

Article

Research on the Impact of Merges and Acquisition Type on the Performance of Listed Agricultural Enterprises—An Analysis of Mediator Effect Based on R&D Input

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Abstract: With the development of global economic integration, merges and acquisition has (M&A) increasingly become the main way to enhance the competitiveness of enterprises. Technological innovation plays an important role as an influential factor in the success of merges and acquisition. This research takes 120 merges and acquisition Enterprises of Chinese listed agricultural enterprises from 2009 to 2019 as the research sample, constructs the comprehensive performance evaluation model based on the factor analysis. And on the basis of the baseline regression model, R&D Input is introduced as an intermediate variable, PSM is used to control the endogenous problem. Through a series of robustness checks, we conclude that, different merges and acquisition types have various effects on the performance of listed agricultural enterprises. Horizontal M&A and vertical M&A have significantly positive effects on enterprise performance, while mixed M&A is negative. R&D Input plays a mediating role between merges and acquisition type and its impact on enterprise performance. Vertical M&A is clearer than horizontal M&A. At the same time, less R&D Input after mixed M&A gives rise to worse performance of agricultural enterprises.

Keywords: merges and acquisition type; listed agricultural enterprises; mediator effect; R&D Input



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1. Introduction

Merges and acquisition is a double-edged sword, focusing on whether market concentration is conducive to technological innovation and whether merges and acquisition can create value for the business buyer. Previous studies have found different results in terms of stock price response, firm performance, technological innovation and market reaction after the announcement of merges and acquisition. This is because empirical research and theoretical analysis are often based on different panel data and research perspectives, which can lead to conflicting conclusions [1]. Why does merges and acquisition cause a heated debate in management and economics? The main explanations are as follows: on the one hand, merges and acquisition can create value, mainly for merges and acquisition can improve the performance of the whole industry [2] as well as the management efficiency [3]; On the other hand, the value created by merges and acquisition is limited or even unsatisfactory, mainly as follows: the stock price is not satisfactory [4], the performance of merges and acquisition rises first and then falls [5], the effect of eva is not ideal [6], and the interest of shareholders is damaged [7], etc.

It is true that merges and acquisition, as a business activity under the market economy, has always played an important role in the globalization, which mainly comes from the internal needs of the business development, and merges and acquisition activities in turn affect the industrial structure, facilitating industrial upgrading and technological innovation [8]. However, with the deepening of research and continuous exploration of practice, scholars and businessmen at home and abroad realize that blind pursuit of merges and acquisition can not improve the competitiveness of enterprises, that is, merges and

acquisition has not achieved the desired effect. On the contrary, merges and acquisition often leads to a decline in benefits, decreased shareholders' interests, and a difficult of restructuring process.

Therefore, the latest research began to pay attention to the impact of merges and acquisition on the innovation of the two parties. On the one hand, it is affirmed that merges and acquisition is beneficial to technological innovation, and it is found that enterprises promote product and technological innovation through merges and acquisition from the perspectives of chemical industry [9], high and new technology [10], patent application volume [11], and resource complementarity [12]. On the other hand, questions are raised about the technological innovation caused by the market concentration resulting from merges and acquisition, which is mainly reflected in the low growth rate of the investment in innovation by the main acquirer [13]. It led to weak innovation capacity [14] and even other negative impact [15], causing firms to gradually slow down or even suspend the invest in R&D as they acquire resources through external merges and acquisition to increase market concentration. In general, although the research direction and research methods of scholars tend to be microcosmic gradually, after decades of research there is still no unified conclusion as they are limited by the sample time, region, and the industry, evaluation methods and the differences in the selection of evaluation indexes [16]. The researches are fragmented, and there is still a lot of space for expansion.

Then, for the agriculture with both risks and weaknesses,

- (1) Will the horizontal M&A model that owns the highest recognition at home and abroad also do well in agricultural enterprises?
- (2) Are there differences in the performance brought about by different M&A types?
- (3) Does it bring continuous technological innovation ability to the acquirer, and is there any heterogeneous impact on the R&D changes of different types of merges and acquisitions enterprises?
- (4) With different types of M&A and R&D investment, what further impact will it have on the performance of the company?

In view of this, this paper will use China's agricultural listed companies M&A data to analyze the above issues, and this paper will move from the theoretical point of view to the final empirical approach. First, this paper begins with the acquirer and its preferences, sorting out the research background and related literature of merges and acquisition. Secondly, we use factor analysis to construct the performance evaluation model in the first year after the merges and acquisition activity. On the basis of the baseline regression, it is the first attempt to introduce R&D Input as an mediator variable into the empirical analysis, which provides a new perspective to reveal the changes of R&D Input before and after different merges and acquisition types, and later result of the difference in performance in different merges and acquisition types.

2. Research Background and Literature Review

Due to the topography and weak development of mechanization, and the natural economy dominating the agricultural industry, it is difficult to carry out centralized and large-scale agricultural production, which restricts the development of agricultural industry. Under such conditions, agricultural enterprises should conform to the needs of current agricultural industrial structure adjustment and promote the transformation and upgrading of agricultural industry through scientific and technological innovation. Internal R&D and external merges and acquisition are two different ways for enterprises to acquire new technologies. However, internal R&D is often limited by funds, talents and time, probably leading to the result that product updates cannot keep up with the market demand, and enterprises lack the potential of development. Therefore, merges and acquisition has become a shortcut to realize rapid integration of resources and technological upgrading among enterprises.

By 2020, there are 4514 A-share enterprises listed in Shenzhen and Shanghai Stock Exchanges. 2948 merges and acquisition Enterprises account for 65.3 percent of the total.

There are 46,768 merges and acquisition events. Health-100, Haitong Securities, TUS-EST, Huawei Media Investment Corporation and Zhongnongfa Seed Industry Group ranked in the top five with the number of merges and acquisition. Among them, there are 174 agricultural listed enterprises, and 167 agricultural listed enterprises had merges and acquisition activities, accounting for 96.5% of the listed agricultural enterprises. The total number of merges and acquisition events is 6216, accounting for 13.29% of the merges and acquisition events in the last ten years (From CSMAR and RESSET). It shows that acquisition and reorganization are the necessary strategy in the development of a company and the merges and acquisition event of the listed agricultural enterprises is outstanding. Although China is a big agricultural country, we still suffer from the hit in the throat in agriculture, the basic and strategic core industry. Especially for the industrial chain, China's listed agricultural companies mainly concentrate in food manufacturing and food processing, in the the middle of the industry chain, which accounts for 66.09% (Table 1). The foreign agricultural listed companies are mainly concentrated in the upstream of the industrial chain of pesticides, fertilizers, and seeds, such as Monsanto, Syngenta, etc. Represented by seed industry, pesticide, therefore, the fundamental and strategic agricultural industry [17–19] presents development pattern with centralization, diversification, and internationalization, through the merger and reorganization of the world [20–22], while agricultural enterprise M&A cases are numerous in China, which mainly concentrated in the middle and downstream industries, fewer merges and acquisitions on the fundamental and strategic agricultural industry.

Table 1. Categorical data of Listed Agricultural enterprises in China in 2020.

Industry Name B—Stock Market Trading Sub-Bank	Food Manufacturing	Food Processing	Farming	Fishery	Animal Husbandry	Wood Processing and Bamboo, Rattan, Palm, Grass Products Industry	Services in Support of Agriculture, Forestry, Animal Husbandry and Fishery	Forestry	Total
number	61	54	20	10	16	7	2	4	174

In addition, on the one hand, the external risks of agriculture, affected by the unilateralism and the COVID-19, have intensified the instability in global agriculture. And agriculture has become a bargaining chip to balance bilateral economic and trade relations. On the other hand, agriculture is of weakness in its inside. Chinese food companies are five times as many as the United States food companies, but the total amount of food produced is only one sixth of that in the United States [23]. Obviously, it is essential to make further optimization and integration of agricultural enterprises, and for the leading enterprises to make use of merges and acquisition and restructure to effectively coordinate the industrial chain, improve industry concentration, expand market competitiveness. However, due to the late start in the merges and acquisition of agricultural enterprises in China and the immaturity of the corresponding merges and acquisition policies, market environment, theory and practice, there are a series of problems in the merges and acquisition of agricultural enterprises. Therefore, the corresponding scientific theory and empirical test are urgently needed to serve the development of agricultural enterprises in China.

At present, there are more and more research on merges and acquisition of listed agricultural enterprises. There are two kinds of literature related to this paper. One is the correlation between merges and acquisition and performance. The second one is the correlation between merges and acquisition and technological innovation.

The research of the relationship between merges and acquisition and performance is as follows. With the development of modern agriculture and agricultural marketization, agricultural enterprises usually choose mixed merges and acquisition to make diversified investment in other fields, in search of scale expansion and new profit growth [24]. This diversification strategy not only enables rapid expansion of existing enterprises, but also disperses the risks associated with uncertainty of agriculture. From the perspective of merges and acquisition performance, the researches mainly discuss the impact of merges

and acquisition on the performance of agricultural listed companies from the perspective of mixed and horizontal merges and acquisition [25–27], however, the research on the impact of merges and acquisition on the performance of agricultural enterprises from different types of merges and acquisition is rare and not well represented [28]. The reason mainly comes from the common problems of merges and acquisition and the restriction of the industry [29]. However, some scholars have put forward different opinions. For example, some industries such as poultry slaughtering and processing industry [30], grain industry [2], food processing industry [2], etc., promote productivity, industry concentration, expanding scale and ultimately promote the integration of agricultural industry through diversified (Mixed merges and acquisition), horizontal, vertical [2,31] and other merges and acquisition.

The research of the relationship between merges and acquisition and technology innovation are as follows. Existing studies show that merges and acquisition can significantly influence the technological innovation of the acquiring firm. First of all, the enterprise with stronger innovation ability tends to merges and acquisition [32]. Secondly, the merges and acquisition are conducive to the level of patent output, the number of citations per patent, and the subsequent innovation [33]. Finally, resources integration after merges and acquisition will bring technical scale effect and synergy effect, to enhance enterprise innovation performance [34], creating a virtuous circle.

In recent years, over 3.7 million enterprises are engaged in the agriculture and agricultural service industry (hereinafter referred to as “agriculture-related enterprises”) in China (enterprises are in operation, existing, moving in, and moving out) (Data from the professional version of Tianeye check). However, technological innovation growth does not happen with the rapid increase in the number of agricultural enterprises. At present, the proportion of agricultural high-tech enterprises is 4.9% [35], and the proportion of agricultural research funds in GDP is only 0.6%, which varies from 2% of the United States and member states in OECD, and 3% of Israel, South Korea, Japan, etc. (From the China Development Forum, the content of the meeting of Fan Shenggen, director of the International Food Policy Research Institute, in 2019). The transformation rate of agricultural scientific and technological achievements is only 30–40%, far lower than 70–80% in the United States and Japan and 90% in European Union countries [36]. Agricultural scientific and technological innovation is one of the most critical internal factors hindering the development of Chinese agriculture-related enterprises. Acquiring technology license through M&A is an effective way that has replaced buying technology to improve innovation ability and core competitiveness [37]. The vital function of technological merges and acquisition in the improvement of products and innovation ability of enterprises is noticed by more and more enterprises [38], especially horizontal mergers and acquisitions, higher technology correlation for both sides maximizes the promoting effect R&D Input to agriculture [23] and research and development achievements [39]. However, some scholars doubt that enterprise R&D investment will have negative or insignificant changes after M&A [40].

Through the study of literature, we found that researchers ignored one important factor, the impact of R&D Input in different types of merges and acquisition, which may led to the opposite conclusions in the performance studies on different types of merges and acquisition. Under different R&D Input, the type and performance of merges and acquisition may change. Therefore, previous studies on the performance of different merges and acquisition types have drawn different conclusions, which may be due to the neglect of R&D Input before and after merges and acquisition. For example, horizontal merges and acquisition with high R&D Input may be better than those with low R&D Input, while Mixed merges and acquisition with low R&D Input may perform worse than those with high R&D Input. When we do not consider the R&D investment before and after merges and acquisition and directly compare the different performance of different merges and acquisition types, we can not judge which merges and acquisition performance is better. This paper introduces R&D Input into the discussion of different types of merges and acquisition performance.

The main contributions of this paper are as follows: first, based on the background of transformation and upgrading of Chinese agricultural enterprises, this paper reveals the internal mechanism of merges and acquisition in agricultural enterprises through different ways of merges and acquisition such as horizontal increasing market concentration, vertical integration of supply chain, and mixed promotion of diversification. The paper puts forward that different types of merges and acquisition affect the performance of enterprises. Secondly, it introduces R&D as an mediator variable. It identifies the changes of R&D Input before and after different types of M&A, the mediator effect between merges and acquisition types and firm performance, and the correlation between merges and acquisition frequency, government subsidy, patent and agricultural firm performance. Thirdly, it put forwards that compared with the horizontal merges and acquisition mode favored by most scholars at home and abroad, vertical merges and acquisition has a more prominent performance in agricultural enterprises through R&D Input. It provides a new perspective for analyzing the mediator effect of R&D Input in different types of agricultural enterprises and a reference for the government to re-examine the merges and acquisition policy of agricultural enterprises.

3. Theoretical Analysis and Research Hypotheses

Merges and acquisition is a kind of business behavior that enables enterprises to merge through the replacement of assets or shares. This way can give full play to the resource allocation function of the micro market and enhance the market concentration, to improve the core competitiveness of enterprises. Therefore, enterprises gradually pay attention to and make use of it. As the demand for China's agricultural transformation and upgrading continues to increase, more and more Chinese agricultural enterprises are preparing to further ensure food security through merges and acquisition including horizontal market concentration, vertical integration of supply chains, mixing to diversification. And it can also facilitate the expansion in global and achieve global operation. This shows that the Chinese agricultural enterprises' merges and acquisition activity with domestic and foreign agricultural enterprises is in progress and has unlimited possibilities in the future.

3.1. Types of Merges and Acquisition and Enterprise Performance

Horizontal M&A: Based on the Market Power Theory, horizontal M&A is the most significant way to form market power, which increases the size and strength of the enterprise, forms scale management, enhances the industry core competitiveness, and profitability of the enterprise. The reference found that horizontal M&A can reduce disordered and vicious competition, and develop its synergistic effect and scale effect to obtain market power or monopoly [41]. The previous paper reveals that horizontal M&A shows good financial and innovation performance in empirical results, so it is favored by most enterprises.

Vertical M&A: through the cost comparison between external transactions and organizational management, the transaction cost theory puts forward the concept of enterprise boundary, which integrates the vertical M&A mode of enterprise merger in the production chain, promotes the vertical integration of different production and operation stages, and transforms external market transactions into internal transactions, which is conducive to reducing costs, improving production efficiency, and then improving shareholder value [42].

Mixed M&A: according to the diversification management theory, mixed M&A has both advantages and disadvantages to enterprise value. Welcomed by the capital market, it is helpful for the original industry to find new growth points and spread risks [43], while it also has problems of internal operation integration risks, excessive investment, and capital dispersion [44]. In the past decades, scholars at home and abroad have done a lot of studies on diversified M&A. Although there are controversies, the academic community held a negative attitude towards diversification after the 1980s [32].

In recent years, China has implemented industrial policies to support the development of listed agricultural companies, to realize professional operation, drive the upgrading of the agricultural industry and promote the industrialization of agriculture. For example,

in the capital listing market, the threshold for the listing of agricultural enterprises is low, but many listed agricultural enterprises in the name of developing agriculture have changed industries after raising a number of funds from the capital market. According to statistics, from 2000 to 2020, 68 listed agricultural enterprises changed their industry categories, accounting for 5.6% of the total number of listed enterprises. Among them, 11 are engaged in non-agricultural business, accounting for 6.3% and 16.18% of the total number of listed agricultural enterprises and the total number of industry categories of listed agricultural enterprises respectively. The main business types of change include real estate development, communication equipment, steel pressure, iron ore mining and selection, coal mining, other public facilities and services, daily chemicals, and so on. Based on the above analysis, the following hypotheses are proposed:

Hypothesis 1. *Different merges and acquisition types have various effects on the performance of listed agricultural enterprises. Horizontal M&A and vertical M&A have significantly positive effects on enterprise performance, while mixed M&A is negative.*

3.2. The Mediator Effect of R&D Input

Represented by horizontal and vertical, mergers and acquisitions will directly reduce the number of competitors [45,46], transferring resources to the superior enterprises rapidly, which will focus on core competitiveness. At the same time, the relative monopoly promotes the innovation of imitators. In the end, the enterprise will get monopoly profits and market forces by continuous innovation [47].

Gilbert and Newbery (1982) demonstrated that a relative monopoly after horizontal merges and acquisition encourages the acquirer to innovate continuously [48]. Due to the speciality of the industry chain in the agricultural industry, we believe that compared with horizontal merges and acquisition, the highly recognized model with abundant research at home [49–54], vertical merges and acquisition makes it possible for the chain integrity, systematic innovation and internal coordination of agricultural enterprises. And increasing R&D Input can further improve the overall efficiency of the innovation system. And the long-term acquisition of the core competitiveness of an enterprise will almost certainly lead to an increase in the overall efficiency of agricultural enterprises, which in turn will have an impact on R&D Input. As technology continues to stack up and upgrade, the agricultural industrial chain can extend and the added value of agricultural products will be promoted. Therefore, compared with horizontal merges and acquisition, vertical merges and acquisition can promote the increase of R&D Input of agricultural enterprises and further improve the financial performance of the acquirers. Based on the substitution effect, it is considered that the Mixed merges and acquisition has substitution effect on the internal R&D of agricultural enterprises. At present, a certain number of agricultural enterprises in China replace their main agricultural business through non-agricultural diversification strategy after listing, resulting in a wide gap between the core technologies of agricultural enterprises and target enterprises in the hybrid merger and acquisition, resulting in reduced enthusiasm for innovation of both sides, reduced investment in independent research and development, and inhibited the growth of enterprises' own research and development capabilities.

Therefore, we believe that the Mixed merges and acquisition will restrain the R&D Input of agricultural enterprises, which will result in the failure of the acquirers' performance to meet the original expectations. Based on the above analysis, the following hypotheses are proposed:

Hypothesis 2. *Different types of merges and acquisition will have different effects on the R&D Input of agricultural enterprises, in which horizontal merges and acquisition has a weak positive correlation with R&D Input, vertical merges and acquisition has a significant positive correlation with R&D Input, Mixed M&A is negatively correlated with R&D Input.*

Hypothesis 3. *Different types of merges and acquisition affect the performance of agricultural enterprises through R&D Input, and R&D Input plays a role as mediator. Compared with horizontal merges and acquisition, vertical merges and acquisition can promote acquirers' financial performance through R&D Input, Mixed merges and acquisition will further reduce the performance of the acquiring firm by R&D Input reduction of agricultural enterprises.*

4. Empirical Research Design

4.1. Data Source and Sample Selection

This paper takes the merges and acquisition cases from Listed Agricultural Enterprises as the research object. This is because this year's No. 1 central document made it clear that we need to accelerate the promotion of agriculture, and support enterprises to be integrated into the global agricultural supply chain. At the same time, it is also mentioned that we should adhere to the principle of self-reliance and self-improvement in agricultural science and technology and improve the support mechanism for fundamental research in the field of agricultural science and technology. This shows that agricultural modernization is agricultural scale production, and the core of agricultural scale is agriculture enterprization. It refers to promote the diversified achievement transformation of agricultural science and technology through improving scientific and technological innovation. The research sample of this paper is the merges and acquisition event of listed agricultural enterprises from 2009 to 2019. The actual sample starts from 2006 as this paper selects the data in lag period in model setting and sample matching. Based on the previous research [55], this paper screens out the merges and acquisition events as follows: (1) the main party is an agricultural enterprise; (2) if there are many merges and acquisition events in the same enterprise in the past ten years, the one with largest transaction value is taken as the research sample; (3) Because the content of this paper is the type of merges and acquisition, we only choose the horizontal, vertical and mixed merges and acquisition cases, excluding the assets adjustment, the change of the largest shareholder and other merges and acquisition events. After excluding, screening and sorting, the equilibrium panel data including 120 samples of listed agricultural enterprises in China over a period of 14 years are finally formed. It should be noted that this study does not include overseas merges and acquisition cases, and each sample selects financial data for a total of five years, the three years before the merges and acquisition, the year of the merges and acquisition and the year after the merges and acquisition. There is no merges and acquisition event in adjacent years, so there is no mutual interference between merges and acquisition effects. The types of merges and acquisition, transnational types, eva output rate and other basic merges and acquisition situations and patents used in this paper come from Guotai'an Database. The data of financial indicators related to R&D Input, merges and acquisition scale and industry performance are all from the Wind database, in which the industry is classified according to the classification standard of the secondary industry in the Wind database.

4.2. Measurement of Variables

4.2.1. Explained Variable

Enterprise Performance: referenced by the research of domestic and foreign scholars, this paper selects six aspects which most scholars pay attention to and use most commonly, including profitability, debt paying ability, running ability, growth ability, equity expansion ability and value creation ability. These are six aspects that can reveal the enterprise's situation best. They are used to measure how the acquirers' performance changes. Among them, profitability is the financial indicator that can most directly reflect the company's performance. In addition, EVA is introduced on the basis of the traditional performance evaluation index system. Compared with the traditional performance index, EVA output rate of total assets per unit and EVA output rate of net assets per unit are important tools to measure the value creation ability of enterprises [56–60]. The composition of the indicators of performance is shown in Table 2.

Table 2. The setting of performance indicator system.

Variable	Symbol	Indicator	Variable Number
Profitability	ROE	return on equity	X ₁
	ROA	return on total assets	X ₂
	EPS	earnings per share	X ₃
	NPM	net profit margin on sales	X ₄
Solvency	-	liquidity ratio	X ₅
Operating capacity	-	asset-liability ratio	X ₆
	-	total assets turnover	X ₇
Growth ability	-	increase rate of business revenue	X ₈
Ability of equity expansion	-	net asset value per share	X ₉
Ability of value creation	-	EVA output rate in unit total asset	X ₁₀
	-	EVA output rate in unit net assets	X ₁₁

4.2.2. Explanatory Variable

The explanatory variable is the type of merges and acquisition. The horizontal, vertical and Mixed merges and acquisition are adopted as the type of merges and acquisition [61].

4.2.3. Mediator Variable

R&D investment is one of the key factors that affect the innovation capability [62]. Most of the existing researches use R&D to measure the innovation of enterprises. This paper takes R&D Input as mediator variable, referencing other scholars, measuring the R&D Input by the ratio of R&D Input to revenue in each period [63,64].

4.2.4. Control Variable

This paper references the mainstream research at home and abroad, controlling the effects of listing years, firm size, asset-liability ratio, high-tech firms, government subsidies, etc. [65–68]. At the same time, the impact on the empirical results of variables related to the merges and acquisition is also controlled, such as share ratio, transaction scale, related transactions, cross-border merges and acquisition, asset restructuring, cross-provincial merges and acquisition [2,69,70].

The specific definitions of the variables are shown in Table 3.

Table 3. Definition and description of the variables.

Category	Symbol of the Variable	Name of the Variable	Definition of the Variables
Explained variable	performance	M&A performance	Use factor analysis method to calculate the comprehensive performance indicators, and select the following year after merges and acquisition as performance
Explanatory variable	horiz vertical mix	Horizontal M&A Vertical M&A Mixed M&A	Horizontal = “1” Vertical = “2” Mixed = “3”
Intermediate variable	rd	R&D expenses	Average R&D expenditure in the three years prior to merges and acquisition/ Average main business revenue in the three years prior to merges and acquisition

Table 3. Cont.

Category	Symbol of the Variable	Name of the Variable	Definition of the Variables
Control variable	age	listed years	Ln (the year of the merges and acquisition—the year when the company went public)
	size	Scale of enterprise	Ln enterprise's total assets at the end of the year
	sthld	Equity ratio	The proportion of equity owned by the acquirer
	mesize	Transaction size	Ln total price disclosed in the merges and acquisition transaction
	associate	associated transaction	If it is an associated merges and acquisition event (dummy variable, is = "1", no = "0")
	country	Cross border merges and acquisition	If it is a cross border merges and acquisition event (dummy variable, is = "1", no = "0")
	reorganize	Asset Restructuring	If it is a major assets restructuring (dummy variable, is = "1", no = "0")
	province	Cross-provincial merges and acquisition	If it is a cross-provincial merges and acquisition (dummy variable, is = "1", no = "0")
	hech	High-tech enterprise	If it is a high-tech enterprise (dummy variable, is = "1", no = "0")
	subsidy	Government subsidy	Ln government subsidies
	menum10	Number of merges and acquisition in 10 years	Number of merges and acquisition in 2009–2019

4.3. Model Building

Considering the factors of explanatory variables, intermediate variables and control variables, this paper makes a regression analysis on the impact of these three variables on the performance of agricultural enterprises:

$$performance_i = \beta_0 + \beta_1 M\&A_{type*i} + \sum control + \mu \quad (1)$$

$$rd_i = \beta_0 + \beta_1 M\&A_{type*i} + \sum control + \mu \quad (2)$$

$$performance_i = \beta_0 m\&A_{type*i} + \beta_2 rd_i + \sum control + \mu \quad (3)$$

Among this, $performance_i$ is the explained variable for the study, and $M\&A_{type}$ is the explanatory variables. rd_i is the intermediate variable, referring to R&D Input. $\sum control$ is the control variable. μ is the random perturbation for the study.

5. Empirical Results and Analysis

5.1. Factor Analysis

In this chapter, we will use the 11 financial indicators listed in Table 2 above to construct the factor analysis model of the enterprise performance. Before the factor analysis, KMO and Bartlett tests are performed to verify the feasibility of examining the factors. The value of KMO is 0.669, greater than 0.6. The Bartlett's test of sphericity gives a p value of 0.000, less than the significance level of 0.01. Therefore, the original hypothesis (Table 4 KMO and Bartlett test) is rejected. As is shown, the 11 financial indicators listed in Table 2 are proper to make factor analysis.

Table 4. KMO and Bartlett Tests.

KMO and Bartlett Tests		0.802
Bartlett Tests	Chi-square	9240.299
	degree of freedom	55
	p value	0.000

As can be seen from Table 5, a total of 2 principal components have characteristic roots greater than 1, so 2 common factors can be extracted from the original 11 indicators. The cumulative variance contribution rate is 0.653, more than 60%, which indicates that the variance of the two common factors can explain 65.3% of the total variance, which can reflect most of the information of 11 original indexes.

Table 5. Variables explaining the total variance.

Factor Number	Characteristic Root	Difference	Variance Contribution	Cumulative Variance Contribution
Factor 1	5.51936	3.85517	0.5018	0.5018
Factor 2	1.66419	0.7563	0.1513	0.653
Factor 3	0.90789	0.06424	0.0825	0.7356
Factor 4	0.84366	0.06188	0.0767	0.8123
Factor 5	0.78178	0.36666	0.0711	0.8834
Factor 6	0.41512	0.02203	0.0377	0.9211
Factor 7	0.39309	0.18561	0.0357	0.9568
Factor 8	0.20748	0.04545	0.0189	0.9757
Factor 9	0.16203	0.07597	0.0147	0.9904
Factor 10	0.08606	0.06671	0.0078	0.9982
Factor 11	0.01935		0.0018	1

According to Table 6, we can clearly see the enterprise performance indicators included in the two common factors. According to the index of larger load value, the factor of the matrix for rotated factor load is defined. Factor 1 has a greater load on return on equity, return on total assets, earnings per share, net profit margin rate on sales, net asset value per share, EVA output rate in unit total asset, and EVA output rate in unit net asset. Factor 2 has a greater load on current ratio, asset-liability ratio, total asset turnover ratio and growth rate of business income.

Table 6. Rotated component matrix.

Variable	Factor 1	Factor 2
X ₁	0.9006	
X ₂	0.9615	
X ₃	0.8811	
X ₄	0.7097	
X ₅		0.8341
X ₆		−0.7765
X ₇		−0.4958
X ₈		−0.2993
X ₉	0.5823	
X ₁₀	0.9594	
X ₁₁	0.8813	

According to Table 7, the two common factor scores of Factor 1 and Factor 2 are calculated respectively and substituted into the following formula, and take the final enterprise performance as the performance after the case M&A event occurs:

$$\text{performance} = (\text{Factor 1} \times 0.5018 + \text{Factor 2} \times 0.1513)/0.653$$

5.2. Empirical Analysis

5.2.1. Description of the Statistics

In order to eliminate the influence of the extreme value on the research, winsorize is applied to the continuous data at 1% and 99% percentile. According to the statistical results after winsorization (Table 8), there is no obvious outlier in the distribution of the maximum and minimum distribution of the variables, which satisfies the requirement of further regression analysis.

Table 7. Component score coefficient matrix.

Variable	Factor 1	Factor 2
X ₂	0.17242	−0.05405
X ₂	0.17777	−0.00244
X ₃	0.16726	−0.04041
X ₄	0.11953	0.10044
X ₅	−0.04561	0.48823
X ₆	−0.01586	−0.43406
X ₇	0.10768	−0.31843
X ₈	0.07708	−0.19644
X ₉	0.09813	0.08189
X ₁₀	0.18167	−0.04009
X ₁₁	0.16184	0.00738

Table 8. Descriptive statistical analysis.

	N	Mean	Std. Dev.	Median	Min	Max
performance	120	1.249	0.479	1.393	0.019	1.955
horiz	120	0.15	0.359	0	0	1
vertical	120	0.567	0.498	1	0	1
mix	120	0.283	0.453	0	0	1
rd	120	17.799	6.458	18.917	0	25.05
age	120	1.886	0.98	2.013	0	3.178
size	120	21.977	0.971	21.945	20.1	24.626
sthld	120	0.639	0.343	0.65	0	1
mesize	120	18.697	2.096	18.739	11.744	22.838
associate	120	0.325	0.47	0	0	1
country	120	0.117	0.322	0	0	1
reorganize	120	0.225	0.419	0	0	1
province	120	0.267	0.444	0	0	1
hech	120	0.392	0.49	0	0	1
subsidy	120	15.438	3.59	16.047	0	20.107

Table 8 shows the average value of enterprise performance is 1.249, the maximum value is 1.955, and the minimum value is 0.019, indicating that the overall performance of listed agricultural enterprises in China is not very high, and the good and bad are uneven. In addition, in the sample of this study, there are more vertical cases than mixed cases in the type of mergers and acquisitions in agricultural enterprises than horizontal cases. The minimum value of R&D expenditure is 0, and the maximum value is 25.05, indicating that enterprises are polarized in R&D expenditure. Some enterprises attach great importance to R&D, while others do not. In terms of other variables, the proportion of cross-border mergers and acquisitions is about 11.7%, which is smaller than that of inter-provincial mergers and acquisitions (26.7%), indicating that the proportion of listed agricultural enterprises in China entering the international market needs to be improved. The proportion of high-tech enterprises is less than 39.2%, and the government gives more subsidies to agricultural listed enterprises, indicating that the Chinese government is gradually increasing its emphasis on agricultural enterprises, but there is still a big gap with developed countries in the transformation of scientific and technological achievements.

5.2.2. Correlation Analysis

As can be seen from Table 9, the maximum correlation coefficient between the independent variables is not more than 0.8, which explains that there is no serious collinearity among the variables. As can be seen from the following table, According to the correlation test between enterprise performance and each explained variable, there is a significant positive correlation between enterprise performance and horizontal and vertical M&A, indicating that both horizontal and vertical M&A can have a positive effect on enterprise performance. Therefore, Hypothesis 1 is preliminarily verified by this analysis. In addition,

there is a positive correlation between performance and R&D expenditure, enterprise size and government subsidy, which means that the above indicators are conducive to the growth of enterprise performance. The number of M&A is positively correlated with listing years and enterprise size, but not with enterprise performance. The more government subsidies, the lower the tendency of mixed M&A, and the more R&D investment, the more inclined to horizontal M&A (horizontal and vertical), on the contrary, the more R&D investment, the lower the probability of mixed M&A. The number of mergers and acquisitions in ten years is positively correlated with listing years, enterprise size and inter-provincial MERGERS and acquisitions, which indicates that listing years, enterprise size and inter-provincial MERGERS and acquisitions will promote the number of mergers and acquisitions.

5.2.3. Different Effects on the Performance of Different Types of M&D

As can be seen from Table 10, the coefficient of horizontal merges and acquisition of agricultural enterprises is 0.309, the significance is at the level of 1%; the coefficient of vertical merges and acquisition is 0.415, also at the level of 1%, and the coefficient of final Mixed merges and acquisition is -0.724 , and at the level of 1%, it shows that horizontal and vertical merges and acquisition of agricultural enterprises have a significant effect on the performance of merges and acquisition, while Mixed merges and acquisition will reduce the performance of merges and acquisition. Therefore, Hypothesis 1 is verified that different types of merges and acquisition have different effects on the performance of listed agricultural enterprises, in which horizontal, vertical merges and acquisition and corporate performance are significantly positive, and mixed M&A and corporate performance are significantly negative.

5.2.4. The Difference of R&D Input Caused by Different Merges and Acquisition Types—Based on the Analysis of Mediator Effect

This part analyses the mediator effect of R&D Input and uses the R&D Input as intermediate variable. Previous research is referenced to construct the regression test [65].

In order to save space, this part is made up of three tables, according to the results from Table 11.

- (1) The coefficient of horizontal merges and acquisition to R&D Input is 2.395, which is significant at the level of 10%. In the model of the third line, horizontal merges and acquisition and R&D Input both have significant effect on merges and acquisition performance. The results show that R&D Input has mediator effects in the process of horizontal merges and acquisition promoting merges and acquisition performance. That is to say, after the horizontal merges and acquisition of agricultural enterprises, the increase of R&D Input will promote the improvement of enterprise performance.
- (2) The coefficient of vertical merges and acquisition to R&D Input is 2.232, which is significant at 10%. In the model of the third column the coefficient of vertical merges and acquisition and R&D Input to merges and acquisition performance is 0.349, which is more significant than horizontal merges and acquisition and R&D Input. To sum up, it is found that R&D Input has mediator effects in promoting performance in vertical merges and acquisition. That is, after the vertical merges and acquisition of Agricultural Enterprises, it increases the R&D Input, and the increase of R&D Input will in turn promote the enterprise performance. And compared with the current horizontal merges and acquisition model, the most recognized one at home and abroad, vertical merges and acquisition have more advantages through the continuous R&D Input after merges and acquisition for agricultural enterprises as they are influenced by the synergy and integrality of industrial chain.
- (3) The coefficient of mixed M&A on enterprise R&D Input is -4.437 , and the significance is at the level of 1%, indicating that the mixed M&A will further reduce the financial performance of the principal and the counterparty by reducing the R&D investment of agricultural enterprises.

Table 9. Correlation Analysis.

	Performance	Ma_Roa	Ma_Roe	Ma_Tobinq	Horiz	Vertical	Mix	Rd	Age	Size	Sthold	Mesize	Associate	Country	Reorganize	Province	Hech	Subsidy	Menu10
performance	1.000																		
ma_roa	0.456 ***	1.000																	
ma_roe	−0.04	0.513 ***	1.000																
ma_tobinq	0.445 ***	0.387 ***	0.119	1.000															
horiz	0.261 ***	0.248 ***	0.176 *	0.207 **	1.000														
vertical	0.462 ***	0.240 ***	−0.217 **	0.190 **	−0.480 ***	1.000													
mix	−0.715 ***	−0.460 ***	0.100	−0.373 ***	−0.264 ***	−0.719 ***	1.000												
rd	0.447 ***	0.326 ***	−0.122	0.308 ***	0.216 **	0.202 **	−0.393 ***	1.000											
age	−0.236 ***	−0.114	−0.051	−0.127	−0.173 *	0.011	0.125	−0.231 **	1.000										
size	0.233 **	0.037	−0.008	−0.024	0.017	0.119	−0.145	0.224 **	0.252 ***	1.000									
sthld	−0.019	0.123	0.075	0.251 ***	0.075	−0.033	−0.024	0.117	0.101	−0.047	1.000								
mesize	−0.014	0.111	0.139	0.104	−0.158 *	0.082	0.035	0.047	0.138	0.174 *	0.410 ***	1.000							
associate	−0.117	0.193 **	0.081	0.021	−0.042	−0.004	0.038	0.08	0.168 *	0.109	0.167 *	0.274 ***	1.000						
country	0.029	−0.015	0.007	0.03	0.065	0.056	−0.113	0.095	−0.026	0.159 *	0.108	0.149	−0.03	1.000					
reorganize	−0.110	0.068	0.07	−0.081	−0.170 *	0.028	0.104	−0.039	0.121	−0.044	0.264 ***	0.518 ***	0.436 ***	−0.009	1.000				
province	0.067	−0.008	0.031	−0.126	−0.042	0.033	−0.003	0.017	0.086	0.047	0.194 **	0.166 *	−0.016	−0.102	0.036	1.000			
hech	−0.023	0.074	−0.011	0.085	0.093	−0.022	−0.05	0.257 ***	−0.177 *	−0.216 **	0.038	−0.025	0.063	0.081	0.058	0.095	1.000		
subsidy	0.302 ***	0.076	−0.185 **	0.037	0.129	0.169 *	−0.288 ***	0.448 ***	−0.137	0.381 ***	0.010	0.003	−0.038	0.121	−0.078	0.052	0.151 *	1.000	
menu10	−0.042	−0.077	0.061	−0.064	−0.123	0.085	0.004	0.054	0.220 **	0.177 *	0.02	0.139	0.112	−0.079	−0.039	0.182 **	0.143	0.113	1.000

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. Baseline regression model.

	(1)	(2)	(3)
	Performance	Performance	Performance
horiz	0.309 *** (3.226)		
vertical		0.415 *** (4.825)	
mix			−0.724 *** (−7.974)
size	0.076 * (1.788)	0.079 * (1.732)	0.064 (1.425)
sthld	−0.051 (−0.344)	0.052 (0.380)	−0.042 (−0.326)
mesize	0.013 (0.529)	−0.002 (−0.110)	0.009 (0.606)
associate	−0.107 (−0.959)	−0.084 (−0.832)	−0.101 (−1.360)
country	−0.063 (−0.453)	−0.082 (−0.694)	−0.122 (−1.297)
reorganize	−0.028 (−0.216)	−0.090 (−0.836)	−0.002 (−0.024)
province	0.072 (0.661)	0.053 (0.521)	0.066 (0.747)
hech	−0.026 (−0.263)	0.021 (0.241)	−0.019 (−0.260)
subsidy	0.030 ** (2.318)	0.023 ** (2.092)	0.009 (0.907)
menum10	−0.007 (−0.632)	−0.012 (−1.574)	−0.007 (−1.294)
_cons	−1.059 (−1.130)	−0.960 (−1.002)	−0.165 (−0.180)
N	120	120	120
F	3.210	5.705	11.966
r2	0.185	0.314	0.558

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

According to the above analysis, the coefficient of horizontal merges and acquisition to R&D Input is 2.533, and vertical merges and acquisition to R&D Input is 2.232, both of which are significant at 10%. However, the coefficient of R&D Input of merges and acquisition is −4.437 and is significant at 1%. Therefore, if Hypothesis 2 is verified, different types of merges and acquisition will have different effects on R&D Input. Among them, horizontal merges and acquisition has a weak positive correlation with R&D Input, vertical merges and acquisition has a significant positive correlation with R&D Input, Mixed M&A is negatively correlated with R&D Input. If Hypothesis 3 is verified, different types of merges and acquisition affect the firm's R&D Input and the firm's performance, and R&D Input has partial mediator effect in the process. Compared with horizontal merges and acquisition, vertical R&D can improve the financial performance more, while Mixed merges and acquisition has a negative impact on the performance of enterprises, which is caused by the reduction of R&D Input. However, the negative impact of the Mixed merges and acquisition of agricultural enterprises on the performance of enterprises will be reduced by reducing the agricultural enterprises' R&D Input.

Table 11. Analysis of mediation effects based on different M&A types.

Type	(1) Performance			(2) Rd			(3) Performance		
	Horiz	Vertical	Mix	Horiz	Vertical	Mix	Horiz	Vertical	Mix
rd	0.309 *** (3.226)	0.415 *** (4.825)	−0.724 *** (−7.974)	2.533 ** (2.040)	2.232 ** (2.095)	−4.437 *** (−4.188)	0.226 ** (2.566)	0.349 *** (4.259)	−0.637 *** (−6.693)
size	0.076 * (1.788)	0.079 * (1.732)	0.064 (1.425)	0.903 (1.060)	0.931 (1.073)	0.840 (0.981)	0.046 (1.029)	0.051 (1.119)	0.048 (1.076)
sthld	−0.051 (−0.344)	0.052 (0.380)	−0.042 (−0.326)	1.868 (1.077)	2.579 (1.527)	2.039 (1.209)	−0.113 (−0.772)	−0.024 (−0.180)	−0.082 (−0.662)
mesize	0.013 (0.529)	−0.002 (−0.110)	0.009 (0.606)	0.237 (0.673)	0.135 (0.400)	0.199 (0.604)	0.005 (0.219)	−0.006 (−0.300)	0.005 (0.348)
associate	−0.107 (−0.959)	−0.084 (−0.832)	−0.101 (−1.360)	0.711 (0.543)	0.865 (0.662)	0.766 (0.614)	−0.130 (−1.258)	−0.109 (−1.167)	−0.117 (−1.599)
country	−0.063 (−0.453)	−0.082 (−0.694)	−0.122 (−1.297)	−0.820 (−0.417)	−0.897 (−0.472)	−1.164 (−0.623)	−0.036 (−0.307)	−0.055 (−0.547)	−0.099 (−1.209)
reorganize	−0.028 (−0.216)	−0.090 (−0.836)	−0.002 (−0.024)	−1.409 (−0.693)	−1.869 (−0.957)	−1.342 (−0.685)	0.019 (0.155)	−0.035 (−0.335)	0.024 (0.289)
province	0.072 (0.661)	0.053 (0.521)	0.066 (0.747)	−0.410 (−0.297)	−0.535 (−0.383)	−0.467 (−0.345)	0.085 (0.872)	0.069 (0.756)	0.075 (0.910)
hech	−0.026 (−0.263)	0.021 (0.241)	−0.019 (−0.260)	2.875 *** (2.694)	3.196 *** (2.956)	2.969 *** (2.791)	−0.121 (−1.359)	−0.073 (−0.907)	−0.077 (−1.130)
subsidy	0.030 ** (2.318)	0.023 ** (2.092)	0.009 (0.907)	0.662 *** (3.095)	0.637 *** (3.081)	0.544 *** (2.867)	0.008 (0.567)	0.004 (0.383)	−0.001 (−0.122)
menum10	−0.007 (−0.632)	−0.012 (−1.574)	−0.007 (−1.294)	−0.077 (−0.927)	−0.116 (−1.554)	−0.086 (−1.333)	−0.004 (−0.456)	−0.009 (−1.273)	−0.006 (−1.055)
_cons	−1.059 (−1.130)	−0.960 (−1.002)	−0.165 (−0.180)	−18.164 (−1.037)	−17.629 (−0.977)	−12.687 (−0.695)	−0.458 (−0.470)	−0.438 (−0.462)	0.084 (0.096)
N	120	120	120	120	120	120	120	120	120
F	3.210	5.705	11.966	4.147	4.445	7.576	6.190	8.619	12.965
r2	0.185	0.314	0.558	0.277	0.286	0.340	0.343	0.439	0.609

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2.5. Endogenetic Test

Different merger and acquisition methods are very heterogeneous, and it is difficult to have completely consistent effects. Second, listed enterprises can choose to implement a manner of mergers and acquisitions. As a result, the way for enterprises to choose what kind of mergers and acquisitions provides a “natural experiment”. In order to handle the problems of endogenous choice, this paper uses PSM to match samples for different ways of M&A of company, to a greater extent, control the choice effect of different ways of mergers and acquisitions, reduce selective bias, and endogeneity problems.

First, calculate the pscore and establish a regression model. The dependent variable is a binary dummy variable, 1 is the treatment group, 0 is the control group, and the independent variable is a number of indicators to evaluate the similarity of the two groups. According to this, calculate the probability of each enterprise becoming the treatment group, which is the pscore. Secondly, match the treatment group and the control group according to the pscore. The commonly used nearest neighbor matching was selected in this paper. According to the pscore, match the group with the smallest absolute difference and the nearest neighbor between the treatment group and the control group. In the control group, retain the samples with similar characteristics to the treatment group and remove the samples with large differences in characteristics from the treatment group. Then, conduct the regression analysis again.

In order to save space, Table 12 is made up of three tables. In Model 1, the performance of horizontal and vertical merges and acquisition are both positively significant at 1%, and the vertical merges and acquisition is negatively significant at 1%. In Model

2, the performance of horizontal and vertical merges and acquisition are both positively significant at 5%, and the vertical merges and acquisition is negatively significant at 1%. In Model 3, the type of merges and acquisition of agricultural enterprises has mediator effect on their performance through R&D Input, and the R&D Input of both horizontal merges and acquisition and vertical merges and acquisition are positively significant at 1%. And with the increase of R&D Input, the performance of horizontal and vertical merges and acquisition is positively still significant at 1%, while the R&D Input of Mixed merges and acquisition is not significant. When R&D Input is added as intermediate variable, the performance of Mixed merges and acquisition is still negatively significant at 1%. It can be seen that the main results shown in Table 10 are consistent with the previous empirical conclusions, indicating the robustness of the results of this study.

Table 12. Endogenetic test.

Type	(1) Performance			(2) Rd			(3) Performance		
	Horiz	Vertical	Mix	Horiz	Vertical	Mix	Horiz	Vertical	Mix
rd	0.311 ** (2.284)	0.349 *** (3.788)	−0.690 *** (−7.382)	2.545 * (1.741)	1.991 * (1.702)	−4.215 *** (−3.730)	0.222 * (1.963)	0.296 *** (3.386)	−0.632 *** (−6.067)
size	0.148 (1.468)	0.060 (1.390)	0.095 (1.603)	1.027 (0.789)	0.626 (0.724)	2.216 ** (2.576)	0.112 (1.473)	0.044 (1.050)	0.065 (0.968)
sthld	−0.083 (−0.327)	0.080 (0.562)	−0.054 (−0.350)	1.530 (0.542)	2.590 (1.416)	3.314 * (1.892)	−0.136 (−0.615)	0.011 (0.080)	−0.099 (−0.640)
mesize	0.075 * (1.977)	0.005 (0.210)	0.014 (0.820)	−0.086 (−0.142)	0.367 (1.035)	0.265 (0.672)	0.078 ** (2.508)	−0.005 (−0.210)	0.011 (0.594)
associate	−0.090 (−0.400)	−0.111 (−1.309)	−0.117 (−1.075)	−0.844 (−0.459)	0.379 (0.260)	0.996 (0.620)	−0.060 (−0.324)	−0.121 (−1.469)	−0.131 (−1.188)
country	−0.183 (−0.979)	−0.079 (−0.687)	0.050 (0.507)	−2.693 (−1.076)	−1.067 (−0.558)	2.789 ** (2.282)	−0.089 (−0.551)	−0.051 (−0.509)	0.012 (0.123)
reorganize	0.221 (0.852)	−0.090 (−0.816)	−0.024 (−0.217)	3.586 (0.981)	−2.693 (−1.304)	−2.378 (−1.118)	0.096 (0.452)	−0.019 (−0.176)	0.009 (0.087)
province	0.195 (1.392)	0.151 (1.647)	0.111 (0.957)	1.611 (0.564)	−0.253 (−0.174)	0.744 (0.501)	0.139 (0.919)	0.157 * (1.948)	0.101 (0.912)
hech	0.094 (0.635)	0.012 (0.143)	0.017 (0.192)	4.002 ** (2.272)	3.115 *** (2.745)	3.671 *** (2.979)	−0.045 (−0.315)	−0.070 (−0.898)	−0.034 (−0.387)
subsidy	−0.137 ** (−2.443)	0.014 (1.265)	0.008 (0.749)	−0.566 (−0.714)	0.652 *** (2.818)	0.493 ** (2.470)	−0.117 ** (−2.469)	−0.004 (−0.331)	0.001 (0.091)
menum10	0.021 (1.548)	−0.007 (−0.893)	−0.009 (−1.280)	−0.106 (−0.456)	−0.114 (−1.358)	−0.147 * (−1.817)	0.025 * (1.846)	−0.004 (−0.562)	−0.007 (−1.039)
_cons	−1.167 (−0.635)	−0.533 (−0.620)	−0.958 (−0.750)	5.008 (0.158)	−14.952 (−0.812)	−44.417 ** (−2.373)	−1.341 (−0.871)	−0.139 (−0.164)	−0.350 (−0.248)
N	45	109	92	45	109	92	45	109	92
F	2.426	3.687	11.206	1.407	4.021	6.801	2.912	6.781	10.817
r2	0.362	0.282	0.571	0.240	0.253	0.464	0.490	0.405	0.590

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2.6. Further Analysis and Robustness Check

In order to verify the robustness of the results, in this part, ROA of one year after merges and acquisition subtracts the ROA of the year prior to merges and acquisition to measure the performance of merges and acquisition [71,72]. It is done respectively in horizontal, vertical and Mixed merges and acquisition. And the results shows that the performance measured by ROA are consistent with the previous conclusions. A higher Tobin Q ratio indicates higher excess returns, which enables the firm to obtain greater market power and excess profits [73]. Therefore, the difference between Tobin Q one year after merges and acquisition and the one year before merges and acquisition is used to measure horizontal, vertical and Mixed merges and acquisition performance [74]. The

result is consistent with the above. In order to save space, Tables 13 and 14 of this section are compiled from 3 tables respectively.

Table 13. Robustness test based on ROA.

Type	(1) Ma_Roa			(2) Rd			(3) Ma_Roa		
	Horiz	Vertical	Mix	Horiz	Vertical	Mix	Horiz	Vertical	Mix
rd	0.033 ** (2.517)	0.025 ** (2.451)	−0.053 *** (−4.994)	2.533 ** (2.040)	2.232 ** (2.095)	−4.437 *** (−4.188)	0.028 ** (2.279)	0.020 * (1.949)	−0.047 *** (−4.167)
							0.002 *** (3.162)	0.002 *** (3.003)	0.001 ** (2.022)
size	0.001 (0.130)	0.001 (0.206)	−0.000 (−0.005)	0.903 (1.060)	0.931 (1.073)	0.840 (0.981)	−0.001 (−0.283)	−0.001 (−0.203)	−0.001 (−0.267)
sthld	0.006 (0.327)	0.015 (0.881)	0.009 (0.569)	1.868 (1.077)	2.579 (1.527)	2.039 (1.209)	0.002 (0.111)	0.010 (0.539)	0.006 (0.387)
mesize	0.003 (0.955)	0.002 (0.650)	0.003 (1.042)	0.237 (0.673)	0.135 (0.400)	0.199 (0.604)	0.003 (0.810)	0.002 (0.546)	0.003 (0.914)
associate	0.020 * (1.783)	0.022 ** (2.028)	0.021 ** (2.219)	0.711 (0.543)	0.865 (0.662)	0.766 (0.614)	0.018 * (1.665)	0.020 * (1.870)	0.020 ** (2.083)
country	−0.012 (−1.176)	−0.012 (−1.532)	−0.016 * (−1.890)	−0.820 (−0.417)	−0.897 (−0.472)	−1.164 (−0.623)	−0.010 (−1.099)	−0.010 (−1.385)	−0.014 * (−1.797)
reorganize	−0.007 (−0.507)	−0.013 (−1.033)	−0.007 (−0.601)	−1.409 (−0.693)	−1.869 (−0.957)	−1.342 (−0.685)	−0.004 (−0.288)	−0.009 (−0.695)	−0.005 (−0.437)
province	−0.002 (−0.250)	−0.004 (−0.394)	−0.003 (−0.354)	−0.410 (−0.297)	−0.535 (−0.383)	−0.467 (−0.345)	−0.002 (−0.164)	−0.003 (−0.294)	−0.003 (−0.294)
hech	0.006 (0.659)	0.010 (1.063)	0.008 (0.858)	2.875 *** (2.694)	3.196 *** (2.956)	2.969 *** (2.791)	−0.000 (−0.003)	0.003 (0.353)	0.004 (0.428)
subsidy	0.001 (0.442)	0.001 (0.330)	−0.001 (−0.480)	0.662 *** (3.095)	0.637 *** (3.081)	0.544 *** (2.867)	−0.001 (−0.420)	−0.001 (−0.550)	−0.001 (−1.002)
menum10	−0.001 (−1.106)	−0.002 * (−1.862)	−0.001 * (−1.686)	−0.077 (−0.927)	−0.116 (−1.554)	−0.086 (−1.333)	−0.001 (−0.982)	−0.001 (−1.560)	−0.001 (−1.488)
_cons	−0.075 (−0.781)	−0.069 (−0.748)	−0.009 (−0.108)	−18.164 (−1.037)	−17.629 (−0.977)	−12.687 (−0.695)	−0.034 (−0.377)	−0.030 (−0.361)	0.008 (0.102)
N	120	120	120	120	120	120	120	120	120
F	2.329	2.482	7.563	4.147	4.445	7.576	3.870	5.369	7.967
r2	0.133	0.141	0.292	0.277	0.286	0.340	0.201	0.205	0.315

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 14. Robustness test based on Tobin Q.

Type	(1) Ma Tobinq			(2) Rd			(3) Ma Tobinq		
	Horiz	Vertical	Mix	Horiz	Vertical	Mix	Horiz	Vertical	Mix
rd	0.671 ** (2.142)	0.690 ** (2.561)	−1.302 *** (−4.742)	2.533 ** (2.040)	2.232 ** (2.095)	−4.437 *** (−4.188)	0.478 * (1.682)	0.528 ** (2.044)	−1.057 *** (−3.609)
							0.076 *** (2.991)	0.072 *** (2.992)	0.055 ** (2.263)
size	−0.014 (−0.096)	−0.007 (−0.051)	−0.034 (−0.231)	0.903 (1.060)	0.931 (1.073)	0.840 (0.981)	−0.083 (−0.641)	−0.075 (−0.590)	−0.080 (−0.615)
sthld	1.178 ** (2.298)	1.378 *** (2.818)	1.216 ** (2.429)	1.868 (1.077)	2.579 (1.527)	2.039 (1.209)	1.035 ** (2.031)	1.191 ** (2.429)	1.103 ** (2.239)
mesize	0.146 * (1.673)	0.117 (1.474)	0.137 * (1.881)	0.237 (0.673)	0.135 (0.400)	0.199 (0.604)	0.128 * (1.712)	0.108 (1.553)	0.126 * (1.940)
associate	0.110 (0.333)	0.154 (0.490)	0.124 (0.416)	0.711 (0.543)	0.865 (0.662)	0.766 (0.614)	0.056 (0.180)	0.091 (0.307)	0.082 (0.284)
country	−0.353 (−1.034)	−0.380 (−1.164)	−0.456 (−1.376)	−0.820 (−0.417)	−0.897 (−0.472)	−1.164 (−0.623)	−0.291 (−0.947)	−0.315 (−1.049)	−0.392 (−1.268)

Table 14. Cont.

Type	(1) Ma Tobinq			(2) Rd			(3) Ma Tobinq		
	Horiz	Vertical	Mix	Horiz	Vertical	Mix	Horiz	Vertical	Mix
reorganize	−0.899 *	−1.025 **	−0.869 *	−1.409	−1.869	−1.342	−0.791 *	−0.890 *	−0.796 *
	(−1.811)	(−2.144)	(−1.820)	(−0.693)	(−0.957)	(−0.685)	(−1.676)	(−1.952)	(−1.746)
province	−0.691 **	−0.726 **	−0.705 **	−0.410	−0.535	−0.467	−0.659 **	−0.688 **	−0.680 **
	(−2.234)	(−2.344)	(−2.400)	(−0.297)	(−0.383)	(−0.345)	(−2.407)	(−2.506)	(−2.539)
hech	0.350	0.440	0.371	2.875 ***	3.196 ***	2.969 ***	0.130	0.209	0.208
	(1.147)	(1.511)	(1.407)	(2.694)	(2.956)	(2.791)	(0.460)	(0.759)	(0.795)
subsidy	0.005	−0.004	−0.030	0.662 ***	0.637 ***	0.544 ***	−0.046	−0.050	−0.060
	(0.083)	(−0.074)	(−0.556)	(3.095)	(3.081)	(2.867)	(−0.785)	(−0.878)	(−1.070)
menum10	−0.023	−0.034	−0.025	−0.077	−0.116	−0.086	−0.017	−0.025	−0.020
	(−0.873)	(−1.486)	(−1.292)	(−0.927)	(−1.554)	(−1.333)	(−0.749)	(−1.248)	(−1.108)
_cons	−2.415	−2.250	−0.808	−18.164	−17.629	−12.687	−1.026	−0.974	−0.110
	(−0.788)	(−0.734)	(−0.251)	(−1.037)	(−0.977)	(−0.695)	(−0.358)	(−0.348)	(−0.037)
N	120	120	120	120	120	120	120	120	120
F	2.316	2.198	5.306	4.147	4.445	7.576	3.954	2.966	5.173
r2	0.175	0.200	0.283	0.277	0.286	0.340	0.255	0.271	0.320

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6. Discussion

Based on 120 cases of M&A events listed on the Shenzhen agriculture from 2009 to 2019 as the research sample, this paper compares the before and after M&A performance of acquiring firm to verify the differences between enterprises' performances that the different merges and acquisition types bring. And verify the changes before and after the R&D Input on different types of M&A and the mediator effect between the M&A type and enterprise performance. The study found that,

- (1) From the perspective of M&A ratio, the similarity and integration of agricultural enterprise resources make up for the difference and asymmetry of enterprise resources. Agricultural enterprises' mergers and acquisitions fulfill cooperation, opening, and integration through technology, products, marketing, supply chain coordination, which indirectly confirms although agricultural listed companies are not many, they accounted for a large proportion in China's M&A cases.
- (2) From the perspective of M&A type, the horizontal and vertical related M&A mode can effectively promote the performance of agricultural enterprises because of its better resource similarity and integration; on the contrary, the Chinese government takes a variety of measures to provide a number of preferential policies for agricultural listed enterprises, but some agricultural enterprises carry out anti-agricultural mergers and acquisitions after listing, which not only leads to excessive decentralization of agricultural enterprises' operations but also inhibits the subsequent financial performance to a certain extent.
- (3) From the perspective of R&D Input, when agricultural enterprises choose horizontal and vertical modes of MERGER and acquisition, R&D Input significantly affects the decision of enterprise merger and acquisition type, and can effectively improve the subsequent financial performance. In general, the two present a positive cycle of mutual promotion. The research also found that because of the particularity of the agricultural industry, vertical M&A has more advantages in chain integrity, coordination and systematicness than the current mainstream horizontal M&A, and has a stronger integration with the whole agricultural industry chain. Therefore, in order to maintain the efficient operation of the chain, agricultural enterprises have the ability to compete with the domestic and foreign markets, and will continue to invest in r&d and innovation output after the vertical merger. On the contrary, the R&D expenditure of agricultural enterprises after hybrid MERGER and acquisition is reduced because the core products of the acquirer and the acquirer are far different in

technology. Therefore, it can be seen that the hybrid merger and acquisition not only damages the internal innovation of agricultural enterprises, but also adversely affects the long-term competitive advantage of agricultural enterprises.

In recent years, some Chinese companies have put many unrelated enterprises together, regardless of their fields. Quantity without quality leads to diseconomy. The above Tables 9 and 10 indicate the relationship between the number of mergers and acquisitions and enterprises' performance is insignificant. However, overmuch mixed mergers and acquisitions lead to management chaos, lack of funds, and inefficiency.

7. Conclusions and Suggestion

7.1. Conclusions

At present, although studies on the relationship between agricultural M&A and performance have been conducted, relevant studies are mainly conducted from a cyclical perspective, ignoring the differentiation of M&A types and the mediating role of R&D investment in the relationship between M&A types and enterprise performance. In this paper, based on the existing literature, based on the transverse of market concentration, vertically integrated supply chain, mix to promote diversified these three kinds of merger and acquisition modes, types of M&A analysis for current agricultural listed companies as well as R&D spending changes before and after the merger and acquisition of different types, finally, it is concluded that after "M&A type + intermediary variable" test the performance of main and side.

Different merges and acquisition types have various effects on the performance of listed agricultural enterprises. Horizontal M&A and vertical M&A have significantly positive effects on enterprise performance, while mixed M&A is negative.

- Different merges and acquisition types have different effects on R&D Input of agricultural enterprises. Horizontal M&A is weak positive correlation with R&D Input, vertical M&A is positively correlated with R&D Input, and mixed M&A is negatively correlated with R&D Input.
- Different merges and acquisition types affect enterprise performance through influencing R&D Input which plays a partial mediating role. Among them, vertical M&A can promote the financial performance of the master merger more through R&D investment than horizontal M&A, while hybrid M&A can further reduce the financial performance of the master merger by reducing the R&D Input of agricultural enterprises.

7.2. Suggestion

- (1) Drive the high-quality development of agricultural enterprises with scientific and technological innovation. The government and agricultural enterprises, as policy directors and market participants, should realize that self-reliance in Chinese agricultural science and technology is important and pay full attention to the positive effect of scientific and technological innovation on the performance of agricultural enterprises. On the one hand, this paper suggests that while strengthening core and key technologies, Chinese agricultural enterprises should actively explore external ways to acquire innovation resources and capabilities, and gradually realize the transformation from relying on secondary innovation to original innovation leading. At the same time, under the condition of incomplete information, the leading and coordinating party should combine the internal correlation between the technical resources of the target party and the enterprise's own technology and products. On the other hand, the empirical study finds that government subsidies can effectively improve the performance of enterprises and promote the occurrence of horizontal and vertical M&A events. In recent years, China's investment in agricultural scientific and technological progress has been increasing, especially because the support for enterprises' technological innovation ability has been significantly improved. However, the original intention of the policy was to promote the R&D leverage effect of agricultural

enterprises rather than to form subsidy dependence. Improper government subsidies may hinder the free flow of factor resources and destroy market fairness. Therefore, in the process of subsidies, the government should implement process supervision and clearly mark the source of funds after mergers and acquisitions, and gradually take the performance of government R&D subsidies and enterprises' subsequent R&D output as the basis for policy improvement.

- (2) Choose right M&A model. The motivation of merger and acquisition of the acquiring firm determines the way and strength of integration. Agricultural enterprises should give full consideration to the relevant driving factors before M&A. If it is only for the consideration of diversification strategy or anti-agriculture, such mixed merger and acquisition mode may only bring short-term effects. Therefore, from the perspective of long-term performance, related mergers and acquisitions should be emphasized. First of all, the core agricultural industry as the focus of related mergers and acquisitions, the implementation of the agricultural industry chain operation strategy, the acquisition of innovative output, and enterprise performance will be more obvious. The empirical results show that agricultural enterprise horizontal M&A has a significant positive effect on promoting the performance of principal and partner, but the performance of vertical M&A is more significant when the mediating effect of R&D Input is included, which is mainly attributed to the synergism and integration of agricultural enterprise-related M&A itself. Secondly, agricultural enterprises should fully consider the synergy between relevant suppliers and demands before choosing vertical M&A. According to relevant experience, in actual M&A activities, agricultural enterprises usually have distinct industrial chain characteristics. In vertical M&A, farming and breeding, processing, logistics, and sales are usually included in the mergers and acquisitions of planting and animal husbandry.

With the transformation and upgrading of Chinese traditional agriculture, agricultural enterprises gradually pay attention to the importance of industrial chain integrity, and the advantage of vertical mergers and acquisitions will become clearer in agricultural listed companies. It not only is able to offer a degree of China's food safety but also can compete with international agricultural companies which constantly infiltrate our country's agriculture industry chain.

7.3. Limitation

This paper explores the relationship between R&D Input in M&A types and agricultural enterprises performance, but there are still some limitations, which need to be further improved in subsequent studies: (1) Due to the small sample size of mergers and acquisitions of listed agricultural enterprises, and the need to exclude asset restructuring, overseas mergers and acquisitions and other types of mergers and acquisitions in the research process, the limitation of sample size may affect the final conclusion of this study; (2) Although the number of agricultural enterprises is small, they cover many secondary industries such as planting industry, food processing industry, food manufacturing industry, agriculture, forestry, animal husbandry, and fishery, etc. Therefore, further discussion on the classification of samples is limited; (3) In this paper, R&D investment is taken as the intermediary, and corresponding indicators such as new product investment can be further considered when the data is available; (4) Although different acquisition methods are analyzed in this paper, the common factors summarized in the factor analysis do not necessarily include all the initial financial indicators selected in this paper, which may be omitted, which will have a slight impact on the final result. We will continue to improve our model and further analyze its mechanism.

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