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The Impact of Employee Performance Commitments on Corporate Earnings Management: A Decision Tree Approach based on Information Entropy

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ABSTRACT

This work explores the relationship between employee performance commitments and corporate earnings management, particularly in the context of mergers and acquisitions (M&A). It highlights that while performance commitments can align employee goals with corporate strategy, reduce information asymmetry, and signal market confidence, they may also incentivize earnings management when targets are unrealistically high. The study leverages a decision tree model based on information entropy to analyze this dynamic using M&A data from 2009 to 2022. The model uses real earnings management as the dependent variable and includes commitment duration, commitment amount, and several financial controls. Results indicate a positive correlation between unrealistic performance commitments and heightened earnings management. A case study of "XX Smart Enterprise" illustrates how excessive commitments led to significant financial strain and potential earnings manipulation. The paper proposes an optimized commitment level of approximately 30% to mitigate such risks. By integrating a generalized entropy increase algorithm into the traditional decision tree framework, the model improves prediction accuracy and offers practical guidance for setting realistic performance targets. The findings caution against overly ambitious commitments in M&A agreements and emphasize the need for balanced incentive structures to prevent short term earnings manipulation that could harm long term corporate health and stakeholder trust.

Keywords: Employee Performance Commitment, Corporate Earnings Management, Mergers and Acquisitions (M&A), Decision Tree Model, Information Entropy, Real Earnings Management, Performance Targets, Information Asymmetry

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1. Introduction

For businesses, employee commitments help plan specific developments for the upcoming quarter and alloca-

te project budgets before execution. This facilitates initial estimates of annual corporate earnings, there by enabling more effective management strategies and informed decision making. As a result, employee performance commitments have always played a crucial role in enterprise growth. With the rise of the stock market, investigating the motivations behind employees' performance commitments has become a prominent topic in academic research. Generally, it is understood that employee performance commitments have the following primary effects: Firstly, there exists a clear positive correlation between employee performance commitments and the projected corporate annual performance. The greater the employee performance commitment, the more closely it aligns with the corporate yearly objectives, sending an encouraging signal to the market and reflecting the company's confidence in its future growth. Secondly, employee performance commitments can help mitigate information asymmetry between the parties. Typically, the less the market understands about a company, the greater the likelihood of an employee performance commitment agreement between the company and its employees. In 2019, Professor Shen Huayu's study titled "Does Target Information Asymmetry Affect Performance Guarantee in Mergers and Acquisitions in China examined unlisted firms through the lens of game theory and discovered that the level of information asymmetry is significantly linked to the probability of signing an employee performance commitment agreement, directly validating the above assertion. Lastly, employee performance commitments can also safeguard the rights of pertinent stakeholders. Neither the market nor the business will engage in collaboration without preparation; even before cooperation, they will consider the worst case scenario and devise a final contingency strategy. In this context, the employee's performance commitment serves as one of the foundations for crafting the contingency plan, and the market may require the inclusion of specific clauses in the employee's performance commitment agreement to protect the interests of both parties effectively. At the same time, it can regulate the rights and responsibilities of both parties, ensuring alignment of interests and utilizing both incentives and constraints to facilitate mutually beneficial cooperation.

Nonetheless, despite these advantages, due to market dynamics and human factors, in certain instances, employee performance commitments have not positively influenced corporate earnings management as anticipated. Instead, in some extreme instances, due to excessively high employee performance commitments, the market may artificially inflate the company's value, and the company can only temporarily mask this through earnings management, leading to the "hollowing out" of employee performance commitments, which can have serious repercussions. Even if the company completes its collaboration with the market based on employee performance commitments, during the post commitment period, many companies experience a rapid decline in performance. Therefore, the aforementioned research indicates that unreasonable employee performance commitments are the primary driver of inappropriate corporate earnings management. Consequently, the focus of research has shifted towards establishing reasonable employee performance commitments to prevent corporate earnings management.

2. Employee Performance Commitment and Corporate Earnings Management

As of March 2023, there are 3,338 studies on "employee performance commitment" on the China National Knowledge Infrastructure (CNKI) platform, indicating that "employee performance commitment" has emerged as a trending subject in academic research. Concurrently, in practice, many companies require employees to create annual plans at the start of the upcoming fiscal year. Among these, the most vital element is the establishment of performance objectives for the forth coming year by employees, referred to as "employee performance commitment." Thus, employees' commitment to performance is essential for managing enterprises

in both theoretical frameworks and practical applications. In the preceding section, we have thoroughly examined its importance. In this chapter, we will delve into this topic and specifically explore the current research landscape regarding the influence of employee performance commitment on corporate earnings management. To begin with, we must recognize the beneficial impacts of employee performance commitments. According to researchers such as Kohers, Ang, and others who were among the first to suggest the signing of employee performance commitment agreements, such arrangements can help prevent firms from overstating their capabilities during collaboration [5].

By formalizing commitments in written form, both parties can bridge information gaps and safeguard market interests. Notably, in their initial concept, in addition to employee performance commitment agreements, both parties would also implement performance compensation commitment agreements to balance their interests and maximize incentives for companies to enhance their performance. In 2014, Chinese scholar Zhang A. performed specific empirical analysis grounded in prior theories [6]. By examining the acquisition processes of certain companies in the market, he discovered that after the acquired firm established employee performance commitments, the pace of project completion for both parties in the acquisition was considerably faster compared to companies that did not implement such commitments. Consequently, it was deduced that employee performance commitments can mitigate transaction costs arising from risks and information asymmetry encountered by the acquirer during the acquisition process, ultimately boosting acquisition efficiency. The scholar concluded that employee performance commitments can convey positive signals to the market and even enable the market to achieve excess returns during the cooperation announcement phase [7].

However, during the same timeframe, many researchers also identified negative repercussions of employee performance commitments, including corporate earnings management, as previously mentioned. Corporate earnings management involves the intentional manipulation of a company's accounting earnings through techniques like falsification to obscure or embellish its actual economic performance [8]. Initially, corporate earnings management primarily entailed manipulation within a defined scope, employing strategies such as prematurely recognizing income or delaying expense recognition to inflate current earnings; subsequently, earnings management evolved to include model driven manipulation, such as excessive production or discretionary cuts to research and development expenditures [9]. Regardless of the method, such behavior is like taking poison to quench thirst. It may temporarily deceive the market, consumers, or even relevant regulatory authorities, but it is highly detrimental to the company's long term development. Moreover, severe corporate earnings management can distort the company's regular business decisions and negatively impact its future operations. Operations involving illegal practices may also be subject to administrative penalties by regulatory authorities [10].

Decision tree models based on information entropy provide a powerful approach to detecting corporate earnings management, with studies demonstrating high predictive accuracy across diverse financial contexts. The evidence is robust: Suduan Chen et al., [11] developed an earnings management detection model using decision tree C5.0 that achieved 97.32% classification accuracy. Huirong Zhao et al., [12] specifically used information entropy as a decision basis, achieving a maximum accuracy of 95% in financial management predictions. Tam Phan Huy et al., [13] further validated tree based models, finding Gradient Boosting Machines outperformed traditional detection techniques in identifying complex earnings manipulation patterns.

The consistent high performance across studies suggests that decision trees with entropy metrics offer a sop-

histicated, data driven approach to understanding and predicting corporate earnings management strategies.

3. The Impact of Employee Performance Commitment and Corporate Earnings Management Based on the Decision Tree Model

3.1 Application of the Decision Tree Model in Enterprise Management

To prevent the company from engaging in unsuitable earnings management, management must identify the most appropriate standard for employee performance commitment. Conventional techniques typically rely on historical data to roughly estimate a figure; however, this method may inadvertently include some employees who set unrealistic, unattainable targets. In such instances, managers frequently struggle to find practical solutions and may not even be aware of the impractical performance objectives established by employees. This research presents an innovative decision tree model. By analyzing the company's historical data along with industry data, the decision tree model seeks to identify an appropriate correlation between employee performance commitment and corporate earnings management, allowing for accurate predictions. Serving as the foundational algorithm for this study, the decision tree model has been previously utilized in enterprise management. The decision tree model entails calculating the likelihood of all potential events and organizing them in a tree like structure to create a decision tree. Using data analysis techniques, the expected net present value is computed, and probabilities greater than zero are used to evaluate project risk and determine decision viability. This model is an intuitive graphical approach to implementing probability analysis in mathematics, and with advancements in machine learning, it has gained widespread application in enterprise management. Figure 1 illustrates how the decision tree assesses the probabilities of two different scenarios and identifies the best solution.

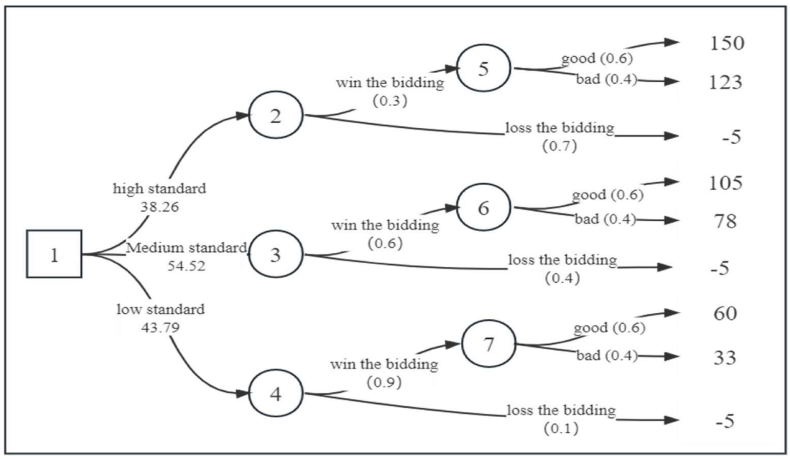

Figure 1. Application Example of a Decision Tree in Enterprise Management Decision

The commonly used decision Tree model is the ID3 algorithm. The decision tree is formed by selecting the attribute with the most significant information gain as the extended attribute. The model building formula is shown in Formulas 1 and 2.

$$H(X,C)=H(X)=-\sum_{i=1}^{n}p(C_i)\log_2 p(C_i) \tag{1}$$

$$H(X\mid a)=-\sum_{i=1}^{n}\sum_{j=1}^{m}p(C_i,a=a_j)\log_2 p(C_i\mid a=a_j) \tag{2}$$

3.2 The Relationship between Employee Performance Commitment and Corporate Earnings Management in Mergers and Acquisitions

Mergers and acquisitions (M&A) represent the primary contexts in which employee performance commitments occur, and the circumstances and backgrounds in these situations are more complex than in typical cases. To effectively illustrate the algorithm's efficacy discussed in this paper, we specifically examine the influence of employee performance commitment on corporate earnings management within M&A contexts. The dataset selected comprises M&A cases from the market spanning 2009 to 2022. After performing necessary data cleaning processes, 5914 M&A samples were retained. Continuous variables were Winsorized to preserve the integrity of the original data by capping values at the 1% upper and lower extremes.

With the cleaned dataset, a decision tree model was developed. In this research, we utilized the absolute value of real earnings management as the dependent variable to gauge the level of corporate earnings management. The duration of employee performance commitment and the amount committed were considered independent variables. Additional factors, including firm size, leverage ratio, return on assets, revenue growth rate, asset turnover rate, ownership structure, and audit quality, were treated as control variables in constructing the decision tree model. The specific model equations are given in formulas 3-5.

$$|REM| = \alpha_0 + \alpha_1 Per + \alpha_i Control_i + \varepsilon \quad (3)$$

$$|REM| = \alpha_0 + \alpha_1 LnCPA + \alpha_i Control_i + \varepsilon \quad (4)$$

$$|REM| = \alpha_0 + \alpha_1 Type + \alpha_i Control_i + \varepsilon \quad (5)$$

After visualizing all the data, we observed that the maximum and minimum values of real earnings were not equal to zero, indicating that all the selected company samples exhibited earnings management behavior. In addition, 47.8% of the companies were still in the performance commitment period, suggesting that at least half of the companies engaged in mergers and acquisitions signed employee performance commitment agreements. Lastly, upon analyzing the data, we found that nearly one-third of the samples did not meet the performance commitments set by the employees. Still, they also did not employ evident corporate earnings management practices. Further data analysis revealed that, while failing to meet performance commitments, 32.1% of companies used the agreed compensation methods during mergers and acquisitions to compensate for unachieved performance. The primary compensation methods were the "stock + cash" method, the stock method, or a combination of both.

Next, we introduced the breadth information entropy to verify the specific relationship between performance commitments and corporate earnings management. We established a fuzzy set Hartley measurement model to generalize the relationship in a fuzzy environment while considering the impact of different degrees of fuzziness among other companies, which is typically viewed in corporate management. The specific formulas are shown in formulas 6 and 7.

$$H_1(A) = \log_2 \sum_{i=1}^{n} A(x_i) \quad (6)$$

$$H_2(A) = \int_0^1 \log_2 |A_\lambda| d\lambda \quad (7)$$

Through constructing the decision tree model, we have established a fuzzy set whose level-cut set can be used to depict the essential characteristics. The level of the cut set reflects the fit between simulated and actual situations. Based on the degree of agreement between the two, the credibility of the decisions made can be confirmed. Therefore, during employee performance commitments, the target guidance can be conducted. The specific results are shown in Figure 2. From Figure 2, we can see that the level of the cut set increases with the level, indicating that, as the deviation between employee performance commitments and theoretical values increases under our model, the probability of the company's interference through earnings management also increases. This indirectly proves that employee performance commitment behavior can, to some extent, elevate the company's real earnings management level.

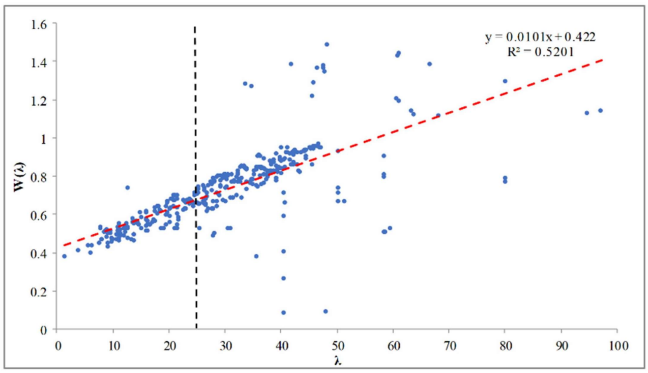

Figure 2. Illustration of the Function of Level Cut Sets

After demonstrating the model's validity, we needed to analyze its performance through examples. Therefore, in subsequent research, we selected a particular company in the market as an example and compared the classical decision tree model with the model proposed in this paper in terms of characteristics and performance, including tree and rule sizes, to demonstrate the advantages of this model.

4. Analysis, Inferences and Results

Drawing from the findings mentioned earlier, we simulated and examined actual market data. We chose XX Smart Enterprise as the focal point of our study and scrutinized the employee performance metrics outlined in the company's documentation related to mergers and reorganizations, along with its financial statements. A preliminary analysis of the data revealed that the commitments regarding employee performance resulted in a substantial financial setback of over 2.7 billion yuan in 2020, which is double the net earnings from 2016 to 2019. Notably, during the merger and reorganization phase, the acquisition price of the company was considerably higher than that of two other firms with superior performance. Thus, we conjectured that the company might be engaging in earnings management throughout the performance commitment period. After gathering and refining the data, we assessed the company's cash flow and historical financial information to identify its genuine earnings management activities from various perspectives. The detailed findings are depicted in Figure 3.

Figure 3 illustrates that the conventional decision tree method forecasts notable variability in the correlation between *XX* company's employee performance commitments and earnings management across the five variables compared. As a result, when juxtaposed with the predictions of the conventional decision tree method, the outcomes of the decision tree method introduced in this paper are more robust across all aspects.

Furthermore, we observed a marked correlation between the two at the 0.1 and 0.5 significance levels for the Type and Size variables, respectively, suggesting that the findings are accurate with 99% and 95% confidence, thereby reinforcing the credibility of this decision making level.

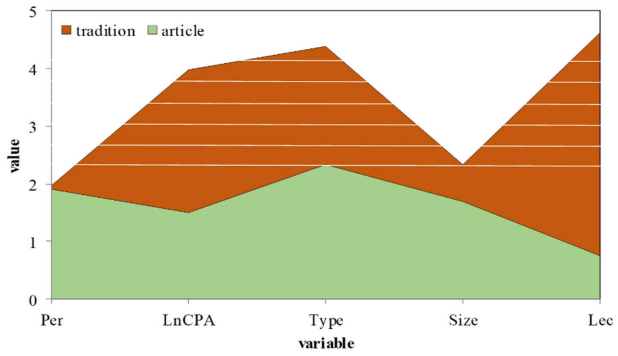

Figure 3. Decision Tree Regression Results for XX Enterprise

5. Conclusion

In conclusion, this paper suggests that the company might resort to earnings management strategies or other concealments to maintain positive profitability during a period of significant cash flow constraints to fulfill employee performance commitments. Nonetheless, it cannot be ruled out that the company could also employ cost-cutting and efficiency enhancement strategies, such as workforce reductions, reducing research and development expenditures, or even misrepresenting actual profit levels to prevent a decline in market and consumer trust and to protect the company's reputation. By implementing this finding within the decision-tree framework, we can determine that the optimal level of employee performance commitment is approximately 30%, thereby reducing the likelihood of the company engaging in earnings management. In summary, this paper began by examining the contemporary research landscape on employee performance commitments and corporate earnings management. It explored the decision tree model's role in reviewing the relationship between these two elements. Additionally, it introduced innovations to the traditional decision tree model by applying the generalized entropy increase algorithm to minimize prediction inaccuracies. Ultimately, by utilizing actual data from XX Smart Enterprise as a case study, the model was validated, revealing that the company was involved in inappropriate employee performance commitments that led to earnings management practices. The findings of this paper also offer valuable insights to relevant stakeholders. When establishing employee performance commitment agreements in mergers and acquisitions, the acquiring entity should set realistic targets to prevent such self defeating earnings management behaviors.

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