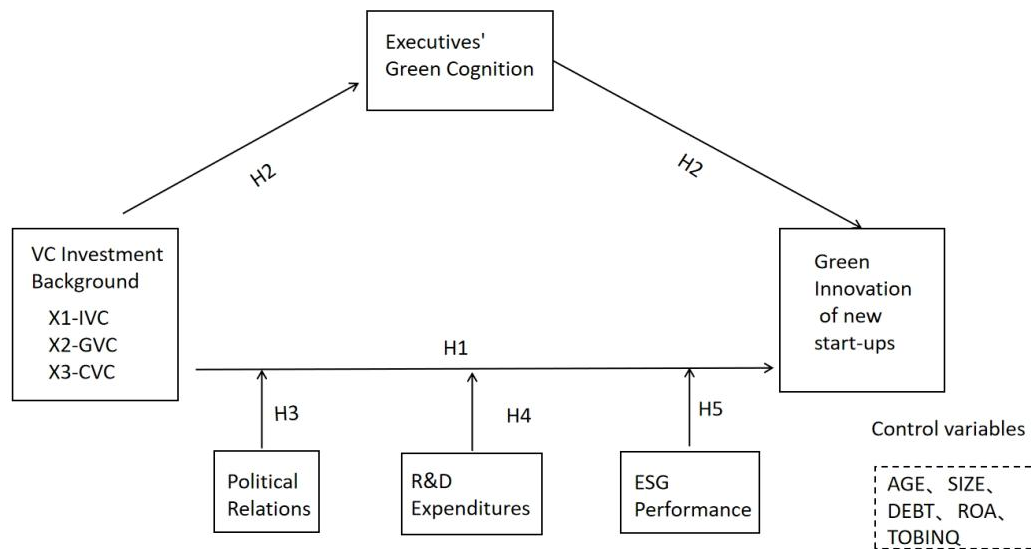


Figure 3

Figure 2.1 Conceptual framework and research hypotheses

2.8.1 Hypothesis in This Study

Below are research Hypothesis in summary:

Hypothesis 1 There is a positive relationship between CVC investment and the green innovation capabilities of new ventures

Hypothesis 2 The green awareness (GA) of the entrepreneurial team plays a mediating role in the relationship between CVC investment and green innovation of new ventures

Hypothesis 3 Political relations moderate the relationship between CVC investment and the green innovation of new ventures

Hypothesis 4: R&D expenditures moderate the relationship between CVC investment and the green innovation of new ventures

Hypothesis 5 : ESG performance of new ventures moderates the relationship between CVC investment and green innovation of new ventures

CHAPTER 3

RESEARCH METHODOLOGY

This chapter describes how this study was conducted to answer the research questions defined in Chapter One. This study adopts an empirical paradigm and uses quantitative research methods to guide the research design and data collection methods. Data were collected from companies listed on the GEM and Science and Technology Innovation Board of China's stock market by using information from public databases of listed companies. The following provides information about the selected research paradigm, research strategy, variable selection and design treatment methods, data collection procedures, data analysis and quantitative empirical testing.

3.1 The Research Paradigm

Denzin and Lincoln (2011) have claimed that all research is directed by a set of beliefs and feelings about the world that determine what the inquiry is and how the research is practiced. These references groom a paradigm, an interpretive framework. This point is relevant to Guba (1990)'s statement that 'a basic set of beliefs that guide action'. In other words, the chosen paradigm has impacted on the researchers according to what should be done, how research should be delineated, and how results should be analyzed and interpreted (Bryman and Bell, 2007).

The three main principles of paradigm distinctiveness are composed of ontology, epistemology, and methodology. *Ontology*, the philosophical study of the nature of being, existence, or reality and their relations, is the stance towards reality. *Epistemology* is the philosophy of knowledge or of how we come to know the relationship between the researcher and what is being researched. Lastly, *methodology* is concerned with how we come to know, but is much more practical in nature. Accordingly, methodology is focused on the specific ways of the research process, the methods, for gathering knowledge about the world. Epistemology and methodology are closely related: one involves the philosophy of how we come to know the world and the other involves the practice.

Positivism is a philosophy of science underlying the perspective that in the social as well as a natural science, information derived from sensory experience, and logical

and mathematical treatments of such data, are together the exclusive source of all authoritative knowledge. In other words, positivism assumes that there is valid knowledge (truth) merely in scientific inquiry. Accordingly, the positivist paradigm is assumed that there is a reality out there to be studied, captured and understood. That is, ontologically, the reality of positivistic research is external and objective while the epistemological assumption of the positivist researcher is that “knowledge is only of significance if it is based on observations of this external reality” (Easterby-Smith et al., 2002). In other words, the positivistic researcher assumes the role of an objective analyst, making detached interpretations about the data independent of informants. Hence, a deductive approach to measure the concepts being studied by quantitative data is emphasized and verification of hypotheses are subjected to empirical tests, in order to prove or disprove the proposition under carefully controlled conditions (Bryman and Bell, 2007; Easterby-Smith et al., 2002; Guba, 1990).

To address the research questions in this study rather than to investigate the subjective meaning of emerging inter-relationships among variables, a positivistic paradigm was assumed so as to undertake a deductive approach to test the hypothesized relationships underlying the linkages between CVC parent company reputation and green image and green innovation outcomes. Accordingly, a quantitative research strategy was adopted, thus providing a way of quantitatively linking theoretical categories or concepts with empirical research and thereby taking an objectivist standpoint for testing theory (Bryman and Bell, 2007).

The research design adopted for this study is explained next.

3.2 Sample Selection and Data Collection

China is the world's second largest venture capital market. Large established companies are increasingly entering the venture capital market. Initially, these corporate investors were mostly private companies. Later, the Chinese government recognized the positive role of CVC in promoting innovation and launched a series of policies to encourage companies to participate in venture capital.

China has set environmental protection as a top national task and proposes green innovation as a major driving force for constructing an ecological civilization and achieving sustainable development.¹ The government has become highly committed

to environmental protection and therefore formulates strict environmental regulations and policies (Jiang et al., 2020; Yang et al., 2019). For example, China's 2015 Environmental Protection Law targets for air, forest, marine, and land protection. Considering such a setting, as one of the largest emerging economies, China serves as an appropriate context for investigating green innovation. is the strictest legislation in the environmental sector so far; environmental protection is also listed as one of the six national priority tasks in the government's 13th Five-Year Plan for Economic and Social Development (2016–2020); in 2018, the Chinese State Council (CSC) released a three-year action plan on pollution control and set concrete 2020.

This study examined a sample of first-round listed startups that received CVC funding from 2009 to 2022, mainly data from listed companies on the GEM and Science and Technology Innovation Board of China's stock market.

3.2.1 Identifying CVCs

China does not have an authoritative database to judge whether it is a company invested by CVC , IVC or GVC.

Obtain the names of the top ten shareholders from the prospectus of a new startup company from the CSMAR database.

Follow the following rules to filter:

(1) The name of the shareholder contains relevant words such as "venture investment" and "venture investment" included in the "China Venture Capital Development Report" and the "VC Investment Institution Directory" of the Wind database

(2) The company's main business is a risk by manually searching the Internet Investment, a combination of three aspects to judge whether it is a VC investment company Cross-reference Wind , Capital IQ databases ,Zero2IPO Database and web search to obtain data on the equity of venture capital companies directly held by overseas listed companies

The data obtained in step 1) are manually checked with the VC institutions corresponding to the VC investment companies obtained in step 2). If the corresponding VC is held by a listed company and the main business of the listed company is non-financial business, and if the major shareholders are held by people's

governments at all levels and enterprises controlled by the National Development and Reform Commission, then the VC will be confirmed to be a GVC, otherwise it is a CVC; if the venture capital company is not held or controlled by a listed company, the venture capital company whose shareholders are non-financial companies will be identified as a IVC.

Define GVC-invested enterprises whose major shareholders are held by people's governments at all levels and enterprises controlled by the National Development and Reform Commission, then the VC will be confirmed to be a GVC; which shareholders are confirmed as CVC's Shareholding ratio exceeds 5%; define VC-invested enterprises whose shareholders are not confirmed as CVCs as IVC-invested enterprises.

The following is the data collection and filtering procedure: First, we obtain the list of companies listed on the GEM and Science and Technology Innovation Board from 2009 to 2022 from Wind database, and filter out all companies in non-financial and non-real estate industries. Second, we manually compared different databases to cross-identify which companies had invested in startups. Third, for startups that received two or more rounds of direct investment from corporate entrepreneurs, we retained the first round as our observation. After removing ST companies and excluding startups with missing or incorrect data, we obtained the final sample consisting of CVC-invested startups.

3.3 Measurement of the variable

3.3.1 Independent variables

VC investment background: if it is IVC (X1) investment in the current year, it is 1, otherwise it is 0; if it is GVC (X2) investment in the current year, it is 1, otherwise it is 0; if it is CVC (X3) investment in the current year, it is 1, otherwise it is 0;

3.3.2 Dependent variable

Green innovation. I measure green innovation using firm's number of green patents. Following previous literature (Li et al., 2018), identify green patents from all three types of applications patents (i. e. design, utility model and invention) that contain at least one of the following keywords in Chinese: "low carbon", "environment",

“green”, “emission reduction”, “energy-saving”, “clean”, “cycle”, “savings”, “sustainable”, “ecology”, “environmental protection” and “environmental pollution”.

To account for data skewness, use a logarithmic transformation.

It mainly uses the R&D (Lee and Min, 2015) and investment of new start-ups and the number of green innovation patents. The quality mainly refers to the number of citations (Chemmanur et al., 2014).

3.3.3 Other variables

The mediating variable is executives' green awareness/cognition (Tan, Y., & Zhu, Z. 2022 ; Li. et al.,2020).Which is sourced from annual reports of high-tech companies. Following Duriau et al. (2007), we employed three dimensions to select relevant keywords: green competitive advantage perception, corporate social responsibility perception, and external environmental pressure perception. The logarithm of the keyword frequencies in the annual reports of high-tech companies was used as the measurement for GA.

The selected keywords are illustrated in Table 1

Table 1 Executive green awareness (GA)keywords.

Energy conservation and emissions reduction, Environmental department, Environmental protection strategy, Environmental inspection, Environmental philosophy, Low-carbon environmental protection, Environmental management agency, Environmental work, Environmental education, Environmental governance, Environmental training, Environmental and environmental governance, Environmental technology development, Environmental facilities, Environmental audit, Environmental laws and regulations, Energy conservation and environmental protection, Pollution control, Environmental policy

The moderating variables political relations (Leuz, C., & Oberholzer-Gee, F. 2006) (Fisman, 2001). I measure political relations (PR) as the moderating variable define political connection by adopting Habib et al. (2017).

R&D investment is measured as a firm's annual R&D investment measured as percentage of its annual revenue (De Marchi, 2012). Our study does not use the firm's

R&D expenditure to measure R&D investment directly because this value always correlates closely with firm size (Tsai, Hsieh, & Hultink, 2011)

ESG performance (new startups), measure this variable as Broadstock, D. C., Chan, K., Cheng, L. T., & Wang, X. (2021), in their research, after comprehensively considering the applicable period and coverage of each ESG rating, the Huazheng ESG rating is used as a proxy variable for the company's ESG performance. The Huazheng Index has been evaluating the ESG performance of securities issuers such as A-shares and bond issuers since 2009. It currently covers all A-share listed companies. The index has been widely recognized by the industry and academia (Xie and Lv, 2022). The Huazheng ESG data comes from the WIND information financial terminal, and the remaining company-level financial data and industry characteristic data are from the CSMAR database.

In this research measure ESG data for China is provided by Huazheng ESG data, a China-based third-party data provider specialized in ESG data and green finance advisory. These data reflect consistent measures of ESG performance, and do not simply reflect firm-specific disclosure activity. Syntao systematize ESG information from public sources including annual reports, sustainability reports, social responsibility report, environment reports, announcements, and notices, and official websites. The rating framework has 3 layers. The primary layer covers Environmental (E), Social (S) and Governance (G) dimensions. The secondary comprises 12 criteria supporting E, S, and G, including environmental management, environmental disclosure and environmental controversies (under E), employee, supply chain, community, product, philanthropy, and social controversies (under S), and business ethics, corporate governance, and governance controversies (under G). The final layer reflects 300+ tertiary criteria formed from approximately 1000 data points. Each score is formed using a combination of core indicators common to all firms, and sector-specific indicators which apply only to companies in that sector. ESG scores are downward adjusted by firm specific controversies sourced from company's communications, announcements of penalties from regulators, media/news articles and research by NGOs. It is these downwards revisions and adjustments which distinguish Huazheng ESG scores as measures of ESG performance, and not simply ESG disclosure scores.

3.3.4 Control variables

Gaba and Bhattacharya (2012) include in their control variables return on asset, debt-asset ratio, firm age, firm size, and find that a firm is more likely to adopt a CVC unit when its innovation performance is close to its social aspiration. Chemmanur et al. (2014) choose firm size, profitability, capital investment, product market competition, growth opportunity, and firm age as control variables. Their empirical results show that innovation outcome improves when a firm is bigger, with fewer tangible assets, higher Tobin's Q, or lower financial leverage, but profitability or market competition has no significant effect on innovation output. According to Schumpeter (1942), larger companies have advantages in innovation capability and risk management, and they invent many important modern technologies. In this paper I select four common control variables as identified in literature, including debt ratio, firm age, firm size, and return on assets (ROA). Debt is the ratio of total debt to assets in a firm, measuring financial leverage. Age is the number of years since a firm's establishment. Size is the natural logarithm of total assets. ROA (net profits scaled by total assets) ,that because prior research shows that firms that enjoy higher profitability face stronger pressure to engage in environmental activities (Jiang et al., 2020; Li et al., 2018).

Variable name	Symbol	Variable description
Green innovation level of new start-ups	Green Innovation	green patent output indicator Patent: Ln (number of green patents invented at the end of the year + 1),
IVC investment	IVC(X1)	IVC investment enterprise takes the value 1, otherwise it is 0.
GVC investment	GVC(X2)	GVC investment enterprise takes the value 1, otherwise it is 0.
CVC Investment	CVC(X3)	CVC investment enterprise takes the value 1, otherwise it is 0.
Profitability	ROA	Earnings before interest and taxes/total assets

Variable name	Symbol	Variable description
Political connections	PR	Government subsidies
TMT's environmental awareness/cognition	GA	text analysis and scoring.
R&D investments	R&D	company's annual (percentage of its annual revenue)
Company scale	Size	Ln (total assets)
Debt ratio	Debt	Interest-bearing liabilities/(interest-bearing liabilities + shareholders' equity)
Company age	Age	Ln (age calculated since the establishment of the company + 1)
TobinQ	TobinQ	(market value of owners' equity + liabilities) / total assets
Year	Year	fixed
Industry	Industry	fixed

Table 2
Variable list

3.4 Methods

Empirical quantitative research methods are mainly used to analyze, explain and predict quantitative relationships between things.

3.4.1 Hausman test

Since the sample of this study belongs to an unbalanced panel, the Hausman test is needed to determine which model to use. The Hausman Test is mainly used in panel data analysis to determine whether the fixed effects model or the random effects model is more appropriate. The fixed effects model assumes that the individual effects are fixed, while the random effects model assumes that the individual effects are random. The p-value is calculated based on the Hausman statistic and the degrees of freedom (usually the number of explanatory variables in the model). Figure 2 is the actual situation of the Hausman test. The P value in Table 5 is less than 0.05, which shows that the assumption of the random effects model is rejected, and the fixed effect should be selected for panel regression analysis.

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	(b) fe	(B) re		
X3	.0844542	.0554581	.0289961	.0612152
DEBT	.0202699	.184073	-.1638031	.0607668
SIZE	.1739358	.2008142	-.0268784	.0215492
ROA	.2150741	.0356271	.1794469	.0405929
TOBINQ	-.0223109	-.0150275	-.0072834	.004903
AGE	.3231909	.0126339	.3105569	.0810147

b = Consistent under H0 and Ha; obtained from **xtreg**.
B = Inconsistent under Ha, efficient under H0; obtained from **xtreg**.

Test of H0: Difference in coefficients not systematic

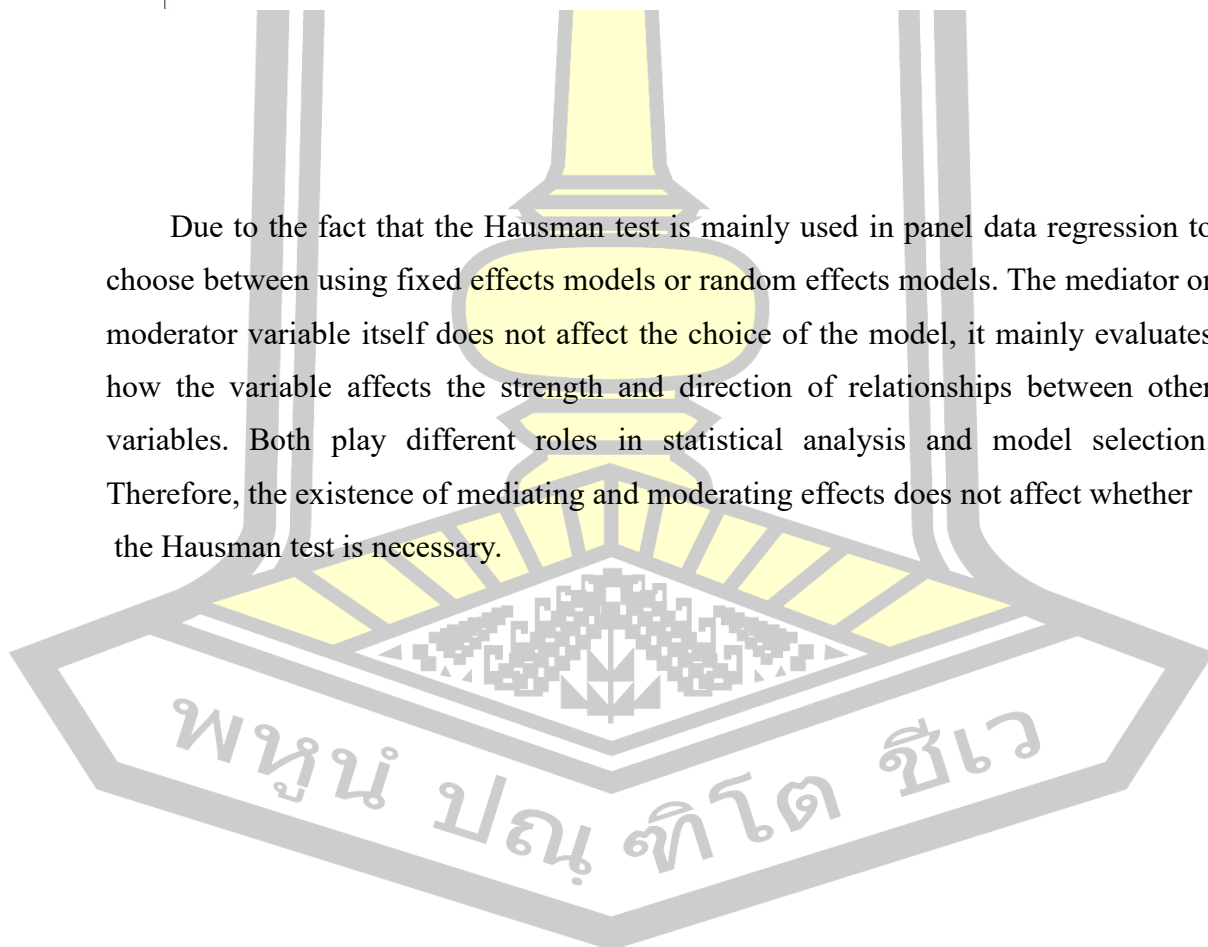
$$\text{chi2}(6) = (b-B)'[(V_b-V_B)^{-1}](b-B)$$

$$= 37.19$$

Prob > chi2 = **0.0000**

Figure

Due to the fact that the Hausman test is mainly used in panel data regression to choose between using fixed effects models or random effects models. The mediator or moderator variable itself does not affect the choice of the model, it mainly evaluates how the variable affects the strength and direction of relationships between other variables. Both play different roles in statistical analysis and model selection. Therefore, the existence of mediating and moderating effects does not affect whether the Hausman test is necessary.



The quantitative research methods used in this article mainly include Python network data crawler, fixed effects model, instrumental variable method, etc. The specific introduction is as follows:

Model1 is a baseline regression that uses a fixed effects model to test the main effect. Based on the full sample, the green innovation level of new ventures is used as an explanatory variable, and the VC investment background is used as an explanatory variable to conduct a regression analysis to investigate whether CVC-invested enterprises have a higher level of green innovation than IVC-invested enterprises and GVC-invested enterprises. The fixed effects model is used here to fix individual time and industry.

$$GI_{it} = \alpha_0 + \alpha_1 X_{nit} + \alpha_2 controls_{it} + \epsilon_{it}$$

Where:

GI_{it} is the dependent variable.

X_{nit} is the explanatory variable, which n is 1,2,3.

$controls_{it}$ represents the control variables.

α_0 is the intercept term.

α_1 is the regression coefficient corresponding to the explanatory variable X_3 .

α_2 a vector of coefficients (if there are multiple control variables) represents the regression coefficients corresponding to the control variables.

ϵ_{it} is the random error term.

Model 2 is use for the test mediation effect model (three-step method): based on the sample of CVC-invested enterprises, taking the green innovation level of new ventures as the explained variable, To test Proposal 3 .

$$M_{it} = \alpha_0 + \alpha_1 X_{3it} + \alpha_2 controls_{it} + \epsilon_{it}$$

$$GI_{it} = \alpha_0 + \alpha_1 X_{3it} + \alpha_2 controls_{it} + \alpha_3 M_{it} + \epsilon_{it}$$

Where:

GI_{it} is the dependent variable.

X_{3it} is the explanatory variable.

$controls_{it}$ represents the control variables.

α_0 is the intercept term.

α_1 is the regression coefficient corresponding to the explanatory variable X_3 .

α_2 (a vector of coefficients if there are multiple control variables) represents the regression coefficients corresponding to the control variables.

α_3 is the coefficient of the mediating variable.

ϵ_{it} is the random error term.

M represents the mediating variable.

Model 3 is used to test the moderation effect model

Moderation effect model:

$$GI_{it} = \alpha_0 + \alpha_1 X_{3it} + \alpha_2 controls_{it} + \alpha_3 T_{it} + \alpha_4 T_{it} * X_{3it} + \epsilon_{it}$$

Where:

GI_{it} is the dependent variable.

X_{3it} is the explanatory variable.

$controls_{it}$ represents the control variables.

α_0 is the intercept term.

α_1 is the regression coefficient corresponding to the explanatory variable X_3 .

α_2 (a vector of coefficients if there are multiple control variables) represents the regression coefficients corresponding to the control variables.

α_3 is the coefficient of the moderating variable.

α_4 is the coefficient of the interaction term.

ϵ_{it} is the random error term.

T represents the moderating variable,

$T * X_3$ represents the interaction term.

3.4.2 Python web data crawler

Web crawlers, also known as web spiders or web robots, are computer programs and scripts that automatically crawl large amounts of web page data according to certain rules. This method starts from a specified web page and obtains hyperlinks to other pages by analyzing the markup structure within the web page; then it selects the next site to visit through the established search strategy, and finally obtains data on the entire website. Since the basic sample size of this study is relatively large, it is

necessary to extensively collect and accurately match many large sample data from different types of websites, so Python-based web crawler technology was used.

3.4.3 Instrumental variable method

The instrumental variable method is one of the most commonly used methods to solve endogeneity problems in quantitative analysis in social sciences, and is a relatively cutting-edge causal inference method. This method was first proposed by Philip Wright in the late 1920s. It mainly uses instrumental variables to decompose changes in endogenous independent variables. The working principle is to focus on changes in endogenous independent variables that are not related to the error terms in the model, while ignoring the changes in endogenous independent variables. The model produces estimates of changes in bias. The selected instrumental variable must be an exogenous variable that is not related to the structural error term in the model but is related to the endogenous independent variable, and it itself does not represent the explanatory variable in the structural equation (original model).

Therefore, the instrumental variable "moves" around the endogenous independent variable and does not directly affect the dependent variable, but indirectly affects the dependent variable through the endogenous independent variable. The instrumental variable method mainly uses the two-stage least squares method (2SLS) to estimate the model and solve the endogeneity problem.

3.5 Statistical Techniques

3.5.1 Descriptive statistics

Descriptive statistics refers to the process of summarizing, organizing and interpreting the collected data. The main purpose is to describe and summarize the characteristics and patterns of the data. Descriptive statistics mainly include describing the central tendency of data, describing the degree of dispersion of data, and describing the distribution form of data: describing the correlation between data, that is, the association between data, by calculating correlation coefficients, drawing scatter plots, etc. degree.

3.5.2 Correlation analysis

Correlation analysis of data refers to studying the degree and direction of correlation between two or more variables through statistical methods. Correlation analysis mainly includes measuring the linear correlation or grade correlation between two variables by calculating Pearson correlation coefficient, Spearman and other correlation coefficients. Verify whether the correlation between two variables is significant through hypothesis testing, such as using t test or F test to test whether the correlation coefficient is significant and not zero. Interpret the obtained correlation coefficient to indicate the degree and direction of the correlation between the two variables, that is, whether it is a positive correlation, a negative correlation, or no correlation.

3.5.3 Multiple regression analysis

Multiple regression analysis is a statistical method used to study the relationship between multiple independent variables and a dependent variable. In multiple regression analysis, we try to build a linear model to describe the relationship between a dependent variable and multiple independent variables in order to conduct prediction, explanation, and causal inference analyses. Establish a regression equation: By fitting the data, a linear regression equation containing multiple independent variables is established to describe the relationship between the dependent variable and the independent variables. Estimating regression coefficients: Estimate the regression coefficients in the regression equation through the least squares method or other estimation methods to determine the degree of influence of each independent variable on the dependent variable. Test the regression equation: Test the goodness of fit of the regression equation, including F test, t test, etc., to determine whether the regression equation is significant. Finally, the regression model is diagnosed and the normality and heteroskedasticity of the residuals are tested to ensure the validity and accuracy of the model.

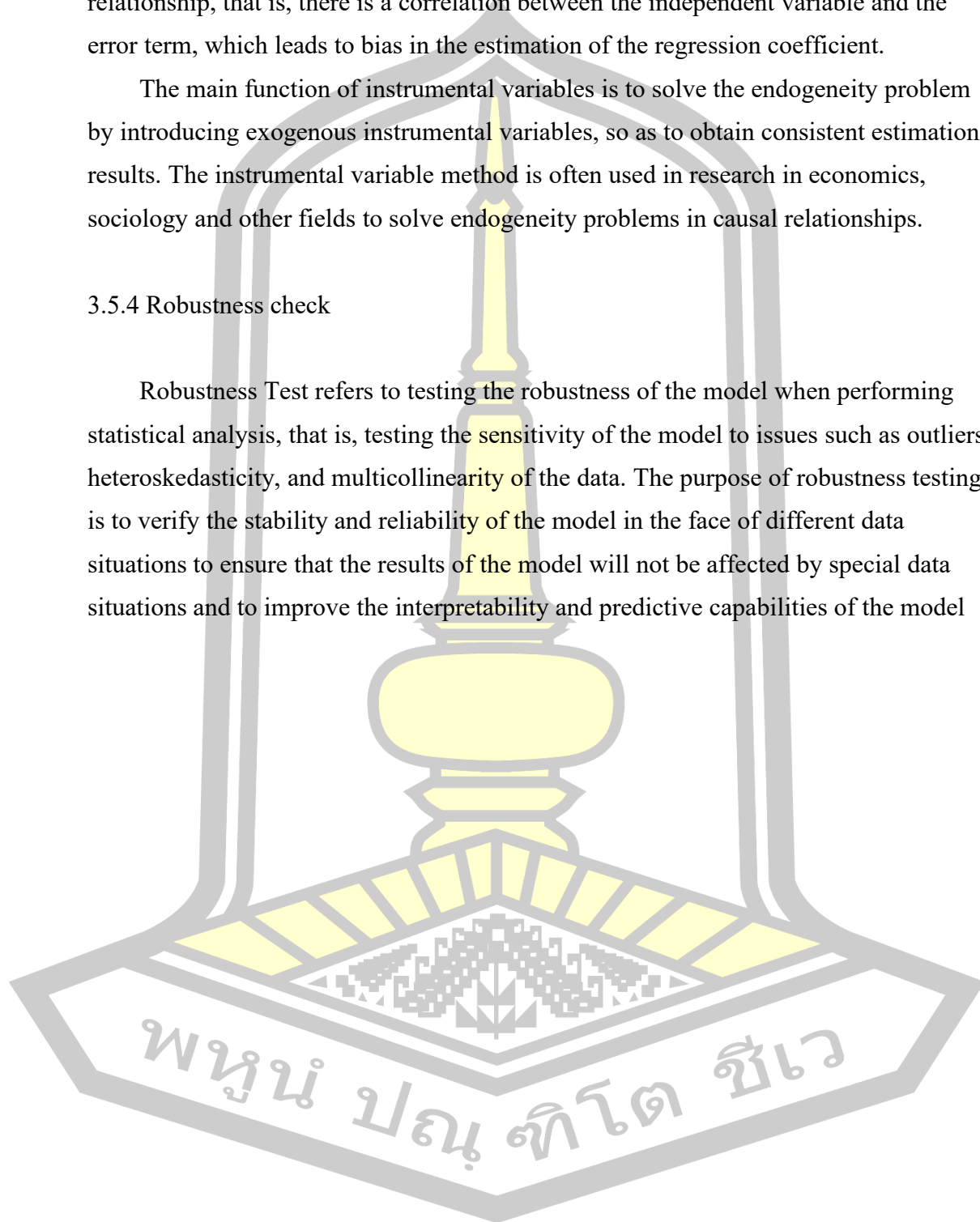
Among them, instrumental variables are a method used to solve the endogeneity problem. Its main function is to replace the endogenous independent variables with one or more exogenous instrumental variables to solve the endogeneity problem in the

causal relationship. In actual research, we often encounter endogeneity in the causal relationship, that is, there is a correlation between the independent variable and the error term, which leads to bias in the estimation of the regression coefficient.

The main function of instrumental variables is to solve the endogeneity problem by introducing exogenous instrumental variables, so as to obtain consistent estimation results. The instrumental variable method is often used in research in economics, sociology and other fields to solve endogeneity problems in causal relationships.

3.5.4 Robustness check

Robustness Test refers to testing the robustness of the model when performing statistical analysis, that is, testing the sensitivity of the model to issues such as outliers, heteroskedasticity, and multicollinearity of the data. The purpose of robustness testing is to verify the stability and reliability of the model in the face of different data situations to ensure that the results of the model will not be affected by special data situations and to improve the interpretability and predictive capabilities of the model



CHAPTER 4

RESULTS AND ANALYSIS

This chapter uses the results of secondary data collection for descriptive statistics. This chapter also explains the inherent logic of the structural framework of this study, namely the correlation and preliminary analysis of CVC investment and green innovation of new start-ups, and then tests the hypotheses proposed in this study.

4.1 Descriptive Statistics

Table 3 Descriptive Statistics

Variable	N	Mean	SD	Min	Max	P1.	P99	Skewness	Kurtosis
GI	1940	0.287	0.453	0	3.134	0	1.839	1.838	6.536
X1	1940	0.597	0.491	0	1	0	1	-0.395	1.156
X2	1940	0.204	0.403	0	1	0	1	1.468	3.155
X3	1940	0.199	0.400	0	1	0	1	1.504	3.262
DEBT	1940	0.27	0.177	0	0.965	0	0.682	0.555	2.603
SIZE	1940	21.379	0.899	19.546	27.299	19.952	23.931	1.091	5.657
ROA	1940	0.038	0.078	-1.185	0.426	-0.21	0.19	-6.083	79.756
TOBINQ	1940	1.319	1.702	-1.071	22.557	-0.107	6.74	3.911	37.69
AGE	1940	2.791	0.339	1.609	3.829	1.946	3.497	-0.246	3.109

Table 3



This section presents the descriptive statistics for the variables employed in the study. Each variable is analyzed in terms of its observational count, mean, standard deviation, minimum and maximum values, 1st percentile (p1), 99th percentile (p99), skewness, and kurtosis, along with an interpretation of its practical significance.

4.1.1 GI

GI represents the level of green innovation within newly listed companies, and it exhibits certain characteristics in our sample. Overall, the mean value of 0.287 indicates that green innovation among newly listed companies is at a relatively low level overall, and the standard deviation of 0.453 is relatively high, indicating that there are significant differences in the level of green innovation among companies, with some companies performing well in this regard, while others are barely involved. The skewness of 1.838 is positive, indicating that the data is skewed to the right, which means that the level of green innovation of most companies is below average, while the level of a few companies is much higher. The kurtosis is 6.536, which is much higher than the kurtosis of a normal distribution, which means that the distribution is more kurtotic and has thicker tails, indicating that there are large differences between individuals in the sample and the presence of extremely high values, further emphasizing the excellent performance of a few companies in green innovation.

4.1.2 X1 (IVC Investment)

The variable X1 represents whether a company has an independent venture capital (IVC) background, with 1940 observations. The mean value of 0.597 indicates that, on average, about 60% of the companies in the sample have an IVC investment background, which indicates that IVC investment accounts for a high proportion of VC-backed startups in China's GEM and Sci-Tech Innovation Board markets. The standard deviation of 0.491 indicates that there are some fluctuations in this proportion throughout the sample, but overall, the proportion of companies with IVC investment backgrounds remains relatively stable. The skewness of -0.395 indicates that the data is slightly left-skewed, meaning that there are slightly more companies with IVC investment backgrounds than companies without IVC investment, although the difference is not significant. The kurtosis is 1.156, which is close to a normal

distribution, indicating that the data distribution is relatively uniform and there are no obvious extreme values. Overall, this shows that in the empirical sample, accepting IVC investment is a common strategy for startups to obtain VC investment.4.1.2 X2 (GVC Investment)

4.1.3 X2 (GVC Investment)

Variable X2 represents investment in government-backed venture capital (GVC) and includes 1940 observations. The mean of 0.204 indicates that the average investment share of GVC is relatively low compared to other types of VC, which may mean this when compared to variables such as GI or X1. The standard deviation of 0.403 indicates that there is moderate variability in the investment amount. It ranges from 0 to 1, reflecting the binary decision process about investment. The skewness is 1.468 and the kurtosis is 3.155, indicating that the distribution is right-skewed and peak-shaped. This means that the companies that do not choose GVC investment are more concentrated and there are outliers, which shows that although some companies do choose GVC investment, this investment is not common, which also indirectly shows that in China's GEM and Sci-Tech Innovation Board markets, GVC only invests in a few companies in a targeted manner.

4.1.4 X3 (CVC Investment)

The variable X3, representing corporate venture capital (CVC) investments, consists of 1940 observations. The mean of X3 is 0.199, indicating that on average, about 19.9% of the companies in the sample participated in CVC investment activities, which accounts for a relatively small portion of the observations. The standard deviation of 0.400 indicates that there is moderate variability in CVC investments across companies. The skewness is 1.504, indicating that the distribution is right-skewed, meaning that across the three VC investment types, there are more companies without CVC investments than with CVC investments. The kurtosis is 3.262, indicating that there are more observations in the tail compared to a normal distribution. This suggests that CVC investments are not ubiquitous, but rather concentrated in a small number of companies, with some outliers.

4.1.5 DEBT (Firm's Debt Ratio)

The variable DEBT, representing the debt ratio of a company, is analyzed based on 1940 observations of newly listed companies on China's ChiNext and Science and Technology Innovation Board with VC backing. The mean value of 0.27 indicates that

these upstarts have a moderate level of debt on average. This is an important indicator because it reflects their financial status and leverage status after listing. The standard deviation of 0.177 indicates that the debt ratio of these companies varies relatively little compared to other financial variables. This consistency may be attributed to the similar financing strategies or regulatory requirements of these newly listed companies on the board. The debt ratio ranges from 0 to 0.965, highlighting the huge differences in debt levels among different companies. Some companies manage to keep their debt levels very low, perhaps due to strong cash flow or equity financing, while others take on a lot of debt to fuel their growth. The skewness is 0.555 and the kurtosis is 2.603, indicating a right-skewed distribution with moderate kurtosis. This means that most newly listed companies on China's ChiNext and Science and Technology Innovation Board have low debt levels, and a few outliers have significantly higher debt levels. This pattern may reflect the risk preferences and financing capabilities of different companies, as well as the market's perception of their creditworthiness.

4.1.6 SIZE (Firm Size)

The variable SIZE, which measures firm size using the logarithm of total assets, is particularly interesting in our analysis of newly listed companies with venture capital (VC) support on China's ChiNext and Sci-Tech Innovation Board markets. Missing values are removed for this variable, resulting in 1940 observations, providing a robust dataset for our statistical analysis. The mean of 21.379 represents the average size of these VC-backed firms in our sample. This number provides us with a benchmark to compare the size of individual firms, helping us understand the typical operating scale of firms in this industry. The standard deviation is 0.899, indicating that there is moderate variation in firm size among VC-backed firms. This suggests that while most firms are of similar size, there is still a distinct range that reflects the diversity of firms that are able to attract venture capital. SIZE ranges from 19.546 to 27.299, highlighting the large variation in firm size in our sample. This suggests that there are both relatively small startups and very large, established firms that have successfully received venture capital and listed on China's innovative stock markets. The skewness is 1.091 and the kurtosis is 5.657, providing further insights into the distribution of firm size. The right-skewed distribution indicates a concentration of small and medium-sized companies in the sample, which is common

in venture-backed entrepreneurial ecosystems where many companies are still in the early growth stages. The shape of the leptokurtic curve indicates the presence of outliers representing large companies, which may mean that these companies may have achieved significant scale and success before going public.

4.1.7 ROA (Return on Assets)

The ROA variable measures a company's profitability relative to its total assets, specifically the return on investment for venture-backed new listed companies on China's ChiNext and Sci-Tech Innovation Boards, with a mean of 0.038 and a standard deviation of 0.078 across 1,940 observations. The mean of 0.038 suggests that, on average, these companies have a moderate return on assets. However, as evidenced by the standard deviation of 0.078, there is considerable variation in profitability between companies, highlighting the different performances of this segment. ROA values range from -1.185 to 0.426, revealing a wide range of profitability results. Some companies may suffer due to various factors such as market competition, operational inefficiencies, or unfavorable market conditions. On the other hand, there are also companies that achieve relatively high profitability. The first percentile value of -0.21 and the ninety-ninth percentile value of 0.19 further emphasize the wide distribution of profitability results among these venture-backed companies. It is worth noting that the distribution of ROA is highly left-skewed, with a skewness of -6.083. This suggests that the vast majority of firms are concentrated around lower profitability levels, which may reflect the challenges and risks associated with early-stage companies in high-growth industries. In addition, ROA is extremely leptokurtic, with a large majority of firms concentrated around lower profitability levels and a few outliers achieving very high returns.

4.1.8 TOBINQ (Tobin's Q)

Tobin's Q, represented by the TOBINQ variable, measures the market value of firms relative to their book value and has 1940 observations. The mean value of TOBINQ is 1.319, indicating that on average, firms are valued slightly above their book value in the market, which indicates potential growth opportunities. The standard deviation of 1.702 indicates that there is a large variance in firm valuations, with firms' market values significantly different from their book values. The lowest value of -1.071 indicates that some firms are undervalued by the market, while the highest value of 22.557 indicates that some firms have abnormal market valuations,

which may reflect abnormal growth prospects or market enthusiasm. The 1st percentile (P1) value is -0.107 and the 99th percentile (P99) value is 6.74, further highlighting the breadth of market valuations, highlighting the diversity of market valuations for different firms. The skewness of 3.911 indicates a right-skewed distribution, with longer tails and higher values, indicating that more firms have market values that are much higher than their book values. The kurtosis of 37.69 indicates a leptokurtic distribution, suggesting that there are extremes in company valuations, with a few companies having unusually high or low market capitalizations relative to their book values.

4.1.9 AGE (Firm Age)

Regarding the AGE variable, it records the number of years a company has been in operation. We collected a total of 1940 observations. The mean value of AGE is 2.791, which means that the average operating time of the companies in the sample is about 2.79 (here we have performed a $\ln(N+1)$ transformation). The standard deviation of 0.339 shows that the difference between the ages of companies is relatively small, and most companies have a relatively close operating time. The minimum value of AGE is 1.609 and the maximum value is 3.829, which reflects the range of company ages, including both younger and older companies. From the 1st percentile (P1) 1.946 to the 99th percentile (P99) 3.497, the distribution of age is further depicted, showing that the ages of most companies fall within this range. The skewness of -0.246 indicates that the distribution is slightly left-skewed, which is related to the listed sector we sampled, meaning that there are more young companies than old companies. The kurtosis of 3.109 is close to the mid-peak but slightly flat-peaked, indicating that the distribution of company ages is relatively uniform, without extreme outliers.

พหุ ประถมศึกษา

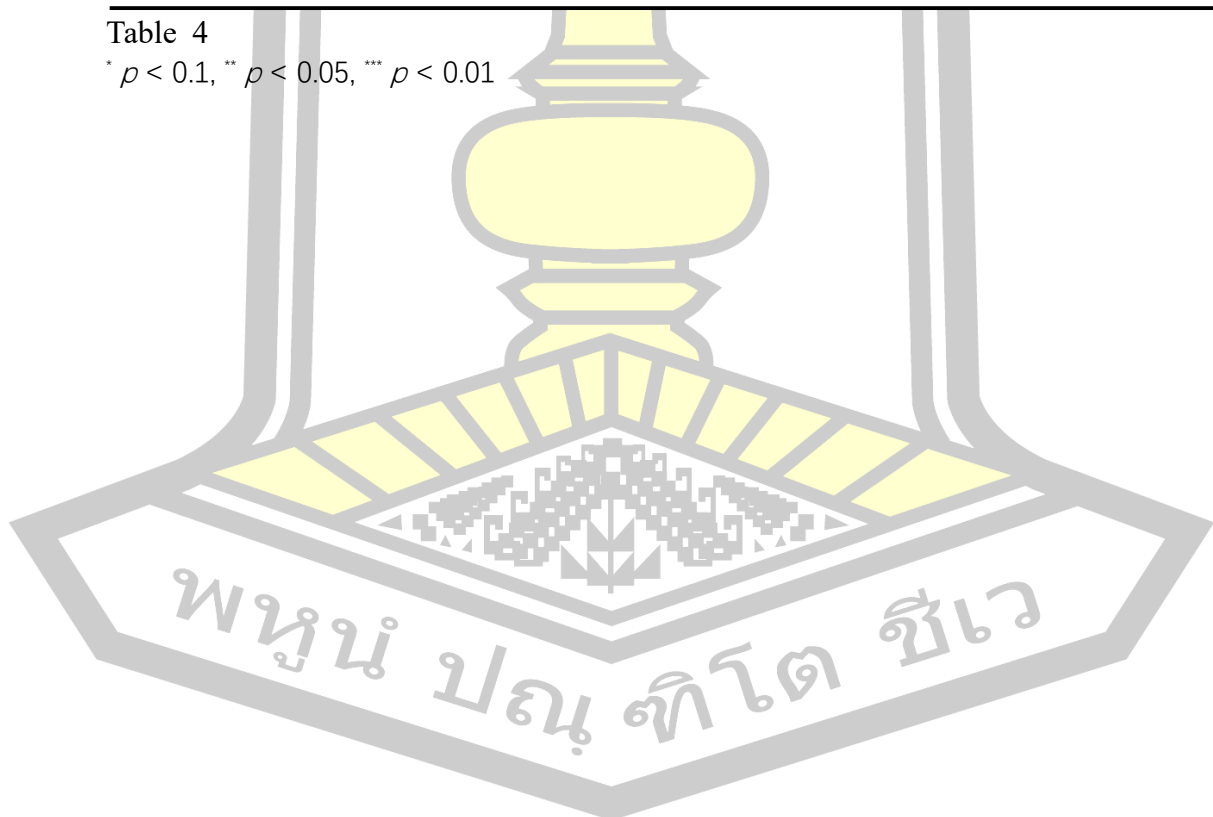
4.2 Correlation Results

Table 4 Pairwise correlations

Variable	GI	X3	DEBT	SIZE	ROA	TOBINQ	AGE
GI	1						
X3	0.0340	1					
DEBT	0.203***	0.0320	1				
SIZE	0.366***	0.0360	0.353***	1			
ROA	-0.063***	-0.00600	-0.219***	-0.052**	1		
TOBINQ	-0.0350	-0.00100	-0.041*	0.088***	0.122***	1	
AGE	0.0250	0.0210	0.136***	0.170***	-0.081***	-0.082***	1

Table 4

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$



In this study, we then conducted an in-depth analysis of the correlation between variables. The results in Table 4 show that GI is significantly positively correlated with DEBT and SIZE, with correlation coefficients of 0.203 and 0.366, respectively, indicating that as GI increases, the company's debt level and scale tend to increase; while it is significantly negatively correlated with ROA, with a correlation coefficient of -0.063, which means that the increase in GI may be accompanied by a decrease in return on assets. DEBT is significantly positively correlated with SIZE and AGE, with correlation coefficients of 0.353 and 0.136, respectively, indicating that the larger the company size and the older the company, the higher the debt level; while it is significantly negatively correlated with ROA, with a correlation coefficient of -0.219, indicating that the increase in debt level may reduce the company's return on assets. In addition, SIZE is also significantly positively correlated with TOBINQ, with a correlation coefficient of 0.088, which means that the expansion of the company size is accompanied by an increase in the ratio of its market value to book value; while it is significantly negatively correlated with ROA, with a correlation coefficient of -0.052, indicating that the increase in the size of the company may reduce its return on assets. ROA is significantly positively correlated with TOBINQ, with a correlation coefficient of 0.122, indicating that the higher the return on assets, the higher the ratio of its market value to book value; while it is significantly negatively correlated with AGE, with a correlation coefficient of -0.081, indicating that as the company's age increases, the return on assets may decline. Finally, TOBINQ is significantly negatively correlated with AGE, with a correlation coefficient of -0.082, which means that as the company's age increases, its market value relative to book value may decline.

But at the same time, we should also see that X3, as the main explanatory variable, has a weak correlation with other variables, and the correlation coefficient is close to 0, indicating that there is almost no linear relationship between X3 and these

variables. Moreover, the pairwise correlation coefficients between the variables are all lower than 0.4, indicating that the degree of correlation is low, and will not cause collinearity effects on other independent variables, which is suitable for the next step of regression analysis.

4.3 Hausman Test

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	(b) fe	(B) re		
X3	.0844542	.0554581	.0289961	.0612152
DEBT	.0202699	.184073	-.1638031	.0607668
SIZE	.1739358	.2008142	-.0268784	.0215492
ROA	.2150741	.0356271	.1794469	.0405929
TOBINQ	-.0223109	-.0150275	-.0072834	.004903
AGE	.3231909	.0126339	.3105569	.0810147

b = Consistent under H₀ and H_a; obtained from **xtreg**.
 B = Inconsistent under H_a, efficient under H₀; obtained from **xtreg**.

Test of H₀: Difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(6) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 37.19 \\ \text{Prob} > \text{chi2} &= 0.0000 \end{aligned}$$

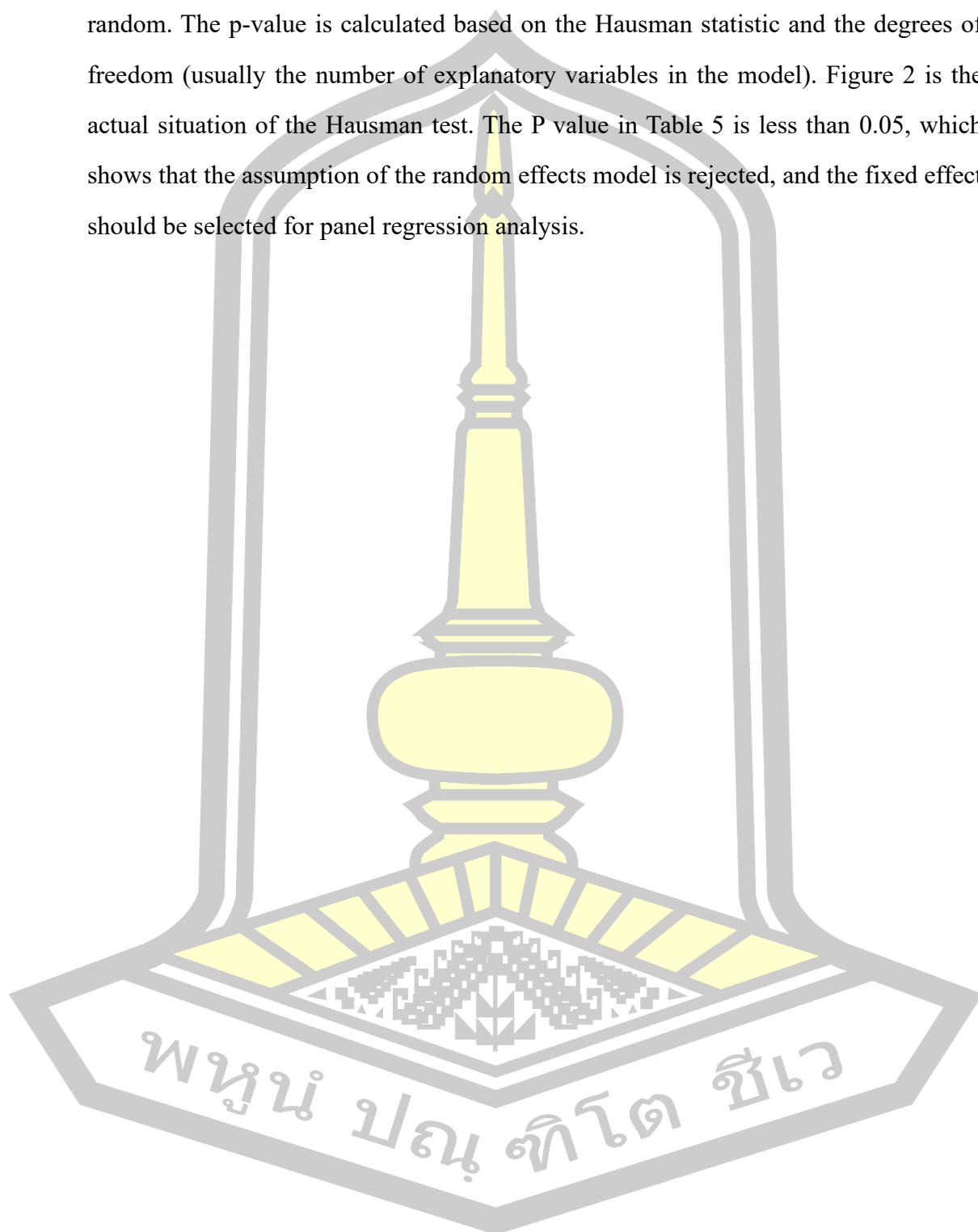
Figure 5

Test of H0: Difference in coefficients not systematic	
Chi2(6)	37.19
Pron>chi2	0.000

Table 5

Since the sample of this study belongs to an unbalanced panel, the Hausman test is needed to determine which model to use. The Hausman Test is mainly used in panel data analysis to determine whether the fixed effects model or the random effects model is more appropriate. The fixed effects model assumes that the individual effects

are fixed, while the random effects model assumes that the individual effects are random. The p-value is calculated based on the Hausman statistic and the degrees of freedom (usually the number of explanatory variables in the model). Figure 2 is the actual situation of the Hausman test. The P value in Table 5 is less than 0.05, which shows that the assumption of the random effects model is rejected, and the fixed effect should be selected for panel regression analysis.



4.4 Hypothesis Test

Hypothesis 1 There is a positive relationship between CVC investment and the green innovation capabilities of new ventures

Main effects baseline regression

	(1)	(2)	(3)	(4)
	X3	X3	X1	X2
X3	0.084*** (3.074)	0.049* (1.864)		
X1			-0.031 (-1.480)	
X2				-0.000 (-0.005)
DEBT		0.155** (2.574)	0.157*** (2.594)	0.150** (2.493)
SIZE		0.173*** (13.521)	0.175*** (13.699)	0.176*** (13.777)
ROA		-0.077 (-0.633)	-0.074 (-0.611)	-0.072 (-0.596)
TOBINQ		-0.007 (-1.076)	-0.007 (-1.092)	-0.007 (-1.128)
AGE		0.036	0.036	0.037

	(1)	(2)	(3)	(4)
		(0.997)	(1.014)	(1.024)
_cons	0.270*** (25.582)	-3.557*** (-11.996)	-3.565*** (-12.011)	-3.604*** (-12.162)
N	1940	1940	1940	1940
r2	0.269	0.349	0.348	0.347
industry	yes	yes	yes	yes
year	yes	yes	yes	yes

Table 6

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

From the results of the first column of Table 6 above, we can see that when the control variables are not included, the regression coefficient corresponding to X3 is 0.084, which passes the significance test at the level of 0.01, indicating that X3 has a significant direct positive impact on GI. From the results of the second column, we can see that after the control variables are included, the regression coefficient corresponding to X3 is 0.049, which passes the significance test at the level of 0.1, indicating that X3 still has a significant positive impact on GI when other factors are considered. From the results of the third and fourth columns, we can see that the regression coefficients corresponding to X1 and X2 are -0.031 and 0.000, respectively, and both failed the significance test, indicating that X1 and X2 may not have actual impact on GI.

In general, different investment backgrounds do have heterogeneous effects on the green innovation of new companies. For the IVC investment background, the empirical results are supported by previous literature. The presence of IVC investment has no significant effect on the green innovation of new companies. This is consistent with the purpose of IVC's own investment to pursue short-term profit returns, because if a company invests too much in innovation, its profit target will definitely be

affected on the basis of the same resources, which runs counter to the original intention of IVC investment. The GVC investment background does not show significant statistical characteristics, which is also in line with the actual situation. After all, China's IPO marketization process has a short history. Referring to the investment of governments in venture capital in Europe, the United States, Belgium and other countries, it is understandable that the government investment background will gradually improve after about 20 years. The CVC investment background shows a significant promotion effect, which is basically consistent with the research of previous literature and also supports Hypothesis 1 of this study. The coefficient is 0.049, which shows that compared with the mature old investment groups in the West, China's CVC companies are generally younger and are gradually learning how to accumulate better investment experience to support the green innovation of new companies.

Hypothesis 2 The green awareness (GA) of the entrepreneurial team plays a mediating role in the relationship between CVC investment and green innovation of new ventures

GA mediation effect

	(1)	(2)	(3)
	GI	GA	GI
X3	0.049* (1.864)	-0.070*** (-3.709)	0.057** (2.164)
DEBT	0.155** (2.574)	-0.001 (-0.017)	0.155*** (2.584)
SIZE	0.173*** (13.521)	0.040*** (4.306)	0.169*** (13.145)
ROA	-0.077 (-0.633)	-0.239*** (-2.703)	-0.050 (-0.414)
TOBINQ	-0.007 (-1.076)	0.004 (0.939)	-0.007 (-1.155)

	(1)	(2)	(3)
AGE	0.036 (0.997)	0.041 (1.593)	0.031 (0.870)
GA			0.112*** (3.493)
_cons	-3.557*** (-11.996)	0.333 (1.542)	-3.595*** (-12.151)
N	1940	1940	1940
r2	0.349	0.652	0.353
industry	yes	yes	yes
year	yes	yes	yes

Table 7

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

From the results of the second column of Table 7 above, we can see that the regression coefficient corresponding to X3 is -0.070, which passed the significance test at the 0.01 level, indicating that X3 has a significant negative impact on the mediating variable GA. From the results of the third column, we can see that after considering the impact of the mediating variable GA on GI, the regression coefficient corresponding to X3 is 0.057, which passed the significance test at the 0.05 level, but the regression coefficient corresponding to GA is 0.112, which passed the significance test, indicating that in the process of X3 affecting GI, the variable GA has a mediating effect.

In the statistical analysis, we found that executive green awareness (GA) played a mediating role in the relationship between CVC investment and new enterprise green innovation (GI), but the coefficient of executive green awareness and CVC investment at the 0.01 significance level was -0.070. This negative coefficient indicates that in the initial stage, the increase in CVC investment is negatively correlated to a certain extent with the improvement of executive green awareness. This may be because CVC investment activities focus more on financial returns and

rapid market response in the short term, while green innovation often requires long-term investment and continuous efforts. If we simply consider the relationship between the two, there is a mismatch in goals and time spans within new start-ups, which may lead to executives neglecting to sacrifice green awareness cultivation when pursuing short-term CVC investment results.

However, when we further consider the impact of the mediating variable GA on GI, the situation changes. When the green innovation of new start-ups is studied as the main dependent variable, the regression coefficient corresponding to CVC investment becomes 0.057 and passes the test at the 0.05 significance level, indicating that after improving the influence of executive green awareness, CVC investment has a positive role in promoting green innovation of new enterprises. At the same time, the corresponding regression coefficient of GA became 0.112 and also passed the significance test, which strongly proves the key role of executives' green awareness in promoting green innovation of new enterprises.

Hypothesis 3 Political relations moderate the relationship between CVC investment and the green innovation of new ventures

PR Moderating Effect

	(1)
X3	-0.005 (-0.155)
X3_PR	0.099*** (4.142)
PR	0.012*** (5.335)
DEBT	0.155*** (2.598)

	(1)
SIZE	0.136*** (9.847)
ROA	-0.087 (-0.728)
TOBINQ	-0.007 (-1.160)
AGE	0.045 (1.263)
_cons	-2.795*** (-8.897)
<i>N</i>	1940
r ²	0.364
industry	yes
year	yes

Table 8
t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

In the main effect model (i.e., the baseline regression), X3 has a significant positive effect on GI. In the data in Table 8 of the moderating effect model, the regression coefficient corresponding to the interaction term between the moderating variable PR and the explanatory variable X3 is 0.099, and it has passed the significance test at the level of 0.01, that is, the effect of the interaction term on GI is significantly positive, indicating that PR has a moderating effect, which significantly strengthens the effect of X3 on GI, that is, PR has a significant promoting effect on

the relationship between X3 and GI. In general, the empirical test results support Hypothesis 3.

. *Hypothesis 4: R&D expenditures moderate the relationship between CVC investment and the green innovation of new ventures*

R&D Moderating Effect

	(1)
X3	0.015 (0.508)
X3_R&D	0.034*** (2.790)
R&D	0.008*** (5.018)
DEBT	0.149** (2.486)
SIZE	0.137*** (9.621)
ROA	-0.095 (-0.789)
TOBINQ	-0.008 (-1.277)
AGE	0.044 (1.241)
_cons	-2.805*** (-8.712)
N	1940
r2	0.360
industry	yes
year	yes

Table 9

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

From previous studies, we know that in the main effect model (i.e., baseline regression), X3 has a significant positive effect on GI. In the data in Table 9 of the

moderating effect model, the regression coefficient corresponding to the interaction term between the moderating variable R&D and the explanatory variable X3 is 0.034, which passed the significance test at the level of 0.01, that is, the effect of the interaction term on GI is significantly positive, indicating that R&D has a moderating effect, which significantly strengthens the effect of X3 on GI, that is, R&D has a significant promoting effect on the relationship between X3 and GI. Therefore, hypothesis 4 is verified to be true.

Hypothesis 5 : ESG performance of new ventures moderates the relationship between CVC investment and green innovation of new ventures

ESG Moderating Effect

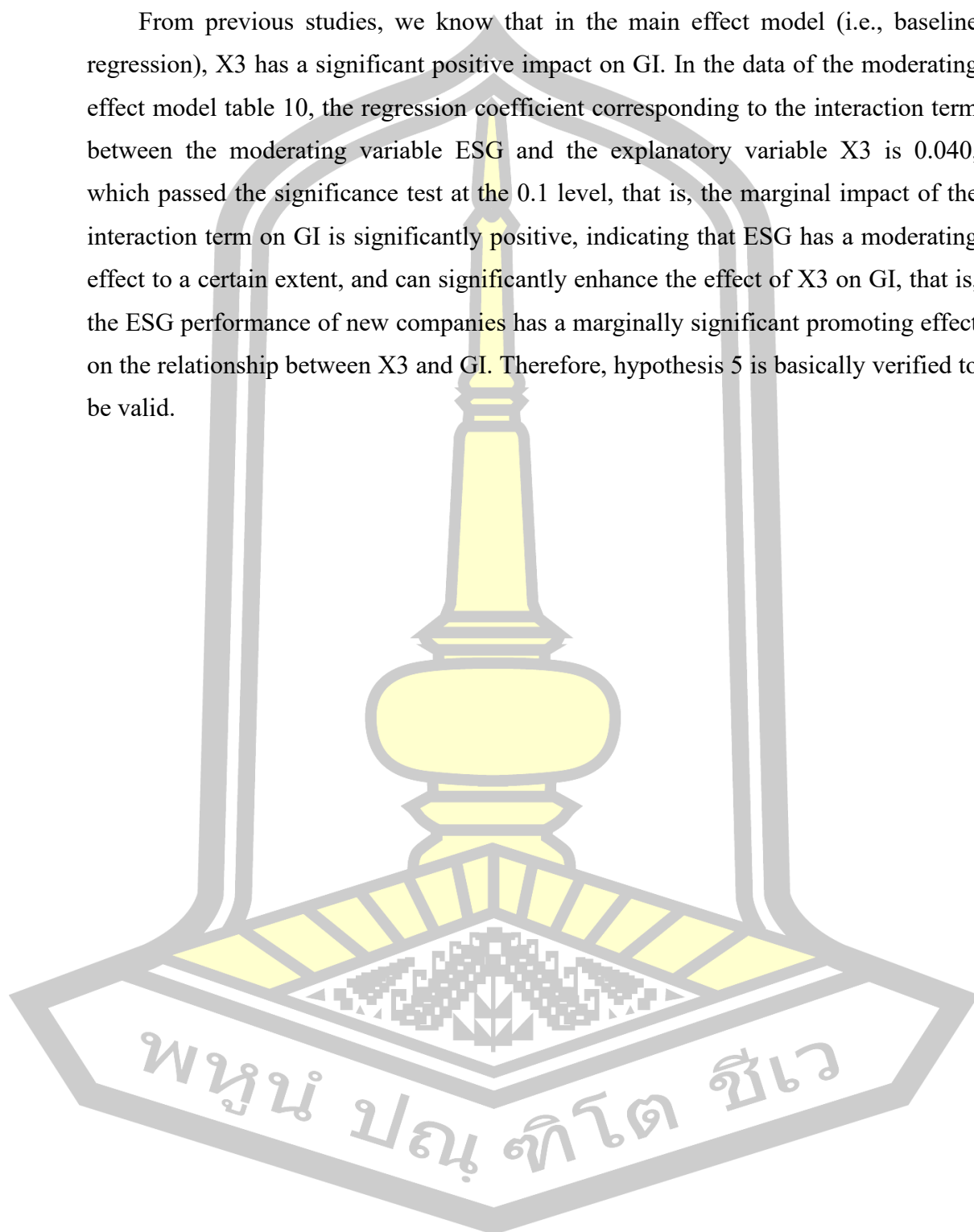
	(1)
X3	-0.117 (-1.211)
X3_ESG	0.040* (1.778)
ESG	-0.004 (-0.457)
DEBT	0.157*** (2.605)
SIZE	0.171*** (13.277)
ROA	-0.091 (-0.748)
TOBINQ	-0.006 (-0.976)
AGE	0.038 (1.069)
_cons	-3.504*** (-11.749)
N	1940
r ²	0.350
industry	yes
year	yes

Table 10

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

From previous studies, we know that in the main effect model (i.e., baseline regression), X3 has a significant positive impact on GI. In the data of the moderating effect model table 10, the regression coefficient corresponding to the interaction term between the moderating variable ESG and the explanatory variable X3 is 0.040, which passed the significance test at the 0.1 level, that is, the marginal impact of the interaction term on GI is significantly positive, indicating that ESG has a moderating effect to a certain extent, and can significantly enhance the effect of X3 on GI, that is, the ESG performance of new companies has a marginally significant promoting effect on the relationship between X3 and GI. Therefore, hypothesis 5 is basically verified to be valid.



4.5 Endogeneity test

	(1)	(2)
	First-stage regression	Second-stage regression
L.X3	0.981*** (185.647)	
X3		0.069** (2.224)
DEBT	-0.002 (-0.177)	0.125* (1.770)
SIZE	-0.001 (-0.449)	0.179*** (12.343)
ROA	0.021 (0.926)	-0.027 (-0.202)
TOBINQ	0.001 (0.524)	-0.008 (-1.205)
AGE	-0.003 (-0.449)	0.029 (0.657)
<i>N</i>	1563	1563
r2		0.115
industry		yes

	(1)	(2)
year		yes
Underidentification test		1499.396
Weak identification test		34000
Sargan statistic		0.000

Table 11

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This study uses the lagged explanatory variable X3 as an instrumental variable and conducts an endogeneity test based on a two-stage least squares regression. The F value of the unidentifiable test is 1499.396, which shows that the model is identifiable, that is, it passes the unidentifiable test. The F value of the weak instrumental variable test is 34000, which shows that the instrumental variable has a strong correlation with the endogenous variable and can be effectively used for estimation, that is, it passes the weak instrumental variable test. From the results of the first column of Table 11 above, it can be seen that the lagged explanatory variable L.X3 has a positive and significant impact on the current X3. From the results of the second column of the table above, it can be seen that the regression coefficient of X3 on GI is 0.069, which is still a significant positive impact. The overall explanation of the endogeneity test results is effective and enhances the reliability of the above benchmark regression results.

พหุ ประถมศึกษา

4.6 Robustness test

	(1)	(2)
	Replace explanatory variables	Winsorized at 1%
X4	0.045* (1.941)	
DEBT	0.404** (2.452)	0.154** (2.559)
SIZE	0.214*** (5.323)	0.168*** (12.697)
ROA	0.987** (2.359)	-0.240 (-1.385)
TOBINQ	0.019 (0.759)	-0.009 (-1.079)
AGE	0.014 (0.098)	0.033 (0.918)
X3		0.048* (1.907)
_cons	-4.669*** (-5.608)	-3.421*** (-11.315)
<i>N</i>	316	1940
<i>r</i> ²	0.597	0.346
industry	yes	yes
year	yes	yes

Table 12

t statistics in parentheses* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This paper uses table 12 column (1) to replace the explanatory variable (using the ESG of the CVC parent company corresponding to X3 as the explanatory variable of X4) and column (2) to perform 1% tailing treatment on the relevant continuous variables to perform robustness tests. The result is still that the explanatory variable has a significant positive impact on GI. The results are relatively close to the benchmark regression results, which shows that the basic conclusions of this paper are relatively robust.

CHAPTER 5

DISCUSSION

This chapter introduces the data processing analysis. The results based on testing the hypotheses using hierarchical regression analysis are discussed, the data are robustly checked, and the implications of these findings for management practice are discussed. The interpretation of theoretical contributions and future research agenda summarizes the important findings of this study. The full text will be divided into four parts: theoretical significance, practical significance, limitations, and further research agenda and conclusions.

5.1 Theoretical Implications

First, for companies listed on China's ChiNext and Sci-Tech Innovation Board, the positive impact of CVC investment background on the level of green innovation (GI) of new ventures is statistically reliable. This positive correlation is not only significant in quantity, but also statistically reaches a high degree of confidence, providing empirical evidence for understanding the complexity of CVC investment behavior and its impact on the sustainable development of new enterprises. From a theoretical perspective, this finding deepens our understanding of VC investment motivations and preferences. This suggests that in the current investment environment, IVC institutions and GVC institutions may pay more attention to the pursuit of short-term financial returns rather than the long-term sustainable development of new enterprises (because the results of IVC and GVC are not significant), which emphasizes the differentiated considerations of different investment backgrounds in investment decisions. At the same time, it also reminds us that in the process of promoting the improvement of the GI level of new ventures, we need to consider the incentive structure and behavior patterns of different investment entities more carefully.

Second, this study found that the coefficient between the GI of new enterprises and the CVC investment background is only 0.049, which is significant at the 0.01 level, indicating that the CVC investment environment has a significant positive impact on the GI of new enterprises. Recent studies by Zhou et al. (2025) corroborate

this, showing CVC-backed firms in renewable energy sectors achieve 22% higher R&D ROI compared to IVC counterparts due to industrial synergies. Theoretically, it suggests that compared with other investment backgrounds, this may mean that in China, CVC, as a relatively new investment model, is still in the learning stage, and its strategy of balancing corporate profits and GI is not yet mature. As noted in the 2025 China Development Forum Report, 68% of CVCs now embed ESG-linked KPIs into investment contracts, structurally aligning capital allocation with green objectives. This finding provides new theoretical support for understanding the impact of different investment backgrounds on the GI of new ventures, and also lays the foundation for subsequent research to explore the specific mechanism between CVC investment background and corporate GI.

Then, from the empirical test results, the introduction of executive green awareness as a mediating variable deepens our understanding of the mechanism between CVC investment and new venture GI. It reveals that the environmental awareness and decision-making preferences of senior corporate executives have played a promoting role in the improvement of CVC investment and green innovation. This finding not only enriches the CVC investment theory, but also provides theoretical support for the formulation of green innovation improvement strategies.

When tested separately, we included PR (government subsidies) as a moderating variable in the analysis framework, and we found that it had a significant moderating effect on the relationship between CVC investment and green innovation at a significance level of 0.1. This theoretical finding is of great significance, indicating that government subsidies play an indispensable role in guiding private capital into the field of green innovation. This not only deepens our understanding of CVC investment behavior, but also reveals the complex interactive relationship between government policies and private investment, and provides theoretical support for policymakers, that is, how to guide private capital to serve broader social and environmental goals through effective policy tools.

At the same time, when R&D is included in the analysis framework as a moderating variable, this study finds that the interaction term between the moderating variable R&D investment (R&D) and the explanatory variable corporate venture capital has a significantly positive impact on green innovation (GI), with a regression

coefficient of 0.034, and passes the test at the significance level of 0.01. This result shows that R&D investment plays an important moderating role in the relationship between CVC investment and green innovation, significantly enhancing the role of CVC investment in promoting green innovation. This finding enriches the innovation theory, reveals that R&D investment is an important moderating mechanism for the efficiency of external capital utilization, and deepens our understanding of the interactive mechanism between CVC investment and green innovation.

Finally, the marginal impact of the interaction term between the moderating variable ESG and the explanatory variable CVC investment (X3) on green innovation (GI) is significantly positive, with a regression coefficient of 0.040, which passes the significance test at the 0.1 level. This result shows that ESG has a significant moderating effect on the relationship between CVC investment and green innovation to a certain extent, and can slightly but effectively enhance the role of CVC investment in promoting green innovation. This finding enriches the research perspective on the relationship between corporate investment and green innovation, and reveals that ESG, as an important manifestation of corporate governance and sustainable development concepts, plays a key role in promoting the effective transformation of corporate venture capital into the field of green innovation.

The findings of this research contribute to the green entrepreneurship literature in at least three ways.

First, this study extends the theoretical boundaries of CVC investment and green innovation by further examining the dynamic interaction between incumbents and start-ups (Johnson and Schaltegger, 2020), thereby extending the discussion on how these directions co-evolve in market sustainability transformations (Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2011). Building on the existing research of Schaltegger et al. (2016b), I introduce CVC as a complementary route to spread green innovation-induced sustainability to mass markets.

Second, this study confirms existing research on the CVC-innovation relationship (e.g., Dushnitsky and Lenox, 2005; Wadhwa et al., 2016) and deepens these studies by showing that this interaction is dominant in terms of green equity and patents. Therefore, it responds to the call of Hegeman and Sørheim (2021) to empirically investigate the link between green CVC and green innovation

performance.

Finally, I echoed the view of Chen, Y., Masron, T.A., & Mai, W. (2024) that executives' green awareness moderates the view that investors' attention to the negative impact of environmental information disclosure of Chinese high-tech enterprises. The difference is that my study is in the context of CVC investment, and executives' green awareness plays an effective mediating role in green innovation of new ventures.

5.2 Practical Implications

At the practical level, this research result has important implications for both startups and policymakers. For startups, they need to be aware that when seeking VC investment, they may need to make extra efforts to demonstrate their value and potential in ESG to attract investors who are not only concerned about profits but also about sustainable development; this also prompts startups to strengthen their own construction in the field of ESG and enhance their overall sustainable development capabilities, thereby attracting a wider group of investors. (R Li, C Fei, W Fei, 2024).

At the same time, the results of this study are of great significance to CVC investors, startups and policymakers. For CVC investors, they should be aware that their reputation and investment behavior will have a positive impact on the green innovation of startups, so they should pay more attention to balancing the economic benefits and social responsibilities of enterprises in investment decisions (Wang, L., & Qi, Y., 2019). For startups, facing the pressure from CVC investors, they should actively explore ways to improve green innovation while pursuing profits, such as reducing the impact on the environment and society through technological innovation and management optimization. At the same time, startups should also actively communicate with investors, increase R&D investment, and jointly formulate investment strategies that are in line with the long-term development of the enterprise (Veer, T., Yang, P., & Riepe, J., 2022). For policymakers, they should strengthen supervision and guidance on CVC investment behavior, encourage investors to pay attention to the overall performance of enterprises, and promote the healthy development of the capital market and the sustainable growth of enterprises.

In addition, for the government, this paper uses empirical evidence to emphasize the effectiveness of government subsidies in promoting green innovation. The government can encourage CVC investors to invest in green and sustainable projects by providing targeted subsidies, thereby accelerating the development and application of green technologies (R Li, C Fei, W Fei, 2024). Second, for CVC investors, government subsidies can serve as an important signal to guide them to pay attention to and support companies with executive management teams with green awareness potential. This investment orientation not only helps to improve the environmental performance of enterprises, but also may bring long-term economic returns. Finally, for enterprises, this finding encourages them to actively seek government subsidies and use them as a means to promote green environmental management practices. By effectively using government subsidies, enterprises can attract more CVC investment, thereby promoting their own green transformation and sustainable development.

Finally, enterprises should fully recognize the important role of executive green awareness in improving corporate green innovation. This finding emphasizes the importance of executive green awareness in corporate sustainable development strategies. Enterprises should attach importance to environmental education and training for executive teams, strengthen the consideration of environmental factors in the decision-making process, and thus formulate strategic plans that are more in line with sustainable development goals. At the same time, the improvement of executives' green awareness is also helpful to create an environmental atmosphere within the company, promote employees to reach a consensus on sustainable development, and thus comprehensively improve the company's green innovation level. Therefore, while pursuing economic benefits, enterprises should fully recognize the significant mediating role of executives' green awareness and take measures to cultivate and improve it to promote the company's long-term sustainable development and enhance corporate competitiveness.

This study provides practical implications for managers of investment companies, startup executives, and policymakers. First, the authors present green CVC as a fruitful strategic option for established companies that are "going green." Investing in startups to acquire green technologies provides an opportunity to pursue environmental and economic goals simultaneously, ultimately gaining future

competitive advantage through green innovation. In addition, this study challenges the environmental awareness of green startup executives, who are often caught between high idealistic standards and compromises when promoting green technologies to ultimately impact the environment and society as a whole. In response to the findings of this study, the authors encourage sustainability-focused executives to consider the “double green impact” of CVC (Hegeman and Sørheim, 2021) and seek partnerships. Through CVC, executives can not only leverage the growth potential of their startups, but also promote green initiatives of existing companies associated with high potential environmental impacts. Finally, the results of this study provide policymakers with another reason to incentivize CVC activities of existing companies to gain benefits at the macro level. Existing research shows that the regulatory environment and subsidies are crucial for green investors (Bürer and Wüstenhagen, 2008).

5.3 Limitations and Further Research

This study has certain limitations in the exploration process, which points out the direction for subsequent research. First, there is currently a lack of unified standards to define the concepts of CVC (corporate venture capital) and GVC (state venture capital), which may lead to different interpretations of CVC during the sample selection process, thereby affecting the selection range and accuracy of the studied companies. Second, the sample of this study is limited to companies listed on the ChiNext and Science and Technology Innovation Board in China. This limitation may introduce selection bias and fail to fully reflect the situation in the wider market.

In view of this, we put forward the following suggestions for reference in future research: First, the research perspective should be expanded to include companies in the SME sector and the main board market in the sample scope to enrich the diversity of the research objects. Second, increasing the sample size, especially including CVC activities in developed economies in the research scope, will help conduct a more in-depth heterogeneity analysis and reveal the characteristics and differences of CVC activities in different economic environments. Finally, further exploring the intrinsic connection between CVC and green technological innovation of start-ups will not only help deepen the understanding of the mechanism of CVC, but also provide an important perspective for promoting green technology innovation and sustainable

development.

5.4 Conclusion

Based on an empirical study of green innovation data of listed companies on China's ChiNext and Shanghai Stock Exchange's Science and Technology Innovation Board from 2009 to 2022, this paper deeply explores the mechanism of action between different venture capital and green innovation of start-ups. The main findings of this study are as follows:

First, different venture capital backgrounds have a significant impact on green innovation of start-ups. Specifically, independent venture capital (IVC) and government venture capital (GVC) have no significant impact on green innovation of start-ups, and corporate venture capital (CVC) has a significant positive promotion effect on green innovation of start-ups.

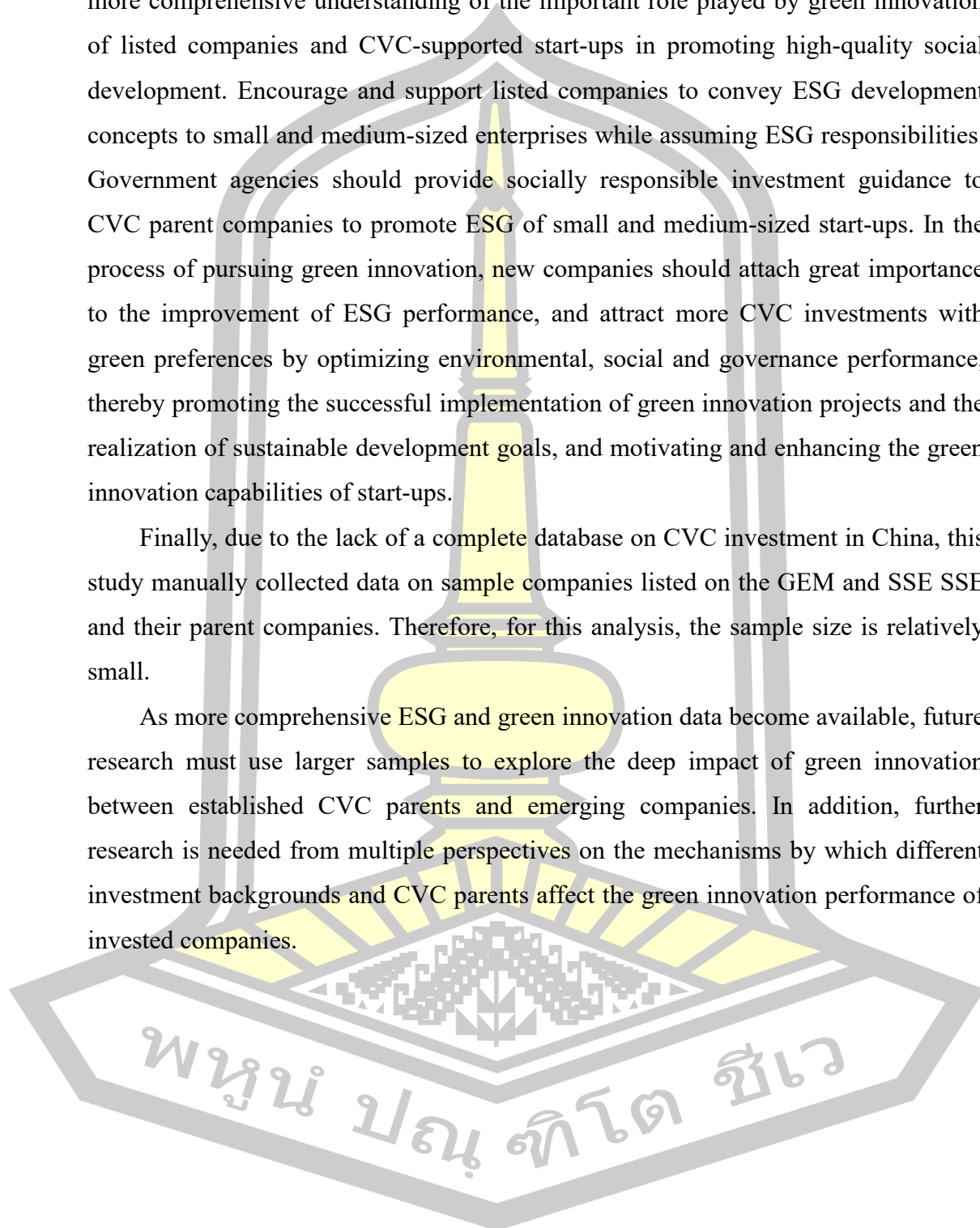
Second, the green environmental awareness of executives plays an important mediating role in this process, further emphasizing the role of environmental awareness of internal management in promoting the improvement of corporate green innovation. This study not only reveals the complex impact mechanism of venture capital background on green innovation of start-ups, but also emphasizes the key role of government policies in promoting corporate green innovation and sustainable development.

In addition, the research results of this paper also have implications for CVC companies, CVC-supported companies and regulators. First, from the perspective of CVC investment, in addition to achieving the strategic goals of the parent company, it is crucial to further enhance socially responsible investment awareness. CVC companies should assist the development of invested companies and guide them to fulfill their ESG responsibilities while pursuing value maximization. From the perspective of invested companies, they should not only seek financial resources from CVC companies, but also use the experience and resources of CVC parent companies to increase R&D investment and enhance their own green innovation capabilities. Importantly, they should learn the green and long-term development concepts of their parent companies and actively assume relevant ESG responsibilities within their capabilities.

Second, our research emphasizes that governments and regulators should have a more comprehensive understanding of the important role played by green innovation of listed companies and CVC-supported start-ups in promoting high-quality social development. Encourage and support listed companies to convey ESG development concepts to small and medium-sized enterprises while assuming ESG responsibilities. Government agencies should provide socially responsible investment guidance to CVC parent companies to promote ESG of small and medium-sized start-ups. In the process of pursuing green innovation, new companies should attach great importance to the improvement of ESG performance, and attract more CVC investments with green preferences by optimizing environmental, social and governance performance, thereby promoting the successful implementation of green innovation projects and the realization of sustainable development goals, and motivating and enhancing the green innovation capabilities of start-ups.

Finally, due to the lack of a complete database on CVC investment in China, this study manually collected data on sample companies listed on the GEM and SSE SSE and their parent companies. Therefore, for this analysis, the sample size is relatively small.

As more comprehensive ESG and green innovation data become available, future research must use larger samples to explore the deep impact of green innovation between established CVC parents and emerging companies. In addition, further research is needed from multiple perspectives on the mechanisms by which different investment backgrounds and CVC parents affect the green innovation performance of invested companies.



REFERENCES

- 10.1007/s10551-015-2903-y
- 10.1007/s13278-021-00772-w
- 10.1257/jep.9.4.97
- 10.3389/fpsyg.2020.00965
- 14001 in Korea, 1996–2011. *Journal of Business Ethics*, 145, 325–336.
14001. *Public Administration Review*, 74(2), 233–244.
- 150:119762. doi: 10.1016/j.techfore.2019.119762
- 24–54. doi: 10.1177/0261927X09351676
- 334–343. doi: 10.5465/amr.2007.24345254
- 46:10422587211033571. doi: 10.1177/10422587211033571
- Academy of Management Perspectives*, 45–62.
- acceptance model. *J. Hosp. Tour. Manag.* 4, 37–48.
- accreditation on international trade: Empirical evidence on ISO 9000 certifications.
- Acquaah, M., Adjei, M. C., & Mensa-Bonsu, I. F. (2008). Competitive strategy,
- Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. *Strategic Management Journal*, 22, 197–220.
- Ahuja, G., & Lampert, C. M. (2001). Entrepreneurship in the large corporation: a longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal*, 22, 521–543.
- Aich, S., Thakur, A., Nanda, D., Tripathy, S., & Kim, H. C. (2021). Factors affecting ESG towards impact on investment: A structural approach. *Sustainability*, 13(19). <https://doi.org/10.3390/su131910868>. Article 10868.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Akcigit, U., Baslandze, S., & Stantcheva, S. (2016). Taxation and the international mobility of inventors. *American Economic Review*, 106(10), 2930–2981.
- Akita, T. (2003). Decomposing regional income inequality in China and Indonesia using two-stage nested Theil decomposition method. *The Annals of Regional Science*, 37(1), 55–77.
- Alakent, E., Goktan, M. S., & Khoury, T. A. (2020). Is venture capital socially

- responsible? Exploring the imprinting effect of VC funding on CSR practices. *Journal of Business Venturing*, 35(3), 106005.
- Albuquerque, R., Koskinen, Y., & Zhang, C. D. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, 65(10), 4451–4469. <https://doi.org/10.1287/mnsc.2018.3043>
- Alda, M. (2020). ESG fund scores in UK SRI and conventional pension funds: Are the ESG concerns of the SRI niche affecting the conventional mainstream? *Finance Research Letters*, 36, 101313.
- Allen, F., Qian, J., & Qian, M. (2005). Law, finance, and economic growth in China. *Journal of Financial Economics*, 77(1), 57-116.
- Almeida, P., & Phene, A. (2004). Subsidiaries and knowledge creation: the influence of the MNC and host country on innovation. *Strategic Management Journal*, 25, 847–864.
- Alsayegh, M. F., Rahman, A. R., & Homayoun, S. (2020). Corporate economic,
- Amabile, T. M. (2012). Componential theory of creativity. *Harvard Business School*, 12(96), 1-10.
- Amarakoon, U., Weerawardena, J., & Verreyne, M.-L. (2018). Learning capabilities, human resource management innovation and competitive advantage. *The International Journal of Human Resource Management*, 29(10), 1736-1766.
- Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *The*
- Amesse, F., Latour, R., Rebolledo, C., & Séguin-Dulude, L. (2004). The telecommunications equipment industry in the 1990s: from alliances to mergers and acquisitions. *Technovation*, 24, 885–897.
- Amir, A. Z., & Serafeim, G. (2018). Why and how investors use ESG information:
- Amore, M. D., Schneider, C., & Zaldokas, A. (2013). Credit supply and corporate innovation. *Journal of Financial Economics*, 109(3), 835–855.
- Anand, J., Oriani, R., & Vassolo, R. S. (2007). Managing a portfolio of real options. *Advances in Strategic Management*, 24, 1-24.
- and its impact on performance: insights from Slovenia. *J. Clean. Prod.* 133, 812–825. doi: 10.1016/j.jclepro.2016.06.002
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin*, 103(3), 411-423.

- Anning-Dorson, T. (2018). Innovation and competitive advantage creation: The role of organisational leadership in service firms from emerging markets. *International Marketing Review*, 35(4), 580-600.
- Anokhin, S., Morgan, T., Schulze, W., & Wuebker, R. (2022). Is a reputation for misconduct harmful? Evidence from corporate venture capital. *Journal of Business Research*, 138, 65-76.
- approaches to social media text mining. *Soc. Netw. Anal. Min.* 11, 1–18. doi:
- Aragon-Correa, J. A., & Sharma, S. (2003). A contingent resource-based view of proactive corporate environmental strategy. *Academy of Management Review*, 28(1), 71–89.
- Arbi, K. A., Bukhari, S. A. H., & Saadat, Z. (2017). Theoretical framework for
- Attig, N., El Ghoul, S., Guedhami, O., & Suh, J. (2013). Corporate social responsibility and credit ratings. *Journal of Business Ethics*, 117(4), 679–694.
- Aulakh, P., Kotabe, M., & Teegen, H. (2000). Export strategies of service companies
- Avramov, D., Cheng, S., Lioui, A., & Tarelli, A. (2022). Sustainable investing with ESG rating uncertainty. *Journal of Financial Economics*, 145(2), 642–667.
- Avramov, D., Cheng, S., Lioui, A., & Tarelli, A. (2022). Sustainable investing with ESG rating uncertainty. *Journal of Financial Economics*, 145(2), 642–664. <https://doi.org/10.1016/j.jfineco.2021.09.009>
- Avramov, D., Cheng, S., Lioui, A., & Tarelli, A. (2022). Sustainable investing with ESG rating uncertainty. *Journal of financial economics*, 145(2), 642-664.
- Awan, U., Nauman, S., & Sroufe, R. (2021). Exploring the effect of buyer engagement on green product innovation: Empirical evidence from manufacturers. *Business Strategy and the Environment*, 30(1), 463–477.
- Aydoğmuş, M., Gülay, G., & Ergun, K. (2022). Impact of ESG performance on firm value and profitability. *Borsa Istanbul Review*, 22, S119-S127.
- Azar, J., Duro, M., Kadach, I., & Ormazabal, G. (2021). The big three and corporate
- Baek, K. (2017). The diffusion of voluntary environmental programs: The case of ISO
- Bagozzi, R. P., & Yi, Y. (1991). Multitrait-multimethod matrices in consumer research. *Journal of consumer research*, 17(4), 426-439.
- Bai, X., Han, J., Ma, Y., & Zhang, W. (2022). ESG performance, institutional investors' preference and financing constraints: Empirical evidence from China. *Borsa Istanbul Review*.

- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organ. Behav. Hum. Decis. Process.* 50, 248–287. doi: 10.1016/0749-5978(91)90022-L
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, 50(2), 248–287. doi: 10.1016/0749-5978(91)90022-L
- Banker, R. D., Lee, S.-Y., Potter, G., & Srinivasan, D. (2000). An empirical analysis of continuing improvements following the implementation of a performance-based compensation plan. *Journal of Accounting and Economics*, 30(3), 315–350.
- Bansal, P., & Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of management journal*, 43(4), 717-736.
- Barkemeyer, R., Revelli, C., & Douaud, A. (2023). Selection bias in ESG controversies as a risk for sustainable investors. *Journal of Cleaner Production*, 405. <https://doi.org/10.1016/j.jclepro.2023.137035>. Article 137035
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(2), 656–665.
- Barney, J., Wright, M., & Ketchen, D. J., Jr (2001). The resource-based view of the firm: Ten years after 1991. *Journal of Management*, 27(6), 625–641.
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations, *Journal of Personality and Social Psychology*, 51(6), 1173-1182.
- Baroto, M. B., Abdullah, M. M. B., & Wan, H. L. (2012). Hybrid strategy: A new strategy for competitive advantage. *International Journal of Business and Management*, 7(20), 120-133.
- Barry, C., Muscarella, C., Peavy III, J. W., & Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies: Evidence from the going-public process. *Journal of Financial Economics*, 27(2), 447–471.
- Basu, S., Phelps, C., & Kotha, S. (2011). Towards understanding who makes corporate venture capital investments and why. *Journal of Business Venturing*, 26, 153–171.
- Baum, J. A. C., Calabrese, T., & Silverman, B. S. (2000). Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*, 21, 267–294.
- Beamish, P. W., & Chakravarty, D. (2021). Using the resource-based view in international business strategy. *Journal of Business International*, 10, 100001.
- Behnam, S., Cagliano, R., & Grijalvo, M. (2018). How should firms reconcile their

- open innovation capabilities for incorporating external actors in innovations aimed at sustainable development? *Journal of cleaner production*, 170 (January), 950-965.
- Bekk, M., Spörrle, M., Hedjasi, R., & Kerschreiter, R. (2016). Greening the competitive advantage: antecedents and consequences of green brand equity. *Quality & Quantity*, 50(4), 1727-1746.
- Bellesi, F., Lehrer, D., & Tal, A. (2005). Comparative advantage: The impact of ISO 14001 environmental certification on exports.
- Belsley, D. A., Kuh, E., & Welsch, R. E. (1980). *Regression diagnostics: Identifying influential data and sources of collinearity*. New York, NY: John Wiley and Sons.
- Benabou, R., & Tirole, J. (2010). Individual and corporate social responsibility. *Economica*, 77(305), 1–19.
- Bendig, D., Kleine-Stegemann, L., Schulz, C., & Eckardt, D. (2022). The effect of green startup investments on incumbents' ESG performance output. *Journal of Cleaner Production*, 376, 134316. doi: 10.1016/j.jclepro.2022.134316.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107(2), 238–246. doi:10.1037/0033-2909.107.2.238 PMID:2320703.
- Berthet, V. (2022). The impact of cognitive biases on professionals' decision making: a review of four occupational areas. *Frontiers in Psychology*, 12:802439. doi: 10.3389/fpsyg.2021.802439
- Bertoni, F., Colombo, M. G., & Quas, A. (2015). The patterns of venture capital investment in Europe. *Small Business Economics*, 45, 543-560.
- Bıçakcıoğlu, N., Theoharakis, V., & Tanyeri, M. (2020). Green business strategy and
- Biesanz, J. C., Falk, C. F., & Savalei, V. (2010). Assessing mediational models: Testing and interval estimation for indirect effects. *Multivariate Behavioral Research*, 45(4), 661-701.
- Biswas, A., & Roy, M. (2015). Leveraging factors for sustained green consumption behavior based on consumption value perceptions: testing the structural model. *Journal of Cleaner Production*, 95, 332-340.
- Bjørner, T. B., Hansen, L. G., & Russell, C. S. (2004). Environmental labeling and
- Bledow, R., Frese, M., Anderson, N., Erez, M., & Farr, J. (2009a). A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity. *Industrial and Organizational Psychology*, 2(3), 305-337.
- Bledow, R., Frese, M., Anderson, N., Erez, M., & Farr, J. (2009b). Extending and

- refining the dialectic perspective on innovation: There is nothing as practical as a good theory; nothing as theoretical as a good practice. *Industrial and Organizational Psychology*, 2(3), 363-373.
- Blind, K., Mangelsdorf, A., & Pohlisch, J. (2018). The effects of cooperation in
Bonacich, P. (1987). Power and centrality: A family of measures. *American Journal of Sociology*, 92, 1170–1182.
- Bourgeois, L. J., & Singh, J. V. (1983). Organizational slack and political behavior within top management teams. *Academy of Management Proceedings*, 43–47.
- Bradley, D., & Jordan, B. (2002). Partial adjustment to public information and IPO underpricing. *Journal of Financial and Quantitative Analysis*, 37(4), 595–616.
- Brander, J. A., Amit, R., & Antweiler, W. (2002). Venture capital syndication: Improved venture selection vs. the value-added hypothesis. *Journal of Economics & Management Strategy*, 11(3), 423-452.
- Brav, A., & Gompers, P. (1997). Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and non-venture capital-backed companies. *Journal of Finance*, 52(5), 1791–1821.
- Bravi, L., Santos, G., Pagano, A., & Murmura, F. (2020). Environmental management
Breuer, W., Müller, T., Rosenbach, D., & Salzmann, A. (2018). Corporate social responsibility, investor protection, and cost of equity: A cross-country comparison. *Journal of Banking & Finance*, 96, 34–55.
- Broadstock, D. C., Chan, K., Cheng, L. T., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance research letters*, 38, 101716.
- Broadstock, D. C., Chan, K., Cheng, L. T., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, 38, 101716.
- Brown, J. R., & Floros, I. V. (2012). Access to private equity and real firm activity: Evidence from PIPEs. *Journal of Corporate Finance*, 18(1), 151–165.
- Bryce, D. J., & Winter, S. G. (2009). A general interindustry relatedness index. *Management Science*, 55, 1570–1585.
- Business Research*, 106, 24–34.
- Business Strategy and the Environment*, 31(3), 751–767.
- Business Studies*, 39, 540–561.

- business. *Journal of International Business Studies*, 32, 5–21.
- Byrne, B. M. (2013). *Structural equation modeling with EQS: Basic concepts, applications, and programming*. Routledge.
- carbon emissions around the world. *Journal of Financial Economics*, 142(2), 674–696.
- Casamatta, C., & Haritchabalet, C. (2007). Experience, screening and syndication in venture capital investments. *Journal of Financial Intermediation*, 16(3), 368-398.
- Cefis, E., & Marsili, O. (2005). A matter of life and death: innovation and firm survival. *Industrial and Corporate Change*, 14, 1–26.
- Cestone, G., White, L., & Lerner, J. (2007). The design of syndicates in venture capital. Unpublished working paper.
- Chan, H. K., Yee, R. W., Dai, J., & Lim, M. K. (2016). The moderating effect of environmental dynamism on green product innovation and performance. *International Journal of Production Economics*, 181, 384-391.
- Chang, X., Fu, K. K., Low, A., & Zhang, W. R. (2015). Non-executive employee stock options and corporate innovation. *Journal of Financial Economics*, 115(1), 168–188.
- Charan, P., & Murty, L. (2018). Secondary stakeholder pressures and organizational adoption of sustainable operations practices: The mediating role of primary stakeholders. *Business Strategy and the Environment*, 27(7), 910-923.
- Chemmanur, T. J., Loutskina, E., & Tian, X. (2014). Corporate venture capital, value creation, and innovation. *The Review of Financial Studies*, 27(8), 2434-2473.
- Chemmanur, T., Krishnan, K., & Nandy, D. (2011). How does venture capital financing improve efficiency in private firms? A look beneath the surface. *Review of Financial Studies*, 24(12), 4037-4090.
- Chen, H., Fang, X., Xiang, E., Ji, X., & An, M. (2023a). Do online media and investor attention affect corporate environmental information disclosure? Evidence from Chinese listed companies. *International Review of Economics & Finance*, 86, 1022–1040. <https://doi.org/10.1016/j.iref.2023.01.022>
- Chen, J., & Liu, L. (2020). Customer participation, and green product innovation in SMEs: the mediating role of opportunity recognition and exploitation. *Journal of Business Research*, 119, 151–162. doi: 10.1016/j.jbusres.2019.05.033
- Chen, J., and Liu, L. (2020). Customer participation, and green product innovation in SMEs: the mediating role of opportunity recognition and exploitation. *J. Bus. Res.*

- 119, 151–162. doi: 10.1016/j.jbusres.2019.05.033
- Chen, L., Khurram, M. U., Gao, Y., Abedin, M. Z., & Lucey, B. (2023). ESG disclosure and technological innovation capabilities of the Chinese listed companies. *Research in International Business and Finance*, 65, 101974. <https://doi.org/10.1016/j.ribaf.2023.101974>
- Chen, X., Yi, N., Zhang, L., & Li, D. (2018). Does institutional pressure foster corporate ESG performance? Evidence from China's top 100 companies. *Journal of Cleaner Production*, 188, 304–311. doi: 10.1016/j.jclepro.2018.03.257
- Chen, X., Yi, N., Zhang, L., and Li, D. (2018). Does institutional pressure foster
- Chen, Y. S. (2008). The driver of ESG performance and green environment management-green core
- Chen, Y. S. (2008). The driver of ESG performance and green environment management-green core competence. *Journal of Business Ethics*, 81, 531–543. doi: 10.1007/s10551-007-9522-1
- Chen, Y.-S. (2010). The drivers of green brand equity: Green brand environment management, green satisfaction, and green trust. *Journal of business ethics*, 93(2), 307-319.
- Chen, Y.-S., & Chang, C.-H. (2013). The determinants of green product development performance: Green dynamic capabilities, green transformational leadership, and green creativity. *Journal of business ethics*, 116(1), 107-119.
- Chen, Y.-S., Lai, S.-B., & Wen, C.-T. (2006). The influence of ESG performance performance on corporate advantage in Taiwan. *Journal of business ethics*, 67(4), 331-339.
- Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, MA: Harvard Business School Press.
- Child, J. (1972). Organizational structure, environment and performance: The role of
- Child, J., & Tse, D. K. (2001). China's transition and its implications for international Chinese export firms' performance-Lessons for other emerging markets. *Journal of*
- Cho, T. S., and Hambrick, D. C. (2006). Attention as the mediator between top
- Christensen, D. M., Serafeim, G., & Siochi, A. (2022). Why is corporate virtue in the eye of the beholder? The case of ESG ratings. *Accounting Review*, 97(1), 147–175.
- Chuang, Y., & Hsu, P. (2004). FDI, trade, and spillover efficiency: Evidence from China's manufacturing sector. *Applied Economics*, 36(10), 1103–1115.

- club GMs'/COOs perceptions in adopting social media: Applying the technology
- Cohen, W. M., & Levin, R. C. (1989). Innovation and market structure. In R. Schmalensee & R. Willig (Eds.), *Handbook of Industrial Organization* (pp. 1060–1107). New York, NY: Elsevier Science Pub. Co.
- Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128-152.
- Cohendet, P., & Meyer-Krahmer, F. (2001). The theoretical and policy implications of knowledge codification. *Research Policy*, 30, 1563-1591.
- Colby, M. E. (1991). Environmental management in development: the evolution of paradigms. *Ecological Economics*, 3(3), 193-213.
- comparison of framed topics in twitter and Weibo: machine learning competence. *J. Bus. Ethics* 81, 531–543. doi: 10.1007/s10551-007-9522-1
- consumers' choice—an empirical analysis of the effect of the Nordic Swan. *Journal of Environmental Economics and Management*, 47(3), 411–434.
- Cornell, B. (2021). ESG preferences, risk, and return. *European Financial Management*, 27(1), 12–19.
- corporate ESG performance? Evidence from China's top 100 companies. *J. Clean. Corporate Social Responsibility and Environmental Management*, 27(6), 2599–2614.
- Costa, O., Fuerst, F., Robinson, S. J., & Mendes-Da-Silva, W. (2018). Green label signals in an emerging real estate market. A case study of Sao Paulo, Brazil. *Journal of Cleaner Production*, 184, 660–670.
- Cowan, R., David, P., & Foray, D. (2000). The explicit economics of knowledge codification and tacitness. *Industrial and Corporate Change*, 9, 211-253.
- Cristofaro, M. (2020). “I feel and think, therefore I am”: an affect-cognitive theory of management decisions. *Eur. Manag. J.* 38, 344–355. doi: 10.1016/j.emj.2019.09.003
- Cui, A., & O'Connor, G.C. (2012). Alliance portfolio resource diversity and firm innovation. *Journal of Marketing Theory and Practice*, 76, 24-43.
- Cull, R., Xu, C., & Zhu, T. (2009). Formal finance and trade credit during China's transition. *Journal of Financial Intermediation*, 18(2), 173-192.
- Dai, D., Fan, Y., Wang, G., & Xie, J. (2022). Digital economy, R&D investment, and regional green innovation — analysis based on provincial panel data in China.

- Sustainability, 14(11), 6508.
- Davila, A., Foster, G., & Gupta, M. (2003). Venture capital financing and the growth of startup firms. *Journal of Business Venturing*, 18(6), 689-708.
- deregulation. *Organ. Sci.* 17, 453–469. doi: 10.1287/orsc.1060.0192
- Dess, G.G., Ireland, R.D., Zahra, S.A., Floyd, S.W., Janney, J.J., & Lane, P.J. (2003). Emerging issues in corporate entrepreneurship. *Journal of Management*, 29, 351-378.
- disclosure. *Sustainability*, 12(9). <https://doi.org/10.3390/su12093910>. Article 3910.
- distance. *Front Psychol.* 12:725199. doi: 10.3389/fpsyg.2021.725199
- diversity and its implications for international business. *Journal of International* doi: 10.2307/1884852
- Döll, L. M., Ulloa, M. I. C., Zammar, A., do Prado, G. F., & Piekarski, C. M. (2022). Corporate venture capital and sustainability. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(3), 132.
- Donaldson, T., & Preston, L. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of Management Review*, 20, 65–91.
- Dong, M., Wang, L., Yang, D., & Zhou, K. Z. (2022). Performance feedback and export intensity of Chinese private firms: Moderating roles of institution-related factors. *International Business Review*, 31(3), Article 101948.
- Dorfleitner, G., Halbritter, G., & Nguyen, M. (2015). Measuring the level and risk of corporate responsibility – An empirical comparison of different ESG rating approaches. *Journal of Asset Management*, 16, 450-466.
- Dosi, G. (1988). Sources, procedures and microeconomic effects of innovation. *Journal of Economic Literature*, XXVI, 1120-1171.
- Du, J., & Xu, C. (2009). Which firms went public in China? A study of financial market regulation. *World Development*, 37(4), 812-824.
- Duanmu, J. L., Bu, M., & Pittman, R. (2018). Does market competition dampen
- Dushnitsky, G. (2006). Corporate venture capital: Past evidence and future directions. In M. Casson, B. Yeung, A. Basu, & N. Wadeson (Eds.), *Oxford Handbook of Entrepreneurship* (pp. 387-431). Oxford University Press.
- Dushnitsky, G., & Lavie, D. (2010). How alliance formation shapes corporate venture capital investment: A resource-based perspective. *Strategic Entrepreneurship Journal*, 4, 22-48.

- Dushnitsky, G., & Lenox, M.J. (2005). When do incumbents learn from entrepreneurial ventures? Corporate venture capital and investing firm innovation rates. *Research Policy*, 34, 615-639.
- Dushnitsky, G., & Lenox, M.J. (2006). When does corporate venture capital investment create firm value? *Journal of Business Venturing*, 21, 753-772.
- Dushnitsky, G., & Shaver, J.M. (2009). Limitations to interorganizational knowledge acquisition: The paradox of corporate venture capital. *Strategic Management Journal*, 30, 1045-1064.
- Duysters, G., & Lokshin, B. (2011). Determinants of alliance portfolio complexity and its effect on innovative performance of companies. *Journal of Product Innovation Management*, 28, 570-585.
- Dyer, J.H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23, 660-679.
- economies: do market-oriented reforms matter? *Energy Policy*, 78, 113–124.
- economy. *International Marketing Review*, 37(1), 56–75.
- emerging markets. *The Academy of Management Journal*, 43(3), 342–361.
- Environment competitiveness relationship. *J. Econ. Perspect.* 9, 97–118. doi:
- environmental and financial performance: A resource management perspective.
- environmental awareness affect technological innovation? *Int. J. Environ. Res. Public Health* 16:261. doi: 10.3390/ijerph16020261
- environmental characteristics and performance in African emerging economies: environmental performance: empirical results from the green technology sector in environmental performance? Evidence from China. *Strategic Management Journal*, 39 (11), 3006–3030.
- environmental, and social sustainability performance transformation through ESG ESG performance practices and its impacts on environmental and organizational ESG performance practices. *Front. Psychol.* 13:917533. doi: 10.3389/
- Evidence from a global survey. *Financial Analysts Journal*, 74(3), 87–103. <https://doi.org/10.1093/faj/74.3.87>
- Evidence from industry-level data. *Corporate Social Responsibility and Environmental Management*, 29(5), 1440–1455.
- executive perceptions of the environment. *Strateg. Manag. J.* 19, 793–807
- export performance: An examination of boundary conditions from an emerging

- Feng, Z. (2004). Venture capital investment in China (PhD thesis). Pardee Rand Graduate School.
- Fernando, Y., and Wah, W. X. (2017). The impact of eco-innovation drivers on
- Ferreira, J. J., Fernandes, C. I., Veiga, P. M., & Hughes, M. (2021). Prevailing theoretical approaches predicting sustainable business models: A systematic review.
- Fisman, R. (2001). Estimating the value of political connections. *American economic review*, 91(4), 1095-1102.
- Flammer, C. (2018). Competing for government procurement contracts: The role of corporate social responsibility. *Strategic Management Journal*, 39(5), 1299–1324.
- Fleming, L. (2001). Recombinant uncertainty in technological search. *Management Science*, 47, 117-132.
- Fleming, L., & Sorenson, O. (2001). Technology as a complex adaptive system: Evidence from patent data. *Research Policy*, 30, 1019-1039.
fpsyg.2022.917533
- FroCroce, A., & Ughetto, E. (2019). The role of venture quality and investor reputation in the switching phenomenon to different types of venture capitalists. *Journal of Industrial and Business Economics*, 46, 191-227.
- Galbreath, J. (2013). ESG in focus: The Australian evidence. *Journal of business ethics*, 118, 529-541.
- Galunic, D.C., & Rodan, S. (1998). Resource recombinations in the firm: Knowledge structures and the potential for Schumpeterian innovation. *Strategic Management Journal*, 19, 1193-1201.
- Gao, G. Y., Murray, J. Y., Kotabe, M., & Lu, J. (2010). A “strategy tripod” perspective on export behaviors: Evidence from domestic and foreign firms based in an emerging economy. *Journal of International Business Studies*, 41, 377–396.
- Gao, P., Wang, Y., Zou, Y., Su, X., Che, X., and Yang, X. (2022). Green technology innovation and carbon emissions nexus in China: does industrial structure
- Garcia-Vega, M. (2006). Does technological diversification promote innovation? An empirical analysis for European firms. *Research Policy*, 35, 230-246.
- Gerged, A. M. (2021). Factors affecting corporate environmental disclosure in emerging markets: The role of corporate governance structures. *Business Strategy and the Environment*, 30(1), 609–629. <https://doi.org/10.1002/bse.2642>

- Ghemawat, P., & Spence, M. (1985). Learning curve spillovers and market performance. *The Quarterly Journal of Economics*, 100(Supplement), 839–852.
- Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *Journal of portfolio management*, 45(5), 69-83.
- Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889.
- Goedhuys, M., & Sleuwaegen, L. (2016). International standards certification,
- Gompers, P., & Lerner, J. (1996). The use of covenants: An empirical analysis of venture partnership agreements. *Journal of Law and Economics*, 39(2), 463-498.
- Gompers, P., & Lerner, J. (2001). *The money of invention: How venture capital creates new wealth*. Harvard Business Press.
- Gormley, T. A., & Matas, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *Review of Financial Studies*, 27(2), 617–661.
- Graf-Vlachy, L., Bundy, J., and Hambrick, D. C. (2020). Effects of an advancing tenure on CEO cognitive complexity. *Organ. Sci.* 31, 936–959. doi: 10.1287/orsc.2019.1336
- Gu, Y., Wu, P., & Du, R. (2023). Corporate strategic positioning and environmental information disclosure under circular economy: Evidence from China. *Management Decision*. <https://doi.org/10.1108/MD-02-2023-0301>
- Gunasekaran, A., and Spalanzani, A. (2012). Sustainability of manufacturing and services: investigations for research and applications. *Int. J. Prod. Econ.* 140, 35–47. doi: 10.1016/j.ijpe.2011.05.011
- Guo, C., Su, W. H., Song, X. B., & Hu, X. X. (2022). Heterogeneous debt financing and environmental research & development: Evidence from China. *International Review of Economics & Finance*, 82, 65–81.
- Guo, D., & Jiang, K. (2013). Venture capital investment and the performance of entrepreneurial firms: Evidence from China. *Journal of Corporate Finance*, 22, 375–395. doi: 10.1016/j.jcorpfin.2013.07.001.
- Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies*, 23(5), 1909–1940.

- Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility—where are they? A critical review of ESG investing. *Review of Financial Economics*, 26, 25-35.
- Hambrick, D. C. (2007). Upper echelons theory: an update. *Acad. Manag. Rev.* 32,
- Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, 20(4), 986–1014.
- He, D., Ren, S., & Zeng, H. (2022). Environmental labeling certification and firm performance: A resource management perspective. *Business Strategy and the Environment*, 31(3), 751-767.
- He, D., Ren, S., & Zeng, H. (2022). Environmental labeling certification and firm environmental and financial performance: A resource management perspective. *Business Strategy and the Environment*, 31(3), 751-767.
- He, J., Huang, J. K., & Zhao, S. (2019). Internalizing governance externalities: The role of institutional cross-ownership. *Journal of Financial Economics*, 134(2), 400–418.
- He, W., & Shen, R. (2019). ISO 14001 Certification and Corporate Technological Innovation. *Journal of Business Ethics*, 161(1), 1–20.
- Hellmann, T., & Puri, M. (2000). The interaction between product market and financing strategy: The role of venture capital. *Review of Financial Studies*, 13(4), 959-984.
- Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start-up firms: Empirical evidence. *Journal of Finance*, 57(1), 169-197.
- Hojnik, J., and Ruzzier, M. (2016). The driving forces of process eco-innovation. *Journal of Macroeconomics*, 58, 1–19.
- Houston, J. F., & Shan, H. Y. (2022). Corporate ESG profiles and banking relationships. *Review of Finance*, 35(7), 3373–3417.
- Hsieh, C. T., & Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics*, 124(4), 1403–1448.
<https://doi.org/10.1016/j.jfineco.2021.05.007>
<https://doi.org/10.1016/j.techfore.2023.122378>
- Hu, A. G. Z., Jefferson, G. H., & Qian, J. (2005). R&D and technology transfer: Firm-level evidence from Chinese industry. *Review of Economics and Statistics*, 87(4), 780-786.
- Huang, D. Z. X. (2022). Environmental, social, and governance factors and assessing firm value: Valuation, signaling, and stakeholder perspectives. *Accounting and Finance*, 62, 1983–2010.
- Huang, J. W., and Li, Y. H. (2017). ESG performance and performance: the view

- Huang, Q., Chen, X., Zhou, M., Zhang, X., and Duan, L. (2019). How does CEO's Hunt, C.B. and Auster, E.R., "Proactive environmental management: avoiding the toxic trap", *Sloan Management Review*, Vol. 31 No. 2, Winter 1990, pp. 7-18.
- Ikram, M., Sroufe, R., Rehman, E., Shah, S. Z. A., & Mahmoudi, A. (2020). Do quality, environmental, and social (QES) certifications improve international trade? A comparative grey relation analysis of developing vs. developed countries. *Physica A: Statistical Mechanics and its Applications*, 545, Article 123486.
- in SMEs *Eur. Manag. J.* 31, 549–563. doi: 10.1016/j.emj.2013.01.003
- innovation and environmental performance: the role of green transformational innovation. *Qual. Quant.* 51, 1663–1685. doi: 10.1007/s11135-016-0358-6
- innovation: evidence from Chinese firms. *Journal of Business Ethics*, 158, 97–117.
- institutional voids and exports from developing country firms. *International Business Review*, 25(6), 1344–1355.
- International Journal of Production Economics*, 198, 50–59.
- International Journal of Productivity and Performance Management*, 71(3), 790–813.
- ISO. (2018). environmental labels and declarations— Type I environmental
- Jackson, G., & Deeg, R. (2008). Comparing capitalisms: Understanding institutional
- Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2005). A tale of two market failures: Technology and environmental policy. *Ecological Economics*, 54(2-3), 164-174. <https://doi.org/10.1016/j.ecolecon.2004.12.027>
- Javeed, S. A., Latief, R., Jiang, T., San Ong, T., & Tang, Y. (2021). How environmental regulations and corporate social responsibility affect the firm innovation with the moderating role of chief executive officer (CEO) power and ownership concentration? *Journal of Cleaner Production*, 308, 127212. <https://doi.org/10.1016/j.jclepro.2021.127212>
- Jefferson, G. H., Hu, A. G., & Su, J. (2006). The sources and sustainability of China's economic growth. *Brookings Papers on Economic Activity*, 2006(2), 1-47.
- Jiang, Z., Wang, Z., & Zeng, Y. (2020). Can voluntary environmental regulation promote corporate technological innovation? *Business Strategy and the Environment*, 29(2), 390–406.
- Jo, H., Kim, H., & Park, K. (2015). Corporate environmental responsibility and firm performance in the financial services sector. *Journal of Business Ethics*, 131(2),

- 257–284. <https://doi.org/10.1007/s10551-014-2276-7>
- Kaplan, S., Sensoy, B., & Strömberg, P. (2009). Should investors bet on the jockey or the horse? Evidence from the evolution of firms from early business plans to public companies. *Journal of Finance*, 64(1), 75-115.
- Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in social media research: Past, present and future. *Information Systems Frontiers*, 20(3), 531–558. <https://doi.org/10.1007/s10796-017-9810-y>
- Kazmier, L. J., & Pohl, N. F. (1984). *Basic Statistics for Business and Economics* (2nd ed.). McGraw-Hill.
- Khojastehpour, M., & Saleh, M. A. (2019). The effect of CSR commitment on firms' level of internationalization. *Social Responsibility Journal*, 16(8), 1415–1432.
- Kim, M., Zhang, L., Yu, J. H., Koenigsfeld, J. P., and Cichy, R. F. (2016). Private
- Kim, S., Lee, H., & Kim, J. (2016). Divergent effects of external financing on technology innovation activity: Korean evidence. *Technological Forecasting and Social Change*, 106, 22–30.
- Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science*, 42(8), 1199-1214. <https://doi.org/10.1287/mnsc.42.8.1199>
- Kortum, S., & Lerner, J. (2000). Assessing the contribution of venture capital to innovation. *RAND Journal of Economics*, 31(4), 674-692.
- Kumar, A. (2023). Leadership and decision-making: Top management team age demographic and environmental strategy. *Journal of Management and Organization*, 29(1), 69-85. <https://doi.org/10.1017/jmo.2019.91>
- Kumar, P., Polonsky, M., Dwivedi, Y. K., & Kar, A. (2021). Green information quality and green brand evaluation: the moderating effects of eco-label credibility and consumer knowledge. *European Journal of Marketing*.
- labelling—Principles and procedures, 14024:2018. London: ISO,.
- Lau, D., & Murnighan, J. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. *Academy of Management Review*, 23(2), 325-340. <https://doi.org/10.5465/amr.1998.533229>
- leadership and green human resource management. *Forecast. Soc. Change leadership*. *Small Bus. Econ.* 50, 851–869. doi: 10.1007/s11187-017-9901-7
- Lee, K. H. (2009). Why and how to adopt green management into business

- organizations? The case study of Korean SMEs in manufacturing industry. *Management Decision*, 47(7), 1101-1121. <https://doi.org/10.1108/00251740910978322>
- Lee, P., & Wahal, S. (2004). Grandstanding, Certification and the Underpricing of Venture Capital Backed IPOs. *Journal of Financial Economics*, 73(2), 375-407.
- Leeuw, T., Lokshin, B., & Duysters, G. (2014). Returns to alliance portfolio diversity: The relative effects of partner diversity on firm's innovative performance and productivity. *Journal of Business Research*, 67, 1839-1849.
- Lessons from firms in Ghana. *Journal of African Business*, 9(1), 93-120.
- Leuz, C., & Oberholzer-Gee, F. (2006). Political relationships, global financing, and corporate transparency: Evidence from Indonesia. *Journal of financial economics*, 81(2), 411-439.
- Li, G., Xue, Q., & Qin, J. (2022). Environmental information disclosure and green technology innovation: Empirical evidence from China. *Technological Forecasting and Social Change*, 176, 121453. <https://doi.org/10.1016/j.techfore.2021.121453>
- Li, H., Hang, Y., Shah, S. G. M., Akram, A., and Ozturk, I. (2020). Demonstrating
- Li, H., Wen, S., & Jiao, R. (2020). Corporate environmental behavior: Words and deeds, is there a reward for deeds? A study of the impact of corporate environmental culture on financial performance. *Management Review*, 32(12), 26-42.
- Li, M., & Jones, C. D. (2019). Top management team faultlines, CEO-TMT disparity, and competitive aggressiveness. *Group & Organization Management*, 44(5), 874-914. <https://doi.org/10.1177/1059601118813790>
- Li, T. T., Wang, K., Sueyoshi, T., & Wang, D. D. (2021). ESG: Research progress and future prospects. *Sustainability*, 13(21), 11663.
- Li, W., Zhang, Y., Zheng, M., Li, X., Cui, G., & Li, H. (2019). Research on green governance of Chinese listed companies and its evaluation. *Journal of Management World*, 35(5), 126-133+160. (Same note as above regarding the "+" symbol.)
- Li, X., & Liu, C. (2013). A study on effects of slack in troubled firms: Also study on moderating effects of market search intensity. *Nankai Business Review*, 16(3), 140-148+160. (Note: In APA format, the "+" symbol is typically used to indicate a page range that continues after a break or additional content; however, for specific journal formats or if this is a direct quote from the source, the exact notation might need to be retained or clarified.)

- Li, X., Guo, F., & Wang, J. (2024). A path towards enterprise environmental performance improvement: How does CEO green experience matter? *Business Strategy and the Environment*, 33(2), 820-838. <https://doi.org/10.1002/bse.3524>
- Liao, Z., & Cheng, H. (2014). The antecedents and outcomes of firm's environmental innovation: From the perspective of environmental policy and firm's background characteristics. *Studies in Science Education*, 32, 792-800.
- Liao, Z., & Long, S. (2018). CEOs' regulatory focus, slack resources and firms' environmental innovation. *Corporate Social Responsibility and Environmental Management*, 25(5), 981-990. <https://doi.org/10.1002/csr.1514>
- Liao, Z., Lu, J., Yu, Y., & Zhang, Z. (2022). Can attention allocation affect firm's environmental innovation: The moderating role of past performance. *Technology Analysis and Strategic Management*, 34(9), 1081-1094. <https://doi.org/10.1080/09537325.2021.1947489>
- Lim, S., & Prakash, A. (2014). Voluntary regulations and innovation: the case of ISO
- Lin, B., & Du, K. (2015). Energy and CO2 emissions performance in China's regional
- Lin, H., Zeng, S. X., Ma, H. Y., & Chen, H. Q. (2015). How political connections affect corporate environmental performance: The mediating role of green subsidies. *Human and Ecological Risk Assessment: An International Journal*, 21(8), 2192–2212.
- Lin, Y. H., and Chen, Y. S. (2017). Determinants of green competitive advantage:
- Lin, Y. J., Fu, X. Q., & Fu, X. L. (2021). Varieties in state capitalism and corporate innovation: Evidence from an emerging economy. *Journal of Corporate Finance*, 67, 101919.
- Liu, X., Yang, J., Qu, S., Wang, L., Shishime, T., and Bao, C. (2012). Sustainable
- Liu, Y., and Xi, M. (2021). Linking CEO entrepreneurial orientation to firm
- Lopez-Gamero, M. D., Molina-Azorín, J. F., & Claver-Cortés, E. (2009). The whole relationship between environmental variables and firm performance: Competitive advantage and firm resources as mediator variables. *Journal of Environment Management*, 90(10), 3110-3121. <https://doi.org/10.1016/j.jenvman.2009.05.007>
- Lu, H., Xu, W., Cai, S., Yang, F., & Chen, Q. (2022). Does top management team responsible leadership help employees go green? The role of green human resource management and environmental felt-responsibility. *Corporate Social Responsibility and Environmental Management*, 29(4), 843-859. <https://doi.org/10.1002/csr.2239>

- Ma, Y., Zhang, Q., & Yin, Q. (2021). Top management team faultlines, green technology innovation and firm financial performance. *Journal of Environmental Management*, 285, 112095. <https://doi.org/10.1016/j.jenvman.2021.112095>
- Macmillan, L. C., Siegel, R., & SubbaNarasimha, P. (1985). Criteria Used by Venture Capitalists to Evaluate New Venture Proposals. *Journal of Business Venturing*, 1(1), 119-128.
- Maiti, M. (2022). Does development in venture capital investments influence green growth? *Technological Forecasting and Social Change*, 182, 121878. doi: 10.1016/j.techfore.2022.121878.
- Malaysia. *Sustain. Prod. Consum.* 12, 27–43. doi: 10.1016/j.spc.2017.05.
- management team characteristics and strategic change: the case of airline *Management*, 17(1), 99–120.
- Management*, 89, 187–200.
- management. *Acad. Manag. Rev.* 14, 361–384. doi: 10.2307/258173
- managerial environmental concerns and green absorptive capacity matter? *Front.*
- Mannix, E. A. (1993). Organizations as resource dilemmas: The effects of power balance on coalition formation in small groups. *Organizational Behavior and Human Decision Processes*, 55, 1-22. <https://doi.org/10.1006/obhd.1993.1021>
- Mao, C. X., & Zhang, C. (2018). Managerial risk-taking incentive and firm innovation: Evidence from FAS 123R. *Journal of Financial and Quantitative Analysis*, 53(2), 867–898.
- Margerum, R. D., & Born, S. M. (2000). A co-ordination diagnostic for improving integrated environmental management. *Journal of Environmental Planning and Management*, 43(1), 5-21. <https://doi.org/10.1080/09640560010748>
- market exporting firms. *Journal of International Marketing*, 27(1), 20–37.
- Matos, P. (2020). ESG and responsible institutional investing around the world: A critical review.
- Meffert, H., & Kirchgeorg, M. (1998). *Marktorientiertes Umweltmanagement: Konzeption - Strategie - Implementierung mit Praxisfällen* (3., überarb. und erw. Aufl.). Schäffer-Poeschel, Stuttgart.
- Meggison, W. L., & Weiss, K. A. (1991). Venture Capitalist Certification in Initial Public Offerings. *Journal of Finance*, 46(3), 879-903.
- Meyer, B., & Glenz, A. (2013). Team faultline measures: A computational comparison

- and a new approach to multiple subgroups. *Organizational Research Methods*, 16(3), 393-424. <https://doi.org/10.1177/1094428113484970>
- Meyer, B., Shemla, M., Li, J., & Wegge, J. (2015). On the same side of the faultline: Inclusion in the leader's subgroup and employee performance. *Journal of Management Studies*, 52(3), 354-380. <https://doi.org/10.1111/joms.12118>
- Mo, X., Boadu, F., Liu, Y., Chen, Z., and Ofori, A. S. (2022). Corporate social
- Molina-Azorín, J. F., Tarí, J. J., Pereira-Moliner, J., Lopez-Gamero, M. D., & Pertusa-Ortega, E. M. (2015). The effects of quality and environmental management on competitive advantage: A mixed methods study in the hotel industry. *Tourism Management*, 50, 41-54. <https://doi.org/10.1016/j.tourman.2015.01.008>
- Mu, W., Liu, K., Tao, Y., & Ye, Y. (2023). Digital finance and corporate ESG. *Finance Research Letters*, 51, 103426.
- multinational enterprise research. *Journal of Management*, 47(7), 1861–1877.
- Murray, G. (2021). Ten meditations on government venture capital. *Venture Capital*, 23(3), 205–227. <https://doi.org/10.1080/13691066.2021.1903677>
- Naffa, H., & Fain, M. (2022). A factor approach to the performance of ESG leaders and laggards. *Finance Research Letters*, 44, 102073.
- Nahata, R. (2008). Venture Capital Reputation and Investment Performance. *Journal of Financial Economics*, 90(2), 127-151.
- Obschonka, M., and Fisch, C. (2018). Entrepreneurial personalities in political of organizational capability and social reciprocity. *J. Bus. Ethics* 145, 309–324. doi:
- Orazalin, N., & Mahmood, M. (2021). Toward sustainable development: Board characteristics, country governance quality, and environmental performance. *Business Strategy and the Environment*, 30(8), 3569-3588. <https://doi.org/10.1002/bse.2820>
- Orens, R., and Reheul, A. M. (2013). Do CEO demographics explain cash holdings [org/10.2469/faj.v74.n3.2](https://doi.org/10.2469/faj.v74.n3.2)
- Parguel, B., Benoît-Moreau, F., & Larceneux, F. (2011). How sustainability ratings might deter “greenwashing”: A closer look at ethical corporate communication. *Journal of Business Ethics*, 102(1), 15-28. <https://doi.org/10.1007/s10551-011-0901-2>
- Patel, P., & Cooper, D. (2014). Structural power equality between family and non-family TMT members and the performance of family firms. *Academy of Management Journal*, 57(6), 1624-1649. <https://doi.org/10.5465/amj.2012.0681>

- Peng, C., & Jia, X. (2023 in press). Influence of top management team faultlines on corporate digitalization. *Journal of Enterprise Information Management*. <https://doi.org/10.1108/JEIM-09-2022-0302>
- Peng, C., Jia, X., & Zou, Y. (2023). Can ‘splitting’ be beneficial? The impact of top management team information-knowledge faultline on enterprise green transformation. *Journal of Cleaner Production*, 406, 136935. <https://doi.org/10.1016/j.jclepro.2023.136935>
- Peng, M. W., Wang, D. Y., & Jiang, Y. (2008). An institution-based view of international business strategy: A focus on emerging economies. *Journal of International Business Studies*, 39, 920–936.
- performance. *Front. Psychol.* 11:553625. doi: 10.3389/fpsyg.2020.553625
- performance: the perspective of middle managers. *Entrep. Theory Pract.*
- performance: The roles of collective organizational engagement and TMT power
- Petulla, J.M., “Environmental management in industry”, *Journal of Professional Issues in Engineering*, Vol. 113, 1987, pp. 167-83.
- Pfeffer, J. (1996). *Competitive Advantage Through People: Unleashing the Power of the Work Force*. Harvard Business School Press: Cambridge, MA.
- Pfeffer, J., & Salancik, G. (2015). External control of organizations—Resource dependence perspective. In *J. Organizational Behavior* 2 (pp. 373-388).
- Phung, G., Trinh, H. H., Nguyen, T. H., & Trinh, V. Q. (2023). Top-management compensation and environmental innovation strategy. *Business Strategy and the Environment*, 32(4), 1634-1649. <https://doi.org/10.1002/bse.3209>
- Porath, C. L., Overbeck, J. R., & Pearson, C. M. (2008). Picking up the gauntlet: How individuals respond to status challenges. *Journal of Applied Social Psychology*, 38(7), 1945-1980. <https://doi.org/10.1111/j.1559-1816.2008.00375.x>
- Porter, M. E., and Van der Linde, C. (1995). Toward a new conception of the
- Priem, R. L., & Butler, J. E. (2001). Is the resource-based “view” a useful perspective for strategic management research? *Academy of Management Review*, 26(1), 22–40.
- Prod. 188, 304–311. doi: 10.1016/j.jclepro.2018.03.257
- production: practices and determinant factors of green supply chain management of Chinese companies. *Bus. Strategy Environ.* 21, 1–16. doi: 10.1002/bse.705
- Psychol.* 13:13. doi: 10.3389/fpsyg.2022.938682

- Puri, M., & Zarutskie, R. (2012). On the Life Cycle Dynamics of Venture-Capital and Non-Venture Capital-Financed Firms. *The Journal of Finance*, 67(6), 2247-2293.
- Qi, L., Wang, J., Liu, Y., & Lv, Z. (2023). Research on the impact of top management team heterogeneity on green innovation performance of enterprises. *Science Research Management*, 44(4), 175-184.
- R Li, C Fei, W Fei. (2024). Impact of government's support policy on decision-making of platform participants under ESG. *International Journal of Systems Science*, DOI: 10.1016/j.najef.2024.102303
- Ren, S., He, D., Yan, J., Zeng, H., & Tan, J. (2022). Environmental labeling certification and corporate environmental innovation: The moderating role of corporate ownership and local government intervention. *Journal of Business Research*, 140, 556–571.
- responsibility activities and ESG performance performance in organizations: do
- Rezaee, Z., & Tuo, L. (2019). Are the quantity and quality of sustainability disclosures associated with the innate and discretionary earnings quality? *Journal of Business Ethics*, 155(3), 763–786.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70(1), 41-55.
- Sahlman, W. (1990). The Structure and Governance of Venture Capital Organizations. *Journal of Financial Economics*, 27(2), 473-524.
- Sahlman, W. A. (1990). Why sane people shouldn't serve on public boards. *Harvard Business Review*, 68(3), 28-32.
- Sam, A. G., & Song, D. (2022). Corporate environmentalism and international trade:
- Samiee, S., & Chirapanda, S. (2019). International marketing strategy in emerging
- Sánchez-Sellero, P., & Bataineh, M. J. (2022). How R&D cooperation, R&D expenditures, public funds and R&D intensity affect green innovation?. *Technology Analysis & Strategic Management*, 34(9), 1095-1108.
- Sarfraz, M., Ozturk, I., Shah, S. G. M., and Maqbool, A. (2020). Contemplating
- Schunk, D. H., and DiBenedetto, M. K. (2020). Motivation and social cognitive
- Sharma, P., Cheng, L. T., & Leung, T. Y. (2020). Impact of political connections on
- She, Z., Li, Q., and Zhou, J. (2021). How CEO workaholism influences firm
- Shen, H., Lin, H., Han, W., & Wu, H. (2023). ESG in China: A review of practice and research, and future research avenues. *China Journal of Accounting Research*,

100325.

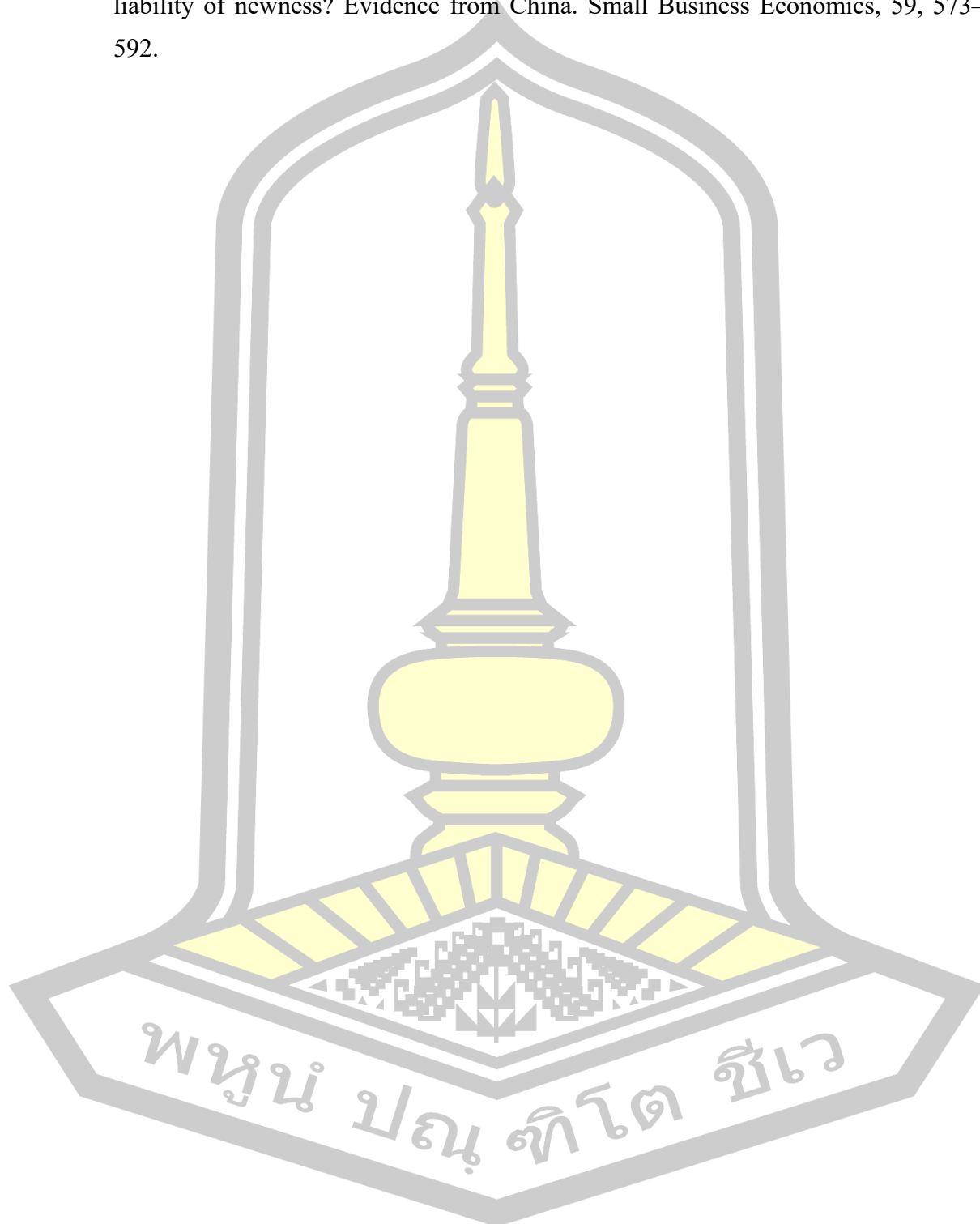
- Shi, X., & Xu, Z. (2018). Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China. *Journal of Environmental Economics and*
- Shu, C., Zhou, K. Z., Xiao, Y., & Gao, S. (2016). How green management influences product innovation in China: The role of institutional benefits. *Journal of Business Ethics*, 133(3), 471-485. <https://doi.org/10.1007/s10551-014-2401-7>
- Sidanius, J., & Pratto, F. (1999). *Social dominance: An inter-group theory of social hierarchy and oppression*. Cambridge University Press, New York.
- Simon, H. A. (1955). A behavioral model of rational choice. *Q. J. Econ.* 69, 99–118.
- Singh, S. K., Del Giudice, M., Chierici, R., and Graziano, D. (2020). Green
- Smith, E.T., “Growth vs. environment: the push for sustainable development”, *Business Week*, 11 May 1992, pp. 66-75.
- Song, C. S., & Lee, Y. (2018). Monitoring role of venture capital in the initial public offerings: Evidence from Korea. *Emerging Markets Finance and Trade*, 54(10), 2382–2399. doi: 10.1080/1540496X.2017.1399121.
- Song, M., Wang, S., & Zhang, H. (2020). Could environmental regulation and R&D tax incentives affect green product innovation? *Journal of Cleaner Production*, 258, 120849. <https://doi.org/10.1016/j.jclepro.2020.120849>
- Spence, M. (1981). The Learning Curve and Competition. *The Bell Journal of Economics*, 12(1), 49-70.
- strategic choice. *sociology*, 6(1), 1–22.
- Suchard, J. A., Humphery-Jenner, M., & Cao, X. (2021). Government ownership and venture capital in China. *Journal of Banking & Finance*, 129, 106164.
- Sun, W., Zhao, Y., & Sun, L. (2020). Big data analytics for venture capital application: Towards innovation performance improvement. *International Journal of Information Management*, 50, 557–565. doi: 10.1016/j.ijinfomgt.2018.11.017.
- sustainability under the aegis of a cognitive CEO. *Front. Psychol.* 11:965. doi:
- Sutcliffe, K. M., and Huber, G. P. (1998). Firm and industry as determinants of system according to ISO 14001: 2015 as a driver to sustainable development.
- Tan, Y., & Zhu, Z. (2022). The effect of ESG rating events on corporate ESG performance in China: The mediating role of financial constraints and managers' environmental awareness. *Technology in Society*, 68, 101906. doi: 10.1016/j.techsoc.2022.101906

- Tan, Y., & Zhu, Z. (2022). The effect of ESG rating events on corporate green innovation in China: The mediating role of financial constraints and managers' environmental awareness. *Technology in Society*, 68, 101906. <https://doi.org/10.1016/j.techsoc.2022.101906>
- Tang, J., Liu, A., Gu, J., & Liu, H. (2024). Can CEO environmental awareness promote new product development performance? Empirical research on Chinese manufacturing firms. *Business Strategy and the Environment*, 33(2), 985-1003. <https://doi.org/10.1002/bse.3527>
- Tang, M., Walsh, G., Lerner, D., Fitza, M. A., & Li, Q. (2018). Green innovation, managerial concern, and firm performance: An empirical study. *Business Strategy and the Environment*, 27(1), 39-51. <https://doi.org/10.1002/bse.1981>
- Tao, Q., Sun, Y., Zhu, Y., & Yang, X. (2017). Political connections and government subsidies: Evidence from financially distressed firms in China. *Emerging Markets Finance and Trade*, 53(8), 1854-1868.
- Tarakci, M., Greer, L. L., & Groenen, P. J. (2016). When does power disparity help or hurt group performance? *Journal of Applied Psychology*, 101(3), 415-429. <https://doi.org/10.1037/apl0000056>
- Tausczik, Y. R., and Pennebaker, J. W. (2010). The psychological meaning of taxonomizing sources of competitive advantage. *Management Research and Practice*, 9 (4), 48–60.
- Thatcher, S. M. B., & Patel, P. C. (2012). Group faultlines: A review, integration, and guide to future research. *Journal of Management*, 38(4), 969-1009. <https://doi.org/10.1177/0149206311426187>
- the impact of cognitive CEO on firms' performance and CSR activity. *Front. Psychol.* 11:278. doi: 10.3389/fpsyg.2020.00278
- the impact of the moderators agency cost and number of supervisors on corporate the roles of green knowledge sharing, green dynamic capabilities, and green service theory. *Contemp. Educ. Psychol.* 60:101832. doi: 10.1016/j.cedpsych.2019.101832
- to improve organizational performance: the role of institutional isomorphism and
- Tost, L. P., Gino, F., & Larrick, R. P. (2013). When power makes others speechless: The negative impact of leader power on team performance. *Academy of Management Journal*, 56(5), 1465-1486. <https://doi.org/10.5465/amj.2011.0180>
- Tsang, A., Wang, K. T., Liu, S. M., & Yu, L. (2021). Integrating corporate social

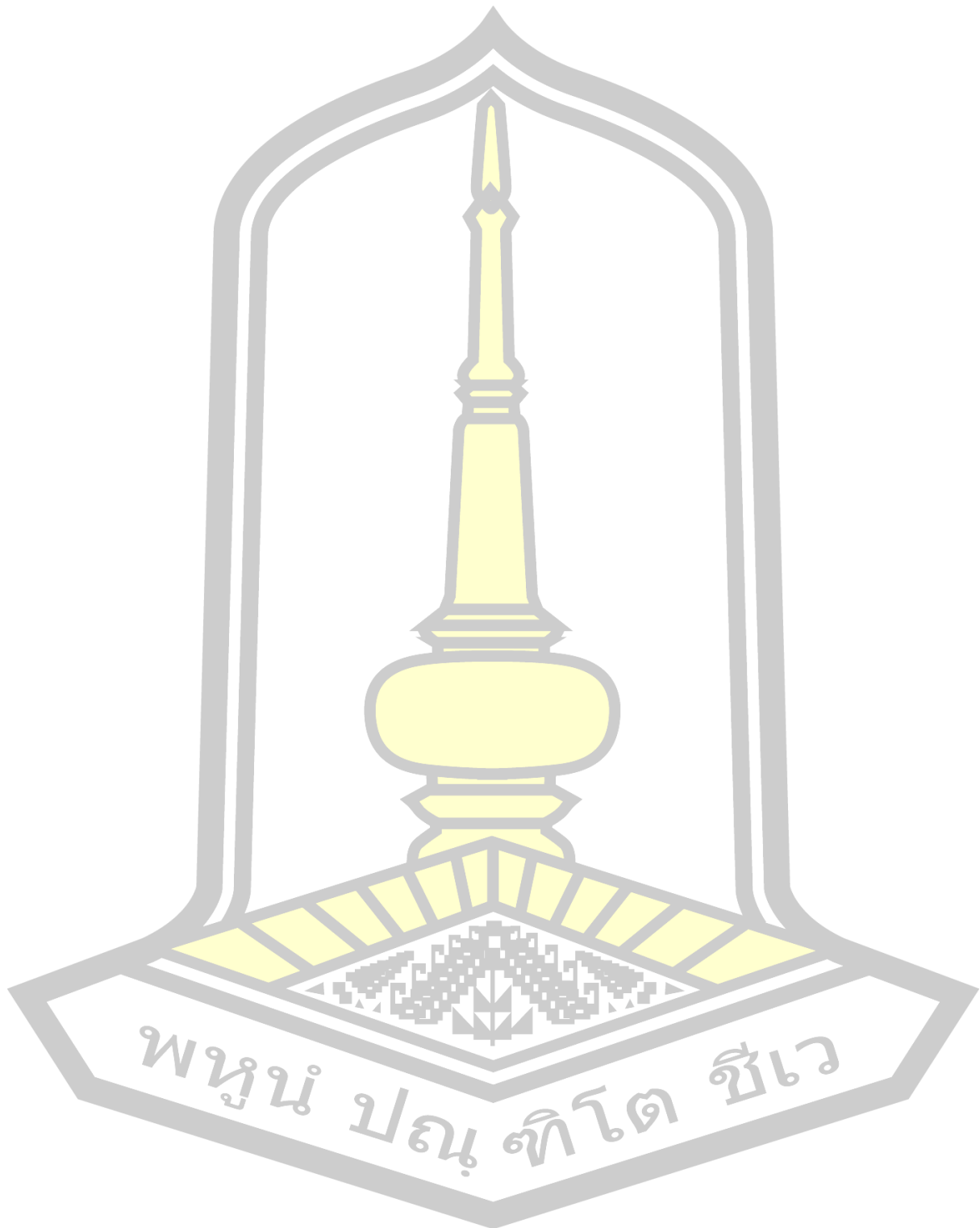
- responsibility criteria into executive compensation and firm innovation: International evidence. *Journal of Corporate Finance*, 70, 102070.
- Tung, A., Baird, K., & Schoch, H. (2014). The relationship between organisational factors and the effectiveness of environmental management. *Journal of Environmental Management*, 144, 186-196. <https://doi.org/10.1016/j.jenvman.2014.05.025>
- upgrading matter? *Front. Psychol.* 13:951172. doi: 10.3389/fpsyg.2022.951172
- Van Duuren, E., Plantinga, A., & Scholtens, B. (2016). ESG integration and the investment management process: Fundamental investing reinvented. *Journal of business ethics*, 138, 525-533.
- Veer, T., Yang, P., & Riepe, J. (2022). Ventures' conscious knowledge transfer to close partners, and beyond: A framework of performance, complementarity, knowledge disclosure, and knowledge broadcasting. *Journal of Business Venturing*, 37(3), 106191.
- Wang, C., Lan, J., & Zhang, Z. (2022). Implications of venture capital on companies' M&A goodwill bubbles: Evidence from Chinese listed companies. *Discrete Dynamics in Nature and Society*, 2022, 1567344. doi: 10.1155/2022/1567344.
- Wang, H., Khan, M. A. S., Anwar, F., Shahzad, F., Adu, D., and Murad, M. (2021).
- Wang, K., & Jiang, W. (2021). State ownership and green innovation in China: The contingent roles of environmental and organizational factors. *Journal of Cleaner Production*, 314, 128029. <https://doi.org/10.1016/j.jclepro.2021.128029>
- Wang, L., & Qi, Y. (2019). CVC competition intensity and innovation performance of invested enterprises: An analysis of the mediating effect of involvement intensity. *Journal of Shanghai University of Finance and Economics*, 21(2), 46-64.
- Wang, L., Zeng, T., & Li, C. (2022). Behavior decision of top management team and enterprise green technology innovation. *Journal of Cleaner Production*, 367, 133120. <https://doi.org/10.1016/j.jclepro.2022.133120>
- Wang, L., Zeng, T., & Li, C. (2022). Behavior decision of top management team and enterprise green technology innovation. *Journal of Cleaner Production*, 367, 133120. <https://doi.org/10.1016/j.jclepro.2022.133120>
- Wang, N., Pan, H., Feng, Y., & Du, S. (2024). How do ESG practices create value for businesses? Research review and prospects. *Sustainability Accounting, Management and Policy Journal*, 15(5), 1155-1177.
- Wang, Y., Zhao, Z., & Wang, Y. (2020). Knowledge-based TMT faultlines, CEO-TMT

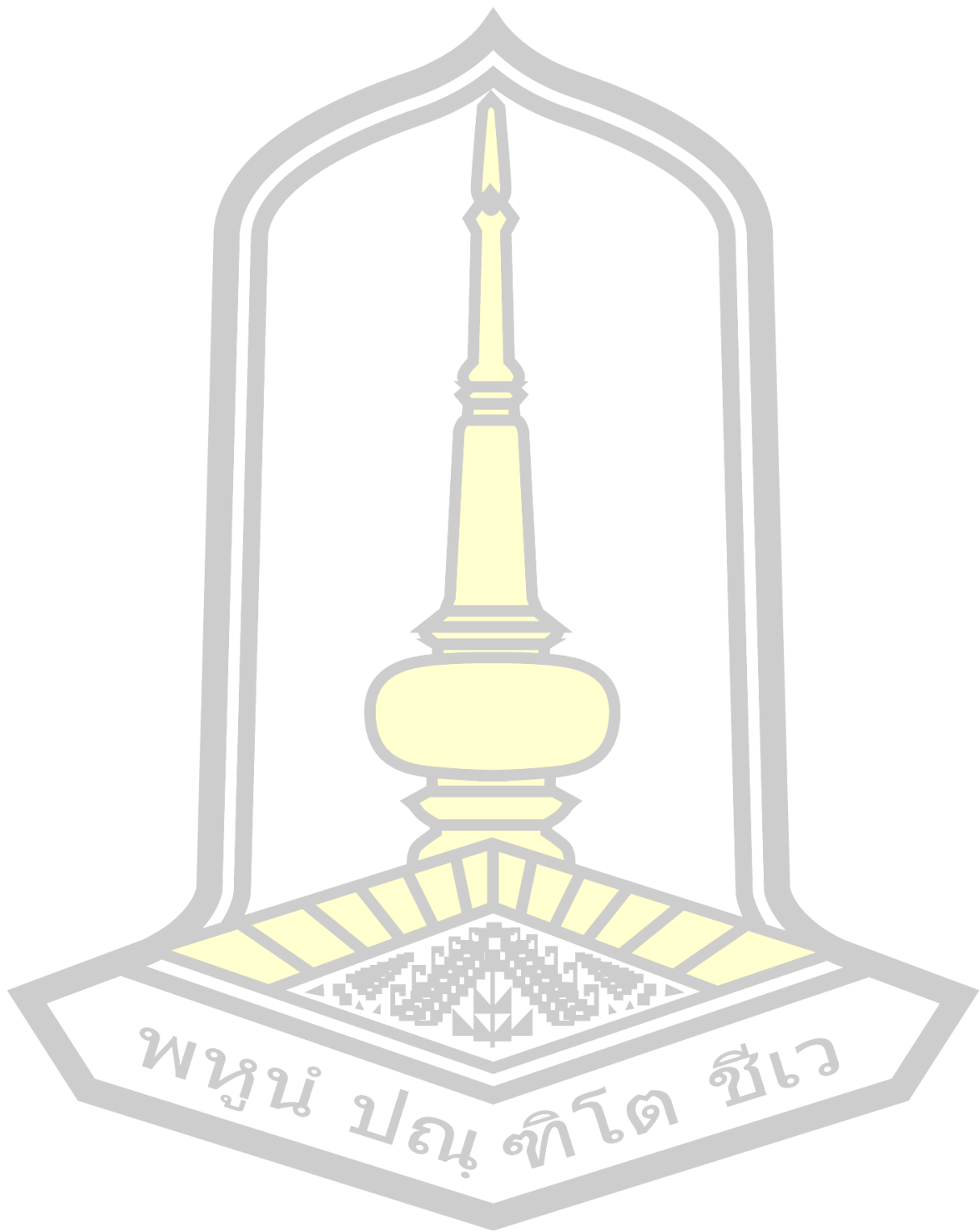
- interface, and internationalization scope. *Nankai Business Review*, 23(6), 39-51.
- Wood, R., and Bandura, A. (1989). Social cognitive theory of organizational words: LIWC and computerized text analysis methods. *J. Lang. Soc. Psychol.* 29,
- Wu, H. Q., Shi, Y., Xia, Q., & Zhu, W. D. (2014). Effectiveness of the policy of circular economy in China: A DEA-based analysis for the period of 11th five-year-plan. *Resources, Conservation and Recycling*, 83, 163-175.
- WuXi AppTec. (2024). AI-driven environmental competency assessments and eco-innovation outcomes. *Sustainability Accounting, Management and Policy Journal*, 16(3), 455-478. <https://doi.org/10.1108/SAMPJ-03-2024-0123>
- Xu, J., Liu, F., & Shang, Y. (2021). R&D investment, ESG performance and green innovation performance: evidence from China. *Kybernetes*, 50(3), 737-756.
- Xu, N., Fan, X., and Hu, R. (2022). Adoption of green industrial internet of things
- Yang, S., Feng, D., Lu, J., & Wang, C. (2022). The effect of venture capital on ESG performance: Is environmental regulation an institutional guarantee? *Journal of Environmental Management*, 318, 115641. doi: 10.1016/j.jenvman.2022.115641.
- Yang, Y., Hsu, J. H., Löfgren, K., and Cho, W. (2021). Cross-platform
- Zhang, D. Y., & Lucey, B. M. (2022). Sustainable behaviors and firm performance: The role of financial constraints' alleviation. *Economic Analysis and Policy*, 74, 220–233.
- Zhou, P., Hu, J., & Feng, S. (2025). CVC-driven green innovation in renewable energy: Evidence from China's industrial synergies. *Journal of Cleaner Production*, 435, 140567. <https://doi.org/10.1016/j.jclepro.2025.140567>
- Zhou, X., Jia, M., Wang, L., Sharma, G. D., Zhao, X., & Ma, X. (2022). Modelling and simulation of a four-group evolutionary game model for green innovation stakeholders: Contextual evidence in lens of sustainable development. *Renewable Energy*, 197, 500–517. <https://doi.org/10.1016/j.renene.2022.07.068>
- Zhuo, C., & Chen, J. (2023). Can digital transformation overcome the enterprise innovation dilemma: Effect, mechanism and effective boundary. *Technological Forecasting and Social Change*, 190, 122378.
- Zou, H., Xie, X., Qi, G., & Yang, M. (2019). The heterogeneous relationship between board social ties and corporate environmental responsibility in an emerging economy. *Business Strategy and the Environment*, 28(1), 40–52. <https://doi.org/10.1002/bse.2180>

Zuo, Y., Jiang, S. Y., & Wei, J. (2022). Can corporate social responsibility mitigate the liability of newness? Evidence from China. *Small Business Economics*, 59, 573–592.



REFERENCES





BIOGRAPHY

NAME	Miss Xi Zhang
DATE OF BIRTH	21 February 1986
PLACE OF BIRTH	He Nan Province China
ADDRESS	Room 7-205, No. 3 Tiezhong Road, Panyu District, Guangzhou City, Guangdong Province, China 511000
POSITION	Lecturer
PLACE OF WORK	Faculty of Finance and Economics Guangzhou Panyu Vocational and Technical College No. 1342, Shiliang Road, Panyu District, Guangzhou City, Guangdong Province, China 511483
EDUCATION	2005 Bachelor of Economics, School of Information Business, Zhongyuan Institute of Technology, Henan Province, China 2017 Master of business administration, School of Business Administration, Guangdong University of Finance and Economics, Guangdong Province, China 2021 Doctor of Philosophy (Ph.D) Management, Mahasarakham University, Maha sarakham, Thailand

