Analysis of the Impact of M&A Goodwill on a Firm's Total Factor Productivity

-- Empirical Evidence from Panel Data of Chinese Listed Companies

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Abstract. Using A-share listed companies in Shanghai and Shenzhen from 2008 to 2020 as the original sample, this paper focuses on the impact of M&A goodwill and on the total factor productivity of firms, so as to gain an in-depth understanding of the profound effect of M&A goodwill on firms. The main findings of this paper are: (1) M&A goodwill is negatively related to total factor productivity, i.e., it significantly reduces the total factor productivity of firms. (2) The mechanisms by which M&A goodwill affects firms' total factor productivity are: first, M&A goodwill changes asset allocation decisions, and second, it increases firms' executive compensation and Over-indebtedness. The research in this paper is based on a new perspective of M&A goodwill, which enriches and extends the micro foundations of total factor productivity theory. It also provides a detailed empirical analysis of the association between M&A goodwill and corporate total factor productivity from the perspective of listed companies as a whole, which is innovative. The further analysis of the relevant reasons remedies the lack of understanding of this aspect in the previous literature. In addition, the findings of this paper provide reflections and policy implications from three perspectives: firms themselves, regulators and investors.

Keywords: M&A Goodwill; Total Factor Productivity; Executive Compensation; Over-indebtedness.

1. Introduction

The 19th Party Congress report on the implementation of the "new development concept, the construction of a modern economic system". This is the first time in a series of important documents of our Party Congress that we propose to improve total factor productivity. Total factor productivity is usually interpreted as the "surplus" in total output that cannot be explained by factor inputs. This surplus is generally referred to as Total Factor Productivity (hereinafter referred to as TFP), which reflects the essence of productivity as an economic concept. [1] In today's rapid development of science and technology, the comprehensive index of total factor productivity plays an increasingly important role in China's social and economic development. At the same time, enterprises, as important micro-economic subjects, are the key to improve total factor productivity.

Goodwill can generally be divided into two parts, one is the subjective judgment of people, such as the recognition of the company's value by customers and employees, the company's cultural value concept, and the company's brand effect, all of which will form goodwill, and these parts are often difficult to quantify specifically; the second is the measurement of goodwill through accounting, according to the "Accounting Standard for Enterprises No. 20" issued by China's Ministry of Finance in 2006 --Business Combination" issued by the Ministry of Finance of China in 2006: "The difference in the fair value of the share of identifiable net assets of the acquiree acquired in a business combination not under common control shall be recognized as goodwill". With the increasing activity of mergers and acquisitions of listed companies in China's capital market, goodwill has become an important item in a company's balance sheet, which has a certain impact on the company's information disclosure, financing, investment decisions and corporate innovation.

Most of the current academic studies around total factor productivity and M&A goodwill do not directly focus on the impact of M&A goodwill of listed companies on the full range of corporate factors. Therefore, it triggers the next thought: what relationship exists between M&A goodwill and

total factor productivity of firms, and what are the reasons for this relationship? And what are the implications?

This paper selected all A-share listed companies in Shanghai and Shenzhen from 2008 to 2020 as the research sample through empirical analysis to obtain the conclusion that M&A goodwill significantly reduces the total factor productivity of enterprises, and proposed a mechanism analysis that may cause a negative correlation. Compared with the previous studies, the possible innovations and marginal contributions of this paper mainly lie in the following: first, the existing literature has done the test only in the scope of a certain industry (such as manufacturing), while this paper expands the sample, increases the sample diversity, and empirically analyzes the relationship between M&A goodwill and enterprise total factor productivity from the perspective of the whole industry of listed companies, which has a certain reference value; second, the possible causes of this relationship are Second, we analyze the mechanism of the possible causes of this relationship, which makes up for the lack of understanding in this area in the previous literature. Third, this paper enriches and extends the micro aspects of the total factor productivity theory based on a new perspective of M&A goodwill.

The subsequent structure of this paper is organized as follows: the second part is a review of the relevant literature and the formulation of the theoretical hypotheses; the third part introduces the data sources and research design of this paper; the fourth part presents the basic empirical results; the fifth part provides further mechanism discussions; and finally, the concluding remarks and policy implications of the whole paper.

2. Literature Review and Theoretical Hypothesis

Different scholars hold different views and conclusions about the impact brought by M&A goodwill on firm value, which can be broadly divided into two views: M&A goodwill has a facilitating/inhibiting effect on firm value. Fu Chao et al. (2016) used all A-share listed companies that had goodwill presented in their financial statements from 2007-2013 in China as the initial sample, and used multiple regression analysis to conclude that M&A goodwill of Chinese listed companies can bring excess returns to firms; while Lv Zhonghong and Fan Simeng (2016) selected the 2009-2014 Shanghai and Shenzhen A-share listed companies in Shanghai and Shenzhen from 2009 to 2014 as the study sample, and concluded that M&A goodwill would promote the growth of corporate performance. Unlike the former, Zhang, Ji and Meng (2021) selected the data of listed companies in Shanghai and Shenzhen A-shares in 2019 for their empirical study. Their findings indicate that: M&A goodwill and gearing show a negative correlation with firm value, while Wang Hongyu and Lv Huan (2021) reach a similar conclusion by selecting firms with goodwill in the closing consolidated statements of GEM listed companies from 2011 to 2017 as their research sample and conclude that M&A goodwill has a negative correlation with firm performance in all three periods. In fact the reason for the completely opposite conclusions may be that goodwill affects firm performance through different pathways and its conclusions may be completely different.

Abroad, a number of studies in the literature have similarly demonstrated the importance attached to the outcome profile of listed companies after the formation of goodwill. Maria Elena Olante (2013) studied the relationship between excess M&A and goodwill impairment using a sample of M&A data from 929 US firms and concluded that M&A characteristics are strong indicators of goodwill impairment. Giner & Pardo (2014) explored the factors influencing goodwill recognition and its subsequent measurement, Ranti (2018) studied the impact of M&A goodwill on financial performance based on Nigerian bank data from 2012-2016 and found that M&A goodwill was significantly and negatively related to return on assets, return on equity and earnings per share. Killins Robert et (2021), on the other hand, examined the relationship between goodwill impairment and CEO overconfidence.

The level of productivity development is expressed by total factor productivity, and scholars are now gradually introducing total factor productivity measures into the study of micro firms, and the literature on micro firm productivity related studies is gradually increasing. Chad Syverson (2011)

investigates recent empirical work on the question of why firms differ in their measured productivity levels and evaluation. Lu and Lian Yujun (2012) used various methods to estimate the total factor productivity of industrial firms in China from 1999 to 2007, and concluded that corrections to estimation methods and regional differences affect productivity in various ways; Wang Qinggang and Chen Xi (2021) selected A-share listed companies in Shanghai and Shenzhen from 2010 to 2018 as the study sample, studied the relationship between total factor productivity of enterprises from the perspective of business management behavior, and examined the influence mechanism between management capability and total factor productivity.

In summary, the existing literature has made some research results on the correlation between M&A goodwill and total factor productivity, but there is little research on the relationship and impact between M&A goodwill and total factor productivity. Whether M&A goodwill has a significant impact on the total factor productivity of enterprises and in what direction, the current research is still at a stage where it can continue to be mined.

This leads to the hypothesis in this paper:

Hypothesis 1: There is a negative effect of M&A goodwill on the total factor productivity of firms.

Hypothesis 2: In M&A goodwill, financial assets mainly cause a "crowding out" effect rather than a "pooling out" effect.

Hypothesis 3: Following an acquisition that brings excessive goodwill, firms may increase incentives for executives, which in turn affects their own productivity.

Hypothesis 4: When a firm acquires goodwill from a merger or acquisition, the excessive goodwill is likely to influence the firm's investment decision, and at the same time, the firm needs higher external financing costs, which in turn brings about a rise in debt.

3. Data Description and Empirical Design

3.1 Sample Selection and Data Sources

Considering the availability and representativeness of the indicators, this paper uses all A-share listed companies in Shanghai and Shenzhen from 2008 to 2020 as the original sample, and the original sample data of listed companies are obtained from Guotaian CSMAR database. Firstly, the paper is screened according to the 2012 edition of the industry classification code of the Securities and Futures Commission, and the financial industry is excluded; secondly, in order to obtain more accurate corporate financial data and avoid the interference of various indicators due to poor corporate operations, the sample of ST companies during the study period is excluded; thirdly, in order to eliminate the influence of extreme values on the empirical analysis, all continuous variables are winsorized by 1% up and down in this paper.

3.2 Variable Definition

1. total factor productivity of the firm. In the benchmark regression, this paper uses total factor productivity constructed by the OP approach (Olley and Pakes, 1996), the core idea of which is to use the firm's level of investment as a proxy variable for productivity. The method assumes that firms make investment decisions based on the current firm productivity profile, and thus uses firms' current investment as a proxy variable for unobservable productivity shocks, thus addressing the simultaneity bias problem.

2. M&A goodwill. Referring to the study by Hongqi Yuan et al. (2021), we construct the core explanatory variable M&A goodwill IGWI: if the listed company forms goodwill increase through M&A in the current year take 1, otherwise 0.

3. other control variables. In addition, to reduce the endogeneity problem caused by omitted variables, the model also controls for firm-level X_{it} . Referring to the classical approach of existing literature, this paper $X1_{it}$. The specific types, names, and definitions of each variable included are detailed in Table 1. Table 2 shows the descriptive statistics of each variable.

Table 1. Types, names and specific definitions of each variable

Variable Type	Variable name and letter representation	Variable Definition Description
Explained variables	Total factor productivity of the company calculated by OP method TFP _{op}	Total factor productivity of listed companies for the year calculated by OP method
Core explanatory variables	Merger and acquisition goodwill(IGWI)	Dummy variable, if the listed company got goodwill through M&A during the year take1, otherwise for0
Enterprise control variables	Enterprise Size	ln (Total assets of listed companies at the end of the year)
	Business Age	Number of years a listed company has been listed
	Leverage	Current year gearing ratio of listed companies
	Business Performance (ROA)	Return on assets of listed companies for the year
	Fixed Asset Size Fix	Percentage of fixed assets to total assets of listed companies for the year
	Cash Ratio	Ratio of cash held by listed companies during the year
	Board Independence (Indratio)	Percentage of independent directors of listed companies in the year
	Board size	Shareholding ratio of the board of directors of listed companies
	Management shareholding ratio (Mshare)	Shareholding ratio of management of listed companies
	Concentration of shares Top1	Shareholding ratio of the largest shareholder of the listed company in the year
	Corporate Ownership SOE	Whether the listed company is a state-owned enterprise
	Family business	If the listed company is a family business take1, otherwise for0

Table 2. Descriptive statistics

	N	Mean	Std. Dev.	min	Median	max
TFP _{op}	32490	4.375	0.742	2.72	4.295	6.523
IGWI	32490	.139	0.346	0	0	1
Size	32490	22.077	1.288	19.35	21.891	26.43
Age	32490	9.464	7.250	0	8	27
Leverage	32490	.421	0.208	.027	.413	.936
ROA	32490	.433	0.461	-.581	.348	3.037
Fix	32490	.214	0.162	.002	.18	.769
Cash	32490	1.255	2.209	.036	.571	30.123
Indratio	32490	38.916	9.951	0	37.5	66.667
Boardsize	32490	10.722	18.238	0	.057	68.606
Mshare	32490	11.468	19.215	0	.086	70.869
Top1	32490	.348	0.149	.082	.328	.758
SOE	32490	.358	0.479	0	0	1
Family	32490	.363	0.481	0	0	1

3.3 Empirical Model Setting

In order to verify the theoretical hypothesis proposed earlier, this paper constructs a two-way fixed-effects model empirical analysis using panel data of listed companies, as shown in equation (1).

$$TFP_{it} = \beta_0 + \beta_1 IGWI_{it} + \beta_2 X_{it} + Ind_i + Year_t + \varepsilon_{it} \quad (1)$$

In equation (1), the subscripts i , t , denote the listed company and the statistical year, respectively. The explanatory variable TFP_{it} is the total factor productivity of listed company i in year t . $IGWI_{it}$ is the core explanatory variable of this paper, which is a measure of corporate M&A goodwill. Therefore β_1 is the core parameter to be estimated in this paper, which is expected from the above theoretical hypothesis β_1 to be significantly negative. In addition to the core explanatory variables, the model includes firm-level financial indicators X_{it} , the specific settings and descriptive statistics are shown in Tables 1 and 2. In addition, the Ind_i are industry fixed effects and $Year_t$ is the time fixed effect. ε_{it} is the perturbation term of the model.

Before conducting the empirical regression analysis, the results of the correlation analysis between the main study variables are also required, and the results of the Person correlation test for the control variables are shown in Table 3. As can be seen from Table 3, the correlation coefficients between the core explanatory variables and each of the control variables are not large, so there is no systematic bias caused by the highly co-linear problem that leads to statistical inference in this paper.

Table 3. Correlation coefficient matrix of variables

	TFP _{op}	IGWI	Size	Age	Leverage	ROA	Fix	Cash	Indratio	Boardsize	Mshare	Top1	SOE	Family
TFP _{op}	1.00													
IGWI	-0.01	1.00												
Size	0.57***	0.05**	1.00											
Age	0.23***	0.05**	0.39***	1.00										
Leverage	0.45***	0.00	0.50***	0.37**	1.00									
ROA	0.39***	0.02**	0.04***	0.04**	0.10***	1.00								
Fix	-0.01	0.08**	0.10***	0.08**	0.10***	0.08**	1.00							
Cash	-0.24***	0.03**	0.26***	0.25**	-0.53***	0.08**	0.18**	1.00						
Indratio	-0.01	0.03**	0.05***	0.06**	-0.04***	0.11**	0.02**	0.06**	1.00					
Boardsize	-0.19***	0.09**	0.31***	0.48**	-0.31***	0.00	0.15**	0.22**	0.07**	1.00				
Mshare	-0.19***	0.09**	0.31***	0.49**	-0.32***	-0.00	0.16**	0.23**	0.07**	0.99***	1.00			
Top1	0.15***	0.04**	0.19***	0.07**	0.05***	0.12**	0.08**	0.00	0.04**	-0.07***	-0.09***	1.00		
SOE	0.20***	0.10**	0.35***	0.43**	0.30***	0.13**	0.22**	0.16**	0.05**	-0.42***	-0.42***	0.23***	1.00	
Family	-0.04***	0.05**	0.17***	0.32**	-0.17***	0.04**	0.09**	0.06**	0.06**	0.33***	0.32***	0.01**	0.56***	1.00

4. Baseline Empirical Results

4.1 Analysis of Baseline Regression Results

Table 4 shows the baseline stepwise empirical results of equation (1) in this paper. The explanatory variable is total factor productivity of listed firms measured using the OP method, and the core explanatory variable is corporate M&A goodwill, which measures the degree of financialization of real firms. Among them, column (1) adds control variables, column (2) adds year fixed effects, and column (3) further adds firm industry fixed effects. It can be seen that the estimated coefficients of all the core explanatory variables of the model are statistically significantly negative at the 1% level, regardless of the controls, i.e., indicating that overall, M&A goodwill significantly reduces the total factor productivity of firms. Thus the previous theory is confirmed.

Table 4. Benchmark stepwise regression: the impact of corporate M&A goodwill on TFP

	(1)	(2)	(3)
VARIABLES	TFP op	TFP op	TFP op
IGWI	-0.0860*** (0.0082)	-0.0608*** (0.0081)	-0.0481*** (0.0078)
Size	0.3067*** (0.0027)	0.3124*** (0.0027)	0.3084*** (0.0027)
Age	0.0018*** (0.0005)	0.0035*** (0.0005)	0.0005 (0.0005)
Leverage	0.5610*** (0.0182)	0.4983*** (0.0179)	0.3773*** (0.0178)
ROA	0.6632*** (0.0063)	0.8117*** (0.0075)	0.7712*** (0.0078)
Fix	-0.4836*** (0.0181)	-0.4710*** (0.0176)	-0.3847*** (0.0194)
Cash	-0.0020 (0.0015)	-0.0049*** (0.0015)	-0.0048*** (0.0015)
Indratio	-0.0020*** (0.0003)	0.0000 (0.0003)	0.0002 (0.0003)
Boardsize	0.0005 (0.0013)	0.0026** (0.0012)	0.0024** (0.0012)
Mshare	-0.0012 (0.0012)	-0.0021* (0.0012)	-0.0018 (0.0011)
Top1	0.0528** (0.0206)	0.0360* (0.0199)	-0.0113 (0.0194)
SOE	-0.0738*** (0.0083)	-0.0798*** (0.0081)	-0.0760*** (0.0079)
Family	0.1078*** (0.0073)	0.1012*** (0.0070)	0.0768*** (0.0068)
Observations	32,490	32,490	32,490
Adjusted R-squared	0.5351	0.5681	0.6007
Year FE	NO	YES	YES
Ind FE	NO	NO	YES

Note: Estimation software is Stata16. observations are at the firm level. yes means that the fixed effect is controlled for, no means that the fixed effect is not controlled for. ***, **, * denote statistically significant at the 1%, 5%, and 10% levels, respectively (all tests below, no further remarks)

4.2 Heterogeneity Analysis

Through the previous empirical analysis, this paper has found that corporate M&A goodwill impairs the productivity of firms. A more important question then is what kind of firms suffer more from this inhibiting effect? This requires further heterogeneity analysis discussion.

First, the difference between large and small firms is examined. Referring to the existing literature, we define large firms as those whose total asset size in the current year is above the median for the whole industry. Table 5 examines the heterogeneity of firms of different sizes. Where column (1) is a subsample regression analysis for large firms and column (2) is a subsample regression analysis for small firms. As can be seen from the results, although the coefficients of the core explanatory variables corporate M&A goodwill are all significantly negative, the coefficients are larger for small firms and are on average 1.65 times larger than those for large firms. Thus, the impact of M&A goodwill on firms' own total factor productivity is more severe in small firms compared to large firms.

Table 5. Heterogeneity analysis: heterogeneity of firms of different sizes

VARIABLES	(1)	(2)
	TFP op	TFP op
	Big Business	Small Business
IGWI	-0.0368*** (0.0104)	-0.0608*** (0.0116)
Size	0.2879*** (0.0046)	0.3306*** (0.0068)
Age	0.0005 (0.0007)	-0.0004 (0.0007)
Leverage	0.4152*** (0.0258)	0.3083*** (0.0251)
ROA	0.7107*** (0.0105)	0.8520*** (0.0118)
Fix	-0.2202*** (0.0259)	-0.5820*** (0.0295)
Cash	-0.0081*** (0.0030)	-0.0062*** (0.0017)
Indratio	-0.0002 (0.0004)	0.0006 (0.0004)
Boardsize	0.0031 (0.0021)	0.0021 (0.0014)
Mshare	-0.0026 (0.0020)	-0.0016 (0.0014)
Top1	-0.0291 (0.0261)	0.0268 (0.0290)
SOE	-0.0641*** (0.0108)	-0.0908*** (0.0118)
Family	0.0582*** (0.0106)	0.0850*** (0.0089)
Observations	16,189	16,301
Adjusted R-squared	0.5568	0.4754
Year FE	YES	YES
Ind FE	YES	YES

Second, this paper also considers the influence of the location of the enterprise. China is a vast country, and the economic development, social system and business environment vary greatly between regions. Compared to the central and western regions, the eastern region of China is home to more firms and is more developed. So are there significant differences between the different regions where firms are located? Table 6 examines the heterogeneity of firms located in the eastern, central, and western regions, respectively. The subsample in column (1) is for firms in the eastern region, the subsample in column (2) is for firms in the central region, and the subsample in column (3) is for firms in the western region. From the results, it can be seen that there is significant heterogeneity among regions. Among them, corporate M&A reputation significantly reduces the total factor productivity of firms located in the eastern region. In contrast, the M&A reputation of firms in other regions does not have any effect on their own total factor productivity.

4.3 Mechanism Analysis

Why does firm M&A goodwill have a significant negative effect on a firm's productivity? This paper argues that firms acquiring goodwill from M&A are more likely to change their asset allocation decisions, while increasing executive compensation and excessive debt, which in turn has a dampening effect on firms' own productivity. In this section the paper further discusses the impact of M&A goodwill on firms.

Table 6. Heterogeneity Analysis: Heterogeneity of Firms in Different Regions

VARIABLES	(1)	(2)	(3)
	TFP op	TFP op	TFP op
	Eastern Region	Central Region	Western Region
IGWI	-0.0553*** (0.0093)	-0.0293 (0.0202)	-0.0237 (0.0215)
Size	0.2975*** (0.0033)	0.3214*** (0.0069)	0.3417*** (0.0066)
Age	0.0003 (0.0006)	-0.0006 (0.0013)	-0.0028** (0.0012)
Leverage	0.3836*** (0.0226)	0.4429*** (0.0458)	0.2756*** (0.0431)
ROA	0.7605*** (0.0099)	0.7859*** (0.0180)	0.8093*** (0.0216)
Fix	-0.4451*** (0.0257)	-0.2360*** (0.0470)	-0.2801*** (0.0444)
Cash	-0.0054*** (0.0017)	0.0014 (0.0046)	-0.0040 (0.0044)
Indratio	0.0005 (0.0004)	-0.0004 (0.0008)	0.0000 (0.0008)
Boardsize	0.0031** (0.0014)	0.0012 (0.0027)	0.0010 (0.0039)
Mshare	-0.0028** (0.0014)	0.0011 (0.0025)	-0.0008 (0.0038)
Top1	-0.0104 (0.0241)	-0.0930* (0.0511)	0.0196 (0.0480)
SOE	-0.0660*** (0.0102)	-0.0444** (0.0196)	-0.1148*** (0.0188)
Family	0.0812*** (0.0081)	0.0751*** (0.0187)	0.0504*** (0.0192)
Observations	21,950	4,507	4,499
Adjusted R-squared	0.6016	0.6238	0.6103
Year FE	YES	YES	YES
Ind FE	YES	YES	YES

First, the impact of M&A goodwill on corporate asset allocation is considered. Firms acquire the underlying assets at high premiums to optimize the allocation of technological resources, improve product quality, and achieve diversification, but the excessive difference in the fair value of net assets may give firms room to pursue profits and acquire a large number of financial assets thus affecting their productivity. Therefore, this paper examines whether M&A goodwill affects the allocation of a firm's financial assets.

Financial assets not only have a "reservoir" effect on enterprises, but also may cause a "crowding out" effect, that is, excessive financial investment will inevitably crowd out the enterprise's main business and innovation, investment and other business behavior. The allocation of different financial asset structures will also bring different effects. Generally speaking, driven by the high rate of return on non-current financial assets such as investment properties, short-sighted companies will invest heavily to obtain returns and forgo investment in R&D and innovation. Compared with long-term illiquid assets, liquid financial assets in general are more likely to contribute to the easing of financing constraints, thus creating a "reservoir" effect.

Regarding the measurement of financial asset allocation, with reference to existing literature practices, the financial assets held by enterprises are classified as liquid financial assets with a maturity of less than one year and illiquid financial assets with a maturity of more than one year, where liquid financial assets (LFIN) are the sum of net trading financial assets, derivative financial

assets and bought-back financial assets; illiquid financial assets (NLFN) are the sum of loans and advances issued (NLFN) is the sum of net loans and advances granted, net held-to-maturity investments, net available-for-sale financial assets, long-term equity investments and net investment properties.

The results in Table 7 show that M&A goodwill significantly increases firms' allocation to illiquid financial assets without affecting the allocation to liquid financial assets. In other words, in the case of M&A goodwill, the financial assets mainly cause a "crowding out" effect rather than a "pooling out" effect.

Table 7. Mechanism analysis: the impact of M&A goodwill on firms' financial asset allocation decisions

VARIABLES	(1) NLFN	(2) LFIN
IGWI	0.5741*** (0.0977)	0.1277 (0.1121)
Size	2.0439*** (0.0333)	1.6035*** (0.0382)
Age	0.1992*** (0.0061)	0.0385*** (0.0069)
Leverage	-1.6443*** (0.2231)	-3.1552*** (0.2559)
ROA	-0.5099*** (0.0982)	1.5635*** (0.1126)
Fix	-4.3326*** (0.2439)	-4.6594*** (0.2797)
Cash	-0.4391*** (0.0183)	0.0695*** (0.0211)
Inratio	-0.0037 (0.0036)	0.0264*** (0.0042)
Boardsize	-0.0321** (0.0149)	-0.0305* (0.0171)
Mshare	0.0164 (0.0142)	-0.0020 (0.0163)
Top1	-2.8780*** (0.2433)	-0.6625** (0.2791)
SOE	0.3699*** (0.0990)	-1.2735*** (0.1135)
Family	-0.0221 (0.0853)	0.2182** (0.0978)
Observations	32,488	32,487
Adjusted R-squared	0.3105	0.2350
Year FE	YES	YES
Ind FE	YES	YES

The second is the excess compensation of corporate executives. After an M&A brings excessive goodwill, firms may increase the incentives for executives, which in turn affects the firm's own productivity. Referring to Jianmin Liu et al. (2019), the excess compensation of corporate executives is derived by measuring the expected compensation of executives and thus the excess compensation of corporate executives. The calculation model is as follows.

$$\ln CEOpay_{it} = \alpha_0 + \alpha_1 \ln Sale_{it} + \alpha_2 ROA_{it} + \alpha_3 IA_{it} + \alpha_4 Zone_{it} + Ind + \varepsilon \quad (2)$$

The fitted value of equation (2) is the expected compensation $\ln Expectedpay_{it}$, and further, the difference between the expected compensation and the actual compensation received is used to obtain the unintended executive compensation level, which is the excess compensation level. As shown in equation (3).

$$Overpay = \ln CEOpay_{it} - \ln Expectedpay_{it} \quad (3)$$

Column (1) of Table 8 demonstrates the effect of M&A goodwill on the excess compensation of corporate executives with a significantly positive core explanatory variable, which indicates that M&A goodwill significantly increases the excess compensation of corporate executives, reflecting the agency problem arising from management's pursuit of private interests, in line with the theoretical hypothesis of this paper.

Table 8. Mechanism analysis: the effect of M&A goodwill on executive overcompensation and Over-indebtedness of firms

VARIABLES	(1) Overpay	(2) EXLEVB
IGWI	0.0316*** (0.0094)	0.0121*** (0.0012)
Size	0.0735*** (0.0033)	-0.0503*** (0.0004)
Age	-0.0052*** (0.0006)	-0.0005*** (0.0001)
Leverage	-0.5007*** (0.0217)	0.8387*** (0.0028)
ROA	0.0484*** (0.0095)	0.0211*** (0.0012)
Fix	-0.3076*** (0.0237)	-0.0275*** (0.0030)
Cash	0.0090*** (0.0018)	0.0019*** (0.0003)
Indratio	-0.0005 (0.0004)	0.0000 (0.0000)
Boardsize	0.0001 (0.0014)	-0.0009*** (0.0002)
Mshare	-0.0022 (0.0014)	0.0012*** (0.0002)
Top1	-0.3260*** (0.0236)	0.0788*** (0.0030)
SOE	-0.1288*** (0.0096)	-0.0240*** (0.0012)
Family	-0.1092*** (0.0082)	0.0018* (0.0011)
Observations	31,932	27,885
Adjusted R-squared	0.0545	0.8087
Year FE	YES	YES
Ind FE	YES	YES

Finally, Over-indebtedness, when a firm acquires goodwill through mergers and acquisitions, the excessive goodwill may affect the firm's investment decision, and at the same time, the firm needs higher external financing cost, which in turn brings about a rise in indebtedness. In this paper, we refer to the discussion of Lu Zhengfei et al. (2015), and consider the large noise of market liabilities

under China's stock market, and adopt the book debt ratio to measure the balance sheet ratio of enterprises. Specifically, according to Harford et al. (2009) and Denis and McKeon (2012), Tobit regressions are conducted on a sample of listed companies by year, and then to predict the target debt ratio of firms, the benchmark prediction model is as follows.

$$LEVB_{it} = \alpha_0 + \alpha_1 SOE_{t-1} + \alpha_2 ROA_{t-1} + \alpha_3 IND_LEVB_{t-1} + \alpha_4 Growth_{t-1} + \alpha_5 FATA_{t-1} + \alpha_6 SIZE_{t-1} + \alpha_7 SHRCR1_{t-1} \quad (4)$$

The control variables of Eq. (1) are selected with reference to Change et al. (2014), which draws on the Bayesian information criterion research method and selects several important factors that affect the stability and reliability of the asset-liability ratio in China, specifically, the profitability of the firm (ROA_{t-1}), the median debt ratio of the industry in which the firm is located (IND_LEVB_{t-1}), the growth rate of enterprises' total assets ($Growth_{t-1}$), the proportion of fixed assets to total assets ($FATA_{t-1}$), the size of the enterprise's total assets ($SIZE_{t-1}$) and the concentration of equity in the enterprise: the shareholding ratio of the first largest shareholder ($SHRCR1_{t-1}$). All factors are treated with a one-period lag. According to model (4), the target debt ratio of the enterprise forecast $\widehat{LEVB}_{it}$. After that, the actual debt ratio of the enterprise in the current year is subtracted from $\widehat{LEVB}_{it}$ is the excessive gearing ratio. $EXLEVB_{it}$. The larger the indicator, the higher the level of Over-indebtedness of the listed company.

Column (2) of Table 8 examines the effect of M&A goodwill on firms' Over-indebtedness. Apparently, the core explanatory variable is statistically significantly positive at the 1% level, i.e., in the face of resource injection from firms with high goodwill, firms require higher external financing costs, which in turn creates Over-indebtedness for firms and reduces their productivity.

5. Conclusion

This paper uses the data of all A-share listed companies in Shanghai and Shenzhen from 2008 to 2020 as the research sample (non-financial sector and after excluding ST companies) to investigate the impact of M&A goodwill on the total factor productivity of enterprises through stata regression. Heterogeneity analysis was also discussed, and it was concluded that the impact of M&A goodwill on firms' own total factor productivity is more severe in small firms compared to large firms. It is also found that there is significant heterogeneity between regions. The paper also analyzes the mechanisms that may contribute to this negative relationship, which are classified as M&A goodwill affecting the allocation of financial assets, the excess compensation of executives, and the Over-indebtedness of firms, and concludes that in M&A goodwill, financial assets mainly cause a "crowding-out" effect on firms rather than a "It is concluded that M&A goodwill greatly increases the excess compensation of executives, and that the injection of resources by companies with high goodwill requires higher external financing costs, which in turn leads to Over-indebtedness and reduces the productivity of enterprises.

Based on the results of this paper, the following insights can be obtained: First, in the frequent M&A activities in China nowadays, it is revealed that enterprises should consider the impact of paying excessive goodwill costs on the total factor productivity of enterprises when carrying out M&A activities, reasonably estimate the actual value of goodwill assets, and make timely disclosure of goodwill information to prevent the risk of serious overestimation of M&A goodwill and subsequent huge goodwill impairment, and prevent the assets from taking up limited resources of enterprises and inhibiting the improvement of the total factor productivity level of enterprises. To prevent the assets from taking up the limited resources of the enterprise to inhibit the improvement of the enterprise's total factor productivity level and cause the waste of resources. Second, regulators need to strengthen the supervision of accounting information disclosure of M&A goodwill of listed companies, and M&A parties should pay more attention to the authenticity of asset value of M&A goodwill to avoid the negative impact of high premium M&A on the enhancement of total factor

productivity of enterprises. Third, for investors, they should pay attention to the listed companies that have over-valued the acquired targets during M&A. Meanwhile, when watching the annual reports, they should pay attention to the item of "consolidated cost and goodwill" of the listed companies, and should avoid the listed companies with too high goodwill to avoid the risk.

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