

Research on Heterogeneous Peer Effect of Investment Decision of Listed Companies in China—Empirical Evidence from Text Similarity

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Abstract: The investment decisions of listed companies are influenced by peers, which is called the peer effect. This paper distinguishes between heterogeneous and homogeneous peers through text similarity to the degree of association of companies in the industry. On this basis, this paper tests the peer effect and competitive mode of listed companies' investment decisions. The results show that listed companies' investment decisions in China have a significant heterogeneous peer effect. Contrary to the competitive assumption of homogeneous peers, heterogeneous peers produce a complementary peer effect, which is more significant in non-state-owned and competitive enterprises. There is a race-to-bottom competition model based on the complementary peer effect of heterogeneous peers.

1. Introduction

"To form a strong domestic market and build a new development pattern" is a major task planned by the Fifth Plenary Session of the 19th CPC Central Committee in the 14th Five-Year Plan period. The meeting called for "deepening supply-side reform" as the mainline of development, improving production and supply efficiency, rationally allocating existing resources, and increasing the proportion of high-quality incremental supply to promote innovation and stimulate the vitality of the real economy. The Central Economic Work Conference held in December 2020 further stressed "is used to speed up the construction of a new development pattern with the big domestic cycle as the main body while promoting the domestic and international double cycles," which specifically proposed to take the supply-side structural reform as the mainline of planning. The central government's response to China's overall consumption trend, the refinement and sublimation of the "supply-side reform" proposed by the central economic work conference in 2015, and the first "demand-side reform" proposed with the times. The typical problems on the demand side, such as insufficient effective demand and structural mismatch, should prove that the structural problems on the supply side are still the principal contradiction in the current economic operation (Huang Qunhui and Chen Chuanglian, 2021). Among the supply-side structural problems, overcapacity bears the brunt. Overcapacity is directly reflected in the low utilization rate. De-production has become the primary task of supply-side reform.

China's capital market is still in the stage of vigorous development. Many investors in the market always follow suit when making investment decisions. Conclusion: They can quickly reach a consensus on the potential fields with development prospects and worth investing in. As a result, many investors rush in when a new industry emerges, and then a "surge phenomenon" occurs, accompanied by overcapacity and a series of associated problems (Lin Yifu, 2007; Lin Yifu, 2010). Therefore, it is necessary to relax the existing premise, effectively expand domestic demand with supply-side reform as the mainline in macro-control and pay attention to demand-side reform management as policy coordination to improve the quality and efficiency of economic development.

The main contributions of this paper are mainly reflected in the following aspects:

First, based on the industry classification of the CSRC in 2012, this paper uses text similarity analysis to distinguish the relevance of peers in the industry. Compared with the existing literature,

which uses indicators such as market share to weight the closeness of peer companies based on the classification of the CSRC and depicts the peer data by average equal-weighted value, this classification method ensures that the screened "peer" information is more finely depicted based on the text produced by the company itself.

Secondly, this paper classifies firms based on homogeneous peers and heterogeneous peers in the industry group's peers based on the degree of similarity between firms. It investigates the characteristic indicators of investment decisions based on heterogeneity, which provides empirical evidence for a heterogeneous competitive effect in peer effect.

2. Literature Review

2.1 Peer Effect in Corporate Investment Decisions

Previous studies have shown a specific Peer Effect when listed companies make investment decisions. Leary and Roberts (2014) give a clear definition of peer effect. Specifically, peer effect is an individual's behavior that may be directly affected by the characteristics of this group, which is a mutual imitation effect between individuals or organizations. The "peer effect" reflects those individuals in a group are influenced by the behavior of the "leaders" with efficiency advantages and leading positions in the same group. In the final analysis, this comes from the asymmetric information in the market-individuals need to rely on the observation of peer behavior to summarize the existing information and plan the future development direction. It is also regarded as "free-riding" behavior to a certain extent.

In recent years, many studies have shown the impact of corporate peer effect on investment decisions from corporate financial data. The traditional economic theory usually assumes that the decisions and actions of economic actors are entirely informative, and it can predict the future condition completely rationally. Under this assumption, the market is completely effective, and the investment decisions are completely efficient. Research by Zhang Tianyu and Zhong Tian Li shows that the investment decisions of listed companies in China are significantly affected by the investment decisions of their peers, and the impact is positive. Foucault and Fresard(2014) found that an enterprise adjusts its investment decision through characteristics such as its share price in the same industry. Yang Haisheng and others (2020) also found a significant positive correlation between the new investment behavior of enterprises and the investment of their peers. They even received signals from their peers' financial data and capital structure to improve their investment strategies. Unfortunately, the judgment of peers in the existing literature is often limited to the existing peer classification standards, which cannot effectively identify the business similarity and investment correlation degree of companies in the industry and deepen the relationship between peer correlation degree and enterprise investment decisions.

2.2 Text Similarity and Information Disclosure of Financial Statements

The text disclosed by the listed company is an important reference for information users to understand the company's operating conditions. The completeness of the financial report information disclosure can eliminate the asymmetric gap between internal and external information acquisition and use (Kryzanowski et al., 2013). It can more flexibly update the positioning of the company and the identity of the company's competitors over time. The intonation, emotion, readability, similarity, and other characteristics of the annual report will also affect the behavior of relevant personnel outside the enterprise to interpret information and make corresponding decisions (Feldman et al., 2010; Miller, 2010; Price et al., 2011; Lee, 2012). The text analysis method of the financial report has been used in the fields of policy analysis (Zhang Tao and Ma Haiqun, 2020), text classification (Wu Yongliang, et al., 2020), and prediction of the probability of non-compliance punishment (Qian Aimin and Zhu Dapeng, 2020), etc. However, there is little research in the existing literature on mining the main business and basic information of listed companies' annual reports. The research method of judging the correlation degree of companies' businesses based on the main business disclosed by the companies has great development potential.

2.3 Research Hypothesis

The peer effect comes from the information asymmetry and uncertainty in the company's investment decision, which makes the decision-maker with limited rationality tend to make the corresponding investment decision by observing his peers' investment and decision-making behavior. Therefore, the peer effect reflects the impact of peers' "average" level on individuals. Empirical research on peer effect among enterprises generally finds that companies tend to pay close attention to the trend of peer enterprises, which makes corporate subjects affected by their characteristics and information and by other subjects in the same field. Based on this, this paper believes that there is a corresponding peer effect in the investment decision-making of China's A-share capital market. Therefore, this paper puts forward hypothesis one:

H1: The investment decisions of listed companies have a significant peer effect. Their transformation is affected by other companies from the same industry.

To distinguish the influence of peer effect caused by the similarity difference among enterprises in the industry, this paper distinguishes the homogeneity and heterogeneity of peer enterprises. According to the traditional economic theory, the influence of peer effect on individuals is reflected by the average level of peers. However, individuals in the same industry must differ in business model, industry status, and enterprise nature. In other words, the most similar companies must exist in the same industry, and they are more similar than other companies in the initial characterization. Specifically, if all peers are considered to have the same impact, peers under this definition method are referred to as Homogeneous Peer; In the definition of peers, peers that consider the direct similarity difference of peers are called Heterogeneous Peer. Under this definition, different companies have specific differences in the impact on each other's relevant characteristics.

Heterogeneous peers often choose different investment fields or development directions to avoid competition between completely similar individuals when individuals carry out company-scale expansion and strategic development planning. It is used to avoid completely homogeneous vicious competition and meaningless factor inputs; However, homogeneous peers do not consider the identification of peer similarity in investment decision-making and compete without difference in strategic development and investment decision-making. Based on this, this paper puts forward hypothesis 2:

H2: Homogeneous peers have a complementary peer effect, and the expansion of peer size and the decrease of cash flow held by peers will generate a positive stimulus to the company's investment decision. Heterogeneous peers have a competitive peer effect. The expansion of peer size and the decrease of cash flow held by peers will negatively affect the company's investment decisions.

To further confirm the different peer effects produced by different peers, this paper analyses the competitiveness and business ownership. Based on the economic theory, the intensity of competition in the market can be divided according to the degree of competition. Different markets with different degrees of competition have different pressures on enterprises. At the same time, the competitiveness of enterprises with different positions in the same market also varies. For the head enterprises with strong competitiveness, their market monopoly power is more substantial, they have more advantages in peer competition, less homogeneous peers, less competitive, and their sensitivity to peer competition is weaker than that of non-head enterprises.

The peer effect has noticeable differences between state-owned units and enterprises and non-state-owned enterprises. State-owned enterprises have the mission and function to realize the appreciation of state-owned assets in the market-oriented operation because the particularity of their ownership determines their different peer effects from non-state-owned enterprises in the process of participating in market competition. In the same industry, state-owned enterprises often occupy a stable market position due to government support and subsidies. Therefore, the complementary peer effect of non-state-owned enterprises is more evident than that of state-owned units and enterprises that occupy a dominant industry position. Combining the competitiveness of enterprises with the business ownership, this paper puts forward hypothesis 3:

H3: The complementary peer effect of heterogeneous peers is more significant in highly competitive and non-state-owned enterprises.

3. Peer Effect Measurement Based on Text Analysis

3.1 Research Design

The main business of the annual report of listed companies is an important medium for investors and managers to understand the enterprise's products, business models, and fields. It has a good direction for mining the changes in the company's business model every year, comparing new businesses, segmenting the relationship, and matching degree between the company and its fields. The traditional view thinks that companies divided into the same industry have equal relevance and contribution to the industry, which in turn has an equal impact on investors and industry managers with similar investment fields. Therefore, the construction method of peer index in most kinds of literature is as follows:

$$X_{peer} = \frac{\sum_1^n X_n - X_i}{n-1} \quad (1)$$

Among them, X_n represents a peer company in the industry, X_i represents a specific company in the industry, n represents the number of companies in the industry, and X_{peer} represents peer data structured for a specific company.

However, from the perspective of a company's business, size, and influence, the adaptability of different companies' main businesses to the industries they belong to is often different. The investment influence of companies on each other is also often different. With the progress of Chinese natural language processing and text analysis technology, unstructured text data disassembly shows its reference and rigor. Researchers have gradually begun to pay attention to the amount of information displayed in the company's annual report's main business text data. These unstructured data can be used as an extension and supplement of financial data to show the company's operating conditions and social contributions and may unconsciously reveal the overall style and tendency of the company's investment and operation. This paper assumes that the higher the similarity between the main business texts extracted from the annual reports of each company in the industry, the more contagious the investment will be, and the indicators such as industry status and development status of the two companies will be closer, and vice versa. Based on this principle, this paper innovatively introduces the method of text analysis to measure the similarity between two companies and then judges their industry influence through the company's weighting of all peers' similarity to construct a more accurate peer index.

3.1.1 Data Pre-processing

In this paper, the text captured is preprocessed by word segmentation and stop words removal, and the unstructured data of the text is converted into the basic format for analysis and processing. This paper uses the Jieba precise model to segment the extracted text, introduces a stop-use dictionary to remove the interfering words (such as personal pronouns, mood auxiliary words, years, common words, etc.) that have nothing to do with the main content, and constructs an enterprise-specific main business dictionary and records the word frequency.

3.1.2 Model Building

1) Similarity Between Word Vector and Cosine

The cosine of the angle between two n-dimensional sample points $X(x_{11}, x_{12}, \dots, x_{1n})$ and $Y(y_{21}, y_{22}, \dots, y_{2n})$ is defined as:

$$\cos(\theta) = \frac{\sum_{i=1}^n (x_i \times y_i)}{\sqrt{\sum_{i=1}^n (x_i)^2} \times \sqrt{\sum_{i=1}^n (y_i)^2}} \quad (2)$$

Among them, the value range of the angle cosine similarity $\cos(\theta)$ is $[0,1]$. The lower limit of 0 means that the two vectors do not coincide, and the upper limit of 1 means that the two vectors are completely coincident. The closer the angle cosine value is to 1, the higher the similarity between the two vectors and the stronger the correlation; the closer the angle cosine value is to 0, the lower the similarity between the two vectors and the weaker the correlation. In the research of this paper, X and Y represent the main business dictionaries of different companies in the same industry, $(x_{11}, x_{12}, \dots, x_{1n})$ and $(y_{21}, y_{22}, \dots, y_{2n})$ represent the word vectors and their weight in the dictionary, respectively. When the two dictionaries are entirely different, the main businesses of the two companies do not overlap at all. In this case, the similarity between X and Y is 0, and the peer will be excluded from the company's segmented peers.

2) Constructing the Similarity Matrix

In the same industry defined by the CSRC in the 2012 edition, this paper calculates the similarity between two companies through the text-similarity model. Then the text-similarity results can be used as an index to judge the business similarity between two companies, and the similarity between two companies in the industry can be judged.

The stock code of the listed company is replaced by b_n , and the cosine similarity of the two companies is replaced by w_{ij} . This paper further constructs the following symmetric square matrix:

$$\begin{bmatrix} 0 & w_{12} & \cdots & \cdots & w_{1(n-1)} & w_{1n} \\ w_{21} & 0 & \cdots & \cdots & w_{2(n-1)} & w_{2n} \\ \vdots & \vdots & & \ddots & \vdots & \vdots \\ \vdots & \vdots & & & \vdots & \vdots \\ w_{(n-1)1} & w_{(n-1)2} & \cdots & \cdots & 0 & w_{(n-1)n} \\ w_{n1} & w_{n2} & \cdots & \cdots & w_{n(n-1)} & 0 \end{bmatrix} \quad (3)$$

Where $w_{12} = w_{21}$, $w_{n(n-1)} = w_{(n-1)n}$ and so on. After standardization, this paper obtains the weight matrix W_{year} constructed by the cosine similarity of all companies in the same industry:

$$W_{year} = \begin{bmatrix} 0 & \frac{w_{12}}{\sum w_{1n}} & \cdots & \cdots & \frac{w_{1(n-1)}}{\sum w_{1n}} & \frac{w_{1n}}{\sum w_{1n}} \\ \frac{w_{21}}{\sum w_{2n}} & 0 & \cdots & \cdots & \frac{w_{2(n-1)}}{\sum w_{2n}} & \frac{w_{2n}}{\sum w_{2n}} \\ \vdots & \vdots & & \ddots & \vdots & \vdots \\ \vdots & \vdots & & & \vdots & \vdots \\ \frac{w_{(n-1)1}}{\sum w_{(n-1)n}} & \frac{w_{(n-1)2}}{\sum w_{(n-1)n}} & \cdots & \cdots & 0 & \frac{w_{(n-1)n}}{\sum w_{(n-1)n}} \\ \frac{w_{n1}}{\sum w_{nn}} & \frac{w_{n2}}{\sum w_{nn}} & \cdots & \cdots & \frac{w_{n(n-1)}}{\sum w_{nn}} & 0 \end{bmatrix} \quad (4)$$

Based on the weighting matrix, the overall weighting matrix W_0 is defined as follows:

$$W_0 = \begin{bmatrix} W_{2007} & 0 & \cdots & 0 & 0 \\ 0 & W_{2008} & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & W_{2018} & 0 \\ 0 & 0 & \cdots & 0 & W_{2019} \end{bmatrix} \quad (5)$$

By multiplying the weight matrix of companies in the same industry with the financial indicator matrix, the peer data weighted by the text-similarity analysis method can be obtained.

4. Empirical Analysis on Peer Effect of Investment Decision

4.1 Model and Variables

This paper selects A-share listed companies from 2007 to 2019 as the research sample, and the data comes from CSMAR. This paper performs the following operations on the initial sample to achieve the purpose of screening: (1) Delete the listed companies from the financial and public utility industries; (2) Delete the observed values of ST companies and companies with missing characteristic data; (3) 1% tail reduction for all variables. The model controls industry and year-fixed effects to control industry characteristics and time factors. The basic investment formula in this paper is shown in formula (6):

$$I_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 CF_{i,t-1} + \beta_3 Size_{i,t-1} + \rho_1 Q_{-i,t-1} + \rho_2 CF_{-i,t-1} + \rho_3 Size_{-i,t-1} + \alpha_j + \delta_t + \varepsilon_{i,t} \quad (6)$$

Where subscripts i and t represent company i and year t , and the investment in the explained variable ($I_{i,t}$) represents the ratio of capital expenditures for the year, i.e., the opening balance of cash paid by an enterprise to construct fixed assets, intangible assets, and other long-term assets divided by the net fixed assets, measured by lagging fixed assets. The explanatory variable $Q_{i,t-1}$ represents the Tobin Q value of company i in year $t-1$, and $Q_{-i,t-1}$ represents the Tobin Q value of company i 's peers. Mean calculation for all firms in year $t-1$ (excluding firm i). $Size_{i,t-1}$, $CF_{i,t-1}$ represent the natural relationship between the book value of company i 's assets in year $t-1$ (see "Size" in Table 1) and cash flow, respectively is calculated as the mean of all firms in the industry to which firm i belongs (excluding firm i) in year $t-1$. $Size_{-i,t-1}$, $CF_{-i,t-1}$ represents the natural logarithm of company i 's peer asset book value and cash flow. Furthermore, this paper accounts for time-invariant firm heterogeneity by including industry fixed effects (α_j) and year fixed effects (δ_t). The coefficient beta measures the relationship between a company's average investment and its stock price over time. This paper allows the error terms ($\varepsilon_{i,t}$) to correlate within firms and corrects for standard deviations as in Peterson (2009). The specific variable definitions are shown in Table 1.

Table 1. Definition and Description of Variables

Variable	Explanation	Definition
<i>Capex</i>	Capital Expenditure	Cash divided by the original value of fixed assets (opening balance) paid for construction, intangible assets, and other long-term assets
<i>PPE</i>	Net Fixed Assets	The original value of fixed assets divides by net after accumulated depreciation and impairment allowance for fixed assets
<i>Q</i>	Tobin's Q	(Market value of owner's equity + total book value of accounts)/book value of total assets
<i>Size</i>	Companies' Size	The logarithm of total assets
<i>TA</i>	Total Assets	Total for each item of assets
<i>CF</i>	Cash Flow	(Net profit after non-recurring gains and losses attributed to shareholders of listed companies (ib)+depreciation (dp))/Total assets (TA)
<i>Sale</i>	Operating Income	Operating income recognized during an enterprise's operations
<i>Opt.</i>	Operating Costs	Ongoing expenses incurred in the day-to-day operations of the enterprise
<i>Markup</i>	Enterprise Competitiveness	The difference between the operating income and operating costs of the enterprise
<i>Mturnover</i>	Main Business Income	Operating income derived by an enterprise from its production and operation activities in its industry

4.1.1 Equal-weighted Peer

Table 2 reports summary statistics for the key variables used other than similarity calculations, with samples covering 31,754 observations. This paper gives its mean, median, 25%, and 75%

quantiles and its standard deviation, and the number of observations for that variable that are not lost. In the upper part of the table, the statistics observed by the own company are provided. Statistics on peer averages (i.e., peer averages observed annually by each company) are provided in the lower half of the table. The total assets (TA) unit is counted as 10 billion (RMB).

Table 2. Descriptive Statistics of Relevant Variables

	Obs.	Mean	25th	Median	75th	St.Dev.
Own Firm						
I_i	31,754	0.364	0.031	0.101	0.338	0.627
Q_i	31,754	1.740	1.070	1.330	1.930	1.060
CF_i	31,754	0.017	0.007	0.019	0.035	0.034
TA_i	31,754	2.360	0.313	0.887	2.390	3.650
Equal-weighted Peer						
I_{-i}	31,754	1.040	0.548	0.756	0.787	0.982
Q_{-i}	31,754	2.300	1.700	1.770	2.380	1.290
CF_{-i}	31,754	0.015	0.011	0.015	0.022	0.009
TA_{-i}	31,754	3.620	1.480	2.170	5.170	2.860

4.1.2 Text similarity peers

Table 3 reports summary statistics for key variables used other than similarity calculations, with a sample covering 27,429 observations. The specific definition is similar to Table 3.

Table 3. Descriptive Statistics of Peer Text Similarity

	Obs.	Mean	25th	Median	75th	St.Dev.
Own Firm						
I_i	27,429	0.281	0.049	0.131	0.302	0.472
Q_i	27,429	1.980	1.210	1.600	2.310	1.420
CF_i	27,429	0.019	0.018	0.019	0.020	1.660
TA_i	27,429	0.933	0.119	0.272	0.681	2.270
Text-based Peer						
I_{-i}	27,429	0.277	0.214	0.235	0.351	0.122
Q_{-i}	27,429	1.940	1.650	1.940	2.290	0.508
CF_{-i}	27,429	0.020	0.019	0.020	0.021	0.767
TA_{-i}	27,429	1.140	0.550	0.755	0.957	1.470

4.2 Test of Peer Effect

4.2.1 Applicability of Investment Decision Benchmark Model

The regression results of model (6) using equal weight peer data are shown in column (1)(2) of Table 4, where the peer in column (1) uses the mean value of peer data and the data in column (2) uses the median value of peer data. There is a significant positive correlation between corporate investment and Tobin Q, cash flow of the company and its peers, but with the expansion of the scale of the company and its peers, the investment will decrease accordingly. These findings are consistent with the research of Foucault and Fresard (2014). The regression results using text similarity peer data are shown in column (3)(4) of Table 4, where peer calculation uses the method of text similarity weighted definition.

As shown in Table 4, first, there is a strong significance in the regression results of equal weight peers and text similarity peers, but the correlation is the opposite. This result shows that the investment decisions of enterprises have a peer effect, but this peer effect is negatively correlated. This paper attempts to explain this result: For one thing, enterprises pay close attention to those

enterprises that are closely related to them in their investment decisions, but in the face of new investment decisions, there are certain complementary investment behaviors among enterprises, i.e., avoiding competition in the same field with enterprises that are more competitive with themselves. For another, the negative correlation of corporate investment decisions manifests the complementary peer effect produced by heterogeneous peers. When companies see peer companies carrying out business expansion or making new investment decisions, they scientifically adjust their business models based on their conditions.

Secondly, when using the peer data defined by text-similarity for regression, except for the correlation symbol, the regression coefficient of Q_{-i} is smaller than that of equal weight peers. Tobin Q reflects the future investment opportunities and investment sensitivity of the enterprise, and the regression of investment decisions to Tobin Q reflects the investment efficiency of the enterprise. The decrease of regression coefficient indicates that the enterprise is due to the decrease of investment opportunities and investment efficiency in heterogeneous peer competition. Different peer enterprises' advantages will release different information and attraction, which will have different impacts on the company's investment decisions.

Table 4. Regression Results of Investment Benchmark Equation

	Equal-weighted Peer		Text-based Peer	
	(1)	(2)	(3)	(4)
	Mean	Median	Mean	Median
Q_i	0.003*	0.004*	0.007*	0.005
	(1.79)	(1.92)	(1.78)	(1.24)
CF_i	0.008**	0.009**	0.010**	0.011**
	(2.28)	(2.32)	(2.25)	(2.39)
$Size_i$	-0.030***	-0.029***	-0.018***	-0.018***
	(-3.85)	(-3.69)	(-5.94)	(-5.87)
Q_{-i}	0.021**	0.879**	-0.004***	-8.450
	(2.24)	(2.47)	(-5.15)	(-0.86)
CF_{-i}	0.008**	10.061**	-0.005**	-0.000**
	(2.39)	(2.06)	(-2.55)	(-2.39)
$Size_{-i}$	-0.000***	-0.170***	0.002***	0.545
	(-2.95)	(-2.96)	(4.64)	(1.57)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	0.691***	21.478***	0.342***	37.439*
	(4.86)	(3.15)	(4.80)	(1.92)
Obs.	22,880	22,900	21,000	21,007
R^2	0.031	0.030	0.058	0.055

Note: ***, **, and * are significant at the significance level of 1%, 5%, and 10%, respectively.

4.2.2 Analysis on Heterogeneity of Peer Effect

In analyzing peer effect heterogeneity, this paper uses text similarity peer data for grouping regression to explore the impact of corporate competitiveness and corporate nature on corporate investment decisions and peer effect.

Markup is defined as the difference between the operating income and operating costs of an enterprise. It is reflected the profitability and profitability of the enterprise. Based on the average competitiveness of peers, the sample is divided into High Markup and Low Markup. This paper holds that, in general, companies with strong profitability and high profitability are more contagious in their investment decisions, more independent in their investment decisions, and less affected by the competitive peer effect. These companies are called monopoly enterprises. However, the early and immature enterprises are called competitive enterprises.

The enterprise competitiveness classification regression results are shown in Table 5(1)(2). The investment decisions of competitive enterprises are more closely related to the cash flows of their peers and the size of the companies, which shows to some extent that competitive enterprises are more sensitive to the competitive effects of corporate investment decisions. However, monopoly enterprises are more sensitive to their financial data and investment decisions and less sensitive to the investment decisions of their peers because they are in the leading position in the market and play the leading and imitative roles in the industry.

The regression results of the classification of enterprise nature are shown in Table 5(3)(4). The regression results show that the sensitivity of non-state-owned enterprises to peer investment decisions is more significant than that of state-owned enterprises, which may be due to the state-owned enterprises' stable position in the market due to the government's management and subsidies. The above conclusions show that the peer effect of investment decisions is related to the competitiveness of enterprises and the nature of enterprises.

Table 5. Regression Results of Peer Investment Equation for Text Similarity of Various Classification Methods

	(1)	(2)	(3)	(4)
	High markup	Low markup	State-owned	Non-state owned
Q_i	0.024**	0.006*	0.018***	0.006
	(2.36)	(1.74)	(3.93)	(1.26)
CF_i	0.008**	0.004	0.003	0.013**
	(2.50)	(0.49)	(0.73)	(2.00)
$Size_i$	-0.005**	-0.006***	-0.002*	-0.005***
	(-2.12)	(-4.38)	(-1.91)	(-6.50)
Q_{-i}	-0.000	-0.003***	-0.002	-0.004***
	(-0.26)	(-3.44)	(-1.64)	(-3.53)
CF_{-i}	0.001	-0.007***	0.005**	-0.006*
	(0.15)	(-3.16)	(2.19)	(-1.90)
$Size_{-i}$	-0.000	0.002***	0.000	0.002***
	(-0.76)	(3.95)	(1.13)	(3.52)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	0.358***	0.353***	0.179***	0.480***
	(2.74)	(7.39)	(3.68)	(7.57)
Obs.	3,150	17,686	7,663	13,298

Note: ***, **, and * are significant at the significance level of 1%, 5%, and 10%, respectively.

4.2.3 The competition situation of enterprises: "strive for the top" or "muddle through"?

(a) The Overall Analysis of Enterprise Competition

According to the financial data of the enterprise's main business income, this paper divides the data of the enterprise's peers again based on text similarity. Based on the median of the industry's main business income, this paper separates the upstream and downstream enterprises in the industry. When exploring the competitive situation between the upstream enterprises, this paper eliminates all the text-similarity data of enterprises. The main business income is lower than the industry median, which constructs the weight matrix from the text-similarity data between the upstream enterprises. It is further constructed more refined peer data; The same approach is used to construct peer data for the race to bottom.

The regression results of the competition situation of the upstream enterprises calculated by homogeneous peers are shown in Table 6(1). According to the regression results, it is easy to find out

that if all peers are regarded as the same, then the investment style of the enterprise shows a positive trend of "race-to-top." Table 6(2) shows the regression results of the competition situation of the enterprises under homogeneous peer calculation. The peer effect of downstream enterprises on identifying investment opportunities is stronger than that of upstream enterprises, indicating that downstream enterprises are crueller in survival competition and more sensitive to identifying survival and development opportunities among enterprises.

The regression results of the competition situation of the upstream enterprises using heterogeneous peer calculation are shown in Table 6(3). The peer effect of the industry-leading position is inversely related to the regression result, but the significance is not obvious. This result reflects the hypothesis of this paper. This paper attempts to explain the result: China's capital market is still in the stage of vigorous development, and most enterprises, even if they are already the upstream enterprises in the industry, still have great uncertainty in peer competition. Therefore, most enterprises tend to be cautious in investment style and attitude. When faced with a similar position in the industry and the actions of leading enterprises, most of the actions taken by enterprises are based on "self-preservation." They tend to develop into different fields from competitors, which proves the trend of "bottom-by-bottom competition" in enterprise competition. The regression results of the competition situation of downstream enterprises are shown in Table 6(4). The results show that the race-to-bottom competition for investment opportunities in the downstream enterprises is intense, and the investment efficiency is lower than that in the upstream enterprises. The above regression results indicate that there are still some disordered and unhealthy investment behaviors in the capital market, which need some guidance and management.

Table 6. Overall Regression Result of Enterprise Competition Situation

	Equal-weighted Peer		Text-based Peer	
	(1)	(2)	(3)	(4)
	Race to Top	Race to Bottom	Race to Top	Race to Bottom
Q_i	0.026 ^{***}	0.028 ^{***}	0.006	0.007 [*]
	(4.93)	(4.00)	(1.52)	(1.88)
CF_i	0.009 ^{***}	0.000 ^{**}	0.012 ^{**}	0.011 ^{**}
	(2.80)	(2.07)	(2.42)	(2.42)
$Size_i$	-0.013 ^{***}	-0.009 ^{**}	-0.021 ^{***}	-0.018 ^{***}
	(-4.87)	(-2.03)	(-6.04)	(-5.96)
Q_{-i}	0.025 ^{**}	0.023 ^{**}	-0.013	-0.037 ^{***}
	(2.50)	(2.29)	(-0.85)	(-3.69)
CF_{-i}	0.001 ^{**}	0.001 [*]	-0.003	-0.008 [*]
	(2.47)	(1.88)	(-0.64)	(-1.89)
$Size_{-i}$	-0.000 ^{***}	-0.000 ^{***}	0.021	0.043 ^{***}
	(-4.14)	(-2.71)	(1.29)	(4.02)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	0.594 ^{***}	0.284	0.307 ^{***}	0.327 ^{***}
	(5.25)	(1.48)	(4.13)	(4.59)
Obs.	14,147	10,364	21,012	21,012
R^2	0.052	0.040	0.052	0.056

Note: ^{***}, ^{**}, and ^{*} are significant at the significance level of 1%, 5%, and 10%, respectively.

The opposite empirical result obtained by distinguishing homogeneous peers from heterogeneous peers further indicates that enterprises should identify peers more accurately. At the same time, the "Race-to-bottom effect" of competition among heterogeneous peers also reflects the existence of investment chaos such as overcapacity and surge effect.

(b) Heterogeneity Analysis of Peer Effect in Race-to-top and Race-to-bottom Enterprises

Upstream enterprises are the backbone of the industry's development and progress. Exploring the causes of "race-to-bottom competition" in upstream enterprises' investment decisions can effectively promote the healthy development of the capital market and the healthy progress of the industry. Based on this, this paper further explores the financial data of upstream enterprises in the industry using text similarity peer data, aiming at exploring whether the enterprise competitiveness (Markup) and the enterprise nature have the same impact on the investment decisions of the upstream enterprises.

The regression results of enterprise competitiveness are shown in Table 7(1)(2). The conclusion that the sensitivity of competitive enterprises to investment opportunities is higher than that of monopoly enterprises is still valid, and the impact of enterprises on their financial data has not changed significantly. However, the sign of the impact of some heterogeneous peer data on this enterprise has changed, and the investment sensitivity of enterprises and peer financial data are positively correlated. The expansion of peer enterprises will also stimulate the expansion of this company. This result shows that competitive enterprises in the upper reaches of the enterprise will be more active in looking for investment opportunities, reflecting a more positive attitude towards investment competition.

The regression results of corporate nature are shown in Table 7(3)(4). It can be found that the investment sensitivity of both state-owned enterprises and non-state-owned enterprises reflects the correlation with peer data. This conclusion indicates that both state-owned and non-state-owned enterprises in the upstream enterprises have evident competition awareness and attention to peers. As the results of corporate competitiveness, companies of different ownerships have also shown concern for the investment opportunities of their peers, and the increase in peer investment will stimulate companies to expand actively. non-state-owned enterprises are more responsive to the heterogeneous peer effect than state-owned enterprises, which reflects the investment sensitivity and peer effect of the enterprise nature still affecting the upstream enterprises. However, the sensitivity of the upstream state-owned enterprises to investment opportunities is much stronger than the overall level of state-owned enterprises.

Table 7. Regression Results of Heterogeneity Analysis of Upstream Enterprises

	(1)	(2)	(3)	(4)
	High markup	Low markup	State-owned	Non-state owned
Q_i	0.029**	0.023***	0.022***	0.020***
	(2.21)	(4.91)	(3.20)	(3.12)
CF_i	0.011**	0.025***	0.000*	0.000**
	(2.21)	(3.10)	(1.70)	(2.46)
$Size_i$	-0.004	-0.015***	-0.014***	-0.003*
	(-0.54)	(-4.04)	(-2.94)	(-1.86)
Q_{-i}	0.015*	0.018***	0.050**	0.078***
	(1.83)	(4.80)	(2.24)	(3.08)
CF_{-i}	-0.008	-0.011**	-0.000*	-0.012*
	(-0.69)	(-2.35)	(-1.95)	(-1.68)
$Size_{-i}$	0.005	0.016***	-0.039*	-0.047*
	(0.39)	(3.32)	(-1.77)	(-1.76)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	0.285	0.352***	0.326***	0.255***
	(1.45)	(5.56)	(3.65)	(2.63)
Obs.	1,811	8,208	3,467	4,518

Note: ***, **, and * are significant at the significance level of 1%, 5%, and 10%, respectively.

5. Conclusions and policy recommendations

This paper conducts an empirical study on the peer effect on investment decisions of A-share listed companies in non-financial and non-public utility industries. Firstly, this paper verifies that peer effect exists in A-share listed companies and measures its significance. Secondly, this paper proposes a text analysis method to measure the similarity between peer enterprises, which uses the text-similarity of the main business module of the annual report as an indicator. Finally, based on the verification that peer enterprises have peer effect in investment decisions, this paper innovatively proposes the peer effect of heterogeneity and homogeneity, peer complementarity and competitiveness. The investment and exploration of the peer enterprises in various fields will help reduce the overcapacity and devaluation of production capacity brought by the surge phenomenon.

Based on the above conclusions, this paper attempts to put forward the following policy recommendations:

Firstly, there is a peer effect in the investment decisions of enterprises, which inspires the government to take a systematic view to carry out policy governance on the problems arising in the investment field. The target of enterprise imitation is often the leading enterprise in the industry, which may continuously move closer to the large enterprise in the business model. It requires the government to guide the enterprise to rationally identify the development direction and development signals in the development process and display various measures to avoid situations such as redundant construction, overcapacity, bike-sharing War, herding effect, etc.

Second, enterprises adopt different competition strategies for heterogeneous and homogeneous peers, which indicates that the government should adopt a different vision to implement precise governance, suit the proper remedy to the case, avoid systematic risks, and deal with "risk risks" according to individual, peer, and industry characteristics, instead of "one size fits all."

Thirdly, non-state-owned listed companies are more sensitive to investment growth opportunities in both competitive and non-competitive markets, while state-owned enterprises do not have such sensitivity. It suggests that the government should actively support non-state-owned enterprises, vigorously cultivate competitive markets, reduce market monopolies, based on more investment opportunities in capital markets, and the same participation plan for enterprises of different natures.

Fourthly, with the gradual increase in China's capital market size, the launch of the New Third Board has also fostered more listing opportunities for small and medium-sized enterprises. However, the investment attitude of most enterprises still tends to be conservative, and the investment strategy of enterprises to protect themselves tends to be "bottom-by-bottom competition." It is suggested that the government should give more strategic guarantees and incentives to the enterprises and guide the enterprises to actively expand the scale of the companies while cultivating a healthy capital market environment, to move forward to the upstream of the industry.

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