



The Moderating Effect of Proprietary Assets on International Performance in the Context of Digital Economy

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Abstract. China's 14th Five-Year Plan calls for the development of China's strategic emerging industries to promote high-quality development of the country's digital economy and artificial intelligence. At present, China's strategic emerging industry compared with Europe and the United States and other developed countries, there are such problems as low degree of internationalization, research and development innovation ability is insufficient, therefore, this article selects 2008 to 2019, China's strategic emerging industries sample data of listed companies, using panel data analysis method, empirical research on the relationship between the degree of internationalization and performance of the company, on this basis, the moderating effect of proprietary assets on the relationship between them is discussed. According to the results, the degree of internationalization has a U-shaped effect on corporate performance, the research and development intensity has a significantly positive and moderating effect on the relationship between the degree of internationalization and corporate performance, and the marketing intensity and capital intensity have no significant moderating effect on internationalization degree and firm performance. The conclusions enrich the research on the performance level of China's strategic emerging industries, and provide empirical basis and decision-making reference for China's digital economy, artificial intelligence and other national policy making and enterprise strategic development.

Keywords: Digital Economy · Degree of Internationalization · Corporate Performance · Proprietary Assets · Moderating Effect

1 Introduction

Under the background of a new round of revolution of science and technology in the 21st century, digital economy and artificial intelligence will be the main driver of high quality and economic development, important during the economic transition of China is facing at present, the party's 14 or 15 planning is put forward, and the development of social economy development route to higher quality, China will focus on strategic emerging industries, to promote China's digital economy, the rapid development of

artificial intelligence. With the development of science and technology at the center, strategically emerging industries are characterized by their low consumption of social resources, their great development potential and their high economic benefits, and their development can significantly promote social and economic transformation and sustainable economic development. As the listed companies in China's strategic emerging industries speed up the pace of going abroad, companies face great risks in the international market, due to the complex and ever-changing international market and their lack of experience in overseas business. In order to gain more shares in the overseas market, the key factor for the success of listed companies in China's strategic emerging industries is to effectively enhance their market competitiveness. Therefore, this study focused on how to effectively enhance their market competitiveness, in order to improve their corporate performance in international trade activities. According to the resource-based view, companies can obtain long-term development power and effectively enhance their market competitiveness by means of the superiority of their own unique resources. These unique resources are generally their research and development technology, their marketing ability and their tangible assets, which are characterized by value, scarcity and difficulty of imitation. Therefore, the unique resource superiority of companies has an important moderating effect on their international performance. Many of the existing studies focus on the relationship between the degree of internationalization and corporate performance; however, few studies focus on the effects of proprietary assets on their relationship.

Hence, this paper uses the listed companies engaged in international trade in seven strategic emerging industries of China's A-share market, from 2008 to 2019, as the research sample, and it explores the relationship between the degree of internationalization and corporate performance, as well as the moderating effects of proprietary assets on their relationship.

2 Literature Review

2.1 Degree of Internationalization and Corporate Performance

For a long time, scholars have undertaken many studies on the relationship between the degree of internationalization and corporate performance, but they have not reached a unanimous conclusion. For example, in an empirical study on 43 independent samples that included 15,648 international start-ups, Schwens et al. (2018) verified that the degree and scope of internationalization are positively related to their performance. Fan and Liu (2018) used Foreign Assets to Total Assets (FATA) and Foreign Sales in Total Sales (FSTS) as the indicators to measure the degree of internationalization. They collected the financial data of Global 500 Companies from 2011 to 2013 as samples for an empirical study, and found that the overseas trade of companies in developed countries can help to improve their corporate performance. Liu and Cheng et al. (2019) based their empirical study on the innovation theory, with the sample data of listed companies in strategic emerging industries, from 2010 to 2015, as the subjects. It was found that the international trade activities of companies have side-effects on the improvement of their corporate performance. Wei and Lin (2021) based on the panel data analysis of listed

companies in Taiwan from 1997 to 2017, it is found that the degree of internationalization has an S-shaped influence on corporate performance. Brida et al. (2016) collected the sample data of Spanish chain hotels, from 2000 to 2013, and found that the degree of internationalization has an inverted U-shaped effect on corporate performance. Ding and Yeh et al. (2019) collected the sample data of 30 start-ups engaging in international trade from the stock exchange market database. According to their study, in the early stage of internationalization, this type of company can enjoy the benefits arising from the development of overseas trade activities; however, in the middle and late stages, the positive effects of the degree of internationalization on corporate performance will gradually disappear and turn into a negative effect; in other words, the degree of internationalization has an inverted U-shaped effect on corporate performance. Wang et al. (2020) collected the sample data for an empirical analysis of 32 companies in the construction industry, from 2010 to 2017, and concluded that the degree of internationalization has a U-shaped effect on corporate performance.

According to the above literature review, scholars have drawn different conclusions on the relationship between the degree of internationalization and corporate performance. The main reasons for this are as follows: (1) the sample data are not from companies in the same industry and in the same period; (2) the company samples researched vary by region; and (3) the research methods and technologies are different. The samples in this study were taken from the listed companies engaging in international trade in seven strategic emerging industries of China's A-share market, from 2008 to 2019. Due to China's economic development, these listed companies in the strategically emerging industries developed late, their resources were not well-integrated and they had not accumulated development experience in the early stages. As a result, the lack of competitiveness in international trade activities led to their low corporate performance in the early stages. However, in the middle and late stages, with the increasingly international trade volume and after becoming familiar with the dynamics of the international market, the companies continued to accumulate developmental experience and to optimize their management modes, so as to reduce their developing costs and to improve their benefits.

2.2 Moderating Effects of Proprietary Assets

According to the resource-based view, if a company seeks long-term development, it should have a unique resource superiority that is different from others. Such a resource superiority has three main characteristics: (1) their value: companies can enhance their work efficiency and improve their performance with these valuable resources, based on their development characteristics and business models; (2) their scarcity: if these resources are not rare, all companies will have resources with a similar value; hence, they cannot develop a competitive advantage that is based on these resources. Therefore, the resources need to be rare; and (3) the difficulty of imitation: if the cost of imitating these resources is low, competitors in the same industry can obtain resources that have a similar effect or function at a low cost, which is not conducive for companies that seek to develop a unique competitive advantage. Therefore, the resources should have characteristics that are difficult to imitate. Proprietary assets are generally embodied by the research, the development and innovation abilities, the capital ability and the marketing ability of a company. Companies in China's strategic emerging industries have developed late, and

may be at a competitive disadvantage in the face of the complex competitive environment in the international market, due to the lack of necessary management experience and core technologies. Proprietary assets can improve the market competitiveness of such companies, and reduce or compensate for the negative effects of their lack of experience in a competitive international market, so as to improve their corporate performance.

2.2.1 The Moderating Effects of Research and Development Intensity

The listed companies in China's strategic emerging industries are behind in their overseas trade activities and they lack the necessary development experience. In order to develop a competitive advantage in the market, they need to master the core technologies related to their products. Wu et al. (2016) argued that if their research and development ability and development experience are improved, companies will be more likely to make use of their own technological advantage to open up in a foreign market and improve their corporate performance. In an empirical study based on the sample data collected from high-tech companies in China, from 2012 to 2017, Kan and Liu (2020) found that companies do not perform well in overseas trade activities because they lack market competitiveness; however, that they can effectively improve their corporate performance in overseas trade by enhancing their technology research and development ability. In other words, research and development innovation has a significant moderating effect on the relationship between the degree of internationalization and corporate performance. We argue that, in order to compete with companies in the foreign market, the listed companies in China's strategic emerging industries need to develop their own technological advantage and produce products that are superior to those of foreign companies.

2.2.2 The Moderating Effects of Marketing Intensity

Based on the resource-based view, Nath et al. (2008) collected the sample data of 102 logistics companies in the United Kingdom for an empirical analysis. They found that a company's financial performance is affected by its marketing ability and that companies with a strong marketing ability will perform well in marketing. In an empirical analysis, Sun et al. (2018) collected the sample data of 1220 service companies in mining, oil, transportation and wholesale, from 1995 to 2015, and found that companies with a strong marketing ability will perform better in the international market than those with a weak marketing ability. In other words, the marketing ability of a company has a significant and positive moderating effect on the relationship between the degree of internationalization and corporate performance.

2.2.3 The Moderating Effects of Capital Intensity

According to the internalization theory, the business objective of a company is to maximize profits; however, in an imperfect competitive market, the transaction costs of a company will be too high. In an internal market, companies can reduce the negative effects of an imperfect competitive market on their business performance, by adjusting and optimizing their resources, such as their assets, research and development technologies and marketing abilities. By collecting the sample data for an empirical analysis

of China's listed companies, from 2008 to 2011, Chen et al. (2014) found that tangible assets can significantly improve the performance of companies engaging in international trade activities.

2.3 Literature Review

According to the literature review, few scholars have studied the relationship between the degree of internationalization and corporate performance, by combining it with three different resource superiorities, namely, the research and development intensity, the marketing intensity and the capital intensity. In the past, most scholars have obtained rich research results by studying the relationship between the degree of internationalization and corporate performance. For example, this relationship is mainly positive, negative, U-shaped and inverted U-shaped under different scenarios.

This paper studied the relationship between the degree of internationalization and corporate performance, and proprietary assets were put into the established research model as a moderating variable, in order to study the moderating effect of proprietary assets on the relationship between the degree of internationalization and corporate performance.

2.4 Article Structure

This paper mainly consists of five parts. Section 1 is the Introduction, which describes the research background and purpose of this paper. Section 2 is a Literature Review, in which literature was collected about the degree of internationalization, corporate performance and the moderating effects of proprietary assets on this relationship, in order to understand the conclusions drawn by scholars in this field. Section 3 consists of the Research Design and Hypotheses, which mainly introduces the research samples, research variables, hypotheses and research models. Section 4 covers the Empirical Results and Analysis, in which the descriptive statistics, correlation analysis and panel data analysis on research samples are carried out, as well as a robustness test on the final results. Section 5 mainly analyzes the Conclusions drawn in Sect. 4.

3 Research Design and Hypotheses

3.1 Samples and Data Sources

This paper used the listed companies engaging in international trade activities in seven strategic emerging industries of China's A-share market, from 2008 to 2019, as the research sample, and explored the relationship between the degree of internationalization and corporate performance and the moderating effects of proprietary assets on this relationship. The research samples mainly included the listed companies in the high-end equipment manufacturing, energy conservation and environment protection, bioindustry, new materials, new energy, new energy automobile and the emerging information industries.

In this paper, the sample data were screened in the following order: (1) eliminate companies showing Special Treatment (ST) from 2008 to 2019; (2) eliminate companies

whose financial data of international trade activities cannot be obtained from 2008 to 2019; and (3) eliminate sample data with abnormal values from 2008 to 2019. According to the above elimination principle, the panel data of 902 companies were obtained from 2008 to 2019, with a total of 8,000 observations. The data in this study were obtained from the annual reports issued by major companies (from the Shanghai Stock Exchange and the Shenzhen Stock Exchange).

3.2 Variable Definition

3.2.1 Explained Variable

3.2.1.1. Corporate Performance (ROA)

Corporate performance is usually measured by the indicators in financial statements, such as Earnings Per Share (EPS), Ratio of Sales (ROS), Return on Net Assets (ROE) and Return on Total Assets (ROA). The ROA was adopted in this paper to measure the corporate performance. The calculation formula is as follows:

$$\text{ROA} = \frac{\text{Net profit}}{\text{Average total assets}} \times 100\% \quad (1)$$

3.2.2 Explanatory Variable

3.2.2.1. Degree of Internationalization (DOI)

Scholars do not have a unified standard to measure the degree of internationalization. There are many indicators to measure it, such as Foreign Sales to Total Sales (FSTS), total overseas assets to total assets (FATA), the ratio of the number of overseas employees to the total number of employees and the Degree of Internationalization (DOI). The DOI was employed in this paper as an indicator to measure the degree of internationalization, with the following calculation formula:

$$\text{DOI} = \ln \left(\frac{\text{Overseas sales revenue} + 1}{\text{Domestic sales revenue} + 1} \right) \quad (2)$$

3.2.3 Moderating Variables

At present, most scholars measure the existing proprietary assets of companies by using three indicators, namely, research and development intensity, marketing intensity and capital intensity.

3.2.3.1. Research and Development Intensity (RDI)

According to Beamish et al. (2004), it is more convincing to use research and development intensity as an indicator to measure the technological advantages of companies, rather than other indicators. This indicator is the percentage of the research and development expenditure in the operation revenue.

$$\text{RDI} = \frac{\text{Research and development expenditure}}{\text{Operation revenue}} \times 100\% \quad (3)$$

3.2.3.2. Marketing Intensity (MAI)

Rugman et al. (2012) argued that the improvement of marketing ability helps to increase product popularity, and marketing intensity can measure a company's marketing abilities. This indicator is the percentage of the marketing expense in the operation revenue.

$$\text{MAI} = \frac{\text{Marketing expense}}{\text{Operation revenue}} \times 100\% \quad (4)$$

3.2.3.3. Capital Intensity (CAI)

Capital intensity generally measures the resource superiority of a company's non-current assets. This indicator is the percentage of the value of the non-current assets of the current period, minus the non-current assets of the previous period.

$$\text{CAI} = \frac{\text{Non - current assets of the current period} - \text{Non - current assets of the previous period}}{\text{Non - current assets of the previous period}} \times 100\% \quad (5)$$

3.2.4 Control Variables

3.2.4.1. Scale of Company (SC)

Contractor et al. (2003) argued that the scale of a company can affect a change in its performance to a certain degree, and the company can develop a competitive advantage when the scale reaches a certain extent. The calculation formula is as follows:

$$\text{SC} = \ln \text{Total assets} \quad (6)$$

3.2.4.2. Equity Ratio (ER)

According to Morck and Yeung (1991), a change in the capital structure of a company will affect its performance to different degrees. The calculation formula is as follows:

$$\text{ER} = \ln \left(\frac{\text{Liability}}{\text{Stockholder's equity}} \right) \times 100\% \quad (7)$$

3.2.4.3. Listing Date (AGE)

According to Pangarkar and Yuan (2009), enterprises that enter a certain field earlier can accumulate more development experience and perform better than those that enter later. The calculation formula is as follows:

$$\text{AGE} = \ln (\text{End of the year} - \text{Date of establishment of company} + 1) \quad (8)$$

Table 1 is a summary table of variable definitions and calculation methods in this paper.

3.3 Research Hypotheses

According to the literature, the degree of internationalization has various effects on corporate performance, which may be caused by the different research samples and research methods used by scholars. China's strategic emerging industries started late and did not

Table 1. Summary table of variables

Variable type	Variable name	Abbreviation	Calculation formulas
Explained variable	Corporate performance	ROA	$ROA = \frac{\text{Net profit}}{\text{Average total assets}} \times 100\%$
Explanatory variable	Degree of internationalization	DOI	$DOI = \ln \left(\frac{\text{Overseas sales revenue}+1}{\text{Domestic sales revenue}+1} \right)$
Moderating variables	Research and development intensity	RDI	$RDI = \frac{\text{Research and development expenditure}}{\text{Operation revenue}} \times 100\%$
	Marketing intensity	MAI	$MAI = \frac{\text{Marketing expense}}{\text{Operation revenue}} \times 100\%$
	Capital intensity	CAI	$CAI = \frac{\text{Non-current assets of the current period} - \text{Non-current assets of the previous period}}{\text{Non-current assets of the previous period}} \times 100\%$
Control variables	Scale of company	SC	$SC = \ln \text{ Total assets}$
	Equity ratio	ER	$ER = \ln \left(\frac{\text{Liability}}{\text{Stockholder's equity}} \right) \times 100\%$
	Listing date	AGE	$AGE = \ln (\text{End of the year} - \text{Date of establishment of company} + 1)$

accumulate rich experience in their overseas trade activities in the early stages. However, in the later stage, as operation and management experience was accumulated over time, their operating conditions also improved. In addition, proprietary assets are a unique and superior resource of an enterprise, and they can improve the core competitiveness of enterprises under certain conditions. On this basis, this paper proposed the following hypotheses:

H1: For the listed companies in China’s seven strategic emerging industries, the degree of internationalization has a U-shaped relationship with corporate performance.

H2: The research and development intensity has a positive moderating effect on the relationship between the degree of internationalization and corporate performance.

H3: The marketing intensity has a positive moderating effect on the relationship between the degree of internationalization and corporate performance.

H4: The capital intensity has a positive moderating effect on the relationship between the degree of internationalization and corporate performance.

3.4 Model Design

According to the reasoning analysis and research hypotheses in the above section, this paper constructed the following models:

Model 1:

$$ROA = C + \beta_0 DOI + \beta_1 RDI + \beta_2 MAI + \beta_3 CAI + \beta_4 DOI^2 + \beta_5 RDI^2 + \beta_6 MAI^2 + \beta_7 CAI^2 + \beta_8 SC + \beta_9 ER + \beta_{10} AGE + \beta_{11} SC1 * AGE1$$

Model 2:

$$ROA = C + \beta_0DOI + \beta_1RDI + \beta_2MAI + \beta_3CAI + \beta_4DOI^2 + \beta_5RDI^2 + \beta_6MAI^2 + \beta_7CAI^2 + \beta_8SC + \beta_9ER + \beta_{10}AGE + \beta_{11}SC1 * AGE1 + \beta_{12}DOI1 * RDI1 + \beta_{13}SC1 * RDI1 + \beta_{14}DOI1 * MAI1 + \beta_{15}SC1 * MAI1 + \beta_{16}DOI1 * CAI1 + \beta_{17}SC1 * CAI1$$

The C is a constant, DOI1, RDI1, MAI1, CAI1, SC1 and AGE1 mean the zero-centered processing of relevant variables, and DOI1*RDI1, DOI1*MAI1 and DOI1*CAI1 are the first-order interaction terms and have a moderating effect on the non-linear relationship between the degree of internationalization and corporate performance.

4 Empirical Results and Analysis

4.1 Descriptive Statistics

Based on the data in Table 2, there are 8000 observations in this study. The return on total assets of the listed companies in China’s strategic emerging industries is 1.82%, on average, indicating that the listed companies in China’s strategic emerging industries are generally profitable, but that they make a low profit. In terms of the average degree of internationalization, most enterprises have a low degree of internationalization and are in the initial stages. A standard deviation of 6.02% indicates that most of such companies are still far from being international.

In addition, an average research and development intensity of -7.38% indicates that most enterprises invest less in research and that their development and innovation ability is weak. The return on total assets, the degree of internationalization, marketing intensity and equity ratio are negative and left skewed, while the research and development intensity, capital intensity, the scale of the company and the listing date are positive and right-skewed. Based on the observations on the kurtosis values of all variables, except that the degree of internationalization as well as research and development intensity are platykurtic (with a kurtosis value lower than 3), the kurtosis values of the other variables are leptokurtic, indicating that the sample data are generally centralized and reliable.

Table 2. Descriptive statistical analysis

	ROA	DOI	RDI	MAI	CAI	SC	ER	AGE
Observations	8000	8000	8000	8000	8000	8000	8000	8000
Mean	1.82	-5.81	-7.38	0.91	0.20	15.18	-0.24	8.73
Median	1.85	-2.95	-9.19	1.27	0.12	15.08	-0.15	8.72
Maximum	4.89	17.13	3.51	6.18	6.03	20.94	7.55	10.38
Minimum	-5.48	-21.75	-17.14	-13.75	-8.78	11.21	-4.36	5.43
Std. Dev.	0.80	6.02	4.62	2.00	0.41	1.36	1.00	0.52
Skewness	-0.67	-0.70	1.07	-3.74	0.61	0.46	-0.20	0.22
Kurtosis	5.84	2.01	2.61	21.81	73.65	3.31	4.29	4.34

Table 3. Correlation coefficient matrices

	ROA	DOI	RDI	MAI	CAI	SC	ER	AGE
ROA	1.00							
DOI	0.02	1.00						
RDI	-0.08	0.08	1.00					
MAI	0.05	0.23	0.12	1.00				
CAI	0.16	0.00	-0.08	0.00	1.00			
SC	-0.22	-0.07	0.03	-0.23	-0.01	1.00		
ER	-0.19	-0.10	-0.12	-0.21	-0.03	0.42	1.00	
AGE	-0.20	-0.10	0.19	-0.06	-0.14	0.31	0.12	1.00

4.2 Correlation Analysis

Table 3 shows the correlation analysis of corporate performance, the degree of internationalization, research and development intensity, marketing intensity, capital intensity, the scale of the company, as well as the equity ratio and listing date for China's strategic emerging industries. According to the above table, the research and development intensity, the scale of company, equity ratio and listing date are negatively related to the return on total assets, and the degree of internationalization, marketing intensity and capital intensity are positively related to the return on total assets. However, the specific effects should be further analyzed.

4.3 Panel Data Analysis

The sample data in this study are panel data, so a hybrid analysis is required to determine whether the time series of the sample data affects the cross-sectional data. In the hybrid analysis, the R2 value and residual sum of the squares of the unweighted statistics are compared with those of the weighted statistics. If the R2 value of the weighted statistics is greater than that of the unweighted statistics and the residual sum of the squares of the weighted statistics is less than that of the unweighted statistics, the sample data in this study will be suitable for a panel data analysis.

According to Table 4, as for the four models in this study, the R2 (0.1, 0.09, 0.25, 0.25) values of weighted statistics are respectively greater than those (0.04, -0.01, 0.12, 0.13) of the unweighted statistics, and the residual sums of squares (4624.96, 4847.39, 4210.89, 4137.55) of the weighted statistics are respectively less than those (4655.92, 4904.46, 4279.24, 4212.00) of the unweighted statistics, indicating that the sample data in this study is suitable for a panel data analysis.

Fixed effect models or random effect models should be selected for the panel data analysis. The Hausman test proposed by Hausman (1978) was employed to select the most effective model for the sample data. According to the test results, at a significance level of less than 0.05, the fixed effects models were more effective for the sample data; otherwise, the random effect models were more effective.

Table 4. Panel data analysis

R ² of weighted statistics	0.1	0.09	0.25	0.25
Residual sum of squares	4624.96	4847.39	4210.89	4137.55
R ² of unweighted statistics	0.04	-0.01	0.12	0.13
Residual sum of squares	4655.92	4904.46	4279.24	4212.00

Table 5. Hausman test data

Chi-square statistics	264.03	239.79	406.38	434.42
Degree of freedom	8	4	12	18
Significance level	***	***	***	***

Note: *, ** and *** indicate a significance level of greater than 0.1, 0.05 and 0.01, respectively.

According to the Hausman test in Table 5, the four models are at a significance level of greater than 0.01. Hence, the fixed effects models are more effective for the four models of this study.

Model 1: Fixed effect model of explanatory and control variables

$$\begin{aligned}
 ROA = & 2.86 + 0.002DOI - 0.05RDI + 0.01MAI \\
 & (0.13) \quad (0.002) \quad (0.006) \quad (0.008) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad * \\
 & + 0.23CAI + 0.0009DOI^2 + 0.006RDI^2 \\
 & (0.02) \quad (0.0003) \quad (0.001) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad *** \\
 & + 0.002MAI^2 + 0.04CAI^2 - 0.1SC \\
 & (0.001) \quad (0.006) \quad (0.01) \\
 & \quad \quad \quad ** \quad \quad \quad *** \quad \quad \quad *** \\
 & - 0.14ER - 0.09AGE + 0.14SC1 * AGE1 \\
 & (0.01) \quad (0.02) \quad (0.01) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad ***
 \end{aligned}$$

Model 2: Modulated variable fixed effect model

$$\begin{aligned}
 ROA = & 3.09 + 0.0003DOI - 0.11RDI + 0.02MAI \\
 & (0.14) \quad (0.002) \quad (0.008) \quad (0.008) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad ** \\
 & + 0.24CAI + 0.0007DOI^2 + 0.01RDI^2 \\
 & (0.02) \quad (0.0003) \quad (0.001)
 \end{aligned}$$

$$\begin{aligned}
 & \text{***} \quad \text{**} \quad \text{***} \\
 & + 0.003\text{MAI1}^2 + 0.03\text{CAI1}^2 - 0.15\text{SC} \\
 & (0.008) \quad (0.01) \\
 & \text{***} \quad \text{***} \quad \text{***} \\
 & - 0.15\text{ER} - 0.1\text{AGE} + 0.13\text{SC1} * \text{AGE1} \\
 & (0.01) \quad (0.02) \quad (0.01) \\
 & \text{***} \quad \text{***} \quad \text{***} \\
 & + 0.0006\text{DOI1} * \text{RDI1} + 0.02\text{SC1} * \text{RDI1} \\
 & (0.0003) \quad (0.02) \\
 & * \quad \text{***} \\
 & + 0.0001\text{DOI1} * \text{MAI1} + 0.004\text{SC1} * \text{MAI1} \\
 & (0.001) \quad (0.003) \\
 & - 0.002\text{DOI1} * \text{CAI1} + 0.009\text{SC1} * \text{CAI1} \\
 & (0.004) \quad (0.02)
 \end{aligned}$$

Note: *, ** and *** indicate a significance level of greater than 0.1, 0.05 and 0.01, respectively.

It can be found from the above fixed effect model that there is a significant influence on the adjustment effect. Since the variables of the adjustment effect in this study are decentralized, the influence of the single variable is significant and needs to be recalculated by Z-test ($Z = \frac{\beta_a - \text{Variable mean} * \beta_b}{\sqrt{S_{\beta_a}^2 + \text{Variable mean} * S_{\beta_b}^2}}$). The calculation results are shown in Table 6.

In Models 1, 2, the interaction term coefficient between the degree of internationalization and other indicators is positive, therefore the degree of internationalization has a U-shaped relationship with corporate performance. This indicates that, when the listed companies in China’s strategic emerging industries continuously strengthen international trade activities, their corporate performance first decreases and then increases,

Table 6. Z test table

Variables	Coefficient and standard deviation	Z test	significance level
DOI	0.005 (0.002)	1.56	
RDI	-0.11 (0.008)	-13.01	***
MAI	0.02 (0.008)	2.08	**
CAI	0.23 (0.02)	7.45	***

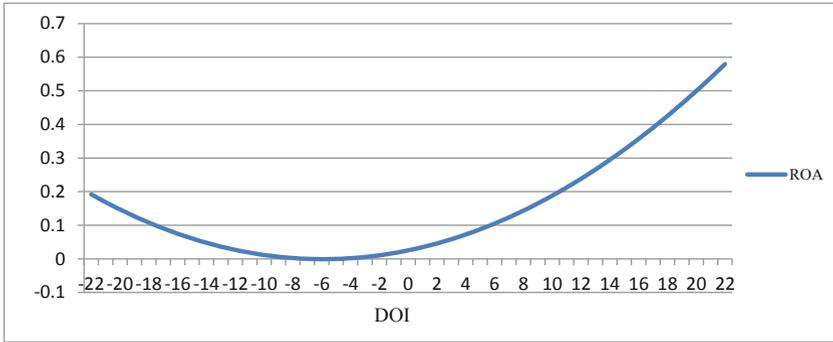


Fig. 1. Degree of internationalization has a U-shaped relationship with corporate performance

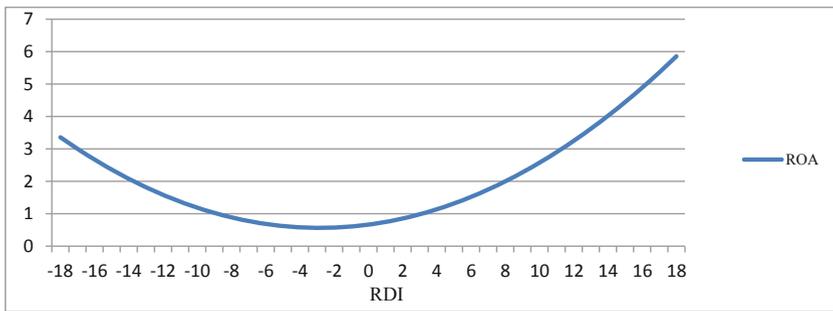


Fig. 2. Research and development intensity has a U-shaped relationship with corporate performance

showing a U-shaped effect. Therefore, H1 is supported. The effects of the degree of internationalization on corporate performance are shown in Fig. 1.

As can be seen from the fixed effect of Model 1, the square term of internationalization degree, R&D intensity, marketing intensity and capital intensity has a significant positive U-shaped impact on corporate performance. The relationship diagram of the impact of R&D intensity, marketing intensity and capital intensity on corporate performance is shown in Fig. 2, Fig. 3 and Fig. 4, respectively. In terms of the control variables, the scale of company, equity ratio and listing date had a significantly negative effect on its corporate performance, and the interaction term between the scale of the company and listing date had a significantly positive effect on its corporate performance. This indicates that, with the gradual improvement of the equity ratio and the long-time companies going public, companies face the problem of financial risk and of increasingly difficult management. These problems are unable to improve corporate performance. Moreover, it is difficult for simple company expansion to have a significantly positive effect on corporate performance. In order to achieve economies of scale, companies should sum up their development experiences and optimize and improve their financial management models in the process of continuous expansion.

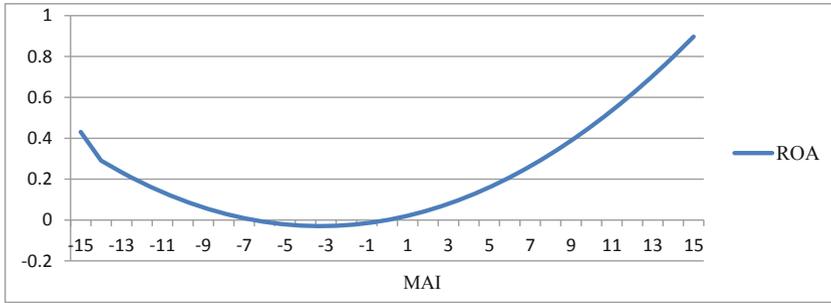


Fig. 3. Marketing intensity has a U-shaped relationship with corporate performance

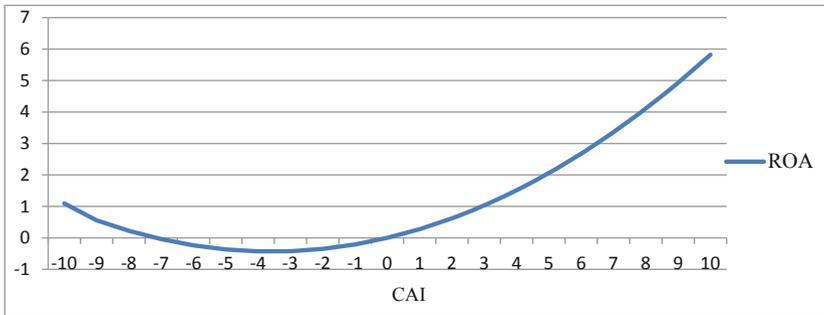


Fig. 4. Capital intensity has a U-shaped relationship with corporate performance

According to the results of fixed effect analysis of Model 2, the coefficients of control variables, such as the scale of the company, the equity ratio and the listing date are negative, indicating that these variables have a significantly negative effect. The interaction term coefficient between the scale of the company and the listing date is positive, indicating that the economies of scale brought by the expansion of the listed companies in emerging industries cannot fully cover the incurred costs, and that the positive economies of scale also requires companies to accumulate development experience.

In the moderator variables, the interaction term coefficient between the research and development intensity and the degree of internationalization was positive and had a moderating effect at a significant level of 5%. In other words, the research and development investment of the listed companies in China's strategic emerging industries had a positive and moderating effect on the relationship between the degree of internationalization and corporate performance, so H2 was supported. The interaction term coefficients between marketing intensity and the degree of internationalization, and between capital intensity and the degree of internationalization were positive and negative, respectively, but had an insignificant moderating effect on the relationship between the degree of internationalization and corporate performance. Therefore, H3 and H4 were not supported.

4.4 Robustness Test

In order to strengthen the reliability of the above conclusions in this paper, by sampling 90%, a robustness test was conducted on the above two models, and the regression results of the robustness test were compared with the results of the benchmark regression. The results are shown in Table 8 below, and the symbols and significance of the variables in the two models are basically consistent with the results of the benchmark regression, which shows that the conclusions of this paper are robust.

Model 1: Fixed effect model of explanatory and control variables

$$\begin{aligned}
 ROA = & 2.69 + 0.001DOI - 0.05RDI + 0.02MAI \\
 & (0.14) (0.002) (0.006) (0.008) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad ** \\
 & + 0.21CAI + 0.001DOI^2 + 0.005RDI^2 \\
 & (0.02) (0.0003) (0.0007) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad *** \\
 & + 0.002MAI^2 + 0.037CAI^2 - 0.09SC \\
 & (0.0009) (0.006) (0.01) \\
 & \quad \quad \quad ** \quad \quad \quad *** \quad \quad \quad *** \\
 & - 0.15ER - 0.09AGE + 0.14SC1 * AGE1 \\
 & (0.01) (0.02) (0.013) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad ***
 \end{aligned}$$

Model 2: Modulated variable fixed effect model

$$\begin{aligned}
 ROA = & 2.19 - 0.0003DOI - 0.11RDI + 0.02MAI \\
 & (0.14) (0.002) (0.008) (0.008) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad ** \\
 & + 0.22CAI + 0.0007DOI^2 + 0.01RDI^2 \\
 & (0.02) (0.0003) (0.001) \\
 & \quad \quad \quad *** \quad \quad \quad ** \quad \quad \quad *** \\
 & + 0.003MAI^2 + 0.03CAI^2 - 0.14SC \\
 & (0.001) (0.009) (0.01) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad *** \\
 & - 0.15ER - 0.09AGE + 0.13SC1 * AGE1 \\
 & (0.01) (0.02) (0.01) \\
 & \quad \quad \quad *** \quad \quad \quad *** \quad \quad \quad *** \\
 & + 0.0008DOI * RDI + 0.02SC1 * RDI1 \\
 & (0.0003) (0.02) \\
 & \quad \quad \quad *** \quad \quad \quad ***
 \end{aligned}$$

$$\begin{aligned}
 &+ 0.0005\text{DOI1} * \text{MAI1} + 0.005\text{SC1} * \text{MAI1} \\
 &\quad (0.001) \quad (0.003) - 0.0005 \\
 &\text{DOI1} * \text{CAI1} + 0.02\text{SC1} * \text{CAI1} \\
 &\quad (0.004) \quad (0.02)
 \end{aligned}$$

Note: *, ** and *** indicate a significance level of greater than 0.1, 0.05 and 0.01, respectively.

5 Conclusions

China's 14th Five-Year Plan focuses on the development of strategic emerging industries, which will assume the major responsibility of promoting the steady digital economic growth and continuously optimizing industrial structure in the future. As China speeds up the pace of going abroad, it is necessary to study the going-abroad situation of companies in emerging industries. Based on the sample data of the listed companies in emerging industries of China's A-share market, from 2008 to 2019, this paper analyzed the effects of the degree of internationalization on corporate performance by using panel data, and explored the moderating effects of proprietary assets on the relationship between the degree of internationalization and corporate performance. The research conclusions are as follows:

Firstly, the degree of internationalization has a U-shaped effect on corporate performance. According to the results, in the early stages, overseas trade has a negative effect on companies in strategically-emerging industries. The reason is that these emerging industries developed late in China, and they faced various problems in the early stages of overseas trade. The first problem was with management, with the expansion of the overseas market, the increases in corporate business and the increased difficulties in management. The second problem was the cultural differences. International trade is restricted by language communication, which makes it difficult for companies to expand their business. The last problem was the business risk, because when overseas business is carried out for the first time, companies might make wrong marketing decisions due to the inevitable problem of the lack of the necessary development experience and because they fail to evaluate the market risks fully. However, in the middle and late stages of overseas market development, companies optimize their operation and management modes and reduce the operational risks, and as the company expands, they continue to accumulate the development experience and begin to make reasonable and strategic marketing decisions. Therefore, overseas trade activities in this stage positively affect corporate performance.

Secondly, the intensity of the research and development of companies has a significantly positive and moderating effect on the relationship between the degree of internationalization and corporate performance, as core competitiveness, research, development and innovation are important to company development. In a similar external competitive environment, an increase in investment in research, development and innovation not only increases a company's new knowledge and new technologies on the basis of the integration of existing knowledge and technology, but it can also enable companies to effectively enhance their core competitiveness in the face of complex foreign markets,

in order to improve their corporate performance. Listed companies in such emerging industries supported by the 14th Five-Year Plan can reasonably increase their investment in research, development and innovations in the value chain production, based on their development experience and scale, so as to produce high-quality and innovative products that are different to those of their competitors in the same industry.

Finally, marketing intensity and capital intensity have an insignificant moderating effect on the relationship between the degree of internationalization and corporate performance. According to previous studies, they have a significant moderating effect on the relationship between the degree of internationalization and corporate performance. However, according to this study, the listed companies in different industries are unique, and different types of companies can improve their performance by using different methods. Listed companies in strategic emerging industries prioritize scientific and technological innovation. If listed companies in strategic emerging industries ignore their own characteristics and blindly increase their investment in advertising and fixed assets, it will not effectively improve their performance, but it will increase their costs.

Overall, in the process of overseas trade activities conducted by the listed companies in China's strategic emerging industries, research, development and innovation can enhance their corporate performance more effectively than advertising investment and capital investment, and this will promote their long-term development.

Main contributions of this paper: (1) the research degree of asset specificity in internationalization and firm performance between the two adjustment, most previous literatures at home and abroad to discuss the research and development strength, marketing strength and capital intensity is one of the three or the three second in international and corporate performance between the two adjustment, few scholars both at home and abroad, combined the three to discuss Research of this article is to study specific assets in international and corporate performance between the two adjustment, at the same time, considering the research and development strength, marketing strength and capital strength, the regulating role in the relationship between the two, enrich the asset specificity between internationalization and firm performance in the relevant theory of regulation. (2) the development of seven strategic emerging industries will benefit China's economy to the development of high quality, and in this paper, we study sample data from China's A shares with international trade business of seven strategic emerging industries listed companies, the empirical results of this paper can provide the new listed companies for this type of investment perspective, better improve the level of corporate performance.

Enlightenment: (1) China's 14th five-year plan focuses on the development of strategic emerging industries, enterprises should pay close attention to national policies, carry out effective resource integration, accelerate enterprise transformation and upgrading, so as to obtain more development opportunities. (2) Enterprises in China's strategic emerging industries should pay enough attention to R&D technology activities, constantly summarize R&D experience and effectively integrate existing resources, so as to enhance the core competitiveness of enterprises. (3) As a key industry supported by the Chinese government, the Chinese government should actively promote enterprises in strategic emerging industries to conduct international trade activities and increase international technical exchanges. At the same time, this type of enterprises also need

to constantly improve the level of management, so as to enhance the competitiveness of the international market.

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