

An Analysis and Evaluation of the Real Earnings Management Constraint Mechanism from the Perspective of Corporate Governance

Fang Lin

North China University of Technology

Abstract

This paper presents the results of empirical studies into the construction of an effective constraint mechanism from the perspective of corporate governance. It includes an examination of the effects of various factors on real earnings management, such as ownership structure, the characteristics of the board of directors and supervisors, and executive compensation. The results show that equity balance, board size and executive incentives have a positive impact on the real earnings management behaviour of listed companies. In addition, an analysis is undertaken using the factor analysis method of the proxy variables which have a significant effect on the real earnings management constraint mechanism. A comprehensive constraint efficiency model is subsequently constructed, tested and evaluated to confirm that the conclusions drawn are effective.

Key words: Real earnings management, corporate governance, constraint mechanism.

Introduction

The separation of ownership and management in modern enterprises, a lack of transparency with regards to managers' input, and poorly defined contracts are issues that contribute to the generation of the principal-agent problem. Agents may rely on the advantage that they have in the form of information to perform reverse selection to the benefit of a company's owners, but to the detriment of a company's market value. This is not only because there is a conflict of interest between the principal and the agent, but also an asymmetry in demand for company earnings information. For example, the management of a company may be more likely to show opportunistic behaviour if contracts are poorly defined, whereby any inconsistency between the shareholders' and management goals could be exploited to maximize their own interests through the manipulation of company earnings. This behaviour not only misleads stakeholders with

regards to the performance of a company and its future development, but also misleads investors into making wrong investment decisions. This has the potential to produce conflicts of interests between owners and managers, and aggravate the relationship between large and small shareholders. Within this context, corporate governance is recognized as an effective tool through which to reduce the risk of managers becoming corrupted, to reduce the adverse selection behaviour of agents, and to protect the interests of investors.

In general, there are four aspects to the corporate governance structure of a company that are important, namely shareholder structure, the characteristics of the board of directors and board of supervisors, and management incentives. Under this framework of corporate governance, which includes the ownership structure and the independence of both boards, as well as the distribution of the rights and obligations of the administrative authorities, the interests of managers can only be maximized under the premise that they maximize the company's value because the two are tied to each other. As a result, the business incentives of executives, as well as the earnings management behaviour, which may be harmful to the value of a company, can be positively affected by the impact of the corporate governance mechanism.

The litmus test for how effective the corporate governance mechanism is in terms of real earnings management behaviour is determined by several factors, a number of which, either alone or in combination with each other, have a significant inhibitory effect on behaviour. These factors include the balance of ownership, the shareholding ratio of the board of directors, executive compensation, etc. This paper puts forward a mechanism for effectively restraining the real earnings management behaviour of listed companies. As part of this development process, the efficiency of the restriction of a single constraint was tested, of which the results were used to form the basis for the construction of a comprehensive model for the evaluation of the efficiency of the constraint mechanism itself. In so doing, the aim was to improve the transparency of the accounting information and the corporate governance structure, provide policy recommendations of theoretical and practical significance, and to contribute to the expansion of research into real earnings management constraint theory.

The rest of this paper is divided into seven parts: literature review and theoretical analysis; sample selection, data sources, research models and methods; measurement results and analysis of real earnings management; test results and analysis of the effectiveness of the real earnings management constraint mechanism; comprehensive evaluation of the effect of real earnings management; and conclusions.

Materials and Methods

Corporate governance is a set of rules and regulations under which the power within a company, responsibilities and conduct are arranged. It is a restrictive mechanism, the goal of which is to protect shareholders and other stakeholders, as well as resolve the benefit assignment problem (Li Weian 2009). Corporate governance therefore plays an important role in a company's earnings management.

Bushee (1998) states that institutional investors can to a certain degree exert pressure on earnings management by demanding reductions in R&D spending to prevent decreases in earnings. Similarly, Bange and De Bondt (1998) found that large institutional investors and CEOs who hold stock exert pressure on management to reduce expenditure on R&D in what is viewed as earnings management opportunism. Cheng (2004) and Roychowdhury (2006) also came to the same conclusions. Respectively, empirical research conducted by Gnanakumar (2008) on a sample set of 6759 companies into the characteristics of boards of directors and audit committees, found that the proportion of independent directors was the only restraining effect on real earnings management. The influence of the size of the boards and/or audit committees, as well as the separation of the roles of chairman and general manager were negligible.

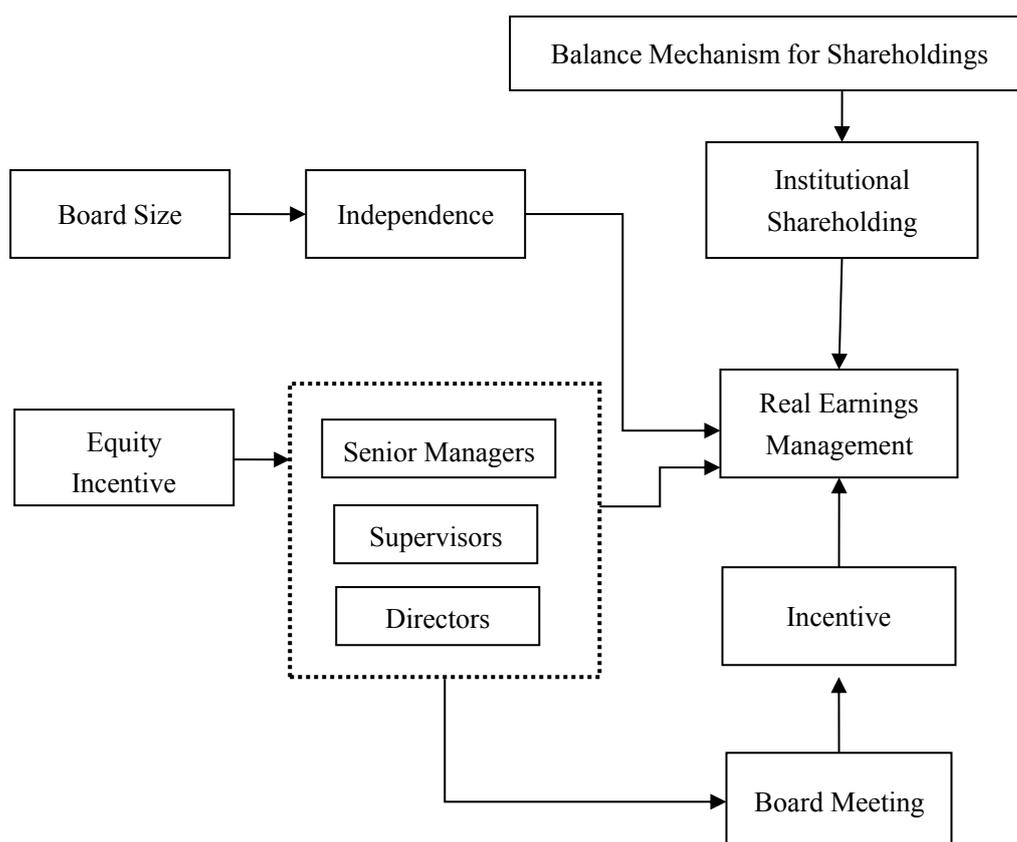
Li Qin and Li Wenyao (2007) suggest that companies should improve their system for appointing independent directors, establish audit committees and make improvements to their performance evaluation systems, as well as other measures, to restrain real earnings management. Zhang Zhihua and Jin Lianhua (2010) conducted empirical research on A-shares listed companies for the period 2003 to 2007, thereby using the degree of ownership concentration, board independence, board size and executive compensation as proxies for corporate governance, and found that real earnings management can be constrained by a sound corporate governance mechanism based on supervision and motivation. Lin Fang and Xu Hui (2012) conducted empirical research into the relationship between equity balances and real earnings management and found that the balance of ownership can to some extent effectively reduce real earnings management in terms of product costs and profit manipulation.

Principal-agent theory, contract theory and asymmetric information theory were created on the basis of the modern enterprise system. The problems associated with real earnings management are rooted in the principal-agent conflict, asymmetric information and poorly defined contracts. It is for this reason that the establishment of a fine-tuned corporate governance mechanism is generally recognized as an effective way to reduce this conflict, promote the two-way flow of information, encourage and restrain the agent, as well as maximize the interests of all the shareholders.

The following proxy variables were selected to represent the corporate governance mechanism: ownership structure; the characteristics of the boards of directors and supervisors; and the executive compensation incentive mechanism. These factors were also further refined. Previous empirical studies have found that some individual factors of the corporate governance mechanism have a significant effect on restraining real earnings management behaviour. These factors include the equity structure governance mechanisms (which includes the balance mechanism for shareholdings and institutional shareholdings), the board of directors (size of the board, number of meetings, shareholding ratio), the board of supervisors (shareholding ratio), as well as the equity incentive mechanism (executive compensation and executive shareholdings). All of the proxy variables mentioned above have significant correlations with real earnings management. Equity balance and institutional shareholdings can be used as a balance

mechanism for shareholdings - directors' and supervisors' shareholding ratios - and executive shareholdings can be recognized as a form of equity incentive. Board size and board meetings express the independence and function of the board respectively. Figure 1 shows the restraint mechanism for real earnings management on the basis of equity balance, board independence, board enthusiasm and equity incentives.

Figure 1. Diagram of the real earnings management constraint mechanism



Source: Author

The restrictive function of equity balance is mainly related to the ability of equity arrangements to control shareholders' tunneling behaviour. The development of the capital market has prompted institutional investors to become more actively involved in corporate governance. This has been made possible because institutional investors have the advantage of having the talent, capital and policies at their disposal for them to do so. As institutional investors have continued to develop and grow, so has their active participation in the improvement of the corporate governance of the companies in which they invest. They do so by exerting their right to participate in the management of companies and in the decision-making of directors or managers. However, although the largest shareholder maintains a dominant position within a company, other small and medium-sized shareholders may on occasion rescind their status as "free riders" to protect their own interests. This is particularly the case when the proportion of shares held by the second largest shareholder is high enough; some smaller shareholders are

more likely to come together and form an offensive or defensive alliance with regards to maintaining some form of equity balance. The reason for doing this is that it is a way to achieve mutual supervision and restraint, and prevents the internal grabbing of assets.

The board of directors is at the core of modern corporate governance structures and therefore of the corporate governance mechanism too. It serves as a link between shareholders and managers, and its structure and efficacy are directly related to a company's success.

A board of directors should be fair and not biased towards the interests of any one party in the process of decision-making, which means a board must be independent from shareholders and managers. Some of the directors must therefore be drawn from outside. The larger the board, the better able it is to accommodate more professionals with financial, financial accounting and management experience. This enables a board to make decisions more professionally and scientifically, and strengthens its ability to identify the real earnings management behavior of the company. Furthermore, the larger the board, the lower the probability that a consensus can be formed between the directors, which reduces the risk of collusion with regards to real earnings management.

Equity incentives for executives, directors and supervisors can actively and effectively support them in the fulfillment of their obligations and responsibilities. Due to the information asymmetry that exists between the principal and the agent, whereby the business executive is the agent, the long-term development goals of a company are often ignored or set aside by executives in the pursuit of their own personal interests. However, the implementation of an equity incentive mechanism can ease the contradiction between the two parties, thereby producing a synergistic effect which motivates the corporate executives to make decisions that benefit the company and other stakeholders. The equity incentive mechanism therefore provides greater support for directors and supervisors in the performance of their regulatory responsibilities, links personal income with the long-term development of a company, and effectively restrains real earnings management behaviour. In addition, the number of board meetings can reflect the extent to which directors participate in corporate governance and how willing they are to take on their responsibilities and obligations. The enthusiasm of a director depends on their personal integrity and an effective incentive mechanism. For example, board meetings may become more active under the influence of equity incentives, directors may communicate more frequently, perform their duties better, and identify risks, including earnings management, more often. Based on this analysis the following hypothesis was formulated:

Equity balance, board independence and equity incentives constitute the main constraint mechanism in listed companies, which forms the most direct constraint on real earnings management behaviour, and directors' enthusiasm is a supplementary constraint on real earnings management behaviour because it only acts as the platform and transmission media mechanism for restraining the main constraint.

Research Design - The measurement of real earnings management

In addition to the measurements utilized by Roychowdhury (2006) and Cohen (2008a), abnormal operating cash flow, discretionary expenses and abnormal product cost were

also used to measure real earnings management. Abnormal operating cash flow (hereinafter referred to as abnormal cash flow), discretionary expenses and abnormal product cost can be calculated on the basis of normal operating cash flow, non-discretionary costs and normal product cost, respectively.

The method put forward by Dechow, et al., (1995) was utilized to calculate the normal operating cash flow (see regression formula (1)). The abnormal operating cash flow was subsequently calculated as the sum of the normal operating cash flow minus the actual operating cash flow. This reflects the fact that price discounts, selling on credit, relaxation of credit terms and conditions, as well as other promotional activities may result in increased sales and profits for a company, but may also have a negative impact on a company's operating cash flow. In other words, an abnormal decrease in operating cash flow might be generated from sales discounts and other promotional activities, which may increase a company's profits.

$$CFO_t / A_{t-1} = \alpha_0(1/A_{t-1}) + \beta_1(St / A_{t-1}) + \beta_2(\Delta St / A_{t-1}) + \epsilon_t \quad (1)$$

Secondly, formula (2) was utilized to estimate the value of non-discretionary expenses. The discretionary expenses were subsequently calculated as the sum of non-discretionary expenses minus the actual costs. Any reduction in discretionary expenses such as R&D, management expenses and sales costs within a company therefore reduces overall costs and increases the profits of a company, whereby the opposite is also true when the situation is reversed.

$$DISEXP_t / A_{t-1} = \alpha_0 + \alpha_1 (1/A_{t-1}) + \beta(St-1 / A_{t-1}) + \epsilon_t \quad (2)$$

Thirdly, product cost is calculated as the sum of the costs of goods sold and the change in the amount of inventory. The linear relationship between the cost of sales and sales in a given year is given in formula (3), and the linear relationship between the change in the amount of inventory and the amount of change in a given year and the previous year is given in formula (4). Formula (3) and formula (4) are subsequently used to estimate normal product cost (5). The abnormal product cost is the difference between the actual cost and the normal cost of the product. An increase in product cost is mainly the result of an increase in product yield, whereby an increase in production should reduce the fixed cost per unit of product. An increase in the abnormal product cost is therefore likely to increase the profitability per unit of product and therefore a company's profits, whereby the opposite is also true if the situation is reversed.

$$COGS_t / A_{t-1} = \alpha_0(1/A_{t-1}) + \beta(St / A_{t-1}) + \epsilon_t \quad (3)$$

$$\Delta INV_t / A_{t-1} = \alpha_0(1/A_{t-1}) + \beta_1(St / A_{t-1}) + \beta_2(\Delta St-1 / A_{t-1}) + \epsilon_t \quad (4)$$

$$PROD_t / A_{t-1} = \alpha_0(1/A_{t-1}) + \beta_1(St / A_{t-1}) + \beta_2(\Delta St / A_{t-1}) + \beta_2(\Delta St-1 / A_{t-1}) + \epsilon_t \quad (5)$$

In the above formula, CFO_t represents net cash flows from operating activities in year t, A_{t-1} represents the total assets in year t, St represents the sales revenue in year t, ΔSt represents the changing amount of sales revenue between year t and year t-1 year. ΔSt-1 represents the change in sales income in last two years. DISEXP_t expresses discretionary expenses in year t, including the cost of sales and management expenses. COGS_t is the cost of product sales in year t. ΔINV_t indicates the change in the amount of inventory between

year t and year $t-1$ year. $PROD_t$ represents the normal product costs in year t , which is made up from the cost of goods sold and the change in the amount of inventory in year t . Abnormal cash flow (R_CFO), discretionary expense^① (R_DISEXP) and abnormal product cost (R_PROD) is the difference between the actual amount and the normal amount. These are also the three indicators used in this paper to measure real transaction earnings management. This is because the abnormal reduction in cash flow, abnormal decrease in discretionary expenses, and abnormal increase in product cost provide an indication of whether a company's profits will increase, whereby the opposite is true if the situation is reversed. In other words, if a company wants to make more profit, it would express lower abnormal cash flow, lower operating costs and higher abnormal product costs.

Finally, there are several ways to potentially measure the overall effect of real earnings management on the basis of real transactions. Cohen (2008) states that the three individual indicators that represent real earnings management are unique in terms of their information content, differences in impact of an increase or decrease, and their ability to mutual offset each other, so if sum the 3 indicators directly, it might be lack of comprehensiveness, and miss some information. Therefore, in order to increase the robustness of the outcome, reference is made to the research methods of Liu Qi-liang, et al., (2009) and Li Zeng-fu (2011), who used formula (6) to measure the extent of overall real transaction earnings management (NRM_Proxy). The higher the NRM_Proxy , the more inclined a company is to manipulate profits through real transactions.

$$NRM_Proxy^{②} = R_PROD - R_CFO - R_DISEXP \quad (6)$$

In order to avoid the impact of outliers, both ends of the related variables were winsorized by 1% to calculate the earnings management index.

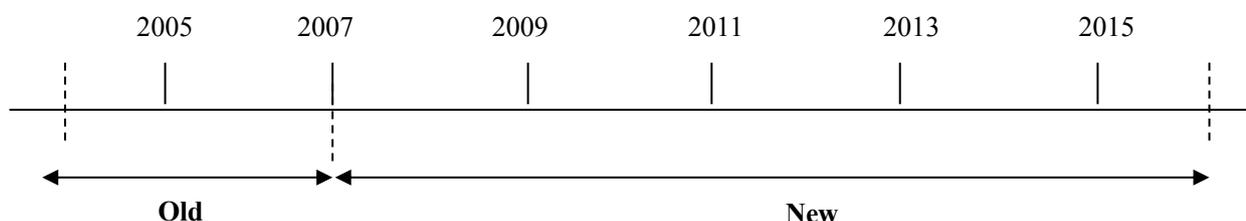
Selection of research samples

In China, the current accounting standards have been in force since 1 January, 2007. These standards are convergent with the international financial reporting standards. The change in the accounting environment may have had an impact on the extent of accrual earnings management and real earnings management (Liu Qiliang, et al., 2009; Lin Fang and Xu Hui 2011), which is shown in Figure 2. It is for this reason that only the data after the promulgation and implementation of the current accounting standards is analyzed in this paper.

^① The indicators include R&D costs, advertising costs and sales and management costs. However, in our country, companies do not specifically disclose R&D and advertising costs, which are included in the costs of sales, management fees and other projects. The index in this paper therefore only contains two items - costs of sales and management costs.

^② Because NRM_Proxy shows the overall effect of adjusting profits through real transactions earnings management, an increase in R_CFO and R_DISEXP would reduce profits, and an increase in R_PROD as a result of excessive production would reduce the costs of selling goods. An increase in R_PROD would therefore increase profits. The index amount is higher, it indicates that the company is likely to increase profits through sales. Therefore, R_DISEXP and R_CFO should be multiplied by -1, such that $-R_DISEXP$ is equal to R_DISEXP multiplied by -1. When the index amount is higher, this indicates that the company is likely to increase profits by cutting discretionary expenses. The indicator $-R_CFO$ is interpreted in the same way as $-R_DISEXP$.

Figure 2. Sample period diagram



Source: Author

The selected sample period was from 2007 to 2011. The companies in the sample set were selected from A-share listed companies in Shanghai and Shenzhen, for which the IPO took place before 1 January, 2006, and according to the value of the interpretation and control variables involved in the lag year of financial data. The sample set of companies was subsequently screened on the basis of the application of the following exclusion criteria: they were a listed financial and/or insurance company (different characteristics to other companies); the observations were ST or *ST; the financial data and corporate governance data were incomplete; they were a newly listed company (company size and capital structure change according to changes in financing); or the sample did not meet model estimates according to Roychowdhury (2006). Roychowdhury determined that a real earnings management evaluation model requires a sample set to have at least 15 companies for every industry for every year of the studied period. After the application of the screening criteria, the sample set consisted of annual samples of 6,358 companies (Firm-Year). The data was generated from the Tai'an CSMAR and CCER databases. The listed companies were classified into 11 main industrial categories according to the "Guidelines for Industry Classification of Listed Companies" issued by the China Securities Regulatory Commission in 2001. Stata 11.0 software was used for the data processing.

Determination of industry classification of listed companies

For the application of the modified Jones model for the measurement of earnings management, it was necessary to categorize the 6,358 samples according to industrial sector. This was done in line with the aforementioned guidelines^①. Due to the fact that manufacturing industry (Code C) is divided into many smaller sub-categories, only those companies that fell within the top two sectors within each sub-category were selected. In total, the sample set was divided into 21 industrial categories - see Table 1.

(Table 1 about here)

^① See: <http://wenku.baidu.com/view>.

Research model and variables

It was previously established that eight variables can have a significant effect on real earnings management behavior. In view of the fact that corporate governance cannot be defined by any single variable, and the information with regards to the variables may be duplicated, it is possible to use Principal Component Analysis ① to continue the compilation and correlation of the information on the eight variables to determine the common factors that form the constraint mechanism.

When the common factors have been determined, multiple regression analysis models can be developed and applied to different constraint factors at the same time and on the same analysis platform. This process makes it is easy to subsequently analyze, compare and evaluate different constraints and therefore to confirm or refute hypothesis 1.

$$RDETit = \beta_0 + \beta_1 \times Comn + \epsilon_{it} \quad (7)$$

Formula (7) is a comparative analysis of the constraining effects of different constraint mechanisms. In formula (7), RDETit is a proxy variable for the degree of real earnings management (this includes abnormal cash flow (R_CFO), discretionary expenses (R_DISEXP), abnormal product cost (R_PROD) and total variable (RM)), Comn represents the common factor which is obtained through Principal Component Analysis, β_0 , β_1 , β_2 and β_3 all indicate the regression coefficient to be estimated, ϵ_{it} is the residual error. The definition of all the variables is presented in Table 2.

(Table 2 about here)

Test results and analysis of the effectiveness of the real earnings management constraint mechanism

Determination of common factors

The results of the analysis show that equity balance (Balance), institutional shareholding (Instock), board size (Bsize), board meeting (Bmeet), director shareholding ratio (Bstock), supervisor shareholding ratio (Jstock), executive compensation (Execom) and executive shareholding ratio (Exestock) all have significant relationships to the proxy variables of real earnings management. Given that there may be a certain degree of information duplication, and that the corporate governance mechanism cannot be clearly defined by a single variable, it was necessary to statistically analyze the correlations, determine whether there was indeed any duplication, and verify whether strong multicollinearity existed. Table 3 presents the correlation coefficients for each variable.

(Table 3 about here)

The results presented in Table 3 show that there are highly significant correlations among the eight studied variables, and high degrees of multicollinearity and information duplication. For example, equity balance (Balance) has a highly significant relationship to institutional shareholding (Instock), board Size (Bsize), director shareholding (Bstock), supervisor shareholding (Jstock), and executive shareholding (Exestock) respectively. The

① Principal Component Analysis (PCA), is a multivariate statistical analysis method for the selection of several important variables by linear transformation. In other words, it is a statistical analysis method to find the characteristic of orthogonal vector representation of data information as little as possible.

Pearson correlation coefficient between supervisor shareholding (Jstock) and director shareholding (Bstock) is 0.537, and between executive shareholding (Exestock) and director shareholding (Bstock) and supervisor shareholding (Jstock) 0.975 and 0.560 respectively, whereby both have a high significance level of 0.001. The results of the correlation analysis shows, that determining the constraint mechanism of real earnings management for each aspect of above referenced eight variables can lead to uncertainty or the drawing of incorrect conclusions, not only because a single variable cannot clearly define corporate governance, but also because the maximum error is caused by the presence of severe multicollinearity.

It is for this reason that it was decided to use SPSS 13.0 to carry out the Principal Component Analysis. By reducing the multicollinearity of the variables through the dimension reduction method, separate information on the corporate governance mechanism could be fully accommodated and integrated into the common factors so that the efficacy of the constraint mechanism of real earnings management could be explored. Table 4 provides an explanation of the variances as a result of the Principal Component Analysis.

Table 4. Explanation of variances

Common Factor	Characteristic Value	Variance Contribution Rate	Cumulative Contribution Rate (%)
1	2.567	32.085	32.085
2	1.282	16.029	48.113
3	1.084	13.544	61.657
4	0.952	11.902	73.559
5	0.815	10.193	83.753
6	0.716	8.948	92.699
7	0.560	7.005	99.704
8	0.024	0.296	100.00

Source: Author

The method for extracting the common factors is different to that of multiple linear regression in that the characteristic value must be greater than 1. As is evident in Table 4, the values of the first three common factors are 2.567, 1.282 and 1.084, respectively. The values for all three are greater than 1, and the cumulative variance contribution rate of these three common factors is 61.657%. As a result, the first three common factors can be retained because they effectively contain the total information of the eight proxy variables. These three common factors were set as Com1, Com2 and Com3. Furthermore, in order to give practical significance to the extracted common factor, the initial factor load matrix must be rotated in accordance with the maximum variance orthogonal rotation method. The results after the rotation of the factor load matrix are presented in Table 5. The factor

load coefficients in Table 5 are sorted according to their numerical size, whereby numerical coefficients below 0.5 are not presented.

Table 5. Factor load coefficients after rotation of the matrix

	Com1	Com2	Com3
Exestock	0.952		
Bstock	0.945		
Jstock	0.739		
Execom	0.702		
Bmeet		0.774	
Bsize		0.679	
Instock			0.764
Balance			0.592

Source: Author

The load coefficients for executive shareholding (Exestock), director shareholding (Bstock), supervisor shareholding (Jstock) and executive compensation (Execom) are 0.952, 0.945, 0.739 and 0.702, respectively. All four show large loads for common factor 1 (Com1). It can therefore be concluded that common factor 1 is successful in providing effective information on the four aforementioned research variables. In addition, executive shareholding ratio, director shareholding ratio and supervisor shareholding ratio motivate executives, directors and supervisors in the form of equity. It can be said that the information generated by the equity incentive mechanism is included in common factor 1. It is for this reason that common factor 1 is therefore considered to be an incentive and restraint mechanism for real earnings management.

The load coefficients for board meeting (Bmeet) and board size (Bsize) are 0.774 and 0.679 respectively. Both show large loads for common factor 2 (Com2). It can therefore be concluded that common factor 2 carried is successful in providing effective information on the two aforementioned research variables. However, board size is a proxy variable for the independence of the board of directors, and board meeting is a proxy variable for functions of the board of directors. That both of these are contained in the same factor is probably an indication that some of the directors are from outside the company. The larger the size of the board, the more frequent the board meetings, the greater the enthusiasm among directors to fulfill their duties and obligations to participate in corporate governance, as well as the more likely the board of directors is to be independent and less likely to be controlled by insiders. It can be said that the independence of directors in the governance structures of listed companies is incorporated in common factor 2. It is for this reason that common factor 2 is therefore considered to be an independent constraint mechanism of the board of directors for real earnings management.

The load coefficients for institutional shareholding (Instock) and equity balance (Balance) are 0.764 and 0.592 respectively. Both show large loads for common factor 3 (Com3). It can therefore be concluded that common factor 3 is successful in providing effective information on the two aforementioned variables. In reality, facts show that institutional investors have played a role in the supervision and balances in corporate governance. It is for this reason that common factor 3 is considered to be an equity balance constraint mechanism for real earnings management.

Calculation of common factor scores

Based on the results of the factor analysis, incentive, independence of directors and equity balance are therefore considered to be the three restraint mechanisms for real earnings management. Furthermore, during the factor analysis it is not only possible to calculate the score for each factor, but also to calculate the factor score in order to quantitatively describe the role of the three restraint mechanisms on real earnings management

From the statistical implications of the original research variables, it can be assumed that if the factor score for the incentive constraint mechanism is higher, the degree of equity incentive is higher i.e. the ratios for director shareholding, supervisor shareholding and executive shareholding are higher. In the same vein, the higher the factor score for the independent constraint mechanism, the higher the degree of independence of the board of directors i.e. the board size is larger and it meets more frequently. Similarly, the higher the factor score for the balance constraint mechanism, the higher the ratio for institutional shareholding and the greater the equity balance. On this basis, a factor score function was constructed to express the real earnings management constraint mechanism. The resulting factor score coefficient matrix is based on calculations carried out using SPSS software.

Table 6. Factor score coefficient matrix

	Com1	Com2	Com3
Balance	0.148	0.025	0.594
Instock	0.443	0.431	0.089
Bsize	-0.103	0.320	0.719
Bmeet	0.069	0.595	-0.453
Bstock	0.936	-0.136	-0.014
Jstock	0.729	-0.123	0.005
Execom	0.180	0.767	-0.021
Exestock	0.945	-0.131	-0.010

Source: Author

The factor score coefficient matrix above was obtained using the method of regression estimation. The factor score function for expressing the real earnings management constraint mechanism was constructed on the basis of formulas (8) to (10) below:

$$Z1=0.148 \times \text{Balance} + 0.443 \times \text{Instock} - 0.103 \times \text{Bsize} + 0.069 \times \text{Bmeet} + 0.936 \times \text{Bstock} + 0.729 \times \text{Jstock} + 0.180 \times \text{Execom} + 0.945 \times \text{Exestock} \quad (8)$$

$$Z2=0.025 \times \text{Balance} + 0.431 \times \text{Instock} + 0.320 \times \text{Bsize} + 0.595 \times \text{Bmeet} - 0.136 \times \text{Bstock} - 0.123 \times \text{Jstock} + 0.767 \times \text{Execom} - 0.131 \times \text{Exestock} \quad (9)$$

$$Z3=0.594 \times \text{Balance} + 0.089 \times \text{Instock} + 0.719 \times \text{Bsize} - 0.453 \times \text{Bmeet} - 0.014 \times \text{Bstock} + 0.005 \times \text{Jstock} - 0.021 \times \text{Execom} - 0.010 \times \text{Exestock} \quad (10)$$

In formulas (7) to (9), Z1, Z2 and Z3 are used to indicate the factor scores for the real earnings management constraint mechanism.

Empirical test on the effectiveness of the real earnings management constraint mechanism

The factor analysis helped us to determine the three constraint mechanisms for real earnings management, qualitatively measure the roles of the constraint mechanisms, and greatly reduce the repetition of information among the different constraint factors. Formula (7) was therefore subsequently used to empirically test the three common factors. The results of the regression analysis are presented in Table 7.

Table 7. Regression analysis results

	RM	R_CFO	R_PROD	R_DISEXP
Com1	-0.010*	-0.007***	0.004	0.002*
	(0.050)	(0.000)	(0.131)	(0.087)
Com 2	-0.035***	0.009***	-0.020***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
Com 3	-0.052***	0.015***	-0.029***	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.468***	-0.095***	0.278***	-0.091***
	(0.000)	(0.000)	(0.000)	(0.000)
F-Value	187.07	37.67	201.79	150.25
Obs	6293	6293	6293	6293
Adj R2	0.052	0.011	0.056	0.043

Note: (1) two tailed tests were used, whereby ***, **, * indicates a significance level of 0.1%, 1% and 5% respectively; (2) in order to check for multicollinearity, the VIF value was tested - the VIF value was below 10, so there is no multicollinearity among the variables.

Source: Author

Table 7 shows the results of the regression analysis based on the common factors. The data shows that the model passed the significance test and that the F value that is used to test the overall setting of the model is highly significant at the level of 0. It is therefore possible to conclude that the model is effective. As is evident from Table 7, when the dependent variable is R_CFO, the regression coefficient for common factor 1 (Com1) is

negative, whereas the coefficients for common factor 2 (Com2) and the common factor (Com3) are both positive, and all three common factors are highly significant at the level of 1%. When the dependent variable is R_PROD, the regression coefficient for common factor 1 is positive, but is not significant, whereas the coefficients for common factors 2 and 3 are both positive and highly significant at the 1% level. When the dependent variable is R_DISEXP, the coefficients for common factors 1, 2 and 3 are all positive, and all of them are highly significant at the 1% level. When the dependent variable is RM, the coefficients for common factors 1, 2 and 3 are also all positive, and are also all highly significant at the 1% level. The results of the regression analysis show that: common factor 1 has a significant constraining effect on abnormal cash flow, abnormal production cost and comprehensive real earnings management; and that common factors 2 and 3 have a significant constraining effect on abnormal production cost, abnormal expenses and comprehensive real earnings management. The higher the score, the lower the degree of real earnings management, so the greater the role of the constraint mechanism. However, this role is very small with regards to abnormal cash flow.

In terms of the real earnings management of abnormal cash flow, the regression coefficient for common factor 1 is -0.007, which is overall the lowest, as well as the lowest for the incentive and restraint mechanism. This result indicates that abnormal cash flow is restricted the most by the equity incentive and restraint mechanism. Under the specific capital market conditions in China, the equity incentive enriches and improves the methods listed companies have to incentivize directors, supervisors and executives, but that this comes at the risk of a reduction in the extent of real earnings management.

In terms of abnormal production cost and comprehensive real earnings management, the regression coefficient for common factor 3 is the smallest, closely followed by common factor 2. In the terms of abnormal expenses and real earnings management, the regression coefficient for common factor 3 is the smallest, closely followed by common factor 2.

Common factor 3 represents the constraint mechanism of equity balance, and common factor 2 represents the independent constraint mechanism of the board of directors. Both constrain real earnings management behaviour from two different perspectives. Equity balance is the arrangement of equity in such a way that it creates internal mutual restraint and stimulates mutual supervision among major shareholders, which in turn effectively restrains real earnings management behaviour and inhibits internal people from plundering assets by preventing major shareholders being able to control the decision-making of a company. In contrast, the board of directors, given an appropriate increase in the number of independent directors with a professional background, an expansion in the number of members on the board, and more frequent board meetings, can also form an effective constraint on real earnings management behaviour because they actively fulfill their supervisory duties and obligations, and directly participate in corporate governance.

The following conclusions can therefore be drawn: (1) equity balance is the most effective constraint on real earnings management behaviour; (2) an independent board of directors can be a very effective constraint on overall real earnings management; (3) the implementation of an equity incentive for directors, supervisors and executives can be an effective constraint on real earnings management behaviour.

Comprehensive evaluation of constraining effects on real earnings management

A comprehensive evaluation follows on the constraint efficiency of all three constraint mechanisms.

Evaluation method

Although the constraint efficiency of the equity balance mechanism is higher, and that of the independence constraint mechanism and incentive mechanism are lower, the overall constraining effect of the real earnings management constraint mechanism cannot be defined by the constraint mechanism alone. If we can achieve the effective evaluation of the efficiency of the comprehensive constraints of the real earnings management constraint mechanism, then when we evaluate the real earnings management and the quality of earnings information of listed companies, we can not only use the evaluation results of the comprehensive constraint efficiency, but also use the evaluation of the efficiency of the comprehensive constraints as a reference.

In order to comprehensively assess the efficiency of the real earnings management constraint mechanism, factor analysis of the variance contribution to the three constraint mechanisms was undertaken. In the process of the corresponding rate as a new statistic weight, and as a comprehensive evaluation model of the efficiency of the real earnings management in listed companies.

$$CS = \frac{\varphi_1}{\varphi_1 + \varphi_2 + \varphi_3} \times Z_1 + \frac{\varphi_2}{\varphi_1 + \varphi_2 + \varphi_3} \times Z_2 + \frac{\varphi_3}{\varphi_1 + \varphi_2 + \varphi_3} \times Z_3 \quad (11)$$

In formula (11), CS represents the comprehensive evaluation of the effectiveness of real earnings management constraints, $Z_1 - Z_4$ represent the factor scores for the three real earnings management constraint mechanisms, $\varphi_1 - \varphi_3$ represent the three corresponding variance contribution rates for the real earnings management constraint mechanisms. On the basis of the cumulative variance contribution rates in Table 4, we adapted formula (11) as follows:

$$CS = 0.5204 \times Z_1 + 0.2600 \times Z_2 + 0.2197 \times Z_3 \quad (12)$$

The comprehensive evaluation of the effectiveness of the real earnings management constraints can now be obtained through the comprehensive evaluation model of earnings management constraint efficiency. Furthermore, the effectiveness and evaluation results can be empirically tested to determine whether the model is reliable or not.

Evaluation results

The results of the overall effect of the real earnings management constraint mechanism can be defined by the comprehensive evaluation model outlined above. If the model is efficient, the constraint efficiency evaluation score not only has a significant negative correlation with the real earnings management, but can also effectively identify the different samples of real earnings management. In other words, the higher the constraint efficiency evaluation score, the lower the real earnings management, and therefore the

more efficient the constraint mechanism is. If this can be illustrated it would confirm the validity of the comprehensive evaluation model of real earnings management and the effectiveness of the evaluation outcome.

Firstly, the descriptive statistics for comprehensive real earnings management were grouped. Secondly, the comprehensive evaluation scores for real earnings management based on the two groups were subsequently compared and analyzed. Thirdly, a logistic regression analysis model was constructed to test the relationship between the extent of real earnings management and the comprehensive evaluation scores for real earnings management constraint efficiency. Lastly, the classification sample levels for real earnings management were identified and tested.

Grouping of descriptive statistics for comprehensive real earnings management

When empirically testing the comprehensive evaluation model for real earnings management, it was also necessary to evaluate the reliability of the comprehensive efficiency evaluation model. The average number of RM (which is the proxy variable for comprehensive real earnings management) was used as the criterion by which to divide the total sample into 2 groups: a higher group (U_RM, $RM > -0.0020$); and a lower group (D_RM, $RM < -0.0020$). The groups obtained consisted of 3,466 and 2,892 test samples, respectively. The results are presented in Table 8.

Table 8. Descriptive statistics for comprehensive real earnings management by group

	N	Min	Max	Mean	S.D
U_RM	3423	-0.0020	0.8564	-0.1871	0.1739
D_RM	2870	-1.0741	-0.0021	-0.2276	0.2379

Source: Author

As can be seen in Table 8, in the higher real earnings management group, the maximum, minimum and average values of U_RM are 0.8564, -0.0020 and -0.1871 respectively. In the lower real earnings management group, the maximum, minimum and average values of D_RM are -0.0021, -1.0741 and -0.2276 respectively.

Analysis of comprehensive evaluation score for real earnings management constraint efficiency

The constraint efficiency score (CS) for each group was calculated according to formula (11). The descriptive statistics for CS are presented in Table 9.

Table 9. Descriptive statistics of comprehensive evaluation score for real earnings management

	N	Min	Max	Mean	S.D
U_RM	3423	4.1436	14.1425	6.2437	1.2191
D_RM	2870	4.1095	15.2709	6.6234	1.3448
RM	6293	4.1095	15.2709	6.4334	1.2975

Source: Author

As can be seen in Table 9, in the higher real earnings management group (U_RM), the average comprehensive evaluation score (CS) for real earnings management constraint efficiency is 6.2437, whereby the maximum and minimum values are 14.1425 and 4.1436, respectively. In the lower real earnings management group (D_RM), the average, maximum and minimum comprehensive evaluation scores (CS) for real earnings management constraint efficiency are 6.6234, 15.2709 and 4.1095, respectively. In addition, as is shown in Table 10, all of the maximum and average values, and standard deviations for CS are higher in the lower real earnings management group. This is reflected in the mean values for each group (see Table 10).

Table 10. Comparison of comprehensive evaluation scores by group mean

	N	Mean	Lower VS	t	Df	sig.
U_RM	3423	4.1436	Higher	15.17**	256	0.000
D_RM	2870	4.1095				

Source: Author

As can be seen in Table 10, the mean value of CS is higher in the higher real earnings management group and lower in the lower group. The value of the t-statistic is 15.17 and is highly significant at the level of 0.01. The empirical test results show that the mean value of CS in the higher real earnings management group is significantly different to that of the lower group. It further illustrates that the constraint efficiency of real earnings management has a significant effect on restricting the level of real earnings management in the listed companies.

Test results of logistic regression analysis

To verify the effectiveness of the real earnings management constraint efficiency model, and to evaluate the efficacy of the evaluation results, it was necessary to construct a classified logistic regression model. This was needed in order to not only test the higher and lower groups, but to also test the relationship between real earnings management and its constraint efficiency evaluation score. The logistic regression model is represented by the following formula (13):

$$\text{Logit (Y)} = \beta_0 + \beta_1\text{CS} + \beta_2\text{Control} + \varepsilon \tag{13}$$

When utilizing the logistic model for the regression analysis, the dependent variables were divided into three categories according to the nature of dependent variable and either one of two classifications, namely disordered multi-classification and ordered multi-classification. On the basis of the previous analysis and the two classification models, the whole sample was divided into two sub-samples.

In formula (13), Y is the independent variable, whereby Y has a value of 0 or 1 according to whether the higher (Y =0) or lower (Y =1) real earnings management group is being tested. CS is the dependent variable, which indicates the comprehensive evaluation score for real earnings management constraint efficiency. Additional control variables were also includes in the empirical model, namely company size (Size), debt ratio (Lev), company

growth (Tobins' Q), accrual earnings management (DA), annual (Year) and industry (Industry).

Table 11 presents the results of the regression of formula (13). As can be seen, the regression coefficient of the dependent variable CS was negative (-0.235), the statistic value of Wald X², which was used for significance testing purposes, is 172.30, and the p-value is 0, which is highly significant at level 0, and which suggests that the variable CS has passed the significance test. In addition, when Y=0, there is a significant negative correlation between the comprehensive evaluation efficiency of real earnings management and the degree of real earnings management. These empirical test results show that, the larger the value of CS, the greater the likelihood that the test sample shows a lower degree of real earnings management.

Table 11. Results of logistic regression analysis

	β	Wald	df	sig.
CS	-0.235***	172.30	0	0.000
Tobin	-0.404***	156.88	0	0.000
Size	-0.071***	10.34	0	0.001
Lev	0.573**	4.81	0	0.028
DA	0.180***	21.54	0	0.000
Constant	4.014***	61.56	0	0.000
Pseudo R2	0.06			
Obs	6292			

Note: ***, **, * indicates a significance level of 0.1%, 1% and 5%, respectively (two tailed test)

Source: Author

Table 12. Discriminant results of logistic regression model

	N	U_RM	D_RM	Correct rate (%)
U_RM	3423	2858	565	83.486
D_RM	2870	2639	231	91.946
RM	6293			87.351

Source: Author

As can be seen in Table 12, in total, there were 5,497 valid samples determined by the model (a rate of 88.372%). In the higher real earnings management group (U_RM), the total number of samples was 3,423, of which 2,858 samples passed the model's criteria (a rate of 83.486%). In the lower real earnings management group (D_RM), the total number of samples was 2,870, of which 2,639 samples passed the model's criteria (a rate of

91.946%). These discriminant results show that the majority of the test samples can be effectively identified by the logistic regression model.

Based on these empirical results, it can be assumed that the evaluation results of the effectiveness of the overall constraint on real earnings management can be defined by the real earnings management constraint efficiency evaluation score.

Conclusion

The following conclusions can be drawn on the basis of the results of the empirical study.

Firstly, the equity balance mechanism, the board of directors, the board of supervisors and the executive compensation incentive mechanism play an important role in restraining real earnings management behaviour. However, overall, the equity governance mechanism, the board of directors and executive incentive mechanism have a greater constraining effect on the real earnings management of listed companies.

Secondly, an effective mechanism for constraining real earnings management was put forward. Factor analysis was conducted to analyze the proxy variables of corporate governance and to construct a constraint mechanism for real earnings management, which was successfully defined through equity balance, directors' independence and executive incentives.

Thirdly, a comprehensive evaluation model was constructed on the basis of the results of the factor analysis in order to evaluate the efficiency of the real earnings management constraint mechanism and the validity of model itself. This was done through sample mean tests and logistic regression analysis.

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Table 1. Table of statistical results of industry categories and research samples

Industry code	Industry name	Sample size	Proportion of the total sample (%)
A	Agriculture, Forestry, Animal Husbandry and Fishery	152	2.31
B	Mining Industry	156	2.37
C0	Food and Beverage Industry	292	4.44
C1	Textile, Garment, Fur Processing Industry	266	4.04
C2	Wood and Furniture Industry	25	0.38
C3	Paper Making and Printing Industry	118	1.8
C4	Petroleum, Chemical, Plastics and Plastics Industry	667	10.13
C5	Electronic Industry	279	4.39
C6	Metal and Nonmetal Industry	570	8.67
C7	Machinery, Equipment and Instrument Industry	1015	15.39
C8	Pharmaceutical and Biological Products Industry	413	6.28
C9	Other Manufacturing	55	0.84
D	Production and Supply of Electricity, Gas and Water	278	4.22
E	Construction Industry	155	2.36
F	Transportation and Warehousing Industry	267	4.06
G	Information Transmission, Computer Services and Software Industry	394	5.99
H	Wholesale and Retail Industry	433	6.58
J	Real Estate Industry	231	3.51
K	Social Service Industry	221	3.36
L	Communication and Cultural Industry	36	0.55
M	Comprehensive Class	317	4.82
Total Sample		6358	100

Source: Author

Table 2. Definitions of variables

Variable reference	Variable (in full)	Definition
RDEP	Real Earnings Management	Is a proxy variable for the degree of real earnings management (this includes abnormal cash flow (R_CFO) , discretionary expenses (R_DISEXP) , abnormal product cost (R_PROD) and total variable (RM).
Balance	Equity Balance	The equity balance is set as a virtual variable, where $0.1 < \text{the ratio of first shareholding}(\text{Shh1}) < 0.5$, and the ratio of second shareholding($\text{Shh2}) > 0.1$, and $\text{Shh1} < \text{Shh1} + \text{Shh2} + \text{Shh3} + \text{Shh4} + \text{Shh5}$, the Balance value is 1, otherwise the value is 0
Instock	Institutional Shareholding	Proportion of total shares held by institutional investors
Bsize	Board Size	The number of board members disclosed in the annual reports of the companies in the sample set
Bmeet	Board Meeting	The number of meetings held by the board of directors of the companies in the sample set during the reporting period
Bstock	Directors Shareholding Ratio	The proportion of the total share capital held by the board of directors as disclosed in the annual reports of the companies in the sample set
Jstock	Supervisor Shareholding Ratio	The proportion of the total share capital held by the board of supervisors as disclosed in the annual reports of the companies in the sample set
Execom	Executive Compensation	The natural logarithm for the total remuneration of the top three executives during the reporting period as disclosed in the annual reports of the companies in the sample set
Exestock	Executive Shareholding Ratio	The proportion of the total share capital of the total share capital of the Sample Firms during the reporting period
Industry	Industry Variable Dummy	17 industry dummy variables
Year	Annual Variable Dummy	The valid samples cover a period of 4 years, so there are 3 annual dummy variables.

Source: Author

Table 3. Pearson correlation coefficients for the main research variables

	Balance	Instock	Bsize	Bmeet	Bstock	Jstock	Execom	Exe-stock
Balance	1							
Instock	0.047*** (0.000)	1						
Bsize	0.060*** (0.000)	0.028*** (0.004)	1					
Bmeet	-0.008 (0.417)	0.074*** (0.000)	-0.047*** (0.000)	1				
Bstock	0.103*** (0.000)	0.257*** (0.000)	-0.093*** (0.000)	0.024** (0.016)	1			
Jstock	0.030*** (0.002)	0.213*** (0.000)	-0.035*** (0.000)	-0.005 (0.589)	0.537*** (0.000)	1		
Execom	0.006 (0.530)	0.205*** (0.000)	0.097*** (0.000)	0.202*** (0.000)	0.076*** (0.000)	0.044*** (0.000)	1	
Exe-stock	0.105*** (0.000)	0.267*** (0.000)	-0.091*** (0.000)	0.019** (0.049)	0.975*** (0.000)	0.560*** (0.000)	0.086*** (0.000)	1

Note: double tailed test p value of the coefficients in given in brackets, whereby *, **, *** indicates a significance level of 1%, 5% and 10% respectively.

Source: Author

Contact address of the author:

Doc. Fang Lin, Ph.D., North China University of Technology, School of Economics and Management, NO. 5 Jinyuanzhuang Road, Shijingshan District, Beijing, China, e-mail: lfang2010@foxmail.com

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