INSTITUTO
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DE LISBOA

The Impact of Government Support to Enterprises in Emerging Industries – The Case of Shenzhen

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Doctor of Management

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Abstract

Emerging industries are the key to China's efforts to transform itself from one of the world's major manufacturers into a global manufacturing powerhouse. Chinese government departments at all levels have always implemented support measures, including financial subsidies, preferential land prices, tax relief, and exemptions to cultivate and expand emerging industries, with some success. Furthermore, issues such as adverse selection and moral hazards have meant that traditional government support models have suffered from weak guidance of private capital and inadequate support for emerging industries. Reform and innovation of the government equity support model, leveraging the participation of private capital, and supporting the high-quality development of emerging industries are practical issues worthy of attention.

Shenzhen is at the forefront of China's efforts to reform and open up. It is also at the forefront of the implementation of the Chinese government's equity support model. Based on a review of the policies of the Chinese government that support emerging industries and of the development status of government equity investment funds, this study summarizes the functions, features of the model, and decision-making process of government equity support. Using a government equity investment institution in Shenzhen as a case study, this study also analyzes in-depth the 85 firms the fund has invested in. A comprehensive analysis and evaluation of the effect of the government equity support model was carried out from multiple dimensions, including the degree of fit with industrial policy.

Following an evaluation of the efficacy of government equity support, this study proposes methods of optimizing the model and the support given to emerging industries, including improving the competence of government equity investment institutions, deepening cooperation with market-based venture capitalists, leveraging incentives such as fiscal rewards and subsidies, and strengthening management of the investment process.

Keywords: government equity investment; emerging industries; support model; Shenzhen
JEL: G24, L52

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Resumo

As indústrias emergentes são a chave para os esforços da China na transformação de um dos maiores fabricantes do mundo numa potência global de fabricação. Os departamentos do governo chinês, em todos os níveis, sempre implementaram medidas de apoio, incluindo subsídios financeiros, preços preferenciais de solos e isenção de impostos para criar e expandir indústrias emergentes, com algum sucesso. Além disso, questões como seleção adversa e riscos morais significaram que os modelos tradicionais de apoio do governo sofreram com a insuficiente participação do capital privado e o apoio inadequado às indústrias emergentes. A reforma e inovação do modelo de apoio ao património por parte do governo, para alavancar a participação do capital privado e apoiar o desenvolvimento de alta qualidade de indústrias emergentes, são questões práticas que merecem atenção.

Shenzhen está na vanguarda dos esforços da China para reformar e se abrir. Também está na vanguarda da implementação do modelo de suporte ao capital próprio por parte do governo chinês. Com base numa revisão das políticas do governo chinês que apoiam as indústrias emergentes e do estado de desenvolvimento dos fundos de investimento em ações do governo, este estudo resume as funções, características do modelo e processo de tomada de decisão de suporte de ações do governo. Usando uma instituição governamental de investimento em ações em Shenzhen como estudo de caso, esta investigação também analisa em profundidade as 85 empresas nas quais o fundo investiu. incluindo o grau de adequação com a política industrial.

Após uma avaliação da eficácia do apoio de capital do governo, este estudo propõe métodos para otimizar o modelo e o apoio dado às indústrias emergentes, incluindo melhorar a competência das instituições governamentais de investimento em capital, aprofundar a cooperação com capitais de risco baseadas no mercado, alavancar incentivos como recompensas e subsídios fiscais e fortalecimento da gestão do processo de investimento.

Palavras-chave: investimento público em capital próprio; indústrias emergentes; modelo de suporte; Shenzhen

JEL: G24, L52

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摘要

新兴产业是中国由制造大国向制造强国转型的重要抓手。一直以来，中国各级政府部门实施了包括财政资金补贴、土地价格优惠、税收减免等各项扶持措施，一定程度上起到了培育壮大新兴产业的作用。同时，由于逆向选择及道德风险等问题，传统的政府扶持模式在一定范围内存在社会资本引导效应弱、新兴成业扶持成效不理想的现象。开展政府股权扶持模式改革创新，撬动社会资本参与，共同扶持新兴产业高质量发展是值得关注现实问题。

深圳市处于中国改革开放的最前沿，在政府股权扶持模式的实践方面也走在全国前列。本文在总结中国政府扶持新兴产业政策导向和政府股权投资基金发展现状的基础上，以深圳市一家政府股权投资机构为例，归纳了政府股权扶持模式的功能定位、模式特征和决策流程，对该基金实施股权投资的 85 家标的企业进行了深入分析。从产业政策契合度等多个维度，对政府股权扶持模式的效果进行了全方位的分析评价。

在对政府股权扶持效果进行评估的基础是，本文从提升政府股权投资机构专业能力、深化与市场化创投机构合作、发挥财政性奖补资金激励作用、加强投资过程管理等方面，提出了优化政府股权扶持模式、提升新兴产业扶持成效的对策建议。

关键词：政府股权投资；新兴产业；扶持模式；深圳

JEL: G24, L52

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Acknowledgements

As I approach the completion of my Doctoral thesis, I remember fragments from the past years. The doctoral study experience constitutes an invaluable asset in my life. I would like to express my heartfelt gratitude to all of you who have ever lent me a hand.

My special thanks go to my supervisor, Professor José Esperança, who has led me with his superb academic level and rigorous academic attitude toward formulating a clear theoretical research path from the perspectives of thesis topic selection, literature reading, framework design, research design, and research review. Without the careful guidance of Professor José Esperança, this thesis would not have been possible. Additionally, I deeply thank my supervisor Professor Rui Ferreira, whose meticulous instructions steadily drive the thesis forward. His immense knowledge and rich experience in the field of investment, as well as his generous sharing, elevate me to a new level in my profession.

I am incredibly grateful to my Chinese supervisor, Professor Ma Yongkai of UESTC (University of Electronic Science and Technology of China). Despite a busy schedule, he constantly attends to the progress of my thesis, oversees the key points, and provides suggestions for many of the problems concerning thesis writing. In the past four years, Professor Ma allocated several timeslots during his business trips to Shenzhen specially for the instruction of my thesis, which proves to be extremely helpful.

On multiple occasions, the busy group faculty in the UESTC (China)-ISCTE (Lisbon University Institute, Portugal) cooperative doctoral program kindly answered my puzzles or offered help. Thank you to Professor Xiao Wen for her care and help. Looking back, each of her pieces of advice marked an important signpost in my Doctoral study process. My thanks also go to Ms. Chen Yang. For my every consultation, she can always supply the most accurate answer on the first try.

I must thank my father, mother, and wife. Their great care and support enabled me to concentrate on my studies. Especially, my wife, Nong Peixian, experienced marriage, pregnancy, childbirth, and child care during my doctoral study. Not only does she take good care of our home, she has also excelled in looking after our son, Lou Mudi.

I should express my gratitude to the leaders and colleagues in Shenzhen ZB Group Co. Ltd and Shenzhen ZY Venture Capital Co. Ltd for their tremendous help and support during my thesis composition.

I appreciate all my classmates in the 2017 Doctoral Class for our mutual learning and

motivation, for advancing together, and fledging together.

I would also like to dedicate this article to all my relatives, friends, teachers, classmates, and colleagues who have cared, helped, and supported me!

致谢

在博士论文即将完成之际，回忆起过去的点点滴滴，我的博士学习经历，是我人生中无比宝贵的财富。我发自内心的向曾给予我帮助的各位表达由衷的感谢：

特别感谢我的导师 José Esperança 教授。José Esperança 教授以高超的学术水平和严谨的治学态度，带着我从论文选题、阅读文献、框架设计、研究设计、研究回顾等方面为我的研究制定了一条清晰的理论研究路径。在 José Esperança 教授的悉心指导下，我才得以顺利完成博士论文。也非常感谢我的导师 Rui Ferreira 教授。他认真细致的指导使得我的论文得以稳步的推进。Rui Ferreira 教授在投资领域的深厚学识、丰富经验和无私的分享，也使得我在专业领域方面更上一个台阶。

非常感谢电子科技大学马永开教授，他虽然工作非常繁忙，但是作为我的中方导师一直关注我论文的进展，很多关键节点都一一过问，对于我在撰写论文中遇到的问题，也多次提出解决方案和建议。过去几年里，马永开教授在来深圳出差的时，数次专门抽空对我的论文进行指导，使我获益良多。

电子科技大学(中国) —里斯本大学学院(ISCTE Lisbon University Institute) (葡萄牙)合作管理学博士项目组的各位老师也是在百忙中，多次解答我的困惑，多次提供帮助。感谢肖文老师的关心和帮助，她每次的建议回想起来都是我博士学习过程中的重要指引。也感谢陈阳老师，每次咨询她问题，她都在第一时间给我最准确的答案。

我要感谢我的父亲，母亲和我的妻子，是他们给予了我生活上的极大照顾和支持，才能得以让我专心向学。特别是我的妻子，农佩贤，在我就读博士的时间内，她经历了结婚，怀孕，生产和照顾孩子。她不仅仅把家照顾的井井有条，还把我们的儿子娄牧迪照顾的非常好。

我要感谢在我的博士论文写作期间给予我极大帮助和支持的深圳市 ZB 集团有限公司和深圳市 ZY 创业投资有限公司的各位领导和同事。

我要感谢我们 2017 博士班的所有同学，大家互相学习、互相进步、互相成长、互相激励。

也谨以此文献给所有曾经关心、帮助和支持过我的亲友、师长、同学和同事们。

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Chapter 1: Introduction

1.1 Research background

Emerging industries develop as a result of scientific and technological innovations, new market demands, and social progress. They are the effective forces in promoting industrial upgrade and industrial structure optimization. Their formation and development follow their own inherent logic and evolution rules. Hence, China must develop emerging industries to transform from a big manufacturing power to a strong one. However, in the early stage of the development of emerging industries, due to reasons such as small scale, immature technology, as well as imperfect infrastructure and service systems, governments should formulate and implement supporting policies to promote the growth and development of emerging industries (Cumming, 2007; Hsu et al., 2014; Y. F. Wang, 2017). Over the years, governments at all levels in China have formulated several supporting policies, such as providing financial subsidies for projects, transferring land at preferential prices, as well as tax reduction and exemption, to promote the development and expansion of emerging industries (Z. J. Yan & Yu, 2017). Meanwhile, as the saying goes "more haste, less speed," the supporting policy of providing free subsidy may lead to speculation behavior among enterprises. For example, China's polysilicon photovoltaic solar energy industry, due to the huge amount of government free subsidy and the soft fund constraint, showed an awkward situation of surplus at the initial stage, pursuing short-term interests and lacking core technologies (Dong & Zhang, 2013). Therefore, to get rid of "supporting development-rapid expansion-overcapacity-comprehensive treatment," we must fully understand the objective laws underlying the development of emerging industries and carefully study the policies and modes to support emerging industries.

The *14th Five-year Plan for National Economic and Social Development of the People's Republic of China and the Outline of Long-term Objectives for 2035* (hereinafter referred to as the "14th Five-year Plan") points out that we should carefully consider the role of venture capital guiding fund and improve the service system for enterprise innovation. Government industrial investment funds and other equity investment capital (hereinafter referred to as government equity investments) are important bodies on the equity investment market as they leveraging social capital with financial funds. In recent years, they have played an important

role in promoting the development of emerging industries, driving social investments, and so on. However, due to the constraints of personnel's professional experience, investment decision-making modes, and market environment, the foundation for professional operation of some government equity investments is relatively weak, which makes them fall into a dilemma in actual operation: if they independently choose investment targets, the limited project due diligence ability and unsmooth exit mechanism would lead to a relatively high risk of loss, putting great pressure on state-owned capital face in maintaining and increasing its value. If they follow market-oriented equity investment institutions, it would be difficult to fully reflect the guidance of industrial policies, investments in early-stage innovation projects would be insufficient, and the balance rate of equity investment capital would be relatively high. This dilemma reflects the weakened guiding effect of government equity investments in attracting social capital to support the development of emerging industries. Based on accurately grasping the actual effect of government equity investments in supporting the development of enterprises in emerging industries, considering the guiding role of government equity investments by optimizing modes and mechanisms is a practical problem that needs to be solved urgently in China during the 14th Five-year Plan period.

Shenzhen City is at the forefront of China's reform and opening-up, and has been committed to the development of emerging industries. In 2017, the added value of emerging industries in Shenzhen contributed 80% to Shenzhen's GDP growth. Government financial support has always played an important role in the development of emerging industries, and new modes and mechanisms of government financial support for enterprises have been continuously explored. In 2015, the Development and Reform Commission of Shenzhen Municipality issued the *Reform Plan for Diversified Support Methods of Special Funds for Emerging Industries*. Among diversified support methods, the focus was on introducing the equity support method. Government investment platforms were utilized to support eligible projects via equity investments, to give full play to the leverage of financial funds and promote co-investment by social capital. In addition, special funds were circulated and used through equity investments. The recovered funds continued to be used to cultivate and support the innovation and development of more enterprises, thereby improving the sustainable support ability for emerging industries. In the equity support plan, the investment mode, management structure, business process, exit mechanism, risk assessment and prevention, and others are clearly defined. The purpose is to explore new modes and mechanisms of financial investments that combine free subsidy with paid subsidy, financial funds with social capital, and government solicitation of projects with evaluation by professional organizations.

Based on the realistic background of China's economic transformation and industrial structure upgrading, combining the Shenzhen municipal government's equity investment orientation and industrial planning, and taking the Shenzhen municipal government's equity investment platform as an example, this study conducts an in-depth analysis on the characteristics of government equity investment modes and the overall effect of supporting enterprises in emerging industries. Accordingly, some countermeasures and suggestions are put forward to optimize equity investment modes and improve the effect of supporting enterprises in emerging industries.

1.2 Research objectives and significance

Increasing the leverage of government equity investment and guiding private capital to participate in and support the development of emerging industries are essential for improving the firm innovation service system and accelerating China's transformation into a global manufacturing powerhouse during the 14th Five-Year Plan. This study aims to explore the role of Chinese government equity investment in supporting the development of emerging industries by selecting a representative case in Shenzhen, in order to reveal the institutional characteristics of the government's equity support model from the level of micro-operations. The focus is on how the Shenzhen government's equity investment institutions can overcome the inefficiencies of the traditional fiscal support model by cooperating with market-oriented venture capital institutions and relying on mechanism design in the areas of equity investment ratio, pricing, and exit methods.

In-depth analysis of projects involving actual investment in emerging industry firms by a government equity investment institution in the early stages (including projects currently being invested in and projects that have already been exited) comprehensively demonstrates the actual role and efficacy of government equity investment funds in supporting the development of emerging industries. This allows an assessment of the guiding effect on private capital of government equity investment as well as the sustainability of the equity support model. Based on evidence of the efficacy of the Shenzhen government's equity investment institution in supporting emerging industries, this study summarizes, and proposes countermeasures to, the main issues with the current equity support model. The importance of this study lies in the following areas: first, it connects the two types of research of equity investment models and emerging industry support policies at the local government level in China; second, the micro-scale case study of Shenzhen supplements existing macro-scale normative discourses on the

leveraging effect of fiscal funds on private capital; and, third, it provides a research basis for optimizing the government equity investment model and policies on emerging industries.

The Chinese government's equity support model for emerging industries has altered the method of allocating fiscal funds. It is an innovation that helps government to implement industrial policies, unleash market vitality, and promote upgrading of the industrial structure. Based on the theoretical basis of the need for government intervention to overcome market failures, combined with the practical experience of Chinese government equity investment to support emerging industry firms, this study proposes a framework for evaluating and analyzing the equity support model from the dimensions of the implementation of industrial policies, guidance of private capital, improvement of corporate finances and innovation, and the sustainability of the support model. This will be valuable as a theoretical reference for understanding the allocation efficiency of government equity support funds and the growth of emerging industry firms.

This study uses as a case study of government equity investment institutions in Shenzhen, one of China's most innovative cities. It analyzes in-depth the model of government support at the micro scale and attempts to present the latest progress in the Chinese government's support for emerging industries. Through analysis and evaluation of the efficacy of equity support for targeted firms, this study summarizes the deficiencies of the existing model in terms of cooperation with market-based equity investment institutions and the design of fiscal reward and subsidy incentive mechanisms. This has practical significance for improving the operational efficiency of institutions in the case study and the effectiveness of support for emerging industries. It also has reference value for other local government equity investment institutions dealing with emerging industries.

1.3 Research content and methodology

1.3.1 Research content

This research is divided into seven chapters. The content of each chapter is as follows:

The first chapter is the introduction. It summarizes the research background, research theme, and the theoretical and practical significance of this study. It presents the framework of the research content and research methods adopted in this study, and it summarizes the innovations and possible deficiencies of this study.

The second chapter is a literature review. It first defines the scope of governmental equity-based support model and emerging industries. On this basis, it conducts a systematic review of domestic and foreign literature concerning research on the governmental equity investment that supports the development of emerging industries. The literature review is based on the research on the theoretical basis concerning the government's equity investment, empirical research on the effectiveness of supporting enterprises in the emerging industries, and factors that influence the effectiveness of supporting the emerging industries. It lays the foundation for subsequent empirical analysis.

The third chapter analyzes the current development status of the market and introduces the case that is studied in this research. The review and analysis are first conducted from top to bottom, focusing on the governmental equity investment model in China and in Shenzhen as well as the current development status of emerging industries. On this basis, the case that involves a governmental equity investment institution in Shenzhen is introduced, and its development status is presented. The institutional characteristics of the government's classic model of supporting the enterprises in emerging industries with equity investment is summarized. The topics studied include the equity investment methods, investment decision processes, and exit mechanisms.

The fourth chapter makes an overall analysis of how the governmental equity investment institution taken as the case study has supported emerging industries. Based on the function orientation of governmental equity investment in guiding social capital to co-support emerging industries, the chapter makes an overall evaluation of the "guiding effect" of the state's equity investment, which lays the foundation for the following in-depth investigation of the effectiveness of the governmental equity-based support. Based on all 85 target enterprises which received equity investment from the institution in 2015 to 2018, this chapter analyzes the full sample on the guiding effect of governmental equity investment. From the perspectives of compatibility of industrial policy orientation, intervened rounds of equity investment in the target projects, composition of the cooperating equity funds, financial performance and innovation capabilities of the target enterprises, and the return on investment of the governmental equity investment, an in-depth analysis on the actual guiding effect of the state's equity investment in supporting the emerging industries is conducted.

The fifth and sixth chapters respectively take two types of target enterprises that have received investment, namely, the enterprises that have exited and the enterprises that have re-entered the projects and further examine the actual effects of governmental equity investment in supporting the enterprises of emerging industry on a micro level. The dimensions of the

analysis of the two chapters are basically the same. The first is the financial performance of the governmental equity investment and the target enterprises, which examines the actual effect of the equity-based support on the enterprises' business performance. The second is the effect of governmental equity investment on the technological innovation of the target enterprises, which examines the effect of equity investment in supporting the enterprises in the emerging industries to conduct research and development for patent technology. The third is the cooperative relationship between governmental equity investment and institutional investors, which examines the actual effect of the professional investment institutions in choosing and motivating the social capital to co-invest.

The seventh chapter summarizes the research conclusions and the policy suggestions of the study. It provides an overall evaluation of the effectiveness of the support, summarizes the main problems existing in the current governmental equity investment model with a problem-oriented approach, and puts forward well-targeted suggestions on methods, such as improving the professional capabilities of governmental equity investment institutions.

1.3.2 Research method

The first method is a combination of qualitative and quantitative analysis. Qualitative analysis mainly consists of the recognized facts and existing theories that form the basis of relevant research in this study, namely, the implementation path and efficacy of government equity investment. Based on institutional documents related to the establishment and operation of government equity investment institutions, this study summarized and analyzed the characteristics of equity investment models, decision-making mechanisms, and exit methods. Quantitative analysis mainly relied on the collection of investment information of representative equity investment institutions, combined with the real business data of target firms. Statistical and risk measurement methods were used to measure the implementation of equity investment and the actual efficacy of government equity investment at supporting the development of emerging industry firms. For example, STATA software was used to carry out regression analysis on the main financial performance indicators of government equity investment and target firms, with both univariate and multiple regression based on panel data (F. F. Cong et al., 2019; Zuo et al., 2017) employed to examine the actual impact of equity investment on the operations of firms.

The second research method is case analysis. Using a government equity investment institution in Shenzhen as a case study, this study summarizes the main features of its operations

and evaluates the efficacy of its support at developing emerging industry firms from various perspectives, including market-based equity investment institution guidance and operational support of target firms, which provides an empirical basis for the conclusions of this study. The single case study method (J. R. Huang, 2021; A. F. Ma, 2014; Y. F. Wang, 2017) is used to present and examine the efficacy of support given to emerging industry firms by the government equity investment institution. This, to an extent, compensates for a lack of empirical research at the macro level of the market.

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Chapter 2: Relevant Concepts and Literature Review

2.1 Basic concepts

2.1.1 Governmental equity-based support model

Since the beginning of this century, the Chinese government has been accelerating the use of financial funds to invest and experiment with supporting the development of enterprises in emerging industries with equity investment. During the course of practice, governmental equity-based support models, such as special governmental funds for industries and government guidance funds have been gradually established (Z. Li et al., 2020; Y. Liang et al., 2017; L. Yan, 2016; Z. L. Zhang, 2018). The two types of governmental support model by equity investment are special existences during the phase in which China's investment and financing systems reform. They are basically the same in terms of function orientation, sources of funds, and industry investment directions. The support models aim to give full play to the leverage effect of the financial funds, attract social capital into the investment field, support the development of the enterprises at specific stages (usually the early phase) and in specific industries (usually strategic emerging industries or high technology industries). Profit is not regarded as the core purpose, but the requirements for fund security are generally higher.

Specifically, special governmental funds for industries are the financial funds used by the central and local governments to support the development of specific industries. It has always been the most direct means of the government to implement industrial policies and nurture specific industries (Du, 2013; Hua et al., 2021; Y. C. Jin et al., 2018; K. M. Wang et al., 2017). The establishment of special funds for industries is a crucial part of China's investment and financing systems reform. The establishment of special funds for industries turns the use of financial funds from a grant to an investment that has to generate returns. It has improved the performance of financial funds, and more importantly, accomplished a great task with little effort by clever maneuvers of the financial funds to promote the establishment of market mechanisms. It also guided more private funds to support the development direction of emerging industries. For a long time, with the operation of the special funds for industries, the government guided industrial development and investment behavior of enterprises, which have played an active role in realizing China's rapid economic development and promoting industrial upgrading. In the process of promoting industrial development, the central and local

governments often used special funds for industries to support specific projects to achieve their own policy intents, especially before 2008 (S. Q. Chen & Jia, 2014; H. H. Li, 2014; Zheng & Liao, 2015). The special funds are mainly established for fields, including strategic emerging industries and high technology industries, which have strong spillover effects, are of great significance to national and regional technological progress, are conducive to promote innovation, promote industrial upgrading, and drive the development of related industries. The funds also support some basic industries, and some fields that may have good development prospects and are of immense social and economic significance but are weak if they only rely on the market due to high risks and insufficient investment (Y. Y. Li, 2014; Zhong et al., 2011). In the early days, most of the special funds for industries were invested in specific projects in the form of financial subsidies. Although the government had established strict systems and standardized procedures for the management of special funds, in reality, there are certain problems in the selection of projects and the supervision after investment of funds. Some of the special funds for industries entail the problems of unreasonable allocation and unsatisfactory efficiency (Geng & Hu, 2013; M. Li & Yin, 2021). With the further clarification of the direction of the economic system reform, the decisive role of the market to allocate resources has become necessary, and the marketization reform process of the special funds for industries has significantly accelerated. The government vigorously promotes special funds for industries to "change from subsidies to investment," while some of the special funds for industries have been reformed into governmental equity funds, i.e., industrial or guiding funds.

With the standardization of the Chinese government's management over financial funds, governments at all levels have begun to promote the market-oriented operation of special funds for industries and turn the funds into government guiding funds, including industrial and venture capital funds. The establishment of a governmental guiding fund involves setting up an industrial fund or a venture capital funds with financial funds, either by sole investment or co-investment with social capital. With market-oriented methods, such as equity investment, various kinds of capital in the society are guided to invest in the key areas and weak links in economic and social development to support the development of the relevant industries and fields (H. Zhang & Wang, 2012). In 2015, the Ministry of Finance issued the *Interim Measures for the Administration of Government Investment Funds* (No. 210 [2015] of the Ministry of Finance) to regulate the investment funds established by the government. The law requires government investment funds to operate according to the principle of "government guiding, market operation, scientific policy-making and risk precaution"; the fundraising, investment, post-investment management, liquidation, and exit of government investment funds must be

market-oriented; the departments of finance are responsible for guiding the establishment of a scientific decision-making mechanism to ensure that the policy goals of the investment funds are achieved and do not participate in the daily management of the funds generally.

It is worth noting that during the "13th Five-Year" period (that is, since 2016), the special funds for industries at the central and local levels gradually transformed into government guiding funds, which include governmental industrial or governmental venture capital funds. However, the transformation of the investment models of the financial funds or the specific type of the models are not the only criterion for judging the efficiency of the governmental equity-based support (F. X. Guo, 2021; Z. L. Zhang, 2018). In reality, on the one hand, a number of special industrial funds have been successively established at the national and local levels in recent years and are continuing to operate. For example, the National Special Funds for the Development of the Cultural Industry was established in 2006; in 2020, Shanghai established the Special Funds for the Promotion of High-Quality Industrial Development. On the other hand, after the special funds for industries of some regions have been transform into industrial funds or guiding funds, the establishment of market-oriented operation mechanisms are delayed so that the effectiveness of supporting the industries is unsatisfactory (Y. Liu, 2017; J. G. Tan, 2021). Therefore, the research on the Chinese government's equity-based support model should follow the "substance over form" principle. The key is to look at the specific governmental equity-based support model's utilization efficiency of financial funds, its investment decision-making mechanism, and the actual effect of nurturing enterprises in the emerging industries.

It is worth noting that, as a governmental support model by equity investment, government guiding funds are significantly different from private equity investment funds in terms of function orientation, sources of funds, and operation methods (Z. Q. Chen et al., 2017; M. Y. Huang et al., 2015). According to the definition given by the China Association of Private Equity, private equity investment funds raise funds from specific entities in a non-public manner, and the assets of the funds are managed by dedicated fund management agencies. The funds mainly invest in equity of the enterprises or invest with other quasi-equity instruments, while also providing management and other value-added services. They generally include venture capital funds, growth funds, holding-type buyout funds, industry investment funds and other equity funds. According to the different investment stages of private equity funds, the industry divides them into categories that include seed capital, venture capital, development capital, buyout, and mezzanine capital.

To sum up, the governmental support model by equity investment investigated in this study refers to the model in which the central and local governments provide funds, with the

implementation of the government's industrial policies as the starting point, while the various types of capital in the society are guided to invest in the key fields for the sake of economic and social development; the funds are invested through the public transactions of enterprise equity, and the development of related industries and fields of strategic emerging industries are supported in the process. Equity investment funds that are purely pursuing commercial interests, and those which invest in infrastructure and public services are beyond the scope of this study. The research on the governmental support model by equity investment in this study emphasizes the evaluation of the support model itself according to actual effectiveness of the support generated by governmental equity investment. However, the discussion of this study does not focus on comparing the characteristics and the level of effectiveness of the special governmental funds for industries or the government guiding fund model in supporting the emerging industries. Concerning the case chosen for the investigation of the governmental support model by equity investment in this study, one of the core features is its cooperation with market-oriented equity funds. Therefore, this study further divides equity investment institutions into governmental investment institutions and market-oriented equity funds based on the different attributes of the equity investment funds. That is, within the scope of the equity investment model, the institutions supported by a budget allocated by the governments at various levels and established by the government alone or jointly with social capital are categorized as governmental equity investment institution. The equity investment institutions that are not supported by a budget allocated by the governments and established by social capital alone are defined as market-oriented equity funds in this study.

2.1.2 The importance of enterprises in emerging industries

Emerging industries are an important power to guide future economic and social development, while the development of emerging industries has become a major strategy for major countries in the world to seize the commanding heights of economic and technological development (Rui, 2018; Z. Sun et al., 2010). With the continuous and rapid progress of the upgrading of China's industrial structure, the concept of emerging industries is being constantly updated. In 2009, China put forward the concept of strategic emerging industries for the first time, confirming that the strategic emerging industries are knowledge and technology intensive industries with less material resource consumption, huge growth potential, and good comprehensive benefits based on significant technological breakthroughs and large development demands, playing a significant leading and driving role in the overall and long-term social and economic

development. In October 2010, the State Council issued the *Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries* (No. 32 [2010] of the State Council). Based on China's national conditions and science, technology, and industrial foundation, the document proposed to prioritize fostering and developing such industries as energy-saving and environmental protection, new generation information technology, biology, high-end equipment manufacturing, new energy resources, new materials, new energy automobiles. In this way, it clarified the connotation and development focus of China's strategic emerging industries. In 2018, the National Bureau of Statistics formulated the "Classification of Strategic Emerging Industries 2018," which included 485 categories of industries in the national economy. The classification covers nine major fields, namely, new generation information technology, high-end equipment manufacturing, new materials, biology, new energy automobiles, new energy resources, energy-saving and environmental protection, digital innovation, and related service industries. Table 2.1 summarizes China's main policies for strategic emerging industries.

Table 2.1 China's main policies for strategic emerging industries

Plan	Chapter title	Main content
14th Five-Year plan suggestions	Develop strategic emerging industries.	Expanding selected industries such as information technology, biotechnology, new energy, new materials, high-end equipment, new energy vehicles, environmental protection, aeronautics and astronautics, and marine equipment.
"13th Five-Year" National Strategic Emerging Industry Development Plan (2016)		Further develop and expand strategic emerging industries, such as information technology, high-end equipment, new materials, biology, new energy vehicles, new energy, energy-saving and environmental protection as well as digital and creative industries.
13th Five-Year Plan (2016)	Support the development of strategic emerging industries	Increase the added value of strategic emerging industries to 15% of GDP. Support the development of new generation information technology, new energy vehicles, biotechnology, green and low-carbon technology, high-end equipment and materials as well as digital and creative industries.
"12th Five-year" Plan for the National Development of Strategic Emerging Industries (2012)		Development Goals: Keep the average annual growth rate of the scale of strategic emerging industries at above 20%. Increase the added value of strategic emerging industries to 3% of GDP by 2015.
12th Five-Year Plan (2011)	Increase the added value of strategic emerging industries to 8% of GDP.	Develop strategic emerging industries such as energy-saving and environmental protection, new generation information technology, biology, high-end equipment manufacturing, new energy, new materials and new energy vehicles. Increase the added value of strategic emerging industries to 8% of GDP.
Decision of the State Council on Accelerating the Fostering and		Based on national conditions and science, technology and industrial foundation, give priority to fostering and

Development of Strategic Emerging Industries (No. 32 [2010] of the State Council)	developing industries such as energy-saving and environmental protection, new generation information technology, biology, high-end equipment manufacturing, new energy resources, new materials, new energy automobiles, etc. By 2015, the ratio of their added value in the GDP should have reached around 8%. By 2020, the ratio of added value of strategic emerging industries in the GDP should reach 15% of GDP. After efforts during another decade, the overall innovation ability and industrial development level of strategic emerging industries should have reached the leading world level.

Source: Chinese government website

Strategic emerging industries have developed into the leading industries of China, serving as pillars for the sustainable development of the national economy, being instrumental in the overall economic and social situation and long-term development. The definition of the statistical scopes of strategic emerging industries is guided by major technological breakthroughs and demands for development. Therefore, with the enhanced levels of technological development and changes in the needs related to national economic development, the content of strategic emerging industries has updated and evolved in scope and depth continuously. Since China explicitly proposed to cultivate and develop strategic emerging industries in 2010, the development plans for emerging industries at the national and local levels have continuously improved, and now involve aspects including the statistical scopes of relevant sub-industries, development directions, technical roadmaps, and product catalogs, so that the specific contents of strategic emerging industries have been further clarified in scope and depth.

Under the guidance of the emerging industry policies at the national-level, local provinces and cities have proposed local policy and plans for the emerging industries according to their own industrial foundation, comparative advantages, and long-term economic development needs. Specific adjustments have also been made on the emerging industry lists according to actual development needs (L. Chen et al., 2010; J. X. Wu & Li, 2012). Some regions have added new categories of strategic emerging industries with local characteristics according to their own situation in addition to the classification standards of the National Bureau of Statistics. For example, Guangxi has added health protection for longevity to its list, while Fujian has added the high technology marine industry. Emerging industries represent the direction of technological innovation and the direction of industrial development, reflecting the deep integration of emerging technologies and emerging industries. High technology industries have characteristics that are basically the same as emerging industries, and they generally belong to the category of emerging industries. However, some industries with relatively mature

technology but without a high potential of growth are not considered as emerging industries (J. Y. Bai, 2019).

The development of emerging industries is highly sensitive to major technological breakthroughs and large development demands. The scale of investment is large and the scope of influence is wide, which determines that the overall development of strategic emerging industries further depends on governmental industrial policies, compared with traditional industries. In particular, in the early stage of nurturing an industry, the government's support in shaping the basic environment, the guidance of technical directions, as well as preferential fiscal and tax policies tremendously influence or even determine whether the enterprises in the industry can grow and flourish. Therefore, some scholars believe that the major entities that support the development of emerging industries, especially the institutions that control various types of financial capital, including governmental equity investment, must devote major efforts to supporting strategic emerging industries, and strive to connect the enterprises and the projects. What is equally important is that the entities closely consider the changes in the state's and the provinces' policies of strategic emerging industries, especially the policy adjustments in specific areas such as the statistical scopes of relevant sub-industries, development directions, technical roadmaps, and product catalogs. Meanwhile, they must continue to communicate with relevant government departments and enterprises in emerging industries on time (L. J. Sun et al., 2022), so that they can seize opportunities promptly, and prevent and control risks effectively, based on their clear understanding of the markets and policy environment in which the enterprises of the relevant industries operate.

The development of emerging industries depends on the cultivation and growth of enterprises in the industries. This is a long-term and continuous process in which the characteristics of high investment and high risks in the initial stage are prominent, while the support of fiscal, taxation, investment, and financing policies that are strong and systematic are needed (Z. J. Yan & Yu, 2017; Yuan et al., 2021). The main problems that have become the constraints on the development of the enterprises in emerging industries appear across several aspects. The scale of venture capital is small, the financing guarantee institutions are underdeveloped, and the multi-level financial market is not perfect. The fiscal and tax incentive policies have failed to exert their effects, and support methods and policy systems need to be further improved (X. H. Li & Liu, 2013; C. Liu et al., 2011). Therefore, the relevant fiscal, taxation, and investment policies for nurturing and developing enterprises in emerging industries have to be transformed further based on the systematic review and evaluation of the current policies to create innovative taxation and financial support so that a policy system that

effectively guides and exerts the power of social investment enthusiasm can be formed.

The sustainable development of enterprises in emerging industries results from a combination of factors, including the governance within the enterprises, their R&D capabilities, financial subsidies, market support, and financial support. Compared with traditional industries, emerging industries have broad prospects for development and solid support from the potential markets. However, the absence of the aforementioned factors may lead to the failure of a single enterprise. Therefore, the "three-high" characteristics, namely high investment, high risk, and high return in emerging industries are particularly prominent. S. L. Li et al. (2022) believe that the institutions that control financial capital should take the following actions in the process of supporting the development of strategic emerging industries and planning the use of credit resources: Set foot in the industries with advantages and the key areas, review and screen the leading enterprises and major projects with reference to factors such as technological processes and equipment, resource utilization efficiency, industry chain linkage within clusters and industry concentration; Based on the market competition situation, adopt different forms of guarantees such as the pledge of charging right, pledge of asset, guarantee provided by the group headquarters or core enterprises of the group, and joint liability guarantee provided by shareholders or a powerful third party, to allocate credit funds reasonably.

From the perspective of enterprise life cycles, the development of emerging industry enterprises has obvious characteristics of undergoing various stages (C. L. Li, 2019; Y. F. Wang, 2019):

First is the introduction stage. Emerging industries in the introduction stage are essentially in the so-called seed or start-up stage. The fundamental reasons for the springing up of emerging industries are the emergence of technologies that can induce the development of emerging industries, and the integration of original technologies in industries. These constitute the driving force for the formation of emerging industries. Furthermore, the driving force may come from three different aspects: Basic or original scientific discoveries, the pull of new market demands, and the needs of national economic security and military. During the introduction stage of emerging industries, numerous creative explorations are conducted, and the economic and market values of emerging technologies are highly uncertain and subjected to tremendous risks. Therefore, the R&D start-up funds that can be invested or obtained by research entities such as enterprises and scientific research institutions are usually far inferior to the level of funds required to achieve a certain growth rate in emerging industries. It is also uncertain whether existing enterprises in traditional industries will turn to operate in emerging industries, and whether new enterprise projects will be established and implemented.

The second is the growing stage. The growing stage of enterprises in emerging industries is important for the industrialization of the R&D achievements of emerging technologies. During the growing stage, enterprise projects in emerging industries often need even more funds. Due to the constraints of financing needs, many R&D achievements that have the potential to be launched in the market may not obtain sufficient funds and fail to be launched eventually. Therefore, scale industrialization cannot be realized. Whether the projects can obtain the tremendous funds that they need depends on whether they are fully connected with market demands. Whether the industry can be instrumental in the market determines the success or failure of an enterprise, and the rise and fall of the industry. Enterprises may have to endure a lengthy process of exploring new markets for new products before they can finally win the trust of consumers and the recognition of the market (X. D. Zhang, 2021). Therefore, in the growing period, a market environment suitable for industrial development becomes increasingly important for emerging industry entities. In addition to moderate market competition, the macro-control of government in the market is also necessary.

The third is the mature stage. When enterprises in emerging industries end their growing stage and enter the mature stage, the existing experience of traditional industries in production and market competition is of lower guidance significance to the enterprises in the field of emerging industries. The fundamental reason is that the products and technologies of emerging industries are usually original, groundbreaking, and cutting-edge. In the mature stage of emerging industries, the entities in the industries have to face challenges of uncertainties in the methods of competition, market rules, and competitors. A consummate system of laws and regulations and a standardized environment for industry development can promote a healthy competition mechanism among enterprises and facilitate the establishment of an appropriate trajectory toward the sustainable development of emerging industries. The overall industry will set out more requirements for the markets of emerging industries and industry standards.

Emerging industries that have undergone the mature stage will play a stronger role in leading and influencing the supporting industries in the country and region where they are located and can have a significant bearing on the upgrade of the whole industry and transformation of the economic growth model. However, what distinguishes them from general traditional industries is that the evolution of the products and technologies of emerging industries will remain ahead of the whole industry. The emerging industries will not enter the recession period at a rapid rate, rather, their penetration into traditional industries will accelerate, and the emerging industries and other industries will integrate more deeply. In the process of penetration and integration, the next generation of emerging industries is in fact being nurtured.

Owing to the different characteristics of the development stages of emerging industries, the characteristics of the financing needs of the corresponding stages also demonstrate certain differences.

An essential task for emerging industry enterprises in the introductory stage is to develop the technology. In particular, enterprises in the seed stage remain largely conceptual and have an urgent need for start-up R&D funds to support research experiments and product creation. However, emerging industry projects in this period cannot meet banks' risk tolerance requirements. Therefore, they can employ the financing strategy of attracting capital support from individual investors and angel funds through promotion, which can be conducted by internal teams or hiring professional intermediaries.

Except for a small number of “unicorn” companies that are sought after by investors, the funds provided by angel funds, in general, may not be much compared to the financing needs of enterprises. Nevertheless, angel funds' insight and business experience in developing emerging industries can help start-ups enter the growth phase faster (S. Q. Lin & Hu, 2022). VCs generally do not interfere too much with companies' day-to-day operations but rather supervise them to improve their financial and internal corporate governance systems. This is also a critical stage when the government can provide financing support for early intervention, which, in addition to various financial support means, includes a package of preferential support in terms of initial factory buildings, land, and personnel employment. In summary, enterprises in the introductory stage exhibit the following characteristics:

- operation characteristics: high operating costs in the start-up stage, irregular financial administration and governance, and uncertain market demand
- risk characteristics: technology risks, market risks, and product risks
- financing needs: R&D expenses, management costs, and marketing expenses

During the growth stage, new products and technologies are verified and brought to the market for emerging industry enterprises. However, in the early release stage, market recognition and penetration ability are still limited. Nevertheless, they might attract the attention of potential competitors. Hence, there is an urgent need to expand marketing and promotion efforts to open up sales fully and increase capital investment rapidly. If the financing needs are not met, the enterprises may have a tight supply chain and stagnant products and, therefore, face the siege of competitors. At this point, if any of the enterprise's R&D, production and sales are disrupted due to financing constraints, it will either be unable to win consumers' trust or be squeezed out of the market by similar enterprises. As the capital flow in growth stage enterprises is relatively high, it is one of the urgent issues for them to raise funds from equity

investment institutions and banks to relieve capital pressure, which is directly related to whether the enterprises can enter the "maturity stage." In summary, emerging industry enterprises in the growth stage demonstrate the following characteristics:

- operation characteristics: faster growth in market demand; rapid expansion of production scale; competition tending to be fierce; common mergers and acquisitions between enterprises;
- risk characteristics: increased risk of competition among similar companies; subject to competitive pressure from substitute markets;
- financing needs: the purchase of equipment for expanded reproduction; research costs for product upgrades; marketing costs.

Emerging industry enterprises in the maturity stage have gone through the test of the growth period and hope to enhance products and develop more effectively. They further aim to increase their market share by the core competitiveness of product technology. Although mature companies have a certain amount of cash flow, more financial support is indispensable if they want to stand firm in the market. For financing in this period, in addition to equity capital, enterprises begin to rely more on bank loans and credit financing, including the preliminary work to start planning a public offering (Y. Q. Deng, 2016). Compared with the introductory and growth periods, the financing pressure on mature companies is generally lower, and their own operating conditions provide the financial bases for the expansion of financing channels. In the case of China, with the promotion of the construction of multi-level capital markets, emerging industries can choose to develop on regional equity exchanges or the Growth Enterprise Market in addition to private equity investment, and the qualified enterprises can be publicly listed on the Science and Technology Venture Board or the main board (L. W. Cong et al., 2018). In summary, emerging industry enterprises in the growth stage demonstrate the following characteristics:

- operation characteristics: occupying a certain market position, forming a certain monopoly power, and raising the barriers to market entry
- risk characteristics: operation risks
- financing needs: purchasing and upgrading equipment, expanding production scale, maintaining a certain intensity of investment in R&D, and increasing marketing investment to expand outlets

2.2 Evolution of the government's support models for enterprises in emerging industries

2.2.1 Research on the evolution of government support model for emerging industry enterprises

The first is the government subsidy model. For supporting the development of new industries, the direct subsidy model used to be a common approach adopted by most countries worldwide. Government subsidies for emerging industries refer to direct or indirect support of government agencies and departments or other public organizations for micro market players (business organizations). Such support is a free transfer of economic benefits, which essentially belongs to the category of government transfer payments (W. J. Li & Zheng, 2016). There are four main types of Chinese government subsidies: financial allocations, tax rebates, government procurement, and financial investment.

1. Financial allocations. These refer to the government's use of financial funds to compensate enterprises for working capital, usually allocated with strict regulations on the specific use of the subsidized funds, for example, technology research and development, purchase of high-tech equipment, or the introduction of high-level technical personnel.

2. Tax incentives. These are also called preferential tax policies or tax relief policies. The taxation department clearly stipulates that preferential tax treatment is given for relevant economic activities, such as the deduction of R&D expenses, that is, when calculating the taxable income, a certain percentage of the actual capital investment in the R&D of new technology, product, and the process is allowed to be deducted from the pre-tax income (Y. Li et al., 2022).

3. Government procurement. This is functionally equivalent to in-advance subsidies for corporate R&D activities. Enterprises in emerging industries generally have certain innovation potential, but due to different degrees of financial constraints, their innovative products remain trapped in the R&D or marketization stage, or the technology or product may be relatively mature but has not yet been recognized by the market. At this point, government procurement can support the enterprises by providing early-stage demand for relevant products or technologies.

4. Financial investment. The government should apply the leverage of financial funds to lead social capital to actively promote the continuous development of enterprises' technological innovation. Meanwhile, in a broader sense, this is one of the ways for the government to

subsidize the industry. In earlier days, financial funds were usually organized and implemented by the department responsible for the specific industry. As the mechanism of using financial funds improves, institutions and platforms specializing in equity investment start to take up the work.

With regard to direct appropriation of funds, the government usually allocates funds to enterprises for specific purposes without requesting compensation. For example, the government of Japan, an economic powerhouse in Asia, provides financial subsidies to purchasers of battery electric vehicles (M. Liu, 2013; J. X. Wang & Matsumoto, 2021). Such assistance is essentially a direct government intervention of in which the government subsidizes enterprises using financial funds when the market mechanism is imperfect and the development of emerging industries has a weak foundation. Some studies find that even though government direct subsidization of emerging industries is effective in the short term, investment efficiency is low, which is likely to lead to a low fund utilization rate and overreliance of the financed enterprises on subsidies (J. Jin, 2019; Zhu & Liu, 2011). As a result, the basic principles of market competition and survival of the fittest cannot be applied.

In the actual process of implementation, the supporting functions of government subsidies may be distorted to a certain degree. Potential effects include the shortening of decision-making processes related to subsidies and the transfer of benefits between officials and the financed enterprises resulting in "improper government intervention." A prominent example is the issue of overcapacity due to the stimulation of government subsidies in some of the emerging industries, which, despite bringing about short-term political achievements, mean that actual high-tech development can only be achieved in the long term. D. H. Yu and Lu (2015) took China's photovoltaic industry, which was vigorously developed in the earlier days, as an example and analyzed the reasons and mechanisms of the phased overcapacity that occurs in emerging industries from the perspectives of government behavior, the internal aspects of industry management, and supply. The study pointed out that both structural and institutional overcapacity occur in the photovoltaic industry. The higher the degree of government administrative intervention via various forms, e.g., financial subsidies, the more serious the overcapacity. Apart from this, some local government officials may seek economic rents from the enterprise managers in emerging industries, so the allocation of financial subsidies tends to favor enterprises with weaker technological innovation capabilities. Meanwhile, those information enterprises that play a leading role in innovation and are in urgent need of financial support may obtain less or even no subsidy funds than what they should receive. Therefore, scholars who advocate for marketization often criticize the government's direct subsidy policy

for emerging industries (J. Y. Lin & Li, 2007; Qiu, 2014).

Researchers are still far from reaching a consensus on the effectiveness of government subsidies in the development of emerging industries. On the one hand, some scholars believe that government subsidies for research and development (R&D) can effectively lower the innovative enterprises' R&D costs. Moreover, the subsidies can partially compensate for the loss of emerging enterprises caused by the fact that the private benefits they obtain are less than the social benefits, so as to stimulate entrepreneurs' enthusiasm for innovation. At the same time, government subsidies constitute a positive and clear signal to the market, which eases an industry's financing constraints and increases the R&D capital investment. An intuitive example is that enterprises that receive government subsidies can enlist the support of bank credits more easily, which proves the positive effect of government subsidies in emerging industries throughout the stages of basic research, application research, and production development (Lu et al., 2014; Wallsten, 2000). On the other hand, some scholars believe that the effect of government R&D subsidies on supporting the development of emerging industries is insignificant and may even negatively impact the development of emerging industries under certain circumstances. Based on samples from the U.S., Catozzella and Vivarelli (2011) found that the impact of government subsidies, either from the federal government or state governments, has no significant effect on the development of the business economy, and the effect may even be negative in some cases. From the perspective of the upgrade of the industrial structure, Y. Wang and Liu (2013) highlighted that in addition to hindering the independent development of emerging enterprises, simply subsidizing them may impact the technological innovation in traditional industries as well as the R&D innovation of enterprises in other fields. Jiang and Zhang (2015) further pointed out that the disproportionate allocation of government subsidies to emerging industries will hurt the resource allocation of the entire society; in particular, it reduces the allocation efficiency of financial resources.

The Chinese economy is characterized by fiscal decentralization and significant differences in regional development. Thus, from the perspective of competition between local governments, the local governments of some wealthier regions may create a differentiated environment for development as they can leverage the effect of subsidies by providing more subsidies to local emerging enterprises or implementing pertinent government procurement. To a certain extent, such strategies achieve the goal and vision of building development hubs of emerging industries. However, administrative intervention, which makes use of direct subsidies, bears obvious traces of regional protectionism that is inconducive to the innovation of emerging industries and the sustainable and healthy development of leading enterprises. Based on further investigation of

different government subsidy methods, some scholars proposed optimizing the subsidy methods, thus providing a reference for how to avoid the limitations of granting subsidies. Q. Wu and Liu (2014) studied the different mechanisms by which the different distribution methods of government R&D subsidies influence the innovation of emerging industries. The study found that the effect of a fixed subsidy is weaker than that of a proportional subsidy on promoting original innovation because a fixed subsidy does not affect the product quality decisions of pioneering enterprises in the strategic emerging industries. Using the dynamic panel data of listed companies in China's emerging industries from 2009 to 2013, Wu and Liu discovered that the fixed R&D subsidies received by listed companies had no significant effect on their innovation output, that is, their technological advancement. Considering that China's central government and local governments commonly distribute fixed R&D subsidies, the scholars suggested replacing fixed R&D subsidies with proportional R&D subsidies so as to increase the incentives for R&D innovation in emerging industries.

The loan-based support model. The sole reliance on policy-based financial subsidies will undoubtedly cause the growth and development of enterprises in emerging industries to stall due to insufficient financial support. This might also lead to a premature launch of projects in the market, and industrial development will become impossible. The financial development of financial intermediaries, represented by banks, positively affects the upgrade of industrial institutions, social technological advancement, and the improvement of total factor productivity significantly (Beck et al., 2000). The loan-based support model mainly supports the emerging industries with bank loans, by granting loans to the links that are most in need of funds, including starting-up, technological transformation, and export. For example, the European Investment Bank (EIB) was established as a special financing institution to promote the development of high-tech enterprises. The European Investment Bank has launched preferential loans, including subsidized loans and loan guarantees, to help high-tech enterprises expand (C. S. Wu et al., 2016). According to the policies of subsidized loans, the state subsidizes the interests that an industry must pay when it borrows money, to support the specific industry, and such loans are called subsidized loans. Financial subsidized loans are generally controlled by the government. It is a form of financial subsidies, the main purpose of which is to improve economic vitality and promote economic development. Loan guarantees are backed up by the state, with the government or financial institutions set up by the government guaranteeing the loan repayment of the financed enterprises.

Under the guidance of the government's industrial policies, the question is can, or should the credit resources of commercial banks be comprehensively and massively used to support

emerging industries. It involves the adjustment of the functional and business structures of Chinese commercial banks, as well as their development direction (Z. B. Liu, 2011). As we all know, as the risks of emerging industry projects are inherently high, even if commercial banks are willing to follow the government's administrative lead, the banks must overcome the inevitable obstacle of risk before credit funds can enter emerging industries. Conversely, emerging industries represent the direction and trend of industrial restructuring. If commercial banks seize the opportunities of financial demand as emerging industries develop, the service center will continue to be formed by the financing platforms of local government, state-owned enterprises, or the real estate industry where traditional manufacturing or loans are more concentrated, than the transformation of commercial banks will be in a passive position. Y. H. Chen (2022) believes that with the rapid development of emerging industries and the intensification of horizontal competition, if commercial banks adopt credit policies that are exceedingly conservative, they will eventually miss out on the benefits brought about by the development of emerging industries.

Compared with traditional industries, the strategic orientation of emerging industries is stronger, while they perform better in innovation and dissemination, are simultaneously exposed to more uncertain risks. Therefore, the institutions that provide loan support to emerging industries must lend out large amounts of funds for long terms, while facing high risks of credit default and highly uncertain returns on loan principals and interests. The life cycle of an emerging industry consists of different stages, including the cultivation, growth, maturity, and recession periods, while industries at different stages exhibit great differences in financing needs and particular financing methods. Therefore, in the general intervention process of loans, an industry's particular financing needs are analyzed according to the different stages it is in. In particular, the enterprises in emerging industries that are in the seed and start-up stages have clear technical roadmaps, immature products, small market capacity, and lack of standardized operation. In those stages, the enterprises usually need a large number of total funds for obtaining human capital, marketing, as well as technological development and innovation. However, due to the limitations of technology, market, operation and other aspects, those enterprises usually have insufficient collateral, higher asset-liability ratios, and weaker ability in credit financing. In fact, there are certain discrepancies between the financing needs of such enterprises and the commercial banks' principles of making credit decisions as well as their risk preferences, which are all market-oriented (J. S. Feng & Gu, 2019). Generally, it is difficult for enterprises to obtain loan support from commercial banks, and they usually must rely on the policy-based guarantees or re-guarantees of the government, to lay the foundation

of risk mitigation in the loan model.

Providing loans to the business activities of enterprises in emerging industries, in reality, raises the standard for commercial banks' operations. L. G. Liu and Xiao (2021) believed that because emerging industries are more sensitive to policies and have different patterns of operation compared with general traditional industries, commercial banks need to conduct in-depth analyses and screening of the policies of emerging industries, the industries, and the development of enterprises themselves, so that the basic work of supplying loans have a higher standard than when dealing with the cases of general enterprises. Due to the asset-light and high-risk characteristics of emerging industries, the banks must speed up the innovation of credit products and management methods, as well as establishing related early warning, risk-spreading, and risk compensation mechanisms. In particular, the work to control the risk of emerging industry projects also challenges the talent pool of commercial banks, as the banks will have to train and recruit a team of experts for internal reviews and a team of account managers who understand the risk characteristics of the industry projects.

When looking for ways to support the development of emerging industries by loans, China should actively learn from the experience of Western developed countries, such as the experience of Silicon Valley Bank (C. Li & Qu, 2019; H. J. Wang, 2019). First, it is necessary to establish a seamless and efficient system that provides risk early warnings, prevention, and resolution, and it is particularly important to strengthen the management of the liquidity and credit risks of target projects. To facilitate the process of credit decision and cooperation between banks, it is necessary to build service networks, ensure the supply of talent and provide relevant support, as well as implementing all-round and whole-process risk management. Second, the banks must establish a clear strategic positioning for themselves, focus on the specific targets of their credit services, instead of trying to serve all emerging industries. That is, a bank should seek to become the expert in serving some particular emerging industries. Lastly, they should aim clearly at the characteristics of the customers' needs, giving full play to the unique advantages of commercial banks in product innovation, service efficiency, and service quality, to provide custom-made, professional, and comprehensive financial service solutions to emerging industry customers.

To give full play to the role of loan models in supporting the development of emerging industries, commercial banks must make changes themselves. Commercial banks should actively adapt to the profound changes in the business environment and regard win-win cooperation as an important business philosophy for implementing the new stage of industrial upgrading. In addition to seeking business innovation and breakthroughs by themselves,

cooperation with financial peers and the government is essential for commercial banks to explore business models that support emerging industries. H. X. Chen and Zhu (2017) point out that to find their position in developing emerging industries, Chinese commercial banks must cooperate with government departments and financial entities such as venture capital companies and non-banking financial institutions. It is necessary to build a comprehensive financing cooperation mechanism of multi-in-one, multi-complementary, and risk-sharing. Creating a comprehensive financial support platform that includes banks, governments, guarantee companies, venture capital, and other entities is also important for providing integrated financial services such as loans, investment, guarantees, and consulting to emerging industries.

Equity support model. The governmental equity-based support model is a relatively new form of model. It mainly involves changing the use of special funds from a granted subsidy to equity investment. In addition to injecting funds to the enterprises' development, the one-off use of fiscal expenditures can be transformed into a recycling use of funds (C. Y. Tan, 2014; Xu & Zhou, 2021). In recent years, in order to gain advantages in the development of emerging industries, many countries have successively launched their development plans for emerging industries as well as formulating and implementing supporting measures. Such measures include financial subsidies, government procurement, the establishment of industrial development funds, and encouraging venture capital to invest in emerging industries. The measures have fostered and promoted the rapid development of emerging industries with different means relating to capital, market, and tax incentives (C. Feng, 2020). At the same time, supporting policies for industries have also aroused great concern and controversy on such aspects as financial investment performance, level playing fields for the enterprises, international trade balance, and intellectual property protection (Y. F. Wang, 2017).

From a global perspective, developed countries have a variety of industry-finance integration models to support the development of emerging industries, namely, market-led, bank-led, and government-led models. If we consider the specific types of models, the stock market-led model prevails in developed countries represented by the United States and the United Kingdom where the private economy has a dominant position. During the development of emerging industries in such countries, market-led financing tools are usually used to raise funds (J. Y. Gao, 2011; X. Q. Wu et al., 2020; Z. Y. Yang & Shi, 2015). The banking-led model prevails in countries, such as Germany and Japan, with bank-based financial systems. Those countries have developed a series of cooperation models between banks and industries, including bank special loans, bank supervision of business operations, and cross-shareholding

by banks and enterprises (L. J. Deng & Xu, 2019; Y. Wang, 2016). In emerging industrial countries, such as South Korea, due to the insufficient development of the capital market, the governments shoulder the responsibility of arrangement so that the financial allocation favors the emerging industries and assist their development. In this way, a government-led model of industry-finance integration is formed (Kang, 2016). In South Korea, the government directly takes the lead and formulates a large number of supporting policies for the industries (Y. J. Yu et al., 2020). With the implementation of these policies, a large amount of capital is invested. The development of the enterprises is promoted, and the markets are fostered with the promotion and application of technology before the growth of the enterprises in the markets is promoted.

Regarding the specific equity-based support models, the US Small Business Innovative Research (SBIR) Program is a support model that was rolled out in an earlier phase and is relatively successful. It mainly invests in small and medium size enterprises in the form of loans and equity investment before deciding whether to invest again, based on value assessments. The program has largely promoted the economic development of the US (J. X. Wang, 2006; Xun et al., 2020; L. Zhang et al., 2013). Since the US plays an exemplary role in supporting small and medium size enterprises with equity investment, other countries have followed suit successively and launched equity-based support models. Programs like the BJTU program of Germany, YOZMA program of Israel, IIF program of Australia, and the Venture Capital Seed Funding of Taiwan of China have emerged and flourished (H. J. Li & Bao, 2012; Z. Y. Zhao & Huang, 2011). Two major types of support models have been formed, namely, the loan-guarantee type of funds that operate in US and Germany and the equity-management type of guiding funds that operate in Israel.

Regarding the situation in China, the government mainly supports emerging industries by formulating industrial policies and innovating the resource allocation methods with directional and strategical considerations. When performing social responsibilities, the government usually considers the realization of economic and social development strategies instead of simply the direct costs and benefits (H. Wang, 2019). One example is the “Guiding Opinions as to Innovation on the Mode of Resources Allocation by the Government” issued by the State Council in January 2017. In recent years, the relevant state departments have also established various industrial development funds and specific supporting policies, such as integrated circuit industrial funds, financial subsidies for electric vehicles, and photovoltaic industry subsidies. Many provinces and cities across the country have also rolled out supporting policies for emerging industries (Gu, 2019; J. W. Yu, 2019). These supporting policies for industries which

feature innovative resource allocation methods by the government have important guiding significance and promotion effect on the development of China's emerging industries.

The government guiding funds in China mainly operate in the form of fund participation model and loan guarantee model. The fund participation model involves the establishment of a fund of funds by the government, attracting social capital to co-build underlying funds by equity participation to promote the development of specific fields. The loan guarantee model involves loan guarantees provided by the government to venture capital institutions and supports their capital expansion (L. Wang, 2015). Ni et al. (2013) suggested government guiding funds to adopt such models as follow-up investment, staged equity participation, risk subsidies, and investment protection based on actual situations. Z. M. Tan and Zhu (2013) compared the pros and cons of typical government guiding fund models in terms of the compatibility of policies and goals, management methods, investment efficiency, and risk control before pointing out the better models. Due to the short course of development of Chinese government guiding funds, many scholars believe that the development of China's governmental equity investment should draw on international experience, such as the European model, the Israeli model, and the American model, on the basis of China's reality (M. Y. Huang et al., 2015; Yue & Lu, 2017).

Regarding the supervision on the governmental equity-based support model, domestic and foreign scholars have conducted research on legislation, division of powers and responsibilities and institutional settings. Dou (2006) pointed out that for the standardized development of the governmental equity-based support model, the institutional rule of laws and regulations are necessary. However, the government should not interfere overly with the operation of equity investment institutions. It can play a necessary guiding role through the establishment of approval procedures and basic investment restrictions on equity investment institutions in accordance with industrial policies and regional development policies. Establish a negative list of partner equity investment institutions can be an issue to consider, Mandatory exited will be conducted for institutions with flawed corporate governance, poor investment risk management capabilities, and frequent negative public reviews. Koppel (2008)'s research concerning US SBIR provided insights from the perspective of the government's administration and management. It held that the relationship between the operation department and supervision department of governmental equity investment should not be a management relationship, and the design of the management framework for governmental equity investment institutions should be further strengthened. Based on the governmental level of local governments, S. Y. Lin and Xie (2014) and He (2019) proposed to set up institutions that provide professional and refined management and evaluation. This facilitates the effective guidance and supervision on

the investment direction and development model of governmental equity investment, while encouraging the investment in specific fields according to the regional strategic development direction during the current phase. Additionally, with tax incentives and talent support, the assessment and evaluation mechanism can be improved, and the development of the governmental support models can be promoted. H. T. Ma and Shi (2016), and Xiang and Li (2016) studied the function orientation of governmental equity investment institutions and believed that it is necessary to unify the management institutions of governmental equity investment institutions, establish a pre-planning system, improve the information disclosure mechanism and the failure tolerance mechanism on the basis of clarifying the boundaries of government functions to ensure the market-oriented operation of governmental equity investment under the institutional framework. At the same time, an information sharing platform for innovative projects should be established to breakthrough geographical restrictions, especially to increase investment opportunities in underdeveloped areas.

2.2.2 Comparative study on policy choice and experience of government equity investment

Affirming that the government equity investment is necessary to support the development of innovative enterprises, some literatures further conducted in-depth discussions on public policy options related to equity investments, examined from the perspective of public decision-making. Compared with traditional methods such as direct subsidies or loans, is equity investment an ideal way to support enterprises in emerging industries? When supporting equity investments, how do we differentiate the risk-taking and profit distribution of the public sector from that of the private sector or market-based equity investment institutions? McGlue (2002) analyzed the European venture capital market and believed that when the supply of equity investment is relatively limited, equity investments may not be applicable for all small and medium-sized enterprises since many start-up enterprises may not be favored by venture capital. The involvement of public venture capital can increase the supply of equity investment capital, thereby improving the applicability of the equity investment scheme. McGlue (2002) pointed out that compared with the relatively mature venture capital market in the United States, the equity investment market in the European Union is underdeveloped. McGlue (2002) believes that the promotion of the development of venture capital market systems such as angel investment by the public sector is the key to improving the effectiveness of the support from equity investments. Samila and Sorenson (2010) affirm the positive role of American venture capital in improving the effectiveness of government research funding. Using the panel data of

major cities in the United States from 1993 to 2002, they confirm that venture capital has promoted corporate innovation and the growth of emerging companies. This increase in the supply has significantly improved the efficiency of innovation and achievement transformation of government-sponsored scientific research. The policy of this research also provides empirical support for the public policy decision of cultivating the venture capital market. Brown and Petersen (2009) as well as Brown et al. (2012) found through research on American and European companies that almost all start-up high-tech companies used internal cash flow and external equity markets to finance R&D investments. The characteristics of R&D investment make it difficult for debt financing to replace equity financing. Further, the development of the equity investment market plays an important role in alleviating the financing constraints of the company's R&D investments.

Based on the empirical study of 32 developed countries and emerging market economies, (Hsu et al., 2014) show that industries, especially high-tech industries, are highly dependent on mature equity markets. In contrast, the development of the credit market has little effect on the R&D and innovation of enterprises in emerging industries. The study further confirms the unique role of equity investment, including government equity investment, in supporting enterprise innovation. In the latest study, Lv and Hu (2021) also point out that, from the practice of various countries, private investment institutions, represented by venture capital, play an important role in the cultivation and development of innovative projects. They believe that although China's private equity investment institutions have developed rapidly in recent years, there remains a sizable gap in the market size of private equity compared with some developed countries. Therefore, they call on the government to reduce or exempt personal or corporate income tax on personal private equity investment, encourage industry guidance funds with government background and private equity institutions to make joint investments to promote the high-quality and large-scale development of venture capital in China.

The existing literature on the effectiveness of government equity investment focus on two aspects.

One is the effectiveness of direct support to companies in emerging industries, reflected in the enhancement of the target companies' operating performance, innovation capabilities, and overall driving effect on emerging industries. However, researchers' conclusions differ in terms of the investment results of the government-guided funds. Lerner (1999) analyzed the U.S. small business innovation research plan and found that the government-guided fund had a positive effect on supporting the development of innovative enterprises.

Some studies confirm that government-sponsored enterprises enjoy higher profit margins

and more research and development investments (Aerts & Schmidt, 2008; Lach, 2002). Based on the higher performance of government-sponsored enterprises, Lerner et al. (2005) focused on creating an environment conducive to the development of the venture capital market and made recommendations for government intervention. Koppel (2008) analyzed three aspects of directors appointed by the President—supervision and coordination, reporting, and audit requirements—concluding that improving the design of the government-guided fund management framework can help improve fund performance. Guerini and Quas (2016) research suggests that government equity investment can reduce the information asymmetry of high-tech startups, assisting them to enter the private capital market. The data show that startups that receive government venture capital (GVC) are three times more likely to receive private venture capital (PVC) than startups that do not receive GVC.

However, some researchers have shown that government funds do not have a significant impact on corporate performance. Through a comparative study, Luukkonen et al. (2013) discovered that there is no statistically significant difference in the comprehensive index of added values among different investors; however, in some specific fields, the added values of different investor types are significantly different. For example, the contribution of independent venture capital (IVC) funds is significantly higher than that of government venture capital funds in several areas; including the development of business ideas, professionalization, and exit orientation. Focusing on high-tech companies, Grilli and Murtinu (2015) found that IVC funds have a greater impact on the growth of high-tech startups. In contrast, the impact of GVC on the sales of high-tech companies is almost negligible.

The second is the leveraging of social capital, which is the guiding effect on market equity investment. The empirical studies on the guiding effect of state-owned venture capital institutions have different conclusions. One type of researcher believes that state-owned venture capital platforms can alleviate information asymmetry and amplify the participation of social capital. J. Yang et al. (2009) confirmed that investing as a limited partner can effectively use the leverage effect of state-owned venture capital. Meng et al. (2010) built a model under the framework of incentive theory, confirming that fixed income return can increase the attractiveness to social capital and expand the scale of venture capitals. J. J. Sun (2018) believes that through policy-oriented effects, state-owned venture capital platforms have effectively amplified the leveraging effect of fiscal funds. Additionally, L. Guo and Guo (2018) believe that state-owned venture capital platforms narrow the funding gap for start-up and innovative companies, stimulate the development of private venture capitals, and have positive external and spillover effects on the local economy. Further, Brander et al. (2015) found that the more

government venture capital platforms in the market, the more private equity investments the company receives, and the more private equity investment institutions.

Other researchers believe that the guiding and supporting effects of state-owned venture capital platforms are not ideal. Y. Yu et al. (2014) argued that after the non-tradable shares reform, the characteristics of state-owned venture capital platforms with short payback periods, high returns, and low costs are more obvious, and lead to a greater impact on removing private capitals. S. Q. Chen et al. (2017) showed that the influence of state-owned venture capital platforms on the regional innovation level has a "threshold effect" of rising first and then dipping. Cumming et al. (2009) used simultaneous equations to empirically test the impact of Canadian government venture capital fund LSVCC on the private venture capitals and discovered that the establishment of LSVCC did not significantly increase venture capitals, but instead reduced the participation of private venture capitals. Cumming and Johan (2013)'s study on the Australian government's pre-seed venture capital project funds (PSF) expressed a similar conclusion.

In terms of foreign researchers' performance evaluation methods for the Government-sponsored equity scheme, Boyns et al. (2003) studied the performance of British enterprise investment schemes (EIS) and venture capital trusts (VCT) and selected indicators from the perspective of government equity investment institutions and project companies. The indicators from the perspective of government equity investment institutions include the impact on the project company, the effect on corporate financing, and the impact on the profitability, production capacity, and sales capacity of the project company. The indicators from the corporate perspective include the project company's management practices, corporate production costs, employee management, new product development, and employee skill levels. In Anthony and Suni (2004)'s evaluation of Israel's Yozma plan, the selected indicators include the proportion of successful investments, the capital scale, the guiding and demonstrative role of the fund, and the number of exits. The result of the study shows that Yozma plays an important role in promoting the development of Israeli startups and has a positive impact on industry growth. Cumming (2007) constructed an indicator system to evaluate the performance of venture capital funds. The indicator system includes the stage of the invested company, its industry, payment status of installments, the portfolio of investment projects, corporate cooperative investments, fund exits, and exit benefits. In the performance evaluation study on the Australian PSF project, Cumming and Johan (2009) revised the performance evaluation indicators to the stage of the invested company, its industry, the payment status of installments, the portfolio of investment projects, and the location of the fund, etc.

In the process of analyzing and evaluating the government-sponsored equity scheme, domestic researchers have made corresponding adjustments in the evaluation dimensions and specific indicator settings based on the indicators of foreign systems and domestic situations. However, in general, domestic research on government equity investment institutions lacks a unified or more authoritative method system. Based on the "Guiding Opinions on the Standardization and Operation of Venture Capital Guidance Funds," H. J. Li (2010) proposed a performance evaluation indicator system for government-oriented venture capital guidance funds. By defining the meanings and calculation methods of the five indicators, including industry-oriented indicators, direction indicators of policy support, indicators of leverage effect, indicators of the fund value, and risk control, H. J. Li (2010) provides a reference for the quantitative assessment of the Government-sponsored equity scheme.

Further, Qin (2014) studied the operational performance indicators of government equity investment institutions in domestic strategic emerging industries through the construction of the policy effect model and the corporate governance model. He empirically tested the indicators by establishing a policy effect indicator system, a corporate governance indicator system, and a sustainability indicator system. He made suggestions on broadening funding sources, clarifying social participation criteria and incentive mechanisms. C. X. Liu et al. (2015) used the Balanced Score Card Principle to design a five-dimensional performance indicator system for the government equity investment institution funds, using the analytic hierarchy process to set the weight of each indicator, and conducted an empirical analysis on Beijing Emerging Industry Venture Capital Guidance Fund using the TOPSIS model. Tang (2021) selected 21 indicators from four aspects—the public finance achievement goal, the social benefits achievement goal, the economic benefits achievement goal, and the standardized management achievement goal—as the indicator system for measuring the performance of government venture capital guidance funds. Tang (2021) conducted an empirical analysis on the construction of the performance evaluation system of the government venture capital guidance fund using the principal component and analytic hierarchy process.

2.2.3 Research on the main factors and action mechanism affecting the effectiveness of government equity support

Government equity investment plays an important role in supporting industrial innovation. However, the professional degree of the operation base of government equity investment institutions will determines whether these institutions can play a leading role in guiding social

capital to support innovation and entrepreneurship. If the government equity investment only acts as a follower, not only the guiding effect is limited, but it may also produce a "crowding out effect." Zuo et al. (2017), based on the authentication mechanism, believe that the passive "following" behavior of government equity investment platforms will reduce the participation of private venture capital institutions. Z. X. Yan et al. (2016) also identified that government equity investment institutions may reduce private capital investments in policy-oriented fields due to agency collusive issues.

Other studies on the restrictive factors of government equity investment are mainly divided into two aspects: an internal factor and an external factor. Regarding the internal factor, A. F. Ma (2014) believes that the imperfect decision-making mechanisms of profit distribution and investment of venture capital platforms have led to the inefficient operation of government equity investment funds, thus restricting the effectiveness of support. Shan (2014) believes that the funding of government equity investment platforms lacks continuity; some state-owned venture capital platforms only have sufficient early funds. The decline in subsequent funds will lead to shrinking investment capacity. In addition, insufficient investment experience, repeated establishments of institutions, and irrational performance systems will weaken the actual supporting role of government equity investments.

For the second is the external factor, the imbalance of regional economic development and the industrial system has caused certain differences in the guiding effect of state-owned venture capital platforms. M. L. Yang et al. (2014) believe that in areas with underdeveloped economies, due to the underdeveloped equity investment market, government financial funds play an important and effective role in guiding the participation of social capital. In provinces with mature equity investment markets, government equity investment tends to crowd out social capital. The credit environment also affects the effectiveness of support from government equity investment institutions. A high-quality credit environment provides comprehensive services for venture capital platforms and enhances investor confidence.

Rapid progress of science and technology and the development of emerging industries since the start of the 21st century mean that emerging industries are increasingly effective at improving regional and national innovation, transforming and upgrading the industrial structure, and enhancing national competitiveness, so they have attracted widespread attention from scholars and politicians alike. Discovering how to foster emerging industries and promote their growth has become important to all countries. During this process, it is vital that the government supports the development of emerging industries through equity investment, whereby government uses fiscal funds as leverage to guide and promote their development in various

ways. As such, government has an irreplaceable role in the healthy and orderly growth of emerging industries (X. J. Hu & You, 2013; Minniti, 2017; Wan & Zhong, 2018). The existing literature includes in-depth research on the mechanisms of government equity investment used to promote the development of emerging industries. Transmission and influence mechanisms can be divided into the following three types.

First are the mechanisms that improve research and development (R&D) investment channels of firms. In the start-up and growth stages, and even in the maturity stage, firms usually face two problems: a lack of R&D funds and the risk that R&D outcomes will not meet expectations. The R&D funding of firms usually comes from internal or external sources (Q. W. Bai & Lv, 2014; Qian & Zhang, 2017).

In their start-up, growth, and even maturity stages, enterprises generally face two challenges: a lack of R&D funds and risk of R&D results failing to meet expectations. The R&D funds of enterprises generally come from two channels: internal operations and external financing (Qian & Zhang, 2017). For enterprises in rapid development fields, especially technology-based SMEs, their operating surpluses are often unable to support their R&D investments. Using SWOT and other methods, Q. W. Bai and Lv (2014) found that when a venture investment is initiated, especially in the R&D stage of SMEs of science-technology, the problem of funding sources for the venture in the R&D stage of SMEs for science and technology in China can be effectively solved by introducing venture investments, including diversified capital from private capital, large state-owned enterprises' capital, foreign capital, and technology innovation funds. Firms undergoing rapid development often lack surplus funds to invest in R&D. The risk-return structure of traditional financing channels, such as bank loans, do not satisfy the financing requirements of corporate R&D investment, and technology firms often fail to meet access requirements (J. Zhang, 2020). Moreover, it takes time for R&D innovations to be launched as products, during which no profit is made, and there is the risk that R&D will fail, but traditional financing channels require firms to pay regular interest, which increases financial costs and squeezes corporate profits further. Government equity support, however, effectively alleviates the problem of firms having insufficient funds for R&D investment (Y. Hu & Ruan, 2017; X. Y. Zhang & Qi, 2016). With capital support, firms can afford to invest in R&D, which enhances their technological innovation. Based on the data of 20 OECD countries from 1970 to 1995, Carlin (2009) pointed out that, compared with bank credit, industries with access to external equity spend more on R&D. Government investment funds can also provide multiple rounds of investment to a firm. Ensuring there are necessary controls in terms of the firm's R&D risks, it can continue to support R&D as required during

the R&D investment stage. As well as providing capital support, government investment funds can coordinate the R&D resources required by firms, such as links with colleges, universities, and scientific research institutes to support R&D development. This is consistent with the thinking on the resources required for R&D Kortum and Lerner (2000) and the wave of innovation in the United States driven by venture capital.

Second are the mechanisms that increase the size of firms. From the perspective of financing funds, after a firm obtains fund investment, its cash flow for development is supplemented, and its financial situation improves (Luo & Chen, 2020). As well as increasing R&D investment, the firm can increase investment in fixed assets, including new factories, production equipment, and raw materials, or intangible assets. It can also recruit quality personnel to improve its R&D and operations management.

From the perspective of a financing fund, the cash flow that is needed for development is supplemented and the financial situation is optimized after the enterprise receives investments from the fund (Luo & Chen, 2020). While increasing R&D investments, enterprises can increase the purchase of fixed and intangible assets, such as the construction of new plants and production of equipment and raw materials. Moreover, it can further recruit high-quality talents to improve R&D and business management. In addition to financial support, the government investment fund entering the enterprise will help improve corporate governance and coordinate the required resources for the enterprise, further strengthening its management and development capabilities from both internal and external aspects, and helping it to expand its scale. With the support of the fund, the scale of enterprise development will be expanded. J. R. Huang (2021) conducted a case study on Contemporary Amperex Technology Co., Limited, and concluded that a government-funded industrial investment fund can provide sufficient funds for enterprise R&D investments by driving social capital, which can effectively stimulate the R&D output of enterprises for science and technology. Moreover, government-funded industrial investment funds and social capital as institutional investments can provide external constraints for enterprises to improve corporate governance, which can help reduce the agency costs between shareholders and enterprise management, thus significantly improving the efficiency of enterprise technological innovation. After obtaining the support of a buyout fund, enterprises can conduct external mergers and acquisitions in the industry or its upstream and downstream industrial chains, to achieve rapid scale expansion. After gaining control of the acquired enterprise, it can use the products, channels, technologies, and related resources of the acquired enterprise to effectively integrate with its own corporate development, further accelerate its development, and strengthen its scale expansion effect.

If a firm receives support from a merger and acquisition (M&A) fund, it can carry out M&A within the industry or upstream and downstream firms in the industry chain to achieve rapid growth. After obtaining control of an acquired company, it can use the products, channels, technologies, and related resources of the acquired company to accelerate its own development and strengthen its expansion.

Third are the mechanisms that create value for the firm. The guiding stage of a government investment fund is the basis of its value creation. Through the establishment of the fund, the traditional method of financial subsidies and spending financial investments have been changed. The efficiency of the use of financial funds has been also improved, and the foundation for its value creation effect has been laid. At the same time, by guiding social capital to achieve capital agglomeration, the scale effect of capital is strengthened, further enhancing the value creation capability of the fund (S. Huang et al., 2011). Y. Chen (2020) studied the value creation effect of buyout funds in China, based on the "buyout fund with A-share listed companies plus PE type" and its impact, by using an event study and propensity score matching method. He concluded that the establishment of buyout funds by listed companies has a significant value creation effect, which is highlighted by the fact that the establishment of buyout funds by listed companies can lead to excess returns on the companies' share prices. However, the value creation effect of setting up a buyout fund is relatively insignificant in the long run compared to comparable listed companies without buyout funds. Besides, the participation of major shareholders or senior executives in buyout funds may weaken the value creation effect of buyout funds on listed companies. In the transmission stage, the value creation effect of government investment funds is reflected in two aspects: on the one hand, it is the value creation effect of the fund itself; on the other hand, it is the value creation effect of the fund in helping enterprises to realize value creation. The value creation effect of both aspects can be quantified at the time of the fund's exit. The value creation effect of the fund itself is reflected in due diligence and other investment procedures. The fund managers make full use of their professional ability, industry experience, and market resources to create the most accurate judgments of enterprises, thus achieving a selection of high-quality enterprises in various industries. Funds help enterprises to realize the value creation effect, mainly through capital support and providing value-added services (F. X. Li et al., 2015). According to Ren (2019), new R&D institutions can often secure sustainable capital appreciation by forming venture capital funds based on their own technological advantages. With the support of capital, the cash holdings of enterprises increase rapidly, and the enterprises can further increase their R&D investments. Data from New Third Board listed companies indicates that the higher the intensity

of R&D investments from high-tech listed companies, the more desirable the profitability indicators (L. X. Liang & Zhang, 2005). W. H. Wu and Wan (2019) conducted an empirical analysis of high-tech SMEs on the New Third Board of China from 2010 to 2013 using a hierarchical regression method, and concluded that high-tech SMEs that received various types of funds, including a government equity investment fund, tended to have more progress in R&D projects; thus, they were able to reduce R&D uncertainty and help improve their capital market valuation level. In addition, in terms of value-added services, fund managers can provide a range of expertise, management experience, market resources, and effectively improve corporate governance to promote rapid growth of enterprises. In the process, the value creation capability of the enterprise is gradually improved, and the value creation effect is amplified.

The existing research on supporting emerging industries has arrived at differing conclusions due to different research objects and perspectives. However, these studies discuss the necessity and feasibility of developing emerging industries for a country's economic development and industrial upgrading and the necessary safeguards for developing emerging industries. Previous studies summarize and compare the current development status and future direction of emerging industries through qualitative analysis and demonstrate their realistic conditions and inherent risk characteristics. Many studies analyze emerging industries from the perspective of the macroeconomic policy system or a specific industry segment. However, few scholars discuss the development issues of emerging enterprises from the microeconomic perspective. Moreover, research at the enterprise level often focuses on evaluating the financing environment, supporting models, measuring the innovation ability of enterprises, etc., in isolation. The is a lack of literature on the in-depth discussion of the government's equity support model and the actual support effect.

This study is also inspired by the existing literature on the relationship between innovation in emerging industries and financing constraints and the relationship between enterprise innovation and government behavior. Regarding the research on the relationship between enterprise innovation and financing constraints, the opinions of the academic community are relatively consistent. Enterprises are faced with financing constraints to varying degrees, restricting their R&D innovation. From this point of view, eliminating the financing constraints is a key part of the government's supporting role in equity investment. The research conclusions regarding the relationship between corporate innovation and government behavior are relatively divergent. Some believe there is an incentive effect, while others believe there is a certain crowding-out effect. However, considering the current situation in China, we argue that the government's "visible hand" will objectively bring more incentives to the development of

emerging industries while following the laws of industrial development. Of course, attention should be paid to the possible negative impact on enterprise R&D innovation during actual operation.

Most relevant research on the government's equity investment model and support effectiveness focuses at the industry, market, or institutional level. Such empirical research has not reached consistent conclusions due to differences in sample objects and time ranges, and the research ideas have certain limitations. Externality theory emphasizes the quasi-public goods' characteristics of technological innovation products. The free-market mechanism that completely excludes government intervention cannot solve the problem of technological innovation spillovers, which also proves that appropriate government intervention is essential. However, will the government's intervention in the market fail due to its defects (such as rent-seeking behavior)? The externality theory argues that this shows the necessity and importance of a well-regulated economic governance system. The theory emphasizes that market failures are objective, even in mature market systems. Although government intervention may also fail, it is possible to improve governance and service capabilities through institutional changes. Additionally, continuous improvement of relevant regulatory measures can be implemented to create a good institutional environment for the growth and development of emerging enterprises through visible hands to promote the optimal allocation of social resources, including innovation resources.

Most relevant research on the government's equity investment model and support effectiveness focuses at the industry, market, or institutional level. Such empirical research has not reached consistent conclusions due to differences in sample objects and time ranges, and the research ideas have certain limitations.

(1) There are problems with supporting data. Empirical tests of the effectiveness of government equity investment support at the macro level rely on large sample data, but the equity investment market does not have mandatory information disclosure requirements like the open market, so there is a lack of comparable, continuous, and complete venture capital data. This makes it difficult to ensure the robustness and validity of empirical results.

(2) There is an issue with endogeneity. The omission of market policy factors may have caused a weak correlation between the establishment of government equity investment institutions and market expansion. Moreover, results have been guided by the proportion of early-stage target investments, but over time there will inevitably be an increase in the proportion of later-stage target investments.

(3) Studies have overlooked micro-level characteristics. Aggregate and structural analysis

at the macro level does not reveal the impact of micro factors, such as the specific investment model and decision-making mechanisms, of government equity investment on the efficacy of support given to emerging industry firms, and the conclusions and suggestions made may accord with the practical reality of government equity investment.

Based on the existing literature, as well as a general summary of government equity investment practices at the macro level, this study selects a representative firm to analyze, with the focus on summarizing micro-scale institutional characteristics of the model of government equity support for emerging industries, so as to demonstrate the actual efficacy of that support.

(1) This study is backed up by basic data. The entity in the case study is a government equity investment platform of Shenzhen municipality with special designation in the state plan. Audited and revised financial data was collected of all the fund's target firms in the period 2015-2018.

(2) The issue of endogeneity is resolved. Case analysis can go deep into the micro level of firms and clearly reveal the leveraging and amplifying effect of government equity investment in leading private capital, thereby showing the actual impact of equity investment on the financial performance and innovation capabilities of target firms.

(3) This study focuses on micro-scale characteristics. By looking at a target firm's characteristics, such as industry distribution, private capital composition, and investment round distribution, it is possible to conduct a targeted evaluation of the efficacy of government equity investment firms in reforming the investment model. Moreover, a case study can avoid the differential aggregation effect between targets in multiple case studies, allowing a clearer and more thorough discussion of the characteristics of the government equity investment model.

2.3 Theoretical basis for government equity investment to support emerging industries

The capital of government equity investment comes from fiscal funds and has the attributes of public capital. Innovative entrepreneurship in the high-tech field has high information asymmetry and strong externalities. Therefore, state-owned venture capital platforms that embody the nature of public services should intervene to overcome market failures (J. Zhao & Yuan, 2021). F. F. Cong et al. (2019) points out that in the face of the venture capital market failure caused by information asymmetry and strong externalities, state-owned venture capital, as one of the important public resources, must support entrepreneurial innovation. D. K. Yang and Li (2012) believe that under the effect of economies of scale and scope, state-owned venture

capital platforms can reduce the marginal innovation costs of enterprises through supporting innovation activities and increasing the quantity and quality of technological innovation enterprises. The involvement of state-owned venture capital platforms makes innovation costs lower than the marginal income of innovation, thereby creating market conditions to attract social capital to support innovation and entrepreneurship. Cumming et al. (2009) believe that the financing gap caused by the high risk of innovative companies cannot be completely filled by the support from private capital.

Many governments can effectively alleviate this problem through the intervention of guidance funds. Brander et al. (2015) find that public venture capital activities pay more attention to those investment projects with positive externalities, and projects that have received state-owned venture capitals can obtain private capital sponsorships with more ease. J. Zhao (2019) indicated that the joint establishment of funds by state-owned venture capital platforms and market-based venture capital institutions is conducive to diversifying the high risk of investing in early-stage science and technology companies, thereby attracting social capital to enter the venture capital market. From the perspective of public finance construction, J. H. Yu and Yang (2009) proposed that the establishment of a government venture capital fund based on local financial resources and economic development level is conducive to improving the efficiency of financial funds, effectively guiding various types of social capital to invest in fields in line with industrial planning. Given the uneven development of regional financial resources and equity investment markets, state-owned venture capital funds can be an effective means to support the development of innovative enterprises. Massimo et al. (2016) believe that the government-guided fund can help achieve broader policy goals. Its investment decisions are determined not only by return on investment but also by enhancing the overall driving effect of innovative enterprises on the industry growth by amplifying the participation of social capital.

The next section will analyze the theoretical underpinnings of government equity investments in supporting the development of emerging industries based on the externality, financial intermediation, principal-agent, and industrial structure theories.

2.3.1 Externality theory

The first fundamental theorem of welfare economics asserts that a well-functioning competitive economy is able to achieve a Pareto-optimal allocation of resources without the need for government intervention. On the other hand, an effective allocation of resources may lack consideration of the fairness of allocation and harbor uncertainties about its ability to meet the

needs of different sectors of society. Furthermore, the assumption of a completely competitive market on which welfare economics is premised is unachievable in practice. In other words, resource allocation entirely determined by the market is very unlikely to be imperfect and some degree of government intervention in economic activities is necessary, especially in circumstances where the resource allocation scheme extends beyond the personal interests of individual investors.

Welfare economics holds that some goods carry externalities, which arise when the provision of such goods brings about beneficial or adverse effects on others, for which no payment of reward or compensation is warranted to or from them. Additionally, externalities are divided into positive ones (external economies) and negative ones (external diseconomies). Goods with positive externalities tend to generate a positive spillover effect, benefitting other market entities that do not seem to be directly related. Government equity investments in high-technology enterprises are quintessential examples of goods with positive externalities.

The positive externalities conferred on the general public by government equity investments are primarily manifested in several ways, including: funding support for new technology industries whose development should be a priority of the national economy; facilitation of the R&D innovation of enterprises for more diverse consumer choices and better consumer welfare; assistance for small and medium-sized enterprises that have recruited the most employees to promote the level and quality of employment; and advancement of social and public welfare work and environmental protection projects. Instead of being restricted to the investor and the company invested in, the positive effects of government equity investments at the micro level will certainly spill over to the overall economic sphere. Consequently, this will lead to positive effects on aspects such as industrial optimization and technological innovation, as well as economic prosperity and increased employment, for which no payment is made by other market entities.

The externality theory constitutes the theoretical underpinnings of government equity investments. Positive externalities are the reason that government equity investments have become a substitute source of good supply, as they create a shortage of effective supply of private equity, especially in the field of high-risk technology investment. Moreover, pure public goods are those with extremely favorable externalities for which the government is theoretically the sole provider. The government's role in industrial transformation can be positioned as a provider of public goods and services and a producer of the positive externalities of equity investments that create a favorable environment for the development of enterprises in emerging industries. One of its intervention approaches is to expend its fiscal funds on equity investments.

The externality theory suggests that using fiscal funds to leverage social capital and promote the rationalization and advanced transformation of industrial structures is an effective solution of great significance to the problem of externality embedded in the process of industrial upgrading.

In modern economics, government equity investments are important embodiments of the government's public finance function. One of the characteristics of public finance is that the government uses its own revenue and expenditure activities to provide public goods and funding support, guide the rational flow of resources, mitigate negative externalities, and accentuate positive externalities, thus realizing a Pareto-optimal allocation of social resources. This characteristic of government functions implies that the government makes equity investments to assist the market and carry out appropriate interventions to facilitate the effective allocation of fiscal funds and innovation resources.

Externality theory emphasizes the quasi-public goods' characteristics of technological innovation products. The free-market mechanism that completely excludes government intervention cannot solve the problem of technological innovation spillovers, which also proves that appropriate government intervention is essential. However, will the government's intervention in the market fail due to its defects (such as rent-seeking behavior)? The externality theory argues that this shows the necessity and importance of a well-regulated economic governance system. The theory emphasizes that market failures are objective, even in mature market systems. Although government intervention may also fail, it is possible to improve governance and service capabilities through institutional changes. Additionally, continuous improvement of relevant regulatory measures can be implemented to create a good institutional environment for the growth and development of emerging enterprises through visible hands to promote the optimal allocation of social resources, including innovation resources.

To solve externality problems, it is important to maintain intervention methods' flexibility and follow the incentive-compatible system design principle. The efficiency of government intervention in the market is not necessarily lower than that of the private sector, and it is no exception in supporting the development of emerging industries. However, if we rely only on the free competition of enterprises under the guidance of market mechanism, it will be much more difficult for the emerging industries to grow, which, to a certain extent, results from the widespread and unsolved problems of externalities, information asymmetry, monopoly, and public goods supply in the market. Government agencies have natural advantages in encouraging economic activities with positive externalities, restraining bad market transactions, and reducing transaction costs. Therefore, supporting the development of emerging industries,

promoting technological progress, and industrial upgrading are also the natural responsibilities of the government.

2.3.2 Theory of financial intermediation

The modern economy cannot operate without the structure of various types of financial intermediaries. These are the institutions or entities that act as a medium or bridge between the supply and demand sides in the process of financing, generally consisting of financing institutions (such as commercial banks) and other non-bank financial intermediaries such as investment institutions and guarantee institutions. As an intermediary organization that organizes direct investment funds providing funding to invested enterprises, government equity investment institutions belong to the category of financial intermediaries. The core issue of financial intermediation theory can be found in a theoretical discussion of the necessity of financial intermediaries, and its principal ideas include the following:

(1) Financial intermediation can improve market failures and reduce transaction costs for all market participants. Financial intermediaries can improve market allocation by providing funding when the fundraising party is subject to independent liquidity shocks. Financial intermediaries can also act as a "liquidity reservoir" to reduce liquidity risks for all parties in the market, for example, by addressing the lack of liquidity of intellectual property rights of high-tech companies.

(2) Financial intermediaries can reduce transaction costs incurred as a result of information asymmetry. The demand and supply sides of funding are often either not instantly matched due to information asymmetry or have to bear the cost of searching for and verifying each other’s validity. Financial intermediaries have the advantage of effectively spreading the cost of searching for investment opportunities among many investors and fundraising parties. This obviates the need for individual investors to incur search costs. Financial intermediaries can leverage their expertise to conduct efficient searches for investment projects and, once a project that appears to be a profitable investment has been identified, it can be shared with other investors, resulting in significant savings in transaction costs and culminating in mutual benefits for the parties involved.

(3) Financial intermediaries are capable of effective risk diversification to achieve asset value creation. In the process of fundraising, financial intermediaries often play the dual role of asset trading and risk management agents, managing and allocating the risks borne by each participant to realize the value of assets. Financial intermediaries not only act as "agents"

between savings holders and investors but also provide added value to their clients by transforming the structure, maturity, scale, location, and liquidity of financial risks through financial product innovation.

Government equity investment funds are innovative financial intermediaries, and financial intermediation theory provides important theoretical support for the value of their establishment, functional positioning, and development direction. Government equity investment has created an effective path to guide the transformation of savings into investment for emerging industries. Since China's reform and opening up, the structure of national savings in China has undergone obvious changes, highlighted by the gradually declining trend of the proportion of savings in the government sector as the main saving entities which are now in the hands of the private sector. In this way, how to better allocate the private sector savings absorbed by commercial banks has become a key issue for economic development. As financial intermediaries, government equity investment funds have created a path to transform residents' savings into investment and support the development of emerging industries by guiding various types of private capital in society through financial contributions. This enables funds from the private sector, which otherwise could be subject to certain constraints, to go directly to the enterprises with capital needs in the form of investment money, especially companies in the high-tech industry. While effectively allocating savings resources and serving as an impetus to contributions from private capital, the operation of government equity investments also helps boost the implementation of the government's industrial policies.

For the investment activities of emerging industries, the actual controller or innovator of the enterprise is in an advantageous position in terms of information compared with equity investment institutions. Further, since the non-exclusive characteristics of innovative R&D projects of emerging companies are more prominent, innovators usually tend not to actively release information related to innovation projects, especially if it may hurt financing. This situation aggravates the information asymmetry between emerging companies and venture capitalists, making the problem more common and severe than in ordinary enterprises.

Conducting in-depth due diligence before deciding on a capital investment project to lower the risk of equity investment as much as possible is an established norm for equity investment institutions. The institutions glean more information about the investment projects through research and thoroughly evaluate the value of the investment targets, including the prospects of the technologies, the return on investment, and the entrepreneurs' professional conduct. Capital venture firms also alleviate the potential risk of investment losses due to information asymmetry by increasing the cost of using equity investment funds. This leads to additional premiums in

the cost of using equity investment, resulting in higher actual financing costs for innovation enterprises when they raise funds through external financing than through endogenous financing. This can also explain why the actual amount of investment in emerging industries is lower than the theoretical optimal level. This further illustrates that, since the performance of the financial system, including that of the equity investment institutions, is slow, the ability of external financing channels to solve information asymmetry is weak. Therefore, emerging enterprises lack necessary financial support and face varying degrees of financing constraints.

Widespread information asymmetry in the equity investment market is a problem, resulting in high costs for investment institutions and fundraising enterprises to search, identify, and verify the information before a cooperative tie can be built. Government investment funds are generally established by government departments at all levels or through the government's injection of capital into market-oriented equity investment institutions. Their government background provides credibility and they are well received in the market, which can alleviate the problem of information asymmetry and thus reduce transaction costs for all parties. In the actual operation of government equity investment, the parties involved reach a consensus based on the partnership agreement and the risk allocation is also clarified. Simultaneously, government investment funds are generally managed by professional investment institutions and operated in accordance with general market practice. There is a risk control department embedded in the process of each project's due diligence, investment agreement signing, and post-investment management, which endows government equity investment operations with a stronger sense of risk control and risk management.

2.3.3 Principal–agent theory

Whether government equity investments are organized as limited partnerships, corporations, or contractual funds, they all operate fundamentally on the premise of the separation of ownership (investment) and management control. As shareholders or investors, the administrative authorities involved usually pursue, above all else, the maximization of socio-economic benefits and return on equity investment (such as the sustained and healthy development of emerging industries), while the actual management involved tend to prioritize the maximization of personal gains (such as personal compensation reports and social reputation). The interests and appeals of the two parties are not fully aligned in actual practice. The management of government equity investments may take advantage of the information asymmetry between the two sides in practice to make overly aggressive investments and take excessive risks in the

investment decision-making process in hopes of generating high returns in the short run. They may be motivated to do so for a handsome performance bonus, evidently at the expense of shareholders' (investors') interests. This will then give rise to a principal–agent problem between the shareholders (investors) and the management, which concerns the principal–agent theory in economics.

The principal–agent theory was developed by scholars and experts studying information asymmetry and the problem of corporate incentives. It focuses on analyzing the "principal–agent problem" arising from the divergence of interests and appeals between the principal and the trustee under information asymmetry. It also casts light on agents' compensation incentives and the problem of risk sharing from several perspectives including information asymmetry, divergence of interests, and uncertainty of the agent's operational performance. In a principal–agent relationship, the inherent differences in the personal pursuits of the principal and the agent result in the inevitable divergence and conflict of interests.

Due to reasons such as the highly variable nature of the external environment, limitations of individuals, and information inequality between two parties, it is not possible to produce complete contracts. Under most circumstances, the inferior party in information asymmetry has great difficulties discerning the behaviors of the superior party and can only access the outcomes of operational behaviors after they have occurred. It is also difficult for the inferior party to evaluate whether the negative consequences are associated with poor operational and management behaviors on the part of the superior party. Therefore, moral hazard is prevalent in incomplete contractual relationships, and it is imperative that business owners seek a suitable check-and-balance mechanism to lower their agency cost. When applied to the specific context of government equity investments, the above problem may lead to collusion between fund managers and the invested enterprises, or even corruption of government agents and tunneling of interests. The check-and-balance mechanisms proposed by Chinese experts and researchers consist of two main types: internal incentives and external regulation and control. Rooted in the separation of ownership and the right of operation in a corporation, the former attempts to transform agents into owners of the company. During the design of equity incentives, efforts are made to ensure that the agents hold part of the company's shares, to "assimilate" them and subsequently shift the role of professional managers from employees to owners. The second type includes supervision over major shareholders and external threats of potential institutional mergers and acquisitions. How the principal–agent problem in the model of government equity support is effectively resolved will have direct bearing on its actual effectiveness in supporting emerging industries.

2.3.4 Industrial structure theory

China's government equity support models, including industrial investment funds, were initially introduced to support the development of specific regions or industries. Most government equity investments are implemented by focusing on one or more interconnected sectors or industries. The significant impact of government equity investment on the social economy often manifests itself in promoting the overall development of a sector or industry (especially strategic ones), such as emerging future sectors such as the Internet and the new energy industry.

Entrepreneurs are at the core of innovation. Their innovation activities are the driving force behind advances in technologies, upgradation to the industrial structure, and transformation of the economic development. Using new means of production, entrepreneurs combine various production factors and conditions to bring out new products or services, which is a crucial micro-foundation for industrial transformation. The innovation activities of an enterprise can result in technology spillover effects and drive the development of other industries and enterprises, in addition to raising the enterprise's own value. On the one hand, some enterprises raise their corporate value by imitating and utilizing the innovative technologies of core enterprises. On the other hand, in response to the competitive pressure brought about by emerging enterprises, organizations actively or passively innovate themselves and achieve technological advancement collectively, driving the optimization and upgradation of the entire industrial structure and, finally, promoting the sustained and rapid growth of the economy.

The "spillover effect" of innovative enterprises has to be maximized to promote the continuous upgradation of the industry, and necessary support from the government is particularly crucial in the process. According to the externality theory mentioned in the above sections, if we rely solely on a market mechanism that operates on the basis of free competition, the innovative activities of entrepreneurs may not be active, especially in the face of increasingly complicated technological advancement. Moreover, without continuous innovation activities, the spillover effects of innovation will dissipate, thereby halting industrial upgradation and economic growth. Therefore, in terms of the upgradation of the whole industrial structure of an economy, the practice of providing equity investment to enterprises in emerging industries by government departments or public institutions will trigger a healthy cycle between enterprises' innovation activities and industrial upgradation. Today, the reliance of global economic development on technological advancement is exceptionally high, and the competition between countries for technological innovation and industrial upgradation is also

the fiercest in history. Against this background, major economies, especially emerging market countries, accelerate their enterprises' innovation with public capital and use this as a powerful lever to achieve upgradation of local industries and take up a favorable position in future industrial and technological competitions with other countries (J. Bai et al., 2021).

Industrial economics focuses on the dynamic relationship between various industries and the patterns of organizational structural changes of enterprises within an industry with economic development and industrialization at the core.

These connections and linkage modes can be investigated from two perspectives: first, from the angle of "quality," it dynamically reveals the overall trend of the changing technical and economic connections and the linkage modes between industries, to discover the laws governing the superseding of leading or pillar industrial departments at different stages of economic development and the corresponding "structural" benefits, thus forming a narrow sense of the industrial structure theory. Second, from the angle of "quantity," it statically studies and analyzes the proportional relationship between technical and economic quantities regarding industrial connections and the linkage modes in a certain period of time, that is, the proportion and comparison of "input" and "output" quantities within and between industries, to form the industrial relations theory. The broad industrial structure theory includes the narrow industrial structure theory and the industrial relations theory.

According to the theory of industrial structure, different stages of industrial development, that is, different levels of industrial structure transformation, are closely related to the structure of economic resource endowment, the development of the financial system, transaction complexity, and types of risks, which necessitates matching the resource endowment structure with the industrial development level to minimize operation and transaction costs. Endowment factors include both tangible structures such as energy structures, transportation systems, and communication systems, and intangible economic structures such as the financial system, talent system, and regulation and control. Nonetheless, these endowment factors have the properties of public goods to varying degrees. As a significant driving force of industrial structure transformation, innovation, to a certain extent, features the non-competition of consumption and the non-exclusiveness of benefit; that is, it satisfies the two basic characteristics of quasi-public goods. Therefore, from the perspective of promoting the continuous upgrading of industrial structures, the supply of innovation as a public good is bound to be insufficient if it relies solely on the market, and there is an urgent need for the timely and effective intervention of government equity investment institutions.

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Chapter 3: Government Equity Support to Emerging Industry Firms: The Case of ZY Venture Capital

This Chapter consists of a summary of Chinese government equity investment and the development of emerging industries, as well as a case study of Shenzhen ZY Venture Capital Co., Ltd. ("ZY Venture Capital"). This allows analysis of a typical model of government implementation of equity investment to support emerging industry firms as well as the functions of a state-owned venture capital platform. This enables us to determine the main characteristics of the government equity investment model, including investment methods, investment decision-making processes, and exit mechanisms, which will lay a foundation for subsequent empirical analysis. ZY Venture Capital was chosen as a case study based on the following three considerations. First, Shenzhen has always been at the forefront of China's reform and opening up, and it is also at the forefront in terms of reform and innovation of government equity investment models and the development of strategic emerging industries. Hence, selecting a Shenzhen government equity investment platform as the research object aligns with the research theme of this study. Second, ZY Venture Capital is an important platform through which the Shenzhen government supports emerging industries. Since its establishment, its performance and the efficacy of its support have been recognized by local government and fully examined by the market, so it has significant research value. Third, it was possible to obtain documents and materials pertaining to ZY Venture Capital through compliance channels, including complete financial data on investment projects since its establishment, which provided a complete basis for in-depth research and analysis.

3.1 China's governmental equity investment in emerging industries

3.1.1 Development of governmental equity investment

(1) Analysis on the development of Chinese government equity investment

The development of China's governmental equity investment started at the beginning of this century. The National Development and Reform Commission promulgated the *Interim Measures for the Administration of Startup Investment Enterprises* in 2005 and for the first time clearly stipulated the establishment and operational rules of venture capital enterprises. With the continuous improvement of the regulatory system and support policies for the equity

investment industry, China's equity investment market has boomed in the past 10 years. According to statistics from the Ministry of Science and Technology, the average annual growth in the number of equity investment institutions and the managed capital in China exceeded 40% from 2010 to 2019; startup capital increased from CNY 240.7 billion to CNY 998.9 billion, which is a more than 4-fold increase in scale. However, during this rapid equity investment market expansion, structural deficiencies have become prominent.

One obvious problem is that the proportion of investment flowing to start-up projects and high technology industry projects is not high. As of the end of 2019, the proportions of the cumulative number of high-technology enterprise projects that received investment and the cumulative amount were 40.1% and 34.5%, respectively. Since 2010, on average, more than 40% of equity investment in China occurs in traditional industries, while in the same period, the proportion in the US is less than 20%. The cumulative amount invested in start-up projects by equity investment institutions in China accounts for 24%, and the proportion in the US is about 40% (Zuo et al., 2017). This situation shows that the role of equity investment capital in supporting the development of emerging industries is weak. In response, the government has adopted a series of measures, the most direct of which is to exert the guiding effect of state-owned venture capital, thereby motivating social capital to co-support development in innovative industries.

From the perspective of the development of governmental equity investment institutions, 2017 can be regarded as the dividing line in the past 10 years, showing obvious characteristics of phased changes. Before 2017, China's governmental equity investment went through early exploration, with special regulations for governmental equity investment institutions successively introduced to clarify their nature and positioning, sources of funds, operating principles, management and supervision, as well as the risk control of the governmental model.

Government investment institutions experienced a growth spurt from 2014 to 2016. According to the data from PEdata.cn, from 2014 to 2016, there were respectively 95, 365, and 499 newly established governmental equity investment institutions nationwide, with a three-year compound annual growth rate of 113.9%, and the target sizes of funds were CNY 327.1 billion, CNY 1636.3 billion and CNY 3730.8 billion, respectively, with a three-year compound growth rate of 368.8%. After 2017, with the gradual expansion in the number and scale of government institutions approved by local governments at all levels, the problems of duplicated policy goals, low fund utilization, and greater risks have become increasingly prominent.

The government's goal began to shift to tighten the budget constraints on governmental equity investment institutions, and to enhance the guiding effect and efficiency of relevant

financial expenditures. In recent years, some local governments have revised their administrative measures. Revisions have been made on aspects including the capital contribution ratio, entry barriers, registration requirements, and performance evaluation systems, moving towards refined investment. After 2017, the number and target size of newly established governmental equity investment institutions nationwide have decreased year by year. From 2017 to 2020, there were 265, 160, 128 and 102 newly-established governmental equity investment institutions respectively, with a compound annual growth rate of -32.8%. The target sizes were CNY 2,648.5 billion, CNY 1,370 billion CNY 944.6 billion and CNY 516.4 billion, respectively, and the compound annual growth rate dropped to -39%. As shown in Figure 3.1.

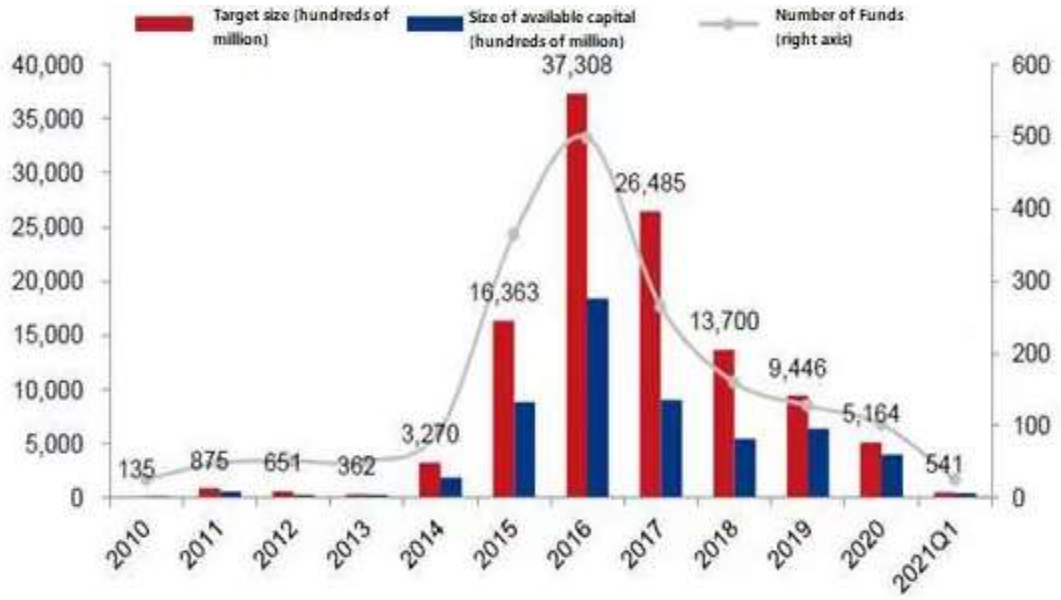

Figure 3.1 Target sizes and number of equity investment institutions set up by all levels of government (as of 2020)

Source: Zdatabase

Looking at the geographical distribution of governmental equity investment institutions, the number of institutions in Jiangsu, Zhejiang, and Guangdong (the province where Shenzhen is located) rank among the top in the country. As of 2020, there are 212, 163 and 160 institutions respectively. The fund sizes of the governmental equity investment institutions in Beijing, Guangdong and Jiangsu rank among the top in the country with CNY 1,715.1 billion CNY 658.2 billion and CNY 362 billion, respectively. The reason why the amount of Beijing's governmental equity investment funds is significantly larger than other provinces is that many national governmental equity investment institutions are headquartered in Beijing. Although the number of institutions is only 90, the total scale is far ahead that of other regions. As shown in Figure 3.2.

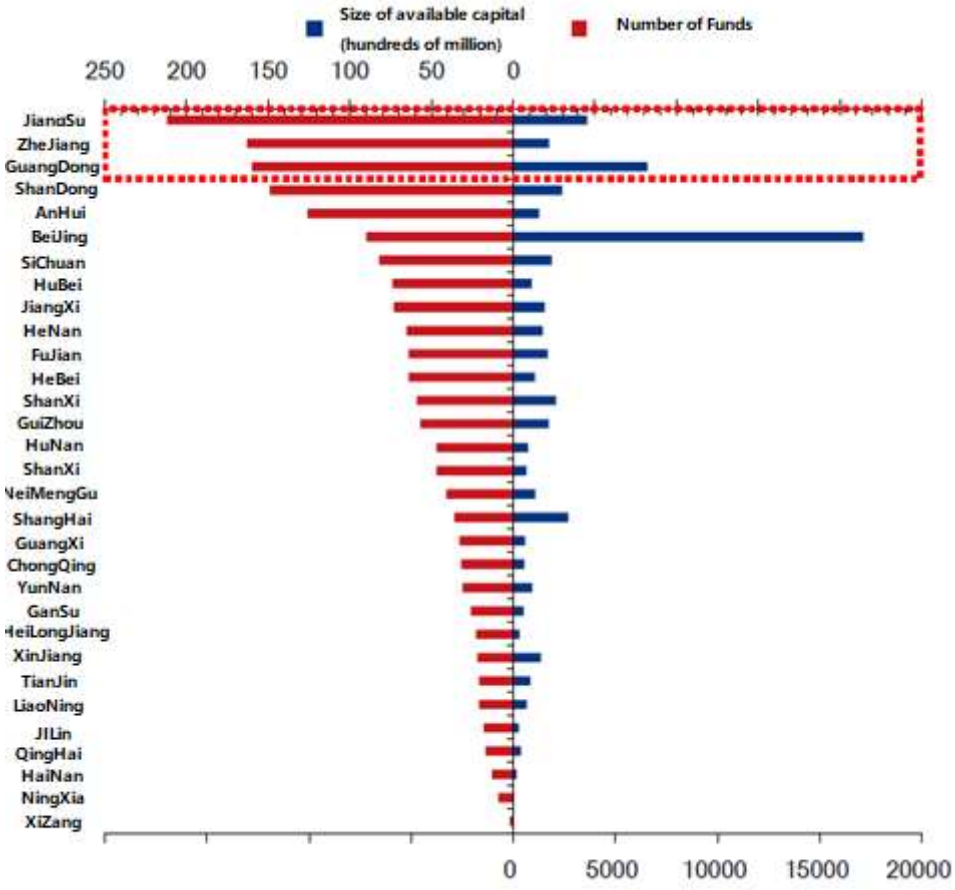

Figure 3.2 Numbers and fund sizes of equity investment institutions set up by provincial and municipal governments (as of 2020)

Source: Zdatabase

At present, the proportion of direct or indirect governmental investment in China's equity investment market has exceeded 30%, but the above-mentioned shortcomings have yet to see fundamental change, and the problems of the governmental institutions themselves have become more prominent.

The first problem is a serious level of homogeneity. Government guiding funds are an important source of governmental equity investment. At present, the number of guiding funds set up at provincial, municipal, and district/county levels exceeds 1,800, with a total target size of over CNY 8 trillion. This leads to homogeneity among governmental equity investment institutions at different levels in terms of investment directions and models. As usable funds and social resources, government's ability to endorse credits, local high-quality projects, and professional talent support decay down the levels, some governmental institutions, especially the low-level venture capital organizations, find it difficult to fulfill their roles of leading social capital and assisting innovation and startups.

The second problem is deviation from the position of state-owned venture capital.

Governmental equity investment institutions face risks in the process of selecting investment targets and investing. Poor management or slow growth of target enterprises will make it difficult for the investment capital to flow and obtain stable returns. Therefore, some governmental equity investment institutions have initiated project financing, equity investment of a debt nature, or investment of a debt nature. They ceased to engage in proactive management and rely on interest to obtain income, so as to avoid investment risks and pursue stable returns. Others conspired with the target enterprises or social capital and have suffered investment losses. Such behaviors are contrary to the original purpose of the venture capital funds.

The third problem is the low capacity to lead social capital. Social capital has little willingness to participate in governmental equity investment, and it is common to see delayed availability or unavailability of social capital in actual investment. In order to encourage such investment, some governmental institutions raise funds in the form of "equity investment of a debt nature," which is attempting to attract social capital with the endorsement of the government's financial resources. This exacerbates the hidden debt risks of local governments. Investment concentration restrictions have further weakened small-scale governmental equity funds' ability to offer guidance. Under the pressure of ensuring "the maintenance and appreciation of state-owned assets," governmental equity investment passively follows the investments of market-oriented institutions. The decision makers focus on ensuring returns when selecting the projects in which to invest, while investment and the support for innovative enterprises in the start-up stage remain insufficient.

Overall, the reform and innovation of China's government-backed equity investment institutions should be geared toward the development of such aspects as non-profit status, market-driven operations, and realization of guided industrial policies. Specifically, the nature of non-profit status is determined by the state-owned capital attributes of government-guided funds. Therefore, the main purpose of establishing government equity investment capital is not to earn profits for the government, but to give full play to the guiding role of government policies and effectively solve the resource allocation problems caused by market failure, while providing funding to the investment market for emerging industries. This is where government equity investment institutions differ from commercial capital equity partners. "Market-oriented operation" means that government equity investment institutions should operate in accordance with the rules of the market and strengthen the integration of internal and external resources to maximize economic and social benefits. The premise of attracting and leveraging social capital is that the guided fund can operate in accordance with market-oriented rules. At the same time, it can urge social capital to operate in a market-oriented, efficient, and reasonable manner. The

purpose of industrial policy orientation is to attract social capital into strategic emerging industries supported by the government, especially high-tech industries, to promote the upgrading of the industrial structure and to drive the industrial optimization and economic development of the region. Meanwhile, with the government's credit endorsement, efforts are made to give full play to the leverage effect of the capital in attracting market capital to supply the venture capital market.

Shenzhen's equity investment market leads the country in overall development, but common and individual problems present themselves. Especially since the implementation of the new asset management regulations in 2018, the supervision has restricted the entry of various funds, making it more difficult to raise funds in the equity investment market. In addition, the impact of COVID-19 and Sino–US trade frictions have worsened fundraising problems. In this context, the state has also alleviated the difficulties of fundraising by establishing national funds, encouraging insurance funds to participate in market investment, and supporting the establishment of bank wealth management subsidiaries. However, due to fierce industry competition and the strengthening normative requirements for fundraising, the "Matthew effect" whereby the larger industries have an even larger share of the available funds in Shenzhen's industry is even more pronounced. To judge from the ever-increasing size of a single fundraising effort, more and more funds are flowing to the top institutions in the city, and the problem of fundraising difficulties for small and medium-sized institutions remains prominent.

Despite Shenzhen's nation-leading post-investment service system, it is still not in the same league as developed foreign markets and cannot meet the demands of current invested companies. Investee companies require that investment institutions not only inject capital, but also seek to provide them with value-added services to make them bigger and stronger, including recommending outstanding talents, connecting with potential partners, helping companies achieve industrial transformation, and improving their management level. At present, more and more venture capital institutions in Shenzhen have begun to form specialized teams to provide post-investment management services. The post-investment work, which used to be a main responsibility of the investors, began to be shared and undertaken by a full-time team. At present, most companies' post-investment services focus on executing investment agreements and tracking the operation of the invested projects. Special attention is paid to post-investment risk control. However, more needs to be done to provide value-added services to the invested projects. In the future, Shenzhen equity investment institutions need to further increase their investment in post-investment services to improve their capabilities in that area,

and to provide such services as strategic planning, governance structure improvement, and M&A investment for invested projects, assisting invested companies to sharpen their competitive edge.

(2) Analysis on the development of equity investment of Shenzhen Municipal Government

Shenzhen constitutes the forefront and successful model of China's reform and opening up. The financial industry, including governmental equity investment, has played an important role in Shenzhen's reform, opening up, and modernization. Shenzhen's equity investment industry started operation more than 20 years ago. After several rounds of economic cycles, Shenzhen has developed into one of the three major cities for venture capital investment in China. According to data from the Local Financial Regulatory Bureau of Shenzhen Municipality, 4,493 management institutions of private investment funds have registered in the region as of the end of 2020, while 15,100 funds have already been registered, with both ranking second in the country. The size of managed funds is CNY 1.9 trillion, ranking third in the country, second only to Beijing and Shanghai. The sizes of the above indicators are all twice those of Zhejiang, Guangdong (excluding Shenzhen) and Jiangsu. In addition to benefiting from strong local economic development, the rapid development of Shenzhen's equity investment industry is closely related to policy support as well as the high-quality and efficient administrative services provided by the local government for equity investment institutions. In 2003, Shenzhen exercised its special zone legislative power to issue the *Regulations of Shenzhen Special Economic Zone on Venture Capital,* which is the first of its kind nationally. In 2010, 2014, and 2017, the city successively rolled out special policies relating to the promotion of equity investment development: the pilot program for overseas investment by qualified domestic investment enterprises, the pilot program for foreign-invested equity investment enterprises, and promotion of the development of venture capital. Shenzhen took the lead in establishing the country's first Angel fund of funds, with a size of a hundred million and 100% of its funds invested in business-incubator projects in the seed and start-up periods. A number of venture capital enterprises with domestic influence that fully represent Shenzhen's local brands has emerged.

The development of Shenzhen's governmental equity investment model leads the country. Shenzhen provides policies that facilitate market-oriented investment for state-owned venture capital enterprises, which has further increased the sources of funds for market equity investment. In 2019, due to the particularity of the venture capital industry, the State-owned Assets Supervision and Management Commission of Shenzhen Municipal People's Government implemented reforms. Since then, the state-owned venture capital enterprises

under the administration of Shenzhen enjoy the same rights as market-oriented equity funds, including market-oriented and facilitated investment decision-making, post-investment management, and investment exit mechanisms; such state-owned enterprises are also exempted from the regular procedures of asset appraisal and economic behavior approval. This has greatly improved the transfer efficiency of equity held by state-owned venture capital enterprises, greatly increased the variety of funds provided by market-oriented equity funds, and maximized the advantages of the superposition of "power of state-owned assets + marketization vitality".

In recent years, affected by factors such as changes in the macroeconomic environment and policy adjustments such as the direction of regulatory policy, the development of Shenzhen's equity investment industry has faced difficulties, including problems in fundraising and a lack of high-quality investment targets. Government-funded equity investment institutions have also been affected to a certain extent. In recent years, areas such as the Yangtze River Delta Region have continued to increase investment as well as fiscal and tax support for such fields as venture capital, advanced manufacturing, and biomedicine. This objectively produced a "crowding out" effect on Shenzhen's equity investment and the projects receiving such investment. The effect of Shenzhen's equity investment, which focuses on injecting funds to early-stage small projects and the technology industry in a long-term manner, needs to be furthered.

3.1.2 The development of emerging industries

(1) Analysis on the development of China's emerging industries

Since the "13th Five-Year Plan," China's strategic emerging industries have on the whole achieved sustained and rapid growth, and their role of being the new drivers of economic growth has expanded. In terms of industry, the enterprises larger than the designated size for strategic emerging industries had seen an average annual added-value growth rate of 10.4% from 2015 to 2019, which was 4.3 percentage points higher than the total added value of all industrial enterprises above the designated size during the same period. The industrial enterprises above the designated size of the strategic emerging industries had seen an average annual growth rate of added value of 8.4% in 2019, which was 2.7 percentage points higher than that of all industrial enterprises above designated size in China during the same period.

In the service industry, the service enterprises above the designated size of strategic emerging industries witnessed an average annual operating income growth rate of 15.1% from 2015 to 2019, which was 3.5 percentage points higher than all service enterprises above the designated size in China during the same period. The service enterprises above the designated

size of the strategic emerging industries saw an average annual growth rate of operating income of 12.7% in 2019, which was nearly 3 percentage points higher than that of all service enterprises above the designated size during the same period.

New leading enterprises continue to emerge in strategic emerging industries nationwide, and the leading effect of the continuous growth of industries as an engine is significant. The State Information Center conducted a survey on more than a thousand typical strategic emerging industry enterprises in the fourth quarter of 2020, and revealed that their overall development is still accelerating under the influence of a series of stable growth policies, with all indicators rising. The characteristics of innovation-driven development have been further clarified. At the same time, the industry's internal development structure is imbalanced. The coronavirus pandemic and the unstable international situation have brought a degree of uncertainty to the development of strategic emerging industries. The next step is to focus on risk prevention to ensure stable development of these industries. As China's economy recovers, the developmental momentum of the Strategic Emerging Industry Prosperity Index further accelerates. Prosperity has reached its highest point in the first two years, fully returning to the pre-pandemic level. Most enterprises have overcome tremendous difficulties and achieved good performance.

Although the development of strategic emerging industries themselves is relatively rapid, a different picture emerges when their proportion in the GDP is considered. In 2019, China's strategic emerging industries accounted for 11.5% of GDP, with an increase of 3.9 percentage points from 2014. It is worth noting that China's "13th Five-Year Plan" has stated that "we will work to ensure that the value-added of strategic emerging industries reaches 15% of China's GDP." Judging from the proportion in 2019, China has a long way to go before reaching that goal.

Next, a comparison is made between regions, taking Shenzhen and Shaanxi as examples (both regions had a total GDP of about 2.6 trillion in 2019). In 2019, Shenzhen's strategic emerging industries had an added value of CNY 1.01 trillion, accounting for 37.7% of GDP in that year. In 2019, the added value of Shaanxi's strategic emerging industries was only 276.6 billion, accounting for 10.7% of GDP in that year.

The development of strategic emerging industries is also examined from the internal perspective of the industrial sector. First is the number of legal entities. According to the data disclosed at a press conference held by the State Council Information Office on the results of the fourth national economic census on November 20, 2019, at the end of 2018 there were 66,214 legal entities for industrial enterprises above the designated size engaged in strategic

emerging industries, accounting for 17.7 percent of all such legal entities above the designated size, an increase of 37.9 percent compared with 2013.

Second is the amount of added value. According to the Statistical Communiqué of the People's Republic of China on 2019 National Economic and Social Development, the value added of the high technology manufacturing industry (this includes manufacture of medicines, aircraft and spacecraft, electronic and communication equipment, computers and office equipment, medical equipment, instruments, and meters, as well as information-industry chemical products; high technology manufacturing industries have a smaller caliber than strategic emerging industries, and do not include new energy vehicles, new energy, energy-saving and environmental protection, and creative digital industries) was up by 8.8 percent, accounting for 14.4 percent of that of all industrial enterprises above the designated size.

Third is the growth rate. From 2016 to 2019, the average annual growth rate of strategic emerging industries' industrial added value was 10.5%, which was 4.4 percentage points higher than that for industries above designated size in the same period. The average annual operating income growth rate of strategic emerging service industries was 15.2%, which was 3.9 percentage points higher than the operating income of the service sector in the same period.

(2) Analysis on the development of information industry in Shenzhen

Shenzhen has been a pioneer in the development of strategically emerging industries and has established six major directions for the development of industries, including the Internet, biomedicine, new energy, culture and creativity, new materials, and new-generation information technology. In 2014, Shenzhen issued the *Outline Development Plan of the Shenzhen National Innovation Demonstration Zone (2015-2020)* to set up the only National Innovation Demonstration Zone named after a city in Mainland China (other similar zones have been established in Zhongguancun in Beijing, East Lake in Wuhan, and Zhangjiang in Shanghai). In recent years, the scale of emerging industries in Shenzhen has expanded, with an added value making up a relatively high proportion of GDP (see Table 3.1).

The development of Shenzhen's strategically emerging industrial sectors can be traced to the strategic transformation of China from an investment-driven economy to an innovation-driven economy. Since the beginning of this century, especially after the 2008 financial crisis, the Chinese government has created a flexible environment for the development and introduction of new technologies, products, and business models through reforms. With an industrial innovation model that features the connection of research breakthroughs and industrialization and the coordination of demand and supply, a new path that drives growth using new technologies and new industries has been carved out. Meanwhile, areas of high

consumption in emerging businesses have also been developed. Open innovation (sino-foreign cooperation) has been adopted to enhance the innovation capabilities of enterprises. Emerging industries have begun to take shape and occupy an increasingly important position in the growth of the national economy.

In March 2015, the State Council of China issued S*everal Opinions on Deepening the Reform of Systems and Mechanisms to Accelerate the Implementation of Innovation-driven Development Strategies*, which stipulates that "Mass Entrepreneurship and Innovation" is the new engine for the economic development of Mainland China. The State Council has also proposed further improvement of the international competitiveness of strategically emerging industries, such as energy-saving and environmental protection, new-generation information technology, and new energy, in *Several Opinions on Accelerating the Cultivation of New Competitive Edges in Foreign Trade*. Taking the new-generation information technology industry as an example, the government has proposed growth policies, such as opening the broadband access market to the private sector, facilitating tri-network integration, and accelerating the use of big data and cross-border e-commerce. Policies and measures that comprehensively support the development of strategically emerging industries will be introduced in succession in the future, creating a favorable investment climate for relevant sectors in the Shenzhen market.

Equity investment in Shenzhen can provide opportunities for the expansion of sectors related to emerging industries. There is a market-oriented mechanism that features risk-sharing and benefit-sharing for direct financing, in which the sources of funds and risks are relatively dispersed, and it has a better ability to serve the real economy, especially innovative start-ups and small and medium-sized enterprises. As an important market for direct financing of Chinese enterprises, Shenzhen's strategically emerging industrial sectors frequently encounter new development opportunities. At present, Shenzhen's ChiNext, where most enterprises in emerging industries are listed, ranks second only to Nasdaq in terms of size, among all second-board markets in the world. ChiNext has formed a group of small and medium-sized technology enterprises from seven major national strategically emerging industries. In the next step, to meet the requirements of the registration system reform, Shenzhen will seek to expand ChiNext's size and implement policies, such as guidelines for emerging industries on industry-specific information disclosure, which will be conducive to the listing and development of more enterprises in emerging industries.

Regarding the development of Shenzhen's strategic emerging industries, Shenzhen has actively responded to national strategic planning and regarded the development of strategic

emerging industries as an important breakthrough in driving economic and social development. Since China proposed vigorously cultivating strategic emerging industries in 2008, Shenzhen has continuously planned and promoted their development. The city has completed formulating plans for 11 strategic emerging industries, namely biotechnology, Internet, new energy, cultural and creative industries, new materials, new-generation information technology, energy-savings and environmental protection, marine, aerospace and aviation, life and health, robots, wearable devices, and smart equipment. The statuses of strategic emerging industries as a pillar and its development goals have been determined. From 2018 to 2020, the added value of strategic emerging industries in Shenzhen increased annually.

After more than 10 years of development, the total volume of strategic emerging industries in Shenzhen has reached a new level. The industries' contribution continues to increase, leading Shenzhen's economic development model to gradually shift from labor-intensive to capital- and technology-intensive, and gradually upgrade from "Made in Shenzhen" to "Shenzhen Creation." With the continuous optimization and adjustment of the industrial structure, the ten districts of Shenzhen are now devoted to constructing strategic emerging industry parks and bases according to industry characteristics. A number of growth nuclei exist, while technological innovation capabilities have also been significantly enhanced, and the influence of enterprises and brands has increased. By 2020, the added value of Shenzhen's strategic emerging industries has reached CNY 1027.2272 billion, an increase of 3.1% year on year, accounting for 37.1% of the region's GDP. Among them, Shenzhen's new-generation information technology industry is the most advantageous segment. In 2020, Shenzhen's it had an added value of CNY 489.345 billion, accounting for 47.64% of Shenzhen's strategic emerging industries. Refer to Table 3.1 for details.

Table 3.1 Growth rate of the added value of Shenzhen's strategic emerging industries from 2018 to 2020 (%)

Strategic Emerging Industries	2018	2019	2020
New generation information technology	52.12%	50.08%	47.64%
Digital economy industry	13.55%	15.72%	15.59%
High-end equipment manufacturing industry	11.64%	11.28%	13.44%
Green and low-carbon industries	10.82%	10.68%	11.94%
Marine economy industry	4.61%	4.82%	4.16%
New material industry	3.99%	4.10%	3.26%
Biomedical industry	3.26%	3.33%	3.97%
Strategic Emerging Industries	100%	100%	100%

Source: Statistics bureau of Shenzhen municipality

As a center of science and technology innovation and of the financial industry in China, Shenzhen has a concentration of capital, thriving financial innovation, outstanding R&D capabilities, and a strong industrial foundation. It has already established a sound system of

collaborative interaction between innovation, entrepreneurship, and venture capital, and is beginning to form a whole-process innovation ecological chain consisting of basic research, technical research, industrial applications of results, and sci-tech financing. It is also building a sci-tech finance ecosystem that is “enterprise-based and market-oriented and deeply integrates industry, universities, research, and capital.” According to data from the Bureau of Statistics of Shenzhen Municipality, at the end of 2019, Shenzhen had a total of 3.28 million commercial entities, accounting for 2.7% of the national total and 26.2% of the total for Guangdong Province. R&D investment is equivalent to 4.2% of GDP, and Shenzhen has been the leading Chinese city in terms of international Patent Cooperation Treaty applications for 16 years straight. The city is home to 17,000 international high-tech firms, 14 colleges and universities, and 132 sci-tech incubators, and it is a world leader in the fields of 5G, gene sequencing, drones, and new energy vehicles. Innovation starts with technology and is built on finance. The financial industry is Shenzhen’s foremost pillar industry. It contributes one-seventh of the city’s GDP and a quarter of its tax revenue with just 1% of the population. In the 28th Global Financial Centers Index compiled and released by the British think tank Z/Yen Group, Shenzhen ranked ninth worldwide.

3.2 Overview of Shenzhen ZY venture capital’s development

3.2.1 Course of development

According to the reform plan for diversified support methods of special funds for emerging industries (hereinafter referred to as the "reform plan"), relevant supporting documents and the entrusted investment agreement approved by Shenzhen municipal government, Shenzhen ZY Venture Capital Co., Ltd. (ZY Venture Capital) was established in 2015. It is a market-oriented and specialized equity investment fund management company, wholly-owned by Shenzhen Capital Operation Group Co., Ltd. Since 2015, as an entrusted management institution for equity investment by Shenzhen’s financial funds, it has engaged in work relating to equity-based subsidies and supported the development of strategic emerging industries together with such industrial authorities as the Development and Reform Commission of Shenzhen, the Industry and Information Technology Bureau, and the Committee for the Development of Military-Civil Fusion. The company engages in the venture capital business; venture capital consultation; and providing management services for startups.

As one of Shenzhen’s city-level national state-owned venture capital platforms focusing on

equity investment in strategic emerging industries and future industries, ZY Venture Capital is the product of Shenzhen's reform and innovation in promoting a support model for emerging industries. Through the establishment of ZY Venture Capital, the government aims to exert equity investment's support in nurturing emerging-industry enterprises, maximizing the motivation for investment by social capital, expanding the scale of investment in emerging industries, and improving the standardized support mechanisms for emerging industry projects. In its overall operating system, ZY Venture Capital introduces market-oriented and professional equity speculators as partners, leveraging its professional advantages to establish a professional evaluation system to overcome the potential inefficiency problems and moral hazard caused by a traditional investment model that involves direct government review of projects. As a directly-responsible entity, ZY Venture Capital is responsible for the follow-up supervision of the use of equity investment funds in emerging industries, and is committed to improving the quality and efficiency of support plans for special funds. A cycling and scrolling mechanism for the use of special funds has been formed through equity investment, in which the return of principal is used to nurture and support the innovative development of more enterprises, and enhances the governmental equity investment institutions' capacity to sustainably support emerging industries.

Since its establishment, ZY Venture Capital has been actively fulfilling its responsibilities as an investor, conducting professional management, continuously offering value-added services, actively introducing factor resources, facilitating the development of investee enterprises, providing strong support for the invested small-and medium-sized-enterprise clusters to enhance their foundation, and guaranteeing the standardized operation and value increase of the managed funds. Based on years of pilot operation experience, ZY Venture Capital has been exploring and tapping into potential in terms of capital flow mechanism, incentive and restraint mechanism, quality control mechanism, focus of support, integration of market and policy, and tapping into the service potential of state-owned capital, in order to fully release the market-oriented and professional advantages of state-owned capital and deepen the support for Shenzhen's industrial policy through ZY Venture Capital's services. In summary, it has played a role in continuously enhancing the foundation of major players in key industrial clusters and facilitating Shenzhen to build up its advantages, strengthen its shortcomings, and further sharpen its competitiveness amid the new round of scientific and technological revolution and competition among cities.

As of the end of October 2021, ZY Venture Capital managed financial investments worth around CNY 1,426 million (including CNY 500 million in agricultural product funds), and the

amount of fiscal equity funds totaled approximately CNY 926 million, corresponding to 98 equity projects covering seven strategic emerging industries in the city, including next-generation information technology and high-end equipment manufacturing. The vast majority of enterprises have continued to grow steadily after receiving equity funding, with their total revenue growing at a compound annual growth rate (CAGR) of 15% and their total assets increasing at a CAGR of 24% over the past three years. The invested projects have been financed approximately 90 times on a cumulative basis, with the refinancing amount exceeding CNY 7 billion, leveraging social capital investment over seven times the amount of the fiscal investment, and the overall valuation of the holdings of financial investment has increased by over 150%. As of the end of October 2021, four enterprises have been listed through merger and acquisition (M&A) and restructuring, two enterprises have been listed in the A-shares market, and the initial public offering (IPO) applications of two enterprises have been approved and are awaiting listing. Based on current stock price, the company's paper profit derived from its holdings in Chipsea Technologies (Shenzhen) is approximately 26 times the amount of the initial investment. The company is assisting seven enterprises with their IPO applications. Among the invested projects, six enterprises have been evaluated as technologically advanced "little giant" enterprises by the Ministry of Industry and Information Technology.

3.2.2 Management structure

ZY Venture Capital focuses on Shenzhen's strategic emerging industries, serves Shenzhen's state-owned assets and industrial authorities, and serves major development projects, such as the "dual districts" construction. It supports the development of emerging industry enterprises in Shenzhen through "market-oriented investment + functional investment." At the company level, a co-investment mechanism for core team members ensures that they are deeply bonded to the fund's overall interests; a standardized corporate governance system and a sound internal control system have been established to implement effective control of company management, business development, financial management, and risk management, among others.

At the level of management decision-making, members of the investment committee have rich investment experience and backgrounds in relevant industries; any investment decision made by the investment committee must be approved by 80% or more of committee members before external investment can be made; fund assets are controlled by qualified custodians and operated in a close-end manner; fund operation status is regularly disclosed to investors in a true, accurate, and complete manner. At the project level, a project team conducts independent

due diligence, and the due diligence of the business, financial, and legal departments occur independently; the independent internal audit mechanism has been strengthened.

ZY Venture Capital is the company that has participated in the largest number of projects, in the widest range of industries, for the longest duration, with the highest frequency, and with the most fully-fledged business forms in the field of equity participation and investment among state-owned venture capital institutions in Shenzhen at present, thus boasting a solid experience. Over the years, the company has witnessed growth in the number of quality enterprises and the turnaround of struggling enterprises and intervened or disposed of a number of risky matters, investment dispute issues, and M&A and restructuring problems. Hence, the team has gained first-hand knowledge and experience of project risks and how to cope with them, business management, industry development, enterprise growth, investment management, and countermeasures and possesses a sound investment analysis framework, as well as risk identification, coordination, and communication capabilities.

In post-investment management, a full-time investment management team exists, which is joined by members from government industrial authorities, banks, securities firms, industrial groups, and accounting firms with extensive experience in corporate governance, corporate strategy, financial management, risk control, and capital market operations, which can provide professional and extensive resource integration services. Strengthening the post-investment management team in turn strengthens post-investment management and value-added empowerment. Active management measures give warnings and deal with problems in advance to avoid possible risks.

3.2.3 Function orientation

The functions of ZY venture capital include:

1. A platform for implementing market-oriented equity investment in Shenzhen. We will aspire to build ZY Venture Capitalinto one of the pilot platforms for the various business teams and departments of Shenzhen Capital Operation Group (the Group) to conduct market-oriented investment and introduce the incentive and restraint mechanism of the Group. In addition, we shall carry out closed-door assessments within teams or departments and continuously enhance the investment capability of the Group’s management team.

2. The main implementation body for the strategic investment of the Group. With inherent convenience in equity transfer, ZY Venture Capital can be considered as the main implementation body for strategic investment (non-controlling) in major targets by the Group.

ZY Venture Capital can acquire a controlling stake in targets and can also merely engage in market-oriented transfer to ensure the efficiency of the transfer.

3. Emerge as a well-noted brand in China in several characteristic fields. We aspire to become a leading brand in the field of M&A and at-scale development of early and medium-term investment projects; we also aim to build the company into a well-noted brand with influence in the field of future industries, including electronic information and life & health; through three-to-five years of development, we aim to build ZY Venture Capital into a new venture capital platform for project incubation, early and medium-term investment, pre-IPO M&A, and other operations that will breed industrial companies, thereby becoming a powerful enabler for the Group to carry out capital operation business.

4. An interface entity that serves Shenzhen's policies for emerging industries. By continuing to deepen communication, we shall optimize services, strive to become the implementation body of Shenzhen's relevant industrial policies and ensure a due fulfillment of that duty, and continue to enhance the Group's brand presence among the city's industrial authorities; on this basis, we shall step up our efforts to attract national projects and quality targets in Shenzhen and other cities for the Group.

5. The main enabler for investment in and M&A of early and medium-term projects. Relying on the advantages of ZY Venture Capital in early and medium-term projects, we will carry out early and medium-term investments in quality teams and targets, put out considerable effort around the upstream and downstream industries, and merge quality targets into the Group when the opportunity presents itself, integrating industrial companies' advantages in team and industrial presence and the Group's advantages in brand, capital, and mechanism to continuously incubate large industrial platforms.

3.3 Characteristics of the government equity investment model

3.3.1 Investment methods

In the process of promoting the reform and innovation of the governmental equity investment model, Shenzhen focuses on the market's decisive role in resource allocation, and optimizes system design to minimize the discretionary power of government industrial authorities in the use of special funds. Therefore, in designing the implementation mode of equity investment, market-oriented equity funds (hereinafter referred to as partner equity investment institutions) are introduced. The professional equity funds that cooperate with Shenzhen ZY are responsible

for tasks such as equity valuation and negotiations for project equity participation. During the investment process, to avoid collusion between the partner equity investment institutions and the target enterprises, these institutions are required to make joint-equity investment in target enterprises with ZY Venture Capital on a 1:1 ratio and at the same price. In addition, to fulfill the role of governmental equity investment to serve the public and give support, in a single project, 50% of each subsidy provided by ZY Venture Capital is used for equity investment, and the other 50% is used for financial subsidies. Direct incentives are given to target enterprises that meet investment requirements. The ratio of the amount of direct government subsidies received by a target enterprise to the amount of equity investment made by ZY Venture Capital is 1:1. Also, in order to control the risks caused by concentrating investment in a single project, the amount of equity investment made by ZY Venture Capital should not exceed 20% of total project investment, and the maximum investment amount is CNY 15 million.

In accordance with the *Circular of the Development and Reform Commission of Shenzhen Municipality on the Issuance of "The Operating Procedures of the Development and Reform Commission of Shenzhen Municipality on the Special Support Program for the Development of Strategic Emerging Industries"* (hereinafter referred to as the "Operating Procedures"), the tiered criteria for the target enterprises and corresponding investment limits are as follows:

(1) Basic entry requirements for the target investment enterprises:

1. Registered in Shenzhen - The applicant is an independent legal entity registered in Shenzhen according to law.

2. In line with the industrial policy - The applicant falls into the key support industries and key support areas determined by the city's industrial authority.

3. Introduction of qualified institutions - The applicant has introduced qualified investment institutions, or intends to introduce qualified investment institutions through the application and to subsequently apply for government equity funding.

4. Project application with the competent industrial authority - The applicant has completed the project application within the specified time frame according to the notice of the city's competent industrial authority.

(2) Tiered criteria for investments in the targeted enterprises:

Depending on the average business income of the enterprise in the past three years, the tiered criteria for equity investment in a single enterprise are as follows:

1. If the average business income in the past three years is over CNY 10 billion (inclusive), the maximum annual funding should not exceed CNY 200 million, and the maximum

cumulative funding in the next three years should not exceed CNY 400 million;

2. If the average business income in the past three years is CNY 1 billion to CNY 10 billion (inclusive), the maximum annual funding should not exceed CNY 100 million, and the maximum cumulative funding in the next three years should not exceed CNY 200 million;

3. If the average business income in the past three years is CNY 100 million to CNY 1 billion (inclusive), the maximum annual funding should not exceed CNY 50 million, and the maximum cumulative funding in the next three years should not exceed CNY 100 million;

4. If the average business income in the past three years is below CNY 100 million, the maximum annual funding should not exceed CNY 20 million, and the maximum cumulative funding in the next three years should not exceed CNY 40 million.

The target enterprises are required to have the following in place for project funds [proof of own funds + expected equity investment funds (including municipal financial equity investment) + bank loans ≥ total project investment, of which own funds are not less than 30% of the total project investment]. It is also generally required that the project should have new construction investment, which should not be less than 40% of the total investment, and, in particular, the construction investment in the field of digital economy should not be less than 20% of the total investment.

The Operating Procedures also specify the basic entry conditions for market-based cooperative equity investment institutions, including:

1. A professional investment institution mainly engaged in investing in unlisted companies.

2. Establishment time and registered capital - Established at least one year ago, with registered capital of not less than CNY 5 million.

3. Past performance - The size of funds under management is not less than CNY 200 million; the amount invested is not less than CNY 50 million; has successful experience in exit or practical management; able to provide written proof.

4. Honesty and trustworthiness - The equity investment institution and its senior managers have no adverse records of having been punished by relevant administrative or judicial authorities.

5. Implementation of not less than three refinancing investment cases; or core management personnel satisfy the aforementioned requirements for investment control or management - The equity investment players, such as the investment funds, actually controlled or managed by the equity investment institutions meeting the above conditions may enjoy the same treatment as the equity investment institutions.

The basic requirements for enterprises to receive investment include:

1. Registered in Shenzhen - the applicant institution is an independent legal person registered in Shenzhen in accordance with law.

2. Complies with industrial policies - the applicant institution is a key supported industry engaged in a key-support business field determined by the municipal industrial authority.

3. Introduced qualified institutions - the applicant institution has introduced qualified investment institutions, or intends to introduce qualified investment institutions through application, before requesting government equity funding.

4. Completed the project application as requested by the industrial authority - the applicant institution has completed the project application within the specified time according to the requests from the municipal industrial authority.

The basic requirements for partner equity investment institutions to participate:

1. A professional investment institution whose main business is to invest in unlisted companies.

2. Establishment time and registered capital - with an establishment time of no less than one year, and a registered capital of no less than five million.

3. Past performance - with a managed fund size of no less than CNY 200 million, and an invested amount of no less than CNY 50 million; has successfully exited or has actual management experience and can provide documentary evidence of this.

4. Integrity and credibility - the equity investment institutions and its senior management personnel have no negative record of punishment by relevant administrative or judicial authorities.

5. No less than 3 cases of investment; or the core management personnel have investment control or fund management experience in funds with conditions not lower than the aforementioned requirements - An equity investment entity such as an investment fund that is de facto controlled or managed by an equity investment institution that meets the above conditions can enjoy the same treatment as the equity investment institution.

3.3.2 Decision-making procedures

The role of the government’s industry authorities in the equity investment management structure is mainly to focus on the macro-level coordination of work that goes towards supporting emerging industries, including determining the annual equity subsidy fund support plan and evaluating fund utilization and performance. The government’s industry authorities do not directly participate in specific equity investment processes such as project screening,

equity valuation, and entry and exit negotiations. ZY Venture Capital is responsible for making capital contributions on behalf of the government and signs equity funding agreements with target firms. Such agreements specify that the government equity investment institution and cooperating equity investment institution will jointly invest in the same number of shares at the same price and enter and exit in their investment together. ZY Venture Capital exercises its rights as an investor in the firm up to the amount of its capital contribution and tracks the progress of the project of the target firm. As a vital part of the government's equity investment decision-making, the cooperating government's industry authorities publicly select equity investment institutions according to certain conditions, and the qualified contracted institutions are managed in a pool. Cooperating equity investment institutions are responsible for conducting due diligence, valuation, and equity participation negotiations, deciding when to exit, and using their resources and experience to provide value-adding services to target firms. One can see that the core function of ZY Venture Capital in the management structure is to maintain the dynamic balance between the government's industrial policy orientation and the implementation of market-oriented equity investment.

In the equity investment management structure, the role of the Administration of Industrial Management is mainly focused on the macro coordination of the equity support of emerging industries, including confirming the annual equity funding support plan, implementing a performance evaluation of the use of funds, and so on. The Administration of Industrial Management does not directly participate in the specific processes of equity investment, such as project selection, equity valuation, and negotiation in the purchase and sale of shares. The partner equity investment institution is responsible for implementing the equity valuation of the enterprises to be invested in, negotiating on buying shares, confirming share price, and so on. Within 20 working days, ZY Venture Capital will complete the qualification verification of the partner equity investment institutions, check the validity of the equity investment contracts or agreements, and review the due diligence reports, before generating a verification report of the enterprises to be invested in and submitting it to the Administration of Industrial Management. In the meantime, the evaluation service agency will provide an expert review of the applied projects. On-site inspections jointly organized by the Administration of Industrial Management and the evaluation service agency will be conducted on the projects that have passed the expert review. The evaluation service agency will complete a project review report and submit it to the Administration of Industrial Management within 20 working days.

ZY Venture Capital fulfills the main responsibility of funding on behalf of the government and signs the equity funding agreement with the target company. The agreement stipulates that

the government's equity investment funds must be invested in the same shares and at the same price as the partner equity investment institution, thereby ensuring they rise and fall together. ZY Venture Capital exercises the investor's rights over the shareholding companies within the limit of the investment amount, tracking the project progress of the target company. As a key factor of the government's equity investment decision-making process, the partner equity investment institutions introduced are publicly selected by the Administration of Industrial Management according to certain criteria. The qualified contracting institutions are put into the database and managed. The partner equity investment institutions are responsible for initiating the work of conducting due diligence investigation on potential target companies, equity evaluation, negotiating on buying shares and determining the time of withdrawal, and using their own resources and experience to provide value-added services for target companies. ZY Venture Capital is also responsible for formulating selection criteria for partner equity investment institutions and implementing dynamic management, making investments on behalf of the Administration of Industrial Management, implementing management and exit after financial equity investment. The core function of ZY Venture Capital in the management structure is maintenance of the dynamic balance between the government-oriented industrial policy and the implementation of market-oriented equity investment. To serve the invested companies more efficiently, ZY Venture Capital has established a professional investment committee mechanism, implementing a flat management to improve post-investment efficiency. ZY Venture Capital strived to introduce a convenient regulatory policy exclusive to "municipal state-owned venture capital," which eliminates asset evaluation and exchange in the market during financial capital investment, management, and withdrawal and, therefore, provides sufficient mechanism and efficiency guarantee for major issues, such as IPO, management improvement, and equity adjustment of the invested companies.

The responsibilities of market-oriented equity investment institutions that are involved in the government's equity investment decision-making include:

1. Conducting due diligence on the applicant companies and negotiating on equity investment, submitting an investment recommendation report, and completing due diligence and equity investment negotiations within two months, as required by the agreement.

2. Co-investment with the government in projects evaluated as worthy of investment.

3. Using their own resources and experience to provide value-added services for the invested companies.

4. Examining the timing of withdrawal, choosing an appropriate time to withdraw, reporting the equity withdrawal situation to the equity holding agencies on time, and signing

agreements stipulating that the government's equity investment funds must be invested in the same shares and at the same price as the partner equity investment institutions, thereby ensuring they rise and fall together.

The main responsibilities of other third-party professional institutions that are involved in the government's equity investment decision-making evaluation service agencies, accounting firms, and partner financial institutions are as follows:

1. The evaluation service agencies are mainly responsible for establishing and maintaining the expert database and project information database entrusted by ZY Venture Capital, conducting an expert review, material inspection, and on-site inspection of the submitted projects, carrying out mid-term project evaluation, substantiation for adjustments and changes, project suspension verification, and so on.

2. The accounting firms are mainly responsible for conducting special audits on the financial status of the submitted companies and the related expenses incurred by the submitted projects, entrusted by the municipal development and reform department to conduct project acceptance, performance evaluation, and so on.

3. The partner financial institutions mainly include banks, guarantee institutions, and equipment financing and leasing companies, among others. The banks, guarantee institutions, and equipment financing and leasing companies are independently responsible for conducting a risk assessment of credit loans, secured loans, and of the submitted equipment financing and leasing companies and their submitted projects, deciding whether to provide loans or financial support, entrusted by the municipal development and reform department to conduct supervision on the use of funds, recovery of non-performing loans, project supervision and inspection, and so on.

The potential target companies are responsible for conducting self-organized project proposals under the requirements of the notice and guidelines, completing the project construction following the content and schedule requirements in the approval document, ensuring that all funds are in place, using the funds in a legal and regulated manner, cooperating with relevant departments to carry out project supervision and inspection, acceptance evaluation, research and statistical work, and so on, and taking responsibility for the use of special funds.

3.3.3 Investment process

The investment process of ZY Venture Capital can be divided into several stages: project

solicitation, screening, and roadshows; equity evaluation; review by government authorities; investment and subsidy fund injection; and market-oriented exit. Equity investment projects are sourced from independent applications by firms in emerging industries and informed by recommendations from cooperating equity investment institutions. When projects are recommended by cooperating equity investment institutions, these institutions will advance directly to the preparation of a project support plan and its submission it to government authorities for review. Figure 3.3 details the investment process.

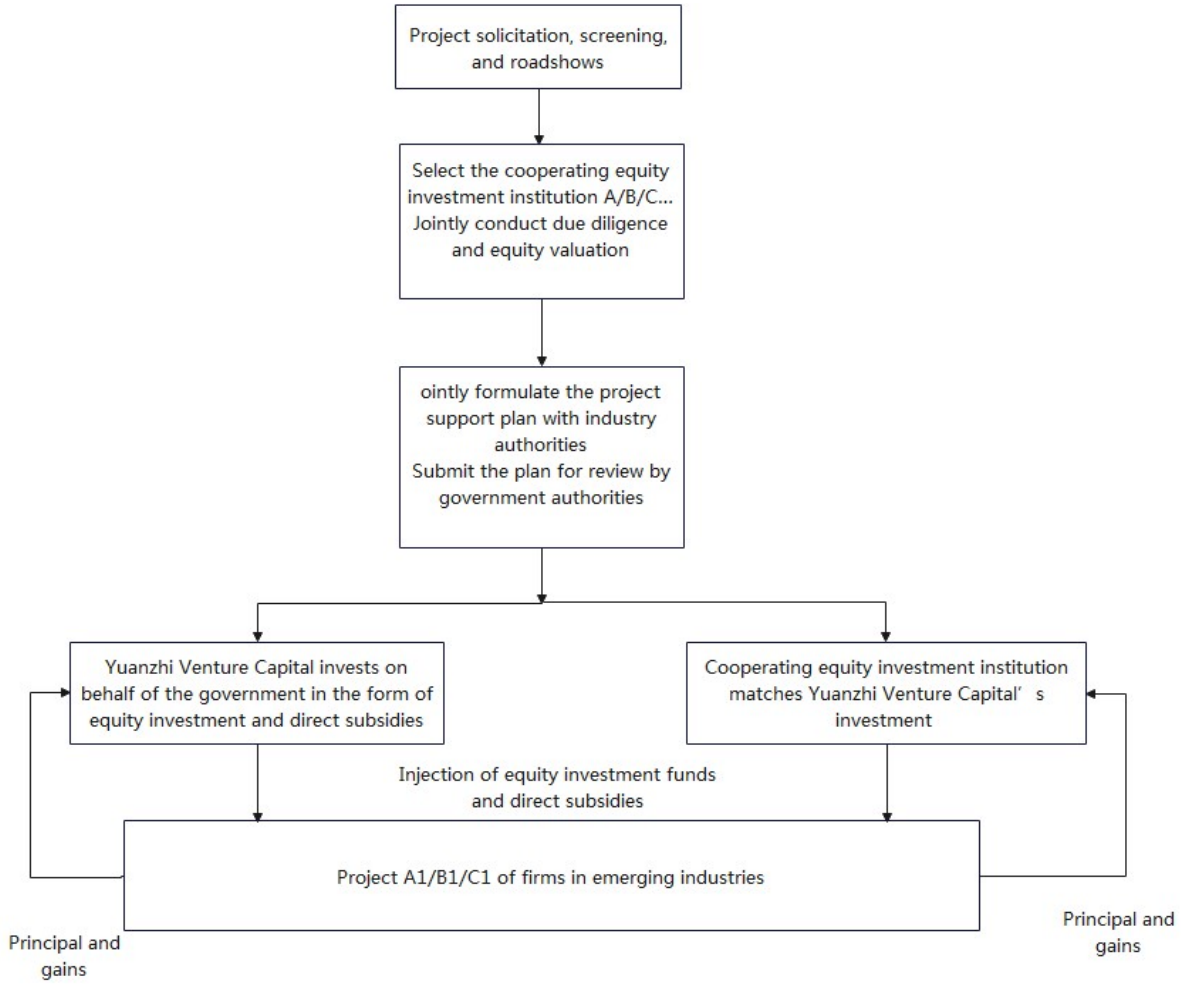

Figure 3.3 Government equity investment process

ZY Venture Capital screens candidate projects as per the city's industrial policy guidance and reviews compliance in the project application report. It organizes project units and cooperating equity investment institutions to carry out roadshows. It also cooperates with equity investment institutions to analyze advanced technologies, the feasibility of the implementation plan, and the growth and investment risks of projects to assess whether it makes sense to invest. Cooperating equity investment institutions conduct due diligence, valuation, and equity participation negations regarding firms with investment value. They also formulate investment

plans that industry authorities review, determine the list of projects to support and issue a support plan, make capital contributions on behalf of the government, allocate equity investment funds, and direct subsidies to projects. Cooperating equity investment institutions invest at the same valuation (price), under the same conditions and in the same amount as the government equity investment institution, to prevent cooperating equity investment institutions from colluding with target firms to create excessive equity valuations.

The government's equity investment funds and project grant funds amount to around CNY 30 million. In principle, the financial equity funds account for 50% of the single investment by the cooperative equity investment institutions, up to a maximum of CNY 15 million. Financial equity investment institutions and cooperative equity investment institutions follow the principle of "same shares, same rights, input and exit together." The entry price is determined by the actual equity price of the cooperative equity investment institution, and the exit price depends on market conditions. The financial equity funds are mainly used for project construction and enterprise R&D production and operation activities. Specific R&D expenses include independent R&D expenses and commissioned development expenses. Specifically, independent R&D expenses mainly cover research material and service fees (including material fees, testing and laboratory processing fees, publication/documentation/information dissemination/intellectual property service fees), human resource fees (including R&D staff salaries, labor costs, expert consulting fees), and other expenses (including travel expenses, conference fees, international cooperation and exchange fees, personnel performance, management fees, etc.). Commissioned development expenses mainly refer to the fees paid by the project organization to purchase R&D outsourcing services. Project grant funds are determined according to the comprehensive evaluation of a project by the review service provider and are used to fund project construction applications. Any enterprise that has been funded by the city's financial equity investment funds shall not enjoy financial equity funding again until the equity exit of the financial funds is completed.

In the process of investment fund disbursement, to prevent possible operational risks, the Operating Procedures stipulate that the financial equity investment funds will be disbursed to the special bank account of an equity holding agency institution, which, in accordance with the project approval documents and the investment contract (agreement), will input the funds into the invested enterprise by disbursing these funds to the special account of the bank supervising the project organization at one time, and the project organization will handle the fund disbursement procedures with the approval documents or contract.

3.3.4 Post-investment management

The main goal of post-investment management is to monitor and evaluate the major decisions of the client enterprises, exercise shareholder rights in compliance with laws and regulations, and effectively protect the company's rights and interests; the operation and management status of the client enterprises are monitored and evaluated to secure the financing funds. Some governmental equity investment institution assigns directors and supervisors to the target enterprises; such personnel shall not receive any remuneration from the enterprises in which they work. The investment department of the governmental equity investment institution is responsible for tracking the operation and management of the invested enterprise, regularly analyzing its operation and management, and reporting to the municipal industrial authority and the Finance Commission of Shenzhen Municipality every six months about the flow of entrusted capital, the operation of the invested projects, and any changes in equity, in accordance with the requirements of the "Entrusted Investment Agreement." During the investment period, the governmental equity investment institution provides the client enterprises with refined and differentiated post-investment value-added services.

In particular, in response to the common phenomenon of irregular corporate governance of small and medium-sized enterprises, ZY Venture Capital uses several methods such as strengthening management communication, regularly consulting partner institutions, and proactively providing technical support, so as to jointly promote the standardized operation of the shareholder meetings of the client enterprises, improve the construction of institutional processes, strengthen information disclosure, and protect the rights and interests of minority shareholders, including the equity investment. To ensure that client enterprises can seize opportunities provided by new capital market policies, such as the Registration of IPO Stocks on the Sci-tech Innovation Board and the registration-based IPO system on the ChiNext, ZY Venture Capital actively assists these enterprises in launching capital operations.

It also provides a full range of post-investment value-added services, which can be divided into seven aspects:

1. Listing services: helps the enterprises to plan financing and IPO capital market operations;

2. Corporate governance: pushes the enterprises to establish highly efficient boards of directors, and assists in designing systems such as equity incentives;

3. Mergers and acquisitions (M&A) integration: provides full assistance in identifying M&A integration targets, assists in investigations, designing plans, and coordinating relationships;

4. Strategy optimization: optimizes the enterprises' development strategies and business models.

5. Internal management: helps enterprises strengthen their financial management, performance appraisal, and process management.

6. Consultation on government policies benefiting enterprises: helps client enterprises to connect with industrial authorities and provides consultations on relevant beneficial policies;

7. Business development: Uses the resources accumulated by fund managers to introduce clients and partners through a wide network of contacts.

The governmental equity investment institution also provides investors with post-investment value-added services on a regular or on-demand basis, including fund reports, fund meetings, exchange activities and training, consultations, and project investment. On the basis of fully protecting the rights and interests of investors, it strengthens in-depth interaction and win-win cooperation with investors.

Poorly developed enterprises will receive professional assessments and opinions from cooperative equity investment institutions and will be considered to recover equity investment funds in a timely manner through repurchase, litigation, restructuring, extension, liquidation, and so on, to resolve recovery and legal risks. According to the Operating Procedures, in the post-investment management process, if a project organization has to give up the equity funding due to objective factors, it should submit a withdrawal application before signing an investment contract or agreement with the equity holding agency institution. If the competent authority approves such a withdrawal after review, the project organization should be required to return all financial equity investment and project grant funds and their yields to the municipal treasury. Once the project organization has signed an investment contract or agreement with the equity holding agency institution, it must fulfill the corresponding legal obligations and handle the financial equity fund injection and equity change procedures as agreed.

3.3.5 Exit mechanism

The exit of government equity investment is implemented as per market-oriented principles. When it comes to a single investment project, the cooperating equity investment institutions involved in the project will assess when the exit should take place. Once the exit conditions are met, ZY Venture Capital and the cooperating equity investment institutions will propose an exit plan in consultation with the project unit, as per their investment agreement. Afterward, ZY Venture Capital and the cooperating equity investment institution will match their exit in terms

of price, method, and timing. Industry authorities have no discretion in designing the exit process. ZY Venture Capital's capital risk and returns are shared with the cooperating equity investment institutions, which helps preclude "pay-to-play" and ethical risks that can emerge during the exit process and ensures the safety of the fiscal equity investment and maximizing returns. After the exit, the proceeds, consisting of the principal and returns are returned to the venture capital institution's dedicated bank custody account, thereby permitting the circular use of the transformation funds. Exit strategies include listing, repurchase, transfer, and liquidation. After exit from the investment project, the business executive department of the governmental equity investment institution will select a proportion of client enterprises needed to carry out post-investment evaluation, summarize experience and lessons learned through the investment; the post-evaluation results will serve as an important reference for future equity investment support.

Chapter 4: The Effectiveness of Government Equity Investment

This Chapter starts with an empirical analysis of equity investment by the Shenzhen government to support emerging industries. By analyzing the development of an equity investment platform (ZY Venture Capital) in the period 2015 to 2018 by the Shenzhen government to support emerging industries, as well as using a research sample of all 85 firms supported by the platform, this study presents an overall assessment of the efficacy of the support provided via government equity investment. First, based on the function of such investment to support emerging industries by guiding private capital, this study evaluated the guidance effect of state-owned equity institutions as a whole. The "guidance effect" mainly focuses on analysis of the implementation of industrial policy guidance and leveraging of private capital for co-investment during the equity investment process by state-owned equity institutions. The four specific evaluation dimensions include: fit with industrial policy, number of rounds of equity investment in a target project, composition of cooperating equity investment institutions, and return on investment (ROI) achieved by government equity investment. The empirical analysis involves government equity investment data and operating data of target firms, all of which comes from ZY Venture Capital unless otherwise specified.

4.1 Industrial policy orientation fit

The high-tech industry is one of Shenzhen's four pillar industries. ZY Venture Capital mainly invests in start-up high-tech firms with businesses in information technology, electronic equipment, semiconductors, bioengineering, and environmental protection. Target firms are mainly concentrated in Shenzhen's strategic emerging industries and industries of the future—namely, life and health, Internet, next-generation information technology, environmental protection, and smart equipment. Among these, investment in next-generation information technology is most concentrated, with the number and amount of investment projects accounting for 48.24% and 43.39%, of total investments, respectively. Table 4.1 shows the relationship between the key development areas in Shenzhen's emerging industry policy and the businesses of the target firms.

Table 4.1 Equity investment in key development areas of the government's plan for emerging industries

Key development area	Number of equity investment projects		Equity investment amount	
	Quantity	Proportion (%)	Amount (CNY 10,000)	Proportion (%)
Life and health	7	8.24	7744	9.63
Internet	14	16.47	12243	15.23
Next-generation information technology	41	48.24	35358	43.97
Environmental protection	3	3.53	2300	2.86
Smart equipment	20	23.53	22766	28.31

Note: The equity investment project statement and the amount of equity investment are calculated according to the operation data of ZY Venture Capital. Key development areas such as life and health were determined as per relevant industrial planning policies, such as the "Special Fund Support Policy for the Development of Strategic Emerging Industries in Shenzhen."

Firms in emerging industries that receive equity investment are mainly concentrated in related subindustries like digital information; this very much aligns with how Shenzhen's high-tech industrial clusters are dominated by the digital information industry (B. Liu, 2018). The top three industries with the highest concentration of investment projects are information technology consulting and other services, electronic equipment and instruments, and computer communication and other electronic equipment manufacturing, accounting for 40 projects (47.06% of all projects). ZY Venture Capital invested CNY 393 million in these industries, accounting for 47.81% of its total equity investments.

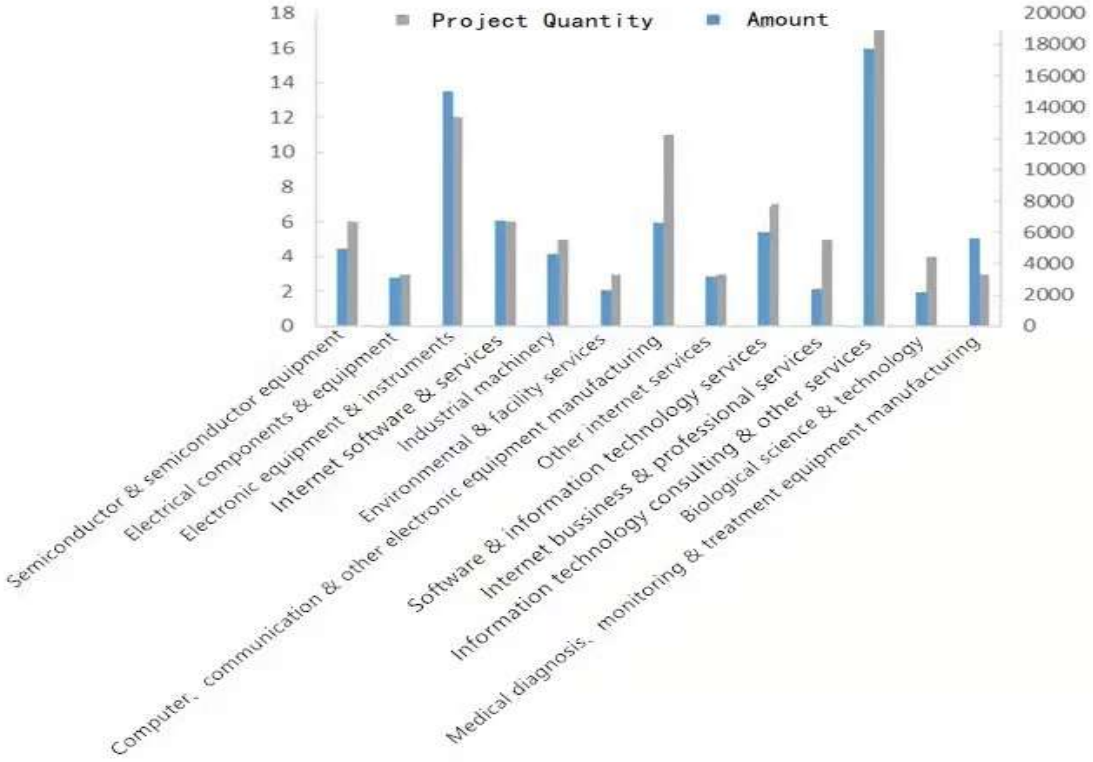

Figure 4.1 Distribution of supported firms in emerging industries, by industry segment

Figure 4.1 presents the distribution of supported firms in emerging industries. From the perspective of the promotion of industrial development by government equity investment institutions, investee companies play an increasingly significant role in leading other industries, driving domestic substitution, and supporting advanced manufacturing. Among them, in the semiconductor industry, Sidea Semiconductor has grown into the largest domestic manufacturer of wafer probers, leading to the realization of the domestic substitution of 12-inch wafer probers; Chipsea Technologies has grown into a leading domestic enterprise in signal chain chips, with some products having reached the international leading level, rapidly promoting the domestic substitution in the field of home Internet of Things.

In the field of the communication industry, Phograin became the first domestic manufacturer to supply high-speed optical communication chips in batches, and the technical level of optical transceiver chips has reached 100Gb/S; NOVA Technology has grown into a leading domestic private network service provider and established core network platforms nationwide.

In the field of advanced manufacturing, the visual motion control products of eSight Technology have broken the monopoly of foreign companies on key processes and successfully solved the problems in advanced manufacturing fields, such as precision measurement, flexible manufacturing, and intelligence testing; Wisonic Medical has grown into a leading domestic manufacturer of clinical imaging equipment, with its products having entered 300 tertiary hospitals in China and continually leading the fields of anesthesia, pain, musculoskeletal, 5G intelligent applications, and remote diagnosis and treatment, leading the development trend of clinical ultrasound; Huole Science & Technology has become an enterprise in the whole industry chain, including cameras, optical lenses, whole machines, and special screens, with independent intellectual property rights, and has broken the monopoly of Japan's Ricoh in the field of ultra-short focal length optical lenses.

In the field of military-civilian integration, one company has grown into a leading manufacturer of military communication equipment, with its integrated communication solution being widely used in the fields of marine communication; Another company has grown into a leading domestic military drone enterprise and is currently involved in two-thirds of the process of developing military drones, and it is expected that annual sales during the 14th Five-Year Plan period will reach 2 billion yuan.

In the field of new materials, Huake Tek has become a leading domestic manufacturer of silver nanowires and has built an integrated industrial system from raw materials to modules and end products; Wedge Central South's projects of superalloys and two-wheel-one-disk are

progressing smoothly, having obtained the supplier qualifications of COMAC and GM, among others, and their technical indicators are approaching the international advanced level.

In the field of the new energy industry, Tian-Power has grown into the largest domestic supplier of third-party battery management systems and has become the largest supplier to major customers, such as Huawei and China Tower, with excellent craftsmanship and abundant product reserve; Winline Technology has become the second-largest supplier in the market of charging modules, leading the industry in high voltage DC power supplies. To this end, many municipal governments or state-owned capitals in Jiangsu, Shandong, and Anhui have offered favorable conditions to attract their supported enterprises to invest and develop their businesses.

4.2 Distribution of equity investments by round

Given the actual investment, ZY Venture Capital mainly invests in projects at the pre-IPO and mid-to-late stages, as well as listed companies' private placement, and moderately invests in mid-to-early technological innovation projects, building an industry that is "based on the present and facing the future," which will continuously contribute to the Group's net profit and cash flow in a relatively short period, and also lay a solid foundation for ZY Venture Capital's subsequent sustainable fundraising.

The effect of the government equity investment on emerging industries and its ability to guide and leverage social capital depends largely on whether corporate projects that receive equity investments are in the early stage of development, or where the round of equity investments is relatively early (Y. Hu & Ruan, 2017; J. R. Huang, 2021). According to the signaling theory, when state-owned venture capital institutions take the lead in finding investment opportunities in neglected regions or industries under government guidance, the invested companies will send positive signals to social capital, leading many holders of social capital to follow (D. Wang et al., 2009). Based on an actual investment case, ZY Venture Capital's equity investment rounds are generally early and evenly distributed. ZY Venture Capital has implemented relatively few A-round investment projects, and both the number of projects and investment amount account for less than 10%. For B-round to F-round, the number of investment projects of each round is more than 10, and the amount of equity investment exceeds CNY 100 million. For B-round to F-round, the number of investment projects is 62 and the amount is CNY 598, accounting for 72.94% of the total number of projects and 71.56% of the total amount of investments, respectively. Table 4.2 shows the distribution of equity investments.

Table 4.2 Distribution of equity investments

Equity investment round	Number of equity investment projects		Equity investment amount	
	Quantity	Proportion (%)	Amount (CNY 10,000)	Proportion (%)
A round	6	7.06	6618	8.04
B round	12	14.12	12356	15.02
C round	13	15.29	13052	15.86
D round	14	16.47	11274	13.70
E round	12	14.12	11725	14.25
F round	11	12.94	10475	12.73
G round	9	10.59	8662	10.53
Others	8	9.41	8128	9.88

Whether the government's equity investment can actually play a supporting role in emerging industries and then guide and leverage social capital depends, to a large extent, on whether it provides equity support for early-stage projects; in other words, whether the equity investment round is relatively advanced (Y. Hu & Ruan, 2017; J. R. Huang, 2021). According to the signaling theory, when state-owned venture capital takes the lead in finding investment opportunities in neglected areas or industries under the guidance of the government, the invested enterprises convey a strong promise to social capital, demonstrating and leading a large number of social capitals to make follow-up investments (D. Wang et al., 2009).

ZY Venture Capital's investments generally take place in earlier rounds. These investments are evenly distributed, in line with ZY Venture Capital's functional position as a state-owned venture capital platform. The coordinated and simultaneous participation of cooperating equity investment institutions reflects the guiding effect of state-owned venture capital. ZY Venture Capital has invested less capital in A and Pre-A rounds than in others. An important reason for this is that the products and profit models of seed-stage start-ups in emerging industries are far from mature, and their team composition is still lacking. At this stage, the risk–return characteristics are more suitable for angel investors and are not compatible with the function of state-owned venture capital platforms. Equity investment is mainly concentrated in the B to F rounds, when funding is invested in emerging firms that can innovate and drive their respective industries but have not attracted sufficient market attention. The fact that target firms can consider a government equity investment institution and cooperating equity investment institution investors shows that the government and the market endorse it. This endorsement provides the target firm with recognition in capital and product markets, thereby effectively assisting in the growth and expansion of firms in the information industry (J. J. Gao, 2018).

Equity funds integrating with the brand effect and professional capabilities of state-owned venture capital play a key role for enterprises, especially those in the start-up and growth stages. During the visit, the author found that the target companies, such as Tian-Power, Winline,

eSight Technology, Wisonic Medical, Chipsea Technologies, YZ-Telecom, Shanlong Intelligent Control, Huole Science & Technology, and PreGene, all highly recognized the utility of financial equity investment and the value-added services provided by capital groups.

4.3 Cooperation with equity investment institutions

The introduction of market-oriented professional equity investment institutions is an integral part of the government's reform and innovation model for supporting firms in emerging industries. The extensive experience, professional ability, and diversified composition of cooperating equity investment institutions relate to the actual guiding effect of the state-owned venture capital platform towards social capital and its ability to support emerging industries sustainably (F. F. Cong et al., 2019; Zuo et al., 2017). The extensive absorption of venture capital institutions with extensive investment experience and strong investment capabilities is key to ZY Venture Capital's efficient equity investments and effective investment risk management. Cooperating equity investment institutions are managed in a pool. Industry authorities select market-oriented equity investment institutions in an open, fair, and just manner to become partners, all while considering several important factors, including areas of investment, investment styles, and capital strength. Among the 85 projects in which ZY Venture Capital has invested, 56 cooperating equity investment institutions have cumulatively invested more than CNY 1.6 billion. There were 15 cooperating equity investment institutions that jointly carried out two or more equity investment projects with ZY Venture Capital, of which 10 institutions invested in two projects each, four institutions invested in three projects each, and two institutions invested in six projects each. The remaining 41 cooperative equity investment institutions each jointly invested with a ZY Venture Capital 1 project. It is worth noting that the largest single-project investment—amounting to CNY 22.41 million—came from a cooperating equity investment institution that cooperated with ZY Venture Capital on only one project. Most cooperating equity investment institutions that have cooperated with ZY Venture Capital do so on only a single project, which is conducive to expanding the coverage of cooperating institutions and maximizing the use of social capital to support firms in emerging industries jointly. Table 4.3 presents the investments made by cooperating equity investment institutions.

Table 4.3 Investments made by cooperating equity investment institutions

Number of cooperating equity investment institutions	Number of invested projects by each cooperating equity investment institution	Average investment per project (CNY 10,000)
45	1	2241
10	2	2049
4	3	950
2	6	1444

Judging from the size of the cooperating equity investment institutions involved (as shown in Figure 4.2), ZY Venture Capital cooperates with equity investment institutions of all sizes, but the majority of them are medium-sized equity investment institutions with registered capital totaling less than CNY 1 billion but more than CNY 10 million. More specifically, there are seven cooperating equity investment institutions with registered capital of more than CNY 1 billion, 18 with registered capital of more than CNY 100 million (inclusive) but less than CNY 1 billion, 17 with registered capital of more than CNY 10 million and less than CNY 100 million, and 15 with registered capital of less than CNY 10 million (inclusive).

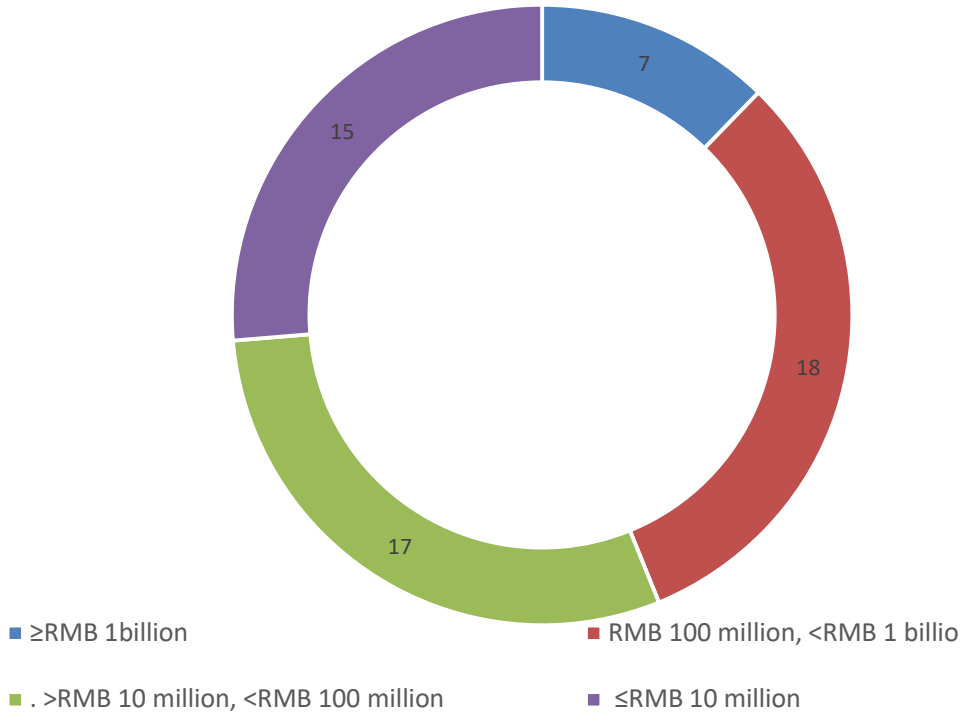

Figure 4.2 Registered capital of cooperating institutions

In terms of experience, the cooperating equity investment institutions' numbers of investments are distributed at all levels (as shown in Figure 4.3). Among the cooperating institutions, there is one mega venture capital company with experience in more than 500 investment projects and 14 institutions with experience in fewer than 10 short-term ones. Overall, most cooperating institutions have experience with fewer than 100 investment projects.

One can see that state-owned venture capital platforms cooperate extensively with market-oriented venture capital institutions and, when deciding whether to cooperate, consider more than their investment experience. On one hand, this reflects the successful positioning of state-owned venture capital platforms in "leading" (or guiding) equity investment institutions by amplifying the participation of social capital in supporting firms in emerging industries. On the other hand, state-owned venture capital platforms proactively select cooperating equity investment institutions so as to diversify their investment portfolio's market and operational risks and reduce the concentration risk of equity investment business cooperation.

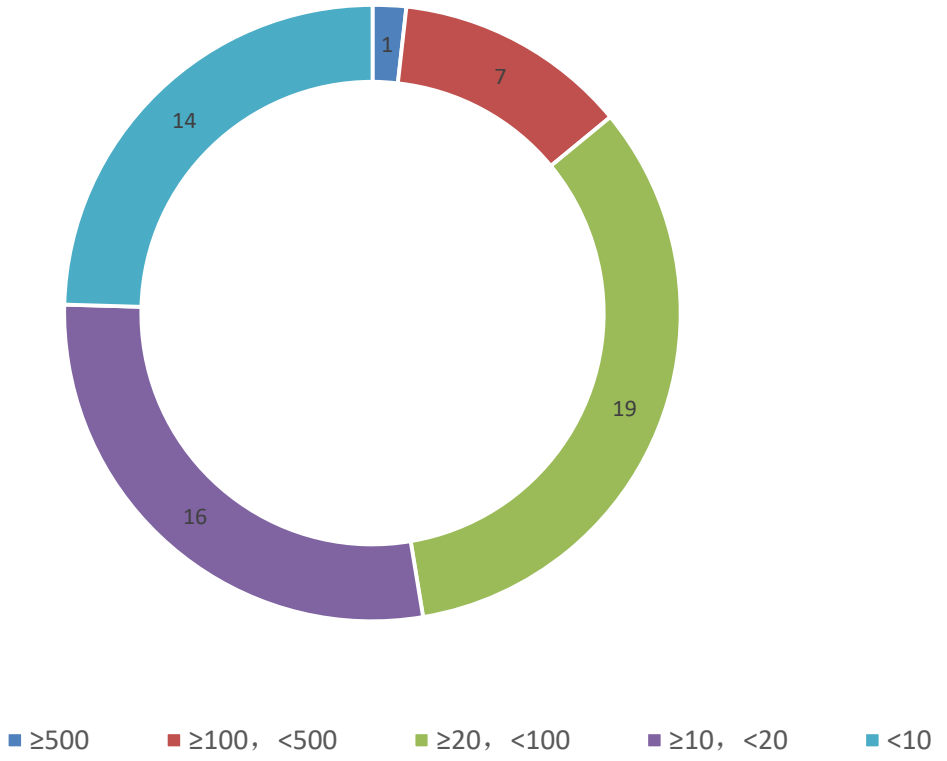

Figure 4.3 Cumulative investment projects of cooperating institutions

In addition, the diversified geographic distribution of cooperating equity investment institutions further reflects the broad vision of ZY Venture Capital as a state-owned venture capital platform in guiding social capital. Shenzhen is a region with one of the highest concentrations of equity investment institutions, and is China's most active equity investment space. However, ZY Venture Capital and its industry authorities do not limit themselves to cooperating equity investment institutions within Shenzhen: they have 16 cooperating equity investment institutions in cities like Beijing, Shanghai, Tianjin, Yantai, Lhasa, and Chengdu that account for 17 investment projects totaling CNY 357 million, including an investment of CNY 21 million in a single project. In comparison, the most that a Shenzhen-based cooperating

equity investment institution has invested in a single project is CNY 18.51 million.

As of December 31, 2019, ZY Venture Capital has invested a total of CNY 893 million in equity, leveraging a total of CNY 6.2 billion in social capital, six times more than the amount of financial equity. The supported enterprises have been highly recognized by social capital, including robust investment institutions, such as Shenzhen Capital Group, BAIC Capital, Alibaba Capital Partners, China Merchants Capital, Guoxin Capital, SDIC Capital, China Jianyin Investment, National Military-Civilian Integration Industry Investment Fund, CAS Investment, ADDOR Capital, and Fortune Capital. From the perspective of financial input sustainability, a total of 10 enterprises have completed their exits to date, with a comprehensive yield of 32%. Together with enabling the projects to approach IPO, the financial funds exited have initially garnered the ability to constantly support the strategic emerging industries in the city thanks to their sound sustainability.

4.4 Return on equity investment projects

The actual return on equity investment serves as a touchstone of the government's role in navigating equity investment. In the final analysis, the size of the equity investment depends on the operating performance of the invested enterprises. From the perspective of boosting enterprise development, most enterprises have continued to grow steadily after receiving equity financing, as evidenced by enhanced R&D level and industrialization capability, rapid development of business performance, and improved modern corporate governance capability. The total revenue and total assets of the invested enterprises have grown at a compound annual growth rate of 15% and 24%, respectively, in the past three years. With the approach of the equity investment cycle, the equity funding policy is becoming increasingly effective. Four enterprises have been listed through M&A restructuring. It is expected that about 10-15 IPOs are to be filed in 2022 (JMGO, PHOGRAIN, VP, Tian Power, Esight Technology, Wisonic, Winline, Sidea, Ningyuan, CN Care, Leader-Tech Electronics, Micropoint, LCF). It is expected that by the end of 2022, about 20 enterprises will be able to achieve a successful IPO or land on the capital market through M&A restructuring, with a five-year securitization rate of more than 20%, which is significantly higher than the industry average level and ranks in the middle to upper level.

The actual return on equity investments is the true test of the guiding effect of government equity investment. Since ZY Venture Capital and cooperating equity investment institutions invest in the same number of shares at the same price and enter and exit in their investment

together, the cooperating equity investment institutions also receive positive returns when the ZY Venture Capital recovers its capital and gains. Under this scenario, the re-injection of the principal and income expands the government's pool of capital for venture capital investment. As a result, cooperating equity investment institutions also benefit; this demonstrates the value of jointly investing with the government equity investment institution and is conducive to attracting other market-oriented venture capital firms to jointly support firms in emerging industries. Otherwise, the scenario could lead to adverse results—including long-term and large-scale floating equity investment loss—that could lead to institutions passively bearing significant losses, a market-oriented exit becoming hopeless, or the emergence of legal disputes. Under such circumstances, the government equity investment funds pool would continue to be eaten away and shrink. Cooperating equity investment institutions would become disheartened and lose their enthusiasm for continuing to support firms in emerging industries. At the same time, news of the negative situation would spread to other market-oriented venture capital firms, in turn diminishing the guiding effect of government equity investment (H. Zhang, 2018).

Table 4.4 Return on investment in projects where government equity investment has exited

Target firm	Annualized rate of return (%)	Exit strategy
A1	19.63	Joint transfer/acquisition by a listed company
A2	31.70	Joint transfer/acquisition by a listed company
A3	8.00	Major shareholder repurchases per agreement
A4	10.00	Major shareholder repurchases per agreement
A5	43.66	Joint transfer
A6	10.00	Major shareholder repurchases per agreement
A7	12.00	Joint transfer
A8	10.00	Major shareholder repurchases per agreement
A9	0.00	Change in the actual controller of the firm
A10	7.05	Joint transfer
A11	10.00	Major shareholder repurchases per agreement
A12	0.00	Joint transfer

Table 4.4 shows the return on investment in projects where government equity investment has exited. ZY Venture Capital and its cooperating equity investment institutions have supported and performed market-oriented exits from 12 firms in emerging industries. These investments have generated generally good investment returns, at an average of 13.5%. The return on investment was 0% for three investments, meaning that the principal was preserved. In terms of exit strategies, the most common was a joint transfer (including acquisition by a listed company, repurchase by the major shareholder per agreement, or a change in the actual controller); this is expected, given that the exit strategies were designed to be market-oriented. Doing so has also helped accumulate helpful experience used in the post-investment management of the 73 firms in which ZY Venture Capital remained invested.

ZY Venture Capital did not suffer losses on certain investment projects like the general

market-oriented equity investment fund, which, to a large extent, reflects that equity investment institutions with government backgrounds have strong control in the process of equity withdrawal in the analysis period. However, as the degree of marketization increases, uncertainties are indeed increasing for the "smooth exit" of government equity investment institutions. In recent years, some of the ZY Venture Capital projects under investment have been involved in legal proceedings; the number of cases with liquidation difficulties has increased, with a few projects having grim exit prospects and a significant rise in the risk of principal loss. Certainly, this is also related to China's depressed macroeconomic environment under the impact of the pandemic in recent years. From the latest situation at the end of 2021, ZY Venture Capital has six ongoing litigation and arbitration projects in its investments. In 2021, the post-investment management team of ZY Venture Capital actively communicated and coordinated with various parties on risk matters such as unsubstantiated repurchase, inability to liquidate, enterprise closure, repurchase disputes, breach of contract disputes, malicious letter-or-visit petitions, malicious litigation, and so on. Continuous efforts have been made in terms of clause protection, conflict resolution, evidence collection, and promoting judgment to minimize the risk of investment losses. Despite this, it can be predicted that over time, a number of loss-making projects may emerge in the future.

In summary, from the viewpoint of the effectiveness in supporting the development of emerging industries, ZY Venture Capital has generally achieved its original design intention of establishing a direct, market-oriented, and professional model of funding industries. To be specific, "direct" means that supporting funds will be put in place once for all to directly respond to the funding policy. This can enhance the accuracy of the use of funds and allow dynamic tracking of enterprises through equity, thus continuously contributing to enterprise development. "Market-oriented" and "professional" include three aspects: First, a market-oriented mechanism is introduced to the project selection process, that is, only the enterprises that receive investment from cooperative equity investment institutions can apply for financial support. The cooperative equity investment institutions can help to enhance the professionalism and accuracy of support. Second, in terms of empowering development, capital groups can support the development of the invested enterprises by virtue of their market-oriented, professional, and comprehensive service capabilities. Third, in the operation and management process, state-owned venture capitals can carry out post-investment management in a professional and market-oriented manner as applied in the field of venture capital by establishing a review and decision-making mechanism specific to the venture capital industry,

thereby improving the operational efficiency of enterprises and protecting the value of the entrusted equity.

Chapter 5: Effectiveness of Government Equity Investments in Exited Firms

Based on an overall evaluation of the government's equity support model, this Chapter seeks to reveal the actual efficacy of government equity investment at supporting emerging industry firms based on the stage of the investment cycle at the micro level, during investment and after exit (post-investment).

The analysis consists of the following three main areas.

The first is analysis of government equity investment and the financial performance of target firms by examining the actual effect of equity investment support on the business performance of firms to determine whether and to what extent the government's shareholding improved the growth of the firms.

The second is analysis of the impact of government equity investment on technological innovation by examining the role of equity investment in supporting patents and R&D of emerging industry firms to determine whether their R&D and innovation capabilities improved after receiving such investment.

The third is analysis of the cooperative relationship between government equity investment and institutional investors by examining the selection of professional investment institutions and leveraging of private capital for co-investment to determine whether such investment attracted more private capital to support the development of emerging industry firms. This analysis framework is also applied to the discussion on firms under investment in Chapter six.

Of the firms in which ZY Venture Capital invested, it has already exited from 12, which involved total investment of CNY 99.81 million and achieved a total ROI of CNY 125.11 million after exit. Each firm received special funding support up to a maximum of CNY 15 million and a minimum of CNY 1.5 million, and a maximum and minimum investment ratio of 9.1% and 1%, respectively. All target firms underwent multiple rounds of equity financing before the government equity investment fund invested, up to a maximum of 11 rounds.

In terms of equity structure, the equity concentration of firms from which the fund has already exited varied significantly. Individual shareholders generally held more than 50% of shares, with a maximum of 76%, and the highest shareholding of a single individual shareholder was 59%. The numbers of individual shareholders of the firms varied greatly, the highest being 57 and the lowest being just 1. In terms of institutional investors, the target firms all had more than two institutional investors, and the highest number was 30. The highest shareholding ratio

of a single institutional investor was 30% and the lowest was 7%.

The industries to which target firms belonged included cross-border e-commerce, 3D printing, medical electronics, biotechnology, and petroleum instruments, which are some of the strategic emerging industries that Shenzhen focuses on. The target firms generally had certain technological capabilities, and the most patents held by a firm was 223.

5.1 Government equity investment and financial performance of target firms

Supporting the growth and development of firms in emerging industries is an important objective of government equity investment, and the value or growth of a firm is highlighted via improved financial performance. From the perspective of corporate financing constraints, government equity investment serves to help replenish the cash flow required for business development and to ease the financial strain (Luo & Chen, 2020), thereby creating favorable conditions for improved corporate profitability. Following the endorsement in the form of government equity investment, firms can introduce social capital and encourage banks to issue loans to further ease their financing constraints. After easing the financing constraints of enterprises, those target firms can further reduce the capital pressure, This, in turn, expands financing channels and ramps up the purchase of fixed and intangible assets, such as the construction of new plants, the purchase of production equipment, raw materials, etc. So that firms can build the talent reserve and talent echelon construction, at the same time contribute to improve the R&D. Firms can also recruit quality personnel to improve their R&D and operations management. Government equity investment in a firm will also help to improve corporate governance, the coordination of resources, strengthen management and development capabilities internally and externally, and help the business expand (J. R. Huang, 2021). Managers of market-based equity investment institutions can contribute professional knowledge, management experience and market resources which will improve corporate governance and promote rapid growth. Through this process, firms' capacity for value creation has gradually improved and is reflected in their financial performance (F. X. Li et al., 2015; Ren, 2019).

To reveal the true impact of government equity investment on the business performance of firms from which investment was exited (post-investment firms), this study conducts analysis from three perspectives.

The first is a comparison of the changes in the firms' financial indicators, with the moment of government equity investment injection and the point of exiting treated as the two reference

benchmarks.

The second is an examination of the correlation between government equity investment and the main profit indicators of post-investment firms. The specific method calculates the correlation coefficient and scatter plot line of best fit to infer whether or not the proportion of government shareholding was positively correlated with firms' financial performance.

Finally, the study uses panel data regression analysis to quantitatively examine whether, and to what extent, government equity investment has enhanced the financial performance of post-investment firms.

The main variable used in the analysis is the government's shareholding ratio (ZY Venture Capital 's equity contribution as a proportion of the total share capital of the target firm, referred to as “govs”). The commonly used indicators of corporate performance to measure profitability are Return on Assets (the ratio of net profit to total assets; referred to as ROA), and Return on Equity (the ratio of net profits to its shareholders' equity, referred to as ROE). The sample group consists of 12 firms from which ZY VENTURE CAPITAL exit its investment between its establishment and 2018. Variable descriptive statistics are shown in Table 5.1 below.

Table 5.1 Variable table attribute statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
govs	23	0.034348	0.027107	0.01	0.09
ROA	23	-0.02957	0.192908	-0.58	0.28
ROE	23	0.279565	0.988017	-1.64	0.84

By studying and comparing the financial data of target firms while the government equity investment fund was invested, it is possible to monitor changes in financial performance of firms once the government equity investment fund became a shareholder. In terms of return on assets (ROA) and return on equity (ROE), of the 12 target firms in the sample, seven experienced varying degrees of improvement in ROA at the end of the investment period compared with when investment began, and four firms’ ROE improved to varying degrees, as shown in Table 5.2. However, examining financial performance indicators can have mixed results as it can be difficult to determine the trend of a firm’s actual financial performance during the period of equity investment. Next, this study further examines the relationship between government equity investment and the financial performance of target firms using statistical fit and regression analysis.

Table 5.2 Improvement in financial performance of target firms during the investment period

Target firm	Investment period	
	Improvement in ROA	Improvement in ROE
A1	Yes	Yes
A2	No	No

A3	Yes	Yes
A4	No	No
A5	No	No
A6	Yes	Yes
A7	Yes	No
A8	Yes	No
A9	Yes	No
A10	No	No
A11	Yes	Yes
A12	No	No

Notes: Improvement in a financial indicator is based on the difference between the value in the year of exit and that of initial equity investment. >0 means that the indicator improved, which is expressed as "Yes" or "No."

The correlation coefficient between the financial indicators of sampled firms after exit (post-investment) and the shareholding ratio of the government special fund was calculated. The results indicate that the proportion of government investment (govs) was positively correlated with firms' ROE, which means that maintaining a high shareholding ratio of government equity investment was conducive to improving a firm's returns, and the higher the proportion of government equity shareholding, the higher the ROE. In addition, the correlation coefficient between the proportion of government investment and ROA of firms was negative, indicating that the relationship between government equity investment and business performance may not be clear in post-investment firms. Therefore, from the perspective of the correlation between the proportion of government equity investment and the financial indicators of post-investment emerging industry firms, it is unclear whether equity investment support achieved the original intention of promoting firm growth.

Table 5.3 Government equity investment shareholding ratio (govs) and firm ROE and ROA

	govs	ROE	ROA
govs	1		
ROE	0.068	1	
ROA	-0.3762	0.8038	1

As shown in Table 5.3, based on the correlation coefficient of the variables, the government capital contribution ratio (govs) was also fitted with operating performance of target firms to further explain the efficacy of equity investment support. The results indicate that the financial performance of the invested firms and the proportion of government equity shareholding have a U-shaped relationship to some extent. At a low government shareholding ratio, the positive relationship between government equity investment and firm performance is relatively insignificant. As the shareholding ratio increases, firm performance gradually improves, and the effect on ROE is more notable. From the perspective of cultivating and helping emerging industry firms to improve their performance, it may be beneficial to increase the shareholding of government equity investment funds under certain circumstances. Figure 5.1 and Figure 5.2 illustrate the relationship between government equity investment and firm performance.

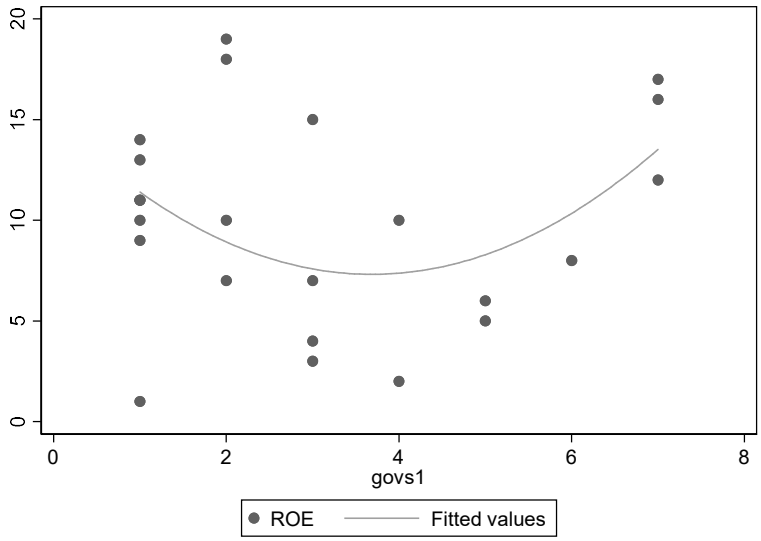

Figure 5.1 Scatter plot of ROE and government shareholding ratio of post-investment firms

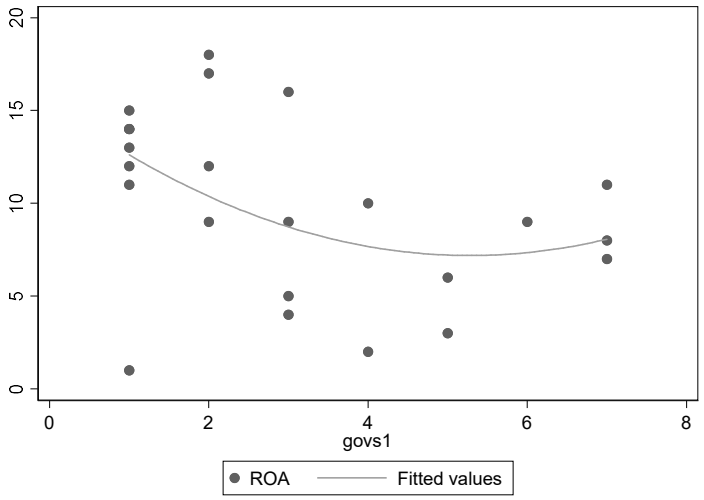

Figure 5.2 Scatter plot of ROA and government shareholding ratio of post-investment firms

Based on comparative analysis and scatter plot lines of best fit, a quantitative analysis tool was used with panel regression to further examine the relationship between government equity investment and the financial performance of post-investment firms. It should be noted that there are only 12 firms in the sample from which ZY Venture Capital has exited its investment and the time interval is 2016-2018. Hence, with reference to the data fit analysis results, to improve the quality of statistical inference from panel modeling with limited observations, univariate regression was adopted to measure the correlation between corporate performance indicators and the shareholding ratio of the government equity investment fund.

$$\boldsymbol{ROA_{it} = \beta_0 + \beta_1 govs_{it} + r_t + \lambda_i + \varepsilon_{it}} \quad (5.1)$$

Where the explanatory variable *ROA* is the return on total assets from the target firm after

exit of investment, the explanatory variable *govs* is the shareholding ratio of the government equity investment fund, *i* is the target firm, and *t* is the year. Considering the individual differences and time-varying factors of the target firms, the individual fixed effect λ and the time fixed effect *r* were also included.

The regression results are reported in Table 5.4 and Table 5.5. The coefficient of the shareholding ratio of the government equity investment fund was positive, which is consistent with the theoretical expectation, but it failed to pass a significance test at the 5% level. When the explanatory variable *ROA* is replaced by *ROE*, the right side of the equation of regression model (1) remains unchanged. The coefficient of the shareholding ratio of the government equity investment fund was also positive, and although this is consistent with the theoretical expectation, it also failed a significance test at the 5% level. The regression results of the comprehensive model do not necessarily confirm that, in post-investment firms, a higher shareholding ratio by the government equity investment fund resulted in a better financial performance.

Table 5.4 ROA and govs regression results of post-investment firms

roa1	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
govs1	0.358	2.852	0.130	0.902	-5.997	6.715
year						
2017	0.487	2.271	0.210	0.834	-4.573	5.537
2018	-2.282	4.584	-0.500	0.629	-12.497	7.933
cons	8.965	10.496	0.850	0.413	-14.422	32.353
sigma_u	4.251					
sigma_e	4.535					
rho	0.467 (fraction of variance due to u_i)					

Table 5.5 ROE and govs regression results of post-investment firms

roe1	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
govs1	2.205	2.899	0.760	0.464	-4.254	8.664
year						
2017	0.564	2.654	0.210	0.836	-5.349	6.478
2018	-0.589	4.409	-0.130	0.896	-10.414	9.234
cons	2.868	10.704	0.270	0.794	-20.981	26.718
sigma_u	6.094					
sigma_e	4.665					

rho	0.630 (fraction of variance due to u_i)

Although the panel data regression results failed to confirm the positive effect of government equity investment on the business performance of target firms, such a conclusion is consistent with our previous comparative, correlation, and scatter analyses. However, from another perspective, it demonstrates that the government's decision to support target firms may not be based solely on their financial performance. Financial indicators are important consideration indicators, these financial indicators are often used as a basis for consideration in a wide range of practical applications, In other words, it is not only firms that perform well that will be considered for government equity investment support. Indeed, the principle of "selective support" of government equity investment funds is relatively flexible. In addition to corporate profitability indicators, support may depend on a combination of the target firm's technology capabilities and business characteristics. It also shows that there is still room for improvement in the equity investment support model. The current equity support model does not perform well in integrating the professional resources of equity investment institutions and stimulating enterprises' enthusiasm for R&D and innovation. Phased equity capital investment has not yet been translated into the improvement of the target firms' profitability. Indirectly, it indicates that in the process of equity support decision-making, the government perhaps pays more attention to potential technological progress of firms and their role in driving the development of an industry as a whole, rather than only investing in emerging industry firms with strong financial indicators.

After target firms received government equity support, approximately half experienced a significant improvement in their overall financial performance, which indicates that the current equity investment model plays a positive role in stimulating the growth and development of emerging industry firms. It is a reflection of the actual effect government equity investment has on integrating market-oriented decision-making and industrial support, as well as the sustainable operation capability of government equity investment funds. It is because the profitability of enterprises at the early stage of development in emerging industries is weak compared with their industrial and commercial counterparts. This is a result of factors such as internal management, technological innovation, and the external market. The financial performance of the other target firms was not ideal, which means there is room for improvement of the current equity investment support model.

5.2 Government equity investment and technological innovation of firms

Theoretical and empirical studies have confirmed that indirect or direct financing that alleviates corporate financing constraints is conducive to firms carrying out high-risk, long-term R&D investment and has a positive role in stimulating their technological innovation (Z. X. Yan et al., 2016; Massimo et al., 2016). In fact, an important starting point of the decision to launch government equity investment support for emerging industry firms was to encourage technological innovation and thereby play a leading role in overall industrial upgrading. Thus, it is important to understand firms' technological capabilities, R&D strengths, technological application prospects, and role in driving an industry during the equity investment process. Nevertheless, due to excessive reliance on the professional ability of professional cooperation institutions, government equity investment decision-making in reality relies more on the judgment of professional cooperative institutions, lacks first-hand control of the technological innovation capabilities of target firms, and lacks detailed data of the R&D investment of such firms.

Based on available data, we analyzed the technological innovation of firms supported by government equity investment by obtaining their patent holdings after the government had invested. Of the 12 target firms from which investment had been exited, 10 increased the number of patents they held during the period of government equity investment, one made a major breakthrough by increasing patents held from zero, and four increased their patents by more than 100%. The largest increase in patents by a firm was 43. Refer to Table 5.6 for more details.

Table 5.6 Increase in patents of firms during investment period

Target firm	Patents held at exit time	Patents held before investment	Increase in patents
A1	11	0	11
A2	20	11	9
A3	62	31	31
A4	25	11	14
A5	11	8	3
A6	0	0	0
A7	2	2	0
A8	56	25	31
A9	38	13	25
A10	60	48	12
A11	245	235	10
A12	223	180	43

It is worth noting that target firms in the sample controlled by someone with a technical background (i.e., someone with direct experience of technical R&D or a university qualification

in science and engineering) tended to have more new patents. In six of the eight firms with more than ten new patents during the period of government shareholding, the controller of the company had a technical background. Generally, a controller with a technical background is better positioned to perceive the technical prospects of a product and strike a balance between R&D capital investment and promoting product iteration. Blind investment due to a lack of understanding of the technical trends or excessive caution that can lead to the unsustainable R&D and innovative capabilities of the enterprise—which can undermine the long-term development of the enterprise—can be avoided. This should also be considered when selecting emerging industry targets for government equity investment and for strengthening the R&D and innovation incentives of target firms. That is, all else being equal, equity investment funds should select firms controlled by those with technical backgrounds, as it may lead to better growth prospects of the supported firms.

This analysis revealed that the support of government equity investment funds increases private capital investment and objectively enhances the financial security of emerging industry firms to conduct technological R&D, helping firms concentrate resources to carry out core technological R&D and innovation. In the case of investment in technological R&D by emerging industries, which have particularly high levels of risk, long cycles, and great uncertainty, the effective endorsement of powerful institutions or financial institutions is needed to effectively enhance the confidence of institutional investors, government equity support boosts institutional investors' confidence and provides a relatively relaxed and favorable financing environment for technological innovation. This is consistent with Z. X. Yan et al.'s (2016) research conclusions on government support for small and medium-sized high-tech enterprises. In addition, when selecting target firms, technological capabilities should be properly emphasized. Among the sample of post-investment firms, one did not have any patents before the government became a shareholder and another had only two patents. This weak technological foundation could explain why the two companies failed to achieve technological innovation breakthroughs during the period of government investment.

5.3 Interaction between government equity investments and institutional investors

As the government equity support model examined in this study is carried out in the form of co-investment with professional collaborating institutional investors, collaborating institutions' experience in the selection of target firms, post-investment management, risk assessment, and

exit mechanisms have a critical influence on the government's equity investment decisions and operations. Interaction and collaboration between the two parties are related to the actual effectiveness of the equity support model in nurturing and supporting firms in emerging industries.

Twelve of the exited sample firms have collaborated with a total of 11 equity investment institutions, which highlights the relatively diverse nature and sources of collaborating institutions. In terms of geographic distribution, these institutions include investment institutions from Shenzhen and other regions. Regarding ownership structure, these institutions include state-owned, foreign, and private investment institutions. The size of these investment institutions also varies greatly, as their registered capital ranges from CNY5 million to over CNY5 billion. These professional collaborating institutions also differ significantly in their accumulation of investment projects, investing in 750 projects at most and 10 projects at least. Table 5.7 shows the equity investment institutions collaborating with firms that have exited from the government equity investment fund.

Table 5.7 Equity investment institutions collaborating with firms that have exited from the government equity investment fund

Venture capital firm	Registered capital (CNY thousand)	Number of invested firm projects	Amount of capital contribution (CNY thousand)	Return on investment
Wensheng (Tianjin) Investment Management Co., Ltd.	US$3.5 million	63	12,000	0.00%
Shenzhen Capital Group Co., Ltd.	5,420,900	816	20,000	43.66%
First Capital Investment Co., Ltd.	1,100,000	60	29,100	0.00%
Guangzhou Securities Innovation Investment Management Co., Ltd.	500,000	49	30,000	19.63%
Shenzhen Longgang Venture Capital Guided Fund Co., Ltd.	500,000	-	8,000	8.00%
Shenzhen Huaxin Capital Management Co., Ltd. (Limited Partnership)	200,000	7	30,000	31.70%
Shenzhen Tongxin Wending Fund Management Co., Ltd.	121,000	17	4,000	10.00%
Shenzhen Pengde Venture Capital Co., Ltd.	30,000	9	23,000	10.00%
Shenzhen Qifu Capital Management Co., Ltd.	12,190	279	7,120	10.00%
Shenzhen Pinevc Capital Partners	10,600	287	6,400	10.00%

Shenzhen Qianhai Ruize Asset Management Co., Ltd.	10,000	15	30,000	7.05%

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Chapter 6: Effectiveness of Government Equity Investments: Funded Firms

To examine government equity investment support given to firms during the period of investment, this Chapter analyzes firms that ZY Venture Capital had not exited investment from as of 2018. The sample consists of 73 firms that ZY Venture Capital invested in and was still invested in at the end of 2018. As there were so many firms under investment, there is abundant data, allowing more detailed analysis at the firm level. As such, the analysis is similar to that of post-investment firms in Chapter five. The main analysis framework is basically the same, but the analysis dimensions have been refined. Specifically, it consists of the following areas. The first is analysis of the financial performance of firms under investment by examining the actual support equity investment provides to the business performance of invested firms, using revenue and asset growth as indicators. The second is analysis of the impact of government equity investment on invested firms by examining whether investment increased patent ownership as well as the relationship between patents held and the number of institutional investors, including government equity investment funds. The third is analysis of the cooperative relationship between government equity investment and institutional investors by examining leveraging of private capital by government equity investment. The geographical distribution of institutional investors is taken into account, thereby broadening the research perspective on the guiding effect of government equity investment funds from a spatial standpoint.

Compared with post-investment firms, the following are the differentiating features of the firms under investment. There is a notable disparity in their numbers of basic equity investors, with institutional investors ranging from one to 27. All target firms underwent multiple rounds (up to 12) of equity financing before ZY Venture Capital invested in them. In terms of equity structure, the equity concentration of firms under investment varied significantly. In terms of individual investors, the largest shareholding ratio of individual investors was 90%, of a single individual investor was 83%, and of a single institutional investor was 91%. Numbers of individual shareholders varied greatly, the highest being 64 and the lowest being zero. In terms of the duration of government equity investment among firms under investment, the longest was seven years and the shortest was one year. Examining corporate innovation, the numbers of patents of most of the target firms increased. A total of 31 companies increased their number of patents held by more than 100%. The most held was 406 patents, an increase of 230 compared

to before government investment.

6.1 Government equity investment and financial performance of target firms

The firms under investment are not all targets of recent government investment. To reveal the true impact of government equity investment on the business performance of firms from which investment was exited (post-investment firms), this study conducts analysis from three perspectives. The first is a fit analysis, which examines the correlation between government equity investment and the main profit indicators of post-investment firms. Specifically, the correlation coefficient and scatter plot line of best fit are calculated to infer the influence of government shareholding ratio on the financial performance of target firms. The second is regression analysis. Based on panel data of firms under investment, multiple regression is used to quantitatively examine whether and to what extent government equity investment improved the financial performance of firms under investment. The third is comparative analysis. Taking government equity investment as the cut-off point, we compare changes in the operational and profit indicators of firms before and during the period of government shareholding. The main variable is the government's shareholding ratio (ZY Venture Capital's equity contribution as a proportion of the total share capital of the target firm, referred to as "govs"). The commonly used indicators of corporate performance to measure profitability are ROA, ROE, operating income, and total assets. A description of the model and changes in the regression analysis is provided below. The sample group consists of 73 firms from which ZY Venture Capital did not exit its investment between its establishment and 2018.

6.1.1 Fitting analysis

This study calculates the coefficients of correlation between the financial indicators of funded sample firms and the percentage of capital contributions from the government equity investment special fund support program. The results show that there is a positive correlation between the percentage of government capital contributions and the return on equity (ROE) of firms, thus implying that maintaining a high shareholding percentage of equity investments is conducive to boosting the return on capital of firms. the correlation coefficient is relatively low (0.06), which means that the promotion effect is limited to a certain extent. Different from the exited enterprises, the correlation coefficient between the proportion of government equity investment and the return on total assets (ROA) of the invested enterprises is also positive (0.12). Unlike in exited firms, the coefficient of correlation between the percentage of capital

contributions from government equity investments and the return on assets (ROA) of firms is also positive, which reflects a relatively consistent relationship between government equity investments and the main business performance indicators of firms. However, this correlation coefficient fails the significance test at the 5% level, thus indicating that for funded firms, there may be uncertainty over whether government equity investment support met the original intention of the decision to support the growth and development of firms in emerging industries.

As in the previous section, this study employs scatter diagram to fit the percentage of government capital contributions to the business performance of target firms based on the coefficients of correlation between variables to further explain the effectiveness of equity investment support. We find to some extent a non-linear relationship between the financial performance of funded firms and the government's shareholding percentage. When the government's shareholding percentage is low (less than 5%), government equity investments have a weak positive correlation with the business performance of firms. As the government's shareholding percentage increases (greater than 5%), the relationship between government equity investments and the business performance of firms becomes unclear; this also appears when fitting the shareholding percentage of capital contributions from government equity investments to firms' ROA and ROE. See Figure 6.1 and Figure 6.2 for the scatter diagrams.

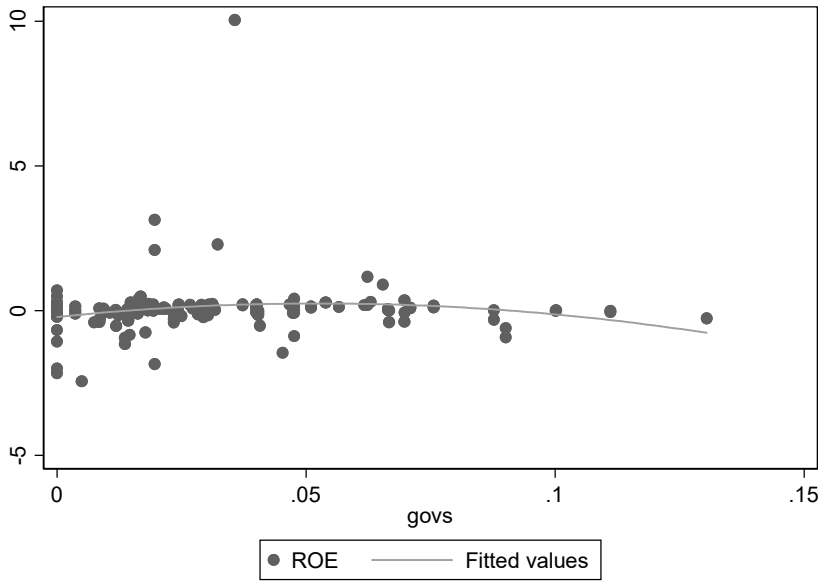

Figure 6.1 Scatter diagram for the relationship between ROE and government shareholding percentage

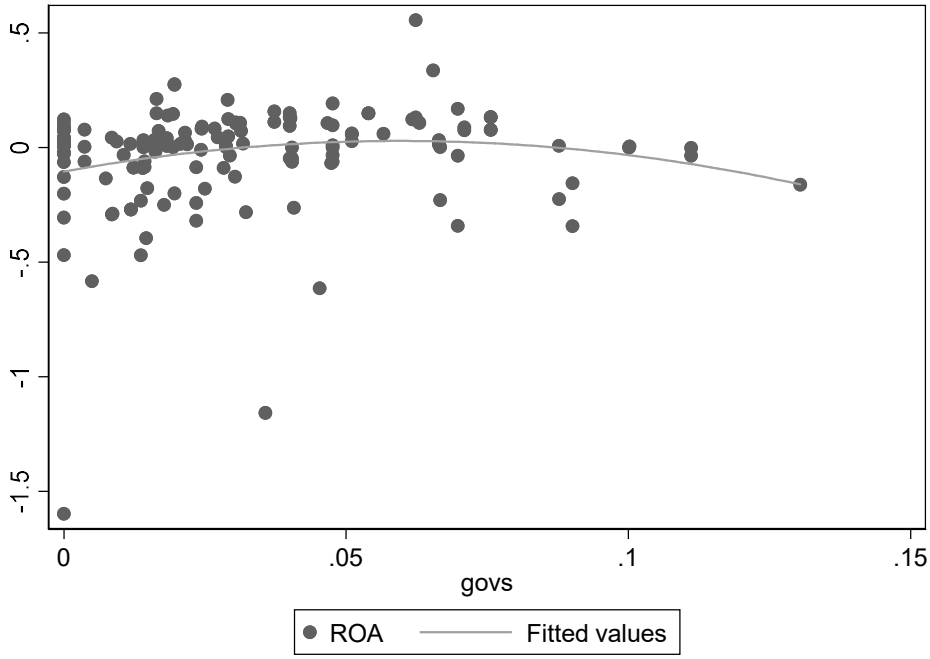

Figure 6.2 Scatter diagram for the relationship between ROA and government shareholding percentage

6.1.2 Regression analysis

Owing to the fact that ZY Venture Capital has funded 73 firms between 2016 and 2018, there are more observations for funded firms than exited firms. In order to improve the quality of statistical inference from short panel data modeling, this study employs a multiple regression model to measure the relationship between the performance indicators of firms and the shareholding percentage of the government equity investment fund.

$$\mathbf{Performance_{it}} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{govs_{it}} + \boldsymbol{\beta_2}\mathbf{controls_{it}} + \mathbf{r_t} + \boldsymbol{\lambda_i} + \boldsymbol{\varepsilon_{it}} \quad (6.1)$$

where dependent variable *Performance* represents the financial performance indicator of an exited target firm, which is measured using return on assets (*roa*) and return on equity (*roe*); independent variable *govs* is the shareholding percentage of the government equity investment fund; *controls* refers to control variables, including gross domestic product (GDP) growth (*gdp*), value added by industry (*industry*), bank loan growth (*credit*), and fiscal revenue growth (*fiscalrevenue*) in Shenzhen Municipality, aimed at controlling for the effects of various macro factors, such as economic growth, industrial development, debt financing environment, and local governments' financial strength; *i* represents a target firm; and *t* represents year. The data of macro control variables are derived from the website of Shenzhen Statistical Bureau and the statistical yearbook of Shenzhen calendar year. The attribute description statistics of the variables are presented in the Table 6.1 below.

Table 6.1 Descriptive statistics of variables for funded firms

Variable	Obs	Mean	Std. Dev.	Min	Max
roa	152	−0.02969	0.227831	−1.59825	0.556436
roe	152	0.046543	1.013662	−2.43759	0.84529
govs	152	0.031353	0.027708	0	0.130435
gdp	152	0.082622	0.006427	0.076	0.0901
industry	152	0.025882	0.079102	−0.04	0.136
credit	152	0.189147	0.029282	0.17354	0.25449
fiscalrevenue	152	0.08148	0.046079	0.061916	0.309452

Considering factors such as individual differences and temporal variation among target firms, this study includes an individual time effect λ and time fixed effect r. The regression results are presented in Table 6.2 below. Based on the regression model using ROA as a measure of the financial performance of firms, the coefficient of the shareholding percentage of the government equity investment fund is positive but fails the significance test at the 5% level. After ROA is replaced with ROE in Regression Model 1, the regression results in Table 6.3 show that the coefficient of the shareholding percentage of the government equity investment fund is still positive and passes the significance test at the 5% level as well. Summing up the regression results above, the positive correlation between the financial performance of funded firms and the shareholding percentage of the government equity investment fund is not significant.

Table 6.2 Regression results for the relationship between ROA and govs

roa	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
govs	0.353	1.161	0.17	0.248	0.668	0.962	
gdp	0.148	2.403	0.06	0.951	−4.643	4.939	
industry	−0.183	0.210	−0.87	0.385	−0.601	0.235	
credit	1.647	1.160	1.42	0.160	−0.666	3.960	
fiscalrevenue	−2.236	0.856	−2.61	0.011	−3.941	−0.530	**
Constant	−0.124	0.339	−0.37	0.716	−0.801	0.552	
Mean dependent var		−0.030	SD dependent var				0.228
R^2		0.184	Number of obs				152.000
F-test		8.444	Prob > *F*				0.000
Akaike crit. (AIC)		−189.503	Bayesian crit. (BIC)				−174.384

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

Table 6.3 Regression results for the relationship between ROE and govs

roe	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
govs	0.917	0.819	0.16	0.447	−10.530	4.696	
gdp	5.262	6.698	0.79	0.435	−8.090	18.614	
industry	−0.458	0.531	−0.86	0.392	−1.517	0.602	
credit	6.922	4.049	1.71	0.092	−1.151	14.994	*
calrevenues	−8.288	3.102	−2.67	0.009	−14.472	−2.104	***

Constant	−0.919	1.083	−0.85	0.399	−3.079	1.241

Mean dependent var	0.047	SD dependent var	1.014
R^2	0.240	Number of obs	152.000
F-test	2.764	Prob > F	0.034
Akaike crit. (AIC)	147.832	Bayesian crit. (BIC)	162.952

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

Like the regression results for exited target firms, the regression results for funded firms are unable to prove or confirm the positive facilitating effect of the government equity investment fund on the business performance of target firms. Likewise, these results suggest from another perspective that a firm's financial performance is not the sole criterion for consideration in the government's decision to support target firms; even firms that are not profitable can also appear on the radar of government equity investment support.

6.1.3 Comparative analysis

As of the end of 2018, the government equity investment fund holds the shares of funded firms for 2.15 years on average, where the fund holds the shares of 45 firms in total for 2 years or less, accounting for 64% of the sample firms, and the shares of 4 firms for 4 years or more. By compiling and comparing variation in the financial performance of firms before and after the government becomes a shareholder, this study can examine the actual effects of government equity investments on the financial performance of firms.

1. Operating revenue and total asset growth. Based on variation in the total assets and operating revenue of target firms during the equity investment period, operating revenue and asset size are roughly proportional to the percentage of capital contributions and years of shareholding during the fund's shareholding period. This shows that for target firms with a high percentage of capital contributions from the fund, the longer the period of shareholding by the fund in these firms, the higher the likelihood that these firms experience an increase in operating revenue and total asset size. Of the target firms, 52 achieve positive growth in operating revenue during the fund's shareholding period, accounting for 72.6% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 4.1% and 2.3 years, respectively. On the other hand, 21 of the target firms demonstrate a decline in operating revenue during the fund's shareholding period, accounting for 27.4% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding in these firms are 3.8% and 1.9 years, respectively, 0.3 percentage points and 0.4 years lower than in target firms with positive revenue growth. Meanwhile, 38 of the sample firms experience an increase in total asset size

during the fund's shareholding period, accounting for 52.1% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding in these firms are 4.2% and 2.2 years, respectively. On the other hand, 35 of the sample firms exhibit a decline in total asset size during the fund's shareholding period, accounting for 47.9% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding in these firms are 3.7% and 2 years, respectively, which are 0.5 percentage points and 0.2 years lower than those in target firms with positive asset growth.

As shown by the variation in operating revenue and total asset growth before and after the equity investment fund becomes a shareholder of the target firms, the operating revenue and total assets of these firms generally grow at a slower pace after the fund becomes a shareholder of these firms, where the longer the fund's shareholding period, the more apparent the slowdown becomes. Furthermore, target firms with a high percentage of capital contributions from equity investments are more likely to experience an increase in operating income, but their total assets grow at a steadier pace. As far as operating revenue is concerned, 21 sample firms experience faster growth in operating revenue after the fund becomes a shareholder of these firms, accounting for 28.8% of the sample firms, while the average years of shareholding by the fund in these firms is 1.9 years. In sharp contrast, 45 sample firms exhibit slower growth in operating revenue after the fund becomes a shareholder of these firms, accounting for 61.6% of the sample firms, while the average years of shareholding by the fund in these firms is 2.1 years. As for total assets, 16 sample firms experience faster growth in total assets after the fund becomes a shareholder of these firms, accounting for 21.9% of the sample firms, while the average years of shareholding in these firms is 1.7 years. Contrariwise, 50 sample firms demonstrate slower growth in total assets after the fund becomes a shareholder of these firms, accounting for 68.5% of the sample firms, while the average years of shareholding by the fund in these firms is 2.1 years. Refer to Table 6.4 for details.

Table 6.4 Financial performance of the enterprise during the holding period of equity investment and before and after taking shares

Operating Revenue and Asset Growth During the Government Equity Investment Fund's Shareholding Period	Growth in operating revenue		Growth in total asset size	
	Yes	No	Yes	No
Number of firms	52	21	38	35
Percentage of firms	72.60%	27.40%	52.10%	47.90%
Percentage of capital contributions	4.10%	3.80%	4.20%	3.70%
Years of shareholding	2.3	1.9	2.2	2
Operating Revenue and Asset Growth Before and After the	Increase in operating revenue growth		Increase in total asset growth	

Government Equity Investment Fund Becomes a Shareholder of Target Firms	Yes	No	Yes	No
Number of firms	21	45	16	50
Percentage of firms	28.80%	61.60%	21.90%	68.50%
Percentage of capital contributions	4.20%	3.60%	2.80%	4.20%
Years of shareholding	1.9	2.1	1.7	2.1

Note: Given the availability of data, operating revenue and total asset growth after the government equity investment fund becomes a shareholder are measured based on growth over the fund's shareholding period. Operating revenue and total asset growth before the fund becomes a shareholder are calculated according to the following principles: If the sampling interval is longer than or equal to the fund's shareholding period, operating revenue and total asset growth are calculated based on data for each year of shareholding by the fund; if the sampling interval is shorter than the fund's shareholding period, operating revenue and total asset growth are calculated based on actual data. Since only the data for the first year of shareholding by the fund are available for 7 sample firms, a total of 66 sample firms have been identified for comparison in this study.

Summing up both aspects of the analysis, it is evident that firms in emerging industries, as recipients of support from equity investments, basically maintain a rapid growth momentum in operating revenue and total assets before appearing on the radar of investments.

On the one hand, firms whose main capability is innovation experience faster growth in size at the beginning of the growth stage; on the other hand, there is an incentive for firms to "beautify" their financial statements, especially to create a "high growth" image that reflects rapid growth in performance, with the intention of attracting equity investments. As firms continue to adjust their business and management strategies, extensive growth may slow down; at the same time, gradually available equity investments provide firms with financial support to maintain a certain pace of development. While firms are expected to gradually enter a stage of stable and healthy development as the years of shareholding by equity investments increases, the motivation of firms with a high shareholding percentage of government capital contributions to pursue size expansion may be restrained more effectively. When selecting high-quality target firms, equity investments should carefully screen out firms that unilaterally pursue high revenue and asset growth or commit financial fraud, pay attention to the status of revenue and asset growth in target firms, and motivate them to engage in stable business operations.

ROA and ROE. This study further examines variation in the profitability of target firms during the fund's shareholding period. As can be observed from comparisons of ROA and ROE, there appears to be insufficient evidence regarding whether government equity investments increase the profitability of target firms during the equity investment fund's shareholding period. Target firms with a high percentage and longer period of shareholding by government equity investments do not show better financial performance; rather, the financial performance of target firms with a low percentage and shorter period of shareholding by government equity

investments is more outstanding. Specifically, 34 sample firms experience an increase in ROA during the fund's shareholding period—that is, their ROA level at the end of the shareholding period is higher than in the year when the fund first became a shareholder, accounting for 47.2% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 3.52% and 2 years, respectively. On the other hand, 38 sample firms experience a decline in ROA during the fund's shareholding period, accounting for 53.8% of the sample firms, while the average shareholding percentage of the fund and the average years of shareholding by the fund in these firms are 4.15% and 2.1 years, respectively, all of which are higher than target firms with an increase in ROA. In sharp contrast, the ROE comparison results show that only 27 target firms experience an increase in ROE during the fund's shareholding period—that is, their ROE level at the end of the shareholding period is higher than in the year when the fund first became a shareholder, accounting for 37.5% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 3.35% and 1.9 years, respectively. Correspondingly, 35 sample firms exhibit a decline in ROE, accounting for 62.5% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 4.16% and 2.2 years, respectively, all of which are higher than in target firms with an increase in ROE. Table 6.5 details the above information.

Table 6.5 Profit status of target enterprises during the holding period of equity investment fund and before and after taking shares

Variation in the Profitability of Target Firms During the Government Equity Investment Fund's Shareholding Period	Increase in ROA		Increase in ROE	
	Yes	No	Yes	No
Number of firms	34	38	27	35
Percentage of firms	47.20%	53.80%	37.50%	62.50%
Percentage of capital contributions	3.52%	4.15%	3.35%	4.16%
Years of shareholding	2	2.1	1.9	2.2
Variation in the Profitability of Target Firms Before and After the Government Equity Investment Fund Becomes a Shareholder	Increase in ROA		Increase in ROE	
	Yes	No	Yes	No
Number of firms	38	28	36	30
Percentage of firms	57.60%	42.40%	54.50%	35.50%
Percentage of capital contributions	3.95%	3.89%	3.78%	4.10%
Years of shareholding	2.1	2.1	2	2.2

Note: Given that ROE and ROE are relative indicators, the principles used in Table X are also applied to the selection of the time interval for comparing these indicators before and after the fund becomes a shareholder of the target firms. Therefore, a total of 66 sample firms have been identified for comparison in this study.

Next, this study expands the scope of investigation by comparing variation in the profitability of target firms before and after the government equity investment fund becomes a shareholder of these firms. Compared with the short time interval over the fund's shareholding period, the fundamental results support the conclusion that the equity investment fund has improved the profitability of target firms. The idea behind this comparison is to calculate the average of ROA or ROE before and after the fund becomes a shareholder using the first year of shareholding by the fund as the dividing line, and then compare the percentage of capital contributions from the equity investment fund and years of shareholding by the fund in the target firm with the variation in the profitability of the target firm before and after the fund becomes a shareholder of the target firm. Specifically, 38 firms experience an increase in ROA after the fund becomes a shareholder of these firms, accounting for 57.6% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 3.95% and 2.1 years, respectively. Correspondingly, 28 firms exhibit a decline in ROA after the fund becomes a shareholder of these firms, accounting for 42.4% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 3.89% and 2.1 years, respectively, not differing greatly from sample firms with an increase in ROA.

In the meantime, 36 firms show an increase in ROE after the fund becomes a shareholder of these firms, accounting for 54.5% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 3.78% and 2 years, respectively. On the other hand, 30 firms experience a decline in ROE after the fund becomes a shareholder of these firms, accounting for 35.5% of the sample firms, while the average percentage of capital contributions from the fund and the average years of shareholding by the fund in these firms are 4.1% and 2.2 years, respectively, all of higher than for target firms with an increase in ROE.

Summing up variation in the profitability of target firms during the fund's shareholding period as well as before and after the fund becomes a shareholder of these firms, government equity investments to some extent play a supporting and facilitating role in the profitability of firms, where most of the firms experience an increase in ROA or ROE after the fund becomes a shareholder of these firms, while the overall average values after the fund becomes a shareholder of these firms are higher than those before the fund becomes a shareholder of these firms. This objectively affirms the positive significance of the government equity investment fund in supporting the development of firms in emerging industries and improving the financial performance of firms. However, the marginal pull effect of equity investments on corporate

performance may tend to decline over time, as evidenced by the fact that the ROA and ROE of over half the target firms at the end of the fund's shareholding period is lower than during the year when the fund first became a shareholder of these firms; furthermore, the longer the period of shareholding by the fund, the more apparent this marginal decrease. This indicates that the short-term effects of the government equity investment fund joining as a shareholder are better than the long-term effects. These inferences can be explained from a number of perspectives. The first is the growth cycle of firms. As firms transition from the start-up stage to the growth stage after receiving equity investment support, related R&D investments and the costs of building and maintaining the industry chain and supply chain increase at a faster pace, putting greater pressure on firms to increase earnings. On the other hand, government equity investment support, as a one-time investment, can quickly meet firms' needs for funding to boost performance over the short term; however, if firms are unable to expand their financing channels correspondingly over the long run, they may face stricter financing constraints in various areas when they grow, which will then cause a certain level of impact on their profitability.

6.2 Equity investments, firm innovation and R&D

Compared with exited firms, funded firms in general are either in the start-up stage or are transitioning from the start-up stage to the growth stage; thus, these firms are more active in R&D and innovation on the whole. At the same time, funded firms generally exhibit weaker stability in product revenue than exited firms, so the earnings of these firms also offer weaker support to R&D and innovation than exited firms on the whole. This shows that funded firms are highly dependent on capital from equity investments regarding innovation and R&D. On the number of new patents held by funded firms, the vast majority of target firms achieve breakthroughs in R&D and innovation after the government equity investment fund becomes a shareholder of these firms, where a total of 63 firms experience growth in the number of patents, accounting for 87.3% of the funded firms. Specifically, the number of new patents held by funded firms is generally distributed in a pyramidal shape. According to this distribution, 27 firms obtain 1 to 5 new patents, accounting for 36.99% of the funded firms, where these firms constitute the main group of funded firms and form the base of the R&D and innovation pyramid. Meanwhile, 13 firms obtain 11 to 20 new patents, accounting for 17.81% of the funded firms; 6 firms obtain 21 to 50 new patents, accounting for 8.22% of the funded firms; and 5 firms obtain 51 to 99 new patents, accounting for 6.85% of the funded firms. Lastly, 2 firms

obtain 100 or more new patents, with one obtaining 230 new patents after the fund becomes a shareholder of the firm, thus serving as the benchmark of innovation and R&D among funded firms. Table 6.6 presents the new patents held by funded firms.

Table 6.6 New patents held by funded firms

Number of new patents	Number of target firms	Percentage of funded firms	Average number of institutional investors in each firm	Average percentage of capital contributions from government equity investments
100 and above	2	2.74%	9	2.92%
51 to 99	5	6.85%	11	2.46%
21 to 50	6	8.22%	7	4.60%
11 to 20	10	13.70%	7	2.29%
6 to 10	13	17.81%	7	3.54%
1 to 5	27	36.99%	7	2.51%
0	10	13.70%	6	4.76%

These figures for the number of institutional investors among target firms and the percentage of shareholding by the fund in target firms indicate that firms with more institutional investors generally experience a greater increase in the number of new patents obtained. This also shows that innovation and R&D among target firms depend on capital support from institutional investors. As can be seen in the scatter diagram for the relationship between the number of patents held by target firms (*patent*) and the number of institutional investors (*inss*), the positive relationship between the two also indicates that the more patents a firm holds, the easier it is for the firm to gain the favor of institutional investors. Meanwhile, capital support from institutional investors further facilitates enhancement of R&D and innovation capabilities among target firms. In sharp contrast to institutional investors, however, there is no clear relationship between the percentage of capital contributions from government equity investments and the number of new patents obtained by target firms, as one of the two groups of firms with an average percentage of capital contributions of more than 4% has obtained zero new patents, whereas the firms in the other group have obtained more than 50 new patents. On the other hand, the scatter diagram for the relationship between the number of patents held by target firms (*patent*) and the percentage of government capital contributions (*govs*) shows that government equity investments have different preferences from other institutional investors when selecting investment targets. Specifically, market-based equity investment institutions in general tend to invest in firms with a more mature R&D system and stronger innovation capabilities, while the government tends to offer capital support to firms with weaker R&D and innovation capabilities, thereby reflecting the functional positioning of government equity investments as “providing assistance in the hour of need.”

6.3 Interaction between government equity investments and institutional investors

Out of the 73 target firms, ZY Venture Capital has chosen to establish market-based equity investment collaboration with 54 venture capital firms. As these collaborating equity investment institutions engage in simultaneous investments in a "1:1" ratio according to the size of the government's capital contribution, ZY Venture Capital has leveraged a total of CNY 1.386 billion from various sources of capital from society, including state-owned venture capital. Considering that other market-based venture capital will also step in to make equity investments in target firms after ZY Venture Capital, the guiding effect of government equity investment institutions on capital from society is no less than that of capital contributions from collaborating equity investment institutions: 45 of the funded firms choose to collaborate with only one institutional investor, accounting for 61.64% of the target firms. ZY Venture Capital's efforts to attract as many market-based venture capital firms as possible to support innovative start-ups enhance the amplification effect of financial capital.

The distribution of the top 20 collaborating equity investment institutions indicates that they are primarily composed of Shenzhen-registered venture capital firms, while one venture capital firm hails from Shanghai and another one is state-funded. Shenzhen Capital Group Co., Ltd., a well-known and influential venture capital firm in China, occupies a leading position in terms of capital strength and investment experience among the collaborating equity investment institutions. It is also the preferred partner of ZY Venture Capital in investment projects, as both firms have collaborated in five investment projects, with the amount of capital contribution in a single project exceeding CNY20 million and a combined capital contribution of more than CNY100 billion. Coming in second is Shenzhen Longgang Venture Capital Guided Fund Co., Ltd., a district-level state-owned venture capital firm with lower amounts of capital contribution in a single project. Overall, ZY Venture Capital does not regard capital strength or investment experience as the sole criterion for consideration when selecting collaborating equity investment institutions. This shows that government equity investment institutions maintain a balance between investment expertise and the breadth of capital sources in attracting capital from society. Table 6.7 summarizes the top 20 collaborating equity investment institutions with investments in funded firms

Table 6.7 Top 20 collaborating equity investment institutions with investments in funded firms

	Name of collaborating institution	Amount of capital contribution (CNY thousand)	Number of collaborating investment projects	Registered capital (CNY thousand)	Cumulative number of investment projects
1	Shenzhen Capital Group Co., Ltd.	115,240	5	5,420,900	816
2	Shenzhen Longgang Venture Capital Guided Fund Co., Ltd.	30,000	5	5,000	-
3	Shenzhen Leaguer Co., Ltd.	40,800	3	216,280	21
4	Shenzhen CDF Capital Co., Ltd.	33,600	3	100,000	113
5	Shenzhen D&R Investment Management Co., Ltd.	60,000	2	1,104,740	10
6	China Merchants Innovation Investment Management Co., Ltd.	60,000	2	100,000	3
7	Shenzhen Hanhua Investment Co., Ltd.	60,000	2	10,000	3
8	Shanghai Milestone Asset Management Co., Ltd.	34,000	2	5,000	27
9	Shenzhen Hongjinwen Asset Management Co., Ltd.	23,840	2	30,100	10
10	China Bao'an Group Asset Management Co., Ltd.	15,000	2	50,000	28
11	Shenzhen Huibo Growth Venture Capital Corporation	30,000	1	300,000	26
12	Shenzhen Zhengxuan Investment Co., Ltd.	30,000	1	180,000	38
13	Shenzhen Qifu Venture Capital Management Center (Limited Partnership)	30,000	1	122,220	279
14	SDIC Innovation Investment Management Co., Ltd.	30,000	1	100,000	19
15	Huayuan Foundation (Beijing) Investment Fund Management Co., Ltd.	30,000	1	100,000	3
16	Shenzhen Anpeng Equity Investment Fund Management Co., Ltd.	30,000	1	100,000	39
17	China Merchants Bank International Capital Management (Shenzhen) Ltd.	30,000	1	100,000	63
18	Shenzhen Goldport Capital Management Co., Ltd.	30,000	1	66,000	46
19	Shenzhen Qianhai Hehui Capital Co., Ltd.	30,000	1	50,000	7
20	Shenzhen Fanglue Capital Management Co., Ltd.	30,000	1	25,000	11
		772,480	38	8,185,240	1,562

Note: The top 20 collaborating equity investment institutions are ranked in descending order of the number of collaborating investment projects, followed by the amount of capital contribution.

ZY Venture Capital has diversified business forms. Through years of investment management, ZY Venture Capital has approached and selected a large number of channel resources represented by leading market-oriented equity investment institutions that can

provide upstream and downstream high-quality enterprises, recommendations of actual enterprise controllers, referrals to reliable investment institutions, recommendations of reliable intermediaries, and more, all of which have room for segmentation. Coupled with channel support from the city's industrial authorities, ZY Venture Capital can effectively gain access to extensive, targeted, and reliable channel resources. ZY Venture Capital has established good communication relationships with senior investors of partner institutions and senior organizers of intermediaries, which are all professional supports for ZY Venture Capital to enable further market-oriented investment in the future.

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Chapter 7: Conclusions and Implications

Leveraging government equity investment to develop emerging industry firms is an inherent requirement for China to improve its innovation service system for enterprises during the period of the 14th Five-Year Plan. Accelerating the cultivation and expansion of emerging industries will support China's transformation from one of the world's major manufacturers into a global manufacturing powerhouse. Local government equity support for emerging industries has altered the method of allocating fiscal funds. It is an institutional innovation that helps China to implement industrial policies, unleash market vitality and promote upgrading of the industrial structure.

Based on the practical experience of Chinese government equity investment supporting emerging industries, the case of Shenzhen ZY Venture Capital illustrates the need for government intervention to overcome market failures, combined with the practice of Chinese government equity investment supporting emerging industry firms. This study proposes a framework for evaluating and analyzing the equity support model from the dimensions of the implementation of industrial policies, guidance of private capital, improvement of corporate finances and innovation, and the sustainability of the support model. The institutional characteristics of the government equity support model were revealed from the level of micro-level operations, with a focus on how government equity investment institutions can overcome the inefficiencies of the traditional fiscal support model by cooperating with market-oriented venture capital institutions and relying on mechanism design in the areas of equity investment ratio, pricing, and exit methods.

In-depth analysis of the operation of emerging industry enterprise projects (including projects under investment and projects that have had investment exited) actually invested in by ZY Venture Capital using the analysis framework of the financial performance of target firms, the impact on technological innovation of firms, and cooperation between government equity investment and institutional investors revealed that the actual role and efficacy of government equity investment fund support for the development of emerging industries, the selection process of professional investment institutions, and the guiding effect in leveraging co-investment with private capital, as well as the sustainability of the equity support model itself. Based on this, the main issues with the current equity support model were summarized and countermeasures proposed. This research has theoretical reference value for understanding the allocation efficiency of Chinese local government equity support funds and the growth of

supported emerging industry firms.

7.1 Main conclusions

First, the local government equity support model represented by Shenzhen ZY Venture Capital has played a positive role in guiding private capital to support emerging industry firms. ZY Venture Capital's 1:1 investment reward and compensation model and its exit method of "equal pricing for the same stock, and synchronized entry and exit from investments" complement the public attributes of government equity investment and the professional advantages of market-oriented venture capital institutions to an extent, leveraging private or venture capital with government equity investment, so as to achieve the government objective of increasing equity investment in emerging industries.

(1) Emerging industry firms supported by equity investment were mainly in high-tech industries, such as electronic information, which corresponded with the dominance of such companies in local high-tech industry clusters.

(2) Joint investment with cooperative equity investment institutions provides the double endorsement of the government and market, which provides a foundation of recognition for emerging industry firms in capital and product markets.

(3) The extensive cooperation between government equity investment institutions and market-oriented venture capital institutions reflects the function of fiscal capital as a leader of investment, encouraging more private capital to participate in supporting emerging industry firms.

(4) The overall return on government equity investment was relatively stable, ensuring the circular and rolling use of capital from such investment. The accumulated useful investment experience also led to more effective post-investment management.

Second, the aforementioned investment played a role in improving the financial performance and R&D innovation of enterprises after investment, but efficacy of support needs to improve.

(1) Improvements in profitability indicators (ROA and ROE) as a result of government shareholding were not significant, which was confirmed by statistical comparisons and regression analysis. This indicates that there is still room for improvement to the current model of equity investment support.

(2) Although not all post-investment firms experienced a significant improvement in technological innovation, target firms whose controllers had technical backgrounds were more

likely to improve R&D and innovation achievements with government equity investment.

(3) Extensive cooperation between government equity investment institutions and market-oriented institutional investors had an important impact on leveraging private capital to support the development of emerging industries.

Third, the firms under investment are the main part of government equity investment, and the reflected efficacy of support for emerging industry firms is basically consistent with the orientation of government equity investment.

(1) The role of such investment in improving the performance of firms under investment is non-linear, which means that increasing the government's shareholding ratio or extending the shareholding period does not necessarily improve the profitability of an emerging industry firm.

(2) Government equity investment is effectively a response to the R&D and innovation needs of the target firms and increasing private capital investment through equity investment eases the financing constraints on firm innovation, thereby encouraging firms to conduct R&D activities and increase patent holdings.

(3) Following government equity investment, most firms continued to obtain other market-oriented venture capital support, so the amplifying effect of government equity investment on private capital was not limited to existing cooperation of equity investment institutions. Moreover, government equity investment institutions demonstrated a high degree of openness when choosing partners.

In view of the empirical analysis results, and in accordance with being problem-oriented, the Chinese local government equity investment model and its operational methods, as represented by ZY Venture Capital, still has room for improvement in terms of the efficiency of capital utilization and the efficacy of its support for emerging industries. This can mainly be seen in the following five aspects:

First, the efficiency of capital management needs to be improved. Under the existing support model of government equity investment institutions, allocations of funds by fiscal departments are made to escrow accounts of equity investment institutions one by one as projects are approved and must be returned one by one following exit of the investment. This means that, in reality, there are frequent small investments and exits across many equity investment projects. The transactions and accounting processes consume considerable management resources of companies and government. Government equity investment institutions also have cumbersome procedures for receiving, disbursing, and recovering funds, which reduce the efficiency of capital operations.

Second, the entry threshold for market-oriented equity investment institutions is not

sufficiently high. Market-oriented venture capital institutions that have established cooperative relationships with government equity investment institutions have a high degree of diversification in terms of registered capital and number of investments. However, this indirectly indicates uneven specialization in the institutions involved in the equity support model. It also restricts the overall efficacy of support to some extent. Among target firms still under investment and those with exited investment, most unsuccessful cases involve small and medium-sized institutions or investment institutions in industries unrelated to their main business. Successful institutions have the common characteristics of being in the business for many years, a stable output of successful projects, sufficient capital, and stable management. The investment success rate of such institutions is very high. However, small and medium-sized and new institutions may contain brilliant individuals, but they tend not to have stable business teams and output capabilities, so their failure rate is notably higher.

Third, incentive and restraint mechanisms need to be refined. The target firms and their shareholders benefit from fiscal support, but the cooperative institution bears the sole responsibility and obligations of "synchronized entry and exit." Although inclusion has a positive effect on the brands and investment quotas of cooperating market-oriented equity institutions, the lack of corresponding incentive and compensation measures means that many institutions act negatively in the process of cooperation.

Fourth, there is a lack of focus on key emerging industries. The current policy covers a wide range of industries, allowing funds to dabble in major local emerging industries. However, there is a lack of industry focus for equity investment. Specifically, there is insufficient support for early-stage and start-up projects in key industrial fields, key links in industry chains, and leading industries. These types of projects find it difficult to obtain market-based investment, and they are most in need of fiscal funds and state credit. The absence of direct government equity investment in some of these areas has weakened the government's efforts to nurture key industry clusters.

Fifth, management policies and regulations for the investment process are too rigid. The operational needs of market players are complex and changeable, and the reasons for the exit of investment by cooperative institutions differ. Expiration of funds, shortage of limited partner funds, satisfying regulatory requirements, and internal management adjustments are some of the reasons that lead to equity adjustments, as well as equity transfers to related parties, targeting new market entities at a lower level, or exit from the target firm. The "synchronized entry and exit" approach can lead to the passive implementation of transactions and sales of high-quality equity.

Sixth, the radius of the management of equity-funded "stock projects" is excessively large. ZY Venture Capital operates the post-investment management and exit work of over 90 equity-funded "stock projects," and is responsible for approximately 20 projects per capita (including one seconded staff member), which far exceeds the industry average number of projects managed per capita. Our "stock business" contains a large number of shareholder meeting motions or review, negotiation and settlement, dispute resolution, exit management, and so on, and involves acting as the subject of action in six projects; with numerous post-investment management contingencies and tight decision-making timelines, our staff have been at full capacity or even overloaded, thereby rendering active management and post-investment empowerment impossible.

7.2 Countermeasures and recommendations

It is necessary to promote adjusting and optimizing the governmental equity investment model, making use of the institutional characteristics of Shenzhen's current governmental equity investment model to further strengthen its guiding effect on social capital. In particular, this requires improving the relevant institutional arrangements in terms of enhancing the professional operation of governmental equity investment institutions, deepening cooperation with market-oriented venture capital firms, optimizing a financial award and subsidy system, as well as diversifying capital exit channels.

7.2.1 To enhance professional capabilities and expand the supply of equity investment in emerging industries

(1) For the government equity investment institutions themselves, they should make full use of their advantages of being supported by governmental funds, being accredited by enterprises, with wide industry coverage and relatively controllable risks, and further consolidate their foundation of market-oriented operation and enhance their professional operation capabilities in terms of investment operations, brand image, project reserves, funding channels and expert resources. They should carry out close-end operations to solve the problem of consuming government management resources due to fund allocation; establish a professional investment committee system endowed with complete investment decision-making and management power, carry out investment management in a fully market-oriented way, avoid rigid decision-making, and flexibly serve industrial policies; strengthen connection of capital and industrial resources, promote the development of client enterprises and the growth of emerging industrial

clusters; continue to harden capital operation capabilities, connect industrial resources, and strengthen equity transfers.

Effective equity participation in projects, strict control of the projects for the aforementioned actively managed blind pool funds, single project funds, and private placement funds, and in-depth and solid investment research must be undertaken to build up the brand of "ZY Venture Capital." The fund primarily invests in pre-IPO, mid- to late-stage funds, and listed companies' private placement funds and other funds, and moderately invests in mid- to early-stage technology and innovation funds, to build an industrial presence that not only has a strong foothold at present, but is also oriented toward the future, to contribute net profit and cash flow to the Group in a relatively short period and lay a solid foundation for the sustainable fundraising of the company.

(2) The government should establish and improve an equity investment capital supply system that matches the development of enterprises in emerging industries by establishing an equity investment market system. On the one hand, improve the support policies for equity investment institutions, especially for the private equity market, such as relaxing entry policies appropriately for private equity funds when supervision requirements implementation is ensured, so as to provide a friendly policy environment for such professional institution's establishment and growth. On the other hand, integrate the existing fiscal equity investment capital, clarify fundamental positioning in supporting emerging industry enterprise development, avoid low-level redundant creation and vicious competition of government equity investment institutions in specific fields, and improve the efficiency of fund use, so as to guide and expand the supply of market-oriented venture capital.

(3) We should enhance our investment service capability covering the whole life cycle of enterprises and bring into full play the pivotal role of industry and capital in the integration of industry, academia, research platforms, and capital for emerging industries by connecting capital and rich industrial resources. We should, through our investment team and incubation platform, provide multi-level and all-around transformation services, including enterprise development consulting, development strategy planning, industrial resource orientation, enterprise operation assistance, equity management services, and connecting factor resources to capital, in order to support the growth and development of incubated enterprises. We should leverage the gathering of social resources for transformation services. We should open up to social capital, incubation institutions, commercial service institutions (legal, financial and taxation, consulting, etc.), carry out qualification and credit management for social capital that cooperates in early-stage investment, incubation institutions that jointly promote incubation,

intermediary institutions that provide commercial services, and so on. We should also give them priority in back-end enterprise services, enterprise financing, and so on, and encourage and guide them in providing various services to science and technology achievement transformation projects, as well as supervising their legal operations.

(4) We should step up our support for enterprises with potential in emerging industries. We should continue to serve the city's industrial authorities and engage in discussions and joint study with them on the subsequent optimization and transformation of equity-funded capital, as well as successfully accomplishing post-investment management and exit-related work on the invested projects, with a focus on projects with extreme performance. First, we should facilitate well-faring companies' listing and refinancing in a timely and efficient fashion. Outperforming companies, favored by capital, constantly attract new funding with their sound performance and strong competitiveness in the industry. As such, multiple projects are at the stage of (preparing) filing for listing. ZY Venture Capital should earnestly facilitate those companies in carrying out capital increase negotiations, breaking the barriers of overseas listing, applying for approval of state-owned equity management, shareholder investigation, information disclosure, and other related work service to retain the company's sound reputation and add to the company's list of successful investments. Second, risk prevention and disposal of problematic projects should be achieved. With the buildup of our investment years, problematic projects have invited many litigation, liquidation, repurchase, and other risk matters, and some intermediate projects have not developed as expected, even triggering repurchase.

(5) Striving to establish more blind pool funds. First, focusing on the strategic emerging industries identified in Shenzhen's "twin regions" initiatives, we enhance collaboration with industrial groups, listed companies, government-guided funds, and financial institutions amongst others. Additionally, we explore the development of various modes of cooperation, including management by ZY Venture Capital and joint participation in fund operation with industrial capital, with the aim to establish more new funds in emerging industries. Second, we explore how to establish single-project funds. We need to cooperate with quality institutions or channels to set up single-project funds with due diligence for high-quality projects that cannot be covered by blind pool funds and are urgent. Third, we explore how to establish private placement funds. After close communication with the investment banking departments of leading brokerage firms and listed companies in the early stage, we have laid a sound foundation to reserve private placement projects, and, in the next step, explore the ways of establishing private placement funds to seek potential funders.

(6) We actively facilitate diverse types of investments of the group. Moreover, to become a management institution of privately offered funds, we strive to study and recommend high-quality M&A projects to the group and provide an important platform to implement equity and strategic investments, raise long-term capital, and strengthen liquidity, utilizing the opportunity presented by ZY Venture Capital.

7.2.2 Deepen the cooperation with market-oriented equity funds

The key to exerting the guiding effect of governmental equity investment capital on social capital is to innovate risk-sharing mechanisms. Simultaneous with enhancing the sense of gain of market-oriented venture capital platforms, encourage them to make full use of their professional capabilities and capital advantages to effectively support emerging industry growth and expansion.

(1) Improve the standards of partner equity institutions, impose requirements in terms of the time of operation, successful cases, entity organization, post-investment capabilities, integrity and compliance, to improve project quality at its source.

(2) For projects recommended by partner equity investment institutions where they have agreed to undertake binding obligations, allow them to receive a certain percentage (such as 10%) of the excess revenues after IPOs or after exit via M&A, thereby encouraging them to continue to supply or introduce high-quality projects.

(3) Integrate the power of the various equity investment funds with government funding; embed innovative and start-up projects into the equity investment fund system; and offer capital support for the full life cycle of enterprises in emerging industries, thereby increasing their attractiveness to social capital, and effectively guiding social capital to “inject funds to small projects at early stages and in the technology industry”.

(4) Join hands with partner equity investment institutions to further increase investment in early-stage projects in key industries and fields, key links of the industrial chain, and leading industries; use the funds and brands to support them through the start-up period, support their financing development, and serve to cultivate key industries.

(5) We use invested projects and their upstream and downstream industries, partner institutions, intermediaries, actual controllers and other resources, as well as quality investment opportunities. We cooperate with first-class institutions and investment managers and directors, including top equity investment institutions, to explore and invest in high-quality projects.

(6) We explore ways to jointly launch special funds with early-stage projects in emerging

industries. After a period of cooperation and incubation, the incubation fund can work with the social capital, based on its actual performance, to establish special funds dedicated to investing in the transformation of emerging industries and grant a certain share of excess returns based on market-oriented rules to mobilize professional social resources. Innovating the risk sharing mechanism is key to bring into play the guiding role of government equity investment capital for social capital and improve the market-oriented venture capital platform's gains, while motivating it to utilize its professional capability and capital advantage to effectively support the growth and development of emerging industries.

7.2.3 Optimize the incentive mechanism design of award and subsidy funds.

(1) Strengthening the incentives for equity investment decision makers.

Based on the actual effectiveness of government equity investment institutions in supporting the development of emerging industries, we aim to provide various forms of incentives. such as follow-up investment rights and financing service incentives. Furthermore, priority investment rights are provided to investment-cum-transformation service personnel to motivate them to effectively explore valuable technological achievements, link industrial demands, introduce social capital, promote the industrialization of achievements, continuously improve their service capabilities, and establish a strong transformation service motivation mechanism. In addition, we expect to establish the government equity investment initiative fault tolerance mechanism. Under the premise of protecting the operational efficiency of the government equity investment fund, minimizing risks to give full play to the function of advancing the transformation of scientific and technological achievements and innovation, and serving high-quality development, the corresponding responsibility can be exempted if the incubation project does not achieve the expected investment effect or causes a certain loss, provided that fund contributors, fund managers, and relevant staff act in compliance with the law and with due diligence.

(2) Optimizing the incentive mechanism in the form of awards and subsidy funds for target enterprises.

In practical operation, governmental equity investment institutions give appropriate awards and subsidies to target enterprise projects, which is conducive to motivating the responsible entities to improve their management and engage in R&D and innovation. To a certain extent, this also reduces the investment risk of partner equity investment institutions. Based on the existing one-off financial award and subsidy policy, the award and subsidy standards should be

linked to the financial performance and innovation capabilities of target enterprises. The reasonable differentiation of award and subsidy criteria is conducive to mobilizing business operation and innovation, as well as improving the efficient use of financial awards and subsidies.

Specifically: The power of governmental equity investment in motivating enterprises to improve their business performance is yet to be strengthened. In particular, 50% of each special fund with a support purpose is injected as a subsidy without asking for returns. In the absence of clear incentive criteria, it is easy to incur sunk costs and produce an adverse selection of target enterprises. This is not conducive to maximizing the effect of governmental equity investment in promoting enterprise growth and innovation, and it is also not conducive to the sustainable operation of the equity-based support model. Compulsory incentive criteria should be set for direct subsidies, so as to link the subsidies to corresponding performance commitments. The intensity of performance commitments can be liaised and agreed with reference to exit conditions. Some examples include improving trends and levels of main financial indicators, achieving a minimum level of R&D investment, or the number of patents held. At the same time, tiered incentive criteria can be set by dividing performance according to different levels of indicator improvement or number of patents held. When the corresponding level of incentive criteria is reached, a direct subsidy will be paid in proportion from the special fund's 50%. If the highest level is reached, all of the 50% of the special fund will be paid to the enterprise without asking for returns.

7.2.4 Strengthen quality control of equity investment management

(1) Give full play to the initiative of governmental equity investment institutions. These institutions should tighten their own requirements, including investment management, operational capabilities, professional guarantees, staffing, empowerment services, and mechanism supply, to ensure that they could adequately implement the governmental equity investment funds. Encourage partner equity investment institutions to implement post-investment responsibilities and carry out dynamic qualification management considering their investment management capabilities.

(2) Broaden the exit channels for equity investment. Although repurchase transactions are still the main channel for the exit of governmental equity investment capital, including for ZY Venture Capital, with the establishment of the Beijing Stock Exchange and the gradual improvement of the listing and transfer systems of the National Equities Exchange and

Quotations, more diversified and market-oriented options for exit of equity investment capital will be available. Governmental equity investment institutions should take the initiative to seize the benefits brought by the reform of China's stock issuance and registration system and motivate social capital to enter the equity investment market seeking long-term investment value.

7.2.5 Promote the professional construction of venture capital core team

(1) Improving the configuration of the professional team and replenishing the professional talents that meet the needs of business development. After six years of development, the company's equity financing business has entered the "Rivalry" zone. The post-investment management and exit business has become increasingly complicated and risk disposal projects are increasing exponentially. In addition, these projects are of great concern to the auditing authorities, as fiscal funds are involved. Hence, allocation of professional legal and financial talents is required urgently to provide adequate professional support. Additionally, we need to supplement a large number of market-oriented investment talents, professional risk control, and financial talents, based on the market-oriented "fund-raising, investment management, and exit" business and meet the needs of the company as a management institution of privately offered funds to meet the compliant governance and timely disclosure requirements of the Asset Management Association of China and the ShenZhen Private Equity Funds Association.

(2) Improving team members and the team's capability in actual business operation. Based on the exploration of and practice in the early stage, we summarize our experience, optimize our approach, and give full play to the strengths of each team member to enhance the team's capabilities in fund raising and matching funds, investment research and analysis, due diligence and negotiation, post-investment management, value-added services, risk disposal and compliance exit, amongst others, to train and groom several capable staff and build saliently outperforming teams.

7.3 Contributions and limitations of this research

This study focused on Shenzhen, one of China's most open and thriving commercial cities. Using a government equity institution in the city as a case study, we examined the cooperation mechanism between Chinese local government and a market-oriented equity investment institution in the process of equity investment from the micro-scale of enterprises, including a summary of the institution's unique 1:1 investment reward and compensation model and its exit

method of "equal pricing for the same stock, and synchronized entry and exit from investments." Based on standard data of representative target firms, the effect and deficiencies of this government equity support model in promoting the development of emerging industry firms were comprehensively examined, and targeted countermeasures and recommendations to further improve the efficacy of the model proposed. To evaluate the efficacy of the government equity support model, this study considered the six dimensions of degree of fit with industrial policy, guiding effect on private capital, timing of equity investment, financial performance and innovation capabilities of target firms, and the sustainability of the support model, and a framework for analyzing the efficacy of government equity support was proposed.

The significance of this study covers the following main areas. First, it links the research on Chinese local government equity investment models and supporting policies for emerging industries, establishing an initial analysis framework for evaluating the government equity support model. Second, the micro-scale case study in Shenzhen supplements existing macro-scale normative discussions on the leveraging effect of fiscal funds on private capital, providing empirical analysis of the actual efficacy of government equity investment in supporting emerging industry firms. Third, based on empirical analysis of representative cases, it highlights the shortcomings of the existing government equity support model, serving as a reference for optimizing the model and improving the outcomes of policies aimed at supporting emerging industries.

The current research has two main limitations.

First, there is currently no official comprehensive and unified statistical data on Chinese government equity investment institutions and investments, so analysis at the national level mainly relies on third-party publications such as the Zero2IPO Database. This may affect analysis on the development status of government equity investment funds at the national level.

Second, the government equity investment institution in Shenzhen used as a case study had been operating for a relatively short period of time. Although we included a full sample of its target firms, the sample size (85) was limited, which may have affected the robustness of the analysis on government equity investment. In addition, countermeasures and recommendations on optimizing the government equity investment model based on the experience of ZY Venture Capital may not be applicable to other local government equity investment institutions. In the future, we will continue to track the progress of reforms to the equity investment model by Chinese governments at all levels, including the Shenzhen government.

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