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Research Paper

Impact of Internationalization on Corporate Performance in Different Stages of the Corporate Life Cycle in China

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ABSTRACT
Based on panel data analysis, this study explores and analyzes the impact of internationalization on corporate performance at different life cycle stages for 3,635 listed companies in China's non-financial sector from 2007 to 2019. The results show that internationalization has a positive U-shaped impact on corporate performance, and it is found that growing enterprises conform to the positive U-shape hypothesis, while enterprises in recession meet the assumption that internationalization is not conducive to corporate performance. Furthermore, this study also finds that proprietary assets, board structure and proportion of external directors and supervisors have a non-linear impact on corporate performance. The competition and cooperation in the right to control mostly falls in the left half of the positive U-shape and is reversed when its value is extremely high, which seems to suggest that it is beneficial to corporate performance (state-owned enterprises) when the first major shareholder has absolute power and can get other shareholders to cooperate with it. A company's economics of scale does not occur immediately as it grows, but there is a threshold value. In other words, before the threshold value is reached, the size of a company has a negative impact on corporate performance, and only after the threshold value is reached will the economics of scale have a significant positive impact on corporate performance.

KEYWORDS: *Corporate life cycle; Internationalization; Corporate performance*

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I. INTRODUCTION

The term "product life cycle" was first proposed by Raymond Vernon in 1966. Since then, the concept of product life cycle has been widely used in management, marketing, and economics literature. For example, product life cycle theory states that it is one of the reasons for the internationalization of enterprises (Vernon, 1966). According to the comparative advantage principle, products can be transferred to different countries in different life cycles, which will enable the efficient transfer of technology overseas. Corporate life cycle theory, which was formed by Mueller (1972), and Rink and Swan (1979) , is based on the concept of product life cycle in marketing and microeconomics. Each product will go through several life cycle stages, such as the beginning stage, growth stage, maturity stage and recession stage. Extending this concept finds that the life cycle stage of an enterprise depends on the life cycle stage of its product portfolio, therefore an enterprise can also be classified into different life cycle stages according to the stage of its product (Smith et al., 1985). Porter (1980) pointed out that in the growth stage of an enterprise's life cycle, the maximum profitability can be obtained through cost saving and competitive advantage, and that if an enterprise is in the recession stage, it will be unable to obtain better profitability through competitive advantage. Therefore, it is believed that the promotion of internationalization in the growth stage will be highly appraised by the capital market and maximize profits. On the contrary, in the recession stage, it is impossible to obtain better profitability through competitive advantage. However, the impact of internationalization on corporate performance at different stages of corporate life cycle is not the main motivation of this study.

Many scholars believe that enterprises can apply their own advantages to markets in other countries through foreign investment (Hymer, 1960), internalize incomplete markets to reduce transaction risks (Buckley

and Casson, 1976), obtain rare resources or factors of production with cost advantages (Dunning, 1995), and obtain comparative advantage in production (Kojima, 1973), so as to provide a significant contribution to organizational performance. Therefore, it is helpful to improve business performance. However, from the point of view of transaction cost theory, the related activities of internationalization will inevitably produce considerable organizational costs, such as transaction, management, and coordination costs (Gomes and Ramaswamy, 1999); at the same time, the overseas operation of enterprises will inevitably be affected by different political, legal, economic and cultural liabilities of foreignness in different countries, thus reducing the benefits of internationalization (Geringer et al., 1989). Internationalization activities bring many benefits and costs to enterprises. However, what is the impact of internationalization on performance? Past scholars' studies have brought up numerous questions, such as does internationalization have any influence on corporate performance (Zeng et al., 2009; Chen et al., 2015; Christian et al., 2018), have a positive correlation (Grant, 1987; Horta, 2016; Feng et al., 2019), a negative relationship (Collins, 1990; Zhao & Ma, 2016), a U-shape (positive U, inverted U), an S-shape, or even a W-shape, respectively? A positive relationship can also be obtained, and some believe there is no significant correlation between the two (Zeng et al., 2009; Chen et al., 2015; Christian et al., 2018).

Scholars studying the U-shape relationship believe that the costs generated by internationalization cannot offset the benefits gained from internationalization at the beginning, which will initially have a negative impact on corporate performance, but as internationalization deepens, the occurrence of economics of scale allows the benefits of internationalization to offset the costs, and an even more favorable forecast correction is expected to occur (Ruigrok and Wagner, 2003; Wei et al., 2019). Scholars studying the inverted U-shape believe that once the internationalization exceeds a certain threshold, because the market is too fragmented, the cost of communication and coordination increases significantly and the growth rate of resources and ability becomes slower than the overseas scale expansion of enterprises; therefore, excessive internationalization has a negative impact on corporate performance (Hitt, Hoskisson, and Ireland, 1994; Juan et al., 2016; Raquel, 2017; Andres et al., 2018).

The S-shape theory is a three-stage theory of internationalization expansion, which holds that there is a horizontal S-shaped curve between internationalization and corporate performance. According to this theory, in the early stage, there is a negative correlation between internationalization and performance due to the internationalization cost, the learning cost at the beginning and the scale of uneconomic growth; as internationalization deepens, the benefits from resource utilization, economics of scale and continuation of the product life cycle exceed the costs, resulting in a positive correlation between internationalization and performance. When internationalization reaches a threshold, the coordination costs outweigh the benefits, and internationalization and corporate performance become negatively correlated. The combination of the above three stages (Contractor et al., 2003; Lu and Beamish, 2004, 2003; Hien et al., 2018; Majid & Preet, 2018) actually produces the different results described above. The above research results are mainly caused by different enterprise attributes, such as country factors, property rights factors and industrial categories. However, there is little research literature based on corporate life cycle. The attributes presented by enterprises in various life cycles are based on the U-shape and the S-shape. Its application in analysis is the topic of this study.

This paper is divided into four parts. The first part is the introduction, which mainly introduces the literature on the impact of corporate life cycle and internationalization on corporate performance. The second part covers the research data and method. This paper uses panel data analysis to study the non-financial listed companies of China from 2007 to 2019. The third part is an empirical analysis, of which the empirical results show that impact of internationalization on corporate performance is different at all stages of the corporate life cycle. The last part is the conclusion.

1. Research Data and Method

This study explores the impact of internationalization on corporate performance and analyzes each stage of the corporate life cycle. The research samples are non-financial listed companies in China from 2007 to 2019. The variables studied include internationalization, corporate performance and corporate life cycle. In order to solve the endogenous and exogenous problems of the explained variables, this study adds a variety of control variables, which are divided into corporate proprietary assets (R&D, marketing and capital intensity), corporate governance (board structure, competition for the right to control) and commonly used control variables (company size, the proportion of property rights and enterprise age). The variables are described below.

1.1 Research Variables

1.1.1 Independent variable

Internationalization is measured in terms of performance, structure, and state. This paper probes into the relationship between performances. In this paper, export sales as a percentage of total sales (ESTS) (Michel and Shaked, 1986); Shaked, 1986) the performance indicator is converted into overseas sales divided by domestic

sales and then taken as a natural logarithm (1 is added to each of them to avoid being equal to 0 so that the natural logarithm cannot be calculated), which is calculated as follows:
This data is derived from the revenue areas published in the annual reports of major companies, classified as domestic and overseas sales, and then calculated through the above formula.

$$DOI = \ln\left(\frac{OS + 1}{IS + 1}\right) \qquad (1)$$

OS : export sales as a percentage

IS : import sales as a percentage

1.1.2 Dummy variable

The purpose of this paper is to probe into the impact of internationalization on corporate performance at various stages of the corporate life cycle. This life cycle is generally divided into four stages, namely, the introduction stage, the growth stage, the maturity stage and the recession stage. There may be few listed companies in the introduction stage. Therefore, according to the methods of Anthony and Ramesh (1992) and Black (1998), corporate life cycle is divided into three stages, namely, the growth stage, the maturity stage and the recession stage. According to Anthony and Ramesh (1992) and Black (1998), the judgment model is based on four variables, namely, the sales growth rate (SG), the capital expenditure ratio (CEV), the dividend payout ratio (DP) and enterprise age (AGE), which is calculated as follows (the calculated data are from the annual reports of major listed companies).

$$SG = \frac{S(t)}{S(t-1)} \qquad S(t) : \text{Sale in period } t \qquad (2)$$

$$CV = \frac{CE(t)}{S(t)} \qquad CE(t) : \text{Cash outflow of fixed assets in period } t \qquad (3)$$

$$DP = \frac{DIV(t)}{NI(t)} \qquad DIV(t) : \text{Cash dividends in period } t \qquad (4)$$

$NI(t)$: Net profit in period t

$$AG = \ln(\text{days of establishment}) \qquad (5)$$

Anthony and Ramesh (1992) used the comprehensive life cycle indicator to determine the stage of the corporate life cycle. The four single indicators of each sample are labeled as 0 (growth stage), 1 (maturity stage) and 2 (recession stage) respectively, as shown in the table, and the four indicator values of each sample are added together to obtain a comprehensive indicator. When the comprehensive indicator number obtained by this program is between 0 and 2, it is classified as belonging to the growth stage, when the number is between 3 and 5 it is classified as belonging to the maturity stage, and when the number is between 6 and 8 it is classified as belonging to the recession stage.

Table 1 Characteristics of Each Stage of the Corporate Life Cycle

	SG	CEV	DP	AGE
Growth stage	High	High	Low	Young
Maturity stage	Medium	Medium	Medium	Adult
Recession stage	Low	Low	High	High

There are three stages, therefore two dummy variables are established as follows:

$$(D_1, D_2) = \begin{cases} (0,0) & \text{Growth stage} \\ (1,0) & \text{Maturity stage} \\ (0,1) & \text{Recession stage} \end{cases} \qquad (6)$$

1.1.3 Dependent variable

Market performance or management performance is generally adopted for corporate performance. ROA and ROE are commonly used as accounting indicators for management performance. However, accounting indicators can be easily alteredd by management. Therefore, in terms of corporate performance, this study

adopts Tobin's Q, which is most commonly used in market performance. Because the replacement cost of assets and the market value of liabilities are not easy to obtain, this study adopts Proxy Q proposed by La Porta et al. (2002).

$$CFP(t)_i = \text{Proxy } Q(t)_i = \frac{ME(t)_i + BD(t)_i}{BA(t)_i} \quad (7)$$

$ME(t)_i$: total market value of i company of for t - period

$BD(t)_i$: total debt of i company of for t - period

$BA(t)_i$: total asset of i company of for t - period

Sources: Shanghai Stock Exchange; Shenzhen Stock Exchange (for share price data)
Annual reports published by listed companies
Calculations by this paper However, individual shares in China's stock market often fluctuate unpredictably, therefore this study takes the average value of the above operative numbers every 12 months as the market performance indicator.

$$CFP(t)_i = \frac{\sum_i \text{Proxy } Q(t)_i}{\text{Opening days in December}} \quad (8)$$

1.1.4 Control variables

As stated at the beginning of this section, the control variables in this study are divided into proprietary assets (9-11), board structure (12-15), competition for the right to control (16, 18) and general control variables (19-21), as follows:

(1) Proprietary assets (R&D intensity, marketing intensity, and capital intensity)

The term "proprietary assets" was first incorporated into the moderating effect by Morck and Yeung (1991) when studying the relationship between internationalization and corporate performance. In the following years, a number of scholars have used a variety of proprietary assets for research. Based on the summary of numerous scholars, the three variables proposed in this study are R&D intensity, marketing intensity and capital intensity (first adopted by Jung, 1991). Some companies spend unusually high amounts on R&D and marketing. In this study, in order to eliminate the influence of outliers, three variables are converted to the natural logarithm (+1 is to avoid zero value without input, which makes the natural logarithm not calculable).

$$RDI(t)_i = \ln\left(\frac{RD(t)_i}{S(t)_i} \times 100 + 1\right) \quad (9)$$

$RD(t)_i$; R & D expenses of i company of t - period

$S(t)_i$; Total sale of i company of t - period

$$MI(t)_i = \ln\left(\frac{MK(t)_i}{S(t)_i} \times 100 + 1\right) \quad (10)$$

$MK(t)_i$; marketing expenses of i company of t - period

$S(t)_i$; Total sale of i company of t - period

$$CI(t)_i = \ln\left(\frac{LA(t)_i}{LA(t-1)_i}\right) \quad (11)$$

$LA(t)_i$; illiquid assets of i company of t - period

(2) Board structure

Four variables are adopted, namely, board size (BSIZE), proportion of external directors, chairman serving concurrently as general manager, and part-time status of directors and supervisors. Yermack (1996) explored the relationship between board size and corporate performance, and the empirical results showed that board size and corporate performance are negatively correlated. In other words, a small board is more likely to fulfill its responsibility to supervise the managers, thus increasing the value of the company. However, Zahra and Pearce (1989) pointed out that when the board size is larger, it can usually include more experts in specialized fields. Therefore, the bigger a board size is, the better its corporate governance will be.

Fich and Shivdasani (2005) found that when most of the board members of a company are directors of three or more other companies, corporate performance will be reduced; Core, Holthausen, and Larcker (1999)

and Shivdasani and Yermack (1999) put forward that when a director or supervisor holds too many positions, he will be unable to effectively supervise managers. However, some empirical results hold the opposite view. For example, Ferris, Jagannathan, and Pritchard (2003) found no evidence to support that when most directors and supervisors hold three or more board positions, they will evade their responsibilities of supervision on managers in the board. Yermack (2004) found that when most directors and supervisors hold three or more board positions, they will still fulfill the responsibilities of supervision on managers.

Relevant external directors and supervisors and inside directors and supervisors jointly constitute the board of a company. From the perspective of supervision, although external directors and supervisors have less information available to use for supervising managers, they are more able to play the role of independent supervisors due to their detached and independent status. When inside directors and supervisors hold positions in a company, they will have more information available for monitoring the managers. However, since there may be a beneficial relationship with the managers, they will control the managers or collude with the managers to create strategies that are not beneficial to the company. Fama (1980) and Baysinger and Hoskisson (1990) believed that external directors and supervisors should have a detached and independent status and be familiar with professional knowledge. Companies hire them in the hope that their professional knowledge will improve the performance of the company. Therefore, when the ratio of external directors and supervisors is higher, it can not only achieve effective supervision but also improve corporate performance through their professional knowledge.

In addition, if the general manager is also an external chairman, it may not be fair; the supervision effect may be greatly reduced, and the agency problem may become more serious. Therefore, the part-time status of directors, supervisors and chairmen serving concurrently as general manager of the above four variables are used as dummy variables and are calculated as follows:

$$\text{Board size (BS)} = \ln(\text{Number of directors}) \quad (12)$$

$$\text{Proportion of external directors and supervisors (OB)} = \ln\left(\frac{\text{Number of external directors}}{\text{Number of non-external directors and supervisors}}\right) \quad (13)$$

$$\text{Part-time status of directors and supervisors (BP)} = \begin{cases} 1 & \text{More than half of the directors and supervisors take 3} \\ 0 & \text{Other} \end{cases} \quad (14)$$

$$\text{Concurrent status of chairman (BM)} = \begin{cases} 1 & \text{Chairman serving concurrently as general manager} \\ 0 & \text{Other} \end{cases} \quad (15)$$

(3) Competition for the right to control

This paper uses two variables, one is Shapley value (SV), which denotes the competition and cooperation of the two consortiums, and another is the high contestability dummy (HCD) controlled by the top four controllers. The status of cooperation with the biggest controller is adopted for SV. This value table is about benefit distribution. The smaller the value, the less likely it is to join the consortium; the higher the value, the easier it is for the four controllers to cooperate. Therefore, SV is expected to have a negative effect on corporate performance.

The competition and cooperation representing two consortiums is adopted in this study, and the calculation formula for the natural logarithm of SV is as follows:

$$SV = \ln(\varphi_i[v]) \quad (16)$$

$$\varphi_i[v] = \sum_{\substack{T \subset N \\ i \in T}} \frac{(t-1)!(n-t)!}{n!}[v(T) - (T - \{i\})] \quad (17)$$

n: Number of all participants

t: Number of members in consortium T

v (T)%: Members' right to control of consortium T

v (T-{i}%: Participant I's right to control excluded in consortium T

The exploration of the control of the top four controllers on the company finds that it is a dummy variable. Maury and Pajuste (2005) pointed out when the control of the top three major controllers is less than 50%, and at least one of the top four controllers has 10% control, it is 1, and the rest are 0. Therefore, when the value is 1, the competition among major shareholders will be higher, and this variable is expected to have a positive effect on corporate performance. The equation is expressed as follows:

$$HCD = \begin{cases} 1 & \text{Meet the requirements} \\ 0 & \text{Other} \end{cases} \quad (18)$$

(4) Other variables

Company size, equity ratio, enterprise age and company risk are used as other control variables in this study. The larger a company is, the more economics of scale it can achieve, and the higher its performance will be. Previous literature has pointed out that company size is positively correlated with corporate performance (Demsetz and Lehn, 1985). However, it is also pointed out in some literature that the expansion of company size leads to the increase of the enterprise operating cost, while the benefits of economics of scale cannot offset the costs, therefore company size is negatively correlated with corporate performance (Wei el at. 2017). In this paper, the natural logarithm of the total book value of assets at the end of the year is used as a guide to measure the size of a Chinese company.

Jensen and Meckling (1976) pointed out that debt financing can subject managers to market supervision as a way to reduce agency problems, thereby allowing managers to use the free funds of the company more efficiently and thus improve corporate performance. However, according to Pecking Order Theory, there is a negative relationship between debt and corporate profitability (Morck et al., 1988). Nevertheless, Stulz (1990) suggested that capital structure has a positive impact on corporate performance. In the presence of corporate tax and individual income tax, corporate debt has a tax shield effect, therefore debt can increase the value of the company. It is thus believed that debt is positively correlated to corporate performance. The equation is expressed as follows:

Company size = ln (total assets) (19)

$$ER(t)_i = \ln\left(\frac{BD(t)_i}{BE(t)_i}\right) \quad (20)$$

$BE(t)_i$: Total book value of assets of company i during t stage

Enterprise age (AG)

$$AG(t)_i = \ln(DATA(t)_i - BT_i) \quad (21)$$

$DATA(t)_i$: Current stage of the company i 12/31

BT_i : Age of the company i

Source: Annual reports of major companies and calculations in this study

1.2 Descriptive Statistics

On the basis of the above introduction of variables, the narrative statistics of each non-dummy variable are as listed in Table 2, and the number of observed values for the dummy variables is listed in Table 3.

In this study, 3,635 listed non-financial companies in China from 2007 to 2019, with a total of 29,438 items of data, are used as samples. Some companies are not listed during the study period, or data is not available, therefore the data adopted in this study is unbalanced panel data. Since most of the research variables in this study adopt natural logarithms, it can be found from Table 1 that the research variables are all smaller than 10 except the maximum company size and the enterprise age, so there should be no trouble of extreme values (to increase the robustness of the study). In terms of the distribution, other than the competition and cooperation relationship of major shareholders (SV) being to the left, the others are all to the right and all show the leptokurtic distribution, except for marketing intensity.

Table 2 Descriptive Statistics

Var.	CFP	DOI	RDI	MI	CI	BS	OB	SV	SC	ER	AG
Obs.	29438	29438	29438	29438	29438	29438	29438	29438	29438	29438	29438
Mean	1.74	-2.99	0.40	1.68	0.19	2.19	-1.04	3.56	22.08	-1.02	8.80
Med.	1.38	-3.84	0.00	1.64	0.11	2.20	-1.10	3.60	21.90	-1.06	8.76
Max.	9.90	4.62	4.43	7.94	4.43	3.22	0.69	4.50	28.64	7.23	10.66
Min.	0.23	-4.62	0.00	0.00	-3.73	1.39	-2.40	-1.03	17.88	-6.65	3.99
Std. D.	1.16	1.89	0.74	0.87	0.39	0.22	0.23	0.42	1.32	1.16	0.51
Sk	2.66	0.94	1.69	0.25	2.17	0.04	0.66	-0.67	0.85	0.19	0.52
K	12.75	3.05	4.75	2.92	21.05	4.29	4.91	4.04	4.17	3.74	4.59

Table 3 Distribution of Observed Values of Dummy Variables

Year	Part-time directors and supervisors		Concurrent post		Shareholders competition		Corporate life cycle			Observed value
	Concurrent post	No concurrent	Concurrent post	No concurren		Concurrent post	No concurren	Concurrent post	No concurren	
2007	36	1263	200	1099	591	708	460	710	129	1299
2008	56	1415	236	1235	668	803	421	858	192	1471
2009	57	1382	246	1193	659	780	342	869	228	1439
2010	78	1713	377	1414	766	1025	673	1003	115	1791
2011	109	1977	526	1560	834	1252	661	1259	166	2086
2012	147	2165	587	1725	914	1398	445	1474	393	2312
2013	163	2085	554	1694	956	1292	398	1433	417	2248
2014	197	1987	539	1645	991	1193	332	1341	511	2184
2015	212	2042	605	1649	994	1260	265	1378	611	2254
2016	53	2522	696	1879	1160	1415	334	1622	619	2575
2017	72	2985	925	2132	1284	1773	422	2030	605	3057
2018	62	3304	1017	2349	1432	1934	367	2154	845	3366
2019	80	3276	1032	2324	1507	1849	299	1951	1106	3356
total	1322	28116	7540	21898	12756	16682	5419	18082	5937	29438
ratio	4.49%	95.51%	25.61%	74.39%	43.33%	56.67%	18.41%	61.42%	20.17%	100.00%

The dummy variables of this study can be seen in Table 2. Few directors and supervisors take part-time jobs and few chairmen hold a concurrent post as general manager, but the situation where the chairman serves concurrently as general manager has increased year by year. The competition and cooperation relationship of major shareholders is nearly 50%, and more enterprises are in the maturity stage of the corporate life cycle.

2.3 Correlation Coefficient Matrix

Table 4 Correlation Coefficient Matrix

Var.	CFP	DOI	RDI	MI	CI	BS	OB	SV	SC	ER	AG
CFP	1										

DOI	-0.03	1									
	***	---									
RDI	-0.03	0.13	1								
	***	***	---								
MI	0.16	-0.01	0.18	1							
	***		***	---							
CI	-0.06	0.01	-0.03	0.03	1						
	***		***	***	---						
BS	-0.09	-0.05	-0.06	-0.09	-0.07	1					
	***	***	***	0***	***	---					
OB	0.01	0.06	0.08	0.07	0.04	-0.11	1				
	*	***	***	***	***	***	---				
SV	-0.15	-0.01	-0.09	-0.10	0.03	<0.01	0.01	1			
	***	**	***	***	***		**	---			
SC	-0.32	-0.06	-0.03	-0.25	<0.01	0.25	-0.01	0.16	1		
	***	***	***	***		***	**	***	---		
ER	0.10	-0.08	-0.02	-0.02	-0.06	-0.01	-0.01	-0.11	-0.07	1	
	***	***	***	***	***		**	***	***	---	
AG	0.04	-0.09	0.05	-0.02	-0.13	0.05	-0.07	-0.10	0.17	0.06	1
	***	***	***	***	***	***	***	***	***	***	---

Ps: *, ** and *** denote significance at the .1, .05 and .01 level

In order to avoid collinearity among the variables of the research model, and to judge the relationship between the variables in this study and the explained variables, the correlation coefficient matrix of each variable is as listed in Table 4.

As can be seen from Table 4, there is no high correlation between variables in this study, and the correlation coefficients of all explanatory variables are also mostly low. The relationship between explanatory

variables and explained variables can be known as internationalization (-0.03), R&D intensity (-0.03), capital intensity (-0.06), and board size (-0.09). The Shapley value (-0.15) is negatively correlated with company size (-0.32) and corporate performance. The reciprocal effect between variables has not been taken into account, and the final results still need to be further analyzed.

As for whether there is collinearity in variables, this study uses the Engle and Granger (1987) cointegration test, which produces the following results: t-Statistic=6.18, P-VALUE ≤ 0.001, indicating that there is no cointegration and that no variables in this study have a collinearity problem.

2.4 Robust Analysis

There is no extreme value in the data of this study after the above basic data analysis, but for purposes of preciseness, this study carries on the robustness analysis further. This study conducts a general regression analysis of the data used and then makes a judgment using the M estimation method of robust regression. The results are shown in Table 5.

Table 5 Comparison of General Regression and Robust Regression

Variable	General	Robust
C	6.85 (0.17) ***	4.10 (0.10) ***
DOI	-0.01 (≤0.001) ***	-0.001 (≤0.001) **
RDI	-0.11 (0.01) ***	-0.05 (0.01) ***
MI	0.13 (0.01) ***	0.07 (≤0.001) ***
CI	-0.14 (0.02) ***	-0.08 (0.01) ***
BS	-0.13 (0.03) ***	-0.05 (0.02) ***
OB	0.09 (0.03) ***	0.04 (0.02) ***
BP	-0.05 (0.03) *	-0.08 (0.02) ***
BM	-0.04 (0.02) **	-0.03 (0.01) ***
SV	-0.15 (0.02) ***	-0.11 (0.01) ***
HCD	0.13 (0.02) ***	0.13 (0.01) ***
SC	-0.26 (0.01) ***	-0.13 (≤0.001) ***
ER	0.06 (0.01) ***	0.03 (≤0.001) ***
AG	0.15 (0.01) ***	0.08 (0.01) ***

Ps: *, ** and *** denote significance at the .1, .05 and .01 level

From Table 5, it can be known that under the general regression and robust regression analyses, the significant status of all variables (α=0.1) is the same as that of the positive and negative directions, indicating that the data in this study will not be affected by extreme values and produce wrong results.

2.5 Research Modeling

According to the above test results, the research data of this study are robust, therefore four models are established on the basis of the previous introduction and the research direction of this study. Model I represents the impact of internationalization on corporate performance (whether internationalization has an impact on corporate performance, linear, U-shape, S-shape and W-shape). In this study, the fourth power is first established for discussion, and it is finally found to be a U-shape, therefore the research model is established as the second power. Model II represents the impact of internationalization on corporate performance at each stage of the corporate life cycle. Model III shows the addition of control variables. According to past studies, the control variables are usually a U-shape. On this basis, Model IV, representing a discussion of the second power of the control variables, is established. However, the second power is often highly correlated with the first

power term, therefore the second power is solved by decentralization in this study. If they are still highly correlated after decentralization, the R of the first power and the second power should be compared to determine which power should be used. The correlation coefficient of the decentralized second term of the first power of each variable is shown in Table 6.

Table 6 Correlation Coefficients of the Second Power of Variables and Self Variables

	X	X^2	$(X - \overline{X})^2$
DOI	1.00	-0.90	0.66
RDI	1.00	0.95	0.88
MI	1.00	0.95	0.18
CI	1.00	0.63	0.49
BS	1.00	1.00	0.02
OB	1.00	-0.98	0.34
SC	1.00	1.00	0.48
ER	1.00	-0.69	0.11

It can be seen from the above table that if the second power is decentralized, there will be no collinear problem (except for R&D intensity, in which, after testing, it is found that the second power is more explanatory than the first power, therefore the decentralized second power is adopted for the R&D intensity in this study.) Because the decentralized second power still retains the first power factor, 5 models are established as follows:

MODEL I

$$CFP = \beta_0 + \beta_1 DOI + \beta_2 \left(DOI - \overline{DOI}\right)^2$$

MODEL II

$$CFP = \beta_0 + \beta_1 DOI + \beta_2 \left(DOI - \overline{DOI}\right)^2 + \beta_3 D_1 DOI + \beta_4 D_1 \left(DOI - \overline{DOI}\right)^2 + \beta_5 D_2 DOI + \beta_6 D_2 \left(DOI - \overline{DOI}\right)^2$$

MODEL III

$$CFP = \beta_0 + \beta_1 DOI + \beta_2 \left(DOI - \overline{DOI}\right)^2 + \beta_3 D_1 DOI + \beta_4 D_1 \left(DOI - \overline{DOI}\right)^2 + \beta_5 D_2 DOI + \beta_6 D_2 \left(DOI - \overline{DOI}\right)^2 + \beta_7 RDI + \beta_8 MI + \beta_9 CI + \beta_{10} BS + \beta_{11} OB + \beta_{12} BP + \beta_{13} BM + \beta_{14} SV + \beta_{15} HCD + \beta_{16} SC + \beta_{17} ER + \beta_{18} AG$$

MODEL IV

$$CFP = \beta_0 + \beta_1 DOI + \beta_2 \left(DOI - \overline{DOI}\right)^2 + \beta_3 \left(RDI - \overline{RDI}\right)^2 + \beta_4 MI + \beta_5 \left(MI - \overline{MI}\right)^2 + \beta_6 CI + \beta_7 \left(CI - \overline{CI}\right)^2 + \beta_8 BS + \beta_9 \left(BS - \overline{BS}\right)^2 + \beta_{10} OB + \beta_{11} \left(OB - \overline{OB}\right)^2 + \beta_{12} BP + \beta_{13} BM + \beta_{14} SV + \beta_{15} \left(SV - \overline{SV}\right)^2 + \beta_{16} HCD + \beta_{17} SC + \beta_{18} \left(SC - \overline{SC}\right)^2 + \beta_{19} ER + \beta_{20} \left(ER - \overline{ER}\right)^2 + \beta_{21} AG$$

2.6 Research Method

A total of 3,635 non-financial listed companies in China from 2007 to 2019 are studied, with 29,438 items of data. Therefore, the data in this study are panel data. Panel data analysis may be considered, because not all panel data are uitable for panel data analysis and need to be validated. In this study, Pooled Regression is used to make judgment. There are fixed effects and random effects in panel data analysis, thus, the Hausman Test is used to make judgment in this study.

3. Empirical Analysis

3.1 Pooled Regression

In this study, Pooled Regression is used to judge whether the data are suitable for panel data analysis. The results of the four models are shown in Table 7 below.

Table 7 Statistics of Pooled Regression

Model	I	II	III	IV	V
			Weighted Statistics		
R^2	≤0.001	0.12	0.31	0.34	0.33
SSE	35005.	35490	30043	29735	29730
			Unweighted Statistics		
R^2	-0.04	-0.03	0.10	0.12	0.12

SSE	41149	41012	35785	34964	34956

As shown in Table 7 that the R^2 weighted statistics (≤0.001, 0.12, 0.31, 0.34, 0.33) of the five models are all greater than the unweighted statistics (-0.04, -0.03, 0.10, 0.12, 0.12). In addition, the SSE weighted statistics (35,005, 35,490, 30,043, 29,735, 29,730) are all smaller than the unweighted statistics (4, 1149, 41,012, 35,785, 34,964, 34,956), suggesting that panel data analysis is suitable for all five models used in this study.

3.2 Hausman Test

Panel data analysis has fixed effects and random effects. In this study, the Hausman Test is used to determine the results, as shown in Table 8.

According to the test results in Table 8, the p-values of all the five models are smaller than 0.05, suggesting that the four models in this study can be explained by the fixed effect.

Table 8 Hausman Test

Model	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob
I	13.94	2	≤0.001
II	41.81	6	≤0.001
III	1457.96	18	≤0.001
IV	1314.93	21	≤0.001
V	1365.00	25	≤0.001

3.3 Panel Data Analysis

Table 9 Analysis of Fixed Effect

Model	I	II	III	IV	V
Variable		Coefficient	t-Statistic Significant level		
C	1.63	1.63	7.07	8.60	8.33
	(85.15) ***	(84.71) ***	(40.87) ***	(50.19) ***	(46.90) ***
DOI	-0.03	-0.04	-0.05	-0.02	-0.03
	(-6.26) ***	(-6.42) ***	(-7.87) ***	(-4.41) ***	(-5.57) ***
$(DOI - \overline{DOI})^2$	0.01	0.01	0.02	≤0.001	0.01
	(4.40) ***	(3.80) ***	(6.06) ***	(2.19) **	(4.88) ***
D_1*DOI		0.01	0.01		0.01
		(1.96) **	(2.39) **		(2.77) ***
$D_1*(DOI - \overline{DOI})^2$		≤0.001	-0.01		-0.01
		-(0.68)	(-3.38) ***		(-3.33) ***
D_2*DOI		0.02	0.02		0.02
		(3.13) ***	(3.45) ***		(3.44) ***
$D_2*(DOI - \overline{DOI})^2$		-0.01	-0.02		-0.02
		(-2.31) **	(-5.41) ***		(-5.41) ***
RDI			2.53		
			(0.01) **		
$(RDI - \overline{RDI})^2$				0.05	0.05
				(8.12) ***	(8.00) ***
MI			0.10	0.08	0.08
			(13.58) ***	(11.31) ***	(11.63) ***
$(MI - \overline{MI})^2$				0.06	0.06
				(10.66) ***	(10.39) ***
CI			-0.21	-0.19	-0.21
			(-13.11) ***	(-10.97) ***	(-11.87) ***
$(CI - \overline{CI})^2$				0.02	0.03
				(2.52) **	(2.63) ***
BS			-0.04	-0.02	-0.02
			(-1.35)	(-0.70)	(-0.71) ***
$(BS - \overline{BS})^2$				0.14	0.13
				(1.98) **	(1.90) *
OB			0.04	-0.06	-0.06
			(1.43)	(-2.01) **	(-2.03) **
$(OB - \overline{OB})^2$				0.28	0.28
				(4.51) ***	(4.45) ***
BP			-0.09	-0.11	-0.11

			(-3.13) ***	(-3.92) ***	(-3.90) ***
BM			-0.07	-0.08	-0.08
			(0.01) ***	(-5.88) ***	(-6.08) ***
SV			-4.81	-0.06	-0.06
			(-6.23) ***	(-3.11) ***	(-2.85) ***
$(SV - \overline{SV})^2$				0.12	0.12
				(5.50) ***	(5.68) ***
HCD			0.13	0.20	0.20
			(8.96) ***	(12.82) ***	(12.82) ***
SC			-0.28	-0.37	-0.37
			(-55.72) ***	(-64.82) ***	(-64.77) ***
$(SC - \overline{SC})^2$				0.06	0.06
				(28.93) ***	(28.99) ***
ER			0.05	0.04	0.04
			(10.39) ***	(8.61) ***	(8.19) ***
$(ER - \overline{ER})^2$				0.01	0.01
				(3.77) ***	(3.91) ***
AG			0.14	0.13	0.15
			(10.40) ***	(10.35) ***	(11.75) ***
R^2	0.10	0.10	0.25	0.27	0.28
F-statistic	228.67	179.01	320.93	336.82	302.02
significance level	***	***	***	***	***

In the final stage, the fixed effect is performed, and the results are as shown in Table 8. It is found in Table 8 that the significant status and direction of all variables of Model IV, from the most basic Model I to the addition of the control variables needed to solve endogenous and exogenous problems, are almost the same. Therefore, this study uses the final Model V for explanation. It can be found in the analysis results of Model V that, except for the first power of board size, which is not significant, the other conditions are significant at the 90% trust level. It is found in Table 9 the equation is as follows.

$$\begin{aligned} CFP = {} & 8.33 - 0.03\,DOI + 0.01\left(DOI - \overline{DOI}\right)^2 + 0.01\,D_1 DOI - 0.01 D_1\left(DOI - \overline{DOI}\right)^2 + 0.02\,D_2 DOI - 0.02\,D_2\left(DOI - \overline{DOI}\right)^2 \\ & + 0.05\left(RDI - \overline{RDI}\right)^2 + 0.08\,MI + 0.06\left(MI - \overline{MI}\right)^2 - 0.21\,CI + 0.03\left(CI - \overline{CI}\right)^2 - 0.02\,BS + 0.13\left(BS - \overline{BS}\right)^2 \\ & - 0.06\,OB + 0.28\left(OB - \overline{OB}\right)^2 - 0.11\,BP - 0.08\,BM - 0.06\,SV + 0.12\left(SV - \overline{SV}\right)^2 + 0.20\,HCD \\ & - 0.37\,SC + 0.06\left(SC - \overline{SC}\right)^2 + 0.04\,ER + 0.01\left(ER - \overline{ER}\right)^2 + 0.15\,AG \end{aligned}$$

The control variables are explained and analyzed separately from the impact of internationalization on corporate performance in each stage of the corporate life cycle.

3.3.1 Internationalization

It can be found from Model VI that internationalization presents a significant U-shape ($-0.02\,DOI + 0.003\left(DOI - \overline{DOI}\right)^2$). Further analysis of the corporate life cycle (Model V) shows that the impact of internationalization on corporate performance in the three stages presents a significant positive U-shape, but it presents an inverted U-shape in the recession stage. Therefore, the impact changes are plotted as shown in Figure 1, and the impact is expressed in mathematical models as follows.

$$CFP_{IV}(DOI,\ X) = -0.02\,DOI + 0.003\left(DOI - \overline{DOI}\right)^2 + f_1(X)$$

$$\begin{aligned} CFP_{V}(DOI,\ X) = {} & -0.03\,DOI + 0.01\left(DOI - \overline{DOI}\right)^2 + 0.01\,D_1 DOI - 0.01 D_1\left(DOI - \overline{DOI}\right)^2 \\ & + 0.02\,D_2 DOI - 0.02\,D_2\left(DOI - \overline{DOI}\right)^2 + f_2(X) \end{aligned}$$

Period	CFP	$\frac{\partial CFP}{\partial DOI}$
Growth	$-0.03DOI + 0.01(DOI + 2.99)^2$	$0.04 + 0.02\,DOI$
Mature	$-0.02\,DOI + 0.004(DOI + 2.99)^2$	$0.01 + 0.01\,DOI$
Decline	$-0.01\,DOI - 0.004(DOI + 2.99)^2$	$-0.04 - 0.01\,DOI$
All	$-0.02\,DOI + 0.003(DOI + 2.99)^2$	$0.001 + 0.003\,DOI$

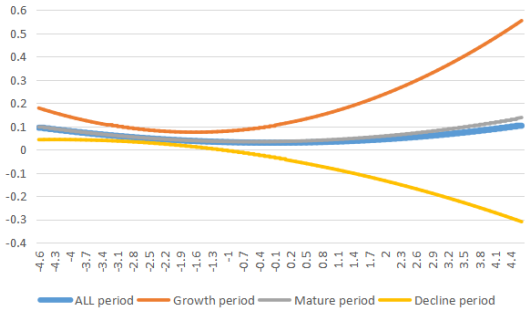

Figure 1 Impact of Internationalization on Corporate Performance

As shown in Figure 1, the impact of internationalization on China's non-financial industry presents a positive U-shape, but the acceleration does not have a significant impact (each additional unit can increase the internationalization by 0.001+0.003 DOI), and the impact during the maturity stage and during the full life circle seems to be similar. There is a relatively significant positive U-shape during the growth stage, and it can be found that each additional unit of internationalization can increase the corporate performance by 0.04+0.02 DOI. Moreover, during the growth and maturity stages, its impact on corporate performance presents a positive U-shape, and the internationalization at any stage has a positive impact on corporate performance. However, during the recession stage, it presents an inverted U-shape in the numerical range of -4.61 to 4.61 in the right half of the U-shape, suggesting that the higher the internationalization in the recession stage, the more unfavorable the corporate performance (each increase of one unit of internationalization will reduce the relative corporate performance by 0.04+0.01 DOI).

3.3.2 Proprietary assets

This paper uses R&D intensity, marketing intensity and capital intensity as indicators. In the past, many scholars pointed out that proprietary assets also present a U-shape impact on corporate performance. The second power is also adopted in this study, and the results are expressed in the following simple model. The relationship is shown in Figure 2.

$$CFP(RDI,\ MI,\ CI,\ X) = 0.053\left(RDI - \overline{RDI}\right)^2 + 0.084\ MI + 0.06\left(MI - \overline{MI}\right)^2 - 0.211\ CI + 0.03\left(CI - \overline{CI}\right)^2 + f_3(X)$$

Var	CFP	CFP '
RDI	$0.053\ (RDI - 0.399)^2$	$-0.042 + 0.106RDI$
MI	$0.084\ MI + 0.06\ (MI - 1.677)^2$	$0.286 + 0.120MI$
CI	$-0.211\ CI + 0.03\ (CI - 0.188)^2$	$-0.201 + 0.052CI$

Through the mathematical formula and results shown in Figure 4, it can be clearly found that although the impact of the three types of proprietary assets present a U-shape, their impact conditions are different. Both R&D intensity and marketing intensity have positive effects on corporate performance and increase with the increase of intensity. Each additional unit increases corporate performance by -0.042+0.106 RDI and 0.286+0.120 MI respectively, but the capital intensity falls in the left half of the U-shape within the numerical range. In addition, when CI=0 (that is, when fixed assets increase over the previous year), the impact on corporate performance starts to turn negative. Every increase in general non-capital intensity affects corporate performance by -0.201+0.052 CI.

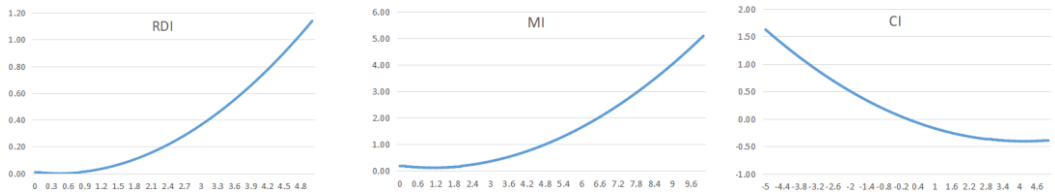

Figure 2 Impact of Proprietary Assets on Corporate Performance

3.3.3 Corporate governance

The variables of corporate governance are mainly discussed from the board structure. The variables include the board size, the proportion of external directors and supervisors, the part-time status of directors and supervisors,

and the chairman serving concurrently as general manager. According to Table 8, the mathematical model is as follows (not significantly BS is not included in the first power). According to the previous example, the impact of board size and external directors and supervisors is as shown in Figure 3. The results show that the board size and the proportion of external directors and supervisors present a positive U-shaped impact on corporate performance, while the part-time status of directors and supervisors and the chairman serving concurrently as general manager present a negative and significant linear impact.

$$CFP(BS,\ OB,\ BP,\ BM,\ X) = 0.130\ (BS - 2.186)^2 - 0.057\ OB + 0.275\ (OB + 1.039)^2 - 0.110\ BP - 0.084\ BM + f_4(X)$$

Var	CFP	CFP '
BS	$0.130\ (BS - 2.186)^2$	$0.260\ BS - 0.570$
OB	$-0.057\ OB + 0.275\ (OB + 1.039)^2$	$0.550\ OB + 0.515$
BP	$-0.110\ BP$	-0.110
BM	$-0.084\ BM$	-0.084

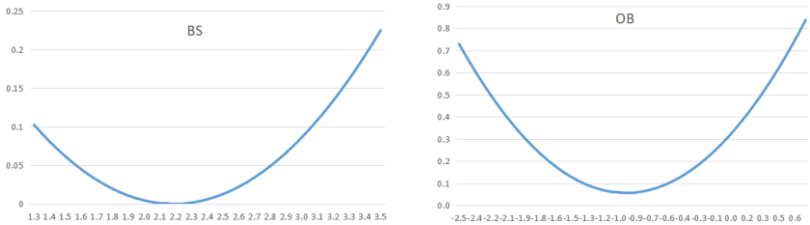

Figure 3 Impact of Board Structure (board size (BS) and (OB)) on Proportion of external directors and supervisors Corporate Performance

3.3.4 Competition for control

Maury and Pajuste (2005) pointed out that there are four main variables in competition for control, namely, control concentration degree, control dispersion degree, degree of competition for control, and competition status. Because the control concentration degree, control dispersion degree, and degree of competition for control are highly correlated, only the degree of competition for control and competition status are included as control variables in this study. The mathematical models of their impacts are as follows, and the impacts of the numerical range of the Shapley value on corporate performance are as shown in Figure 4. It is found that the range of the Shapley value presents a positive U-shape on corporate performance and is in the left half. In other words, the larger the value is, the more adverse it is to corporate performance. The competition for control also presents a positive impact.

$$CFP(SV,\ HCD,\ X) = -0.057\ SV + 0.124\ (SV - 3.561)^2 + 0.198\ HCD + f_5(X)$$

Var	CFP	CFP'
SV	$-0.057\ SV + 0.124\ (SV - 3.561)^2$	$-0.938 + 0.247\ SV$
HCD	$0.198\ HCD$	0.198

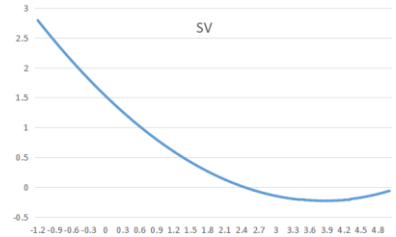

Figure 4 Relationship between Shapley Value and Corporate Performance

3.3.5 General variables

General variables are the control variables added by the researchers, including company size, property rights proportion and enterprise age. According to Table 9, the impact on corporate performance is as shown in Figure 5, and the mathematical model is constructed as follows. It can be found that the impact of company size and property rights proportion on corporate performance presents a positive U-shape, while the impact of company size on corporate performance is mostly negative and will turn positive only when it exceeds 37. Enterprise age also has a positive significant impact on corporate performance.

$$CFP(SC, ER, AG, X) = -0.371\ SC + 0.063\ (SC - 22.082)^2 + 0.042\ ER + 0.011\ (ER + 1.021)^2 + 0.154\ AG + f_6(X)$$

Var	CFP	CFP '
SC	$-0.371\ SC + 0.063\ (SC - 22.082)^2$	$0.126\ SC - 3.146$
ER	$0.042\ ER + 0.011\ (ER + 1.021)^2$	$0.021\ ER + 0.020$
AG	$0.154\ AG$	0.154

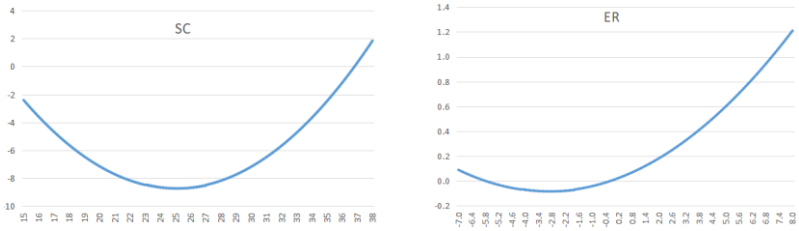

Figure 5 Impact of Company Size and Property Rights Proportion on Corporate Performance

IV. Conclusion

This study investigates the impact of internationalization on the corporate performance of listed companies in China's non-financial industry from 2007 to 2019, and further analyzes its impact during different stages of the corporate life cycle. A total of 3,635 enterprises are studied, and there are 29,483 data items, therefore panel data analysis is adopted for analysis. In addition to exploring the internationalization, this study further explores the impact of proprietary assets, board structure, competition for control, and capital structure on corporate performance.

In this study, it is found that the impact of internationalization on corporate performance presents a U-shape, but the second power effect is very small (although still significant) and approaches the positive linear effect quickly. However, when each stage of the corporate life cycle is taken into account, it is obvious that growing enterprises conform to the positive U-shape hypothesis. That is to say, in the early stage of internationalization, enterprises unfamiliar with foreign environments, and they have a lack of resources, competence, economic scale and other factors (Daniels and Bracker, 1989; Ruigrok and Wagner, 2003); therefore, internationalization shows a downward trend in the early stage of corporate performance. However, because of the low cost in China (such as labor raw material costs), it is unlikely to have a negative impact, and a positive impact remains. When an enterprise goes into a recession stage, all costs increase, product innovation is insufficient, and internationalization has a negative impact on corporate performance due to factors such as dispersed markets, greatly increased communication and coordination costs, and the slow growth of resources and ability (because the enterprise enters a recession stage).

Positive and negative impacts and even non-linear impacts have been found in research on proprietary assets (Lucas and Ayse, 2018). The results of this study show that R&D intensity and marketing intensity have a nonlinear status and fall in the right half of the positive U-shape. In other words, higher investments in R&D and marketing can accelerate the positive impact on corporate performance. However, capital intensity is in the left half of the positive U-shape, which is consistent with Chaiporn (2016; 2017), who states that "higher physical assets make a company more financially constrained", which may adversely affect the company's ability to invest.

In terms of the board structure, the part-time status of directors and supervisors and the chairman serving concurrently as general manager in this study are in line with the general assumption, presenting a significant negative impact. However, board size and external directors and supervisors present a U-shape, which also seems to integrate the opinions of the two groups of scholars. A small board can better fulfill the responsibility of supervising the managers, thus enhancing the value of the company (Yermack, 1996). After the exploration of the relationship between board size and corporate performance, the empirical results all find that board size and performance are negatively correlated, and when board members continue increasing the number of directors who are complementary professionals (Zahra and Pearce, 1989), a positive reversal on corporate performance begins to appear.

In this study, the Shapley value (negative significant) and the competition relation (dummy variable, positive significant) of the competition and cooperation relation are adopted, and the results are roughly the same as those of previous researchers. However, the Shapley value is in the left half of the positive U-shape and reverses when it is extremely high, suggesting that it is good for corporate performance when the largest shareholder has absolute power to get other shareholders to cooperate with it (state-owned enterprises).

In addition, this study also finds that a company's economics of scale does not occur immediately as the company grows, and there are thresholds. In other words, before the threshold value is reached, the size of a

company has a negative impact on corporate performance, and only after the threshold value is reached will the economics of scale have a significant positive impact on corporate performance.

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