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ANALYSIS ON THE IMPACT OF MANAGERS' OVERCONFIDENCE ON ENTERPRISE'S INNOVATION INVESTMENT

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Abstract

Innovation is an important source of power for enterprise development and an important weapon for enterprises to adapt to market competition. However, the investment in innovation decision-making of enterprises will be affected by many factors, and more and more scholars are beginning to pay attention to the element of overconfidence of enterprise managers. Managers' overconfidence is a common mental state. When managers are overconfident, they will make decisions more easily. So, does the manager's overconfidence affect the company's innovation investment? Existing research results show that overconfident managers can promote enterprise innovation investment, but overconfident managers are a double-edged sword. Scholars believe that on the one hand, overconfidence of managers will promote the innovation investment of enterprises; on the other hand, overconfident managers are often blindly arrogant, which may increase the business risk of the enterprise and even lead to bankruptcy. Therefore, it is necessary to look at the problem of managers' overconfidence dialectically. Through empirical analysis, this article will take the Shanghai and Shenzhen A-share manufacturing and information industry companies as specific research objects to explore the relationship between corporate managers' overconfidence and corporate innovation investment. In this paper, by proposing a hypothesis-verifying hypothesis basic research method, it verifies the relationship between overconfidence in corporate innovation financing, innovation input, market response and corporate value. In order to enable overconfident managers to play their positive role in the process of enterprise innovation investment and prevent the risks caused by overconfidence, this article proposes relevant improvement suggestions from both positive and negative aspects.

Keywords: Overconfidence; Innovation Input; Corporate Value

Introduction

From a national macro level, innovation is the soul of progress and an inexhaustible driving force for the prosperity of a country. Especially in the current economic transition period, the international environment is complex and changeable, the domestic economy is down, and some industries have severe overcapacity. During this period, innovation became the core force for the country to maintain its competitiveness. The National 13th Five-Year Plan once again emphasizes the need to strengthen the leading role of technological innovation and implement the innovation-driven development strategy. In 2016, Premier Li Keqiang pointed out that by 2020, the investment intensity of R&D expenditure in the whole society should reach 2.5%, and the contribution rate of scientific and technological progress to economic growth should reach 60%, and it will become an innovative country and a talented country. Innovation drives the destiny of the country, strong innovation will lead to prosperity, and weak innovation will lead to failure of the country. Insufficient technological innovation is an important reason for my country's backwardness in modern times. Therefore, making good use of science and technology is the key to the great rejuvenation of the Chinese nation and the realization of the Chinese dream. From the micro level of enterprises, as the main body of independent innovation, enterprises must increase investment in innovation if they want to gain a dominant position in the market. Only in this way can we enhance our own competitiveness and benefit its long-term development. Griliches (1979) pointed out sharply that all improvements in production efficiency, if reasonably measured, are related to innovation input. This is especially true for manufacturing and information technology companies with high R&D intensity. Sany Heavy Industry has created the "myth" of the equipment manufacturing industry: "One excavator will be off the assembly line in 5 minutes, and a pump truck will be off the assembly line in an hour; 8 years, continuous investment of 1 billion yuan" The reason why Sany Heavy Industry is far ahead in the industry is inseparable from its continuous investment in innovation. (Zhu et al., 2020; Petryk et al., 2020; Miller & Yoon, 2020)

Miao Wei, Minister of Industry, and Information Technology, said: “All industrial enterprises can only improve their competitiveness through continuous innovation and remain invincible in the competition.” Therefore, promoting transformation and upgrading through innovation, and moving towards the high-end market through innovation, has become the only way for all companies to achieve sustainable development.

Based on China's reality, the "*Statistical Bulletin of National Science and Technology Investment in 2018*" shows that my country's total R&D investment in 2018 was 1.4 trillion yuan, which was an increase of 38.1% over 2017, with an average annual growth rate of 1.4%. Relevant data show that after my country's R&D expenditure surpassed Germany in 2010, its surpassed Japan in 2013, and it has become the world's second largest R&D expenditure country after the United States. At the same time, my country’s total social research and experimental development funding intensity was 2.1% in 2015, which was about 3.7 times that of 1995. This shows that my

country's innovation-driven role is significant, and scientific and technological innovation is full of motivation. However, there is still a big gap in R&D intensity compared with developed countries. Especially for enterprises, the main body of R&D innovation, the R&D investment intensity of my country's manufacturing and information technology enterprises is still very insufficient. Related agencies reported that the ratio of R&D investment to product sales revenue of Chinese manufacturing companies in 2018 was only 1.1%, compared with 4% in the United States and 3.4% in Japan. However, it is generally accepted internationally that only 2% of R&D intensity can meet the basic survival conditions of enterprises, and only 5% of enterprises can be competitive. Therefore, the R&D investment of Chinese enterprises needs to be further increased, and the task of achieving an innovative power is still very arduous. Therefore, under the strategic background of innovation-driven development and under the actual conditions of insufficient R&D and innovation of Chinese enterprises, in-depth analysis of the reasons that restrict the investment in R&D and innovation of enterprises is an important issue related to the survival of enterprises and even the development of the country.

So, what factors affect the innovation investment of enterprises? The traditional perspective is mainly from the macro level of government subsidies, tax incentives, and legal culture. The industry level such as market structure and the micro level of the company such as company scale, corporate governance, and resource capabilities are used to analyze the factors that affect the R&D investment of enterprises. However, the existing traditional theories cannot give a reasonable explanation for the difference in innovation input of those enterprises with similar fundamentals or the same enterprise before and after the management change. Traditional financial theories are based on the rational assumption of managers. However, with the unexplainable anomalies in the financial market, behavioral finance has gradually emerged and put forward the irrational assumption of managers. Psychology, economics, and sociology related research show that people are not completely rational, but bounded rationality or even irrational (Simon, 1955; Becker, 1962). This irrationality may cause people to deviate from the goal of maximizing the effect in the decision-making process (Kahneman D and Tversky A, 1979). Overconfidence is the most important psychological bias that affects decision-making behavior after relaxing the assumption of "rational man", and it is the most stable finding in human psychology experiments (De Bondt et al., 1995; Gervais et al., 2007) . It refers to the psychological deviation that people tend to underestimate their probability of failure and overestimate the probability of success. Psychological research results mostly show that people generally have the psychological characteristics of overconfidence. And the traditional culture of our country provides the soil for managers to breed overconfidence. For thousands of years, the idea of "monarch and minister" advocated by Confucian culture has been deeply rooted in enterprises. The idea of absolute authority of "top leader" gives top managers absolute status and decision-making power, which makes it easier to form overconfidence. At the same time, the special economic system environment during the transition period of China's economy has allowed the overconfidence to take root. In the period of economic transformation, the legal system is not perfect, and the restraint mechanism of managers is not perfect, which can easily

lead to the overconfidence of executives. However, the existing literature on enterprise innovation investment decision-making mostly ignores the influencing factor of executive psychological deviation. Therefore, it is imperative to deeply analyze the influence of managers' overconfidence on enterprise innovation investment decisions.

Roll (1986) opened the prelude to the study of managers' overconfidence for the first time, analyzed the influence of overconfident managers on corporate mergers and acquisitions, and put forward the hypothesis of managers' self-righteousness. This has inspired scholars to study the phenomenon of manager overconfidence. Subsequently, Heaton (2002), Malmendier and Tate (2005) analyzed the influence of managers' overconfidence on corporate investment behavior. Ben-David (2007), Landier and Thesmar (2009) have analyzed the influence of managers' overconfidence on corporate financing behavior and capital structure. Doukas and Petmezas (2007), Malmendier and Tate (2008) have also analyzed the influence of managers' overconfidence on corporate mergers and acquisitions. However, in the early research results, scholars agreed that managers' overconfidence often leads to underinvestment or overinvestment, and some mergers and acquisitions that reduce value. Then there are some doubts: Since overconfident corporate managers are not conducive to corporate development, why do many companies hire overconfident people as corporate senior management? This is the so-called mystery of manager overconfidence. In order to unravel this mystery, this opened the valve on managerial overconfidence and corporate innovation research. Recent research results explain the mystery of overconfidence from the perspective of corporate innovation. Most managers who believe that overconfidence like to take risks or carry out R&D creative activities. As a result, more innovation investments will be made and more patents will be produced, thus proving their value by improving their innovation capabilities (Galasso et al., 2011; David et al., 2012; Chang et al., 2015; Kong Dongmin, 2015; Yu Changhong, 2015; Yi Jingtao, 2015). Then, will managers' overconfidence and aversion to external financing also restrict the input of corporate innovation funds? Will the phenomenon of managers' overconfidence in underinvestment or overinvestment in corporate investment disappear in this special form of innovation investment? Can the manager's overconfidence further enhance the value of the enterprise through the increase of innovation input and thus increase market revenue? This series of issues has rarely been studied in the existing literature. This article will follow the basic idea of "funding source-decision behavior-decision result" to deeply analyze the manager's overconfidence in corporate innovation.

Problem Statement

Innovation is the core driving force of a country's development. Promoting enterprise innovation is a concrete manifestation of national innovation. For the enterprise itself, promoting innovation and development is not only an inevitable requirement to adapt to the development trend of the times, but also a positive response to the current production capacity conversion in China, and it is also a key path for the enterprise's own development. But in fact, in the process of promoting

enterprise innovation, the problems exposed by enterprises are extremely numerous. From the perspective of managers, the factors affecting enterprise innovation include:

(1) The level of corporate managers' awareness of innovation will directly affect the company's innovation activities. At present, most business managers have clearly realized the important role of innovation in the development of enterprises, but this understanding is not deep. But do not know much about how to promote innovation and build innovation paths. This has led many companies to blindly innovate in the process of implementing innovation and development. At the same time, it also led to the effect of enterprise innovation with half the effort and did not achieve the expected effect.

(2) The personal characteristics of corporate managers will also have a great impact on corporate innovation. The emotions and personality characteristics of business managers have been a topic that has attracted more attention in recent years. For example, some scholars pointed out that if managers tend to be conservative, it is not conducive to the innovation and development of enterprises; If the manager is too radical, although it can promote the innovation and development of the enterprise to a certain extent, it is often too radical, leading to insufficient funds and excessive strategic goals for the innovation and development of the enterprise; If managers are overconfident, it is a double-edged sword, and this is the main issue that this article will study.

(3) The strategic vision and decision-making level of corporate managers are also important factors affecting corporate innovation. In the process of implementing innovation strategy development, what kind of shortcomings in the past should be eliminated, what new direction should be found, how the company funds are used, and how personnel are deployed all depend on the strategic vision and decision-making level of the company's managers. If business managers lack a strategic vision and have a low level of decision-making, it is very likely to lead to the failure of enterprise innovation and development.

In order to systematically analyze the impact of corporate managers' overconfidence on corporate innovation investment decisions, in-depth analysis of whether overconfident corporate managers restrict the source of corporate innovation funds in terms of funds; In terms of decision-making behavior, whether its adverse impact on corporate investment disappears in the way of corporate innovation investment; In terms of decision results, whether it will increase corporate value and market revenue through corporate innovation investment, to effectively identify the potential costs and benefits of overconfident corporate managers and propose corresponding countermeasures. Therefore, this article will focus on the following issues:

(1) Question 1: How to find reasonable indicators to measure the overconfidence of business managers?

A reasonable and objective measure of the overconfidence level of business managers is the focus and difficulty of this research. Before conducting a series of demonstrations, this article

first starts from the perspective of psychology and pre-measurement, and manually searches the personal resumes of sample enterprise managers. According to the early promotion situation of enterprise managers, the promotion frequency index of enterprise managers was calculated, and finally the overconfidence index of enterprise managers was reconstructed.

LITERATURE REVIEW

Dependent Variable: Manager Overconfidence

Managers' overconfidence refers to the overconfidence of some managers in their management ability, the ability to choose better investment opportunities, and the richness of knowledge. Their judgment of themselves is always higher than the actual situation. Many studies on psychology and behavioral economics have shown that most people have overconfidence, and managers are even more serious. Odean believes that managers, especially senior managers, are more prone to overconfidence. Because in the selection process of corporate talents, due to the existence of information asymmetry, companies cannot have a comprehensive understanding of managers, so people with strong self-confidence are usually more concerned. (Guo et al., 2020; Olaussen et al., 2020; Jomaa et al., 2020)

This selective bias makes it easier for overconfident people to become corporate managers. Business managers are mostly successful people, and the existence of self-attribution bias is more likely to tend to overconfidence. The study of psychology and behavioral economics on the overconfidence characteristics of corporate managers provides a theoretical basis for the study of corporate financial decision-making behavior from the perspective of managers' irrational. And it provides the most direct evidence for the overconfidence hypothesis of behavioral corporate finance managers. Langer's research found that managers' overconfidence is more serious than ordinary employees. In an enterprise, most managers will overestimate the profitability of the company and their own operating capabilities and will seriously overestimate the probability of success of investment projects.

Previous research

Regarding the relationship between overconfident managers and corporate value, this has not yet formed a unified conclusion in academia. Some scholars believe that managers’ overconfidence undermines corporate value; Other scholars believe that under certain conditions, managers’ overconfidence enhances corporate value; Some scholars believe that there is no obvious relationship between managers' overconfidence and corporate value. The following will summarize the literature according to different viewpoints.

1. Destruction theory. When Roll (1986) first introduced the concept of overconfidence, he believed that managers' "arrogance" would often lead to inefficient mergers and acquisitions,

which would damage the value of the enterprise**.** Heaton (2002) believes that when the principal-agent problem and information asymmetry are not considered, overconfident managers will cause overinvestment or underinvestment in the enterprise, which will destroy the value of the enterprise. Fairchild (2005) found by constructing an information asymmetry model that in the case of information asymmetry, overconfident managers will over-debt, which increases the probability of corporate bankruptcy and destroys corporate value; By constructing a moral hazard model, it is also found that overconfident managers tend to prefer debt financing, which increases the possibility of enterprises falling into financial crisis and damages their value. Chinese scholar Ye Bei et al. (2009) used my country's Shanghai and Shenzhen listed companies as a sample, and through a three-stage least squares estimation method, they concluded that the manager's moderate self-confidence can increase the value of the company, but the manager's overconfidence can undermine the value of the company. .

2. Ascension theory. Hackbarth (2003) believes that overconfident managers tend to debt financing, on the one hand it will increase the cost of using corporate funds and undermine corporate value; But on the other hand, the company will actively repay debts and avoid investing this part of the funds in projects with negative net present values, which will also increase corporate value. When Fairchild (2005) established a moral hazard model, it was found that overconfident managers can reduce agency costs and thereby increase corporate value. Goel and Thakor (2008) assumed that managers with a certain degree of overconfidence are risk averse, and concluded that a certain degree of overconfidence of managers can increase the efficiency of principal-agent, reduce the phenomenon of underinvestment, and enhance the value of the enterprise. But if it exceeds this limit, it will undermine corporate value. Weinberg (2009) found through research that moderate overconfidence can make managers brave to take risks, invest in projects with a positive net present value, and enhance corporate value, but excessive overconfidence will destroy corporate value.

3. No relation theory. Chinese scholar Rao Yulei et al. (2010) used my country's A-share listed companies as a research sample and measured the overconfidence of corporate managers through the proportion of corporate managers' shareholding. The empirical results found that there is an insignificant negative correlation between managers' overconfidence and corporate value; The overconfidence of corporate managers is measured by the frequency of mergers and acquisitions. The empirical analysis found that there is no significant positive correlation between managers' overconfidence and corporate value. In short, the above research conclusions show that there is no obvious relationship between managerial overconfidence and corporate value. Summarizing earlier relevant studies, it is consistent to conclude that overconfident managers will rely on internal cash flow in the financing process.; In the investment process, underinvestment or overinvestment is often caused. So, since overconfident managers are so detrimental to the development of the company, why hire such managers is the so-called mystery of manager overconfidence. This mystery has not been solved for a long time in the field of behavioral company finance. (Gietl et al., 2020; Rzeszutek et al., 2020; He et al., 2020)

METHODOLOGY

Research Design

This article will start from the perspective of pre-measurement and psychology and explore a more reasonable method of measuring overconfidence. Before the manager takes office, the channel to obtain his personal information more comprehensively is the manager's personal resume. On the personal resume, we can clearly observe the promotion process of each manager before taking office, and promotion itself has a great relationship with the formation of overconfidence mental state. Take an example to illustrate. For example, if two persons A and B enter the company at the same time, A will be promoted once a year on average, and B will be promoted once every five years, so that A will be promoted to a higher position at a very fast speed. And the promotion speed is too fast, it will make A become more self-inflated, will attribute every success to his own ability, attribute failure to the external environment and bad luck, which forms a self-attribution bias. Self-attribution bias is an important factor in overconfidence (Kahneman and Tversky, 2000; Hirshleifer, 2001; Baker et al., 2004). So compared to B, A will be more prone to overconfidence. Therefore, this study attempts to measure overconfidence through the promotion frequency of managers before they become managers.

Since the research object of this article is business managers, the overconfidence of business managers is measured by the managers' early promotion frequency. This method is to measure the promotion frequency of each stage by analyzing a series of promotion process experienced by enterprise managers before assuming their positions. In order to reflect the different effects of young and older promotion on overconfidence, different weights are set for each age group's promotion. The promotion frequency of each stage is multiplied by the weight and summed up to get the total promotion frequency index of each enterprise manager. Then ranked according to the promotion frequency index, the top third are overconfident business managers, otherwise they are non-overconfident business managers.

Since the entry age of corporate managers in the sample is not equal to the age of becoming corporate managers, in order to unify the research, we assume that the age range of all managers from entry to becoming managers is 20-60 years old. Then it is divided into four stages: 20-30 years old, 30-40 years old, 40-50 years old, and 50-60 years old. Based on the psychological basis that the faster the promotion at the young stage, the easier it is to overconfident, this article sets different parameters for the four stages. The promotion parameter $\beta_{20\text{-}30}$ for 20-30 years old is 0.8; The promotion parameter $\beta_{30\text{-}40}$ for 30-40 years old is 0.6; The promotion parameter $\beta_{40\text{-}50}$ for 40-50 years old is 0.4; The promotion parameter $\beta_{50\text{-}60}$ for 50-60 years old is 0.2. We manually searched all the promotion experiences of the sample enterprise managers before taking up the post and synthesized the promotion frequency of each stage multiplied by the promotion parameters to get the final promotion frequency index. Then sorted according to the

promotion frequency index to get the degree of overconfidence of each manager. The specific calculation model of the promotion frequency index is as follows:

PF=β20-30(S20-30/t20-30)+β30-40(S30-40/t30-40)+β40-50(S40-50/t40-50)+β50-60(S50-60/t50-60)=0.8*(S20-30/t20-30)+0.6*(S30-40/t30-40)+0.4*(S40-50/t40-50)+0.2*(S50-60/t50-60)

Among them, S20-30, S30-40, S40-50, and S50-60 respectively represent the number of promotions of managers in different age groups. t20-30, t30-40, t40-50, and t50-60 respectively represent the time it takes for corporate managers to be promoted in different age groups. This article uses the promotion time used by each manager. The reason why we did not set the promotion time for each stage to 10 years is to control the level of promotion. Because of the differences in the position setting of different companies, it is impossible to obtain the promotion position data. However, considering that there may be managers who have been promoted very few times but are promoted to high positions, this will also be overconfident. In order to control the level of position, each stage of promotion takes different time. For example, corporate managers A and B are two people. A entered the company from the age of 30 to become a senior manager of the company at the age of 35, during which time he was promoted twice; B entered the company at the age of 30 to become a senior manager of the company at the age of 40, during which he was promoted three times. If calculated by the average 10 years of promotion time between 30-40 years old, B's confidence level is higher than A. However, it takes five years for A to become a corporate manager, and it takes ten years for B to become a corporate manager. Obviously, A is more prone to overconfidence than B. Although A has been promoted twice, but the promotion position is relatively high. Therefore, the promotion time in this study is the actual time, A is 5 years, and B is 10 years. Then the promotion frequency of A is 0.4 and that of B is 0.3, which controls the promotion position and measures overconfidence more objectively.

As shown in Figure 3-1, the horizontal axis represents the age of the manager, and the vertical axis represents the promotion position. Suppose that both A and B started working at the age of 20, and they were promoted to senior managers at the age of 50. It can be seen from the figure that A’s promotion frequency is faster, and he is promoted faster in the young stage, so compared to B, A is more likely to be overconfident.

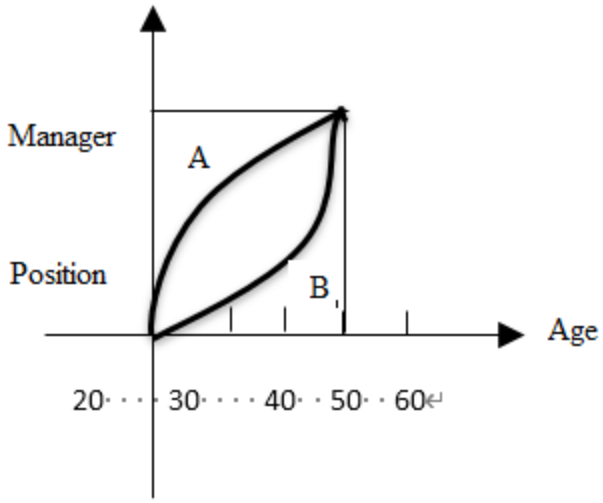

Figure 3-1 Diagram of promotion

Population/Sampling/Unit of Analysis

This research uses the manufacturing and information technology companies listed on the Shanghai and Shenzhen A shares from 2006 to 2018 as the research samples and uses the CSMAR database and manual search annual reports as the data sources. The data in this article are indirect data (second-hand data) and do not involve statistical sampling methods of original data (or primary data). After the data is collected, the researcher sorts and deletes the research samples to ensure the accuracy and authenticity of the data. The conditions for screening and deleting specific samples are as follows:

(1) Delete ST and *ST companies. These companies face special handling by the stock exchange when their financial or operating conditions are abnormal. It will affect the representativeness of the sample and cause interference to the data results, so it needs to be deleted;

(2) The deletion of listed financial companies such as banks and insurance companies lies in the particularity of their financial indicators and the particularity of their business operations. It may affect the data results, so it needs to be deleted;

(3) Delete samples with missing data or obvious abnormalities;

Delete the sample data according to the above conditions, and finally get 11343 observations. The basic data sorting is mainly carried out through excel, and the subsequent descriptive statistics, correlation analysis, and multiple regression analysis. Further analysis and robustness test were processed by STATA.14.0.

FINDINGS AND DISCUSSIONS

Innovation is a very complicated process. For production and information companies, innovation means that companies must make a lot of initial investment. In fact, the various resources invested in these early stages will eventually be involved in innovation activities in the form of capital. When an enterprise manager makes a certain innovation decision, it means that the enterprise must prepare the corresponding funds. However, the power of the enterprise is limited, and the capital that the enterprise has is also limited. Moreover, in order to ensure the normal operation of the enterprise, it is impossible for the enterprise to use all its cash flow for innovation activities. Therefore, in order to support the innovative decisions made by managers, companies must rely on various financing methods. Whether it is internal financing or external financing, it is very important for enterprises. But does overconfidence affect the innovation financing of enterprises?

"Overconfidence will ruin Huawei" this is when Huawei Technologies Co., Ltd. has reached the top of the global telecommunications equipment supplier, when it is well-known worldwide, Huawei President Ren Zhengfei screamed. He believes that if Huawei loses the qualities of caution, humility, and tolerance, it will fall overnight. However, as an overconfident manager representative, the former president of Apple Steve Jobs (Steve Jobs) created one myth for Apple because of his overconfident quality, leading the company's innovation time and time again. He was named the greatest innovator by Business Weekly. As the important decision-makers of the company, the senior executives of the enterprise have their behavior characteristics crucial to the development of the company. Many studies have shown that managerial overconfidence has a significant impact on the company's investment and financing decisions, company performance and long-term development. Then, in the innovation activities of Chinese enterprises, what influence does overconfident managers have on their sources of funds? Will these effects further lead to distortions in corporate innovation investment?

Most scholars who have studied the impact of managers' overconfidence on R&D innovation investment directly analyze whether this behavior characteristic increases or decreases innovation investment. And there is a common premise that companies have sufficient funds to ensure innovation investment, so that overconfident managers will drastically increase investment in innovation. Then, when the company's internal funds are insufficient and the company faces financing constraints, will overconfident managers increase their investment in innovation? Different from the existing research, this article will analyze the relationship between manager’s overconfidence and the sensitivity of R&D investment cash flow from the perspective of financing constraints. If the sensitivity of R&D investment cash flow is very high, it will lead to underinvestment when cash flow is insufficient, and overinvestment when cash flow is enough. This deviates from the optimal investment scale and fails to achieve the goal of maximizing corporate value, and the so-called investment distortion problem arises. This will weaken the company's ability to grow, and at the worst, it may drag the company into the quagmire of financial crisis. Therefore, we further verify the influence of managers'

overconfidence on the distortion of R&D investment on this basis. Analyze under what circumstances cause overinvestment or under what circumstances lead to underinvestment.

The sample period analyzed in this article is 2006-2018. During the sample period, it experienced two major financial events, namely the equity split reform and the financial crisis in 2008. This will provide a more comprehensive analysis of the impact of changes in the external financial market on the sources of corporate innovation funds. Considering that the estimation of variables requires data from the previous year, the time span of the sample is deferred forward by one year, and the actual time span is 2005-2018. In addition, the following screening and adjustments were made to the sample: 1) Considering the continuity of R&D expenditures, we exclude companies that have not disclosed R&D expenditures for 3 consecutive years; 2) Eliminate companies with abnormal financial data; 3) In order to ensure consistency with the later research samples, companies with missing corporate managers' personal information are excluded here. Finally, 3230 observations of 313 samples were obtained. For further research, the sample is divided into young enterprises and mature enterprises. The classification standard is based on Browntal. (2009) and regards companies that have been on the market for more than (including) 15 years as mature companies, otherwise they are regarded as young companies. Among the 313 research samples, 126 are mature companies and 187 are young companies.

Most of the data in this article comes from the CSMAR database. Regarding the R&D investment data and the missing parts in the CSMAR database before the implementation of "Accounting Standards for Business Enterprises No. 6-Intangible Assets" in 2007, this article was obtained by manually collating the company's annual report. In order to unify the caliber, it is mainly obtained from the technical development expenses, research and development expenses, research and development expenses, scientific research and development expenses, scientific research expenses, scientific research experiment expenses and other items in the column of "Other cash flow paid related to operating activities" in the financial report. The annual report data mainly comes from www.cninfo.com, while other financial data comes from the CSMAR database.

① Regarding the measurement of overconfidence, the variables of overconfidence in this article are all measured by the method of promotion frequency index for corporate managers proposed in Chapter 3 of this article, and will not be emphasized in the following chapters. ② As for the measurement of financing constraints, as early as 1988, Fazzari, Hubbard and Petersen proposed the classic free cash flow sensitivity theory. They believe that if corporate investment is significantly sensitive to internal cash flow, then corporate investment will face financing constraints, and this method has also been widely used by later scholars. After that, many methods of measuring financing constraints appeared, such as KZ index, WW index, SA index and so on. However, considering that this article mainly analyzes the dependence of corporate managers' overconfidence on corporate internal cash flow to verify its influence on R&D investment distortion. Therefore, this study mainly uses the classic investment cash

flow sensitivity to measure financing constraints. ③ Regarding the measurement of investment distortion, this article mainly refers to the research methods proposed by Richardson (2006) and Hua Guiru et al. (2010). The residual error in the investment model is used to express the difference between the actual investment level and the predicted investment (the degree of investment distortion, expressed in Invdis). When the absolute value of this residual is relatively large, the greater the degree of deviation, the greater the degree of investment distortion. When the residual is greater than 0, it is over investment; Less than 0 means insufficient investment. See the following chapters for specific models. ④ Other variables are shown in the following table 4-1:

Table 4-1 Definition of other variables

Variable	Variable definitions
FIt	Increase in fixed assets of the enterprise in year t/total assets at the beginning of the year
RDt	Enterprise's total R&D investment in year t/total assets at the beginning of the year
OC	Indicates the manager’s overconfidence variable. When the manager’s promotion frequency index is in the top third, it is taken as 1, otherwise it is taken as 0
Assett	The logarithm of the company's total assets in year t
Levt	Enterprise's total liabilities/total assets in year t
Returnt	The stock return is measured by the market-adjusted annual stock return
Casht	The sum of cash and short-term investment in year t/total assets
Q	Market value/asset replacement cost
Age	Year minus the year the company went public

In this section, when analyzing the impact of managers' overconfidence on the sensitivity of corporate investment cash flow, the explained variables include current fixed asset investment (FIt) or R&D investment (RDt). The explanatory variable manager is overconfident variable OC. The control variables include the fixed asset investment or R&D investment in the previous period and its square, the internal cash flow (CF) and sales revenue (S) variables of the current period and the previous period. It also includes financing variables such as equity financing (STK) and debt financing (DBT) for the current and previous periods. When analyzing the distortions of managers’ overconfidence on corporate R&D investment, the explained variable is

the residual in the investment model. The investment model involves total assets (Asset), asset-liability ratio (Lev), stock return (Return) and so on.

Analysis

This research refers to the investment model of Browntal. (2012) and considers the impact of current and previous variables on R&D investment. Furthermore, in order to study the influence of managers' overconfidence on R&D financing constraints, the author adds the cross-variable OC*CF to the dynamic R&D investment model. The final R&D investment model is as follows:

$$RD_{i,t} = \beta_0 + \beta_1 RD_{i,t-1} + \beta_2 RD^2_{i,t-1} + \beta_3 CF_{i,t} + \beta_4 CF_{i,t-1} + \beta_5 S_{i,t} + \beta_6 S_{i,t-1} + \beta_7 STK_{i,t} + \beta_8 STK_{i,t-1} + \beta_9 DBT_{i,t} + \beta_{10} DBT_{i,t-1} + \beta_{11} OC + \beta_{12} OC*CF_{i,t} + \beta_{13} OC*CF_{i,t-1} + d_t + \alpha_i + v_{i,t} \quad (4.1)$$

Among them, OC*CFi,t-1 and OC*CFi,t are the cross variables of newly introduced enterprise managers' overconfidence and the cash flow of the previous period and the current period. We mainly observe the coefficients of the cross-variables to analyze the impact of managers' overconfidence on the sensitivity of corporate R&D investment cash flow and verify its impact on corporate R&D financing constraints. In addition, the model includes the fixed effects of company and year.

At the same time, in order to measure the distortion of corporate R&D investment, this article mainly refers to the research methods proposed by Richardson (2006) and Hua Guiru et al. (2010). The specific model is as follows: Among them, Invi,t represents the fixed asset investment or R&D investment of enterprise i in year t. The residual represents the degree of investment distortion, expressed by Invdis. When the residual is greater than 0, it is over-invested; less than 0, it is under-invested.

$$Inv_{i,t} = \beta_0 + \beta 1 Asset_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Age_{i,t-1} + \beta 5 \,\mathrm{Re}\, turn_{i,t-1} + \beta_6 Cash_{i,t-1} + \beta_7 Inv_{i,t-1} + \sum Industry + \sum Year + \xi_i \quad (4.2)$$

1. Descriptive analysis

Table 4-2 shows the R&D investment and financing of companies with over-confidence and moderate self-confidence, state-owned and non-state-owned companies, young and mature companies, and large and small companies. From the perspective of financing ratios, no matter which type of company is classified, the same trend is shown. That is, cash flow accounts for the largest proportion, followed by equity financing and debt financing, which is contrary to the basic financing pecking theory "endogenous financing-debt financing-equity financing" sequence. Due to the special nature of R&D investment, companies with high R&D intensity generally seldom use debt financing. The instability of income makes the debt financing structure not suitable for these companies, and the characteristics of R&D investment with

limited mortgage value have caused R&D financing to be more inclined to endogenous financing and equity financing.

In addition, corporate managers' R&D investment and sales revenue of overconfident companies are significantly higher than those of moderately confident companies, and the difference in financing is not significant. The R&D investment intensity of non-state-owned companies, young companies and small companies is obviously very high. This may be because these companies are basically at the initial stage of development, and the enthusiasm for R&D is relatively large, and new R&D technologies and products are particularly important to them. For those relatively mature large-scale enterprises, R&D technology has formed a certain system, and the focus of investment may be on later work such as mass production of new products and effective introduction to the market. In terms of financing, state-owned enterprises have significantly more equity financing than non-state-owned enterprises; Younger small companies rely more on endogenous financing and equity financing; Large companies have more debt financing than small companies. This may be because large companies are more likely to obtain external debt financing. In summary, for non-state-owned companies, young companies and small companies, R&D investment opportunities are relatively large, and internal cash flow can no longer fully meet the investment needs of these companies. Therefore, these companies are more likely to face financing constraints.

Conclusion

Based on the theory of behavioral corporate finance, this article focuses on the managers who have higher management decision-making power in the enterprise as the research object. Use a combination of theoretical analysis and empirical testing. Following the research idea of "funding source-decision behavior-decision result", systematically explored the influence of managers' overconfidence on enterprise innovation investment decision. Before carrying out all the research, this article starts from the perspective of psychology and pre-measurement and constructs the manager's overconfidence index based on the manager's early promotion frequency index, which provides a theoretical basis for subsequent research. The theoretical analysis part constructs a two-phase investment and financing model of managers' overconfidence and a career focus model of managers' overconfidence including financing constraints; The empirical test part uses the manufacturing and information technology companies listed on the Shanghai and Shenzhen A shares from 2006 to 2018 as samples. CSMAR database and manual search annual report are used as data sources, and difference test, panel regression analysis, DID method, etc. are used as research methods. Among them, the source of funds has verified the importance of external equity financing from the macro level; From the micro level, it is verified whether managers’ overconfidence is distorted by corporate innovation investment due to their aversion to external equity financing. The part of decision-making behavior verifies the importance of entrepreneurial characteristics to enterprise

innovation investment from the macro level; From the micro level, it verifies the influence of managers' overconfidence on enterprise innovation investment decision. In the part of decision-making results, we verify whether managers' overconfidence can ultimately increase corporate value and stock returns through corporate innovation investment from the corporate value level and market response level. The conclusions of this article are as follows:

(1) Based on the early promotion frequency index, the manager's overconfidence index was constructed, and it was found that although the existing index has certain reference value, there are still many shortcomings. This article is the first to construct a manager's promotion frequency index from the perspective of pre-measurement and psychology and use this index to measure managers' overconfidence. Through analysis, it is found that the managerial promotion frequency index method conforms to the theoretical basis of self-attribution bias psychology. And compared with the shareholding ratio method of Hao Ying et al. (2005) and the investment performance method of Yi Jingtao et al. (2015), it is more reasonable. At the same time, the personal characteristics of overconfident managers measured by the index are basically in line with the existing literature. Therefore, the construction of this indicator provides a reliable theoretical premise for the subsequent empirical research.

(2) In terms of funding sources. Through theoretical analysis by constructing a two-phase investment and financing model based on managers' overconfidence, it is found that overconfident managers rely on internal cash flow in the financing process, and the sensitivity of investment cash flow in the investment process is very high. This phenomenon is more obvious in companies that are vulnerable to financing constraints, and it is also most obvious in innovation investment.

On the basis of theoretical analysis, the macro-level empirical test of the impact of the external financial market on the innovation input of enterprises and found that changes in the external financial market will lead to changes in the innovation input of enterprises. The financial crisis events can reasonably explain the ups and downs of corporate innovation investment in 2009, and the financial crisis has restricted corporate innovation investment. The research in this paper also found that empirical tests at the macro level have demonstrated the importance of external sources of funds (especially equity financing) for corporate innovation investment in a progressive manner.

However, the literature shows that overconfident managers often think that the cost of equity financing is too high and will not conduct equity financing. Will this aggravate financing constraints, leading to distortions in corporate innovation investment? The empirical test results at the micro level provide the answer. At the micro level, panel regression is performed on the R&D dynamic investment model and the investment distortion model. It is found that, compared with investment in fixed assets, managers' overconfidence has a more obvious impact on the financing constraints of corporate innovation, which leads to a more obvious impact on corporate innovation investment distortion. At the same time, when the cost of equity financing decreases,

the influence of managers' overconfidence on the constraints of corporate innovation financing and distortion of innovation investment will also decrease. In addition, by examining the heterogeneity of enterprises, it is found that in enterprises vulnerable to financing constraints, managers' overconfidence can lead to insufficient investment in innovation; However, in companies that are not susceptible to financing constraints, managers' overconfidence will not lead to excessive investment in innovation.

From theoretical model analysis to empirical tests at the macro and micro levels, it is concluded that in terms of funding sources, in companies that are vulnerable to financing constraints, managers' overconfidence will aggravate financing constraints and lead to distortions in innovation investment; Only in companies that are not susceptible to financing constraints, managers' overconfidence will not restrict corporate innovation funds.

(3) Decision-making behavior. Theoretical analysis is carried out by constructing a manager's overconfidence career concern model including financing constraints. It is found that in an equilibrium state, the greater the degree of managerial overconfidence, the greater the possibility that the enterprise will invest in innovation. There is a positive correlation between the two, and this phenomenon is more obvious in companies that are not susceptible to financing constraints.

At the micro level, a static panel regression and a dynamic DID model were tested and found that managers' overconfidence is conducive to promoting enterprise innovation investment. And the promotion effect is more obvious in enterprises with strong R&D intensity, weak restraint mechanism and not subject to financing constraints. In terms of decision-making behavior, from theoretical model analysis to empirical testing at the macro and micro levels. It can be concluded that in companies that are not easily subject to financing constraints, managers' overconfidence has a more obvious role in promoting corporate innovation investment.

(4) In terms of decision-making results, it has passed empirical tests on two levels of corporate value and market response. It is found that there is a significant positive correlation between enterprise innovation investment and enterprise value, but there is a two-year lag period. In companies that are vulnerable to financing constraints, managers' overconfidence that investing in corporate innovation will undermine corporate value; In companies that are not susceptible to financing constraints, managers' overconfidence can increase corporate value through corporate innovation investment, but it is lagging. At the same time, corporate innovation investment can increase the company's future stock returns, but it has a one-year lag. In companies that are subject to financing constraints, managers are overconfident and cannot increase stock returns by investing in corporate innovation. In companies that are not susceptible to financing constraints, managers' overconfidence can increase future stock returns by promoting corporate innovation investment, which also has a lag. In addition, this article uses the SA financing constraint index to reproduce the financing constraints of enterprises and finds similar conclusions. (Kang & Cho, 2020; Dick et al., 2020)

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