

Research on the Impact of Total Factor Productivity on Real Earnings Management of Enterprises

Luo Kangming

*School of Economics, Guangxi University, Nanning, China
1546779099@qq.com*

Keywords: Total Factor Productivity, Real Earnings Management, Revenue Growth Rate

Abstract: This article takes A-share listed companies in the Shanghai and Shenzhen stock markets of China from 2006 to 2021 as research samples to evaluate the impact of total factor productivity on real earnings management of enterprises. The research has found that: (1) Improving total factor productivity in enterprises will reduce real earnings management of enterprises. (2) Mechanism analysis shows that an increase in total factor productivity of enterprises will lead to an increase in revenue growth rate, thereby inhibiting the real earnings management of enterprises. The conclusion of this article indicates that in good operating conditions, companies will reduce real earnings management of enterprises.

1. Introduction

Enterprise management sometimes deliberately constructs or adjusts the true activities of the enterprise, such as intervening in accounting information by deliberately changing the operation, investment, and financing activities of the enterprise^[1,2]. This type of earnings management based on real transactions is referred to as real activity earnings management or real earnings management. Unlike accrual earnings management, which only reflects the actual earnings of a company during different accounting periods through accounting treatment methods^[2,3], real earnings management mainly constructs or adjusts the nature, timing, and content of true trading activities^[4], changing the actual economic activities of a company and having an impact on its future value.

The changes in total factor productivity of enterprises will affect all aspects of production and operation. If the total factor productivity of a company is low, its profits will decrease. In order to beautify the business situation, business managers will have the motivation to whitewash the actual business activities. If the total factor productivity of a company is high, managers may not take risks to beautify their business situation. Based on this analysis, changes in total factor productivity of enterprises may affect their real earnings management. Therefore, this article attempts to answer the following question: Will total factor productivity of enterprises affect their real earnings management? If there is an impact, how is the impact transmitted?

The main contributions of this article are as follows: (1) By exploring the impact of total factor productivity on real earnings management in enterprises, this article expands the research on the influencing factors of real earnings management in enterprises. (2) This article summarizes the mechanism by which total factor productivity of enterprises affects their real earnings management, providing new ideas for understanding how total factor productivity of enterprises affects their real

earnings management.

The following parts of this article mainly include: The second part is theoretical analysis and research hypotheses; The third part is research design; The fourth part is empirical analysis; The fifth part is the conclusions and suggestions.

2. Theoretical analysis and research hypotheses

Based on the interpretation of signal transmission theory, in order to convey a positive signal of the future value of a company to the market, management will construct or adjust the nature, timing, and content of actual trading activities. Since real earnings management is an impermissible manipulation behavior, will companies reduce the occurrence of such behavior when they develop well, such as when their total factor productivity is improved?

The improvement of total factor productivity in enterprises can accelerate the efficiency of resource allocation and increase the space for profit growth. The increase in total factor productivity of enterprises will give them an advantage in market competition, thereby improving their income situation. Under favourable business conditions, in order to release positive signals to the market and avoid unnecessary risks, enterprise managers are more likely to reduce their willingness to deliberately construct or adjust the true activities of the enterprise, thereby disclosing the true economic activities. Therefore, this article proposes the following research hypotheses:

Hypothesis 1: The total factor productivity of enterprises will suppress their real earnings management.

Hypothesis 2: The increase in total factor productivity of enterprises will lead to an increase in revenue growth rate, thereby inhibiting the real earnings management of enterprises.

3. Research Design

3.1. Sample Selection and Data Sources

This article selects A-share listed companies in the Shanghai and Shenzhen stock markets of China from 2006 to 2021 as the initial research sample. To avoid the impact of abnormal samples on the conclusion, this article follows the following steps to process the raw data: (1) exclude financial and listed companies with a listing status of "ST" or "* ST"; (2) Excluding data with significant missing values in related variables; (3) Using linear interpolation method to fill in some missing data of individual listed companies; (4) To avoid the impact of extreme values on the results, this article performed Winsorize processing on all continuous variables at the 1% level above and below. After the above processing, a total of 35,565 non equilibrium panel data of 3,551 enterprises from 2006 to 2021 were obtained. The data of listed companies used in this article comes from the CSMAR database, and the industries to which the enterprises belong are classified according to the industry classification standards of the China Securities Regulatory Commission in 2012.

3.2. Basic Regression Model

This article explores the impact of total factor productivity on the real earnings management of enterprises through the following model (1).

$$Trem_{it} = \alpha_0 + \alpha_1 TFP_{it} + \alpha_2 Controls_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (1)$$

Where i represents the enterprise and t represents the year; $Trem_{it}$ is the dependent variable, representing the real earnings management of the enterprise; TFP_{it} is the core explanatory variable, representing the total factor productivity of the enterprise; $Controls_{it}$ is a collection of control

variables that may affect the real earnings management of a company obtained by referring to existing literature^[5], including: (1) Return on Assets (ROA_{it}), expressed as the ratio of pre interest and tax profit to total assets at the end of the year; (2) Asset Liability Ratio (Lev_{it}), expressed as the ratio of year-end total liabilities to year-end total assets; (3) Equity Concentration ($Top1_{it}$), represented by the shareholding ratio of the largest shareholder; (4) Enterprise Size ($Size_{it}$), represented by the natural logarithm of total assets at the end of the year; (5) Combination of Two Positions (Com_{it}), if the chairman and general manager are the same person, Com_{it} is 1, otherwise it is 0; (6) Executive Compensation ($Salary_{it}$), expressed as the natural logarithm of (1+total compensation of the top three management); (7) Property Nature ($State_{it}$), if it is a state-owned enterprise, $State_{it}$ is 1, otherwise it is 0; (8) Equity Structure ($Share_{it}$), represented as the proportion of ownership of the listed company owned by the actual controller, specifically the ownership of the listed company owned by the actual controller through concerted action, multiple tower shareholding, cross shareholding, etc; (9) Board Size ($Board_{it}$), expressed as the natural logarithm of the number of board members; (10) whether it has been audited by the four major accounting firms ($Big4_{it}$), if the auditor is from the four major accounting firms in China, $Big4_{it}$ is 1, otherwise it is 0. In addition, η_i represents individual fixed effects; μ_t represents a fixed time effect; ε_{it} is a random error term.

3.2.1. Total Factor Productivity of Enterprises (TFP)

There are several common calculation methods for total factor productivity of enterprises (TFP), including OLS method, FE method, OP method, LP method, and GMM method. The LP method uses intermediate inputs as proxy variables, which can reduce sample losses. Therefore, this article uses the LP method to measure the total factor productivity of enterprises (TFP). The specific method is: based on the "prodest" command in software Stata17, using the natural logarithm of operating income as the output variable, the natural logarithm of the number of employees as the free variable, the natural logarithm of net fixed assets as the state variable, and the natural logarithm of cash paid for goods and services as the proxy variable, running the "prodest" command to obtain the total factor productivity of the enterprise (TFP)^[6].

3.2.2. Real Earnings Management of Enterprises (Trem)

Referring to the research of Roychowdhury^[1], the specific calculation method for real earnings management (Trem) is as follows:

$$\frac{Cfo_{it}}{Assert_{it-1}} = a_0 + a_1 \frac{1}{Assert_{it-1}} + a_2 \frac{Rev_{it}}{Assert_{it-1}} + a_3 \frac{\Delta Rev_{it}}{Assert_{it-1}} + \varepsilon_{it} \quad (2)$$

$$\frac{Prod_{it}}{Assert_{it-1}} = b_0 + b_1 \frac{1}{Assert_{it-1}} + b_2 \frac{Rev_{it}}{Assert_{it-1}} + b_3 \frac{\Delta Rev_{it}}{Assert_{it-1}} + b_4 \frac{\Delta Rev_{it-1}}{Assert_{it-1}} + \varepsilon_{it} \quad (3)$$

$$\frac{Disexp_{it}}{Assert_{it-1}} = c_0 + c_1 \frac{1}{Assert_{it-1}} + c_2 \frac{Rev_{it-1}}{Assert_{it-1}} + \varepsilon_{it} \quad (4)$$

$$Trem_{it} = A_Prod_{it} - A_Cfo_{it} - A_Disexp_{it} \quad (5)$$

Among them, Cfo_{it} represents the net cash flow generated from operating activities; $Assert_{it-1}$ is the total assets at the end of the year for the t-1 period; Rev_{it} is the year-end operating income of period t; ΔRev_{it} is the change in year-end operating income for period t; ΔRev_{it-1} represents the change in year-end operating income for the t-1 period; $Prod_{it}$ is the production cost of the enterprise, expressed as the sum of the operating costs in period t and the changes in net inventory in period t; $Disexp_{it}$ is the operational cost of the enterprise, expressed as the sum of the sales expenses in period t and the management expenses in period t.

This article first regresses models (2), (3), and (4) by industry and year, and the resulting residuals

are abnormal cash flows from operating activities (A_Cfo_{it}), abnormal production costs (A_Prod_{it}), and abnormal discretionary expenses (A_Disexp_{it}). Then, the real earnings management of the enterprise ($Trem_{it}$) is calculated using formula (5).

3.3. Mechanism Analysis Model

This article uses the following models (6) and (7) for mechanism analysis.

$$Growth_{it} = \alpha_0 + \alpha_1 TFP_{it} + \alpha_2 Controls_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (6)$$

$$Trem_{it} = \alpha_0 + \alpha_1 Growth_{it} + \alpha_2 Controls_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (7)$$

Among them, $Growth_{it}$ is a mechanism variable that represents the growth rate of operating revenue, and the calculation formula is (closing operating revenue - opening operating revenue)/opening operating revenue; The symbolic meanings of other variables are the same as those of model (1).

4. Empirical Analysis

4.1. Descriptive Statistics

This article obtains descriptive statistics as shown in Table 1. From it, it can be seen that the mean of real earnings management for enterprises ($Trem$) is -0.001, the minimum value is -0.819, the median is 0.007, and the maximum value is 0.711. This indicates that there are significant differences in the overall real earnings management ($Trem$) of the sample enterprises. The average total factor productivity of enterprises (TFP) is 2.690, with a minimum value of 2.358, a median of 2.688, and a maximum value of 2.971. This indicates that the total factor productivity (TFP) of the sample enterprises generally does not differ significantly. The numerical distribution of other variables is within the normal range.

Table 1: Descriptive statistics.

Variable type	Variable name	Observations	Mean value	Standard deviation	Minimum value	Median	Maximum value
Explained variable	<i>Trem</i>	35,565	-0.001	0.205	-0.819	0.007	0.711
Core explanatory variable	<i>TFP</i>	35,565	2.690	0.072	2.358	2.688	2.971
Mechanism variable	<i>Growth</i>	35,565	0.187	0.462	-0.620	0.112	3.022
Control variables	<i>ROA</i>	35,565	0.051	0.069	-0.263	0.051	0.246
	<i>Lev</i>	35,565	0.449	0.212	0.057	0.444	1.007
	<i>Top1</i>	35,565	0.349	0.148	0.088	0.327	0.750
	<i>Size</i>	35,565	22.078	1.317	19.194	21.916	26.038
	<i>Com</i>	35,565	0.248	0.432	0.000	0.000	1.000
	<i>Salary</i>	35,565	14.332	0.803	12.110	14.350	16.432
	<i>State</i>	35,565	0.418	0.493	0.000	0.000	1.000
	<i>Share</i>	35,565	0.346	0.168	0.035	0.330	0.776
	<i>Board</i>	35,565	2.141	0.202	1.609	2.197	2.708
	<i>Big4</i>	35,565	0.059	0.235	0.000	0.000	1.000

4.2. Benchmark Regression Results

This article obtains the benchmark regression results shown in Table 2 based on model (1). Column (1) and (2) of Table 2 control for individual fixed effects, but not for time fixed effects. Column (3) and (4) of Table 2 control for individual fixed effects and time fixed effects. Column (1) and (3) of Table 2 shows that, without controlling variables, the coefficients of total factor productivity of enterprises (TFP) are respectively -0.162 and -0.412, and they are negative at the 1% significance level. Column (3) and (4) of Table 2 shows that, with the addition of control variables, the coefficients of total factor productivity of enterprises (TFP) are respectively -0.268 and -0.289, and they are also negative at the significance level of 1%. This indicates that the total factor productivity of enterprises will suppress their real earnings management. Hypothesis 1 is verified.

Table 2: Benchmark regression results.

	(1)	(2)	(3)	(4)
Variable name	<i>Trem</i>	<i>Trem</i>	<i>Trem</i>	<i>Trem</i>
<i>TFP</i>	-0.162***	-0.268***	-0.412***	-0.289***
	(-3.689)	(-3.980)	(-7.872)	(-4.282)
Control variables	No	Yes	No	Yes
Constant	0.436***	0.417***	1.063***	0.667***
	(3.684)	(3.117)	(7.666)	(4.713)
Individual fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	No	Yes	Yes
Observations	35,565	35,565	35,565	35,565
Adjusted R ²	0.001	0.034	0.010	0.036

Note: (1) * * *, * * and * respectively represent significance levels of 1%, 5%, and 10%; (2) The values in parentheses represent the t-value of the bilateral test; (3) This article adopts the robust standard error of clustering at the enterprise level. (4) Due to space limitations, this article does not display the specific values of the control variables, a complete table can be obtained from the author if needed. The following tables are the same.

4.3. Robust Test

Table 3: Robust test.

	(1)	(2)	(3)	(4)
Variable name	<i>Trem</i>	<i>Trem</i>	<i>Trem</i>	<i>Trem</i>
<i>TFP_OP</i>	-0.153***	-0.207***	-0.418***	-0.238***
	(-3.209)	(-2.955)	(-7.229)	(-3.383)
Control variables	No	Yes	No	Yes
Constant	0.420***	0.347**	1.101***	0.627***
	(3.204)	(2.335)	(7.055)	(3.954)
Individual fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	No	Yes	Yes
Observations	35,565	35,565	35,565	35,565
Adjusted R ²	0.001	0.033	0.009	0.036

This article uses the OP method to calculate the new total factor productivity of enterprises, and replaces it with the core explanatory variable for robustness testing. The main method is to replace the proxy variable in the LP method with enterprise investment, measured by the natural logarithm

of cash paid for the purchase and construction of fixed assets, intangible assets, and other long-term assets; The remaining variables remain unchanged; Then run the "prodest" command to obtain the new enterprise total factor productivity (*TFP_OP*). The results of Table 3 indicate that after replacing the core explanatory variables, whether without or with control variables, the coefficient of total factor productivity of enterprises (*TFP_OP*) is still negative at the significance level of 1%. This indicates that the conclusion that total factor productivity of enterprises will suppress their real earnings management still holds.

4.4. Mechanism Analysis

Based on the previous analysis, this article uses the growth rate of operating revenue as a mechanism variable to explore the mechanism by which total factor productivity of enterprises affects real earnings management. Table 4 shows the empirical results obtained based on models (6) and (7). Table 4 shows that total factor productivity of enterprises (*TFP*) positively promotes revenue growth rate (*Growth*), while an increase in revenue growth rate (*Growth*) can effectively suppress real earnings management of enterprises (*Trem*). Hypothesis 2 is verified.

Table 4: Mechanism analysis.

	(1)	(2)	(3)	(4)
Variable name	<i>Growth</i>	<i>Growth</i>	<i>Trem</i>	<i>Trem</i>
<i>TFP</i>	4.453***	4.420***		
	(36.109)	(27.700)		
<i>Growth</i>			-0.044***	-0.032***
			(-10.740)	(-7.635)
Control variables	No	Yes	No	Yes
Constant	-11.524***	-9.522***	-0.012	0.099
	(-35.434)	(-30.127)	(-1.182)	(1.276)
Individual fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	35,565	35,565	35,565	35,565
Adjusted R ²	0.129	0.169	0.018	0.042

5. Conclusions and Suggestions

5.1. Conclusions

This article takes A-share listed companies in the Shanghai and Shenzhen stock markets of China from 2006 to 2021 as research samples, and obtains imbalanced panel data from 3,551 companies with a total of 35,565 observations to evaluate the impact of total factor productivity on real earnings management. The research has found that: (1) Based on the explanation of signal transmission theory, improving total factor productivity of enterprises will reduce real earnings management behavior. (2) Mechanism analysis shows that an increase in total factor productivity of enterprises will lead to an increase in revenue growth rate, thereby inhibiting the real earnings management of enterprises. The conclusion of this article indicates that in good operating conditions, companies will reduce real earnings management of enterprises. This article not only expands the research on the influencing factors of real earnings management, but also provides new ideas for understanding how total factor productivity affects real earnings management by sorting out the mechanism of how total factor productivity affects real earnings management.

5.2. Suggestions

Based on the research conclusions obtained, this article proposes the following suggestions.

(1) Financial supervision institutions should pay attention to the impact of total factor productivity of enterprises on their real earnings management, and strengthen supervision of their real earnings management. From the conclusions of this article, it can be seen that when the total factor productivity of enterprises decreases, the behavior of enterprises in conducting real earnings management will increase. At this point, enterprise managers will deliberately construct or adjust the true activities of the enterprise to release erroneous signals to the market. Financial supervision institutions should strictly supervise such behavior.

(2) Enterprise management should treat real earnings management behavior with caution. If an enterprise wants to improve its operating conditions and enhance its value, it should start with technological upgrades and other aspects, rather than obtaining false operating conditions by constructing or adjusting the real activities of the enterprise. Beautifying the business situation cannot solve practical problems.

References

- [1] Roychowdhury, S. (2006) *Earnings Management through Real Activities Manipulation*. *Journal of Accounting & Economics*, 42(6), 335-370.
- [2] Wang, F. S., Ji, S. S., Cheng, F. (2014) *The Effect of Earnings Management on Future Operating Performance: A Comparative Study between Accrual Earnings Management and Real Earnings Management*. *Nankai Business Review*, 17(2), 95-106.
- [3] Schipper, K. (1989) *Earnings Management*. *Accounting Horizons*, 3(4), 91.
- [4] Fang, H. X., Jin, Y. N. (2011) *Can High Quality Internal Control Reduce Earnings Management? An Empirical Research Based on Voluntary Internal Control Audits Reporting*. *Accounting Research*, (8), 53-60.
- [5] Li, Z. F., Dong, Z. Q., Lian, Y. J. (2011) *Should it be Accrual-based Management or Real-earnings Management? A Research Based on China's 2007 Income Tax Reform*. *Journal of Management World*, (1), 121-134.
- [6] Zhao, Z. Z., Cheng, Z., Lyu, D. S. (2021) *Has the National Low-carbon Strategy Increased Companies' Total Factor Productivity? A Quasi-natural Experiment Based on the Low-carbon City Pilot*. *Industrial Economics Research*, (6), 101-115.