THE INFLUENCE OF M&A ON TECHNOLOGICAL INNOVATION AND PERFORMANCE RESULTS—BASED ON THE EMPIRICAL STUDY OF GEM LISTED COMPANIES

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ABSTRACT: *In the recent wave of M&A, listed companies on the GEM have paid great attention to acquiring relevant technology and knowledge assets. In order to enhance their technological innovation capabilities, they also concern about the technology which can improve their defects when choosing the M&A targets. Correspondingly, the acquisition of new technologies and new products through M&A has become one of the typical motivations among the listed companies on the GEM in China in recent years. This phenomenon has gradually attracted the attention of domestic scholars. In China, the research on M&A behavior of GEM listed companies, especially the study on technology innovation and performance results of M&A behavior, still lags behind the development of practice. This paper takes China's GEM listed companies as the specific research object, selects its relevant data in 2011-2016, and objectively discusses the impact of M&A on the technological innovation and performance results, and has carried out the empirical analysis based on the related data, which shows that the R&D investment will decrease and the technological innovation performance will increase after M&A. Finally, based on the empirical results and the actual situation of the current market, this paper puts forward two practical suggestions for the M&A and technological innovation and performance results of China's GEM listed companies.*

KEYWORDS: M & A, Technological Innovation, Innovation Performance

INTRODUCTION

Research background

In the eyes of other countries, China is a big country of production rather than the big one of creation. This is due to the relatively few core technologies of Chinese companies, and according to statistics, nearly half of the invention patent applications are from other countries. Thus, in recent years, the call for us to move from "Made in China" to "Created in China" has become stronger and stronger.

In March 2014, the State Council's opinion on optimizing the result of M&A in enterprises indicated that it is a safer way to conduct M&A with other companies if those enterprises want to improve their innovative skills. Therefore, as new technologies continue to emerge, companies may face multiple competitions, such as differences in various asset sources and customer order requirements. The innovative methods of domestic companies are also changing, from the use of their own R&D innovation to the re-innovation after obtaining technical support from third parties. Therefore, the adoption of this strategy of M&A to increase the intensity of R&D and enhance the innovation performance of the company has attracted the attention of all sectors of society.

Research significance

The significance of this paper is to study the relationship between M&A and R&D intensity and innovation performance of GEM listed companies, to provide direct reference for domestic M&A activities. This paper can also provide practitioners with a theoretical basis for the relationship between M&A, R&D intensity, and innovation performance. At the same time, in order to offer some proposals on reducing the risk of M&A strategy for listed companies and increasing the innovative output of M&A outside the company, we will analyze the factors affecting this relationship.

Research Ideas

The first part is the introduction. This part makes a statement on the research background, the significance of the topic, the research ideas and the innovations.

The second part is a literature review. This part mainly describes the results of the impact of M&A on R&D and the impact on innovation performance, and comprehensively reviews the above research results.

The third part is proposed for theoretical analysis and research hypothesis. First, we will show the theoretical analysis. Secondly, the hypotheses of this paper is put forward. Hypothesis 1: The R&D investment of the enterprise will decrease after the merger; Hypothesis 2: The technological innovation performance of the enterprise will increase after the merger.

The fourth part is the design of empirical research. This section includes sample selection, data sources, model and variable design, descriptive statistics, and multiple regression analysis.

The fifth part is conclusions and recommendations.

Innovations

Exploring the impact of current M&A on R&D investment and innovation performance of China's GEM listed companies is not only the deepening of M&A performance research, but also the deepening of the research on strategy and innovation management of GEM listed companies. It can also provide a more specific reference for the research on M&A behavior

and R&D technology innovation in China. China has gradually paid more attention to the innovation activities of research enterprises in recent years, but the relevant data is not very sound. This paper can supplement the previous research by means of patent data and R&D intensity.

LITERATURE REVIEW

Overview of relevant theoretical research on M&A and R&D

After five waves of M&A, M&A among enterprises have already become part of the daily business activities. Since the 1980s, some scholars have begun to explore the R&D investment of enterprises after M&A. The current research on M&A has become more in-depth and has achieved extensive research results. Among these researches, the conclusions are not consistent. Some scholars find that M&A can have a positive impact on R&D, some find that M&A has negatively inhibited R&D and others believe that the role of M&A is not obvious. These findings all indicate that the conclusions on the relationship between M&A and R&D investment are not clear and need to be further explored.

Overview of foreign research

We find that the conclusions on the relationship between M&A and R&D are not consistent:

Some scholars have pointed out that M&A can promote the company's R&D. Hagedoorn and Duysters (2002) conducted research based on the US computer industry, and the results indicate that M&A has a positive positive effect on R&D performance; Arora and Ceccagnoli et al. (2008) conducted empirical analysis based on data from the chemical industry from 1987 to 1997, and reached similar conclusions. It is also proposed that M&A are used to correct internal inefficiencies, agency problems and imperfect capital markets.

Some scholars have proposed the opposite conclusion that M&A have an inhibitory effect on R&D. Ravenscraft and Scherer (1987) used the sample of US companies and found that corporate M&A have a negative effect on R&D spending. Hitt and Hoskisson (1991) proposed that the wave of M&A in the 1980s dampened the company's innovation and R&D capabilities seriously, because companies pay too much attention to M&A and neglect the improvement of their own R&D capabilities. At the same time, corporate M&A may increase the debt burden of enterprises, and managers will put more effort into the finance and neglect the investment in R&D.

However, some scholars believe that the role of M&A in R&D is not obvious. Olivier (2005) studied the wave of M&A since the 1990s, and explored the impact of domestic M&A and cross-border M&A on R&D separately. The study found that several large-scale wave have not substantially affected the R&D investment of domestic enterprises. Only a small number of industries will actively promote R&D investment, and the impact is not significant.

Overview of domestic research

Similar to the conclusions of foreign scholars, Chinese scholars have two opposite conclusions, that is, M&A are conducive to the development of R&D and M&A have a depressing effect on R&D.

Most scholars have proposed that M&A has a significant role in promoting R&D. For example, Li Muchun (2010) proposed that M&A has a positive impact on innovation in the following aspects: it can enhance R&D capabilities, shorten life cycle of products, enhance core competitiveness, which will help implement strategic transfer, form late-comer advantages and save transaction costs. Li Yanqin (2010) studied Chinese high-tech enterprises' financial situation in the past three years. Based on these M&A, she found that the M&A have played a leading role in R&D activities. Zhou Mohan and Liu Qinggang (2013) studied the R&D investment of many companies that have acquired M&A. The results show that the M&A decisions will affect R&D investment. If the cost of R&D is not high, the acquirer is willing to increase R&D investment to lower the purchase price and save cost. The acquired party tends to increase R&D investment to enhance their own value, so as to raise the purchase price and gain benefits in the M&A.

Overview of research on M&A and innovation performance

Overview of foreign research

We also find that scholars have different opinions on the changes in the company's innovation performance caused by M&A.

Some scholars believe that M&A will have a negative impact on the company's innovation performance. They believe that horizontal M&A are within the industry, so the number of competitors will decrease after M&A. If it is a vertical M&A, competition with upstream and downstream companies in the supply chain will be reduced, thus companies will be less vigilant and tend to reduce R&D investment, so that the company's innovation performance will decline after the M&A (Granstrand and Sjolander, 1990) . Other studies have shown that the M&A will bring a lot of debt, which will also reduce the R&D investment. In addition, the study also points out that the integration problem faced by the acquiring company will disperse the human and financial resources. Therefore, it will also lead the companies to reduce innovation investment (Hall and Lerner, 2010) . Hitt and Hoskisson (1991) analyzed the effect of M&A strategy on innovation investment and innovation output and found that due to the inconsistency of target between the business operator and the owner, the company's innovation performance will be significantly reduced after the M&A.

Some scholars have not found a positive or negative relationship between M&A and innovation performance. After researching some larger companies in the pharmaceutical industry, Ornaghi (2009) pointed out that the M&A strategy did not actively promote the company's innovation output.

There are still many scholars who believe that M&A strategy will promote the results of company's innovation performance. Phillips and Zhdanov (2013) found that when companies have strong patent reserves, in order to reduce the cost of research, they can achieve technological innovations through the implementation of M&A strategies. According to Aghion's (1994) study, companies with weaker innovation tend to merge companies with frequent R&D investment and smaller scale to enhance their own technology. According to Porter's (1981) study, if an enterprise wants to acquire core resources, it can rely on merging other companies with such core resources, and directly obtain the key resources of the acquired company.

Overview of domestic research

Most of the domestic literature has only appeared in the past three or five years, and there are one or two papers that are slightly earlier. Deng Leyuan and Cheng Liangbin (2004) get some preliminary understanding through the summary of specific M&A events based on the advantages and disadvantages of M&A. They believe that the occurrence of M&A sometimes increases the possibility of market monopoly and weakens market competition. When the integration of technological innovation is unreasonable, it will even reduce the innovation results. If M&A can break down technical barriers and integrate the technology of both sides fully, it will effectively improve innovation and the companies' market competitiveness. Fu Xiaoyun (2015) believes that the impact of M&A on technological innovation capabilities is achieved through multiple ways. First, when M&A enable enterprises to fully integrate the acquired technologies and proprietary technologies after obtaining innovations from other companies and optimize various asset allocations, we can give full play to the advantages of M&A and continuously promote enterprises to carry out innovation activities. However, some M&A strategies only expand the scale of enterprises, but don't integrate resources sufficiently. Such M&A will only reduce the efficiency of management and damage the technological innovation capability, which is not conducive to the improvement of market competitiveness. Liu Hongjiang (2015) believes that the M&A strategy can positively affect acquirers' innovations. The effective means for the acquirers to enhance the innovation capability and innovation efficiency is to acquire the target company and obtain its patent. On this basis, the technological innovation output of the acquirers can be improved, which can also enhance their technological competitive advantage. Hu Xuefeng and Wu Xiaoming (2015) believe that the M&A strategy has a positive impact on the innovation output. They also prove their theoretical analysis based on the data of pharmaceutical listed companies. Chen Yugang and Cai Haibin (2015) are also based on the perspective of foreign M&A and analyze whether foreign M&A promotes the technological innovation of the target company. They think it depends on the technological innovation performance of the target company. If the target company's innovation performance is high, it may be transferred after the acquisition, which will decline in innovation performance. At the same time, they also conducted data analysis, but the results show that foreign M&A have not significantly improved the innovation performance of Chinese target companies.

Theoretical basis and research hypothesis

M&A has the potential to promote innovation in companies, mainly for the following reasons: First, technical knowledge is often considered to be viscous and difficult to transfer between firms (Larsson et al., 1998). In order to avoid excessive transaction costs, companies may prefer to directly acquire knowledge and technology resources through M&A (Bresman et al., 1999) . Second, M&A can increase the target's overall R&D budget and share R&D's fixed costs on a larger scale, thereby reducing the risk of a single company engaging in large-scale R&D projects. Third, the increasingly fierce competition has shortened the life cycle of products. To quickly enter the market, the advantages of internal development of new technologies are relatively weak (Leonard-Barton, 1992) , besides, the risk will increase and it also takes too long (D'Aveni, 1993) . It is a good choice to acquire the target companies that already own R&D resources to enter new. Therefore, the effective integration of technical resources through M&A will gain greater advantages in terms of the speed and effectiveness of technological innovation than those without collaboration and integration. However, companies are often not good at all aspects of innovation management, so companies may need to adopt different innovation management models and methods. After acquisition or merger, companies can learn from each other and adopt the best innovative management model and improve R&D performance: The same budget leads to more new technology development.

Based on the analysis, the hypothesis is as follows:

Hypothesis 1: After M&A, the R&D investment of enterprises will decrease;

Hypothesis 2: After M&A, the technological innovation performance of enterprises will increase.

THE DESIGN OF EMPIRICAL RESEARCH

Sample Selection and Data Sources

Sample selection

This paper selects China's GEM listed companies from 2011 to 2016 as samples, and on this basis, eliminates and pairs according to the following criteria:

1) The enterprises that have occurred and completed M&A on the GEM from 2012 to 2015 are selected, the other data are excluded, and the data sets formed by the number of years before and after the merger (2011-2016) are included.

2) According to the selected enterprises that have completed M&A, the same industry and similar asset scale, the enterprises that have not M&A will be paired.

3) Exclude companies with incomplete data.

Through the above criteria and steps, 3740 observations were finally obtained.

Data source

The data about the M&A cases and the company's finance used in the paper are mainly derived from:

1)   WIND database

2)   CSMAR

3)   Chinese Intellectual Property Office

Selection of variables

There are many indicators to measure the value of M&A. If it is only evaluated by a certain indicator, it will inevitably cause a considerable one-sidedness. Of course, too many variables will form unnecessary duplication. According to this, the variables involved in this article are mainly:

1)   Explanatory variables

A. M&A

The M&A is used as an explanatory variable. We believe that unfinished M&A can not fully exert their influence on the innovation performance, so the research only deals with completed M&A. Generally, the purchase of assets and equity is completed by the completion of the registration of business administration and equity changes, which is reflected in the "implementation" or "achievement" in the WIND.

Creating two dummy variables after1 and after2. The definition of after1 is: It values 1 when the M&A occurs in that year or from that year to 2016 and it is 0 when it occurs in the previous year; the definition of after2 is: It values 1 when it occurs after the merged year while before 2016, and it is 0 when M&A occurs in 2011 till the previous year of the merged year. The value of the merged year was null.

2)   Explained variables

B. Patent

As an explanatory variable, patent is relatively an objective reflection of the company's technical strength, and it has become the most common indicator of technological innovation performance or R&D performance measurement in the world. This is mainly because patents are a concrete reflection of the practical and commercialization of scientific results, and are a very important kind of technical information closely related to technological innovation and economic development. Empirical analysis also shows that the number of patents is a fairly reliable indicator of the innovation performance.

Considering that China's patent application has a review stage from submission to disclosure, it usually takes about half a year to a year and a half, and it takes a considerable amount of time to open the authorization. Since there is a time lag from the disclosure of patent applications to authorization, this article draws on Zhang Fanghua (2006), Wei Ying (2006), Fang Shu (2007) and Sun Kai (2008) and other scholars' research and the view of the United Nations Intellectual Property Organization "The number of patent applications is an important indicator to measure the technological innovation and technology introduction of a country and enterprises", and takes the logarithm of "the number of patent applications +1 " as the metric of innovation performance, which is expressed in PATENT.

C. R&D investment (R&D intensity)

R&D is the core of technological innovation, it refers to systematic and creative activities, including basic research, applied research, and experimentation, to increase the total amount of knowledge and to use this knowledge to create new applications. There are two types of measurement of R&D investment generally: one is the ratio of the R&D expenditure to the main operating income, and the other is the ratio of the R&D expenditure to the total assets. The measure used in this paper is the ratio of the company's R&D expenditure to the main operating income. It is measured by the ratio of the company's R&D expenditure to the total assets in the robustness test.

3) Control variables

D. Enterprise scale

A large number of empirical studies in the past have shown that the factor of enterprise scale is of great significance to the development of enterprises. Similarly, the size of the business has a significant impact on the company's M&A. There are several different ways to measure the size of an enterprise. One is the total sales, the second is the total assets, and the third is the total number of employees. Since the total sales is fluctuated by various factors in different years, the total number and structure of employees between different enterprises are also quite different. Therefore, in order to control the impact of enterprise scale on R&D, the natural logarithm of total assets of this study are used, which is expressed in SIZE.

E. Asset-liability Ratio

The asset-liability ratio is the ratio of total corporate debt to total assets. It mainly reflects the proportion of corporate liabilities to total assets, indicating the long-term solvency of enterprises.

F. Rate of Return on Total Assets

The rate of return on total assets is the percentage of the company's net profit to the average total assets.

G. Tobin Q value

The Tobin Q value is one of the reasons that affect the effectiveness of monetary policy and is defined as the ratio of the market value of an asset to its replacement value. It can also be used to measure whether the market value of an asset is overvalued or undervalued.

H. Total number of patents in previous years

Select the patents from the year the company was established to the year before the data is used as a control variable, which is denoted by PATENT0.

I. Company age

The age of the company represents the time elapsed from the date of establishment of the company to the date of the start of the study, indicating the existence time of the company. Domestic and foreign literatures confirm that the company's age has an important impact on the company's management philosophy, organizational structure, etc., and will also affect the company's technological innovation. Since the company's age has an important impact on the company's R&D and innovation capabilities, this paper introduces the company's age as a control variable. And the year of completion of the merger as the benchmark minus the year of establishment as a specific measure, expressed as AGE.

J. Equity concentration indicator

The equity concentration expresses the concentration or dispersion of equity due to the difference in shareholding ratio.

4)   Dummy variables

K. Industry

In the empirical study of M&A activities, industry is a commonly controlled variable because it has a greater impact on R&D investment, and government fiscal policies tend to support certain Industry development. Therefore, this paper controls the industry and implements the quantification of the industry in the form of dummy variables. It is realized by adding "industry number-1" dummy variables, which is represented by INDU.

L. Year

The external environment such as the economic situation of the company is always changing. The dynamic nature of the environment requires that the business decision-making should be flexibly changed to adapt to changes in the external environment. The company's financial support for M&A and R&D will change with time, the company's internal environment and external environment are constantly changing every year and the company's R&D decisions will be constantly adjusted to adapt to the changing market environment. Thus, it is necessary

to introduce year variables for control. This article introduces "the number of year -1" dummy variables, represented by YEAR.

Model Design

The problem discussed in this paper is the impact of the company's M&A behavior on the R&D investment and technological innovation performance. And we adopt the double difference model (DID model) to solve the endogenous problems.

To test hypothesis 1: After M&A, R&D investment will be reduced. This paper constructs the following model:

Model 1:

$$R \& D = \alpha_0 + \alpha_1 \text{CON\_A} FTER1 + \alpha_2 CON + \alpha_3 AFTER1 + \alpha_4 SIZE + \alpha_5 LEV + \alpha_6 TOBINQ + \alpha_7 ROA$$
$$+ \alpha_8 SHRCR + \alpha_9 AGE + \sum^{5} \alpha_{9+j} YEAR + \sum^{30} \alpha_{14+k} INDU + \varepsilon$$

The observation interval is from 2011 to 2016. The experimental group is the enterprise that has M&A during the period. The control group is the enterprise that did not have M&A during the same industry.

To test hypothesis 2: After M&A, the technological innovation performance will increase. This paper constructs the following model:

Model 2:

$$PATENT = \alpha_0 + \alpha_1 \text{CON\_A} FTER1 + \alpha_2 CON + \alpha_3 R \& D + \alpha_4 PATENT0 + \alpha_5 AFTER1 + \alpha_6 SIZE$$
$$+ \alpha_7 LEV + \alpha_8 TOBINQ + \alpha_9 ROA + \alpha_{10} SHRCR + \alpha_{11} AGE + \sum^{5} \alpha_{12+j} YEAR + \sum^{30} \alpha_{17+k} INDU + \varepsilon$$

The observation interval is from 2011 to 2016. The experimental group is the enterprise that has M&A during the period. The control group is the enterprise that did not have M&A during the same industry.

Descriptive statistical analysis

Among the 3,740 companies, there were 96 M&A, and 3,644 were not. Descriptive statistics of variables for these two sets of data are presented in this paper, see Tables 4-1 and 4-2.

Table 4.1. Descriptive statistical analysis of enterprises with M&A

variable	R&D	PATENT	SIZE	LEV	TobinQ	ROA	SHRCR	AGE
max	0.250	3.027	2.380	0.814	34.505	0.114	53.90	24
min	0	0	0.771	0.0592	0.885	-0.069	7.341	5
ave	0.064	1.297	1.344	0.325	6.534	0.043	29.424	12.875
med	0.048	1.314	1.314	0.308	5.180	0.046	27.193	13
std	0.055	0.715	0.270	0.158	5.786	0.035	10.850	4.630
observation	96	96	96	96	96	96	96	96

Table 4.2. Descriptive statistical analysis of Enterprises without M&A

variable	R&D	PATENT	SIZE	LEV	TobinQ	ROA	SHRCR	AGE
max	0.983	2.962	2.508	0.886	35.082	0.297	69.363	29
min	0	0	0.464	0.011	0.618	-0.646	4.379	1
ave	0.084	0.893	1.161	0.240	3.870	0.054	31.965	11.771
med	0.055	1	1.102	0.204	3.103	0.053	29.994	12
std	0.086	0.774	0.307	0.157	2.787	0.051	12.567	4.643
observation	3644	3644	3644	3644	3644	3644	3644	3644

Regression analysis of variables

Regression of hypothesis 1

Table 4.3. Regression results of Model 1

R&D	Coef.	t	P>|t|
Con_after1	-0.016**	-2.19	0.029
CON	-0.014**	-2.73	0.006
AFTER1	0.008**	2.02	0.044
SIZE	0.034***	6.64	0.000
LEV	-0.186***	-19.45	0.000

TobinQ	0.006***	9.97	0.000
ROA	-0.478***	-17.44	0.000
SHRCR	-0.000***	-8.92	0.000
AGE	-0.000**	-2.92	0.003
cons	0.090	8.30	0.000
F	71.99		
Prob>F	0.000		
Adj-R²	0.2217		
N	3740		

Note: *, **, *** indicate significant at the 10%, 5%, and 1% (two-sided) levels respectively.

From the regression results in Table 4-3, the regression coefficient of the impact of M&A on the R&D investment is -0.016, and the test is also passed when the significance level is 5%, which reveals that the M&A has a significant negative effect on R&D investment, so it is concluded that the R&D investment of the company will be reduced after M&A, which is consistent with Hypothesis 1. Observing the regression coefficient and P value of each variable, we can see that the regression coefficient of the company size and TobinQ value on the company's R&D investment are 0.034 and 0.006 respectively, and pass the test when the significance level is 5% and 1%. Therefore, it can be considered that the company size and TobinQ value have a significant positive effect on the company's R&D investment. The regression coefficients of the asset-liability ratio, the rate of return on total assets, the equity concentration and the company's age on the company's R&D investment are -0.186, -0.478, -0.000 and -0.000 respectively, which also passed the test at the saliency level of 5% and 1% respectively. So it can be considered that the asset-liability ratio, the rate of return on total assets, equity concentration and company age have a significant negative effect on the R&D investment.

Regression of hypothesis 2

Table 4.4. Regression results of Model 2

PATENT	Coef.	t	P>|t|
Con_after1	0.277*	1.73	0.084
CON	-0.078	-0.80	0.424
R&D	-0.892**	-2.68	0.007

PATENT0	-0.003***	21.50	0.000
AFTER1	-0.206	-2.67	0.008
SIZE	0.294**	2.64	0.008
LEV	-0.124	-0.57	0.566
TobinQ	-0.046***	-3.88	0.000
ROA	-1.231**	-2.09	0.037
SHRCR	0.002	0.85	0.395
AGE	-0.016**	-2.66	0.008
cons	2.797	15.47	0.000
F	64.97		
Prob>F	0.000		
Adj-R²	0.2485		
N	3096		

Note: *, **, *** indicate significant at the 10%, 5%, and 1% (two-sided) levels respectively.

From the regression results in Table 4-4, the regression coefficient of the impact of M&A on technological innovation is 0.277, and the test is also passed when the significance level is 10%, which is considered that M&A has a significant positive effect on innovation performance, so it is concluded that the technological innovation performance will increase after M&A, which is consistent with Hypothesis 2. Observing the regression coefficient and P value of each variable, the regression coefficient of company scale with enterprise technology innovation performance is 0.294, and it passes the test when the significance level is 5%. Therefore, it can be considered that the company scale has a significant positive effect on the technology innovation performance; the regression coefficients of TobinQ value, the rate of return on total assets and company age with enterprise technology innovation performance are -0.046, -1.231 and -0.016 respectively, when the significance level is 5% or 1%, they passed the test respectively. Thus, it can be considered that the TobinQ value, the rate of return on total asset and the age of the company have a significant positive effect on the technological innovation performance.

Robustness test

In order to further verify the reliability of the evidence, this paper conducts a robustness test: R&D (the ratio of R&D expenditure to the total assets) is substituted for R&D (the ratio of R&D expenditure to the income of the main business) to regress; using after2 to replace after1 for regression. The specific regression results are as follows. Compared with before the M&A,

the R&D investment will decrease and the technological innovation performance of the enterprises will increase after the M&A. This is consistent with Hypothesis 1 and Hypothesis 2, which further validates the conclusions of this paper:

Table 4.5. Regression results of the robustness test (1)

R&D	Coef.		t		P>|t|	
	T1	T2	T1	T2	T1	T2
Con_after1/ Con_after2	-0.005**	-0.014*	-2.61	-1.68	0.009	0.093
CON	-0.006***	-0.014**	-4.68	-2.8	0	0.005
AFTER1/ AFTER2	0.003**	0.010*	2.79	1.73	0.005	0.084
SIZE	-0.005***	0.037***	-3.58	6.59	0	0
LEV	-0.006**	-0.190***	-2.43	-17.96	0.015	0
TobinQ	0.002***	0.007***	11.62	9.58	0	0
ROA	0.003	-0.508***	0.5	-16.16	0.619	0
SHRCR	-0.000***	-0.001***	-8.58	-8.07	0	0
AGE	-0.000*	-0.001**	-1.79	-2.35	0.073	0.019
cons	0.027	0.079	10.02	6.4	0	0
F	56.33/60.32					
Prob>F	0/0					
Adj-R²	0.182/0.2248					
N	3740/3069					

Note: *, **, *** indicate significant at the 10%, 5%, and 1% (two-sided) levels respectively.

From the regression results in Table 4-5(T1), the regression coefficient of M&A with R&D investment is -0.005, and the test is also passed when the significance level is 5%, which is considered that M&A has a significant negative effect on the R&D investment, so it can conclude that the R&D investment after M&A, which is consistent with the view of Hypothesis 1.

From the regression results in Table 4-5(T2), the regression coefficient of M&A with the R&D investment is -0.014, and the test is also passed when the significance level is 10%, and it is considered that the M&A has a significant negative effect on the R&D investment, so it can conclude that the R&D investment will be reduced after M&A, which is also consistent with the view of Hypothesis 1.

Table 4.6. Regression results of the robustness test (2)

PATENT	Coef.		t		P>|t|	
	T1	T2	T1	T2	T1	T2
Con_after/ Con_after2	0.300*	0.414*	1.85	1.82	0.065	0.069
CON	-0.063	-0.101	-0.64	-1.04	0.521	0.297
R&D	0.649	-1.021**	0.48	-2.72	0.633	0.007
PATENT0	0.003***	0.004***	21.5	18.58	0	0
AFTER1/ AFTER2	-0.215**	-0.552***	-2.78	-5.2	0.005	0
SIZE	0.263*	0.400**	2.37	3.12	0.018	0.002
LEV	0.066	-0.203	0.32	-0.81	0.748	0.416
TobinQ	-0.052***	-0.043**	-4.34	-2.92	0	0.004
ROA	-0.79	-1.721**	-1.39	-2.46	0.163	0.014
SHRCR	0.003	0	1.31	0.11	0.19	0.915
AGE	-0.015**	-0.013*	-2.52	-1.89	0.012	0.059
cons	2.69	2.839	14.82	10.24	0	0
F	64.39/51.99					
Prob>F	0/0					
Adj-R²	0.2468/0.2518					
N	3096/2425					

Note: *, **, *** indicate significant at the 10%, 5%, and 1% (two-sided) levels respectively.

From the regression results in Table 4-6(T1), the regression coefficient of M&A with the technological innovation performance is 0.300, and the test is also passed when the significance level is 10%, which is considered that M&A has a significant positive effect on innovation performance, so it is concluded that the technological innovation performance will increase after M&A, which is consistent with the view of Hypothesis 2.

From the regression results in Table 4-6(T2), the regression coefficient of M&A with the technological innovation performance is 0.414, and the test is also passed when the significance level is 10%, which is considered that M&A has a significant positive effect on innovation performance, so it is concluded that the technological innovation performance will increase after M&A, which is consistent with the view of Hypothesis 2.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This paper focuses on the impact of corporate M&A on corporate performance and innovation. After specifically analyzing the regression results of the empirical test, the following research conclusions are obtained: Judging from the test results of Hypothesis 1 and Hypothesis 2, the empirical test based on the data of China's GEM listed companies shows that the M&A behavior of China's GEM listed companies in the past four years has had a positive impact on their own technological innovation performance. M&A is an important means of enterprise development, industry restructuring and optimization, and enterprise resource integration. This research shows that M&A with technology acquisition as the main motivation in recent years has played a positive role in the technological innovation performance.

Policy Recommendations

Paying attention to research the target company before M&A

Before the M&A, the M&A strategy should be selected and designed. The target enterprise should be consistent with the development prospects of the enterprise. Besides, when the enterprise chooses the M&A plan, they must take into account the matching of the main business, the complementarity of the enterprise resources and the optimization of the knowledge structure and so on. If the target company and the company have similarities in the main business, it can bring close knowledge and technical resources, which is more conducive to the integration of resources after the M&A, and also promotes the innovation capacities. The M&A strategy cannot be unclear, and it cannot be blindly acquired just in order to expand the scale of the enterprise.

Enhancing the resource integration effect after M&A

The success of M&A does not mean that the company can succeed in the resource integration stage after the M&A. Two companies that exist independently before should integrate smoothly into a whole after the completion of the M&A, and need to arrange the personnel of the target company, technology, equipment, brand, corporate culture and many other tangible and intangible resources reasonably, so that it can integrate into the whole as soon as possible. The hidden resources of enterprises have important significance for R&D, but the hidden resources are difficult to transfer and difficult to integrate. Therefore, both parties must cooperate with each other, do a good job of resource integration after M&A and expand their knowledge to create value for enterprises jointly, enhance the ability of enterprises to innovate, and increase investment in R&D.

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