

The Impact of Product Market Competition on Investment Efficiency from the Perspective of Life Cycle

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Abstract: This paper selects China's A-share listed companies in Shanghai and Shenzhen from 2010 to 2020 as the research object, and empirically tests the influence of product market competition on enterprise investment efficiency from the dynamic perspective of enterprise life cycle. The research results of this paper show that: first, product market competition can improve the investment efficiency of enterprises, that is, it can restrain over-investment and under-investment; Secondly, for enterprises in recession, product market competition will restrain the over-investment of enterprises, but aggravate the under-investment of enterprises; The influence of product competition on over-investment is more significant in growth enterprises; Thirdly, the robustness test is carried out by the substitution variable method, and the regression result is still valid. This paper enriches the related research of enterprise life cycle, the related research of influencing factors of capital allocation efficiency, and provides a certain reference value for improving China's capital allocation efficiency. This paper selects China's A-share listed companies in Shanghai and Shenzhen from 2010 to 2020 as the research object, and empirically tests the influence of product market competition on enterprise investment efficiency from the dynamic perspective of enterprise life cycle. The research results of this paper show that: first, product market competition can improve the investment efficiency of enterprises, that is, it can restrain over-investment and under-investment; Secondly, for enterprises in recession, product market competition will restrain the over-investment of enterprises, but aggravate the under-investment of enterprises; The influence of product competition on over-investment is more significant in growth enterprises; Thirdly, the robustness test is carried out by the substitution variable method, and the regression result is still valid. This paper enriches the related research of enterprise life cycle, the related research of influencing factors of capital allocation efficiency, and provides a certain reference value for improving China's capital allocation efficiency.

1. Introduction

Investment is not only the driving force for economic growth, but also the destination of enterprise funds. As the core of the three financial decisions, it plays a decisive role in the survival and development of enterprises. Effective foreign investment can improve the use efficiency of idle assets, improve the efficiency of capital use, and encourage enterprises to open up new product markets. At the same time, foreign investment is also an important channel for enterprises to obtain economic information, and various channels and favorable conditions can be used to timely capture the information beneficial to enterprises. The existence of agency and information asymmetry makes the inefficient investment of enterprises more common, which seriously hinders the sustainable development of enterprises. With the complexity of China's external environment, the uncertainty of the external economic environment faced by enterprises has increased, and the market competition has become increasingly fierce. The existing researches mainly focus on the impact of internal environment of enterprises, such as management incentives, shareholder and board governance, on investment efficiency (Cheng Ke, Cheng Li, 2011; Zhao Chunxiang, Zhang Dunli, 2013) and the external environment, such as market competition, government control,

investment expenditure and capital composition, etc., to analyze the impact on enterprise investment efficiency (Xu Yimin, Zhang Zhihong, 2010; Liu Li, 2011). Enterprise development is a dynamic process similar to living organisms, and the business activities, investment activities and financing activities of enterprises with different life cycles are quite different, which makes the investment motivation of management also affected to varying degrees. Looking at the existing researches, most of them mainly analyze the influence of product market competition on the efficiency of enterprise capital allocation from a static perspective, but the relationship between them from the dynamic perspective of enterprise life cycle is scarce, which also provides an opportunity for this research[1-5].

Therefore, this paper selects China's A-share listed companies in Shanghai and Shenzhen from 2010 to 2020 as the research object, and empirically tests the influence of product market competition on enterprise investment efficiency from the dynamic perspective of enterprise life cycle. The research results of this paper show that: first, product market competition can improve the investment efficiency of enterprises, that is, it can restrain over-investment and under-investment; Secondly, for enterprises in recession, product market competition will restrain the over-investment of enterprises, but aggravate the under-investment of enterprises; The influence of product competition on over-investment is more significant in growth enterprises; Thirdly, the method of substitution variables is used to test the robustness, and the regression results are still valid.

The possible contributions of this paper are as follows: First, this paper enriches the research on the life cycle of enterprises and the factors affecting the efficiency of capital allocation, which has certain reference value for investors; Secondly, from the dynamic perspective of enterprise life cycle, this paper empirically tests the influence of product market competition on investment efficiency, expands the relevant research perspective, and provides some reference for the research of related topics.

The rest of the paper is arranged as follows: The second part is literature review and research hypothesis; The third part is the empirical research design; The fourth part is the analysis of empirical results; The fifth part is further analysis and discussion; Finally, it is the conclusion and enlightenment of this paper.

2. Literature Review and Proposing Hypothesis

2.1 Literature Review

2.1.1 Market Competition and Investment Efficiency

There are many existing researches on product market competition. The resource-based enterprise competitiveness theory holds that although different enterprises in the industry produce similar products, their differences in resources and capabilities lead to their differences in competitiveness. The reason why the resources of enterprises can produce competitive advantage is that many resources are scarce, or the acquisition cost of competitors is extremely high or impossible to obtain. Such as know-how, patents, corporate culture, experience, etc. With regard to the resources that can form the competitive advantage of enterprises, Barney (1991) thinks that it includes financial, physical, personnel, trade, technology and organizational assets, etc. Therefore, to sum up, the resources that can form the competitive advantage of enterprises are the capital resources, material resources, technical resources, goodwill resources, human resources and organizational resources of enterprises[6].

Efficiency, simply put, is the degree of utilization of resources. The allocation of resources in the investment activities of enterprises to places with high production efficiency shows high-efficiency investment, and vice versa, it is low-efficiency investment or inefficient investment. Jensen (1986) introduced the problem of over-investment for the first time. Over-investment means that the investment behavior of enterprises deviates from the normal growth ability and invests in projects with negative net present value. Market competition has a certain degree of influence on investment efficiency, which can be manifested in alleviating under-investment or restraining over-investment.

When an enterprise is in the fierce competition of product market, the greater the bankruptcy risk it faces, thus prompting managers to be more cautious in making decisions, which also means that the competition of product market inhibits managers' excessive investment behavior to some extent. Hou and Robinson(2006) found that the profit rate of the industry will decrease due to the improvement of the competition degree in the industry, and enterprises will face more risks, so the operators of the company will make investment decisions carefully. On the other hand, the research conclusion of Holmstrom(1982) is that product market competition has an incentive effect, which can effectively improve investment efficiency[7-9].

The degree of product competition affects the investment behavior of enterprises, and even determines the investment scale of enterprises to a certain extent. At present, scholars' research mainly focuses on the interaction between product market competition and enterprise capital structure and the relationship between product competition and enterprise investment expenditure. For example, Li Qingyuan and Wang Yonghai (2008) think that with the increase of product market competition, the asset-liability ratio will increase at first, and then turn to a downward trend after reaching a certain critical value. Chen Deqiu (2012) believes that product market competition and manager incentives can effectively improve managers' efforts and promote the company's operational efficiency. Chen Jian and Wang Dapeng (2006) believe that there is a negative correlation between the degree of product market competition and capital structure, and the fierce product market competition leads enterprises to adopt low financial leverage. Zhang Xiangjian (2009) thinks that the improvement of product market competition has promoted the level of capital investment expenditure of listed companies, and the new investment expenditure of enterprises is positively related to the pressure of product market competition. Cheng Hongwei and Liu Li (2009) believe that there is a negative correlation between the degree of competition in the product market and the scale of the company's investment expenditure. The more competitive the product market in which the company is located, the more cautious the company will make investment decisions, usually reducing investment expenditure[10-14].

2.1.2 Enterprise Life Cycle and Investment Efficiency

Enterprises in different life cycle stages have great differences in business activities, investment activities and fund-raising activities, and the agency problems and information asymmetry problems faced by enterprises are also different in varying degrees. However, the investment activities of enterprises with great strategic significance are bound to be affected by the above problems, thus affecting the overall investment efficiency of enterprises. In the existing domestic and foreign studies, there is still a lack of direct research on the relationship between enterprise life cycle and investment efficiency.

Deangelo (2006) divided the life cycle of enterprises with retained earnings as the index. The research results show that enterprises in the growth stage have more investment opportunities and need to invest a lot of money, while enterprises in the mature stage don't have much investment demand. The continuous cash inflow has more surplus funds for dividends and returns to shareholders. However, enterprises in the recession stage are less willing to invest and expand their business territory, and the decline in profitability won't have enough retained earnings. Saravia (2013) According to the theory of enterprise life cycle, as the company matures, their cash flow increases greatly, while their investment opportunities decrease. To prevent contraction, the management needs to invest in negative net present value projects. However, over-investment will lead to low valuation of the company and may lead to hostile takeover.

Domestically, based on the principal-agent theory, Liu Yan (2015) discussed the over-investment of enterprises from the perspective of life cycle, taking into account both cash flow and the impact of agency conflict. He believes that the causes of underinvestment and overinvestment are different. The overinvestment behavior of mature and declining enterprises is due to the principal-agent contradiction between managers and external shareholders, while the underinvestment of growing enterprises is more due to financing constraints. Qu Qingmei (2019) used the public data of A-share manufacturing companies in 2015-2017 as samples, considered the impact of enterprise life cycle,

and used the methods of factor analysis and regression analysis to study the relationship between executives' overconfidence and enterprise investment. From the different stages of life cycle, there are significant differences in the incompleteness of the relationship between overconfidence and over-investment. The maturity period is more significant than the growth period, but there is no significant correlation between them in the recession period.

Based on the investigation of the above problems, this paper focuses on the influence of the change of product market competition on the investment efficiency of enterprises in different life cycles. This study is not only helpful to fully understand the evolution of enterprise investment efficiency in enterprise life cycle, but also helpful to understand the influence of product market competition on company investment efficiency in different enterprise life cycles from a dynamic perspective, which is of great significance to the adjustment and transformation of enterprise investment efficiency in China at different development stages of enterprise life cycle.

2.2 Theoretical Analysis and Research Hypothesis

As can be seen from the above literature, product market competition has a certain degree of influence on the investment efficiency of enterprises, but the direction of influence is different, and there are two situations: promotion or inhibition. From the above literature, we can also know that inefficient investment problems are caused by principal-agent problems and information asymmetry, and the fierce competition in the product market can alleviate the impact of principal-agent problems and information asymmetry on the investment efficiency of enterprises to a certain extent.

Fierce product market competition has dual effects on management's investment decisions. On the one hand, fierce product market competition may bring negative effects on management's work and reduce management's enthusiasm. On the other hand, the fierce competition in the product market has restrained the power of the management to a certain extent. Under the pressure of enterprise bankruptcy risk, the management has to make more cautious decisions, so as to avoid enterprise bankruptcy. Market competition, as an uncontrollable factor in the external environment, makes use of the binding force of the market to effectively supervise the behavior of the enterprise management, thus reducing the possibility of the management making behaviors detrimental to the enterprise's interests out of their own interests. The research of Ying Zhou (2019) shows that in the enterprises with higher information transparency, better external governance environment and better internal control, the management capability plays a more significant role in improving the investment efficiency of enterprises.

In the environment of fierce product market competition, the management will be urged to make decisions that are beneficial to the development of the enterprise, so as to avoid over-investment by taking advantage of its authority. In addition, from the perspective of long-term legal array of the enterprise, the management will seize favorable investment opportunities in the process of resource allocation, thus avoiding the inaction of the management to maintain the status quo of the enterprise, thus suppressing the phenomenon of under-investment of the enterprise.

On the other hand, the fierce competition in the product market makes the information of enterprises tend to be transparent, and other stakeholders, such as shareholders, can get more information about the operating conditions of enterprises. This phenomenon greatly inhibits the opportunistic behavior of management. Based on this, this paper makes the following assumptions:

H1: With other conditions unchanged, product market competition can improve the investment efficiency of enterprises,

Enterprise life cycle and product market competition have a certain impact on the investment efficiency of enterprises. Enterprises in different life cycle stages have great differences in business activities, investment activities and fund-raising activities. The agency problems and information asymmetry problems faced by enterprises also have different degrees, and the investment activities of enterprises with great strategic significance are bound to be affected by the above problems, thus affecting the overall investment efficiency of enterprises. However, there is no research on the relationship among them in the existing research. This paper focuses on the impact of product market competition on the investment efficiency of enterprises in different stages of life cycle.

Because this paper is based on the data of listed companies, it is assumed that all the companies studied have passed the start-up period.

Enterprises in the growth stage are growing at a high speed and their business is expanding. In order to cope with the competition in the external product market, enterprises must vigorously develop their own patents, so as to occupy a place in the market. Therefore, enterprises tend to invest heavily. At the same time, the scale of the organization has increased rapidly, and professional managers have been introduced, which leads to the initial separation of management rights and ownership. Because the internal mechanism of enterprises in the growth period is flexible, and it can fully cope with the competition in the external market, the organizational structure of enterprises is not jumbled, and there are many investment opportunities faced by enterprises. At this time, the financial situation of enterprises is getting better and better, and the cash flow of enterprises is gradually changing from negative to positive. Managers may tend to over-invest in order to quickly occupy the market and seize the competitive opportunities. Furthermore, due to the small popularity of growing enterprises, the serious problem of asymmetric information of enterprises, and the ambition of managers to expand at this time, to some extent, managers are encouraged to make excessive investment. Based on the above analysis, this paper puts forward the following assumptions:

H2a: For enterprises in the growth stage, competition in the product market intensifies over-investment.

In the mature period, the development of the enterprise tends to be stable: it has a large market share and a large number of customers, and the cash inflow is stable. The sufficient capital flow is the premise for the enterprise to invest, which makes the enterprise have the conditions to expand its investment, and may prompt managers to over-invest in negative net present value opportunities. At this time, enterprises have sufficient capital to cope with the external market competition, and the risk of bankruptcy caused by participating in the competition is low. Therefore, enterprises choose to increase investment in order to cope with the increasingly fierce competition in the product market, which to some extent promotes the occurrence of over-investment behavior of enterprises. On the other hand, the internal level of mature enterprises is increasing, and the ownership of enterprises is further decentralized, which makes managers have more independent decision-making power, and the principal-agent problem in enterprises will become more serious. At the same time, because enterprises have a lot of free cash, it provides conditions and possibilities for over-investment, which will make the over-investment problem of enterprises more serious. Moreover, mature enterprises have successfully established a good image in the market, and their financing channels tend to be diversified. The stable inflow of funds, the accumulation of internal wealth and the small external financing constraints all provide conditions for the over-investment of executives. Based on the above analysis, this paper puts forward the following assumptions:

H2b: For mature enterprises, product market competition intensifies the behavior of over-investment of enterprises.

In the recession period, due to the emergence of a large number of new products and substitute products, the market of enterprises is shrinking gradually, and enterprises will face harsh internal and external environment. In the external environment, the profit rate of enterprises is also declining due to the decline of market share, the lack of innovation of products and services, the inability to effectively cope with the changes brought about by product market competition, and the decrease of cash flow speed. Internally, the complicated management mechanism and low flexibility of enterprises in recession will also hinder the development of enterprises. At this time, the investment opportunities faced by enterprises will be reduced, and managers will focus on how to save the enterprises and ensure their long-term and stable development. Therefore, managers at this time are more inclined to make rational and conservative decisions. In order to avoid bankruptcy risks or worry that the risks of new investment opportunities will endanger vested interests, enterprises may take a cautious attitude towards the market with fierce product competition, thus missing the growth opportunities with huge market potential, resulting in insufficient investment of the company. However, for the enterprises with abundant free cash, managers may try their best to find the second

venture opportunity of the enterprise in order to avoid the bankruptcy of the enterprise, so as to increase their investment in new growth opportunities. However, the enterprises in this period did not engage in risky financial investment, and did not blindly pursue scale expansion in production, but focused on the intensive way of improving capital flow efficiency and continuously reducing costs, so as to find new growth points of financial resources as quickly as possible and realize strategic shift. If the enterprises concentrate all resources and accurately select new ones. Based on this, this paper puts forward the following assumptions:

H2c: For enterprises in recession, the competition in product market will restrain the over-investment of enterprises, but aggravate the under-investment of enterprises.

3. Research Design

3.1 Model Construction and Variable Definition

$$IV = a_0 + a_1 HHI + a_2 Lifec + a_3 asset \sum Industry + \sum Year + \varepsilon$$

3.1.1 Explained Variable

Investment efficiency (IV). Referring to the research of Pichardson (2006) and Chen et al. (2011), we use the residual value of the model as the proxy variable of investment efficiency to estimate the normal capital investment level of the company. The specific model is as follows:

$$IV_{i,t} = b_0 + b_1 TQ_{i,t-1} + b_2 Lev_{i,t-1} + b_3 Cash_{i,t-1} + b_4 Age_{i,t-1} + b_5 Size_{i,t-1} + b_6 Ret_{i,t-1} + b_7 IV_{i,t-1} + \sum YearDummy + \sum IndustryDummy + \varepsilon_i$$

Among them, the dependent variable $IV_{i,t}$ is the capital investment of company I in the t year. We define $IV_{i,t}$ as the cash expenditure of fixed assets, intangible assets and other long-term assets minus the cash income from the sale of assets, divided by the total assets at the beginning of T year. TQ is the growth of the company, that is, Tobin Q value, which is defined as the sum of market value and liabilities of tradable shares and non-tradable shares divided by total assets. Lev is the asset-liability ratio of the enterprise. $Cash$ is the company's cash holdings, defined as the monetary fund divided by the total assets at the end of the year. Age is the age of the listed company. Calculated by the natural logarithm of the difference between the current year and the year of listing. $Size$ is the natural logarithm of the company's total assets. Ret is the company's annual rate of return in the stock market.

We use the absolute residual value of the model as proxy variable ($inveffi$) to measure the investment efficiency. The larger the value of $inveffi$, the lower the investment efficiency of the company. At the same time, the company is divided into two groups according to the residual error. If the residual error is greater than 0, it indicates that the company is over-invested, which is expressed by $over_inv$; If the residual error is less than 0, it indicates that the company has insufficient investment, which is represented by $under_inv$.

3.1.2 Explanatory Variable

3.1.2.1 Product Market Competition(Hhi)

Referring to Jia Jing's treatment, Herfindal index is used as an index to measure the market competition of products. This index can accurately reflect the degree of market competition through the market share of major market competitors in the industry. The larger the index, the greater the degree of market competition. Otherwise, the smaller the index, the smaller the market competition. Therefore, in regression analysis, the reciprocal of this index is generally used for measurement.

3.1.2.2 Division of Life Cycle

Comprehensive score evaluation method (Bens et al., 2002; Hribar and Yehuda, 2015) to divide the life cycle. In this paper, the life cycle of a company is measured by the scores of four variables: sales revenue growth rate, retained earnings rate, capital expenditure rate and company age. The specific method is: score the four indicators by industry to get a comprehensive score. Then, according to the scores, they are sorted from big to small by industry, with the highest score of 1/4

being growth enterprises, the lowest score of 1/4 being recession enterprises, and the middle half being mature enterprises.

3.1.3 Control Variable

Three variables, total assets, industry and time, are selected as control variables. Industries are classified according to the initial code, and industry fixed effects and annual fixed effects are analyzed as show in Table 1.

Table 1 Variable Statistics

| Variable | Symbol |
|----------------------------|-----------|
| efficiency of investment | IV |
| Overinvestment | Over_inv |
| undercapitalize | Under_inv |
| Product market competition | HHI |
| lifecycle | Life |
| total assets | asset |

3.2 Sample Filter

The data of investment efficiency and product market competition in this paper come from Guotai 'an database and annual reports of listed companies. We select the data of A-share listed companies in Shanghai and Shenzhen from 2010 to 2020, and use Stata software to analyze them, and obtain 30,313 initial observations, and propose 12,182 observations of companies with missing data. After processing, 18,131 observations were obtained as final samples.

4. Empirical Analysis

4.1 Descriptive Statistic

As can be seen from Table 2, the average value of product market competitiveness index is 0.1575, and HHI index is small, indicating that the monopoly degree of the market as a whole is low. The maximum value of the index is 0.8199, and the minimum value is 0.0399, which indicates that the degree of product competition among companies is different. From the investment efficiency, the maximum value is 0.4645, and the minimum value is 0. The investment efficiency among companies is quite different. In terms of company life cycle, the average score is 7.7123, and the median score is 8, indicating that about 1/2 companies are in the growth period, 1/4 companies are in the mature period, and 1/4 companies are in the decline period.

Table 2 Descriptive Statistic

| Variable | N | Mean | P50 | SD | Min | Max |
|--------------|-------|----------|---------|----------|--------|---------|
| inveffi | 18131 | 0.0401 | 0.0254 | 0.0521 | 0 | 0.4645 |
| Hhi_c | 18131 | 0.1575 | 0.1046 | 0.1392 | 0.0399 | 0.8199 |
| score | 18131 | 7.7125 | 8 | 1.7839 | 4 | 12 |
| Life1 | 18131 | 0.1801 | 0 | 0.3843 | 0 | 1 |
| Life2 | 18131 | 0.3122 | 0 | 0.4634 | 0 | 1 |
| Life3 | 18131 | 0.5077 | 1 | 0.5000 | 0 | 1 |
| Total assets | 18131 | 212.1618 | 49.1798 | 961.6256 | 0.4587 | 27331.9 |

4.2 Correlation Analysis

As can be seen from Table 3, through Stata analysis, product competitiveness of explanatory variables (HHI_C) and investment efficiency of explained variables (inveffi) are significant at 1% level, with over-investment at 1% level and under-investment at 1% level, and there is a significant correlation between explanatory variables and explained variables.

Table 3 Correlation Analysis

| | | | | | |
|--------------|-----------|-----------|-----------|----------|--------------|
| | ineffi | over_inv | under_inv | hhi_c | Total assets |
| ineffi | 1.000*** | | | | |
| over_inv | 0.864*** | 1.000*** | | | |
| under_inv | 0.243*** | -0.279*** | 1.000*** | | |
| HHI_C | 0.055*** | 0.037*** | 0.035*** | 1.000*** | |
| Total assets | -0.036*** | -0.005 | -0.058*** | 0.064*** | 1.000*** |

4.3 Investment Efficiency and Product Market Competition

Using Stata software for linear regression analysis, the relationship between product market competition and investment efficiency is tested by industry fixed effect and time fixed effect under the condition of controlling industry and time. As shown in Table 4, the correlation coefficient between ineffi and HHI_C is 0.013, which is significant at the level of 1%, indicating that product market competition will improve the investment efficiency of enterprises, and verifying the establishment of hypothesis 1.

Table 4 Regression Analysis Results

| | |
|----------------|---------------------|
| | ineffi |
| HHI_C | 0.013*** (0.001) |
| Industry | YES |
| Time | YES |
| R ² | 0.04 |

4.4 Investment Efficiency, Product Market Competition, Life Cycle

Table 5 Regression Analysis Of over-Investment in Different Life Cycles

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|--------------|------------------------|-------------------------|--------------------------|-------------------------|-------------------------|
| | over_inv | over_inv | over_inv | over_inv | over_inv |
| hhi_c | -0.0344* (0.0192) | 0.00269 (0.0111) | 0.00207 (0.00423) | -0.00154 (0.00508) | 0.0185** (0.00755) |
| asset | 0.0315*** (0.00388) | 0.0123*** (0.00230) | 0.00812*** (0.000919) | 0.0166*** (0.000957) | 0.0154*** (0.000953) |
| hhi_c_Life1 | | | | 0.0190*** (0.00701) | |
| Life1 | | | | 0.0229*** (0.00165) | |
| hhi_c_Life2 | | | | | -0.0162** (0.00776) |
| Life2 | | | | | -0.0173*** (0.00177) |
| hhi_c_Life3 | | | | | -0.0216*** (0.00781) |
| Life3 | | | | | -0.0314*** (0.00182) |
| Constant | -0.0830*** (0.0166) | -0.0276*** (0.00976) | -0.0234*** (0.00372) | -0.0517*** (0.00396) | -0.0214*** (0.00425) |
| Time | YES | YES | YES | YES | YES |
| Industry | YES | YES | YES | YES | YES |
| Observations | 2,921 | 5,410 | 9,024 | 18,124 | 18,124 |
| R-squared | 0.355 | 0.330 | 0.236 | 0.206 | 0.218 |

According to Stata's grouping regression analysis, it can be seen from Table 5 that 1-3 is the sub-sample regression of each life cycle, and from the full-sample regression 4, the cross-product term of over-investment and market competition (hhi_c_Life1) is 0.019, which is significant at the level of 5%, indicating that for enterprises in the growth stage, the intensification of market competition will have a positive effect on over-investment, which verifies the hypothesis that H2b will grow immediately. However, the interaction coefficient between market competition and

over-investment of mature enterprises is -0.0162, which is significant under the condition of 5%, indicating that there is a negative correlation between market competition and over-investment of mature enterprises, so it is assumed that H2a is not established. As can be seen from Table 6, the cross-product term of underinvestment and market competition (hhi_c_Life3) is 0.019, which is significant at the level of 5%, indicating that the market competition of enterprises in recession is positively related to underinvestment. From Table 5, the cross-product coefficient of market competition and over-investment hhi_c_Life3 is -0.0216, which is significant at the level of 1%.

Table 6 Regression Analysis Of Underinvestment in Different Life Cycle

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|--------------|-----------|-----------|------------|-------------|------------|
| | under_inv | under_inv | under_inv | under_inv | under_inv |
| hhi_c | 0.00380 | 0.0181*** | 0.0111*** | 0.0128*** | 0.00138 |
| | (0.00688) | (0.00549) | (0.00352) | (0.00264) | (0.00393) |
| hhi_c_Life2 | | | | | 0.0117*** |
| | | | | | (0.00404) |
| Life2 | | | | | 0.00565*** |
| | | | | | (0.000920) |
| hhi_c_Life3 | | | | | 0.0106*** |
| | | | | | (0.00407) |
| Life3 | | | | | 0.0105*** |
| | | | | | (0.000947) |
| asset | 0.00116 | 0.000371 | -0.00152** | -0.000850* | -0.000470 |
| | (0.00139) | (0.00114) | (0.000764) | (0.000496) | (0.000497) |
| hhi_c_Life1 | | | | -0.0102*** | |
| | | | | (0.00364) | |
| Life1 | | | | -0.00780*** | |
| | | | | (0.000854) | |
| Constant | 0.00814 | 0.0147*** | 0.0269*** | 0.0230*** | 0.0130*** |
| | (0.00594) | (0.00484) | (0.00309) | (0.00205) | (0.00221) |
| Time | YES | YES | YES | YES | YES |
| Industry | YES | YES | YES | YES | YES |
| Observations | 2,921 | 5,410 | 9,024 | 18,124 | 18,124 |
| R-squared | 0.299 | 0.336 | 0.300 | 0.209 | 0.213 |

4.5 Robustness Test

Table 7 Robustness Test

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|--------------|------------|------------|------------|------------|------------|
| | over_inv | over_inv | over_inv | over_inv | over_inv |
| hhi_b | -0.0395** | 0.00400 | -0.000902 | -0.00450 | 0.0132* |
| | (0.0176) | (0.0108) | (0.00416) | (0.00491) | (0.00693) |
| hhi_b_Life2 | | | | | -0.0145* |
| | | | | | (0.00769) |
| Life2 | | | | | -0.0177*** |
| | | | | | (0.00171) |
| hhi_b_Life3 | | | | | -0.0217*** |
| | | | | | (0.00770) |
| Life3 | | | | | -0.0316*** |
| | | | | | (0.00177) |
| asset | 0.0314*** | 0.0123*** | 0.00813*** | 0.0166*** | 0.0154*** |
| | (0.00388) | (0.00230) | (0.000919) | (0.000957) | (0.000954) |
| hhi_b_Life1 | | | | 0.0175** | |
| | | | | (0.00704) | |
| Life1 | | | | 0.0234*** | |
| | | | | (0.00161) | |
| Constant | -0.0822*** | -0.0278*** | -0.0230*** | -0.0514*** | -0.0207*** |
| | (0.0165) | (0.00974) | (0.00371) | (0.00395) | (0.00422) |
| Time | YES | YES | YES | YES | YES |
| Industry | YES | YES | YES | YES | YES |
| Observations | 2,921 | 5,410 | 9,024 | 18,124 | 18,124 |
| R-squared | 0.356 | 0.330 | 0.236 | 0.206 | 0.218 |

The substitution variable method is used to test, hhi_b is used instead of hhi_c as the

measurement index of investment efficiency, and Stata is used as the grouping regression. From the results in Table 7, it can be seen that there is still a positive correlation between market competition and over-investment in growing enterprises, with a correlation coefficient of 0.0175. There is still a negative correlation between market competition and over-investment in declining enterprises, with a correlation coefficient of -0.0217, which is significant at 1%. The results are consistent with those measured by HHI_C. Therefore, through the robustness test.

5. Discussion

5.1 Conclusion

Enterprise life cycle and product market competition have a certain impact on the investment efficiency of enterprises, and will have a huge impact on the strategic investment activities of enterprises. From the empirical results, it can be seen that the competition in the product market will help improve the investment efficiency of enterprises as a whole. However, enterprises in different life cycles will have an impact on investment behavior. Growing enterprises will aggravate the problem of over-investment because of product competition, which will cause unnecessary consumption of enterprise funds, which is not conducive to the business performance of enterprises. Therefore, enterprises in the growth stage should pay attention to whether the investment is in line with the company's development strategy, and make reasonable investment activities under the joint decision of senior management. The intensification of the product market of mature enterprises will lead to insufficient investment, which may be due to the fact that enterprises are too mature and have already occupied a large share in the product market, thus leading to insufficient investment motivation of enterprises. Therefore, mature enterprises should further innovate their products and invest in innovative departments, so as to improve their product competitiveness and benefit their own development. For enterprises in the declining period, competition in the product market will aggravate the lack of investment. Managers focus on saving enterprises, and enterprises may take a cautious attitude towards the market with fierce product competition, thus missing out on the potential ones.

5.2 Enlightenment and Suggestions

In China's current economic environment, in order to effectively solve the over-investment and under-investment behaviors of enterprises and improve the efficiency of capital investment, enterprises and the government need to make joint efforts. Enterprises should optimize the company supervision mechanism according to the competitive characteristics of different industries and the specific conditions of enterprises. The government should create a unified, open and competitive market environment, and ensure that the basic role of the market in allocating resources can be better played. First, crack down on local protectionism and trade protectionism in accordance with the law, increase the spin-off and reorganization of natural monopoly enterprises, and reduce barriers to entry of private capital, so as to alleviate the problem of insufficient competition in monopoly industries; Second, government departments should change their functions, reduce government intervention, and strictly solve the institutional exit obstacles of state-owned enterprises according to law; Third, guide the industrial upgrading and optimization, and through the implementation of independent innovation strategy, ease the disorderly competition caused by the high homogenization of enterprise products; Fourthly, optimize the evaluation mechanism of state-owned enterprise managers, and solve the problem of over-investment caused by asymmetric powers and responsibilities of state-owned enterprise managers.

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