

# Investment Efficiency Research Theme Changes and Development Trends on the basis of CiteSpace

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**Abstract**—In order to systematically understand the field of enterprise investment efficiency, this paper analyzes the trend of the development of investment efficiency in the enterprise over time, establishes a cross-sectional research direction and a vertical timeline system, and combines the economic background and research status to make scientific predictions on future development trends. This paper selects “CNKI” and “web of science” as the literature search engine in 2003-2018, and uses the tool (CiteSpace) to cluster and analyze the data, showing the relationship between knowledge structure, main research institutions and evolution law of enterprise investment efficiency. The research results show that the research path of domestic and foreign investment efficiency is different. The domestic undergoes the process from the micro-features of enterprises to the combination of macro-economy. Foreign countries are cutting from macroeconomics and industry factors, gradually combining the micro-features of enterprises, and changing with time. There is a clear trend in research direction. The future development direction of enterprise investment efficiency mainly focuses on the combination of micro-characteristics with economic environment and policies, the commitment of social responsibility, and the influence of market participants' behaviors and emotions on corporate investment efficiency. This research combs the development of research on investment efficiency in domestic and foreign enterprises, and provides a directional reference for the future development of this field.

**Keywords**—Enterprise investment efficiency; Research theme; Research method; Future development

## I. INTRODUCTION

In the process of China's economic transformation, optimizing the investment structure is the main content of transforming economic development. The investment efficiency and influencing factors of enterprises have always been the main issues discussed by scholars. However, investment decisions will be affected by many factors, such as resources, environment, expectations and many other factors, so that the company's decision-making can not meet the maximum value of the enterprise, resulting in the problem of "non-efficiency investment." The improvement and solution of enterprise investment efficiency has aroused the interest of scholars. The discussion on the factors affecting the efficiency of enterprise investment and the path of improvement caused by more than ten years are endless. The solution of this problem can effectively solve the treatment of enterprise investment and meet the requirements. The demand for China's economic transformation optimizes the investment structure. The analysis of enterprise investment efficiency has very important theoretical and practical significance for corporate finance. The

research on this aspect is endless, so the combining and analysis of research results is very important for the development of future theory. This paper uses Visual Document Analysis Tool as CiteSpace, which is a software used in the scientific literature to identify and display new development trends and dynamics of science. It uses scientific maps to express the authors, themes and research trends in the field literature [1-2].

## II. DEFINITION OF ENTERPRISE INVESTMENT EFFICIENCY

The MM theory proposed by Modigliani and Miller (1958) [3] believes that under perfect market conditions, corporate investment is only related to investment opportunities. However, due to capital market friction, companies may not always respond to growth opportunities, including information asymmetry and agency issues.

“Inefficient investment” can be used to explain and measure the efficiency of corporate investment. Inefficient investment can be divided into two stages, namely, over-investment and under-investment, which respectively indicate that the company can accept investment projects with net present value less than zero or give up some projects with net present value greater than zero.

## III. KNOWLEDGE MAP ANALYSIS OF ENTERPRISE INVESTMENT EFFICIENCY BASED ON CITESPACE

### A. Data source

The study selected China Knowledge Network and Web of Science as a literature search engine in 2003-2018 to analyze the research structure and evolution law of enterprise investment efficiency. Taking one year as a time span, 354 articles were obtained from China Knowledge Network, and 1552 articles were obtained from Web of Science.

### B. Visualization of research literature

#### 1) Visualization and Analysis of CNKI Literature

CiteSpace is used to analyze the keywords of 2003-2018, and each time as a time slice, select the top 20 keywords in each patch to form a knowledge network.



Fig. 1 CSSCI Enterprise Investment Efficiency Keywords for 2003-2018

As shown in Figure 1, the clustering label for the study of enterprise investment efficiency in 2003 is extracted from the top five clusters. A total of 54 nodes are found. The frontier labels are property rights, over-investment, and stochastic frontier models. Corporate property rights and investment

behavior represent the frontiers of research in this field. At the same time, we can get the time, frequency and degree of centralization in the 54-node keyword research set. The top ten node keywords of the degree of centralization are shown in Table 1 below:

TABLE I SUMMARY OF ATLAS ANALYSIS

Freq	Centrality	Keyword	Year	Freq	centrality	keyword	year
227	1.2	Investment efficiency	2007	2	0.09	Foreign Direct Investment	2017
30	0.27	Overinvestment	2009	2	0.08	Supply side structural reform	2017
48	0.18	Financing constraints	2011	15	0.07	Enterprise investment efficiency	2015
45	0.15	Underinvestment	2011	5	0.07	Investor sentiment	2015
12	0.09	Corporate Governance	2012	6	0.06	Investment scale	2015

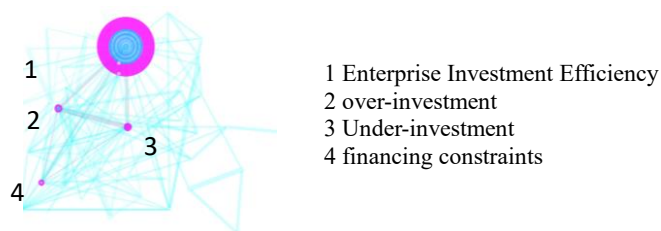


Fig. 2 CSCI Enterprise Investment Efficiency Key Words Relationship in 2003-2018

As shown in Figure 2, the interaction between hotspot keywords in 2003-2008 is shown. The greater the radius of the node, the higher the frequency of occurrence, and the nodes of the purple outer circle have higher centrality, which is compared in the knowledge network. The important nodes, as shown in Table 1, can also be seen that the enterprise investment

efficiency, over-investment, and under-investment are keywords with a high degree of centralization. We will use the serial numbers to indicate 1, 2, 3, and 4 nodes respectively. Show the relationship between these four important central nodes and other nodes as shown in the following table:

TABLE II ENTERPRISE INVESTMENT EFFICIENCY, OVER-INVESTMENT, UNDER-INVESTMENT, FINANCING CONSTRAINTS AND OTHER NODE CONTACTS

Important node	Contact node
Enterprise investment efficiency	Monetary policy, financial development, agency conflict, finance company, agency cost, family business, resource allocation, environmental uncertainty, nature of property rights, state-owned enterprises, product market competition, investor sentiment, board capital, loss of losses, investment opportunities, politics Relevance, institutional environment, government intervention, inefficient investment, accounting conservatism, management power, corporate value, working capital management, financing constraints, corporate governance, listed companies, investment scale
Overinvestment	Monetary policy, equity incentives, agency costs, political connections, accounting conservatism, internal control, financing constraints, supply-side structural reform, corporate governance
Underinvestment	Equity incentives, agency costs, institutional environment, corporate investment efficiency, accounting conservatism, internal control, financing constraints, corporate governance, corporate investment behavior, over-investment
Financing constraints	Monetary policy, financial development, agency conflict, agency costs, nature of property rights, government intervention, working capital management, capital investment efficiency

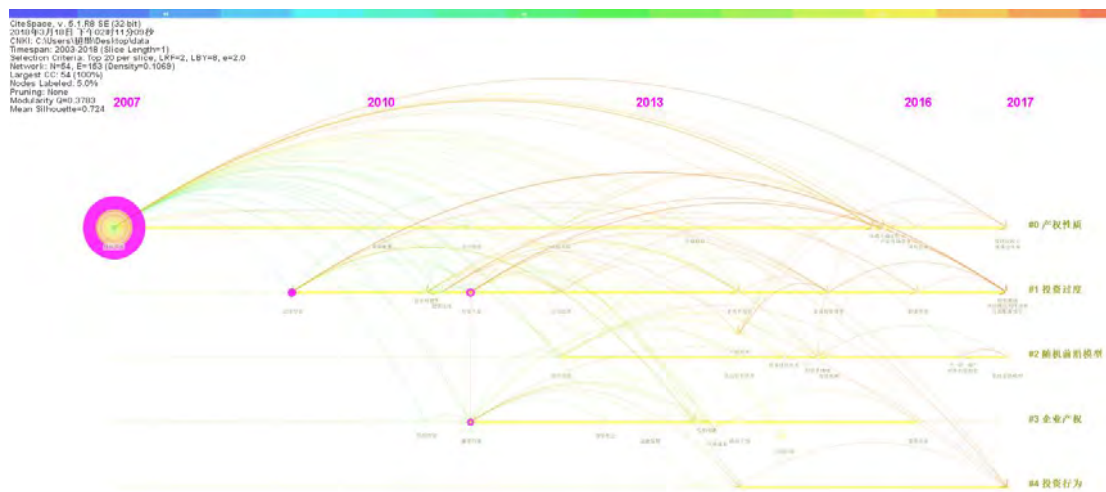


Fig. 3 CSSCI Enterprise Investment Efficiency Keyword Timeline Development in 2003-2018

As can be seen from the above figure, the investment efficiency of enterprises has been a lot of academic research since 2007. According to the extracted keywords, we can find that the investment efficiency of enterprises has exploded since 2007, and can be seen from Table 1. Out, the 2007 burst was 8.49, and burst is a significant fluctuation in the number of studies in the short term. It is used to measure the rapid increase in the number of citations of featured documents, while other keywords have not suddenly exploded. The research in 2007-2010 is mainly about enterprise investment efficiency and over-investment, resource allocation, research on the relationship between cash holdings, external financing of enterprises and the efficiency of corporate investment. For example, the increase in cash holdings of restricted companies is an expensive external A value-added response to financing [4]. The relationship between research hotspots is relatively simple, mainly between the investment efficiency of enterprises and over-investment, and the impact of corporate investment efficiency on resource allocation.

In 2010-2013, the topics of accounting conservatism, underinvestment, financing constraints, political connections, corporate governance, and monetary policy were added. Compared with the 2007-2010 study, the combination of macroeconomics and micro is closer. In terms of accounting conservatism, before 2013, it was the impact of corporate investment efficiency, over-investment, corporate value, under-investment and corporate governance on accounting conservatism. It believed that sound accounting policies could limit the excessive investment behavior of enterprises [5-7]. The problem of underinvestment is mainly the impact of underinvestment on accounting conservatism, corporate governance, over-investment and corporate investment efficiency. The financing constraint problem mainly studies the impact of financing constraints on investment efficiency, accounting conservatism, investment opportunities, and monetary policy. The factors that form financing constraints are mainly the impact of agency conflicts on financing constraints.

In 2013-2016, there were new topics such as investor sentiment [8], working capital management [9], and internal control [10], and they were closely related to monetary policy and financing constraints. The research on the combination of monetary policy and micro-level of enterprises mainly came out. During this period, monetary policy has an impact on working capital management, investor sentiment, and investment scale. It can be seen from Table 1 that the research on financing constraints has been concentrated since 2011, as shown in the figure:

After 2016, the research on corporate investment efficiency mainly combines "One Belt and One Road" [11], environmental uncertainty [12], institutional environment [13], supply-side structural reform [14], management power [15]. And the extensive use of random effects frontier models. It can be found that since 2003, in the research of enterprise investment efficiency, before 2007, it was mainly the micro-enterprise research to the combination of micro-enterprises and policies in 2007-2016, and the latest "Belt and Road" with 2016-2017, The combination of development directions such as supply-side reform is a process of gradual integration and development from micro to macroeconomics.



Fig. 4 Main research institutions for corporate investment efficiency in 2003-2018 (domestic)

TABLE III FREQUENCY AND ANNUAL DISTRIBUTION OF MAJOR RESEARCH INSTITUTIONS

Frequency	Institution	Year	Frequency	Institution	Year
15	School of Economics and Business Administration, Chongqing University	2013	6	Zhongnan University of Economics and Law, School of Accounting	2014
9	Renmin University of China Business School	2013	6	Nankai University Business School	2009
8	University of International Business and Economics International Business School	2014	6	Dongbei University of Finance and Economics Accounting School	2013
8	Tianjin University of Finance and Economics Business School	2013	4	Peking University Guanghua School of Management	2012
8	School of Economics and Management, Wuhan University	2016	4	Tianjin University of Finance and Economics	2014

The table shows the institutions with high investment efficiency of research enterprises. The top five are Chongqing University, Renmin University of China, University of International Business and Economics, Tianjin University of

Finance and Economics and Wuhan University. Concentrated in 2013-2017.

## 2) Research on the Visualization of Enterprise Investment Efficiency Literature in Web of Science

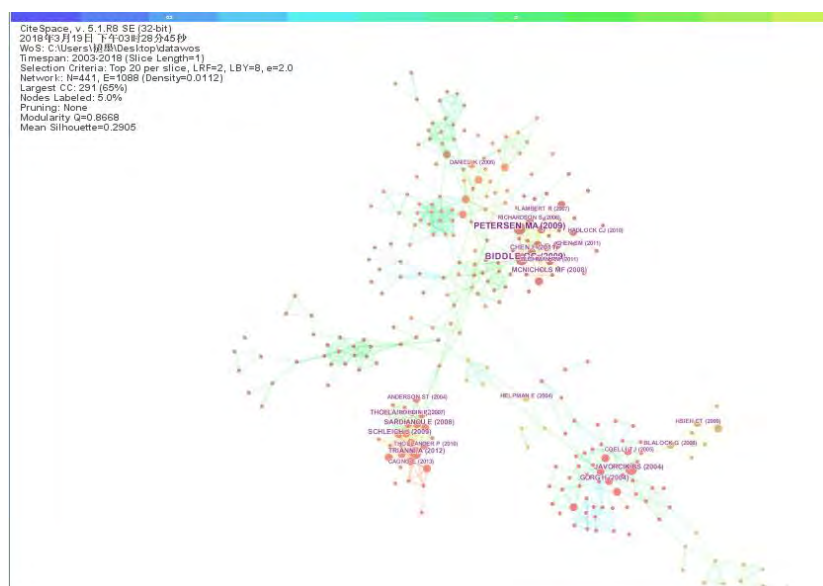


Fig. 5 Co-cited literature analysis

As shown in Figure 5, a co-cited literature analysis chart from 2003 to 2018 was generated, and the data was compiled to:

TABLE IV TOP 10 CITATIONS

citation counts	References	cluster #
52	Petersen MA, 2009, REV FINANC STUD, 22, 435	1
45	Biddle GC, 2009, J ACCOUNT ECON, 48, 112	1
23	Javorcik BS, 2004, AM ECON REV, 94, 605	0
22	Trianni A, 2012, ENERGY, 37, 494	2
19	Schleich J, 2009, ECOL ECON, 68, 2150	2
18	Gorg H, 2004, WORLD BANK RES OBSER, 19, 171	0
17	Sardianou E, 2008, J CLEAN PROD, 16, 1416	2
17	Chen F, 2011, ACCOUNT REV, 86, 1255	1
16	Thollander P, 2008, ENERG EFFIC, 1, 21	2
15	McNichols MF, 2008, ACCOUNT REV, 83, 1571	1



TABLE V BURST'S TOP 10 LITERATURE

bursts	References	cluster #
13.45	Biddle GC, 2009, J ACCOUNT ECON, 48, 112	1
10.69	Petersen MA, 2009, REV FINANC STUD, 22, 435	1
7.72	Trianni A, 2012, ENERGY, 37, 494	2
7.11	McNichols MF, 2008, ACCOUNT REV, 83, 1571	1
6.39	Cagno E, 2013, RENEW SUST ENERG REV, 19, 290	2
6.14	Hadlock CJ, 2010, REV FINANC STUD, 23, 1909	1
5.95	Lambert R, 2007, J ACCOUNTING RES, 45, 385	1
5.78	Richardson S, 2006, REV ACCOUNT STUD, 11, 159	1
5.77	Blalock G, 2008, J INT ECON, 74, 402	13
5.62	Chen SM. 2011. J CORP FINANC. 17, 259	1

Compared with domestic research, foreign research on enterprise investment efficiency is earlier. According to the citations of the literature, we find that the concentrated reference time is concentrated in 2006-2012. The top ten articles cited by the literature are published by Javorcik BS in 2004. In addition to the articles, they are also concentrated in this section.

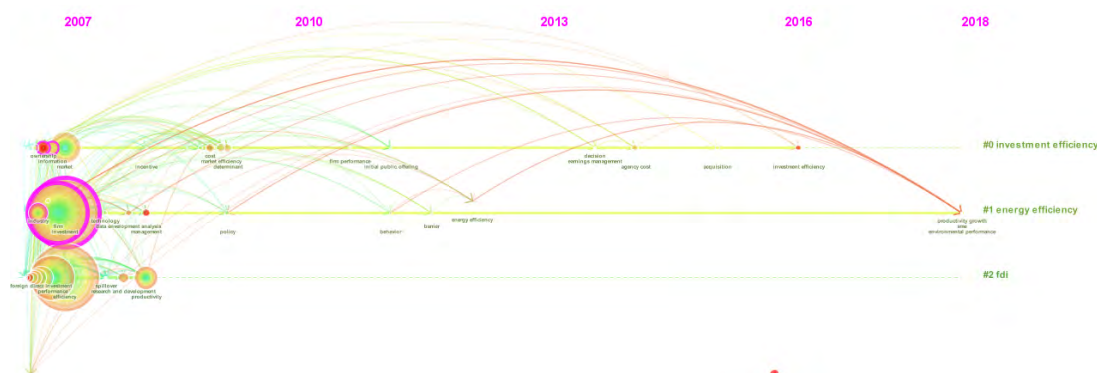


Fig. 6 Keyword timeline analysis extracted by Wos

As can be seen from Figure 6, a large number of articles on corporate investment efficiency emerged in 2007-2010, mainly on the nature of ownership, money market, foreign investment, incentive policies, technology, cost, and market efficiency. In 2010-2013, we mainly studied corporate performance, public donations, energy use efficiency, corporate behavior, and industry entry barriers. Compared with the micro-traits of enterprises in 2007-2010, such as product cost and market, the focus will be shifted to the impact of research enterprise behavior on corporate investment efficiency, such as corporate social contribution, energy use efficiency, and government intervention<sup>[16]</sup>, also look beyond the industry to consider. The 2013-2016 study focused on the impact of earnings management and agency issues on corporate investment efficiency, and found that compared to previous studies on the impact of corporate traits or behavior on firm investment efficiency, this period of time is a modular process for earnings. There are many ways to manage, mainly focusing on the impact of the module of earnings management on corporate investment efficiency, such as accounting information quality, internal control<sup>[17]</sup>, and accounting conservatism<sup>[18]</sup>. In 2016-2018, it is mainly used to improve production efficiency, environmental issues and SME methods. This part may be due to the development of artificial intelligence technology in recent years,

TABLE VI  
SUMMARY OF 2016-2018 KEYWORDS IN WOS

Freq	burst	Keyword	Year	cluster
3		Country	2018	1
3		Coordination	2018	1
3		Conservation	2018	1
3		productivity growth	2018	1
3		Sme	2018	1
3		environmental performance	2018	1
27	11.07	investment efficiency	2016	0

We have observed that the literature in the last three years is available. In 2016, there was a large-scale citation of corporate investment efficiency, and the burst reached 11.07. After entering 2018, the national factors, foreign investment, and inter-enterprise were more related to corporate investment efficiency. Coordination and coordination capabilities, business communication, business productivity, contribution to environmental factors, and in 2018 a large number of scholars use structural equations (SME) to study corporate investment efficiency.



Fig. 7 Main modules and institutions for enterprise investment efficiency in 2003-2018

It can be seen from Figure7 that a relatively complete module is formed between the clusters, and there are many links between the modules. By ranking the top three organizations in the top 5 cluster categories, you can get the following Table 6:

TABLE VII MAIN RESEARCH INSTITUTIONS OF THE TOP 5 CLUSTERS

Freq	University	Year	cluster
10	Univ Oxford	2008	energy efficiency
9	World Bank	2007	energy efficiency
7	Erasmus Univ	2010	energy efficiency
12	Univ Chicago	2009	analyst earnings forecasts
11	Harvard Univ	2009	analyst earnings forecasts
8	Univ Houston	2009	analyst earnings forecasts
13	Natl Taiwan Univ	2013	ownership structure
10	CESifo	2012	ownership structure
9	Univ Nottingham	2007	ownership structure
11	Natl Bur Econ Res	2009	asset pricing
11	Univ Calif Berkeley	2010	asset pricing
10	Univ Michigan	2009	asset pricing
10	Univ Calif Los Angeles	2010	vertical spillover
6	Peking Univ	2015	vertical spillover
5	Cent Univ Finance & Econ	2016	vertical spillover

From the above table, the foreign literature is highly active in different clusters, and the 2016-2018 study is counted. Among them, the research on energy efficiency clusters in the past three years is more active by the University of Reading, Rutgers State University, UCL, Yale University, Georgia State University, Rice University under the Analyst earnings forecast cluster, and more studies on the ownership structure by City University Hong Kong, University Loughborough, CERGE EI and Xi'an Jiaotong University. Most of the research in vertical spillover is from Central University of Finance and Economics, Nanyang Technological University, The University of Utah and Beijing Normal University.

#### IV. CONCLUSIONS AND PROSPECTS

##### A. Research conclusions

Through the previous analysis, the papers on Web-science and CNKI on enterprise investment efficiency in 2003-2018 were selected. The method of knowledge map analysis

(CiteSpace) was used to summarize the domestic and foreign knowledge structure relationship and evolution law of enterprise investment efficiency. The study found:

From the overall development context, Western concerns about corporate investment efficiency are initially from industry, market and spillover effects to information asymmetry, energy efficiency, to productivity gains in recent years, corporate behavior, and the environment. The contribution is generally from the macro issue to the investment efficiency of enterprises, and then gradually from the macro to the micro-enterprise process. In recent years, attention to energy use and contribution to the environment has gradually increased. The path of domestic research experience is mainly from the study of micro-enterprises, to study the impact of corporate traits on corporate investment efficiency, and gradually combine monetary policy research on corporate investment efficiency after 2010, and transition to micro-traits and macro-policies. The economic environment is combined with the stage of research. From 2016 to the present, the combination of economic environment and policy changes, such as the "Belt and Road" and supply-side reforms, have an impact on corporate investment efficiency. Generally speaking, it is a process of merging from the microscopic perspective and gradually integrating with the macroeconomic environment.

##### B. Research outlook

Although the research on the efficiency of enterprise investment is different from the starting point of view at home and abroad, it has experienced different stages and the shift of research focus, but the context of development is very clear. Following the development context and the inertia of current research, there are two main aspects to the future development of corporate investment efficiency. On the one hand, it is more concerned about the changes in the economic environment, and it is more clear and timely to study the changes in the investment efficiency of enterprises in different contexts, the influencing factors, and the path and conditions for generating investment changes in efficiency. On the other hand, it pays more attention to the commitment of corporate social responsibility and studies the social contributions undertaken by enterprises, such as the contribution to the environment and resources and the impact of corporate investment efficiency.

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