ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE **(APNOR)**

INSTITUTO POLITÉCNICO DE BRAGANÇA

The Relationship between Corporate Governance, Investment Efficiency and Financial Performance

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Supervisors:

Prof. Doutora Ana Paula Monte

***Bragança*, December, 2024.**

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Abstract

In recent years, with the slowdown of the global economy, a series of reform policies introduced by various countries have emphasized the improvement of market structure and the removal of production capacity. At the heart of the reform is the issue of corporate governance, which can effectively reduce agency costs and enhance investment efficiency, thus improving financial performance. This paper focuses on the relationship between corporate governance, investment efficiency and financial performance in three countries: China, Germany and Portugal. On this basis, seven research hypotheses are formulated and four models are developed to test these hypotheses. There is the model of the relationship between corporate governance and financial performance, the econometric model of investment efficiency, the model of the relationship between corporate governance and investment efficiency, and the model of the mediating effect to test the mediating role of investment efficiency. Finally, the empirical analyses found that: (1) Corporate governance is significantly and positively related to financial performance. (2) Corporate governance is significantly positively related to investment efficiency. (3) The mediation effect test model finds that there is a partial mediation effect of investment efficiency.

On this basis, this paper puts forward corresponding policy recommendations from two aspects. First, corporate governance. This includes strengthening equity governance, improving board governance mechanisms, and increasing CEO gender diversity.

Second, investment efficiency. The company should establish rational, scientific and standardized investment decision-making procedures to enhance the usefulness of decision-making to improve financial performance.

Keywords: corporate governance, investment efficiency, financial performance

Resumo

Nos últimos anos, com o abrandamento da economia global, uma série de políticas de reforma introduzidas por vários países enfatizaram a melhoria da estrutura do mercado e a eliminação da capacidade de produção. No centro da reforma está a questão do governo das sociedades, que pode efetivamente reduzir os custos de agência e aumentar a eficiência do investimento, melhorando assim o desempenho financeiro. Este documento centra-se na relação entre o governo das sociedades, a eficiência do investimento e o desempenho financeiro em três países: China, Alemanha e Portugal. Nesta base, são formuladas sete hipóteses de investigação e são desenvolvidos quatro modelos para testar essas hipóteses. Há o modelo da relação entre a governação empresarial e o desempenho financeiro, o modelo econométrico da eficiência do investimento, o modelo da relação entre a governação empresarial e a eficiência do investimento e o modelo do efeito mediador para testar o papel mediador da eficiência do investimento. Por último, as análises empíricas concluíram que: (1) O governo das sociedades está significativa e positivamente relacionado com o desempenho financeiro. (2) O governo das sociedades está significativamente relacionado de forma positiva com a eficiência do investimento. (3) O modelo de teste do efeito de mediação conclui que existe um efeito de mediação parcial da eficiência do investimento.

Nesta base, o presente documento apresenta recomendações políticas correspondentes em dois aspetos. Em primeiro lugar, a governação das empresas. Este aspeto inclui o reforço da governação em termos de ações, a melhoria dos mecanismos de governação dos conselhos de administração e o aumento da diversidade de géneros dos diretores executivos.

Em segundo lugar, a eficiência dos investimentos. A empresa deve estabelecer procedimentos racionais, científicos e normalizados de tomada de decisões de investimento para aumentar a utilidade da tomada de decisões, de modo a melhorar o desempenho financeiro.

Palavras-chave: Governação corporativa, eficiência dos investimentos, desempenho financeiro

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Abbreviations and/or Acronyms

DEA	Data envelopment analysis (DEA)
AHP	Analytical Hierarchy Process
BS	Board size
CEO	Chief Executive Officer
FHP Model	Fazzari, Hubbard and Petersen Model
GEN	Gender
Inv	Investment
NPV	Net Present Value
sd	Standard Deviation

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Introduction

Analyzed from a micro point of view, enterprises are the mainstay of the market economy. The core of the reform is corporate governance, because a reasonable corporate governance mechanism can effectively reduce the agency cost and promote the improvement of financial performance.

Corporate governance is generally divided into internal governance and external governance, of which internal governance is the key, so this paper mainly studies the internal governance of the company.

At the same time, for listed companies, the correctness of investment decisions is closely related to the realization of their business objectives and strategic plans. So, the cost of investment decisions plays an important role in the competitiveness and sustainable development of listed companies. This paper focuses on the relationship between internal corporate governance, investment efficiency and financial performance.

This paper is based on a detailed explanation of the concepts and theoretical foundations. Then on this basis, seven research hypotheses are proposed and four models are established to test the above hypotheses, which are the model of the relationship between corporate governance and financial performance, the econometric model of investment efficiency, the model of the relationship between corporate governance and investment efficiency, and the model of the mediating effect to test the mediating role of investment efficiency.

In this paper, equity concentration, board size and CEO gender are selected to measure three aspects of corporate governance and return on total assets is used to measure financial performance. This paper takes the data of Chinese manufacturing listed companies, German manufacturing listed companies and Portuguese industrial companies between 2017 and 2022 as the research sample, where the data of 2017 is to estimate the optimal investment level in the lagged model of investment efficiency, and finally obtains 952 observations from 2019 to 2022.

Considering the influence of individual fixed effects and time fixed effects on the dependent variable, this paper adopts a two-way fixed effects model to statistically analyses the sample by country and by year, and the regression analysis reveals the following: (1) Shareholding concentration, board size and CEO gender are all significantly positively correlated with the return on total assets. (2) Equity concentration, board size and CEO gender are also significantly positively related to investment efficiency indicators. (3) The mediation effect test model finds that there is a partial mediation effect of investment efficiency indicators.

Finally, based on the results of the analysis, effective recommendations are made optimize the shareholding structure, improve the board system, increase the gender differentiation of the board, and reduce the inefficient investment, so as to effectively improve the return of financial performance. The research in this paper enriches and expands the theoretical foundation, empirical results in this field and has important theoretical and practical significance.

The dissertation is organized in three parts or chapters, besides this introduction and the conclusion. On the first chapter, a literature review on corporate governance, investment efficiency and performance definition are developed. It also presented the theoretical foundations and the review on international research about the relationships between Corporate Governance and financial performance and investment efficiency. Then, in the second chapter, named Methodology, starts with the objectives of the research and research hypothesis, then the model design and variables selection are presented and after the description of data collection. On the third chapter the results are presented and analyzed. It starts with the descriptive statistics, then the correlation analysis and multicollinearity tests, as well as the analysis of intermediation effects and heterogeneity analysis. To close the chapter, robustness tests are presented. To conclude, limitations and suggestions for further research (future lines of research).

1. Literature Review

Throughout the current state of corporate governance research, it is found that there is a large amount of literature on the relationship between corporate governance and financial performance, but there is no unanimous conclusion. Among them, the relationship between shareholding governance efficiency, board governance efficiency, CEO gender governance efficiency and financial performance have significant positive, negative, irrelevant or non-linear correlation conclusions. There is also a large body of research on the relationship between corporate governance and investment efficiency. In contrast, there are more studies in China than abroad, especially on the impact of board governance on investment efficiency, which is less in the international literature and basically considered to be negatively correlated, while there are more studies in China with different views. There are relatively fewer studies on the relationship between investment efficiency and financial performance, and both Chinese and international scholars basically agree that the two are significantly positively correlated. In general, there are more studies on the relationship between corporate governance and financial performance, corporate governance structure and investment efficiency, and investment efficiency and financial performance individually, and very few scholars consider the combination of the three. In this paper, we take this as a breakthrough point, measure corporate governance from equity governance, board governance and CEO gender governance, and comprehensively analyze the relationship between corporate governance, investment efficiency and financial performance. Drawing on the idea of 'mechanism-behavior-outcome', this paper establishes a model to empirically test whether and to what extent

investment efficiency has an impact on the relationship between corporate governance and financial performance. The research in this paper enriches and expands the theoretical foundation and empirical results in this field and has important theoretical and practical significance.

1.1. Concepts and definitions

1.1.1. Definition of Corporate governance

Internal corporate governance is one aspect of corporate governance. As for the concept of corporate governance, there is still no uniform definition, and there are several representative views in the academic world. Firstly, there is the institutional arrangement theory represented by Mayer et al. (1995). He proposes that corporate governance is an institutional arrangement that represents and serves investors, including the structure of the company's board of directors and management incentive programs. Zhang and Yu (1994), a famous Chinese researcher, also proposes that corporate governance in a broad sense is a set of institutional arrangements on how to distribute control and residual claims of a company.

Secondly, there is the organizational structure theory represented by Wu (1999). He proposed that corporate governance is an organizational structure formed by shareholders, directors and management. The shareholders entrust the assets to the board of directors for safekeeping, and the board of directors implements the allocation of resources by hiring and supervising the management.

Furthermore, there is the decision-making mechanism theory represented by Hart (1992). He suggests that corporate governance is a decision-making mechanism that determines the use of a firm's residual claims on its non-human capital in the absence of an initial contract that specifies the rights to use the assets.

There are different definitions based on different perspectives. In general, corporate governance includes both internal and external governance. Internal governance covers the internal organizational structure of the company, as well as decision-making, monitoring and incentive mechanisms. Specifically, it embodies the supervisory and check-and-balance relationship between the general meeting of shareholders, the board of directors, and the management of the company. This paper draws on the research methods of previous scholars to measure the internal governance of a company in terms of shareholding governance, board of directors' governance, and CEO gender governance, and selects shareholding concentration, board size, and CEO gender as the indicators respectively.

Shareholding is a right enjoyed by shareholders. Since shareholders invest in the company and are the owners of the company's assets, they need a certain unit of measurement to measure the proportion of their investment, and as an indicator to share the benefits of the company afterwards, and shareholding is such a unit of measurement. In modern corporate organizational structures, the shareholders' meeting is usually the highest authority of the company, and shareholders who own shares have the right to speak and vote in the shareholders' meeting according to the law, and they

will directly determine the company's major strategic decisions. Shareholding governance is to supervise and manage the company's shareholding by establishing certain governance mechanisms, the most important of which is the shareholding structure. Shareholding structure can reflect the shareholding of each shareholder in the company (Jiraporn & Gleason, 2007).

Generally, shareholding concentration is chosen as the indicator. Usually, the proportion of shares held by the first largest shareholder represents the company's equity concentration, and when the proportion is greater than or equal to 50%, it is the absolute holding type, also known as the highly concentrated type of equity. When the proportion is between 20% (including) and 50%, it is a relative holding type. If the ratio is less than 20 per cent, it is a dispersed type (Saravia et al., 2025).

The board of directors is an intermediary force in the organizational structure of the company, under the direct authority of the general meeting of shareholders and supervising the management. Board governance is mainly about controlling and managing the board of directors, which is also an important part of corporate governance, of which the size of the board of directors is an important indicator. The size of the board of directors is the number of board members, which is clearly stipulated in China's Company Law, with 3 - 13 members in a limited liability company and 5 - 19 members in a joint-stock company (Lu & Zhu, 2020). The management is usually professional talents with appropriate talents, selected through layers of selection, mainly responsible for the daily operation and management of the company.

With the development of the economy, the status of women is rising, and more and more women are participating in all corners of society and playing important roles (Naveed et al., 2023). As men and women think differently, they also produce different results in decision-making. This paper takes the gender difference of CEO as the basis to study its effect in corporate governance.

1.1.2. Definition of Investment efficiency

According to traditional financial theory, investment is the process of selecting projects with the aim of maximizing expected returns. Physical investment refers to the use of the company's funds to purchase a variety of assets in physical form to maintain the necessary production operations (Modigliani & Miller, 1958). Financial investment refers to the use of a company's funds to acquire financial assets with monetary value to obtain the income generated by the transfer of the right to use them.

There is still no uniform definition of investment efficiency. From an economic point of view, investment efficiency is relative to the desired capital stock, and only those capital expenditures that push the capital stock to the level of the desired capital stock are efficient and vice versa are inefficient investments. From a financial point of view, an investment is efficient when its rate of return is equal to the embedded rate of return. An investment is underinvested if its rate of return is greater than the embedded rate of return, and overinvested if it is less than the embedded rate of return. Biddle et al. (2009) suggests that efficient investment means that in the absence of frictions in the market, a firm invests in all projects with positive net present values (NPVs) and foregoes all projects

with negative NPVs. However, a large number of studies have shown that such an ideal market state does not exist. Due to the existence of principal-agent relationship, information asymmetry, financing constraints, etc., real firms will have over-investment or under-investment to a greater or lesser extent. In this paper, to facilitate the quantification, the opposite of the absolute difference between the actual investment and the optimal investment level is used as the index to measure the investment efficiency.

1.1.3. Definition of Financial performance

According to La Rosa (2021), financial performance includes both organizational and individual performance. The former is characterized by three dimensions, namely effectiveness, efficiency and change. The latter is also reflected in three aspects, namely, the degree of effort, efficiency, characteristics and capabilities. Many scholars in China understand it as the results of the company's business activities within a specific period of time and with limited resources. Simply put, it is the result of the company's operation, which can be measured in terms of the company's competitiveness, financial status and development prospects. This paper also draws on the views of most scholars to measure financial performance with financial position indicators.

1.1.4. Mediation effect

The mediation effect originates from the theory of organic molecular structure and has been widely used in sociology, management and other disciplines. Its main mechanism is that when studying the impact of X on Y, if the impact is achieved through M, then MI is a mediating variable and plays a mediating role in the impact of X on Y. Among them, if X affects Y completely through M, then M plays a complete mediating role, and if the impact of X on Y is partially achieved through M, then M plays a partial mediating role. The schematic diagram of the mediating variable is shown in Figure 1.

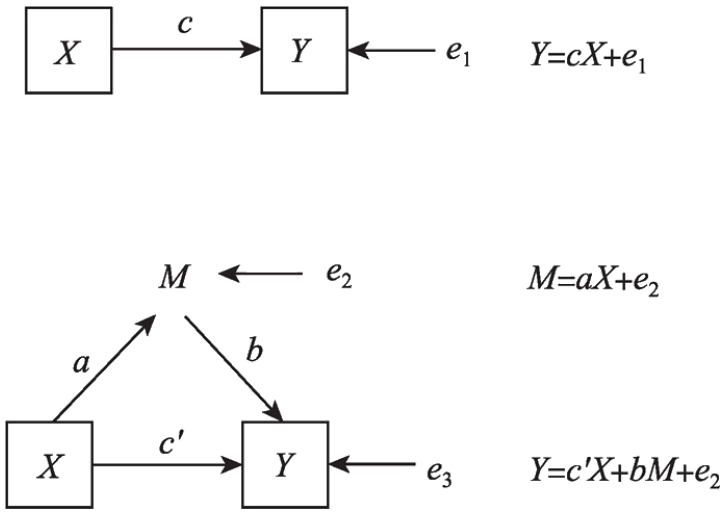

Figure 1. Diagram of mediating variables

source: MacKinnon et al. (1995, p. 45)

1.2. Theories that impact on Governance, Investment efficiency and Financial Performance

1.2.1. Principal-agent theory

According to Jensen and Meckling (1976), due to the increasing dispersion of ownership and specialization of management, owners as principals delegate the management of the company to the management.

Management, as the trustee, uses its own expertise and ability to make decisions about the day-to-day operation of the company, thus creating a principal-agent relationship. Since both parties are rational brokers, both have ‘egoism’, and their objectives are not the same, it is easy to generate agency conflicts. Therefore, the owner needs to monitor the work of the management to minimize information asymmetry, which generates agency costs. With the development and continuous improvement of the principal-agent theory, its research focuses on how to mitigate the agency conflict and reduce the agency cost through the establishment and improvement of decision-making, monitoring and incentive mechanisms when ownership and control are separated.

1.2.2. Information Asymmetry Theory

Since the 1970s, American scholars began to study the problem of information asymmetry in the market, starting from the used car trading market at the earliest, and then it was widely applied to other fields, gradually forming the theory of information asymmetry (Akerlof, 1970). According to the theory, in the market economic activities, the two parties to the transaction cannot have all the information, but there are many uncertainties. There are differences in their understanding of the information, and the one who has more information has an advantage in comparison. This is also the case in modern companies, where the management, as trustees, make direct business decisions and know the details of the company's operations. Shareholders, as principals, can only obtain information about the enterprise through supervisory organizations and relevant reports. Therefore, there is a serious information asymmetry problem between shareholders and managers, in contrast, managers have more information than shareholders and are in an advantageous position.

1.2.3. Motivation theory

Motivation theory is based on the research of organizational behavior and psychology, taking people's needs as the starting point, and considering that motivation originates from certain needs, and needs determine people's behavior (Bandhu et al., 2024). Appropriate incentives can stimulate people's hearts and strengthen their behaviors. In modern enterprises, due to the existence of the principal-agent relationship, the owner and the manager's goals are not the same, so the company owner needs to promote the convergence of the two goals through a certain incentive mechanism, which is an important element of corporate governance (Wu, 1999).

1.2.4. Free Cash Flow Theory

The concept of free cash flow was first formally introduced by Mann and Sicherman (1991), that is, after a company's capital has satisfied all the investment projects with positive NPV, the remaining portion of the capital is the cash flow that can be freely disposed of. Ideally, when a company has free cash flow, dividends should be paid to protect shareholders' rights and interests. However, in reality, due to the existence of principal-agent relationship and information asymmetry, managers will be for their own interests, choose those investment projects that are not optimal, only to expand the size of the company to obtain 'in-service consumption (Jensen & Meckling, 1976). These over-investment behaviors seriously damage shareholders' rights and interests.

1.2.5. Financing constraints theory

The financing constraints theory is based on the information asymmetry theory, which suggests that there is also an information asymmetry between investors and company managers, and that investors have less information about the company (Fazzari & Athey, 1987). Therefore, they will try to compensate for the risk of insufficient information by obtaining additional returns. When a company raises debt financing, the debtor will usually add a risk premium to compensate for the potential loss, which will increase the cost of financing. In the case of share financing, due to the lack of information available to investors, they will usually increase the return on equity funds to compensate for the investment risk by depressing the share price to protect their own interests. This will increase the financing cost of the enterprise and create financing constraints.

1.3. Review of the state of international research

1.3.1. The relationship between corporate governance and financial performance

Currently, most of the studies on the relationship between corporate governance and financial performance are based on the principal-agent theory. Since Berle and Means (1932) first proposed that modern companies are characterized by the separation of ownership and control, many scholars have begun to theoretically study the mechanism of the impact of financial performance. The concept of corporate governance was first proposed by American scholars in the early 1980s, and since then, research on the relationship between corporate governance and financial performance has been highly sought after. Through combing the existing literature, we find that most scholars study financial performance from the perspective of internal corporate governance. In this paper, we also select three internal corporate governance factors, shareholding governance, board governance and CEO gender, and study their impacts on financial performance respectively.

1.3.1.1. On the impact of shareholding governance on financial performance

As early as Berle and Means (1932) started to study the issue of corporate shareholding, their study is based on the principal-agent theory, and they found that the shareholding structure of modern corporations is very dispersed, and shareholders' and management's objectives are not the same,

and shareholders are unable to monitor management strongly, which may lead to the management making decisions that are harmful to the interests of shareholders.

In other words, a dispersed shareholding structure reduces financial performance. Shareholding structure is an important aspect of corporate governance, and shareholding concentration is an important indicator of shareholding structure. In this paper, we use shareholding concentration to measure the efficiency of corporate governance and review the literature on the relationship between shareholding structure and financial performance.

After that, a large number of researchers have shown that the two are positively correlated. Jensen and Meckling (1976) used theoretical analyses to classify shareholders into two types for the first time: internal shareholders and external shareholders, with internal shareholders having the decision-making power of the company. They point out that dispersion may lead to ‘moral hazard’ for internal shareholders and ‘free rider’ behavior for external shareholders, which may affect the financial performance of the company. Edwards and Weichenrieder (1999) select a sample of companies listed in Germany and find that although there are both positive and negative effects of shareholding concentration on financial performance, the positive effect is significantly higher than the negative one. Tran et al. (2022) use the financial data of small and medium-sized companies listed in Australia and find a positive correlation between the two effects.

Other researchers have different views, such as Sutton et al. (2018) based on the perspective of agency conflict between majority and minority shareholders, using financial data of 748 listed companies in the United States, empirically analyzing the relationship between the two.

It is found that the controlling shareholders' control over the firm increases significantly with the increase of their shareholding ratio, and the interests of minority shareholders will be harmed to the detriment of the firm's performance. Similar findings are also found in the study of Porta et al. (1998). Demsetz (1986) use financial data of US listed companies and use expected return as an indicator of financial performance in their study. The empirical results show that when the concentration of shareholding is too high, both insiders and outsiders will reduce financial performance.

1.3.1.2. On the impact of board governance on financial performance

O’Connell and Cramer (2010) began to study the problem of corporate board governance, based on the monitoring function of the board, and measured the board governance efficiency by the size of the board. They found that as the board size increases, different directors tend to hold different opinions, and ultimately have to take into account the interests of multiple parties before making a decision, which can effectively reduce the risk of the board being easily manipulated by the management, and thus reduce the number of decisions that are unfavourable to the interests of shareholders. In this paper, we also choose this path and use board size as a measure of board governance. In a subsequent study, Denis and Sarin (1999) take 583 listed companies in the United States between 1983 and 1992 as their research sample, and through empirical analyses, they find that as the size of the board of directors increases, the market rate of return of the company increases, i.e., the two are positively correlated.

Some researchers have a different view, for example, Singh and Davidson III (2003) based on the agency cost theory and found that as the size of the board of directors increases, the agency cost will be increased, and the cost will be much higher than the benefit.

Therefore, the size of the board of directors should be limited. The smaller the size of the board, the greater the role it plays in the operation of the company. Yermack (1996) was the first to use empirical research to study the relationship between the two, and he used the financial data of 500 listed companies in the United States between 1984 and 1991, and introduced control variables, and the results also obtained the conclusion that the two are negatively related.

1.3.1.3. On the impact of CEO gender on financial performance

In recent years, the percentage of women on board management teams has attracted attention and discussion. According to Reuters, although women make up nearly half of the US workforce, only 16.6% of the boards of the world's top 500 companies are made up of women, and this percentage has been gradually increasing in recent years.

In Europe, a wave of reforms to the board system has begun, with countries such as Spain, France and Italy already implementing programs in which they seek to achieve a 40% gender differentiation of board executives in listed companies. In Europe, they think that single personality characteristics tend to be limiting and create information bias, while gender diversity helps to reduce this discrepancy, thus improving corporate governance efficiency and increasing financial performance. In China, according to the International Business Questionnaire Report, more than 95 % of the more than 200 companies surveyed have female executives, with the percentage of women increasing from 25 % in 2012 to 51 % in 2022, a result that is much higher than the global level of 21 %. As women's share of companies grows, so does the research on the benefits of female executives to companies.

Khan and Vieito (2013) found that the earnings of companies led by female CEOs are stronger than those governed by male CEOs by examining data from listed companies from 1992-2004; Simon et al. found, by collecting data from a total of 13,206 companies in the COMPUSTAT database for the period 1996-2008, that female Simon et al. found that female CEOs are more likely to maintain the completeness and accuracy of their firm's financial reporting and strive for smoother financial performance. Lee and James (2007), on the other hand, point out that when companies announce that the gender of the CEO they are hiring is a woman, the company's stock price drops to some extent, due to the lack of social recognition of women's managerial ability. In conclusion, different gender characteristics of CEOs can have different effects on the company's results.

1.3.2. The relationship between corporate governance and investment efficiency

1.3.2.1. On the impact of shareholding governance on investment efficiency

International researchers first began to study the investment efficiency of listed companies. However, many studies have found that listed companies have over-investment or under-investment. That is, inefficient investment. Research on the relationship between shareholding governance and investment efficiency is also increasing, this paper chooses shareholding concentration as a

measure of the efficiency of shareholding governance and sorts out the literature on the relationship between it and investment efficiency.

Gorton and Schmid (1999) argue that if the shareholding structure of a company is too dispersed due to the inconsistency between the objectives of owners and management, the monitoring role of shareholders will be greatly weakened, which may lead to overinvestment or underinvestment by the management for their own selfish interests, and reduce the efficiency of investment of the company. The empirical study by Mínguez-Vera and Martín-Ugedo (2007) confirmed this viewpoint by using the financial data of 135 listed companies in Spain to study the impact of shareholding concentration on the company's investment efficiency, and found that there is a positive correlation between the two.

Some researchers hold different views, for example, Goergen and Renneboog (2001) use empirical analyses to explore the impact of corporate shareholding concentration on investment efficiency. It is found that the larger the proportion of equity held by shareholders, the more likely to generate over-investment behaviors. Burkart and Panunzi (2006) use theoretical analysis to show that the increase of shareholding concentration cannot alleviate the role of agency conflict, but rather exacerbate the agency problem between large and small shareholders, leading to inefficient investment.

1.3.2.2. The Impact of Board Governance on Investment Efficiency

To maintain the consistency of the article, this paper still chooses the board size as an indicator of board governance efficiency. Baysinger and Hoskisson (1990) argues that if the size of the board of directors is too large, usually more than eight, the board of directors will not be able to play an effective supervisory and management role, and it will be easy to be controlled by the management, which will lead to the phenomenon of under-investment or over-investment. Lipton and Lorsch (1992) found that, although the increase of board size can improve the monitoring function to a certain extent, the increase of the number of board members will lead to the decrease of the decision-making efficiency, which will increase the operation cost of the company. Dalton et al. (1999) also argues that if the board size is large, there will be dispute due to the diversity of views, resulting in a lack of cohesion in the board, and easy to be influenced and exploited by the management, which will lead to inefficient investment.

1.3.2.3. The Impact of CEO Gender Governance on Investment Efficiency

Resource dependence theory, which emerged in the 1940s, emphasizes that organizational bodies need to draw resources from their surroundings to survive, and to grow and depend on each other with their surroundings. The theory states that many of the resources of a firm will not be circulated and traded in the market. Hillman et al. (2000) explain how female members of the board of directors can enhance the governance of the company and thus improve financial performance based on the resource dependence theory. Fu and Wang (2024) also pointed out in their article that the board of directors brings resources to the firm through three ways: negotiation, legitimacy and information exchange.

Research from Cornell University suggests that investors have a significant bias against the gender of chief executive officers (CEOs), which directly affects their perceptions of corporate governance and investment decisions. The study found that female CEOs tended to receive more positive ratings when they adopted a cooperative strategy in the face of shareholder activism, while male CEOs were more favored when they took a dominant or assertive stance. This phenomenon reflects societal stereotypes of gender roles, where investor evaluations are not based exclusively on the effectiveness of the response, but are deeply influenced by gender bias. The study suggests that female CEOs often need to choose their response strategies more carefully when confronted with activist shareholders to avoid negative evaluations for not conforming to traditional gender expectations.

Female CEOs can mitigate negative investor perceptions when confronted with activist shareholders by providing explanations of common interests. For example, when female CEOs explain a non-cooperative stance as a prioritization of investor interests, investors react more positively. This suggests that communication strategies play a key role in shaping investor perceptions, especially for female leaders. They need to pay more attention to the way in which messages are delivered when responding to shareholder activism to ensure that they can effectively manage investor expectations and reactions.

In conclusion, gender bias is significant in investor responses to corporate governance, especially in the context of shareholder activism. Understanding and responding to gender bias is not only a necessary condition for achieving fair governance, but also an important strategy for enhancing long-term corporate value. By proactively addressing these challenges, companies can better meet investor expectations and drive sustainable growth in a complex market environment. Understanding these dynamics not only helps corporate leaders navigate the complexities of shareholder relations but also provides an important perspective for promoting fairer and more effective business practices.

1.3.3. The Relationship between corporate governance, investment efficiency and financial performance

Using the financial data of Chinese listed companies from 2014 to 2023, Pan et al. (2025) empirically examines the relationship between corporate governance, investment behaviour and financial performance by constructing a corporate governance index using principal component analysis and drawing on the mediation effect model. The results show that the corporate governance index is negatively related to inefficient investment and positively related to financial performance, and that corporate investment behavior plays a role in the relationship between corporate governance and financial performance. Gao et al. (2012) use the data of 1,496 listed companies in China's A-share market in 2010 to empirically examine the relationship between corporate governance, investment efficiency and financial performance. A composite financial governance indicator is used to measure financial governance factors, and a regression analysis is conducted using the mediation effect model of Baron and Kenny (1986). The results show that corporate governance is positively related to financial performance, and investment efficiency plays a partial mediating role in the relationship.

Zhou et al. (2021) measured the level of corporate governance by Analytical Hierarchy Process (AHP), investment efficiency by Data Envelopment Analysis (DEA) model and financial performance by factor analysis. Using the financial data of 1432 listed companies in China's A-share manufacturing industry from 2010 to 2012, the relationship between the three is empirically examined using structural equation modelling. It is found that corporate governance is significantly and positively related to investment efficiency, investment efficiency is significantly and positively related to financial performance, and corporate governance is also significantly and positively related to financial performance. L. Zhang and Cai (2023) find that some of the characteristics of executives are positively correlated with investment efficiency, and investment efficiency is also positively correlated with financial performance.

2. Research Methodology

2.1 Purpose of the study and research hypothesis

This paper mainly discusses the relationship between corporate governance, investment efficiency and financial performance.

Through the study of the relationship between the three, a reasonable corporate governance plan is determined, which ultimately promotes the improvement of financial performance.

This paper assumes the relationship between corporate governance and financial performance, the relationship between corporate governance and investment efficiency, and the mediating role of investment efficiency to verify the relationship between the three.

2.1.1. Hypothesis on the relationship between corporate governance and financial performance

Based on the principal-agent theory, owners (i.e. shareholders) do not directly make decisions on the daily production and operation of the company but are directly managed by the management. Instead, management directly manages the company, and shareholders indirectly supervise and control management through their voting rights based on the size of their shareholdings. Firms can mitigate the agency conflict between the two through shareholding governance. Usually, when the company's shareholding is concentrated, the larger shareholders have a direct and effective

monitoring mechanism over the management, which can reduce the information asymmetry between the two. If the shareholding is too dispersed, it is often necessary for the majority of shareholders to make decisions together, and the disagreement between shareholders can be easily exploited by the management, which will directly affect the financial performance (Alexander, 2001). Therefore, this paper proposes the following hypothesis:

H1: Shareholding Governance Efficiency is Significantly Positively Associated with Financial Performance

The board of directors is the middle force of corporate organizational structure, shareholders directly manage the board of directors, and the board of directors directly supervises the management. The size of the board of directors will directly affect the effectiveness of board governance. In today's complex market environment, board members need to have both strong professional knowledge and rich experience and resources to cope with various uncertainties. Compared with smaller boards, larger boards are more likely to be able to draw on a wide range of talents and complement each other's strengths, becoming a team with strong overall capabilities. The stronger the comprehensive governance ability of the board of directors, the more effectively it can play its supervisory and management functions and improve financial performance (Zheng and Han, 2025). Therefore, this paper puts forward the following hypotheses:

H 2: Board governance efficiency is significantly and positively related to financial performance

Sah and Stiglitz (1991) pointed out in their research that individuals are prone to decision-making errors due to their own limitations and information asymmetry, and that team decision-making is more conducive to corporate governance because of the advice and thinking of members of different genders, backgrounds, and cultures. Daily et al. (2002) found that women executives are more likely to provide insightful and meaningful advice when dealing with specific areas, such as female consumers, employees, or partners, which can be beneficial to the company's growth. Wang et al. (2016) points out that in business management, the conflicts, contradictions, and additional cognitive differences caused by diverse teams can often lead to new perspectives and solutions that facilitate optimal choices.

At the same time, female executives also enrich the corporate culture, and Yang and Konrad (2025) point out that when there are more women, the informational and social differences they bring positively contribute to the management behavior of the board of directors, encouraging more women to strive for top management positions. Blomkvist et al. (2025) pointed out in their study that female executives are more conducive to creating a friendly culture within the company.

H3: CEO gender governance efficiency is significantly and positively related to financial performance.

2.1.2. Hypothesis on the Relationship between corporate governance and investment efficiency

According to the theory of financing constraints, companies usually face higher financing costs. In this case, the management will tend to use its own funds to invest, and when the funds needed for

investment exceeds its own funds, it is easy to cause underinvestment (Kalatzis et al., 2025). Based on the free cash flow theory, management may overinvest for its own benefit. In this case, the company needs to implement shareholding governance to reduce the information asymmetry between shareholders and management, and then reduce the company's inefficient investment activities. Therefore, this paper proposes the following hypotheses:

H 4: Shareholding governance efficiency is significantly and positively related to investment efficiency.

Based on the principal-agent theory, the board of directors has a principal-agent relationship with shareholders and management, so good board governance is very necessary. The board size is usually used to measure the board governance, and further analyzed, a large-scale board of directors can achieve the effect of complementary expertise and resource sharing among its members (Amin et al., 2020). It can also provide various suggestions and opinions for the company's strategic decision-making, and finally make decisions after multi-party consultation, which can effectively reduce the risk of decision-making errors. The same is true in investment decision-making, large-scale board of directors can make better investment decisions, reduce the possibility of underinvestment or overinvestment, thereby reducing inefficient investment and enhancing the company's investment efficiency. Therefore, this paper proposes the following hypotheses:

H 5: Board governance efficiency is significantly and positively related to investment efficiency

In extensive research in economics, sociology and applied sciences, it has been found that gender determines the style of doing things. Verhaeghen and Salthouse (1997) point out that the difference in gender determines that men and women think differently, with men having a bolder style of doing things and women tending to be more careful. And their cognitive thinking is the main factor leading to changes in investment efficiency; Similarly, Mo and Lee (2022) believe that not only cognitive thinking, but also gender differences, brought about by differences in personality, male and female enthusiasm for the same thing will be different, they use a large number of unlisted companies as a sample, and found that the performance of investment efficiency and the Board of Directors CEO's gender shows a significant negative correlation.

But on the other hand, CEOs of different genders will have different management experience and knowledge base, etc. Korniotis and Kumar argued that a wide range of experience in one's job can at least offset the differences brought about by gender. In order to investigate the impact of CEO gender differences on investment efficiency in corporate boards (Ullah et al., 2021), this paper proposes the following hypothesis:

H6: CEO gender governance efficiency is significantly and positively related to investment efficiency.

2.1.3. The mediating role of investment efficiency

Based on the above theories and assumptions H1-H6, this paper expects that the direction of the impact of corporate governance factors on financial performance is consistent with the direction of the impact of corporate governance first affects the investment efficiency and then affects the financial performance through the investment efficiency, and the direction of the impact of the two

steps combined. Therefore, this paper draws on the idea of mediation effect and puts forward the following hypothesis:

H 7: Investment efficiency plays a mediating role in the relationship between internal governance and corporate finance.

2.2. Model design and variable selection

2.2.1. Model of the relationship between corporate governance and financial performance

Based on the theoretical foundation and research hypotheses in the previous section, this paper draws on the studies of Waheed and Malik (2019), Ahrens et al. (2025) and Brahma et al. (2021) to establish a model (2.1) to test the hypotheses H I, H2 and H3.

$$ROA_{it} = \alpha_0 + \alpha_1 Top_{it} + \alpha_2 BS_{it} + \alpha_3 GEN_{it} + CV + \mu_i + v_t + \varepsilon_{it} \quad \text{[Model 2.1]}$$

With,

ROA	- return on assets	a_0	- constant
TOP	- shareholding ratio of the largest shareholder	a_i	- coefficient …, with i=1…3
BS	- board size	m_I	- coefficient …, with i=China, Germany, Portugal
GEN	- gender	t	- coefficient …, with i=2017…..2022
CV	- control variable		

Drawing on the research of Ahrens et al. (2025) and others, the return on total assets (ROA) is chosen as the explanatory variable to measure financial performance. It is specifically expressed as the ratio of the firm's net profit to its average total assets.

Drawing on the studies of Gaur et al. (2015), Waheed and Malik (2019), Brahma et al. (2021), and others, we select shareholding concentration (TOP), board size (BS), and gender of CEO (GEN) as the explanatory variables. Among them, shareholding concentration (TOP) is a measure of the efficiency of corporate governance, which is expressed as the proportion of the number of shares held by the largest shareholder to the total number of shares of the company. Board size (BS) is a measure of board governance efficiency, which is expressed as the natural logarithm of the total number of directors of the company. CEO gender (GEN) is a measure of CEO governance efficiency.

Drawing on the studies of Habibniya et al. (2022), Yadav et al. (2022), we control for capital structure (lev), growth capacity (grow), and the amount of new investment (inv) is replaced by CV (control variable) in this formula. The year μi (year) and individual effect Vt (firm) are also selected as dummy control variables. The capital structure (lev) is the firm's year-end negative asset ruin ratio, which is expressed as the ratio of total liabilities to total assets at the end of the year. The growth capacity (grow) is represented by the growth rate of net profit, which is the ratio of the current year's net profit to the previous year's net profit.

It is the ratio of the difference between the current year's net profit and the previous year's net profit divided by the previous year's net profit. The amount of new investment (inv) is calculated based on a number of items in the cash flow statement, see the definition of the variable table for details of the calculation method. Year Vt (year) is a dummy variable that takes the value of 1 if it is the current year and 0 otherwise. Individual effects μi (firm) is also a dummy variable that takes the value of 1 if it belongs to the current industry and 0 otherwise.

Drawing on the research of Danilov (2024), Gormley and Matsa (2014) and so on, controlling for capital structure (lev), growth capacity (grow), the amount of new investment (inv) is replaced by CV(control variable) in this formula. The year μi (year) and individual effect Vt (firm) are also selected as dummy control variables. The capital structure (lev) is the firm's year-end negative asset ruin ratio, which is expressed as the ratio of total liabilities to total assets at the end of the year. Growth (grow) is the growth rate of net profit. The difference between the current year's net profit and the previous year's net profit divided by the ratio of the previous year's net profit. The amount of new investment (inv) is calculated based on a number of items in the cash flow statement, see the definition of the variable table for details of the calculation method. Year Vt (year) is a dummy variable that takes the value of 1 if it is the current year and 0 otherwise.

Above α_0 is the intercept term, α_1, α_2, α_3, α_4 are the impact coefficients, whose value is positive, representing that an increase in the study variables will cause an increase in Y, whose value is negative, representing that an increase in the study variables will cause a decrease in Y, which refers to the variables on the left side of the equation, and the rest of the variables are similar to the inference, and ε_{it} is the random error term, which contains the effects of other variables not considered in this paper, in order to control for the double fixed effects of year and individual, the year effect Vt and the individual effect μ_i are added, and since the above table already shows the control variables, this model design highlights the core explanatory variables and CV is the control variable.

2.2.2. Models for measuring investment efficiency

In order to study the relationship between investment efficiency and other variables, the first step is to define the investment efficiency measurement model. After combing through the existing literature, we find the following three representative models, as shown in Table 1.

All the three econometric models below (see Table 1) can reflect the investment level of the company to a certain extent, but after comparison, it is found that the FHP model and the VoGT model can indicate the relationship between the sensitivity of the investment cash flow and the investment opportunities, but they cannot judge the investment efficiency in a certain year. The Ricardson model can make up for this shortcoming, so this model is chosen in this paper.

Table 1. List of investment efficiency models

Model's Name	Formula Variable Explanation
FHP model [Model 2.1.1]	$(I/K)_{it} = f(X/K)_{it} + g(CF/K)_{it} + \varepsilon_{it}$ With, I/K: business investment; f(X/K): investment opportunities, expressed in terms of Tobin's Q; g(CF/K): internal cash flows of the business
Vogt model [Model 2.1.2]	$(I/K)_{it}=\beta_0+\beta_1(CF/K)_{it}+\beta_2(Cash/K)_{it}+\beta_3(Sales/K)_{it}+\beta_4Q_{it-1}+\beta_5(X/K)_{it}*Q_{it-1}+\varepsilon_{it}$ With, CF: cash flow; Cash and Sales: cash and sales revenue; Q: investment opportunities
Richardson model [Model 2.1.3]	$I_{it}=\beta_0+\beta_1Lev_{it-1}+\beta_2V/P_{it-1}+\beta_3I_{it-1}+\beta_4AR_{it-1}+\beta_5Size_{it-1}+\beta_6Age_{it-1}+\beta_7Cash_{it-1}+\Sigma Year+ +\varepsilon_{it}$ With, I: amount of new investment of the enterprise; Lev: debt-to-asset ratio; V/P: investment opportunities; AR: rate of return of individual stocks; Size: scale of the enterprise; Age: years of establishment of the enterprise; Cash: cash balance of the enterprise; Year: dummy variable; Industry: industry dummy variable

Source: Own Elaboration

This paper draws on the work of Richardson (2006), Gong et al. (2023) to develop a model (2.2) to represent the efficiency of investment.

$$inv_{it}=\beta_0+\beta_1lev_{it-1}+\beta_2grow_{it-1}+\beta_3inv_{it-1}+\beta_4size_{it-1}+\beta5cash_{it-1}+\Sigma year+ +\varepsilon_{it} \quad \text{[Model 2.2]}$$

In model 2.2, the amount of new investment (inv) is the explanatory variable, which represents the investment level of the firm in year t. The calculation method is consistent with that in model (2.1).

The explanatory variables are all lagged one period, including capital structure (LEV), growth capacity (GROW), new investment (INV), firm size (SIZE), and cash holdings (CASH) in period t-1.

At the same time, we control for the vintage V_t (year) and individual effects μ_i (firm) dummy variables. In particular, the measures of capital structure (lev), growth capacity (grow), new investment (inv), and stock return (ret) are the same as those in model 2.1, as well as the method of calculation.

In addition, firm size (size) is expressed as the natural logarithm of the total assets of the firm at the end of the year. Cash holdings (cash) are measured by dividing the 'balance of cash and cash equivalents at the end of the period' in the cash flow statement by the value of average total assets.

First, we use model (2.2) to regress and get the company's optimal investment level in year t. Then the difference between the actual investment and the optimal investment level in year t (i.e., the model residuals) is used to represent the degree of inefficient investment, and the residuals of the model are extracted using the Stata 13.0 software. Further analysis, if the difference is greater than 0, it is over-investment, on the contrary, if the difference is less than 0, it is under-investment.

This paper uses the absolute value of the residuals of the opposite (ib) as a measure of investment efficiency indicators, the greater the absolute value of the residuals, the smaller the opposite (IB), the higher the degree of non-efficient investment, the lower the investment efficiency. Conversely, the smaller the absolute value, the larger the opposite (IB), the higher the investment efficiency.

2.2.3. Modelling the relationship between corporate governance and investment efficiency

This paper draws on the studies of Yahya-Jafeel et al. (2023), Dinh et al. (2023), Al-Hiyari et al. (2025) and Faccio et al. (2016) to construct model (2.3) to test hypotheses H4, H5 and H6.

$$IB_{it} = \alpha_0 + \alpha_1 Top_{it} + \alpha_2 BS_{it} + \alpha_3 GEN_{it} + CV + \mu_i + v_t + \varepsilon_{it} \quad \text{[Model 2.3]}$$

With,

IB	- investment efficiency indicator	a_0	*- constant*
TOP	- shareholding concentration	a_i	*- coefficient …, with i=1…3*
BS	*- board size*	*ml*	*- coefficient …, with i=China, Germany, Portugal*
GEN	*- CEO gender*	*nt*	*- coefficient …, with i=2017…2022*
CV	*- Control variables*		

Drawing on the studies of Yahya-Jafeel et al. (2023), Dinh et al. (2023), the investment efficiency indicator (IB) is chosen as the explanatory variable, and its value is calculated according to the results of model (2.2). Drawing on the studies of Al-Hiyari et al. (2025), Faccio et al. (2016), shareholding concentration (TOP), board size (BS) and CEO gender are used as the explanatory variables, and the specific calculation method is consistent with the model (2.1).

The control variables CV are capital institutions (lev), new investment volume (inv) and cash holdings (cash). And the year μ_i (year) and individual V_t are used as dummy variables. The control variables are calculated in the same way as in model (2.2) for the same variables.

Above α_0 is the intercept term, α_1, α_2, α_3, and α_4 are the impact coefficients, whose positive values represent that an increase in the study variable causes an increase in Y, and whose negative values represent that an increase in the study variable causes a decrease in Y, which refers to the variable on the left side of the equation.

The rest of the variables are reasoned similarly, ε_{it} is the random error term, which contains the effects of other variables not considered in this paper, and in order to control the double fixed effects of year and individual, the year effect V_t as well as the individual effect μ_i are added, and since the above table has shown the control variables, the core explanatory variables are highlighted in the design of this model, and CV is the control variable.

2.2.4. Modelling the mediating effects of investment efficiency

Based on the studies of Baron and Kenny (1986), Gao et al. (2012), etc., we add investment efficiency indicators (ib) to the model (4.1) to test whether there is intermediation in investment efficiency and the extent of intermediation.

$$ROA_{it} = \alpha_0 + \alpha_1 Top_{it} + \alpha_2 BS_{it} + \alpha_3 GEN_{it} + \alpha_4 IB_{it} + CV + \mu_i + v_t + \varepsilon_{it} \quad \text{[Model 2.4]}$$

Where,

ROA	– return on assets.	a_0	- constant
TOP	–shareholding concentration	a_I	- coefficient …, with i=1…3
BS	–board size	m_I	- coefficient …, with i=China, Germany, Portugal
GEN	- CEO gender	n_t	- coefficient …, with i=2017…..2022
CV	- Control variables		

The specific interpretation of each variable in the model (2.1) to model (2.4) is shown in Table 2.

Table 2. Indicators for calculating investment efficiency

Variable Properties	Description of variables	variable name	variable calculation
Explained variable	New investment volume	INV	Cost paid for acquisition of fixed assets, intangible assets or other long held assets/total assets at beginning of period
Explanatory variable	Capital Structure	LEV	Total liabilities at year-end/total assets at year-end
	Growth Capacity	GROWTH	Profit/total income
	New Investment Volume	INV	Costs paid for the acquisition of fixed assets, intangible assets or other assets held for the long term
	Company Size	SIZE	Natural logarithm of total assets at year-end
	Cash holdings	CASH	Balance of cash and cash equivalents/average total assets at end of period
	year effect	YEAR	Year dummy variable, which takes the value of 1 if it belongs to the current year, otherwise 0;
	individual effect	FIRM	Firm effects, controlling for the impact from each firm

Note: All the above explanatory variables need to be lagged in the investment efficiency model.

According to the explained variables, explanatory variables and control variables selected in this article, the indicators are set as follows in Table 3.

Table 3. Variable settings

Variable Properties	Description of variables	variable name	variable calculation
Explained variable	Return on Total Assets	ROA	Net profit/average total assets
Robustness test alternative variable	Return on Equity	ROE	Net profit/equity
explanatory variable	Shareholding Concentration	Top	Shareholding ratio of the largest shareholder
	Board Size	BS	Total number of people on the company's board of directors
	CEO Gender	GEN	If the gender of the CEO is male, it takes the value of 1; otherwise it takes the value of 0
Mediating variables	Investment efficiency indicators	IB	Calculated from the Richardson model
control variable	Company Size	SIZE	Natural logarithm of total assets at year-end
	Capital Structure	LEV	Total liabilities /total assets
	Growth Capacity	GROW	Profit/total revenue
	Year effect	YEAR	Year dummy variable, which takes the value of 1 if it belongs to the current year and 0 otherwise;
	Individual Effect	FIRM	Firm effects, controlling for the impact from each firm

2.3. Description of data collection

The data of listed and unlisted companies in China, Germany and Portugal were selected from Wind database, Sabi, Bloomberg, Yahoo finance, North data and Borse Frankfurt data sources are authoritative websites, which guarantees the credibility of the data as well as its implement ability.

Due to the specificity of some enterprises, the conclusions of the empirical analysis are based on general data, therefore, some abnormal data are removed, including the samples of enterprises with financial crises such as ST enterprises, ST* enterprises and delisted enterprises, as well as the samples with missing data, and the above special enterprises are excluded, and the balanced panel data are used for the study.

Using the data of the period 2017-2022 to get the research data of investment efficiency of 2019-2022, the final use of 2019-2022 four-year sample interval, the number of enterprises is 238 enterprises, the overall sample number of 952 sample data into the model for analysis, due to the

relatively large amount of data in this paper, it is necessary to carry out minorize shrinking tail processing to prevent abnormal values. Possible adverse effects on the results of the model, shrinking the parameters set to the upper and lower 1%, that is, the upper and lower 1% of the data for the outliers, shrinking the tail to the normal range.

2.4. Description of data analyses

In the first step, the preliminary data processing, descriptive statistics, correlation analysis and multicollinearity test are carried out. Descriptive statistical analysis is carried out on the above processed data to obtain the general trend of data fluctuation, the fluctuation interval of the data, and the preliminary correlation between the data is judged by correlation analysis, and the data can be initially judged whether the data has a strong multicollinearity based on the critical value of 0.8, and the model is then further judged whether there is any problem through the critical value of 10 of VIF test. Subsequently, through the critical value of VIF test 10 to further determine whether there is a problem with the model, after the above processing, the second step of the analysis.

In the second step, baseline regression analysis is carried out, in order to make the model estimation results more accurate, individual and year effects need to be fixed, and after judging the overall significance of the model, the positive and negative direction of the influence of the core variables on the explanatory variables and the significance of the influence are studied, so as to verify the assumptions underlying the article.

In the third step, through the mediation effect analysis, it is understood whether the influence of the explanatory variables on the explained variables is through the influence of the mediating variables in this article, i.e., whether the explanatory variables will affect the mediating variables and thus the explained variables.

In the fourth step, the heterogeneity analysis is conducted to find out whether there is any difference in the relationship between the explanatory variables, the mediating variables and the explained variables in different countries.

In the fifth step, the robustness test is carried out, and the robustness test is an auxiliary verification of the results of the benchmark regression analysis, if the results are still consistent, it means that the results obtained in this paper are universal and not randomly obtained.

Through the above five steps, the conclusion of this paper validation is obtained.

3. Empirical Results Analysis

In this chapter will be presented the results from the models [2.1. to 2.4], described in the previous chapter. The chapter starts with the descriptive analysis of the variables as follows. The original and all empirical analysis (the regressions and the validation of the assumptions) is presented in Appendix. The following tables just summarize the relevant data to validate the research hypothesis settled for this research.

3.1. Descriptive statistics

The following table (Table 4) shows the descriptive statistics for the variables added to the models used in this paper. It shows the number of observations, the mean, standard deviation (Std. Dev.), minimum and maximum.

As can be observed from Table 4, the number of observations in the samples are all 952, indicating that there is no missing data, which has been processed in advance, the mean value of ROA is 8.6417(%), the range of fluctuation is -15.2739, 39.2304, the range of fluctuation is not large, while the standard deviation is 10.3124, which is greater than the mean, the coefficient of dispersion is higher, indicating that the fluctuation of ROA is larger.

Table 4. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ROA (%)	952	8.6417	10.3124	-15.2739	39.2304
TOP	952	40.7801	28.2223	0.5000	100.0000
BS	952	9.0357	3.8262	2.0000	20.0000
GEN	952	0.9443	0.2294	0.0000	1.0000
IB	952	0.5234	0.4395	0.0050	1.9089
SIZE	952	8.7276	1.8047	3.9762	12.1206
LEV (%)	952	49.3492	55.4163	0.0000	413.4333
GROW (%)	952	9.5731	12.9004	-36.6549	50.4726

Note: The dispersion coefficient mentioned below is the standard deviation/mean. The higher the value, the greater the fluctuation. Obs. – number of observations; Std. Dev – Standard Deviation; Min. – Minimum; Max.- Maximum; ROA – return on assets; (%) – value in percentage; TOP – shareholding concentration; BS – Board size; GEN – CEO gender; IB – investment efficiency indicator; SIZE- Company Size; LEV – Capital Structure; GROW – Growth.

Still analyzing Table 4, the mean value of TOP is 40.7801 (sd=28.2223), the mean value of BS is 9.0357 (sd=3.8262), the proportion of male CEOs is 94.43%, the mean value of IB is 0.5234 (sd=0.4395), the mean value of gearing is 49.3492 (sd=55.4163), the fluctuation of GROW is larger, and the standard deviation is also larger than the mean.

3.2. Correlation analysis

The measure of correlation analysis can be initially based on the t-test of correlation analysis (with or without an asterisk automatically output by the software) to get whether the relationship between the variables is significant or not, and based on the positive and negative correlation coefficients to determine the direction of correlation between the variables, if it is positive, then it is the same direction of change, and vice versa. Afterward it is the opposite and the higher the absolute value of the correlation coefficient, the higher the correlation, but the correlation is only between the two, so it is only used as a basis for preliminary judgement.

Table 5. Correlation analysis

Variables	ROA	Top	BS	GEN	IB	SIZE	LEV	GROW
ROA	1							
TOP	0.4329***	1						
BS	0.4647***	0.5533***	1					
GEN	0.0104	-0.1579***	-0.0373	1				
IB	-0.4550***	-0.3841***	-0.5722***	0.1041***	1			
SIZE	0.2007***	0.4333***	0.5470***	-0.1840***	-0.4015***	1		
LEV	-0.0847***	0.1301***	0.0839***	-0.0907***	-0.0825**	0.3125***	1	
GROW	0.5577***	-0.0987***	-0.0092	0.1395***	-0.0421	-0.1158***	-0.3192***	1

Note: *, **, *** indicate the 10%, 5%, and 1% significance levels; ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth.

As we can see in Table 5, the correlation coefficient between TOP and ROA is 0.4329, which is significant at 1% level of significance, and an increase in TOP causes an increase in ROA, which initially verifies the hypothesis, while the correlation coefficient between BS and ROA is 0.4647, which is also significant at 1% level of significance, i.e., there exists a statistical significant and positive correlation between BS and ROA, and the correlation coefficient between GEN and ROA is not high, however due to the inaccuracy of the correlation analysis, the relationship between the variables needs to be controlled for more factors to get more accurate results. Therefore, it needs to be verified by subsequent regressions, except for the first column, the highest absolute value of the correlation coefficient from the second to the last column is 0.5722, which does not exceed the critical value of 0.8. Consequently, the covariance of the model is not serious, and regression analyses can be carried out without interference.

3.3. Multicollinearity test

The variance inflation factor (VIF) test is a more precise test to verify whether the model has a high degree of multicollinearity, this method is to fit each explanatory variable to the remaining non-explained variables, the fitted R-squared as long as the R-squared is not higher than 0.9, its VIF value will be less than 10, it means that a certain degree of covariance has not been reached, if it is higher than 10, then it is necessary to remove the variables that cause a high degree of covariance to be analyzed.

Table 6. The variance inflation factor (VIF) test

Variable	VIF	1/VIF
BS	2.1300	0.4692
SIZE	1.6900	0.5917
IB	1.5400	0.6485
Top	1.5400	0.6501
LEV	1.2300	0.8130
GROW	1.1500	0.8733
GEN	1.0800	0.9270
Mean VIF	1.4800	

Note: TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE-Company Size; LEV - Capital Structure; GROW – Growth; VIF - The variance inflation factor.

According to the results shown in the

Table 6, the VIF value of BS is 2.1300, and the inverse of its VIF value is also greater than 0.1, which meets the criteria, and the rest of the variables all meet the criteria that the VIF is less than 10 and the inverse of the VIF is greater than 0.1. According to Larry A. Wasserman's all of statistic, we know it is further verified that the model covariance is not serious, and it will not be subjected to comparatively large disturbances.

3.4. Benchmark regression results

This study controls for the effects of year effects and individual effects because the explained variables are different for different years and individuals, and the results obtained by using the double fixed effects model are more accurate.

Table 7. Model (2.1) estimation, ROA

Variables	Coefficients	Variables	Coefficients
TOP	0.1069***	GROW	0.3304***
	(3.0466)		(6.7485)
BS	1.1752***	Constant	-6.4475
	(4.8592)		(-0.6298)
GEN	-1.6111	Year	control
	(-0.5034)	individual effect	control
SIZE	-0.0860	Observations	952
	(-0.0761)	Number of company	238
LEV	-0.0118	R-squared	0.4020
	(-0.9179)	F	17.2756***

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth

The results of the benchmark regression model show that the goodness of fit of the model is 40.20% (Table 7, although the goodness of fit is not high, but for a relatively large amount of data, the goodness of fit is a more reasonable state, the F-test value is 17.2756, that is, the whole model is through the test, in the analysis of individual variables, the impact coefficient of the core explanatory variable TOP is 0.1069, which is statically significant at 1%. level, indicating that the relationship between TOP and ROA is in the same direction of change, that is, with the increase of TOP, the ROA of the company is also increased, similarly, the impact coefficient of the core variable BS is 1.1752, which is significant at 1% level of significance, the increase of BS, will cause an increase in ROA, is also consistent with the hypothesis. While the coefficient of GEN is -1.6111, which is insignificant, i.e., the effect of CEO's gender on firm's performance is insignificant, and an increase in the control variable GROW causes an increase in ROA.

3.5. Analysis of intermediation effects

According to the three-step approach to mediating effects, the results of the above baseline regression analyses are the first step of mediating effects, followed by the second and third steps of analyses, as shown in Table 8. Since the higher IB represents the lower the investment efficiency of the enterprise, in the second step of the mediation effect, the coefficient of TOP on IB is -0.0058 (see Table 8), i.e., an increase in TOP causes a decrease in IB, that is, it will cause an increase in the investment efficiency of the enterprise. Similarly, the coefficient of the effect of BS is -0.0397, which is significant at 1% level of significance, therefore an increase in BS will cause an increase in investment efficiency. In the third step of the mediating effect, the effect of TOP and BS on ROA is

still positive, and the effect of IB on ROA is negative, then it shows that the increase of TOP and BS of the firms will promote the increase of ROA of the firms by promoting the increase of the investment efficiency of the firms, and thus the mechanism is established.

Table 8. Analysis of intermediation effects

	(model 2.3)	(model 2.4)
Variables	**IB**	**ROA**
TOP	-0.0058***	0.0985***
	(-2.8150)	(2.7896)
BS	-0.0397***	1.1170***
	(-5.0715)	(4.5900)
GEN	-0.0280	-1.6523
	(-0.2337)	(-0.5440)
IB		-1.4667*
		(-1.7269)
SIZE	0.1405**	0.1200
	(2.4313)	(0.1054)
LEV	0.0002	-0.0115
	(0.8390)	(-0.8874)
GROW	0.0005	0.3312***
	(0.5323)	(6.6969)
Constant	-0.0522	-6.5240
	(-0.1032)	(-0.6414)
year effect	control	control
individual effect	control	control
Observations	952	952
R-squared	0.0975	0.4062
Number of idz	238	238
F	5.6657***	16.1028***

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth

3.6. Heterogeneity analysis

Heterogeneity analysis, as the name suggests, looks at whether the impact of the explanatory variables on the explained variables varies with the choice of different samples, dividing the sample into China, Germany and Portugal, according to the country to find out whether there is a significant difference in the impact of the explanatory variables in different groups: The results of the regression for each country is presented in Table 9, Table 10,and Table 11, respectively.

Table 9. Heterogeneity analysis (China)

	(1)	(2)	(3)
Variables	**ROA**	**IB**	**ROA**
TOP	0.1226**	-0.0131**	0.0980*
	(1.9970)	(-2.1783)	(1.6628)
BS	0.4965***	-0.0749***	0.3554**
	(2.7164)	(-3.5438)	(2.0664)
GEN	2.4933***	-0.3132***	1.9030**
	(3.5991)	(-8.2974)	(2.4663)
IB			-1.8847**
			(-2.3296)
SIZE	-1.8252	0.2495***	-1.3549
	(-0.9511)	(2.8369)	(-0.6947)
LEV	-0.0210	0.0018	-0.0176
	(-0.5086)	(0.8072)	(-0.4106)
GROW	0.5556***	0.0026	0.5605***
	(5.5713)	(1.0882)	(5.4300)
Constant	10.2293	-0.2947	9.6740
	(0.7090)	(-0.3582)	(0.6716)
Year Effect	control	control	control
Individual Effect	control	control	control
Observations	532	532	532
R-squared	0.6220	0.1511	0.6298
Number of idz	133	133	133

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth; Number of idz- Company lawsuit.

It can be seen from Table 9 that for ROA, the impact coefficients of TOP, BS, and GEN are 0.1226, 0.4965, and 2.4933, respectively, which exist with two or three stars, which is a significant state, i.e., the three hypotheses are satisfied for the samples of Chinese firms, and in the second step of mediation effect, the impact coefficients of TOP, BS, and GEN are - 0.0131, -0.0749, and -0.3132, respectively, exist with two or three stars, which is a significant state, while in the third step of the mediation effect, both explanatory and mediating variables are significant, i.e., all the hypotheses are fulfilled for the Chinese firms.

Table 10. Heterogeneity analysis (Germany)

	(1)	(2)	(3)
Variables	**ROA**	**IB**	**ROA**
TOP	-0.0172	-0.0051***	-0.0347
	(-0.1987)	(-3.1626)	(-0.3802)
BS	2.1478***	-0.0221***	2.0718***
	(3.2783)	(-3.1425)	(3.2588)
GEN	-4.0598***	0.1675***	-3.4822**
	(-3.9150)	(3.1511)	(-2.5426)
IB			-3.4479
			(-0.9911)
SIZE	1.9439*	0.0571	2.1407**
	(1.8265)	(0.6923)	(2.0188)
LEV	0.0358	0.0003	0.0368
	(1.2415)	(0.1317)	(1.3723)
GROW	0.0840**	-0.0013	0.0797*
	(2.0725)	(-1.4320)	(1.8869)
Constant	-24.9266***	0.5759	-22.9411***
	(-3.1899)	(0.9928)	(-3.5403)
Year Effect	control	control	control
Individual Effect	control	control	control
Observations	248	248	248
R-squared	0.3890	0.2869	0.3933
Number of idz	62	62	62

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth; Number of idz- Company lawsuit.

It can be seen that for ROA (Table 10), the coefficient of influence of BS and GEN is 2.1478 and -4.0598, respectively, and the existence of three stars, respectively, is a significant state, i.e., an increase in BS promotes an increase in Germany's ROA, and the performance of firms in which female CEOs are located is higher compared to male CEOs, while an increase in TOP and BS both cause an increase in investment efficiency, and female CEO's investment efficiency is higher.

Table 11. Heterogeneity analysis (Portugal)

	(1)	(2)	(3)
Variables	**ROA**	**IB**	**ROA**
TOP	0.0084	-0.0028***	-0.0560
	(0.2312)	(-5.5124)	(-1.0393)
BS	1.9115***	-0.0205***	1.4444***
	(5.3833)	(-8.1853)	(5.6824)
GEN	-0.8347**	0.0185***	-0.4129
	(-2.6262)	(3.8881)	(-1.3803)
IB			-22.7919**
			(-2.4467)
SIZE	0.2576	0.0256	0.8402
	(0.2066)	(1.0298)	(0.7226)
LEV	-0.0028	-0.0000	-0.0038*
	(-0.8491)	(-0.5543)	(-1.7143)
GROW	0.0467	0.0008*	0.0650
	(0.9164)	(1.7153)	(1.3194)
Constant	-14.6292	0.5086*	-3.0370
	(-1.0445)	(1.9972)	(-0.2801)
Year Effect	control	control	control
Individual Effect	control	control	control
Observations	172	172	172
R-squared	0.5359	0.7745	0.5685
Number of idz	43	43	43

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth; Number of idz- Company lawsuit.

It can be seen in Table 11 that for ROA, the coefficient of influence of BS, GEN is 1.9115, -0.8437, which is significant state, that is, the increase in the size of the board of directors causes an increase in financial performance, and the performance of the firms with female CEOs is higher, and in the second step of the mediation effect, the coefficients of the influence of TOP, BS, GEN are -0.0028, -0.0205 , 0.0185, which is a significant state, and in the third step of the mediation effect, BS is fulfilling the hypothesis that BS will promote financial performance by promoting the investment efficiency of the company.

3.7. Robustness test

The robustness test is used to assist in verifying whether the regression analysis results are stable. That is, through a method, if the results of the core explanatory variables are consistent with the previous text, it means that the results are non-random and credible. This robustness test is carried out by changing the explained variables, converting the return on total assets ROA into the return on Equity ROE, and performing a robustness test as follows, exhibited in Table 12.

Table 12. Robustness test

Variables	(1) **ROE**	(2) **IB**	(3) **ROE**
Top	0.1766**	-0.0058***	0.1647**
	(2.1269)	(-2.8150)	(2.0133)
BS	1.5093***	-0.0397***	1.4271***
	(3.3744)	(-5.0715)	(3.1093)
GEN	-10.2371	-0.0280	-10.2952
	(-0.8146)	(-0.2337)	(-0.8328)
IB			-2.0727*
			(-1.7196)
SIZE	1.1261	0.1405**	1.4173
	(0.5939)	(2.4313)	(0.7262)
LEV	-0.0319	0.0002	-0.0315
	(-0.8141)	(0.8390)	(-0.7990)
GROW	0.6984***	0.0005	0.6995***
	(5.9886)	(0.5323)	(5.9623)
Constant	-12.2244	-0.0522	-12.3325
	(-0.6185)	(-0.1032)	(-0.6285)
Year Effect	control	control	control
Individual Effect	control	control	control
Observations	952	952	952
R-squared	0.4108	0.0975	0.4129
Number of idz	238	238	238
F	12.0809	5.6657	11.7214

Note: *, **, *** 10%, 5%, and 1% significance levels; The t-values are in parentheses. ROA – return on assets; TOP - shareholding concentration; BS - Board size; GEN - CEO gender; IB - investment efficiency indicator; SIZE- Company Size; LEV - Capital Structure; GROW – Growth

In the case of replacing variables, the regression coefficients of the explanatory variables BS and GEN on ROE are 0.1766 and 1.5093 respectively (Table 12), both of which are significantly positive and still significant, that is, the direction of influence and the significance of the influence are consistent. Therefore, the results are non-random and credible. The promotion effect of TOP and BS on corporate investment efficiency still exists. In the third step of the mediating effect, it also passed the test and is consistent with the previous results. Therefore, the results are stable.

Conclusions, Limitations and Future Research Lines

This paper takes Chinese listed companies, German listed companies and Portuguese unlisted companies as the research samples from 2017 to 2022, in which the data of 2017 and 2018 are used to estimate the optimal investment level in the lagged model of investment efficiency. Finally, a total of 952 observations were obtained between 2019 and 2022, on the basis of which a model is built to empirically test the relationship between corporate governance, investment efficiency and financial performance. The following conclusions are obtained:

(1) The regression results of model (2.1) show that hypotheses H I, H2 and H3 are validated.

It shows that shareholding governance efficiency, board governance efficiency and CEO governance efficiency are significantly and positively related to financial performance among corporate governance factors in China, Germany and Portugal. It is also consistent with the theoretical analyses in the previous section, that is, under the principal-agent relationship, shareholding governance can reduce the information asymmetry between shareholders and management and thus improve financial performance.

The larger the size of the board of directors, the stronger its comprehensive governance ability, and the more beneficial it is to the improvement of financial performance. In Germany and Portugal, financial performance is higher under female CEOs compared to male CEOs.

(2) The regression results of model (2.2) verify hypotheses H4, H5 and H6. From regression results of model (2.2) the hypotheses H4, H5 and H6 are validated.

It shows that shareholding governance efficiency, board governance efficiency and CEO gender governance efficiency are all significantly positively related to corporate investment efficiency in China, Germany and Portugal. It verifies the previous theoretical analysis that based on the financing constraint theory and free cash flow theory, management may make inefficient investments for their own interests. Strengthening shareholders' constraints on management through shareholding governance can effectively alleviate agency conflicts and improve corporate investment efficiency.

Board governance can enable the board to make better investment decisions and reduce the possibility of underinvestment or overinvestment. At the same time, CEO gender governance can also effectively improve corporate investment efficiency. In Germany and Portugal, investment efficiency is higher under female CEOs compared to male CEOs.

3) The regression results of model (2.3) verify hypothesis H7, that is, investment efficiency plays a partial mediating role in the relationship between internal governance and financial performance in China, Germany and Portugal. Specifically, investment efficiency partially mediates the relationship between shareholding governance and financial performance, the relationship between board governance and financial performance, and the relationship between CEO gender governance and financial performance, respectively. Investment activity is an important driving force of national economic growth and one of the most important activities of enterprises. Investment efficiency is an indicator to test whether the company's investment decisions and implementation results are reasonable, and high investment efficiency indicates that the company has made the optimal investment decisions and has been properly implemented.

Through the theoretical analysis and regression results show that good corporate governance can improve the company's investment efficiency, higher investment efficiency can improve financial performance and proves the mediating role of investment efficiency. Therefore, companies should pay attention to investment efficiency. Firstly, by establishing rational, scientific and standardized investment decision-making procedures, the usefulness of decision-making can be improved, and the possibility of under-investment and over-investment decisions can be reduced. After that, an effective monitoring mechanism should be established to supervise the implementation of the management's decisions, to ensure that reasonable investment decisions are implemented in an appropriate and timely manner, to enhance the company's investment efficiency and further improve financial performance.

In view of the shortcomings of the above research, this paper believes that the following points can be carried out in the follow-up research: (1) Select more indicators to measure corporate governance, and even further expand the scope to include the influence of external governance, so as to comprehensively study the issue of corporate governance. (2) Subdividing inefficient investment into two categories of underinvestment overinvestment and conducting regression analyses to study whether there is any difference in the impact of corporate governance under different circumstances, and whether the impact on financial performance is the same.

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Appendix

Data analysis original output result diagram:

```
R-sq:                                                 Obs per group:
     within  = 0.4020                                               min =         4
     between = 0.5827                                               avg =       4.0
     overall = 0.5600                                               max =         4

                                                      F(9,237)          =     17.28
corr(u_i, Xb)  = -0.0043                              Prob > F          =     0.0000

                                        (Std. Err. adjusted for 238 clusters in idz)
------------------------------------------------------------------------------
             |               Robust
         ROA |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         Top |   .1069361   .0351001     3.05   0.003     .0377882    .1760841
          BS |   1.175176   .2418462     4.86   0.000     .6987333    1.651619
         GEN |  -1.611148   3.200463    -0.50   0.615    -7.916137    4.693841
        SIZE |  -.0860096   1.130148    -0.08   0.939    -2.312429    2.140409
         LEV |  -.0117915   .0128455    -0.92   0.360    -.0370975    .0135145
        GROW |   .3304334   .0489641     6.75   0.000     .2339729    .4268939
             |
        year |
        2020 |  -.0052641   .2700984    -0.02   0.984    -.5373645    .5268362
        2021 |  -.1805305   .4223034    -0.43   0.669    -1.012478    .6514175
        2022 |  -.6122319   .4060427    -1.51   0.133    -1.412146     .187682
             |
       _cons |  -6.447493   10.23717    -0.63   0.529    -26.61496    13.71997
-------------+----------------------------------------------------------------
     sigma_u |  6.2387384
     sigma_e |   3.283041
         rho |  .78313257   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
R-sq:                                                 Obs per group:
     within  = 0.0975                                               min =         4
     between = 0.0310                                               avg =       4.0
     overall = 0.0339                                               max =         4

                                                      F(9,237)          =      5.67
corr(u_i, Xb)  = -0.3948                              Prob > F          =    0.0000

                                        (Std. Err. adjusted for 238 clusters in idz)
```

IB	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Top	-.0057671	.0020487	-2.82	0.005	-.0098031	-.0017311
BS	-.0396547	.0078192	-5.07	0.000	-.0550586	-.0242507
GEN	-.0280381	.1199955	-0.23	0.815	-.2644321	.208356
SIZE	.1404731	.0577759	2.43	0.016	.0266531	.2542931
LEV	.0002055	.0002449	0.84	0.402	-.000277	.000688
GROW	.000513	.0009639	0.53	0.595	-.0013858	.0024119
year						
2020	-.0397923	.016521	-2.41	0.017	-.0723391	-.0072454
2021	-.045369	.0199972	-2.27	0.024	-.084764	-.0059741
2022	-.0970025	.0205156	-4.73	0.000	-.1374186	-.0565863
_cons	-.0521575	.5052458	-0.10	0.918	-1.047504	.9431889
sigma_u	.43734263					
sigma_e	.18619907					
rho	.84655086	(fraction of variance due to u_i)				

```
. sum ROA Top BS GEN IB SIZE LEV GROW
```

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	952	8.641684	10.31236	-15.2739	39.2304
Top	952	40.78008	28.2223	.5	100
BS	952	9.035714	3.826245	2	20
GEN	952	.9443277	.2294083	0	1
IB	952	.5233783	.4395451	.0050481	1.908857
SIZE	952	8.727607	1.804678	3.976218	12.12064
LEV	952	49.34924	55.41628	0	413.4333
GROW	952	9.573107	12.9004	-36.6549	50.4726

```
.
. asdoc pwcorr ROA Top BS GEN IB SIZE LEV GROW,star(all) dec(4) nonum replace
```

	ROA	Top	BS	GEN	IB	SIZE	LEV	GROW
ROA	1.0000							
Top	0.4329***	1.0000						
BS	0.4647***	0.5533***	1.0000					
GEN	0.0104	-0.1579***	-0.0373	1.0000				
IB	-0.4550***	-0.3841***	-0.5722***	0.1041***	1.0000			
SIZE	0.2007***	0.4333***	0.5470***	-0.1840***	-0.4015***	1.0000		
LEV	-0.0847***	0.1301***	0.0839***	-0.0907***	-0.0825**	0.3125***	1.0000	
GROW	0.5577***	-0.0987***	-0.0092	0.1395***	-0.0421	-0.1158***	-0.3192***	1.0000

```
Click to Open File:  Myfile.doc
```

```
. reg ROA Top BS GEN IB SIZE LEV GROW
```

Source	SS	df	MS	Number of obs	=	952
				F(7, 944)	=	242.76
Model	65016.5767	7	9288.08239	Prob > F	=	0.0000
Residual	36117.339	944	38.259893	R-squared	=	0.6429
				Adj R-squared	=	0.6402
Total	101133.916	951	106.344811	Root MSE	=	6.1855

ROA	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Top	.117733	.0088142	13.36	0.000	.1004353	.1350308
BS	.5754851	.0765292	7.52	0.000	.425298	.7256722
GEN	-.1121125	.9081226	-0.12	0.902	-1.894285	1.67006
IB	-5.076767	.5666401	-8.96	0.000	-6.188786	-3.964747
SIZE	-.5244124	.1444897	-3.63	0.000	-.8079706	-.2408543
LEV	.0101012	.0040142	2.52	0.012	.0022235	.0179789
GROW	.4711819	.0166374	28.32	0.000	.4385313	.5038325
_cons	.9712453	1.59093	0.61	0.542	-2.150923	4.093414

within	= 0.1511	min	= 4
between	= 0.1011	avg	= 4.0
overall	= 0.0957	max	= 4
		F(8,132)	= .
corr(u_i, Xb)	= -0.5921	Prob > F	= .

(Std. Err. adjusted for 133 clusters in idz)

IB	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Top	-.0130918	.00601	-2.18	0.031	-.0249802	-.0012035
BS	-.0748764	.0211289	-3.54	0.001	-.1166715	-.0330813
GEN	-.3132423	.0377517	-8.30	0.000	-.3879189	-.2385656
SIZE	.2495133	.0879514	2.84	0.005	.0755367	.4234899
LEV	.0017879	.0022149	0.81	0.421	-.0025934	.0061693
GROW	.0026294	.0024163	1.09	0.278	-.0021503	.0074091
year						
2020	-.0952666	.0319877	-2.98	0.003	-.1585414	-.0319918
2021	-.1518907	.0505458	-3.01	0.003	-.2518752	-.0519061
2022	-.2367393	.0543732	-4.35	0.000	-.3442949	-.1291838
_cons	-.2946567	.8226731	-0.36	0.721	-1.921985	1.332672
sigma_u	.42771189					
sigma_e	.2380312					
rho	.76352369	(fraction of variance due to u_i)				