

*Original Research Article*

**The Moderating Role of Checks and Balances and Monitoring  
Mechanisms in the Degree of Strategic Aggressiveness: A Case Study  
of China's Listed Software and IT Services Industry**

**Abstract**

In this paper, software and information technology service industries listed in China's A-shares during 2018-2021 are selected as research samples to explore the moderating role of checks and balances and supervision mechanism in the degree of strategic radicalism. According to the above empirical results, two conclusions of this paper are summarized: 1. The degree of separation of two rights has a positive moderating effect on the degree of strategic radicalism and investment efficiency, especially when the degree of separation of two rights is at the middle and low level. 2. When the general manager and the chairman of the board are the same person, there is a negative moderating effect between the degree of strategic radicalism and investment efficiency. The higher the degree of strategic radicalism, if the chairman and the general manager are combined, the investment efficiency will be significantly reduced. According to the above research results, this paper puts forward corresponding suggestions for enterprises.

**Keywords:** Checks and balances, Degree of strategic aggressiveness, Investment efficiency

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## 1 Introduction

In 2019, the news that the famous car dealer PD Group is facing bankruptcy and reorganization has caused a sensation. Known as the "king of 4S", PD Group was once China's largest listed auto dealer, occupying half of China's auto sales market, with a market value of more than \$60 billion, PD Group was initially restructured from a state-owned enterprise, and rode the wind of the rise of China's automobile production and marketing industry all the way to the top, and since 2004 PD Group has been awarded the agency right of Subaru in eight provinces in northern China. Since 2004, when PD Group obtained the agency right of Subaru in 8 provinces in northern China, Pang, the founder, chairman, general manager, and the largest shareholder of the company, has led the company to start expanding frantically. From 2008 to 2010, Pang Automobile's sales volume grew at an annual rate of 45.46%, with a market share of close to 3%, and after going public in 2011, it obtained a large amount of financing. Only in 2011 the domestic added 410 sales outlets, an annual growth rate of up to 59%, two months after the listing, huge will be raised to 6.04 billion funds consumed, after this, huge began to lose money year after year, and ultimately fell apart. The huge event triggered this paper to carry out the correlation between the degree of corporate strategy aggressiveness and investment efficiency, as well as in the expansion of the checks and balances of the mechanism on the investment efficiency of the enterprise caused by how to influence the discussion.

Studies have analyzed the impact of corporate strategy on investment efficiency from the perspectives of strategic differences, innovation, and equity checks and balances, but fewer studies have focused on the economic consequences from the perspective of the degree of strategic aggressiveness, and there is a dearth of studies that have introduced checks and balances and supervisory mechanisms as moderating variables. Based on this, this paper attempts to study the relationship between the degree of strategic aggressiveness and investment efficiency of listed companies in China's software and information technology services industry from the perspective of the degree of strategic aggressiveness and to explore whether the checks and balances and supervision mechanisms play a moderating role in it. In order to improve the

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depth and rigor of this paper's research, as well as the preferability of the results, on the basis of regression analysis using the Ordinary Least Squares (OLS) method, we use the SPSS software plug-in program PROCESS 3.5 developed by Hayes (2017) to analyze the moderating role of checks and balances and supervisory mechanisms, which, in addition to empirical testing of the overall research model, can also further The program, in addition to empirical testing of the overall research model, can further analyze the moderating variables to understand under what circumstances the moderating effect is more significant. It is expected that the results of this paper can provide valuable theoretical support for improving the investment efficiency of companies and provide a reference basis for enterprises and investors to make investment decisions.

## **2 Literature Review**

### **2.1 Performance of checks and balances and monitoring mechanisms in corporate governance**

Shleifer and Vishny (1997) focus the study of corporate governance on the ways in which shareholders ensure their own access to the company's profits, the efficiency with which managers preserve and utilize the company's assets, and their oversight of managers. Zheng (1998) defines corporate governance as the problems associated with the ways in which the providers of corporate capital ensure that they receive a return on their investment. With the increasing development of the world economy and the continuous enrichment of corporate governance theory, the academic research on corporate governance has become more in-depth, and there is a general consensus in the international theoretical community that a better corporate governance structure should have certain common elements: accountability mechanisms and responsibilities, the principle of fairness and the principle of transparency. (Lu, 2001). Many scholars have further attempted to quantify the quality of corporate governance and establish a rating system through indicators such as board structure, shareholders' power and auditing (Khanchel, 2007; Waweru, 2014; Turrent and Ariza, 2016).

Comprehensively described in the above literature, this paper summarizes that the board structure and equity structure are two focal points in corporate governance

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issues, as the degree of strategic aggressiveness and investment efficiency mainly studied in this paper belongs to the company's operational decision-making, and the board of directors is precisely the highest decision-making department of the company's operation, therefore, the check and balance mechanism focused on in this paper is the checks and balances on the operational power, including the degree of equity checks and balances, the setup of independent directors, the degree of the separation of the two powers and the impact of combining the positions of chairman and general manager. The relevant research literature will be analyzed and summarized later in this chapter.

## 2.2 Definition and evaluation model of strategic aggressiveness

Corporate strategic behavior is a career activity that involves "overall organizational priorities and goals, as well as new priorities and directions" (Muller and Kunisch, 2018). In the 1960s, academics began to pay attention to the issue of corporate strategy, and the study of strategy types, strategy selection, strategy implementation, and strategy innovation came into the view of scholars. A large amount of research literature related to strategy began to appear. Innovation and other research into the vision of scholars, a large number of strategy-related research literature began to appear. Chandler (1962) first proposed that corporate strategy is "the determination of the basic long-term goals and decisions of the organization, the implementation of specific measures of action for the realization of this goal and the rational allocation of resources". Porter (1996) states that the essence of strategy is that a firm chooses to do its activities differently or in a different way than its competitors. The definition of corporate strategy has been gradually improved in academic research and practical exploration, Chandler (1962) focuses on the relationship between strategy and corporate structure and concludes that "the organizational structure of the company will be constantly adjusted with the changes in corporate strategy."

On this basis, scholars have developed a variety of different types of strategy division, Rumelt (1974) summarized two types of strategy through research: specialization strategy and diversification strategy, Miles et al. (1978) divided the

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company's strategy type into three categories: offensive, analytical, and defensive. Porter (1980) suggests different ways of dividing corporate strategy into cost leadership strategy, differentiation strategy, and specialization strategy. March (1991) analyzes the types of corporate strategy divisions from another perspective and divides corporate strategy into exploitation strategy as well as exploratory strategy. Treacy et al. (1995) suggest that corporate strategy can be classified into excellence in business, product leadership, and customer intimacy. Based on the shift in strategic behavior from conservative to aggressive, Miles and Snow (2003) classified corporate strategies as conservative, analytical, and aggressive. Among them, companies that adopt radical strategies are more willing to develop markets and enhance the benefits of innovation to achieve the company's goals, while companies that adopt conservative strategies tend to achieve their business goals through price advantages product quality, etc. Companies that are in between conservative and radical strategies are classified as analytical. Bentley et al. (2013) constructed a strategic indicator to represent an organization's business strategy type. The model scores six dimensions, namely, R&D propensity, growth, productivity, organizational stability, number of employees, and capital intensity, and a higher final score represents a more aggressive strategy.

### 2.3 Definition and Evaluation Model of Investment Efficiency

In an ideal world where capital markets are not flawed and agency costs do not exist within firms, firms can invest at an optimal level that maximizes firm value (Hayashi, 1982). However, in the real world, the existence of information asymmetry can cause firms to underinvest (Myers and Majluf, 1984) and the existence of agency conflicts between managers and shareholders can trigger firms to overinvest (Jensen, 1986). FHP (Fazzari et al., 1988) uses investment-cash flow sensitivity to measure the degree of financing constraints faced by firms. Although this model has been used by scholars in several countries, some scholars have argued that in this model, there are problems such as investment and cash flow sensitivity do not necessarily increase only with the degree of financing constraints (Kaplan and Zingales, 1997), as well as bias in the measurement of Tobin's Q (Erickson and Whited, 2005). Vogt (1994) then

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improved on these problems by constructing an econometric model that includes investment opportunities, cash flows, and their interaction terms, but still suffers from measurement bias in Tobin's Q value.

Since neither of these models can quantify the extent of inefficient investment in a specific firm, Richardson (2006) uses the residuals of model (1) to measure the firm's inefficient investment as follows:

$$\begin{aligned} \text{INVEST}_{it} = & \alpha_0 + \alpha_1 \text{GROWTH}_{i,t-1} + \alpha_2 \text{LEV}_{i,t-1} + \alpha_3 \text{CASH}_{i,t-1} + \alpha_4 \text{AGE}_{i,t-1} \\ & + \alpha_5 \text{SIZE}_{i,t-1} + \alpha_6 \text{RETURNS}_{i,t-1} + \varepsilon_{it} \end{aligned}$$

Where INVEST is the new investment in the current period (normalized by total assets), GROWTH is the growth rate of operating income in the previous period, LEV is the gearing ratio in the previous period, CASH is the cash ratio in the previous period, AGE is the number of years since the listing in the previous period, SIZE is the natural logarithm of the book value of total assets in the previous period, and RETURNS is the annual return on a company's stock in the previous period.  $\varepsilon$  is the residual, which is the inefficient investment, represents overinvestment,  $\varepsilon$  value is greater than 0 indicates overinvestment, less than 0 indicates underinvestment, the explanatory variable (ININVEST) in this paper is the inefficient investment represented by  $\varepsilon$ . This is the most commonly used investment efficiency assessment model in academia.

#### 2.4 Research literature on the degree of strategy aggressiveness and investment efficiency

Strategy serves as the starting point for a series of business decisions of enterprises, and differences in strategy will inevitably have different impacts on financial decisions (Wang et al., 2018). SINGH et al. (1986) argued that strategic differences challenge the survival and development of enterprises; Li et al. (2016) found that strategic differences exacerbate enterprise risks and deteriorate the conditions of enterprise financing; Wang et al. (2017) argued that for external stakeholders, higher returns are demanded in order to compensate for the rising

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information costs and risk losses due to strategic differences, which also increases the cost of capital for firms.

Strategic aggressiveness may lead to investment aggressiveness, i.e. overinvestment. Faster expansion of strategically aggressive firms is prone to overinvestment (Wang et al., 2016), coupled with the lack of industry benchmarking, higher information asymmetry (Aboody et al., 2000), and more decentralized internal control mechanisms (Miles et al., 1978) in strategically aggressive firms. This will further reduce the cost of overinvestment for management and provide decision space for them to overinvest. Overinvestment implies that firms allocate their assets to projects with NPV less than 0, leading to a decrease in overall investment efficiency (Guo et al., 2021).

Scholars further used the strategic aggressiveness analysis model to discuss the investment efficiency level of firms using different strategies. Miles et al. (1978) found that overinvestment was significantly associated with offensive strategies and underinvestment was significantly associated with defensive strategies. Ye et al. (2015) measured strategy differences in terms of six indicators: advertising intensity, degree of innovation, capital intensity, degree of renewal of fixed assets, overhead expenditures, and financial leverage, and their study found that firms with large strategy differences have more opportunities for speculative risk-taking by executives, which leads to an increase or a decrease in investment efficiency. Jiang and Liao (2022) conducted further research on this basis and found that strategy differences in were significantly positively correlated with inefficient investment, indicating that the more a company deviates from the industry's conventional strategy, the greater the degree of inefficient investment. Lin et al. (2021) found that corporate strategy plays an important role in corporate investment behavior and the formation of investment efficiency and that companies that adopt a defensive strategy and an analytical strategy can both mitigate overinvestment through high social responsibility. Habib and Hasan (2021) found that firms using an attacker-type strategy are associated with inefficient labor investment, while firms using a defensive strategy are associated with efficient labor investment.

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Summarizing the above literature, the degree of corporate strategic differentiation is characterized by overconfidence, over-optimism, and preference for high-risk, high-return projects, which tend to lead to overinvestment in large, which may be manifested as overly aggressive strategies and overly conservative strategies. Managers who tend to have aggressive strategies usually; managers who tend to have conservative strategies generally show loss aversion and risk aversion qualities that tend to trigger underinvestment. Therefore, this paper proposes research hypothesis 1.

H1: The degree of strategic aggressiveness has a negative and significant effect on investment efficiency.

## 2.5 Research Literature on Checks and Balances and Supervisory Mechanisms on Strategy or Investment Efficiency

Most of the checks and balances and supervisory mechanisms mentioned in the current literature include the degree of separation of powers, the degree of equity checks and balances, the ratio of two positions and the ratio of independent directors, which are organized as follows:

### 2.5.1 Equity Checks and Balances

Regarding the impact of equity checks and balances on investment efficiency, the academic community has always consisted of two different voices, Wu and Pang (2022) summarized the positive and negative points of view: the first point of view is that equity checks and balances play a positive role. Equity checks and balances can effectively reduce the agency cost between shareholders and managers, which in turn improves corporate performance and promotes efficient investment. This view is supported by the research of Hu (2021), who found that there is a significant positive correlation between the equity checks and balances of enterprises and investment efficiency; Lu (2018) also argued that the concentration of equity can contribute to the occurrence of inefficient investment. The second view argues that equity checks and balances play a negative role. When the interests of major shareholders are aligned with each other, they may conspire to usurp the interests of other shareholders and undermine the internal control of the enterprise, which in turn impairs investment efficiency. Similarly, some scholars support the second view, Fu and Shi (2017) and

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Wang et al. (2021) argue that equity concentration is significantly positively related to the investment efficiency of Chinese firms. Wang et al. (2019) adds the variable of internal control in his study and argues that there is a positive relationship between the quality of internal control and investment efficiency and that when the degree of equity checks and balances is low, the effect of internal control on the inhibition of low level of investment efficiency is weak.

There are fewer studies on equity checks and balances and strategy. He and Dai (2019) found that equity structure has a moderating effect on the relationship between cost stickiness and operating performance of a firm, which will affect the firm's decision-making in innovation transformation.

#### 2.5.2 Duality of the positions of Chairman and CEO

In terms of investment efficiency, Dey et al. (2012) found that firms that separate the positions of general manager and chairman due to investor pressure have lower performance, earnings, and investment efficiency. However, most scholars favor the opposite opinion, when the positions of chairman and general manager of an enterprise are held by the same person, the general manager is subject to less pressure from the board of directors to supervise and check and balance and may have opportunistic tendencies out of self-interest, which negatively affects the enterprise's investment efficiency, so the investment efficiency of the enterprise with two positions is likely to be less than that of the enterprise with two separated powers (Yu, et al., 2016; Wang et al. 2020; Yang et al, 2019). Wang et al. (2020), on the other hand, are of the opinion that there is an effect of equity concentration on the relationship between two-job integration and investment efficiency and that two-job integration is significantly negatively related to investment efficiency in firms with higher equity concentration.

In terms of strategy, Cheng (2018) argues that the degree of two-job unity is significantly and positively related to firms' R&D and innovation strategies; Sun and Ren (2019) point out that the leadership structure of two-job unity is one of the most important factors that lead to the differences in internationalization strategies among firms; Tang et al. (2022) find that the two-job unity has a significant impact on the

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degree of strategic change implemented by firms.

### 2.5.3 The degree of separation of two rights and investment efficiency

In terms of investment efficiency-related research Xiao and Zhu (2016) according to the nature of property rights of Chinese enterprises into state-owned enterprises and private enterprises, found that the degree of separation of the two rights of state-owned enterprises and the enterprise's investment scale there is a significant positive correlation, while the degree of separation of the two rights of private enterprises and the scale of investment shows a significant negative correlation. Mai (2019) found that the higher the degree of separation of the two rights of controlling shareholders, the more the company tends to expand the scale of investment, and there is a significant positive correlation between the two; the separation of the two rights of controlling shareholders has a significant positive correlation with overinvestment, while there is no significant correlation with underinvestment. Zhang (2019) found that there is a positive relationship between the degree of separation of the two powers and corporate overinvestment; when analysts follow up, corporate overinvestment caused by the separation of the two powers does not fall, but rather, the positive relationship between the degree of separation of the two powers and corporate overinvestment is enhanced; this enhancement effect is more significant in the state-owned enterprises. There are fewer studies in the area of separation of powers and strategy; Zhang and Ju (2021) advocate that there is a difference in the governance effect of heterogeneous institutional investors and that supervisory investors have a significant governance effect, and the difference is especially significant in the context of control with a low degree of separation of powers; Xie et al. (2019) find that separation of powers in a family-owned firm weakens the propensity of family-owned firms to invest in research and development (R&D) with the R&D intensity.

### 2.5.4 Percentage of independent directors and investment efficiency

The impact of the proportion of independent directors on enterprises is more complex, influenced by corporate strategy and the characteristics of independent directors such as education and background. In recent years, domestic and foreign

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scholars have launched research on independent directors and investment efficiency from various angles, Hang (2017) believes that companies with a high proportion of financially independent directors and financially independent directors are more effective in curbing overinvestment and underinvestment; Rajkovic (2020) found that there is a positive correlation between the presence of the lead independent director in the board of directors of a company and the investment efficiency, which is also influenced by the This relationship is also affected by the level of corporate governance and financial status: Liu et al. (2020) found that: the network of independent directors reduces the investment efficiency of state-owned listed companies, however, the network of independent directors plays a significant role in the improvement of investment efficiency in commercially competitive firms. Li et al. (2022) focused on the impact of scholarly independent directors on corporate investment efficiency, they found that the higher the proportion of scholarly independent directors, the higher the corporate investment efficiency, and when there is a high percentage of highly educated scholarly independent directors, when the scholarly independent directors have been in the position for a longer period of time, or when the number of part-time firms is more, the scholarly independent directors can perform their functions better, and better improve the investment efficiency of the company.

In the research literature on independent directors and corporate strategy, Sheng and Zhu (2021) found that the professional resources of independent directors have a positive and significant effect on the strategic change of the enterprise, and the social capital of independent directors and the strategic change of the enterprise has an inverted U-shape relationship; Gong and Peng (2021) pointed out that technological independent directors tend to be more concerned about the long-term development of the enterprise, and therefore are more capable of Jiao and Sun (2021) claim that academic independent directors can not only improve the level of R&D input and output, but also help to improve the efficiency of corporate innovation, and that technical academic independent directors who serve as members of the strategy committee have a more pronounced effect on the promotion of R&D output.

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After summarizing the above literature, research hypothesis 2 is proposed.

H2: Supervision and check-and-balance mechanisms have a significant effect on both investment efficiency and corporate strategy.

### 3 Methodology

Based on the references to domestic and international related literature and summarizing their findings, this paper summarizes two research hypotheses, H1: the degree of strategic aggressiveness has a negative and significant impact on investment efficiency, and H2: the monitoring and check-and-balance mechanism has a significant impact on both investment efficiency and corporate strategy. Based on the above research hypotheses, this paper establishes the following relationship figure 1 as the basis of the research design to explore the relationship between the degree of strategic aggressiveness, supervision and check-and-balance mechanism and investment efficiency.

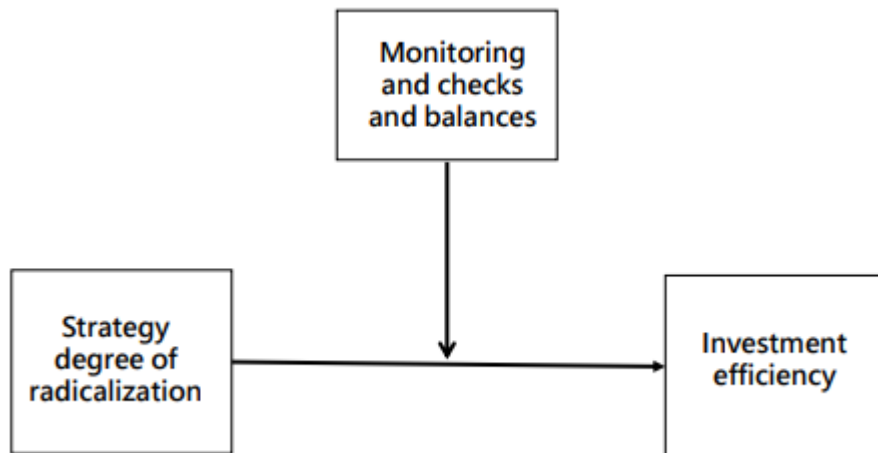


Figure 1 Relationship between the degree of strategic aggressiveness, monitoring, and checks and balances, and investment efficiency

The Fifth Session of the Thirteenth National People's Congress in 2022 explicitly stated that "it is necessary to increase incentives for enterprise innovation and promote the development of entrepreneurial investment", in which "productive service industries such as information technology services are developing faster and the resilience of the industrial chain has been improved". The software and information technology service industry, as an enterprise innovation industry, has

been developing rapidly and the resilience of the industry chain has been improved. The software and information technology services industry as an enterprise innovation "force", compared with banks and, the traditional manufacturing industry, has a high degree of strategic aggressiveness, and frequent investment and financing activities, in the framework of the study has a strong representativeness and researchability.

Based on the software and information technology services industry is so important, this paper takes the 2018-2021 Chinese A-share listed software and information technology services industry as a research sample, all the sample data are taken from the CSMAR database, and after the data are downloaded, incomplete samples with incomplete information are deleted first, and then the extreme values are deleted, and a total of 642 valid samples are obtained.

In terms of research methodology, the OLS method was used for regression analysis, and the moderating role of checks and balances and supervisory mechanisms was carried out with the plug-in program PROCESS V3.5 of SPSS. With the progress of scientific research, the structure of the study is becoming more and more complex, and the least squares method of regression analysis can only predict a specific explanatory variable with multiple explanatory variables if the mediation model is analyzed with SPSS software, it needs to be verified gradually by performing multiple steps. If there are both mediating and moderating effects in the research model, SPSS software can only test them in segments, but it is not known whether the results of the segmented test are the same as the overall test. Based on this phenomenon, Hayes (2017) developed the PROCESS analysis module, which can be directly applied to the SPSS software to directly analyze complex research architecture. The regression model design for this paper is as follows:

$$ININV_{i,t} = \alpha_0 + \alpha_1 STRG_{i,t} + \alpha_2 SPR_{i,t} + \alpha_3 STRG * SPR_{i,t} + \alpha_4 SCALE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 FCF_{i,t} + \alpha_7 SOE_{i,t} + \alpha_8 CYEAR_{i,t} + \varepsilon_0 \dots \dots \dots (1)$$

$$ININV_{i,t} = \alpha_0 + \alpha_1 STRG_{i,t} + \alpha_2 CHGM_{i,t} + \alpha_3 STRG * CHGM_{i,t} + \alpha_4 SCALE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 FCF_{i,t} + \alpha_7 SOE_{i,t} + \alpha_8 CYEAR_{i,t} + \varepsilon_0 \dots \dots \dots (2)$$

$$ININV_{i,t} = \alpha_0 + \alpha_1 STRG_{i,t} + \alpha_2 EQBL_{i,t} + \alpha_3 STRG * EQBL_{i,t} + \alpha_4 SCALE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 FCF_{i,t} + \alpha_7 SOE_{i,t} + \alpha_8 CYEAR_{i,t} + \varepsilon_0 \dots \dots (3)$$

$$ININV_{i,t} = \alpha_0 + \alpha_1 STRG_{i,t} + \alpha_2 INDEP_{i,t} + \alpha_3 STRG * INDEP_{i,t} + \alpha_4 SCALE_{i,t} + \alpha_5 AGE_{i,t} + \alpha_6 FCF_{i,t} + \alpha_7 SOE_{i,t} + \alpha_8 CYEAR_{i,t} + \varepsilon_0 \dots \dots (4)$$

Variable Description:

1. Explanatory variables: the explanatory variable of this paper is inefficient investment (ININV), using Richardson's (2006) investment efficiency model, and using the residuals in the model as a proxy variable for inefficient investment, and the investment efficiency evaluation model is described in detail in the literature review.

2.Explanatory variables: the explanatory variable in this paper is the degree of strategic aggressiveness (STRG), which is scored using the strategic aggressiveness evaluation model of Bentley et al. (2013), and the scoring criteria are explained in Table 1.

Table 1 Description of Bentley et al.'s (2013) model for evaluating strategic aggressiveness

Variable	meanings	Calculation	Scoring Criteria
RD	The company's propensity for R&D and innovation	Average value of enterprises' R&D expenditure as a percentage of main business revenue in the past five years	ndicators were ranked from smallest to largest and categorized into five levels, with 1, 2, 3, 4, and 5 points
EMPS	Company productivity	Mean value of the ratio of the number of employees to the main business revenue of the enterprise in the past five years	awarded in order from the smallest group to the largest.
REV	Growth of the company	Average of the growth rate of business revenue of the	

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		enterprise in the past five years	
SEXP	The company's propensity to expand	Average value of the ratio of selling and administrative expenses to main business income of the enterprise in the past five years	
EMP	Stability of the organizational structure	Standard deviation of the number of employees of the enterprise in the last five years	
PPE	Capital intensity of the company	Average of the ratio of fixed assets to total assets of the enterprise in the past five years	The indicators are ranked from smallest to largest and categorized into five grades, from the smallest group to the largest group in the order described above. 5, 4, 3, 2 and 1 points are given from the smallest group to the largest group in the order described above. One, two, three, four and five points will be awarded.

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Summing the above six metrics will result in an overall score between 6 and 30, which is the level of strategic aggressiveness. Companies with a score between 6 and 12 have a defensive strategy, companies with a score between 13 and 23 have an analytical strategy, and companies with a score between 24 and 30 have an offensive

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strategy.

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3. Moderating variables: The moderating variables in this paper are the checks and balances and monitoring mechanisms in corporate governance, including the degree of separation of powers (SPR), the two jobs (CHGM), the degree of equity checks and balances (EQBL) and the proportion of independent directors (INDEP) four mechanisms as a proxy variable, the way of calculating and measuring the method is described below:

3.1 Degree of Separation of Powers (SPR): refers to the difference between control and ownership, which represents that the owner is delegating the task of management operation to others, following the trend of management specialization.

3.2 Duality of the positions of Chairman and CEO (CHGM): this variable is a dummy variable, the value is 0 when the general manager of the company is also the chairman of the board of directors, and vice versa is 1.

3.3 Degree of Equity Check and Balance (EQBL): it represents the degree to which it is possible to compete with the first largest shareholder and is calculated by dividing the percentage of shares held by the second to fifth largest shareholders by the percentage of shares held by the first largest shareholder.

3.4 Percentage of independent directors (INDEP): the proportion of seats occupied by independent directors among the total number of seats on the board of directors, calculated as the total number of independent directors divided by the total number of directors on the board of directors.

4. Control variables: this paper selects company size (SCALE), company age (AGE), free cash flow (FCF), the nature of property rights (SOE) and the epidemic year (CYEAR) as the control variables, the measurement method is described below:

4.1 Company size (SCALE): with reference to Yuan (2014) study, company size has a significant impact on investment efficiency, so this paper lists company size as one of the control variables and takes the total assets of the company as an alternative variable to company size, and in order to narrow the gap between the absolute value

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of this variable and the other variables but not to affect the relative relationship, so the natural logarithm of the variable is taken.

4.2 Firm age (AGE): Drawing on the study of Li and Sun (2022), the life cycle of a firm has a significant impact on the investment rate, so this paper includes the age of the firm as one of the control variables.

4.3 Free Cash Flow (FCF): Li and Li (2017) found that free cash flow has a significant impact on investment efficiency, so this paper lists free cash flow as one of the control variables, due to the large amount and part of the sample has a negative number of cases, in order to narrow the gap between the absolute value of the variables, so it adopts the unit of RMB million yuan.

4.4 Nature of ownership (SOE): Sun et al. (2023) found that state-owned enterprises generally have better investment efficiency than private enterprises, so this paper selects the nature of ownership as one of the control variables, which is a dummy variable, set to "1" if it is a state-owned enterprise, or "0" if it is not. "

4.5 Epidemic year (CYEAR): refer to Zheng and Liu (2021) found that the new crown epidemic on the investment efficiency of enterprises caused a negative and significant impact, so this paper will be the epidemic year as one of the control variables, this is a dummy variable, if the epidemic year is set to "1", otherwise set to "0".

#### 4 Results and Discussion

The empirical results and analytical notes obtained based on the execution of the research design are presented in Tables 2 to 6.

Table 2 Descriptive statistics (N=642)

Variable	Min.	Max.	Ave.	S.E.
ININV	0.001	0.222	0.031	0.037
STRG	9.000	27.000	17.989	4.434
SPR	0.000	17.508	1.739	3.902
EQBL	0.094	3.245	0.979	0.654
CHGM	0.000	1.000	0.375	0.485

INDEP	0.333	0.500	0.382	0.048
SCALE	19.833	23.936	21.598	0.880
AGE	10.189	34.682	19.511	4.720
FCF	-181.700	179.971	-2.539	48.742
SOE	0.000	1.000	0.148	0.355
CYEAR	0.000	1.000	0.268	0.443

Note: For each variable code, please refer to the variable descriptions in 3 Methodology.

According to the statistics in Table 2, the data of each variable of all the samples cover a fairly large range, which reflects that there are great differences in the business environment and business results of all the sample enterprises during the three-year sample period, so in addition, this paper, on the basis of the regression analysis using the method of least squares, increases the use of the plug-in program PROCESS V3.5 of SPSS to analyze the moderating effect of the checks and balances and supervisory mechanisms, which can more deeply explore which level of the moderating effect is more significant, and will make the research results more practical. In-depth exploration of the regulatory effect in the sample data at which level is more significant, will make the results of the study more practical. The empirical results of the least squares method are analyzed in Tables 3 to 6.

Table 3 The empirical results of model (1) (N=642)

Variable	Coefficient	t value	p value
Con_	0.181	4.995	0.000***
STRG	0.001	1.558	0.120
SPR	0.005	2.533	0.012**
STRG*SPR	-0.000	-2.372	0.018**
SCALE	-0.007	-4.189	0.000***
AGE	-0.000	-0.789	0.430

FCF	0.000	0.001	0.999
SOE	-0.009	-2.051	0.041**
CYEAR	0.000	0.007	0.994
Fvalue	4.449***		
Analysis of the moderating effect for SPR			
	SPR	EFFECT	confidence interval
STRG	0.000	0.001	0.000~0.001
STRG	0.000	0.001	0.000~0.001
STRG	3.594	-0.000	-0.001~0.000

Note 1: For each variable code, please refer to the variable descriptions in 3 Methodology.

Note 2: Significance is \*\*\* for  $p \leq 0.01$ , \*\* for  $0.01 < p \leq 0.05$ , and \* for  $0.05 < p \leq 0.1$ .

The empirical results in Table 3 show that the degree of separation of powers is positively related to corporate overinvestment, which is basically consistent with the results of previous studies such as those of Zhang (2019) and Mai (2019); however, in the empirical results of Table 3, it is also found that the cross-terms of the degree of strategic aggressiveness and the degree of separation of powers and the efficiency of investment are presenting a significant positive correlation, which suggests that the higher the degree of strategic aggressiveness of a firm, the higher the This indicates that the higher the degree of strategic aggressiveness of the enterprise, the higher the degree of separation of powers contributes to the improvement of investment efficiency, that is, the degree of separation of powers has a moderating effect between the degree of strategic aggressiveness and investment efficiency. In addition, firm size and property right nature have a significant effect on investment efficiency, and large-scale firms and state-owned enterprises tend to have higher investment efficiency. In addition, the moderating effect analysis shows that the moderating effect is most significant when the degree of separation is at the low versus medium level. This conclusion is different from the research claim of Mai (2019) that "the degree of

separation has a significant positive relationship with the company's investment size", and this difference is related to the different industries selected for the research sample, the software and information technology services industry has the characteristics of technology-intensive and geographic span, and the higher the degree of innovation of the industry's development, The software and information technology services industry is technology-intensive and geographically spanning, the higher the degree of innovation in industry development and the larger the scale of business is the main way of investment return.

Table 4 The empirical results of model (2) (N=642)

Variable	Coefficient	t value	p value
Con_	0.191	4.967	0.000***
STRG	-0.000	-0.465	0.642
EQBL	-0.007	-0.699	0.485
STRG* EQBL	0.001	0.908	0.364
SCALE	-0.007	-4.087	0.000***
AGE	-0.000	-0.617	0.538
FCF	0.000	-0.003	0.998
SOE	-0.011	-2.552	0.011**
CYEAR	0.000	0.052	0.959
F value	3.769***		

Note 1: For each variable code, please refer to the variable descriptions in 3 Methodology.

Note 2: Significance is \*\*\* for  $p \leq 0.01$ , \*\* for  $0.01 < p \leq 0.05$ , and \* for  $0.05 < p \leq 0.1$ .

According to the empirical results in Table 4, it is found that there is no moderating effect of equity checks and balances between strategic aggressiveness and investment efficiency. In this case, the descriptive statistics in Table 2 show that the degree of equity checks and balances and the degree of separation of powers in the

software and information technology services industry are generally low, and the moderating effect in Table 3 also shows that the degree of separation of powers has the best moderating effect in the middle and low levels, which indicates that there are most "one share only" situations in this industry, so the business operation is the main factor that affects the investment efficiency. Therefore, the right to operate the business is the main factor affecting the investment efficiency, and the structure of the shareholding cannot significantly affect the decision-making of the financial and business.

Table 5 The empirical results of model (3) (N=642)

Variable	Coefficient	t value	p value
Con_	0.183	5.002	0.000***
STRG	-0.000	-0.609	0.543
CHGM	-0.020	-1.474	0.141
STRG* CHGM	0.001	1.709	0.088*
SCALE	-0.007	-3.885	0.000***
AGE	-0.000	-0.639	0.523
FCF	0.000	0.051	0.959
SOE	-0.011	-2.556	0.011**
CYEAR	0.000	0.067	0.947
Fvalue	4.027***		
Analysis of the moderating effect for CHGM			
	CHGM	EFFECT	confidence interval
STRG	0.000	-0.000	-0.001~0.000
STRG	1.000	0.001	0.000~0.002

Note 1: For each variable code, please refer to the variable descriptions in 3 Methodology.

Note 2: Significance is \*\*\* for  $p \leq 0.01$ , \*\* for  $0.01 < p \leq 0.05$ , and \* for  $0.05 < p \leq 0.1$ .

From the empirical results in Table 5, it is found that two-job unification has a significant negative moderating effect between the degree of strategic aggressiveness and investment efficiency. And the analysis of the moderating effect shows that the moderating effect is most obvious especially in the case of the two positions of chairman and general manager, which is basically the same as the findings of Liu (2022) on the study of the two positions and the dual innovation of the enterprise; the study advocates that the two positions have no significant impact on innovation in the introductory period, diverges significantly in favor of breakthrough innovation but not in favor of incremental innovation during the growth period, facilitates and hinders two types of innovations in the maturity period and the decline period, respectively, and significantly hinders incremental innovation in the turbulence period. Facilitates and hinders both types of innovations, and significantly hinders incremental innovations during turbulent periods. This suggests that the impact of dual-role integration on enterprises is complex, and phased, and needs to be viewed dialectically.

Table 6 The empirical results of model (4) (N=642)

Variable	Coefficient	t value	p value
Con_	0.253	3.900	0.000***
STRG	-0.002	-0.773	0.440
INDEP	-0.173	-1.369	0.172
STRG*INDEP	0.006	0.868	0.386
SCALE	-0.007	-4.175	0.000***
AGE	-0.000	-0.600	0.549
FCF	0.000	-0.091	0.928
SOE	-0.012	-2.855	0.004***
CYEAR	0.000	0.080	0.937
Fvalue	4.285***		

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Note 1: For each variable code, please refer to the variable descriptions in 3 Methodology.

Note 2: Significance is \*\*\* for  $p \leq 0.01$ , \*\* for  $0.01 < p \leq 0.05$ , and \* for  $0.05 < p \leq 0.1$ .

The empirical results in Table 6 show that there is no moderating effect of the percentage of independent directors between strategic aggressiveness and investment efficiency. It indicates that independent directors in the software and information services industry do not have the ability to provide professional contributions to the company.

### **Conclusions and recommendations**

This paper selects China's A-share listed software and information technology services industry as a research sample from 2018-2021 to explore the moderating role of checks and balances and supervisory mechanisms in the degree of strategic aggressiveness. Based on the above empirical results, a total of two research conclusions of this paper are summarized:

1. The degree of separation of powers has a positive moderating effect on the degree of strategic aggressiveness and investment efficiency, especially when the degree of separation of powers is located in the middle and lower levels, the effect is more obvious.
2. When the general manager and the chairman of the enterprise are the same person, it has a negative moderating effect between the degree of strategic aggressiveness and investment efficiency, the higher the degree of strategic aggressiveness of the enterprise, if the chairman of the board of directors and the general manager of the two positions together, it will significantly reduce the investment efficiency.

According to the above research results, this paper puts forward the corresponding recommendations as follows:

1. software and information technology services industry has a high degree of technological innovation and highly competitive industry characteristics, and the internal checks and balances and supervision mechanism can avoid too impulsive decision-making, but based on the industry characteristics, but also needs to have fast

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timeliness, so as not to miss the business opportunities; therefore, enterprises should not only consider the form of the checks and balances and supervision mechanism of the practice but should pay more attention to recruiting the appropriate professionals and risk management personnel to participate in the operation. Therefore, the practical operation of the check and balance and supervision mechanism should not only consider the form but should pay more attention to recruiting suitable professionals and risk management talents to participate in the operation.

2. The purpose of the separation of powers between the chairman and the general manager is to constrain the power, the chairman and the general manager have a very high status in the organizational structure, so if the decision is wrong, the impact on the company is even more significant, so it is recommended that enterprises should avoid the setup of the two positions, so that the company's major financial and business to make the right decision will provide better protection.

3. At present in the domestic listed companies, independent directors generally do not play due professionalism and independence, almost all of them are the chairman of the board of directors or major shareholders of friends and relatives, so they will only be attached to the chairman of the board of directors or major shareholders of the views, coupled with the empirical data in this paper shows that this paper studies the software and information technology services industry in general there is a phenomenon of one share of the sole, the role of the independent directors can not be wielded, which is the major shareholders and the chairman should think about the problem, how to change the situation? The chairman should think about the problem of how to change the concept and trust the professionals.

**COMPETING INTERESTS DISCLAIMER:**

**Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.**

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