



## The Influence of Company-specific Assets on Corporate Performance Interaction

Shih-Yung Wei<sup>1</sup>, Li-Wei Lin<sup>2\*</sup>, Su-Rong Yan<sup>2</sup>, Yun-Han Zhang<sup>2</sup>

<sup>1</sup>Business School of Yulin Normal University, Yulin, China, <sup>2</sup>School of Information, Zhejiang University of Finance and Economics Dongfang College, Zhejiang, China. \*Email: [linlw1982@gmail.com](mailto:linlw1982@gmail.com)

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### ABSTRACT

This paper studies the interaction between the exclusive assets of listed companies (except the financial industry) and the performance of listed companies in Taiwan during the 20 years from 1998 to 2017, and studies the changes of the interaction, and divides the time point into two stages, namely, 1998 (the end of the Asian financial turmoil), 2008 (the beginning of the world financial tsunami) and 2017. In this study, it is found that there is interaction among R&D intensity, marketing intensity and capital intensity. Due to the mutual exclusion of costs, the pairwise effect is almost negative, but the attributes still have additive effect with each other (the interaction of the three attributes is positive). However, in the later period (2008-2017), this study found that the interaction between R&D intensity and marketing intensity showed a positive effect, which can be seen that the investment in R&D in the future is also helpful to the company's advertising. It is found that when an economy wants to develop internationalization, the degree of internationalization will be a positive effect on corporate performance, and when it reaches a certain degree, the positive effect will disappear and show a nonlinear effect. This study finds that Taiwan shows a W-shaped effect in the later stage of this study.

**Keywords:** Specific Asset, Interaction Panel Data, The Influence of Company-specific Assets on Corporate Performance Interaction

**JEL Classifications:** C32, O13, O47

### 1. INTRODUCTION

The exclusive advantage (firm specific advantages) is considered to be one of the important factors affecting the operating performance of the enterprise, and the research generally supports that the advantage of the manufacturer has a positive impact on the performance of the (Delios and Beamish, 1999; Morck and Yeung, 1991). Other scholars believe that the factors that help to improve the performance of manufacturers are the advantages of manufacturers (such as R&D, advertising and capital-intensive) (Jung, 1991), and the exclusive assets owned by manufacturers themselves. (Firm-Specific Asset) is the most important resource (Dess et al., 1995). According to the resource base perspective (Resource-Based View, RBV) (Barney, 1991), the company's unique resources and proprietary assets gain a competitive advantage and generate persistent rewards for excellence

(Barney, 1991; Rugman and Verbeke, 2002). These resources may include products Brand name, skilled labor force, scientific and technological knowledge and efficient production process (Wernerfelt, 1984). These resources, such as assets, know-how and skills are difficult to formalize and replicate by competitors, so they can be used for excellent compensation, and these resources are called company-specific assets.

The company's specific assets are currently measured in the relevant studies using R&D strength, capital strength and marketing intensity (Caves, 1971; Jung, 1991; Morck and Yeung, 1991; Kotabe et al., 1997; Delios and Beamish, 1999; Kotabe et al., 2002; Zeng et al., 2009). Or only to explore the impact of R&D strength and marketing intensity on the Company's performance (Qian and Wang, 1999; Lu and Beamish, 2004; Chari et al., 2007; Bae et al., 2008; Ravichandran et al., 2009), but does not take into

account the impact of capital intensity on corporate performance. In addition, Taiwan enterprises are relatively small compared to the multinational enterprises (MNCs) in Europe and America. Can assets improve the performance of manufacturers? This is the research problem that this study wants to clarify very much.

Morck and Yeung (1991) uses various assets to represent the company-specific advantages (FSAs) in terms of actual variable measurements. These assets include know-how, marketing capabilities, customer satisfaction, effective and proprietary management. Proprietary assets, as defined in Delios and Beamish (1999), refers to the technical and marketing assets owned by a manufacturer, measured by research and development density (R&D expenditure to total sales amount) and advertising intensive (advertising expenditure). Represented by the ratio of the total pin amount. The capacity of innovation and marketing used in Hitt et al. (1997) and Kotabe et al. (2002) is also defined in R&D intensive and advertising-intensive, and Grubaugh (1987) uses sales and general management costs (Selling, General and Administrative Expenses, SG & A) represents the proportion of total sales to agent marketing or marketing strength, because it is difficult to define the variables that respond to effective management include the use of different proxy variables to measure management quality. Rugman and Verbeke (2002) integrates the theory of (FSAs), internalization of the company's exclusive advantage and the resource base point of view, and holds that the company's proprietary advantage should be regarded as a collection of knowledge, in the form of assets and learning ability. Even special relationships with external roles. Jung (1991) incorporates the company's capital intensity into the company's exclusive advantage (FSAs), uses R&D intensity, capital intensity and marketing intensity to measure the company's proprietary assets. Li (1991) (5) use the company's property, plant and equipment as a proportion of total sales to measure capital intensity. Chari et al. (2007) and Ravichandran et al. (2009) proprietary assets are measured in terms of IT investment or IT strength. To sum up, the relevant literature measures the (firm specific assets) (Bae et al. of the company's proprietary assets in terms of R&D intensity, marketing intensity, capital intensity and IT intensity. 2008; Lu and Beamish, 2004 (Jung, 1991)

In Research & Development Intensity (RDI), companies can use the design or research development of products to improve performance and improve manufacturing process. If the company has excellent product design, it can gain the differentiated advantage from the competitors and get better compensation. Similarly, if innovation in the process can reduce its production cost and improve its production quality relative to competitors. Therefore, innovative reactions are in R&D capabilities to enable companies to achieve operational efficiency (Hitt et al., 1994). The division's access to the international market and the creation of operations is important, and the company can also take advantage of its innovative products to gain additional revenue, or to further reduce production costs, to take advantage of its manufacturing process and to achieve economies of scale.

The past studies have used R&D strength to measure innovation and believe that innovation or process innovation (Kotabe et al.,

2002), whether it is a product, can improve the operating efficiency of the manufacturer (Hitt et al., 1994), so, The study also found that the relationship between R&D strength and the manufacturer's performance has a positive regulation of internationalization and the company's performance (Delios and Beamish, 1999; Kotabe et al., 2002; Lu and Beamish, 2004; Bae et al., 2008). Hirschy and Connolly (2005) found that research and development expenditures of American manufacturers have a positive impact on their market value (as measured by Tobin's Q); and with respect to small companies, the R&D input of large companies has a greater impact on Tobin's Q.

Although the international corporate literature generally supports the positive relationship between R&D and firm performance, some scholars have found the reverse relationship between R&D activities and corporate performance (Chan et al., 1990/Mank and Nystrom, 2001). Therefore, it is questioned that the investment returns of R&D activities may be quite low (Rouse and Boff, 1998). Franzen and Radhakrishnan (2009), from 1982 to 2002, a total of 47,167 annual data were collected to explore the influence of research development expenditure on the stock value of profitable companies (profit firms) and lossmaking companies (loss firms). The empirical results show that the investment of research and development has a negative correlation with the stock price of profitable companies, that is to say, the investment of research and development has a negative impact on the value of profitable companies.

In addition to the R&D and innovation ability of the manufacturer, the unique marketing ability, such as brand management or trademark, is one of the important advantages of the manufacturer in the "proprietary asset" (proprietary assets) referred to in Caves (1996). As the market becomes more globalized across national boundaries, manufacturers with more marketing capabilities can produce better performance than those with less investment (Caves, 1996/Hennart, 1991; Lall, 1980). Therefore, manufacturers expect higher advertising and marketing costs to be able to overseas markets generate higher sales (Kotabe et al., 2002).

Delios and Beamish (1999) found that advertising expenditure had a negative impact on the performance of the subsidiary. Sriram and Sapienza (1991) discussed the effect of marketing capacity on the performance of small and medium-scale exporters, and did not find evidence of the performance of the marketing activities. Qian (2002) put the marketing intensity into the model and considered the control variable to be discussed, and it has no significant effect on the performance of the firm.

On the capital strength, the company expands the production capacity to reach the economies of scale through the investment in the equipment of the plant, reduce the production cost of the unit, and obtain the competitive advantage of the cost, so as to obtain more orders. And the product with lower production cost can be sold to other countries with higher production cost so as to obtain the compensation. So the research thinks that if the company has a higher capital strength, it will achieve better performance from the internationalization strategy.

There is very little interaction between the “specific assets” and the effect of the company’s performance, and the interaction between the variables will be more or less, especially if the “should” will exist in the resource allocation of the “specific assets,” Therefore, this study is to study the situation and compare the change of interaction under the change of time.

This paper is divided into four parts. The first unit is the literature about “specific assets” introduced by Introduction, and the second chapter is the main content of Research data and Research Method, which is the data acquisition of this study and the explanation of each research variable, as well as the research method Panel data analysis of this study. The third chapter is Empirical Analysis, divided into univariate analysis, bivariate analysis, general regression analysis and Panel data analysis, union. This paper distinguishes the variables into the status of the interaction of “exclusive assets,” the degree of internationalization, board structure and other control variables studied in this study. The result of empirical analysis shows that the “exclusive assets” of Taiwan enterprises does have the effect of teaching interaction. The final chapter is Conclusion, which summarizes and suggests the results of this article.

## 2. RESEARCH DATA AND RESEARCH METHOD

### 2.1. Research Data

The purpose of this study is to study the interaction of the specific assets of Taiwan’s listed companies (excluding the financial industry) to the performance of the Company during the period from 1998 to 2017, and to study the change of the interaction, and to separate the time points into two stages. In 1998 (the end of the Asian financial crisis) - 2007, 2008 (the world financial tsunami started) - 2017. In the course of the study, the data of this study was deleted, so the data of this study was unbalanced. The industrial structure of the listed companies in Taiwan from 1998 to 2017 is shown in Table 1. The present research can be found the number of research samples is 26,637 home/year, and Taiwan is the largest in the electronic industry and the export guidance is very obvious. Therefore, this study is to explore the effect of the specific assets of the company on the performance of the company, and further explore the effect of the export proportion on the company’s performance. That is, the effect of the degree of internationalization on the performance of the company and the effect of the structure of the board and other control variables on the performance of the company.

### 2.2. Research Variable

#### 2.2.1. Independent variable- corporate proprietary assets

When firms obtain differential benefits from international expansion, they should maximize the benefits of internationalization and minimize the costs of internationalization with their capabilities. Such capabilities could be considered proprietary corporate assets. Proprietary corporate assets include a firm’s R&D and its capital strength (Jung, 1991). Therefore, this study believed that a firm’s R&D and capital strength could enable the firm to obtain benefits from an internationalization strategy. Kotabe et al. (2002) was of

Table 1: Table of industrial structure of listed companies in Taiwan from 1998 to 2017

Industry difference	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	
Glass ceramic	5	13	6	6	6	6	6	6	4	5	4	4	4	6	6	7	6	6	6	6	110	
Trade department																						437
Store																						
Textile fibers	47	49	50	47	48	48	48	46	48	49	49	50	50	51	52	52	52	53	54	54	994	
Electro mechanics	60	68	67	68	75	78	81	80	83	83	83	83	83	85	92	97	101	107	109	109	1670	
Electrical cable	10	10	10	11	12	12	13	14	14	13	12	13	14	14	17	16	15	15	16	16	266	
Electronic industry	310	413	519	611	709	756	754	732	745	781	797	828	866	888	899	918	906	890	891	891	15102	
Iron and steel industry	44	43	41	37	38	40	41	41	41	41	42	42	43	45	44	46	46	47	46	46	854	
Tourism shipping	8	10	10	10	12	12	10	10	11	12	12	12	12	16	18	21	26	27	28	28	292	
Business transform	9	10	10	9	9	9	9	8	11	11	12	11	12	13	14	12	14	13	13	13	223	
Students' skills	46	59	63	71	79	82	86	82	89	87	98	109	112	129	150	157	166	177	182	182	2167	
Other buildings	44	52	54	58	65	66	64	63	64	63	60	61	62	72	72	76	82	88	89	89	1324	
Materials construction	47	50	54	60	59	58	54	54	56	58	55	58	57	57	49	49	56	58	58	58	1095	
Automotive industry	5	4	5	4	4	5	5	4	4	4	4	4	4	4	5	5	5	5	5	5	88	
Rubber industry	8	8	8	8	9	11	11	11	12	13	12	11	11	12	12	12	12	13	13	13	219	
Food industry	31	31	31	31	29	27	28	26	24	23	24	25	25	25	29	27	28	29	29	29	548	
Cement industry	3	3	3	3	3	4	5	5	6	6	6	6	6	6	5	6	5	6	6	6	98	
Paper manufacturing	8	7	7	7	7	7	7	7	7	7	7	6	7	7	7	7	7	6	6	7	139	
Plastic industry	25	25	24	23	24	25	25	23	25	24	23	23	23	24	26	26	26	26	26	26	489	
Oil electric combustion	6	8	8	8	8	8	9	8	8	10	10	10	10	10	10	10	10	10	10	10	181	
Total																						

the view that a firm with R&D and marketing capabilities could be able to obtain higher prices for their innovative products or expand overseas markets to reach economies of scale with its R&D and marketing capabilities so as to reduce production costs. Based on above discussion, this study proposed the following hypothesis: proprietary corporate assets (including R&D expense ratio, marketing expense ratio and fixed asset growth rate) could reduce the costs of products, improve the added value of products, and improve firm performance through internationalization activities.

### 2.2.1.1. R&D expense ratio

R&D intensity is used to measure innovations, and both product innovations and process innovations are considered helpful to improve the operation efficiency of firms. Research has also found that R&D intensity is positively related to firm performance (Bradley et al., 1984; Morck et al., 1988; Titman and Wessels, 1988; Crutchley and Hansen, 1989; McConnell and Servaes, 1990; Hermalin and Weisbach, 1991; Jensen et al., 1992; Hirschey and Weygandt, 1993; Klette, 1996; Delios and Beamish, 1999; Kotabe et al., 2002; Lu and Beamish, 2004; Bae et al., 2008; Missaka, 2015; Josheski and Sopova, 2013; Shih-Yung et al., 2017).

However, some scholars have found that R&D activities are negatively related to firm performance (Chan et al., 1990; Rouse and Boff, 1998; Mank and Nystrom, 2001; Franzen and Radhakrishnan, 2009), and thus stated that the investment incomes of R&D activities may be quite low, that is, R&D investment has negative effects on the value of profitable firms. Scherer and Ross (1965) and Lev and Aboody (2001) demonstrated that the benefits of R&D activities have the time lag effect. This research comprehensively discusses the previous research results obtained by scholars and explores the long-term effects of R&D intensity on firm performance. The R&D expense ratio is used as the proxy variable of R&D intensity.

$$\text{R\&D Expense Ratio (RD)} = \text{R\&D expense} / \text{Sale revenues} \quad (1)$$

### 2.2.1.2. Growth rate of fixed assets (LA)

Agrawal and Knoeber (1996), Titman and Wessels (1988), and Shih-Yung et al. (2017) noted that the higher the growth rate of fixed assets is, the more opportunities for future investment and growth a company has. The growth rate of fixed assets is also an indicator of corporate performance.

$$\text{LA} = (\text{Total fixed assets of the year} - \text{Total fixed assets of the previous year}) / \text{Total fixed assets of the previous year} \quad (2)$$

### 2.2.1.3. Strength in marketing

Morck and Yeung (1991) found that under international M&As of major firms, investors have a positive impact on the market value of firms. Kravis and Lipsey (1992) demonstrated that both firms' R&D investment and advertisement costs could contribute to improving export performance. Kotabe et al. (2002) and Lu and Beamish (2004) demonstrated that higher advertisement and marketing costs could contribute to improving the sales of international firms in overseas markets. Shah et al. (2009) utilized cross-sectional data from 1990 to 1998 in the UK and 9752 observed values to research the value relevance of the main

media advertisement costs of ACNielsen MEA, and the results showed a positive correlation between advertisement costs and the market value of the firm. The marketing expense ratio refers to the marketing cost of a firm (including costs for publishing advertisements in newspapers and magazines, on television stations, at cinemas and theaters, advertisement designs and productions from advertising agencies, touring propaganda, color advertising boards, electric advertising, and printing of advertising materials, as well as free samples and items) within a certain period (generally 1 year) divided by operating revenue. This ratio is generally expressed as a percentage:

$$\text{Strength in marketing (MI)} = \text{Marketing cost} / \text{Sale revenues} \quad (3)$$

### 2.2.2. Dependent variable-corporate performance (Tobin's Q)

This study adopts Tobin's Q, the most commonly used indicator to measure a company's market performance. La Porta et al. (2002) employed Tobin's Q, but failed to figure out Tobin's Q, because they could not obtain the replacement cost of company assets. As a result, they replaced Tobin's Q with Proxy Q, and the latter was adopted by Claessens et al. (2000). Proxy Q is measured as follows:

$$\text{Tobin's Q} = (\text{Market value of equity} + \text{market value of debts}) / \text{Asset replacement cost} \quad (4)$$

$$\text{Proxy Q} = (\text{Market value of equity [common stocks + special stocks]} + \text{book value of debts}) / \text{Book value of assets} \quad (5)$$

### 2.2.3. Dependent variable-corporate performance (Tobin's Q)

#### 2.2.3.1. Degree of internationalization (FS)

By measuring the degree of internationalization with the ratio of foreign sales to total sales (FSTS), Kafourous et al. (2008); Hsu and Pereira (2008); Bae et al. (2008); Gaur and Kumar (2009); Filatotchev and Piesse (2009), and Brouthers et al. (2009) believed that a higher degree of internationalization has more positive effects on firm performance.

$$\text{Degree of internationalization} = \text{Ratio of foreign sales} / \text{to total sales} \quad (6)$$

#### 2.2.3.2. Scale of company (SC)

Firms with a large scale can generally be regarded as having the capability to acquire a profit margin above the normal level, as compared with general firms. Therefore, such firms are able to operate in an imperfect market and acquire a higher excess profit by leveraging their monopoly or oligopoly strength. Furthermore, firms with a large scale may have access to funds with a low cost in the capital market or operate in the market with a low cost due to risk diversification.

In respect of the impact of the scale of a company on performance, it is easier for firms with a larger scale to utilize the advantage of economies of scale to result in good operating performance. Therefore, scale of company was defined as a control variable. Measurement of the scale of company includes total assets, total operating revenue, and number of employees (Kotabe et al., 2002; Lu and Beamish, 2004; Chari et al., 2007; Bae et al., 2008; Ravichandran et al., 2009). Generally, the total assets or operating

cost of a firm at natural logarithms is defined as a proxy variable. Therefore, in this study, the carrying amounts of the total assets of the sample firms at natural logarithms were used as proxy variables.

$$\text{Scale of company} = \log(\text{total assets}) \quad (7)$$

### 2.2.3.3. Debt-asset ratio (D/A; DA)

Myers and Turnbull (1977), Jensen (1986), Morck et al. (1988), Stulz (1990), Shih-Yung et al. (2017) argued that the debt-asset ratio, on the one hand, implies the information of corporate tax shields; on the other hand, according to the Pecking Order Theory, the higher the debt-asset ratio is, the lower the rate on investment is, and the smaller the corporate value will be.

$$\text{Debt-Asset ratio} = \text{Book value of debt} / \text{Book value of asset} \quad (8)$$

### 2.2.3.4. Firm age; AG

The firm age of this study refers to the natural firm age, and so its calculation mode is as follows:

$$\text{Firm age} = (\text{Date of data collection [supposed December 31 of that year]} - \text{Date of establishment}) / 365 \quad (9)$$

### 2.2.3.5. Board structure

This variable is presented in three forms in this study: board size (BSIZE; BS), ratio of external directors (PE), and concurrent positions of directors (CP). Yermack (1996) and Shih-Yung et al. (2017) studied the relationship between board size and corporate performance. The empirical results of their studies show that board size and performance are negatively correlated - that is, a smaller board of directors can better supervise managers to raise the corporate value. Fich and Shivdasani (2005) found when most of the members of the board of directors are concurrent directors of three or more other companies that corporate performance will be undermined; Core et al. (1999) and Shivdasani and Yermack (1999) proposed when members of the board of directors hold multiple positions concurrently that they cannot effectively supervise the managers. However, the empirical results of some foreign literature hold the opposite view. For example, Ferris et al. (2003) found no evidence to indicate when most directors hold three or more positions that they will evade their responsibilities - that is, evading the responsibility of supervising managers. Yermack (2004) noted when most board directors hold three or more positions that they will still fulfill the responsibility of supervising managers.

Regarding a board of directors composed by external and insider directors, from the supervisory point of view, although external directors have less information to supervise managers, they can play a more independent supervisory role, because of their independent status. Internal directors who hold positions within the company will have more information to supervise managers, but their potential conflicts of interest with managers may subject them to the control of managers or make them more inclined to collaborate with managers to adopt strategies that compromise corporate interests. Fama (1980) and Baysinger and Hoskisson (1990) believed that external supervisors, who are independent inside the company and boast know-how, are hired by companies in the hope that they use their professional knowledge to improve corporate performance. Therefore, the higher the ratio of external directors in a company is,

the more effective the supervision can be, and the better the corporate performance can be achieved through their professional knowledge.

$$\text{Scale of board of directors} = \text{Total seats of directors} \quad (10)$$

$$\text{Ratio of external directors} = \frac{\text{Seats of external directors}}{\text{Total seats of directors}} \quad (11)$$

The concurrent position of directors is a virtual variable. If more than half of the board of directors assume three or more positions (including their position in the sampled company), then the variable is 1 and otherwise 0.

Due to problematic data acquisition, the definition of positions is mainly those directors and managers present in the annual reports of listed companies.

### 2.2.3.6. Proportion of pledged shares by directors (Pledge; PL)

This proportion is one of the commonly used indicators for corporate governance. Yeh and Lee (2001) and Shih-Yung et al. (2017) argued that the higher the proportion is of pledged shares by major shareholders, the deeper their involvement in the stock market is, and the worse the corporate performance will be.

$$\text{Proportion of pledge shares by directors} = \frac{\text{Quantity of pledge by directors}}{\text{Total shares by all directors}} \quad (12)$$

The estimated impact of the control variables in this study on corporate performance is shown in Table 2.

## 2.3. Research Method

This study explores the impact of Long-term Effects of Research and Development on corporate performance from 1998 to 2017, and so Panel Data represents the data of this study.

Panel Data is a form of data that take cross-section data and time sequence into account simultaneously. As a result, if the data for analysis are heterogeneous, then the traditional analysis method of the least square method (OLS) will cause invalid results in the analysis of Panel Data, in that OLS can only process either cross-section or time sequence data. When cross-section and time sequence both exist in the data, OLS ignores the differences between these two, resulting in inefficient estimation results. However, the Panel Datamodel can process data featuring a mixture of heterogeneity and time sequence and can produce more effective estimation results.

The Panel Data model is unable to process all kinds of data featuring a mixture of heterogeneity and time sequence. Whether this model can be adopted should be decided by comparing the general regression model with the mixed regression equation model.

The Panel Data model can be basically divided into the fixed effect model and random effect model, both of which have their respective characteristics and applicability. The model type can be selected through a simple judgment. Intuitively, cross-sectional units that are selected without sampling should adopt the fixed effect model; conversely, cross-sectional units that are selected after sampling should adopt the random effect model. However, there is no scientific basis for such judgment. Mundlak (1978) believed that errors will

occur if the intercept term of the random effect model correlates with the independent variable. In this case the fixed effect model should be adopted; if the intercept term is independent of the independent variable, then the random effect model should be adopted. To decide on which model, the Hausman Test of Hausman (1978) can be used.

## 2.4. Empirical Analysis

### 2.4.1. Uni-variable analysis

In this unit, the number of samples of this study is 26,637, and the data are divided into 11,400 and 15,237 samples respectively, and the narrative statistics of the study variables can be observed from Tables 3-5.

As can be found in Tables 3-5 that Tobin's Q, R&D Expense Ratio, Scale, Board Size, Concurrent Post Holding, Growth Rate of Fixed Assets and Pledge Ratio are leptokurtosis, the other (Degree of Internationalization, Firm Age, Proportion of External Directors and Liability Ratio) are platykurtic.

In terms of skewness, only the whole period and later Degree of Internationalization showed left deviation, and the rest were left-handed. The degree of divorce from Tables 3-7 also found that the degree of Degree of Internationalization divorce was the largest in the whole period. The average and median of central trends do not change much.

**Table 2: The estimated impact of the control variables in this study on corporate performance**

Variable	Definitions	Expected	Notes
Dependent variable Tobin's Q	Market value of equity (common stocks+special stock)/Book value of assets		
Independent variable R&D Expense Ratio (RD)	R&D Expense Ratio (RD)=R&D expense/Sale revenues	*	Morck et al. (1988), Shih-Yung et al. (2017).
Strength in marketing (MI)	Strength in marketing (MI)=Marketing cost/Sale revenues	+	Morck and Yeung (1991), Kravis and Lipsey (1992), Kotabe et al. (2002), Lu and Beamish (2004) and Shah et al. (2009)
Growth rate of fixed Assets (LA)	(Total fixed assets of the year–Total fixed assets of last year)	+	Agrawal and Knoeber (1996)
Control variables degree of Internationalization (FS)	Foreign Sales as a percentage of Total Sales, FSTS(FSTS)	+	Bae et al. (2008); Gaur and Kumar (2009); Filatotchev and Piesse (2009); Brouthers et al. (2009)
Pledge ratio (PL)	Pledge Shares held	–	Yeh and Lee (2001), ShihYung Wei et al.(2017)
Liability ratio (DA)	book value of debts book value of assets	*	McConnell and Servaes (1995), Shih-Yung et al. (2017)
Scale (SC)	ln (Total assets)	+	Shih-Yung et al. (2017)
Board size (BS)	Seats of directors	–	Yermack (1996), Shih-Yung et al. (2017)
Concurrent post holding (CP) (dummy variable)	Half of the directors hold three or more positions else	*,–	Fich and Shivdasani (2005), Shih-Yung et al. (2017)
Proportion of external directors (PD)	Number of external directors total number of direct	+	Fama (1980) and Baysinger and Hoskisson (1990), Shih-Yung et al. (2017)

**Table 3: All-period description of statistics**

All	Tobin's	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Obs.	26,637	26,637	26,637	2,6637	26,637	26,637	26,637	26,637	26,637	26,637	26,637	26,637
Mean	1.1526	0.0529	0.0041	0.1229	9.2443	0.1468	0.0888	0.0779	14.9542	0.4232	23.2011	51.1508
Median	0.8900	0.0179	0.0000	0.0046	9.0000	0.1667	0.0000	0.0000	14.7655	0.4253	21.1753	57.4650
Maximum	20.7800	8.6411	0.0999	4.9597	32.0000	0.8000	1.0000	1.0000	21.9492	0.9931	71.7178	100.0000
Minimum	0.0000	0.0000	0.0000	–0.8940	1.0000	0.0000	0.0000	0.0000	9.6711	0.0061	0.0055	0.0000
Std. dev.	0.9325	0.2212	0.0109	0.4825	2.4283	0.1522	0.2845	0.1727	1.4525	0.1796	12.7345	37.0844
Skewness	5.4131	20.8428	4.5005	4.3640	1.8965	0.4745	2.8910	2.8412	0.7716	0.1499	0.6661	–0.1756
Kurtosis	57.3813	565.7500	26.8591	30.3443	12.0794	2.0389	9.3578	11.4167	3.9825	2.6556	2.9958	1.4650

**Table 4: Pre-period description of statistics**

Before	Tobin's	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Obs.	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400
Mean	1.0949	0.0439	0.0046	0.1932	9.1889	0.0982	0.0800	0.0908	14.8179	0.4408	19.7756	0.4284
Median	0.8700	0.0152	0.0004	0.0407	9.0000	0.0000	0.0000	0.0000	14.6239	0.4466	17.5219	0.4054
Maximum	11.3900	7.7954	0.0999	4.9597	30.0000	0.7500	1.0000	1.0000	20.5809	0.9907	62.0466	1.0000
Minimum	0.0000	0.0000	0.0000	–0.8917	1.0000	0.0000	0.0000	0.0000	9.6711	0.0155	0.1425	0.0000
Std. dev.	0.7950	0.1967	0.0114	0.5336	2.8194	0.1510	0.2713	0.1940	1.4036	0.1768	11.7307	0.3621
Skewness	4.3639	21.5627	4.2635	3.7713	1.8401	1.1447	3.0963	2.6096	0.7792	0.0925	0.7239	0.1598
Kurtosis	33.6499	565.7401	24.4798	22.8446	10.5638	2.8439	10.5870	9.5545	3.7813	2.6800	2.9538	1.4919

2.4.2. Bi-variable analysis

From Tables 6-8, the correlation coefficient matrix table can find that the correlation coefficients among the various explanatory variables are mostly low-related, the interaction effect between the representations is not small, and the regression analysis does not generate a result which is different from the actual situation, and the self- variable is Scale, Age, The D/A ratio and Pledge ratio is negatively correlated with the dependent variables Tobin's Q, and most of these variables are negatively correlated with other variables, while other variables are positively correlated with Tobin's Q. However, the effect of the variable and Tobin's Q is still needed. Step by step econometric analysis can be obtained.

First behavior correlation, second behavior t-statistical first behavior significance.

2.4.3. Regression analysis

Before panel data analysis, the general regression analysis should be carried out to determine what kind of model the sample data is suitable for. The general regression analysis model of this study, the regression analysis of company specific assets, internationalization degree, board structure and other variables of the advanced research, and then the analysis of the overall variables is carried out. The analysis results are as shown in Table 9. In this study, the results of regression analysis were as follows: Table 10 (early stage) and Table 11 (later stage), and the results of regression

Table 5: Post-period description of statistics

All	Tobin's	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Obs.	15,237	15,237	15,237	15,237	15,237	15,237	15,237	15,237	15,237	15,237	15,237	15,237
Mean	1.1958	0.0596	0.0036	0.0704	9.2857	0.1832	0.0954	0.0682	15.0562	0.4100	25.7631	0.5737
Median	0.9100	0.0207	0.0000	-0.0116	9.0000	0.2000	0.0000	0.0000	14.8682	0.4095	23.7644	0.6884
Maximum	20.7800	8.6411	0.0989	4.9226	32.0000	0.8000	1.0000	1.0000	21.9492	0.9931	71.7178	1.0000
Minimum	0.0200	0.0000	0.0000	-0.8940	2.0000	0.0000	0.0000	0.0000	9.7953	0.0061	0.0055	0.0000
Std. dev.	1.0212	0.2377	0.0105	0.4331	2.0875	0.1427	0.2938	0.1541	1.4800	0.1805	12.5832	0.3651
Skewness	5.6143	20.2043	4.7117	5.0845	1.8763	0.0971	2.7547	2.9821	0.7575	0.2017	0.6272	-0.7014
Kurtosis	59.8690	532.0998	29.0551	41.1339	12.5734	2.2452	8.5883	12.5857	4.0834	2.6626	2.9427	1.6485

Table 6: All-period correlation coefficient matrix

	Tobin's Q	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Tobin's Q	1											
RD	0.18	1										
MI	-8.35	-12.8	1									
LA	-15.6	-11.63	-3.84	1								
BS	-2.66	-0.02	-0.02	-0.04	1							
BO	-27.66	-9.21	-8.99	-2.25	-0.55	1						
BP	-1.22	0.03	-0.04	0	0.06	0.04	1					
PL	-0.08	-0.03	0.03	-0.04	0.01	-0.15	0.03	1				
SC	-0.08	-0.13	-0.06	-0.03	0.29	-0.06	0.23	0.24	1			
DA	-0.25	-0.17	-0.03	-0.02	-0.03	-0.09	-0.01	0.18	0.26	1		
AG	-0.16	-0.14	-0.05	-0.17	0.16	-0.15	-0.04	0.15	0.35	0.11	1	
FS	0.05	0.03	-0.22	-0.01	-0.04	0.24	0.05	-0.11	0.03	-0.04	-0.08	1

**Table 7: Pre-period correlation coefficient matrix**

	Tobin's	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Tobin's	1											
Q		1										
RD	0.04 -4.43 ***											
MI	-0.02 (-2.48) ***	0.12 -13.23 ***	1									
LA	0.09 -9.94 ***	0.06 -6.26 ***	0.01 -0.64 ----	1								
BS	0.04 -4.18 ***	-0.02 (-1.64) *	-0.01 (-1.42) ***	-0.06 (-6.49) ----	1							
BO	0.18 -19.43 ***	0.02 -2.53 ***	-0.06 (-6.65) ***	-0.01 (-0.89) ----	0.06 (6.78) ----	1						
BP	0.05 -4.95 ***	0.01 -1.4 ***	-0.04 (-4.16) ***	0.02 -2.52 ***	0.07 (7.99) ----	0.01 (1.01) ----	1					
PL	-0.1 (-10.37) ***	-0.03 (-3.60) ***	0.03 -3.29 ***	-0.07 (-7.78) ***	0.01 (1.54) ***	-0.19 (-20.53) ***	0.03 (2.98) ----	1				
SC	0.04 -4.59 ***	-0.13 (-14.54) ***	-0.07 (-7.09) ***	-0.03 (-2.98) ***	0.34 (38.14) ***	-0.12 (-12.56) ***	0.22 (24.25) ***	0.32 (35.50) ***	1			
DA	-0.27 (-30.11) ***	-0.15 (-16.32) ***	-0.03 (-3.45) ***	-0.04 (-4.10) ***	-0.04 (-4.61) ***	-0.06 (-6.61) ***	-0.03 (-2.90) ***	0.22 (23.59) ***	0.25 -----	1		
AG	-0.17 (-18.06) ***	-0.16 (-17.10) ***	-0.03 (-2.79) ***	-0.19 (-21.09) ***	0.2 -21.83 ***	-0.17 (-18.40) ***	-0.08 (-8.73) ***	0.23 (25.69) ***	0.36 -40.67 ***	0.16 -17.75 ***	1	
FS	0.14 -15.61 ***	0.01 -1.49 ***	-0.21 (-22.52) ***	0.03 -3.42 ***	-0.04 (-4.28) ***	0.24 -26.33 ***	0.03-0.15 (3.19) ***	0.03 (-15.79) ***	-0.08 -3.47 ***	-0.1 (-8.35) ***	1	
												-----

analysis were as follows: Table 10 (early stage) and Table 11 (later stage) in addition to the comparison between the previous and late periods of time (1998-2007, 2008-2017)

From Tables 9-11, 15 regression equations are constructed in this study. Through F test, the 15 regression equations can be obtained, which indicates that all variables have explanatory power to corporate performance.

The overall regression equation of the whole period, the early stage and the later stage is as follows:

Model 1. Whole period global regression equation

$$\text{Tobin's } Q = 0.60RD + 4.01MI + 0.15LA - 0.11RD*LA - 5.34RD*MI - 2.05MI*LA + 4.87RD*MI*LA$$

(0.04) (0.55) (0.01) (0.03) (1.23) (0.89) (1.20)

\*\*\* \*\*

$$-0.75FS + 3.81FS2 - 6.19FS3 + 3.18FS4 + 0.01BS + 0.80BO - 0.05BP$$

(0.28) (1.29) (2.01) (1.00) (0.00) (0.04) (0.02)

\*\*\* \*\*

$$-0.06PL + 0.02SC - 1.12DA - 0.01AG + 1.20$$

(0.03) (0.00) (0.03) (0.00) (0.06)

\* \*\*

Model 2. Early overall regression equation.

$$\text{Tobin's } Q = 0.10RD + 0.37MI + 0.11LA - 0.17RD*LA - 1.13RD*MI - 2.22MI*LA + 1.77RD*MI*LA$$

(0.06) (0.67) (0.02) (0.06) (1.32) (1.07) (1.53)

\* \*\*

$$+0.14FS + 0.00BS + 0.75BO - 0.06BP - 0.10PL + 0.11SC - 1.24DA - 0.01AG + 0.08$$

(0.02) (0.00) (0.05) (0.03) (0.04) (0.01) (0.04) (0.00) (0.08)

\*\*\* \*\*

**Table 8: Post-period correlation coefficient matrix**

	Tobin's	RD	MI	LA	BS	BO	BP	PL	SC	DA	AG	FS
Tobin's	1											
Q	-----											
	0.24	1										
RD	-30.39 ***	-----										
	0.1	0.05	1									
MI	-12.83 ***	-6.47 ***	-----									
	0.11	0.09	0.03	1								
LA	-14.25 ***	-11.44 ***	-3.67 ***	-----								
	0	-0.03	-0.02	0	1							
BS	(-0.30)	(-3.25) ***	(-2.15) **	(-0.10)	-----							
	0.15	0.07	-0.03	0.05	-0.09	1						
BO	(18.61) ***	(8.09) ***	(-3.49) ***	(6.40) ***	(-10.78) ***	-----						
	-0.02	0.03	-0.04	0.00	0.05	1.00						
BP	(-1.92) ***	(4.26) ***	(-4.87) ***	(-0.59) ***	(6.41) ***	(6.79) ***	-----					
	-0.07	-0.03	0.02	-0.02	0	-0.09	0.03	1				
PL	(-8.28) ***	(-4.11) ***	-2.91 ***	(-2.78) ***	-0.49 ***	(-10.88) ***	-4.12 ***	-----				
	-0.16	-0.14	-0.05	-0.01	0.25	-0.07	0.23	0.2	-----			
SC	(-19.75) ***	(-17.38) ***	(-6.08) ***	(-1.00) ***	-32.26 ***	(-8.72) ***	-29.84 ***	-24.56 ***	-----			
	-0.24	-0.17	-0.04	-0.02	-0.01	-0.07	0.01	0.13	0.28	1		
DA	(-30.45) ***	(-21.51) ***	(-4.58) ***	(-2.83) ***	(-0.97) ***	(-9.00) ***	-0.86 ***	-16.6 ***	36.46 ***	-----		
	-0.18	-0.15	-0.04	-0.11	0.13	-0.28	0.03	0.12	0.33	0.12	1	
AG	(-22.30) ***	(-19.29) ***	(-5.44) ***	(-13.25) ***	(15.81) ***	(-35.62) ***	(-3.28) ***	-14.79 ***	43.50 ***	14.71 ***	-----	
	-0.02	0.02	-0.23	0	-0.06	0.17	0.06	-0.06	0.01	0.01	-0.16	1.00
FS	(-2.40) **	-3.05 ***	(-29.31) ***	-0.56 ***	(-7.47) ***	-21.52 ***	-7.8 ***	(-7.98) ***	0.86 ***	1.43 ***	(-19.72) ***	-----

Model 3. Later integral regression equation

$$\text{Tobin's } Q = 0.79RD + 6.20MI + 0.20LA - 0.21RD*LA + 4.71RD*MI + 0.10MI*LA + 12.17RD*MI*LA$$

(0.05) (0.82) (0.02) (0.03) (2.49) (1.35) (1.97)

\*\*\* \*\*

$$-1.07FS + 4.73FS2 - 7.82FS3 + 4.10FS4 + 0.02BS + 0.75BO - 0.04BP$$

(0.42) (1.93) (2.94) (1.44) (0.00) (0.06) (0.03)

\*\* \*\*

$$-0.08PL - 0.03SC - 0.97DA - 0.01AG + 2.00$$

(0.05) (0.01) (0.05)  
(0.00) (0.09)

\*\*\* \*\*

From Table 9/11 and Model 1/3, it is preliminarily determined that specialized assets have interactive effects on corporate performance, and the degree of internationalization has a significant positive impact on corporate performance in the

whole and later periods, while most of the board structure and other variables also have significant effects on corporate performance.

2.4.4. Panel data analysis

The sample of this study is PanelData, so it is necessary to judge whether the time series and cross-sectional data of the sample data have influence. The study uses the Pooled Regression Model to judge whether the relevant analysis results are shown in Tables 12-14.

2.4.4.1. All-period pool regression equation model

The full period is greater than the unweighted R-squared (0.01, -0.03, 0.01, 0.05 and 0.08) in the five-set weighted R-squared (0.06, 0.01, 0.16, 0.18, and 0.25), and the weighted Sum-squared reside (18,966.34, 19,507.46, 20,098.29, 18,613.63, and 17,826.257) is also smaller than the unweighted Sum-squared residue (22,907.15, 23,846.51, 22,841.94, 22,083.98 and 21,222.29) indicates that the sample is suitable for Panel Data Analysis. in the whole period of this study.

In the earlier stage, five sets of weighted R-squared (0.02, 0.01, 0.06, 0.25, and 0.61) are found in Table 13 above the unweighted R-squared (-0.02, -0.01, 0.01, 0.08, and 0.13) and the weighted Sum-squared residue (62,410, 6267.56, 5966.20, 5516.83, and

**Table 9: All-period general regression model**

Variable	Coefficient, std. error and significance level				
RD	0.92		0.6		
	-0.04	***	-0.04		***
MI	3.98		4.01		
	-0.55	***	-0.55		***
	(0.01)***				(0.01)***
RD*LA	-0.2				-0.11
	(0.03)***				(0.03)***
RD*MI	-7.41				-5.34
	(1.28)***				(1.23)***
MI*LA	-2.08				-2.05
	(0.93)**				(0.89)**
RD*MI*LA	5.28				4.87
	(1.25)***				(1.20)***
FS		-0.25			-0.75
		-0.29			(0.28)***
FS2		2.19			3.81
		-1.37			(1.29)***
FS3		-3.73			-6.19
		(2.13)*			(2.01)***
FS4		1.93			3.18
		(1.06)*			(1.00)***
BS			0.01		0.01
			(0.00)***		(0.00)***
BO			1.02		0.8
			(0.04)***		(0.04)***
BP			0		-0.05
			-0.02		(0.02)***
PL				-0.14	-0.06
				(0.03)***	(0.03)*
SC				0.02	0.02
				(0.00)***	(0.00)***
DA				-1.26	-1.12
				(0.03)***	(0.03)***
AG				-0.01	-0.01
				(0.00)***	(0.00)***
C	1.07	1.09	0.94	1.58	1.2
	(0.01)***	(0.01)*** (0.01)***	(0.02)***	(0.06)***	(0.06)***
R2	0.04	0	0.03	0.08	0.12
Sum squared	22,190.66	23,102.96	22,510.37	21,268.3	20,375.63
F-statistic	166.86	17.55	257.76	593.5	202.39
Prob (F-statistic)	***	***	***	***	***

5599.89) is also smaller than the unweighted Sum-squared residue (7339.47, 7258.93, 7156.44, 6614.27, and 6282.90) indicate that the pre-study samples of this study are suitable for Panel Data Analysis.

In the later stage, it was found in Table 14 that the weighted R-squared of the five groups (0.10, 0.00, 0.08, 0.41 and 0.42) was larger than that of the unweighted R-squared (0.060, 0.02, -0.01, 0.006 and 0.12) and the weighted Sum squared residue (12,409.39, 13,348.48, 12,982.70, 12,925.09 and 11,887.51) were also higher than those of the unweighted Sum squared residue. (14,994.36, 16,270.35, 15,977.68, 14,929.11 and 14,015.04) this result indicates that the later samples of this study are suitable for Panel Data Analysis.

Then it is determined that the research samples are suitable for Panel Data Analysis, and then the fixed effect and random effect model are selected. The results of the analysis are as follows: Table 15/17. The analysis results of the whole period can be seen from Table 15. The five groups of analysis are suitable

for analysis with fixed effect models, and their equations are as follows: model 4 - 8.

Model 4. The fixed effect of the variable of specific assets in the whole period

$$\text{Tobin's } Q = 0.89RD + 4.64MI + 0.23LA - 0.20RD*LA - 7.24RD*MI - 2.53MI*LA + 5.75RD*MI*LA + 1.07$$

(0.04) (0.54) (0.01) (0.03) (1.26) (0.91) (1.23) (0.01)

\*\*\* \*\*

Model 5. The Fixed Effect of the Variable of the Whole-period Internationalization

$$\text{Tobin's } Q = -0.29FS + 2.42FS2 - 4.15FS3 + 2.12FS4 + 1.11$$

(0.29) (1.35) (2.10) (1.05) (0.01)

\* \* \* \* \*

**Table 10: Pre-period general regression model**

Variable	Coefficient, std. error and significance level				
RD	0.38				0.1
	-0.06	***			-0.06
MI	-1.26		*		0.37
	-0.7				-0.67
LA	0.17				0.11
	-0.02	***			-0.02
RD*LA	-0.29				-0.17
	-0.06	***			-0.06
RD*MI	-3.46		**		-1.13
	-1.42				-1.32
MI*LA	-2.78				-2.22
	-1.15	**			-1.07
RD*MI*LA	3.72				1.77
	-1.65	**			-1.53
FS		0.32			0.14
		-0.02	***		-0.02
BS			0.01		0
			0	***	0
BO			0.93		0.75
			-0.05	***	-0.05
BP			0.13		-0.06
			-0.03	***	-0.03
PL				-0.23	-0.1
				-0.04	-0.04
SC				0.11	0.11
				-0.01	-0.01
DA				-1.25	-1.24
				-0.04	-0.04
AG				-0.01	-0.01
				0	0
C	1.06	0.96	0.93	0.28	0.08
	-0.01	-0.01	-0.03	-0.08	-0.08
R2	0.01	0.02	0.03	0.12	0.15
Sum squared	7106.92	7053.49	6954.63	6348.3	6128.82
F-statistic	22.3	243.68	136.37	384.12	133.18
Prob. (F-statistic)	***	***	***	***	***

Model 6. The fixed effect of the structural variables of the Board of Directors in the whole period

$$-0.63FS + 3.47FS^2 - 5.81FS^3 + 3.01FS^4 + 0.01BS + 0.60BO - 0.05BP$$

Tobin's Q = 0.01BS + 1.01BO + 0.00BP + 0.94,

$$(0.27) (1.27) (1.98) (0.98) (0.00) (0.04) (0.02)$$

(0.00) (0.04) (0.02) (0.02)

\*\*\* \*\*

\*\*\* \*\*

$$-0.04PL + 0.02SC - 1.08DA - 0.01AG + 1.28 (0.03) (0.00) (0.03) (0.00) (0.06)$$

Model 7. Fixed effect of other control variables during the whole period

\*\*\* \*\*

Tobin's Q = -0.06PL + 0.02SC - 1.20DA - 0.01AG + 1.67

(0.03) (0.00) (0.03) (0.00) (0.06)

\* \*\*

Model 8. The fixed effect of all-time all-variable

Tobin's Q = 0.58RD + 4.13MI + 0.17LA - 0.11RD\*LA - 5.14RD\*MI - 2.38MI\*LA + 5.16RD\*MI\*LA

(0.03) (0.54) (0.01) (0.03) (1.21) (0.88) (1.18)

\*\*\* \*\*

The analysis of the whole period (1998-2017) showed that the effect of the interaction effect of the specific asset variables (RD \* LA, RD \* MI, MI \* LA and RD \* MI \* LA was not 0) and the degree of internationalization had a W-shape, respectively. The structure of the board of directors has found that the part-time status of the board supervisor is not significant, and the influence of other control variables on the performance of the company is about the same as that of the past scholars. However, the results of the overall impact on the performance of the company still need to be through the complete regression model to get the most true answer.

The results of the model 8 are as follows:

**Table 11: Post-period general**

Regression model variable	Coefficient, std. error and significance level				
RD	1.11				0.79
MI LA	(0.05)***				(0.05)***
	7.9				6.2
RD*LA	(0.81)***				(0.82)***
	0.25				0.2
	(0.02)***				(0.02)***
	-0.3				-0.21
	(0.03)***				(0.03)***
RD*MI	3.1				4.71
	-2.57				(2.49)*
MI*LA	0.36				0.1
	-1.4				-1.35
RD*MI*LA	11.42				12.17
	(2.04)***				(1.97)***
FS		-0.58			-1.07
		-0.45			(0.42)**
FS2		2.82			4.73
		-2.07			(1.93)**
FS3		-4.94			-7.82
		-3.17			(2.94)***
FS4		2.68			4.1
		(1.55)*			(1.44)***
BS			0.01		0.02
			0		(0.00)***
BO			1.08		0.75
			(0.06)***		(0.06)***
BP			-0.09		-0.04
			(0.03)***		-0.03
PL				-0.09	-0.08
				(0.05)*	-0.05
SC				-0.04	-0.03
				(0.01)***	(0.01)***
DA				-1.17	-0.97
				(0.05)***	(0.05)***
AG				-0.01	-0.01
				(0.00)***	(0.00)***
C	1.08	1.24	0.95	2.5	2
	(0.01)***	(0.02)***	(0.04)***	(0.08)***	(0.09)***
R2	0.08	0	0.02	0.08	0.14
Sum squared	14,618.1	15,880.6	15,528.9	14,580	13,590.61
F-statistic	189.83	3.02	119.16	343.09	143.29
Prob. (F-statistic)	***	***	***	***	***

#### 2.4.4.2. Specificity assets

In this paper, the interaction of specialized assets is studied. The results of interaction of specialized assets are similar to those of model 4, and the results of interaction are as shown in Table 16.

The results show that the three attributes have a positive and significant impact on the performance of the company, but the three intensity attributes of the company are mutually exclusive in the use of funds, so the first-order interaction has negative significance, but the three attributes can produce the performance of the company can produce fish water, water fish work, so there is a positive significance under the interaction of the second street.

#### 2.4.4.3. Degree of internationalization

In the degree of internationalization, it is found that W-type is produced in the whole period (-0.63FS 3.47FS2-5.81FS3 3.01FS4), and the power of  $1 \geq 4$  is significant, but because the range of internationalization index is between 0% and 100%,

the trend diagram of its composition is W-shaped, as shown in Figure 1.

Further analysis shows that the impact on corporate performance when the enterprise increases the degree of internationalization is  $-0.63$   $6.94FS$   $-17.43FS2$   $12.04FS3$ , and the chart is as follows.

It can be found from Figure 2 that when the internationalization is  $13\% \leq 48\%$  and  $84\%$ , the performance of the company can be increased only by strengthening the degree of internationalization.

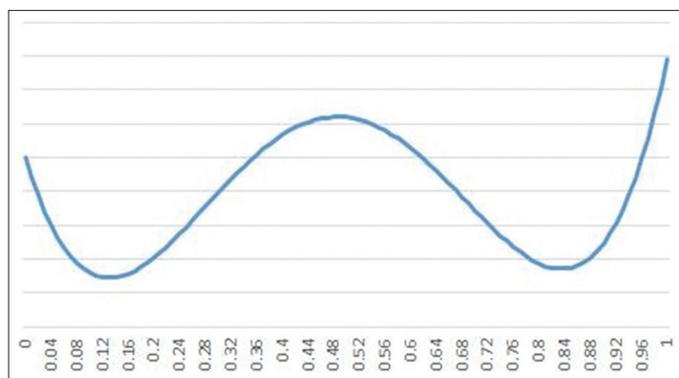
#### 2.4.4.4. Board structure

In the structure of the board of directors, it is found that the size of the board of directors (0.01) and the proportion of independent supervisors (0.60) have a positive and significant impact on the performance of the company, but the part-time situation of the board of directors does not show significant results.

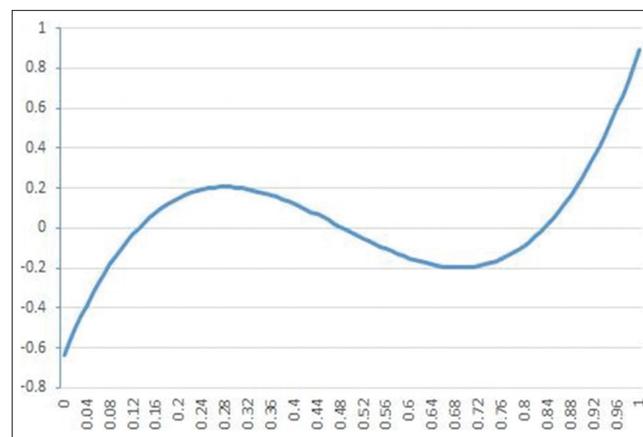
**Table 12: All-period pool regression equation model**

Variable	Coefficient, std. error and significance level				
RD	0.75 (0.04)***				0.52 (0.04)***
MI	1.36 (0.27)***				2.29 (0.23)***
LA	0.09 (0.01)***				0.08 (0.01)***
RD*LA	-0.11 (0.02)***				-0.03 (0.02)*
RD*MI	0.11 -2				1.65 -1.87
MI*LA	-1.57 (0.47)***				-1.74 (0.41)***
RD*MI*LA FS	-0.51 -1.98				-2.6 -1.93
FS		-0.56 (0.11)***			-0.53 (0.09)***
FS2		3.22 (0.54)***			2.58 (0.45)***
FS3		-5.24 (0.86)***			-4.22 (0.72)***
FS4		2.66 (0.44)***			2.2 (0.37)***
BS			0.01 (0.00)***		0.01 (0.00)***
BO			0.95 (0.01)***		0.48 (0.01)***
BP			-0.05 (0.01)***		-0.02 (0.01)***
PL				-0.11 (0.01)***	-0.06 (0.01)***
SC				0.02 (0.00)***	0.02 (0.00)***
DA				-0.78 (0.01)***	-0.69 (0.01)***
AG				-0.01 (0.00)***	0 (0.00)***
C	0.95 (0.00)***	0.96 (0.00)***	0.81 (0.01)***	1.21 (0.02)***	1.01 (0.02)***
Weighted statistics R2	0.06	0.01	0.16	0.18	0.25
Weighted statistics SSE	18,966.34	19,507.46	20,098.29	18,613.63	17,826.25
Unweighted statistics R2	0.01	-0.03	0.01	0.05	0.08
Unweighted statistics SSE	22,907.15	23,846.51	22,871.94	22,083.98	21,222.29

**Figure 1:** Chart of the impact of internationalization on corporate performance throughout the period



**Figure 2:** The impact of increased internationalization on corporate performance throughout the period



**2.4.4.5. Other control variables**

In other control variables, the size of the company has a positive significance on the performance of the company (0.02), while the ratio of debt (-1.08) and the age of the company (-0.01)

has a significant negative impact, while the proportion of the stock pledge of the supervisor has no significant effect on the performance of the company.

**Table 13: Pre-period pool regression equation model**

Variable	Coefficient, std. error and significance level				
RD	0				0.32
	-0.04				(0.03)***
MI	-2.6				0.18
	(0.21)***				-0.22
LA	-0.04				0.06
	(0.01)***				(0.01)***
RD*LA	0.03				-0.06
	-0.04				-0.04
RD*MI	2.68				-6.73
	(1.40)*				(1.23)***
MI*LA	0.82				-2.4
	(0.39)**				(0.51)***
RD*MI*LA	-1.88				0.9
	-1.38				-1.32
FS		0.08			0.08
		(0.01)***			(0.01)***
BS			0		0
			(0.00)***		(0.00)***
BO			0.59		0.43
			(0.02)***		(0.02)***
BP			0.05		-0.05
			(0.01)***		(0.01)***
PL				-0.16	-0.08
				(0.01)***	(0.01)***
SC				0.08	0.09
				(0.00)***	(0.00)***
DA				-0.8	-1.05
				(0.02)***	(0.01)***
AG				-0.01	-0.01
				((0.00)*)***	(0.00)***
C	1.02	0.96	0.96	0.33	0.3
	(0.00)***	(0.00)***	(0.01)***	(0.03)***	(0.03)***
Weighted statistics R2	0.02	0.01	0.06	0.25	0.61
Weighted statistics SSE	6242.1	6267.56	5966.2	5516.83	5599.89
Unweighted statistics R2	-0.02	-0.01	0.01	0.08	0.13
Unweighted statistics SSE	7339.47	7258.93	7156.44	6614.27	6282.9

The previous analysis results are shown in Table 16, and the five-group analysis is suitable for analysis with a fixed-effect model, such as models 9 to 13.

**Model 9. Fixed effect of pre-specific asset variables**

Tobin's Q=0.39RD-0.69MI+0.19LA-0.29RD\*LA-3.57RD\*MI-2.90MI\*LA+4.01RD\*MI\*LA+1.05

(0.06) (0.69) (0.02) (0.06) (1.40) (1.13) (1.63) (0.01)

\*\*\* \*\*

**Model 10. The fixed effect of the variables of the degree of internationalization in the early stage**

Tobin's Q=0.30FS +0.97

(0.02) (0.01)

\*\*\* \*\*

**Model 11. The fixed effect of the structural variables of the Board of Directors in the early stage**

Tobin's Q=0.01BS +0.98BO +0.13BP+0.92 (0.00) (0.05) (0.03) (0.03)

\*\*\* \*\*

**Model 12. Fixed effect of other control variables in the previous period**

Tobin's Q=0.38PL +0.10SC -1.24DA -0.01AG-0.18

(0.08) (0.01) (0.04) (0.00) (0.04)

\*\*\* \*\*

**Model 13. Fixed effect of full variables in the early stage**

Tobin's Q=0.11RD+0.44MI+0.11LA-0.19RD\*LA-1.21RD\*MI-2.44MI\*LA+2.16RD\*MI\*LA

(0.06) (0.66) (0.02) (0.06) (1.30) (1.06) (1.52)

\*\* \*\*

**Table 14: Post-period pool regression equation model**

Variable	Coefficient, std. error and significance level				
RD	1.03 (0.05)***			0.65 (0.05)***	
MI	4.9 (0.40)***			4.06 (0.35)***	
LA	0.16 (0.01)***			0.15 (0.01)***	
RD*LA	-0.24 (0.03)***			-0.1 (0.03)***	
RD*MI	5.58 (1.92)***			12.32 (2.44)***	
MI*LA	-0.92 -0.87			-2.75 (0.72)***	
RD*MI*LA	9.46 (3.41)***			6.84 (3.47)**	
FS		-0.84 (0.16)***		-0.67 (0.12)***	
FS2		4.17 (0.73)***		2.15 (0.55)***	
FS3		-6.87 (1.12)***		-3.1 (0.85)***	
FS4		3.52 (0.55)***		1.54 (0.42)***	
BS			0.01 (0.00)***	0.01 (0.00)***	
BO			0.65 (0.02)***	0.46 (0.02)***	
BP			-0.06 (0.01)***	-0.01 -0.01	
PL				-0.11 (0.01)***	-0.12 (0.01)***
SC				-0.04 (0.00)***	-0.03 (0.00)***
DA				-0.84 (0.01)***	-0.67 (0.01)***
AG				-0.01 (0.00)***	0 (0.00)***
C	0.96 (0.00)***	1.07 (0.01)***	0.84 (0.01)***	2.15 (0.02)***	1.73 (0.03)***
Weighted Statistics R2	0.1	0	0.08	0.41	0.42
Weighted statistics SSE	12,409.39	13,348.48	12,982.7	12,925.09	11,887.51
Unweighted statistics R2	0.06	-0.02	-0.01	0.06	0.12
Unweighted statistics SSE	14,994.36	16,270.35	15,977.68	14,929.11	14,015.04

$$+0.14FS + 0.00BS + 0.72BO - 0.06BP - 0.10PL + 0.11SC - 1.22DA - 0.01AG + 0.12$$

$$(0.02) (0.00) (0.05) (0.03) (0.04) (0.01) (0.04) (0.00) (0.08)$$

\*\*\* \*\*

The previous analysis (1998-2007) showed that the marketing intensity in the variables of specialized assets was not significant, while the intensity of R&D and capital was significant, and the effect of interaction between variables of specialized assets (RD\*LA, RD\*MI, MI\*LA and RD\*MI\*LA) was not significant (RD\*LA, RD\*MI, MI\*LA and RD\*MI\*LA was significantly not 0), and the results of the previous analysis (1998-2007) showed that the marketing intensity in the variables of specialized assets was not significant, but the intensity of R&D and capital was significant (0.19). The degree of internationalization (0.02) showed a significant linear positive situation, while the board structure

found that all three variables were significant, and the other control variables were significant to the public. The influence of division performance is roughly the same as that of scholars in the past. However, the overall impact on corporate performance still needs a complete regression model to get the most real answer.

The results of model 13 are as follows Specialized assets

The effect of the interaction between the specific assets and the interaction of the specific assets is similar to that of the model 4, and the interaction results are shown in Table 16.

The results of the analysis result in three kinds of attributes, the marketing intensity has a positive effect on the performance of the company and the negative effect of the capital strength multiplier, and the R&D strength itself has a positive effect on the performance of the company, but under the action of the marketing intensity, the positive effect is slightly reduced. The



capital strength also presents a positive effect, but the effect is reduced after the post-session R&D strength and the marketing intensity.

**2.4.4.6. Degree of internationalization**

At the level of internationalization, it was found that in the early stage, the positive significance of single existence was found(0.14).

**2.4.4.7. Board structure**

In the structure of the board of directors, it is found that the size of the board of directors has no significant effect on the performance of the company and the proportion of independent directors (0.72) has a positive and significant effect on the performance of the company, but the part-time situation of the board of directors (-0.16) has a negative and significant impact on the performance of the company.

**Table 16: Table of interaction status of proprietary assets (throughout the period)**

Specialized assets	Interaction
Research and development intensity	0.58-0.11LA-5.14MI+5.16MI*LA
marketing intensity	4.13-5.14RD-2.38LA+5.16RD*LA
capital strength	0.17-0.11RD-2.38MI+5.16RD*MI

**2.4.4.8. Other control variables**

The scale of the company on other control variables is of positive significance to the performance of the company (0.11), while the proportion of the stock pledge (-0.10), the ratio of liabilities (-1.22) and the age (-0.01) of the company show a significant negative effect.

The results of the later analysis can be seen from Table 19. Except that the internationalization degree variables are suitable for random effect analysis, the other four groups of analysis are suitable for the analysis of fixed effect models, and their equations, such as model 14 ≤18.

Model 14. The fixed effect of the variables of specialized assets in the later period

$$\text{Tobin's } Q = 1.10RD + 8.12MI + 0.27LA - 0.30RD*LA + 2.73RD*MI - 0.02MI*LA + 11.75RD*MI*LA + 1.08$$

(0.05) (0.80) (0.02) (0.03) (2.53) (1.38) (2.01) (0.01)

\*\*\* \*\*

Model 15. The Random effect of the variables of internationalization degree in the later stage

**Table 17: Pre-period fixed and random effects model**

Variable	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random
RD	0.39 (0.0)***	0 (0.06)							0.11 (0.0)**	-0.07 -0.06
MI	-0.69 (0.6)	-1.96 (0.85)							0.44 (0.6)	-1.11 -0.81
LA	0.19 (0.0)***	0.06 (0.01)							0.11 (0.0)**	0.06 -0.01
RD*LA	-0.29 (0.0)	-0.12 (0.05)							-0.19 (0.0)**	-0.09 -0.05
RD*MI	-3.57 (1.4)**	-1.18 (1.22)							-1.21 (1.3)	-0.47 -1.18
MI*LA	-2.9 (1.1)	-0.88 (0.97)							-2.44 (1.0)**	-0.95 -0.94
RD*MI*	4.01	2.52							2.16	1.39
LA										
FS			0.3 (0.0)	0.16 (0.0)					0.14 (0.0)**	0.03 -0.03
BS					0.01 (0.0)	0.03 0			0 (0.0)	0.02 0
BO					0.98 (0.0)	0.68 -0.05			0.72 (0.0)**	0.68 -0.05
BP					0.13 (0.0)***	0.05 -0.03			-0.06 (0.0)**	-0.02 -0.03
PL							0.38 (0.0)**	-0.24 (0.05)	-0.1 (0.0)**	-0.14 -0.05
SC							0.1 (0.0)**	0.14 (0.01)	0.11 (0.0)**	0.1 -0.01
DA							-1.24 (0.0)**	-1.13 (0.05)	-1.22 (0.0)**	-1.1 -0.05
AG							-0.01 (0.0)**	-0.01 (0.00)	-0.01 (0.0)**	-0.01 0
C	1.05 (0.0)***	1.12 (0.01)	0.97 (0.0)**	1.05 (0.0)	0.92 (0.0)***	0.79 -0.03	-0.18 (0.0)**	-0.13 (0.04)	0.12 (0.0)	0.08 -0.12
χ <sup>2</sup>	186.19		73.22		100.83		92.15		225.37	
χ <sup>2</sup> d.f.	7		1		3		4		15	
Prob.	***		***		***		***		***	

Tobin's Q=-1.05FS +4.77FS2 -8.09FS3 +4.35FS4 +1.35 (0.00) (0.06) (0.03) (0.04)  
 (0.48) (2.04) (3.05) (1.49) (0.03)  
 \* \*\* \* \*\* \* \*\* \*

\*\* \*\* \* \*\* \* \*\* \*

Model 16. The fixed effect of the structural variable of the later board of directors

Tobin's Q= 0.01BS +1.04BO -0.09BP+0.95

Model 17. Fixed effect of other control variables at the later stage

Tobin's Q=-0.05PL -0.04SC -1.14DA -0.01AG +2.51

(0.05) (0.01) (0.05) (0.00) (0.08)

\*\*\* \*\* \* \*\* \* \*\* \*

**Table 18: Table of interaction status of exclusive assets in the previous period**

Specialized assets	Interaction
Research and development intensity	0.11-0.19LA
Marketing intensity Capital intensity	-2.44LA
	0.11-0.19RD -2.44MI

Model 18. The fixed effect of the whole variable in the later stage

Tobin's Q=0.77RD+6.27MI+0.23LA-0.22RD\*LA+4.47RD\*MI -0.19MI\*LA+12.42RD\*MI\*LA

**Table 19: Post-period fixed and random effects model**

Variable	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random
RD	1.10 (0.0)**	0.38 (0.0)											0.77 (0.0)**	0.26 (0.0)
MI	8.12 (0.58)**	1.91 (0.9)											6.27 (0.8)**	1.08 (0.9)
LA	0.27 (0.0)**	0.08 (0.0)											0.23 (0.0)**	0.08 (0.0)
RD*LA	-0.30 (0.0)**	-0.01 (0.0)											-0.22 (0.0)**	-0.01 (0.0)
RD*MI	-3.0 (1.2)**	-0.01 (1.0)											4.47 (2.4)*	2.38 (2.2)
MI*LA	-2.53 (0.9)**	-1.33 (0.7)	*										-2.38 (0.8)**	-1.41 (0.7)
RD*MI*	5.75 (1.2)**	4.57 (1.0)	***										5.16 (1.1)**	4.43 (1.0)
LA													-0.63 (0.2)**	-0.68 (0.2)
FS			-0.70 (0.4)	-1.05 (0.4)	**	*							3.47 (2.0)*	3.03 (1.2)**
FS2			3.47 (2.0)*	4.77 (2.0)	**	*							-5.81 (3.1)*	-4.98 (3.0)
FS3			-5.90 (3.1)*	-8.09 (3.0)	**									
FS4				(2.1)**	(2.0)	*							(1.9)**	(1.9)
BS				2.12 (1.0)**	2.05 (1.0)	**			0.01 (0.0)**	0.02 (0.0)	**		0.01 (0.0)**	0.02 (0.0)
BO								1.01 (0.04)**	0.6 (0.0)	**			0.6 (0.0)**	0.74 (0.0)
BP								0 (0.02)	-0.04 (0.0)	**			-0.05 (0.0)**	-0.03 (0.0)
PL													-0.06 (0.0)*	-0.2 (0.0)
SC													0.02 (0.0)**	0 (0.0)
DA													0.02 (0.0)**	-0.03 (0.0)
AG													-1.2 (0.0)**	-0.92 (0.0)
C	1.07 (0.0)**	1.21 (0.0)	***	1.11 (0.0)**	1.26 (0.0)	**	0.94 (0.02)**	0.98 (0.0)	**	1.67 (0.0)**	1.81 (0.1)	**	-0.01 (0.0)**	-0.01 (0.0)
χ <sup>2</sup>	664.04			38.71			214.9			232.16			738.19	
χ <sup>2</sup> d.f.	7			4			3			4			18	
Prob.	***			***			***			***			***	

(0.05) (0.81) (0.02) (0.03) (2.45) (1.33) (1.94)

\*\*\* \*\*

-1.10FS +4.98FS2 -8.22FS3 +4.27FS4 +0.02BS +0.59BO  
-0.04BP

(0.42) (1.89) (2.89) (1.42) (0.00) (0.06) (0.03)

\*\*\* \*\*

-0.06PL -0.03SC -0.96DA -0.01AG +2.04

(0.05) (0.01) (0.04) (0.00) (0.09)

\*\*\* \*\*

The analysis of the later period (2008-2017) was based on the results of the analysis of each group of the models 14-17, and it can be found that the specific asset variable has a positive effect on the performance of the company, but the effect of the interaction is only RD \* LA and RD \* MI \* LA is not 0), and the degree of internationalization is the same as that of the whole time. The three variables of the board structure are significant, and the influence of other control variables on the performance of the company is about the same as that of the past scholars (in addition to the fact that the proportion of the stock pledge of the board of supervisors is not significant to the performance of the company). However, the overall performance of the company The results still need a complete regression model to get the most true answer.

The results of the model 18 are as follows:

2.4.4.9. Specialized assets

In this paper, the interaction of specialized assets is studied. The results of interaction of specialized assets are similar to those of model 4, and the interaction results are shown in Table 20.

The results show that the three attributes have a positive and significant impact on the performance of the company, but in the later stage, it is found that the interaction between marketing intensity and R&D intensity is a positive present effect, while R&D intensity and capital intensity are negative and significant. The interaction of the three attributes is positive and significant.

2.4.4.10. Degree of internationalization

In the degree of internationalization, it is found that W-type is produced in the whole period (-1.10FS 4.98FS2-8.22FS3 4.27FS4), and the power of  $1 \geq 4$  is significant, but because the range of internationalization index is between 0% and 100%, the trend diagram of its composition is W-shaped, as shown in Figure 3.

Further analysis, when the enterprise increases the degree of internationalization, the effect on the company's performance is  $-1.1 + 9.96FS - 24.66 FS2 + 17.08 FS3$ , and the trend chart is shown in Figure 4 below.

Table 20: Table of interaction status of later proprietary assets

Specialized assets	Interaction
Research and development intensity	0.77-0.22LA+4.47MI +12.42MI*LA
Marketing intensity	6.27 +4.47RD+12.42RD*LA
Capital intensity	0.23-0.22RD +12.42RD*MI

Figure 3: A chart of the impact of internationalization on corporate performance in the later period

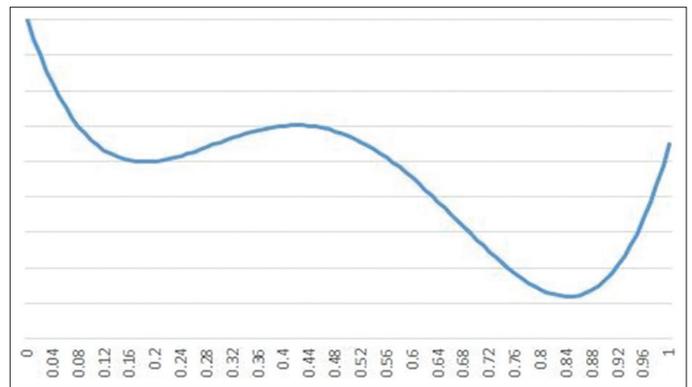
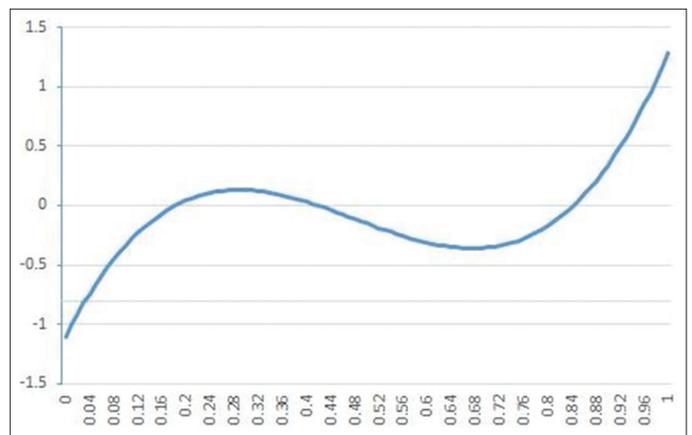


Figure 4: Impact of increased internationalization on corporate performance at a later stage



It can be found from Figure 4 that when the internationalization is  $19\% \leq 41\%$  and  $85\%$ , the performance of the company can be increased only by strengthening the degree of internationalization.

2.4.4.11. Board structure

In the structure of the Board of Directors, the study found that the scale of the board of directors (0.02) and the proportion of independent supervisors (0.59) had a positive effect on the performance of the company, but the part-time status of the Board of Supervisors did not present a significant result, which was the same as that of the whole period.

2.4.4.12. Other control variables

In other control variables, the size of the company (-0.03), the ratio of debt (-0.96) and the age of the company (-0.01) are negatively significant to the performance of the company, while the proportion of the pledge of the supervisor's stock shows no significant effect on the performance of the company.

### 3. CONCLUSION

This study focuses on the interaction of corporate proprietary attributes on corporate performance in Taiwan, and further discusses the impact of internationalization and board structure on corporate performance, from 1998 to 2017, and takes the financial tsunami as the cutting point to explore the impact of the previous and later variables of this study.

In the interaction of company proprietary attributes, this study found that there is indeed interaction among R&D intensity, marketing intensity and capital intensity. Because of the mutual exclusion of costs, the results are almost negative and significant, but the attributes still have multiplication effect with each other (the interaction of the three attributes is positive and significant). However, in the later period (2008-2017), this study found that the interaction between R&D intensity and marketing intensity showed a positive effect, which can be seen that the investment in R&D in the future is also helpful to the company's advertising.

Secondly, in the degree of internationalization, this study found that when an economy wants to develop internationalization, the degree of internationalization will be a positive effect on corporate performance. When it develops to a certain extent, the positive effect will disappear and show a nonlinear effect. This study finds that Taiwan shows a W-shaped effect in the later stage of this study (the whole period is also W-shaped), first falling and then rising, and then falling. The factor that will lead to the decline may be Taiwan's special economic status, and the cost of developing internationalization is higher than that of other regions. When there is international experience, it will form the S-shaped effect put forward by scholars in the past, and this "international classics" This study found that about 13%. Instead, it should be the formation of the earth village in the world and the acceleration of international competition. Therefore, in the later stage, the W-shaped situation is tilting to the right, that is, internationalization will have a weak effect on corporate performance at 41%, until 85%. This obviously shows that the degree of internationalization in Taiwan is going to the second end. The internationalization of fully internationalized enterprises (85%) or moderately internationalized enterprises ( $19 \leq 41\%$ ) has a positive impact on corporate performance.

In the influence of the board structure and other variables on the performance of the company, the size of the company in the later stage is negative to the performance of the company, which should be that most of the small and medium-sized enterprises in Taiwan are small and medium-sized enterprises (with high flexibility) and lack of 100-year-old stores with excellent performance. The larger the size of the company produces the rigidity of the operation of the company, resulting in the negative and remarkable effect of the size of the company on the performance of the company. Most of the other results of this study are similar to those of the previous scholars. Therefore, there is no discussion.

### 4. ACKNOWLEDGMENT

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