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## Article

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# Limited partnership agreement structure and stock price crash risk

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## ABSTRACT

The ownership structure of listed companies affects the risk of stock price crash. Under the background of agency conflict and decentralised equity era of listed companies in China, how to effectively reduce the risk of stock price crash is an urgent problem to be solved. The limited partnership agreement structure has the advantages of risk isolation and equity incentive, therefore, in recent years, more and more enterprises in China's capital market have begun to incorporate the limited partnership agreement into the company's equity structure. Using a sample of companies listed on Shanghai and Shenzhen A-shares from 2014 to 2021, this study empirically examines how the limited partnership agreement structure (LP Structure) affects the stock price crash risk of listed companies. The results show that the limited partnership agreement structure can significantly reduce the risk of future stock price crash, and the research results are still robust after a series of robustness tests and control of endogenous problems. The mechanism test shows that the LP agreement structure can reduce the risk of stock price crash of listed companies by restraining the tunnelling behaviour of actual controllers, strengthening the supervision effect of minority shareholders, realising effective incentives for employees and improving the information transparency of listed companies. In addition, the heterogeneity analysis shows that the LP agreement structure has a more significant impact on the stock price plunge risk of listed companies under the conditions of dispersed ownership and good legal environment. The research in this study provides an incremental literature contribution to further understanding the economic consequences of LP agreement structure, and also provides empirical evidence for more listed companies to adopt LP agreement structure as a flexible architecture.

## KEYWORDS

Limited partnership agreement structure; stock price crash risk; information asymmetry; employee stock ownership; principal-agent problem

## 1. Introduction

The stock price crash refers to the financial phenomenon in which stock price falls sharply under unexpected circumstances. The sharp downward fluctuation of the stock price not

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only damages the confidence and interests of investors, but also undermines the financial order, and even makes it difficult for the real economy to operate healthily and stably (Xu et al., 2012). Therefore, it is of great theoretical significance and practical value to study the influencing factors of stock price crash risk and explore the mechanism of various mitigating factors on stock price crash, which is helpful for the company to take measures and regulatory authorities to formulate policies to reduce the risk of stock price crash, so that China's capital market can develop more healthily and rapidly. Existing studies mainly discuss the formation mechanism of stock price crash risk based on the perspective of information asymmetry and behavioural finance (Gennotte & Leland, 1990; Hong & Stein, 2003; Jin et al., 2022; Zhang & Zhang, 2020), and also studies the impact of factors such as management characteristics, equity structure and institutional investors on the risk of stock price crash. Most literatures believe that many companies with stock price crashes were caused by the exposure of negative news, but the underlying reason lies in the internal structure of the company. Therefore, it is of great significance to discuss the influence of the ownership structure of listed companies on the risk of stock price crash for resolving systemic financial risks and stabilising the capital market.

With the concentrated outbreak of a series of control rights disputes represented by Vanke's equity dispute in 2015, China's capital market entered the era of equity dispersion (Zheng, 2018). According to the statistics in this study, the average shareholding ratio of the largest shareholder of the listed companies with the same shares and rights decreased from 42% in 2004 to 34% in 2015 after excluding the listed companies with different rights of the same shares, and continued to decline to 32% in 2022, which is lower than one-third of the relative controlling shares marked by 'one vote veto'. Under such a background, it may promote the emergence of more 'barbarians' and seriously affect the stability of the control right. Therefore, how to strengthen and stabilise the control right is urgent for the actual controllers of listed companies. Most of the existing literature on stabilising control rights has been studied from the perspectives of modifying the company's articles of association, adding provisions to block 'barbarians' or setting up a dual-class share structure (Luo et al., 2018). However, the effect of these measures to stabilise corporate control rights will be limited by factors such as the nature of ownership and institutional investors, which will affect their stabilising effect. Therefore, finding a stable and innovative mechanism has become an urgent problem to strengthen the control. Different from the mechanism of dual equity stabilising equity through voting rights, the limited partnership agreement structure is an innovative-oriented equity framework. By setting up a limited partnership, the general partner can assume unlimited (joint) responsibility to concentrate the resources of the limited partnership to obtain the status of the controlling shareholder of the listed company. Therefore, it has become an important tool for the actual controller of the general partner to obtain and stabilise the control rights. In this study, the control chain formed by the actual controller through the limited partnership enterprise is called the limited partnership agreement framework, or LP agreement structure for short.

Limited partnership agreement structure first grew out of a contract in Italy around the 10th century that became known as *Commenda*, a partnership that formed a combination of general and limited partners. In the design of the equity structure of the target company, the control chain formed by the actual controller based on the limited partnership investment agreement is called the limited partnership agreement structure (Zheng

et al., 2022). Generally speaking, the actual controller of the company acts as the general partner of the limited partnership enterprise, carries out the partnership enterprise affairs and assumes the management function; the role of a limited partner can be played by the target company's motivated employees or external investors, who bear limited liability only to the amount of capital contribution. Such ownership structure has the characteristics of realising the ideal phenomenon of 'separation of cash flow rights and control power' in the minds of entrepreneurs, so most of the actual controllers of the company who want to use limited capital to own and consolidate their own control rights may be inclined to choose LP agreement structure to build the ownership structure to achieve the purpose of attracting external investment and continuing to control the company. Such as Zhongrun Resources Investment Corporation, its equity structure chart in 2022 is shown in Figure 1, the final actual controller Guo Changwei enjoys 23.99% of the voting rights of the listed company with 0.0205% of the shares. In addition, LP agreement structure can mobilise the enthusiasm of minority shareholders in supervision, reduce the 'free riding' behaviour of minority shareholders in supervision of major shareholders, and give play to the advantages of executives and employees as limited partners of limited partnerships and executives of listed companies in corporate governance and performance initiative. But LP agreement structure also has the following problems: the first problem is information disclosure, the organisational form and benefit distribution mechanism of LP agreement structure are relatively complicated, and listed companies lack the motivation of full information disclosure. The second problem is corporate governance, the ownership and control rights of the actual controller are separated under the LP agreement structure. In such a case, corporate governance will be highly dependent on the moral standard of the actual controller, which may cause more complex corporate agency problems and damage the interests of external shareholders and creditors. The third problem is tax, on the one hand, the tax rate of exit when the partnership transfers equity is uncertain, some areas believe that the tax rate of 5%-35% is applicable according to 'production and operation income', some areas also apply 20% tax rate according to 'property transfer income', and some areas believe that different tax rates should be applied to general partners and limited partners respectively; on the other



Figure 1. Ownership structure chart in 2022 of Zhongrun Resources Investment Corporation.

hand, shareholders who obtain dividends distributed by the invested company through the partnership must pay individual income tax on 'dividend income'.

There are few literatures on LP agreement structure. In the limited literatures and practices, LP agreement structure of listed companies will have two different influences on corporate governance. On the one hand, Zheng et al. (2022) believe that the LP agreement structure, as a tool for the actual controller to strengthen the control right, helps the actual controller to realise the 'unequal voting rights' control right arrangement like the pyramid holding structure arrangement, further leads to the separation of the cash flow right and the control right of the actual controller, and becomes the basis for the actual controller to 'hollow out' the resources of the listed company. However, as a general partner, he needs to bear unlimited responsibilities, so the actual controller may alleviate the agency conflict with small and medium shareholders out of the need for risk prevention, thus forming a long-term and short-term effect of restraining tunnelling and facilitating tunnelling. On the other hand, many limited partnerships built on the basis of employee stock ownership platform<sup>1</sup> can coordinate the interests of employees, executives and shareholders, tie the interests of limited partners (employees and executives) together with the long-term interests of listed companies (John & Wayne, 2001), and help retain core talents (Paul & Scott, 2004). Finally, it will promote the improvement of governance efficiency of listed companies. Then, what impact will this special LP agreement structure appearing in the governance process of listed companies have on the stock price crash risk of listed companies? There is little reference to this in the existing literature.

This study empirically examines how LP agreement structure affects the governance of listed companies and further affects the stock price crash risk of listed companies by taking the A-share listed companies in Shanghai and Shenzhen from 2014 to 2021 as samples. The possible contributions of this study are as follows: First, it enriches the research on limited partnership in China and examines the impact of LP agreement structure as an innovative equity framework on listed companies. Previous studies have shown that the LP agreement structure has become a governance system innovation that encourages enterprise R&D and innovation through the specialised division of shareholder rights (Zheng et al., 2022), and this study further examines how the LP agreement structure affects the risk of corporate stock price crash. Second, it has enriched China's research on the economic consequences of employee equity incentives. Based on the agency theory, the existing research believes that employee stock ownership plans will become a tool for major shareholders to buy employees (Guan et al., 2022). The opportunistic motivation of major shareholders behind employee stock ownership plans distorts its incentive function (Chen et al., 2019; Dai & Lin, 2018; Shen et al., 2018), which is conducive to hoarding negative news by actual controllers or major shareholders. This study empirically examines the effective incentive of LP agreement structure to management and core employees, and the research shows that the employee equity incentive under LP agreement structure has strong stability. The discussion in this study brings enlightenment for listed companies to meet the Internet wave and retain the intellectual

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<sup>1</sup>In the limited partnership platform formed on the basis of employee stock ownership platform, the actual controller is usually the general partner of the limited partnership platform, and the employees and executives who hold shares become the limited partners of the limited partnership platform.

capital needed for development, and also constitutes an important supplement and extension of the literature on employee equity incentive model. Third, it has enriched the research on factors affecting the stock price crash risk of listed companies. Previous literatures have conducted studies from the perspectives of management tone, major shareholder shareholding, macro policy, media regulation and institutional investor shareholding (Gan et al., 2019; Wang et al., 2015; Zhang et al., 2022), and this paper studies from the perspective of the ownership structure of listed companies to provide a reference for adjustment from the internal perspective of companies to reduce the risk of stock price crash.

The contents of this study are as follows: In Chapter 2, reviews the relevant research literature at home and abroad, and then puts forward the hypothesis to be tested on this basis; In Chapter 3, mainly introduces data source, variable definition and model setting. In Chapter 4, descriptive statistics of the main variables are carried out, and basic regression is carried out based on the model to interpret the results. Then the robustness test is carried out from the aspects of endogenous solution and replacement of explained variables. Chapter 5 examines the mechanism of LP structure affecting stock price crash risk, and analyzes the heterogeneity of samples. Finally, a brief summary is given.

## 2. Literature review and research hypothesis

### 2.1. Literature review

#### 2.1.1. Ownership structure and stock price crash risk

The earliest research on stock price crash appeared in the 1970s. The existing research on the factors affecting the risk of stock price crash mostly started from the perspectives of management tone, institutional investor shareholding, executive characteristics and analysts' attention (Cho & Kim, 2020; Gao et al., 2022; Huang et al., 2014; Xiao, 2021), the theories and mechanisms formed mainly include barre effect hypothesis, volatility feedback hypothesis, incomplete information hypothesis, heterogeneous belief hypothesis and random bubble model hypothesis. Jin et al. (2022) put forward the 'information hiding hypothesis' and explained the potential cause of stock price crash: there are inside investors and corporate executives with inside information in the stock market, and outside investors cannot know the inside information. Enterprise insiders have the ability to hide negative inside information. As negative information accumulates to a threshold and is suddenly exposed, investors carry out panic selling in the market, which is a huge impact on stock prices.

The internal factors research on the influence of ownership structure on stock price crash risk of listed companies is mainly conducted from the perspectives of shareholding ratio of the largest shareholder, individual major shareholder shareholding and employee shareholding plan. From the perspective of corporate governance, individual major shareholders have a large investment and a large risk burden. Considering their own long-term interests, they are willing and able to collect information about the company's operation and strengthen supervision over the company's management, so as to reduce the concealing of bad news and reduce the risk of stock price crash. The decision of the largest shareholder with the most shares has a huge impact on listed companies, Grossman and Hart (1980) believes that the decentralised ownership structure will lead

to 'free riding' among shareholders, and the relatively centralised ownership structure will give the major shareholders considerable returns, which can improve the enthusiasm of the major shareholders to supervise the management, solve the 'free rider' problem of minority shareholders in the context of equity dispersion and restrain the behaviour of managers to obtain private gains (Shleifer & Vishny, 1986), so as to alleviate the first type of agency problem, reduce the concealization of bad news, and reduce the risk of stock price crash. However, Wang et al. (2015) also proposed that with the increase of shareholding ratio, the largest shareholder would be more capable of hollowing out, thus increasing the risk of stock price crash.

From the perspective of employee stock ownership, the incentive of stock ownership is more stable and effective than that of salary incentive, but research on how employee stock ownership plans affect the risk of stock price crashes is inconclusive. On the one hand, from the incentive effect of employee stock ownership, after employees hold equity, the interests of owners and agents tend to be consistent, which can alleviate the principal-agent problem to a certain extent. The right to share corporate profits conferred by the employee stock ownership plan can attract and retain talents and achieve effective incentives for employees (Wang et al., 2017); The increase in employee satisfaction with the company will also have a positive impact on the company's stock price. From the information transmission effect of employee stock ownership, Conte et al. (1996) believes that employee stock ownership can transmit a good signal to the outside world to buy company stock. Li and Stewart (2004) took the data of China's A-share listed companies as samples to study the relationship between employee stock ownership and stock price crash, and found that employee stock ownership announcements were significantly negatively correlated with the company's stock price crash risk; This is because the announcement of employee stock ownership sends a positive signal to the market that insiders are optimistic about the future value of the company, which helps to enhance investor confidence and reduce the behaviour of investors to sell their shares at a low price due to the disclosure of bad news, thus reducing the risk of a stock price crash. On the other hand, employee ownership may also help the major shareholder or the actual controller to increase the hollowing out. In the context of the era of decentralised ownership, most of the employee stock ownership plans of listed companies are launched by major shareholders for the purpose of stabilising the PBC, resulting in the incentive distortion of employee stock ownership plans (Zheng et al., 2021). In addition, China's employee stock ownership plan has the characteristics of short term, deep participation of major shareholders and low participation of employees. In the long run, employee stock ownership plan will become a tool for major shareholders to achieve short-term market value management, help the private interests of major shareholders (Chen et al., 2020), and ultimately increase the risk of stock price crash of listed companies.

Most of the literatures analysing the relationship between a company's external characteristics and stock price crash focus on the perspective of institutional investors. Most of the existing studies believe that institutional investors have two influence channels on the risk of stock price crash, one is the inhibition channel and the other is the aggravation channel. On the one hand, compared with retail investors, institutional investors have stronger rationality and more professional knowledge reserves, and have sufficient ability to study the decision-making of the management of listed companies (Dong et al., 2020), so as to improve corporate governance, increase information

transparency and improve stock pricing efficiency (Shleifer, 1986). After further classifying institutional investors, it is found that stable institutional investors with a longer shareholding period and a larger shareholding ratio are more inclined to long-term interests, and they can supervise the management at a supervision cost far lower than the supervision income, restrain the opportunistic behaviour of the management, alleviate the internal and external information asymmetry of the enterprise, and reduce the risk of stock price crash (Li et al., 2015; Yang et al., 2020b). On the other hand, under the special system background of China, the proportion of shares held by institutional investors in listed companies is low, and the cost of supervision is high, so it is difficult for individual institutional investors to influence the decision-making of listed companies. For short-term interests, institutional investors are likely to 'work in collusion' with management (Yang et al., 2020a), ignore their own private information, and buy a large number of listed companies' stocks (Bohl & Siklos, 2004); In addition, other investors in the market generally believe that institutional investors are informed, and the resulting herding effect will increase the risk of stock price crash (Xu et al., 2013). Further research found that the higher the proportion of institutional shareholding, the greater the probability of the future stock price crash risk of listed companies (Wu et al., 2019). After the institutional investors are divided into specialised institutional investors and short-term institutional investors, it is found that short-term institutional investors have adverse effects on the company, and will increase the risk of stock price crash in the future. The higher the proportion of independent institutional investors, the higher the risk of stock price crash (Liu & Di, 2019).

### *2.1.2. Limited partnership agreement structure*

In modern corporate governance, limited partnership agreement structure, as one of the most representative organisational structures, has become increasingly close to listed companies by virtue of its advantages in risk isolation. In recent years, more and more listed companies have adopted this kind of structure, but there are few literature studies on listed companies setting up limited partnership agreement structure. Xu and Tan (2021) analysed the practical application and existing problems of this framework by taking limited partnerships among major shareholders of Shenzhen-listed companies as samples and found that the number of listed companies with limited partnership structure adopted by the top ten shareholders increased year by year. At the same time, it also points out that the LP agreement structure is more and more involved in the production and operation of listed companies, corporate governance, control acquisition and other aspects, but at the same time, there are problems such as unstable control, inadequate information disclosure, and high risk of leveraged buyout. The study of Zheng et al. (2022) shows that the LP agreement structure forms a specialised division of labour between general partners and limited partners in the implementation of shareholder rights, and entrepreneurs can enhance their control and influence on listed companies through the LP agreement structure. In the short term, the 'binding effect' is greater than the 'transfer effect', and the actual controller's behaviour of 'hollowing out' the listed company is reduced. In addition, LP agreement structure can help the management team and core technical personnel of listed companies share risks and benefits, improve the stability of the core team, encourage entrepreneurs to take more risks, and ultimately encourage enterprises to invest more in long-term research and development (Zheng et al., 2022).

Although the existing literature has studied the influencing factors of stock price crash risk from different aspects, the literature has not studied the influence of LP agreement structure on the stock price crash risk of listed companies from the perspective of LP agreement structure. In view of this, this study makes a test from this perspective and finds that LP agreement structure has a negative impact on the stock price crash risk of listed companies in the short term, that is, it can reduce the stock price crash risk.

## ***2.2. Corporate governance logic and research hypothesis under LP agreement structure are proposed***

### ***2.2.1. Corporate governance logic under LP agreement structure are proposed***

According to the above analysis, it can be found that LP agreement structure can promote the actual controller to occupy more control rights of listed companies with less investment. In addition, other logic analysis of LP agreement structure affecting corporate governance can be expanded from the following aspects:

First, from the perspective of the general partner's responsibility of the actual controller, although the actual controller of the listed company can control the listed company with less investment, whether it is a general partner under the control chain or a general partner under the employee stock ownership platform, it must bear unlimited (joint) responsibility for corporate governance effects, management and other related obligations. This unlimited (joint) responsibility will prompt the actual controller to further weigh the excess control benefits and costs under the LP agreement structure. Second, under the LP agreement structure, facing the reality that the actual controller obtains more control rights of listed companies with less resources, the small and medium-sized shareholders of listed companies may change the traditional 'free rider' behaviour, more actively and actively supervise the behaviour of major shareholders, especially the actual controller, and further participate in the governance of listed companies. Third, in the limited partnership under the control chain or employee shareholding platform, the general partner who is the actual controller of the listed company and the limited partner who is the executive, employee and external person of the listed company will form a principal-agent relationship, in which the limited partner entrusts the assets to the general partner for operation and management, and the general partner operates and controls the limited partnership. Therefore, the principal-agent relationship within the limited partnership will prompt the limited partners acting as executives, employees or outsiders to strengthen the supervision of the general partners acting as actual controllers. The mechanism that affects corporate governance under the above LP agreement structure is bound to have an impact on the stock price crash risk of listed companies.

### ***2.2.2. General motivations for listed companies to set up LP agreement structures***

In the two typical false statement cases of Kangmei Pharmaceutical and Shanghai DZH, the actual controller, as the main responsible person, was judged by the court to bear a huge amount of joint civil compensation, which had a huge deterrent effect on the corporate governance and management. Therefore, although the LP agreement structure will induce the actual controller's tunnelling motivation to a certain extent, the institutional arrangement of the general partner's unlimited liability and the strict implementation of the actual law will greatly increase the actual controller's tunnelling cost. The

additional criminal responsibility, the huge administrative penalty and the administrative responsibility of life-long ban make the tunnelling cost infinitely enlarged, thus forcing the actual controller to actively restrain or even give up the short-term behaviour of tunnelling based on their own interests. The institutional arrangement based on LP architecture, through the mutual checks and balances and mutual incentives between general partners and limited partners, will promote the enterprise to survive efficiently in the foreseeable future, which is more in line with the long-term interests of the actual controller of general partners and the long-term interests of limited partners. This is also the governance advantage of LP structure, an institutional arrangement favoured by more and more listed companies.

In addition, this study further statistics the listed companies set LP agreement structure industry distribution. [Table 1](#) can be found that listed companies with LP agreement structure are mainly concentrated in the computer, communication and other electronic equipment manufacturing industry (44.05%), pharmaceutical manufacturing industry (19.7%) and information transmission, software and information technology service industry (10.64%). These industries are generally knowledge-intensive, high R&D investment and high risk. It requires a lot of knowledge, technology, capital and a higher risk bearing ability. The LP agreement structure arrangement just meets the above needs of knowledge, technology and capital, and can mobilise professional and technical personnel with rich knowledge reserves and investors with strong funds to join the LP agreement structure to become limited partners. Entrepreneurs with rich pioneering spirit and rich professional skills can establish and control enterprises by becoming general partners under the LP agreement structure and assuming unlimited (joint and several) liability in the face of capital shortage, so as to realise the purpose of starting a business and increasing enterprise value. Therefore, through the analysis of descriptive statistical results by industry, it can be found that although the setting of LP agreement structure will increase the suspicion of the actual controller's hollowing out of listed companies to a certain extent, the infinite (joint) liability risk and the consideration of the company's long-term development will often make it take the initiative to give up this short-term behaviour. Moreover, this structure can help the actual controller to concentrate more resources into the listed company with the help of the limited partnership enterprise, so that it can manage the limited partnership enterprise and finally control the listed company while becoming the general partner to assume unlimited (joint and several) responsibilities, so as to realise the purpose of the actual controller to establish and control the enterprise by assuming unlimited (joint and several) responsibilities in the case of shortage of funds, technology or other resources.

### ***2.2.3. Theoretical derivation and hypothesis of the relationship between LP agreement structure and stock price crash risk of listed companies***

According to the theory of stock price crash risk, agency problem and bad news hoard are important factors affecting stock price crash risk. This is because the principal-agent problem exists in listed companies, and managers are motivated to acquire personal interests, carry out opportunistic behaviours such as perquisite consumption and inefficient investment, which leads to the bad news of listed companies (Kothari et al., 2009). In addition, the existence of the second principal-agent problem means that major shareholders hollow out and usurp the interests of minority shareholders, which affects the

Table 1. Descriptive statistics of LP by industry.

Industry name	Industry code	Frequency	Percent	Industry name	Industry code	Frequency	Percent
Agriculture/Forestry/Farming/Fishery	A	20	0.7	Information transmission/Software/Information technology service	I	303	10.64
Mining	B	24	0.84	Finance	J	13	0.46
Food manufacturing	C1	124	4.36	Real estate	K	40	1.4
Pharmaceutical manufacturing	C2	561	19.7	Lease/Business service	L	72	2.53
Computer/Telecommunications/Electronic equipment manufacturing	C3	1254	44.05	Scientific research/Technical service	M	75	2.63
Instrumentation	C4	63	2.21	Water conservancy/Environment/Public facilities management	N	39	1.37
Electricity/Heat/Gas/Water production and supply	D	18	0.63	Resident service/Repair/Other services	O	5	0.18
Building	E	39	1.37	Education	P	10	0.35
Wholesale/Retail	F	76	2.67	Hygiene/Social work	Q	13	0.46
Transportation/Storage/Logistics	G	51	1.79	Culture/Gymnastics/Entertainment	R	34	1.19
Accommodation and Catering	H	5	0.18	Synthesis	S	8	0.28

performance and value of listed companies and leads to the emergence of bad news of listed companies (Hao & Liang, 2009). The generation and hoarding of bad news leads to great information asymmetry inside and outside listed companies, which increases the hoarding of bad news and thus increases the risk of stock price crash of listed companies (X. H. Zhang et al., 2022). Based on principal-agent theory and bad news hoard theory, this paper analyzes the impact of LP agreement structure on stock price crash risk of listed companies.

**2.2.3.1. Theoretical analysis based on principal-agent.** According to the agency theory of stock price crash risk, the first layer of agency problem between management and shareholders and the second layer of agency problem between large shareholders and small and medium shareholders are important factors affecting the risk of stock price crash. From the perspective of LP agreement structure to reduce the agency cost between large shareholders and small and medium shareholders, first of all, from the perspective of the actual controller under the LP agreement structure as the general partner of the limited partnership enterprise, although the LP agreement structure helps the actual controller to obtain more control with less resources, the actual controller generally plays the role of the general partner, and bears unlimited joint and several liability for the decision-making of the listed company. The constraints of the external legal environment will increase the cost of the actual controller's private behaviour, which will form a strong constraint on the actual controller's behavior. Therefore, under the deterrent of the general partner's unlimited (joint and several) responsibility, the actual controller may be more careful to 'play' the role of the actual controller, and will fully consider the legal risks that need to be borne by the behaviour of hollowing out listed companies under the LP agreement structure, and even reduce the behaviour of hollowing out listed companies (Zheng et al., 2022), thereby reducing the possibility of actual controllers infringing on the rights and interests of minority shareholders. Secondly, LP agreement structure can strengthen the supervision effect of minority shareholders, reduce the tunnelling behaviour of actual controllers, and alleviate the agency problem between major shareholders and minority shareholders. After the actual controller of the listed company sets up the LP agreement structure, the cash flow right represented by the actual controller's investment amount is further separated from the sum of the voting rights obtained through direct shareholding and LP agreement structure, which makes the actual controller face the situation that the private income obtained by tunnelling is greater than the shared income obtained based on the improvement of corporate performance (Wu, 2019). The minority shareholders of listed companies will be aware of this possibility after the actual controller has set up the LP agreement structure, thus reducing the 'free rider' behaviour, increasing the supervision of the actual controller, fully evaluating the company's transactions, and reducing the possibility of the actual controller hollowing out the listed company through related party transactions. Third, in the LP agreement structure, employees, executives or external investors of listed companies as limited partners hand over their own assets to the general partners of the actual controllers to operate and share the residual income of listed companies. For executives and employees who are limited partners, their interests in listed companies come not only from the monetary compensation given by listed companies, the income generated by employee shareholding platforms, but also from the income distributed by limited partnerships. This

more multiple return often depends on the operation and governance results of listed companies, so it will stimulate the enthusiasm of executives and employees, and increase the enthusiasm of employees to supervise major shareholders, thus alleviating the agency cost between major shareholders and small and medium-sized shareholders, and even improve the efficiency of internal governance, thereby reducing the risk of stock price crash.

Secondly, the LP agreement structure can effectively alleviate the agency cost between shareholders and management, thus reducing the risk of stock price crash. From the perspective of the LP agreement structure, the actual controller can obtain greater control with less investment through the structure. Although it is constrained by the unlimited (joint) responsibility of the general partner, there is still a greater suspicion of hollowing out the listed company. Therefore, small and medium-sized investors will not only strengthen the supervision of the behaviour of major shareholders, but also actively supervise the behaviour of management. They may strengthen supervision through small and medium-sized investors field research or hiring high-quality auditors (Wei & Chen, 2023), inhibit the opportunistic behaviour of management, improve the accounting information of listed companies, and effectively reduce the risk of stock price crash. On the other hand, from the logical analysis of the impact of LP agreement structure on corporate governance, it can be found that executives and employees may serve as limited partners in limited partnerships. For listed executives, the earnings from listed companies and limited partnerships can exceed the earnings from opportunistic behaviours such as on-the-job consumption, which can reduce the agency cost between management and shareholders, thereby reducing the risk of stock price crash. For the employees of listed companies who serve as limited partnerships, they have multiple identities. One is the employees of listed companies, followed by the limited partners of limited partnerships, that is, the shareholders of listed companies. Employees' appointment as partners in limited partnerships gives employees the right to share benefits and enhances the willingness of employees to supervise management (Conyon & Freeman, 2006). Employee shareholders have the ability to identify management's self-interest behaviour based on the company's real situation and reduce the agency cost between shareholders and management (Zhai et al., 2022). At the same time, employees as limited partners allow employees and others to enjoy the residual claim of the enterprise, effectively realising the coordination of the interests of employees and management with the owner, can enhance the sense of belonging and responsibility of employees and management to the company, so that employees and management can consciously and actively safeguard the interests of the company, reduce the friction and self-interest behaviour with shareholders, and ultimately improve the efficiency of enterprise agency (Jiang et al., 2009; Li & Zhang, 2014; Luo & Shen, 2013; Murphy, 1986). In addition, employees serving as limited partners of limited partnerships are often knowledge-based and technical core employees, who generally have high knowledge and accomplishment, and are more likely to form an atmosphere of mutual supervision and common progress among them. Moreover, these employees who are familiar with the internal operation and internal management of listed companies are more aware of the specific behaviours of management, so there is more opportunity for them to

supervise the behaviour of management, thus reducing the supervision cost within the company (Yang & Song, 2016). Therefore, employees, as shareholders of listed companies, will be more willing to use the limited partnership as a controlling shareholder platform to supervise the management of listed companies and inhibit the behaviour of inconsistent interests between management and shareholders, thereby reducing the agency cost between management and shareholders. In such an atmosphere, management will also restrain their own behaviour, reduce self-interested behaviour, and reduce agency costs (Zhou et al., 2019). This reduction in agency costs between shareholders and management can effectively reduce the risk of stock price crash (Kothari et al., 2009).

Finally, the LP structure is often accompanied by an employee stock ownership plan, which supports employees and executives to enjoy the company's residual income rights as well as shareholders. Through the employee stock ownership plan, a principal-agent relationship between employees (small and medium shareholders) and actual controllers (controlling shareholders) is formed. The employee stock ownership plan grants the company's shares to employees, and establishes an employee stock ownership platform to ensure the rights and interests of employees. The LP-structured employee stock ownership platform, in which the actual controller serves as the general partner and the employee serves as the limited partner, enables employees to share the benefits of listed companies as limited partners with only a small part of the risks, and better binds the interests of employees to the value of listed companies. The correlation between employees and the interests of the enterprise greatly increases the enthusiasm of employees to work, and employees can consciously improve their behaviour, invest their energy in professional knowledge related to the long-term development of the enterprise, and show stronger ability in solving problems (Hales et al., 2015). At the same time, under the employee stock ownership platform of LP agreement structure, the motivated employees will be more sensitive to the stock price fluctuation of listed companies, and their earnings will also be seriously affected by the stock price crash. Therefore, they will have the motivation, ability and opportunity to supervise the behaviour of the actual controller and reduce the impact of the behaviour of the actual controller's related party transactions on the stock price. In addition, in the increasingly competitive Internet era, the importance of intellectual capital is increasing, and employees with management skills and core technology have become important resources required for enterprise development. Only by effectively attracting intellectual capital can enterprises gain competitive advantages in the future development. Under the LP agreement structure, on the one hand, the actual controller can strengthen its control position through the employee stock ownership platform, and the enthusiasm for implementing equity incentives is also higher, such as Danghong Technology (688039), Kaizhong Precision (002823) and Torch Logistics (001202). On the other hand, it can integrate multiple employees with core technology into the employee stock ownership platform, motivate more employees, maintain the stability of core employees, reduce the risk of corporate governance affected by the departure of core employees from the company, improve the willingness and opportunity of employees to participate in the company's decision-making, improve the company's performance (Larcker et al., 2010), reduce the company's operating risk, reduce the generation of bad news within the enterprise from the root, thereby reducing the risk of stock price crash.

**2.2.3.2. Analysis based on bad news cellaring theory.** An important formation mechanism of stock price crash risk is information asymmetry, and the main reason for information asymmetry of listed companies is the hoarding of internal bad news. First of all, the actual controller of the general partner under the LP agreement structure needs to bear the constraint of unlimited (joint) responsibility, which will reduce the probability of bad news hoarding behaviour of listed companies. From the previous analysis, it can be found that the actual controller of the listed company as the general partner of the limited partnership needs to bear unlimited (joint and several) responsibilities. Then, under the deterrent of legal responsibility, the actual controller will fully disclose the information of the listed company to reduce the possibility of assuming unlimited (joint and several) responsibilities. That is to say, the unlimited (joint and several) responsibility of the actual controller will encourage listed companies to fully disclose bad news, reduce the probability of bad news hoarding, and thus inhibit the occurrence of stock price crash. Secondly, out of doubt about the agency problems that may arise under the LP agreement structure, the minority shareholders of listed companies will strengthen the supervision of the actual controllers of listed companies, reduce the 'free rider' behaviour, and promote listed companies to improve the quality and quantity of information disclosed to the outside world, thereby alleviating the degree of internal and external information asymmetry, and at the same time inhibiting the management's behavior of obtaining private benefits by hiding bad news. Third, the LP agreement structure makes the management become the limited partner of the limited partnership, so that the management is the sharer of the residual interests of the enterprise, and its interests will be affected by the profitability of the listed company and the fluctuation of the stock price. Therefore, the management can strengthen its own constraints, reduce private interests and short-term behaviors such as earnings management, reduce the concealment of bad news, and ultimately improve the transparency of corporate information (Chaplinsky & Niehaus, 1994). Fourth, employees serving as limited partners of limited partnerships under the LP framework have dual identities of employees and shareholders, and the interests of employees are more closely related to the interests of listed companies (John & Wayne, 2001), so that the personal interests of employees are highly tied to the stock price and business performance of listed companies. As employees, employees fully understand the real situation of the internal business of listed companies; As shareholders, employees should supervise the decision-making of management and safeguard their own interests. Therefore, employees and shareholders have sufficient motivation and certain ability to actively participate in the corporate governance process, thus playing a supervisory role, improving the quality of information disclosure, and having a negative impact on the risk of stock price crash (Francesco et al., 2015). In addition, employees acting as limited partners in limited partnerships is based on the principle of voluntary participation, which to some extent reflects employees recognition of the company's value and future development prospects, which can convey a positive signal to the market, alleviate the degree of information asymmetry, improve the internal information environment of enterprises, and reduce the information asymmetry between employees and shareholders. At the same time, compared with other shareholders, employees who serve as limited partners of limited partnerships have more supervisory advantages and can closely perceive the difference between the specific situation of the company and the information disclosed by the company. The dual benefit characteristics

of the compensation benefits of listed companies and the limited partnership earnings of limited partnerships strengthen the interest binding between employees and listed companies. It will strengthen the supervision of information disclosure of listed companies, promote the internal information environment of enterprises to be more transparent, reduce the degree of information asymmetry inside and outside enterprises, and thus restrain the behaviour of listed companies to hoard bad information and reduce the risk of stock price crash.

In summary, based on the principal-agent theory and the theory of bad news hoarding under information asymmetry, on the one hand, the actual controller under the LP agreement structure should bear unlimited (joint) responsibility for the relevant decision-making, so as to play the deterrent effect of unlimited (joint) responsibility, and strengthen the supervision effect of small and medium-sized shareholders, thereby inhibiting the behaviour of large shareholders such as tunnelling and reducing agency costs, and ultimately reducing the risk of stock price crash. On the other hand, the LP agreement structure enables employees to serve as limited partners in limited partnerships, and highly binds the interests of employees with the interests of the company, which can inhibit the opportunistic behaviour of management and improve the transparency of corporate information. At the same time, the employee stock ownership platform (limited partnership) under the LP agreement structure can also be used to effectively motivate employees, help listed companies retain talents, enable employees to fully participate in corporate governance, and improve the scientific nature of corporate decision-making, thereby reducing the company's stock price crash risk. Based on the above analysis, we propose the following hypothesis:

**H1:** Under the condition that other conditions remain unchanged, listed companies with LP agreement structure have lower risk of stock price crash in the future than listed companies without LP agreement structure.

### 3. Research design

#### 3.1. Sample selection and data source

Although LP agreement framework has appeared in listed companies in China since 2012, it is extremely rare in number, and it was not until 2014 that more LP agreement framework appeared in listed companies in China. Therefore, this study selects A-share listed companies in Shanghai and Shenzhen from 2014 to 2021 as the initial sample. According to the research needs, samples were screened according to the following criteria: 1) Excluding firms with annual trading weeks less than 30 weeks (for the purpose of calculating the SPCR index); 2) Excluding the observed value of financial and insurance enterprises; 3) Remove ST and delisted observations; 4) Eliminate observations with missing data. Eventually 16,926 valid samples were obtained. The data identification related to the LP agreement framework is manually sorted out by the equity structure chart disclosed in the annual report of the listed company. Other financial data of the listed company are derived from the CSMAR database, the Reith database and the Wind database. To reduce

the influence of outliers, all the continuous variables are winsorised at the 1% and 99% levels.

### 3.2. Primary variable definition

#### 3.2.1. Dependent variable: stock price crash risk

The dependent variables of this study is stock price crash risk, which is represented by  $NCSKEW_{i,t}$  and  $DUVOL_{i,t}$ .  $NCSKEW_{i,t+1}$  is the negative conditional return skewness coefficient in period  $t + 1$ ,  $DUVOL_{i,t+1}$  is the down-to-up volatility in period  $t + 1$ . Following the lead of previous studies (Chen et al., 2001; Kim et al., 2011a, 2011b), we calculate stock price crash risk mainly use the company’s stock weekly yield, the market return rate weighted by the market value of the circulation and the number of trading weeks of the company for one year. The specific methods are as follows:

We estimate the residuals from the market model to evaluate the firm-specific weekly stock returns for year  $t$ , and in order to reduce the possible errors caused by asynchronous trading as much as possible, the lead term and lag term of market return are added in the model by referring to Dimson (1979). The specific regression model is as follows:

$$r_{i,t,m} = \alpha + \beta_1 r_{b,t,m-2} + \beta_2 r_{b,t,m-1} + \beta_3 r_{b,t,m} + \beta_4 r_{b,t,m+1} + \beta_5 r_{b,t,m+2} + \epsilon_{i,t,m} \quad (1)$$

Where  $r_{i,t,m}$  denotes the return of firm  $i$  in week  $m$  of year  $t$ ,  $r_{b,t,m}$  denotes value-weighted market return rate in week  $m$ ,  $\epsilon_{i,t,m}$  represents the residuals. Using residual return ( $\epsilon_{i,t,m}$ ) derived from Eq (3-1), we then compute the firm-specific weekly return for firm  $i$  in Week  $m$ :  $w_{i,t} = \ln(1 + \epsilon_{i,t})$ :

$$w_{i,t,m} = \ln(1 + \epsilon_{i,t,m}) \quad (2)$$

We then construct the negative conditional return skewness ( $NCSKEW$ ) to measure a firm’s SPCR. The higher the  $NCSKEW$ , the greater the degree of negative skewness of the stock yield of the listed company’s stock, which indicates a higher SPCR. The specific model is as follows:

$$NCSKEW_{i,t} = - \left[ \frac{n(n-1)^{3/2} \sum w_{i,t,m}^3}{(n-1)(n-2)(\sum w_{i,t,m}^2)^{3/2}} \right] \quad (3)$$

Where  $n$  indicates the number of trading weeks of firm  $i$  during year  $t$ .

We then construct the down-to-up volatility ( $DUVOL$ ) to measure a firm’s SPCR. The specific model is as follows:

$$DUVOL_{i,t} = \log \left[ \frac{(n_u - 1) \sum_{down} w_{i,t,m}^2}{(n_d - 1) \sum_{up} w_{i,t,m}^2} \right] \quad (4)$$

Where  $n_u$  refers to the number of weeks in which the weekly peculiar return of listed company  $i$  in the year  $t$  is higher than the average weekly peculiar return, and  $n_d$  refers to the number of weeks in which the weekly peculiar return of listed company  $i$  in the year  $t$  is lower than the average weekly peculiar return.  $DUVOL_{i,t}$  represents the ratio between the standard deviation of the return of the stock in the rising stage and the falling stage. The down-to-up volatility is expressed as the degree of leftward deviation of the return rate of the listed company’s stock, a higher value of  $DUVOL$  indicates a higher SPCR.

### 3.2.2. Independent variable: whether the listed company has LP agreement framework

For reference to the practice of Zheng et al. (2022), the identification of LP agreement structure is based on the equity structure chart disclosed in the annual report of a listed company. It indicates that the listed company has an LP structure when a limited partnership company appears in the actual controller chain,  $LP$  equals to 1, otherwise 0.

### 3.2.3. Control variables

Refer to the existing literature (Dou et al., 2022; Hutton et al., 2008; Wang et al., 2015; Xu et al., 2013; Yang et al., 2020b). We also controls the following other variables that may have an impact on the risk of stock price crash: firm size by taking the natural logarithm ( $Size$ ), return on net assets ( $Roe$ ), the debt-to-assets ratio ( $Lev$ ), book-to-market ratio ( $BM$ ), the average of a given weekly return ( $Ret$ ), standard deviation of a stock's weekly specific return ( $Sigma$ ), earnings management ( $AbsAcc$ ), monthly excess turnover rate ( $Dturn$ ), Big4 audits ( $Big4$ ), institutional shareholding ( $InHold$ ), executive ownership ratio ( $Hold$ ), agency cost ( $Ac$ ), equity balance degree ( $Balance$ ). Besides, we also include indicators for each industry and year ( $y_t$  &  $u_i$ ). The main variable definitions in this study are shown in Table 2.

### 3.3. Empirical model

We estimate model (3–5) to test Hypothesis, where  $CRASH_{i,t+1}$  is the stock price crash risk index ( $NCSKEW_{i,t+1}$  and  $DUVOL_{i,t+1}$ ),  $LP_{i,t}$  is the index of whether the listed company has a limited partnership framework,  $Controls_{i,t}$  is the control variable of company  $i$  in period  $t$ , including the one-period lag  $CRASH_{i,t}$ . We also include indicators for each industry and year ( $y_t$  &  $u_i$ ). And all standard errors in this study are clustered by the company. According to the previous analysis, if hypothesis H1 is assumed to hold, the coefficient  $\beta_1$  in the formula (3–5) should be significantly negative.

$$CRASH_{i,t+1} = \beta_0 + \beta_1 LP_{i,t} + \beta_2 Controls_{i,t} + y_t + u_i + \varepsilon_{i,t} \quad (5)$$

## 4. Empirical results

### 4.1. Descriptive statistics

Table 3 shows the descriptive statistical results of various variables. As can be seen from Table 3, the mean and standard deviation of  $NCSKEW$  of explained variables are  $-0.288$  and  $0.728$ . The mean and standard deviation of  $DUVOL$  is  $-0.189$  and  $0.479$ . From the perspective of the mean value of the two variables, it is basically consistent with the existing literature findings (Wang et al., 2015; N. H. Xu et al., 2013); From the perspective of standard deviation, the  $NCSKEW$  and the  $DUVOL$  are not concentrated among the sample companies, that is, the difference of stock price crash risk among the sample companies is significant. The mean of the independent variable is  $0.066$ , which indicates that fewer companies have set up LP agreement structure. In terms of control variables, the maximum value of  $BM$  is  $0.774$  and the minimum value is  $0.048$ , indicating that there is a large difference in the growth of sample enterprises. The average  $Roe$  is  $0.054$ , indicating that the average profitability of the sample firms is at a low level; The maximum value of  $Lev$  is



**Table 2.** Descriptive Statistics of LP Framework by Industry.

Industry Name	Industry Code	Frequency	Percentage	Industry Name	Industry Code	Frequency	Percentage
Agriculture, Forestry, Fishing, and Hunting	A	20	0.7%	Information Transmission, Software, and IT Services	I	303	10.64%
Mining	B	24	0.84%	Finance	J	13	0.46%
Food Manufacturing, etc.	C1	124	4.36%	Real Estate	K	40	1.4%
Pharmaceutical Manufacturing	C2	561	19.7%	Leasing and Business Services	L	72	2.53%
Computer, Communication, and Electronic Equipment Manufacturing	C3	1254	44.05%	Scientific Research and Technical Services	M	75	2.63%
Instrument Manufacturing	C4	63	2.21%	Water, Environment, and Public Facilities Management	N	39	1.37%
Utilities (Electricity, Gas, Water)	D	18	0.63%	Residential and Repair Services	O	5	0.18%
Construction	E	39	1.37%	Education	P	10	0.35%
Wholesale and Retail Trade	F	76	2.67%	Healthcare and Social Work	Q	13	0.46%
Transportation, Warehousing, and Postal Services	G	51	1.79%	Culture, Sports, and Entertainment	R	34	1.19%
Hospitality and Catering	H	5	0.18%	Conglomerates	S	8	0.28%

**Table 3.** Descriptive statistics.

Variables	N	Mean	Median	Sd	Minimum	Maximum
$NCSKEW_{i,t+1}$	16926	-0.2876	-0.2515	0.7283	-2.4505	1.7876
$DUVOL_{i,t+1}$	16926	-0.1890	-0.1901	0.4786	-1.3630	1.0552
$Iscrash_{i,t+1}$	16926	0.0202	0.0196	0.0158	0	0.0600
LP	16926	0.0665	0	0.2491	0	1
Ret	16926	-0.0014	-0.0011	0.0012	-0.0066	-0.0001
Sigma	16926	0.0500	0.0464	0.0201	0.0170	0.1157
BM	16926	0.3318	0.3142	0.1537	0.0484	0.7738
Roe	16926	0.0537	0.0668	0.1382	-0.7922	0.3096
Lev	16926	0.4240	0.4150	0.1991	0.0649	0.8833
Dturn	16926	-0.1027	-0.0207	0.5102	-2.1508	1.1070
Size	16926	22.3120	22.1421	1.2747	19.9978	26.2477
AbsAcc	16926	0.0624	0.0437	0.0629	0.0008	0.3483
InHold	16926	0.4153	0.4287	0.2511	0.0010	0.9669
Big4	16926	0.0567	0	0.2313	0	1
Hold	16926	0.0724	0.0020	0.1366	0	0.5993
Balance	16926	0.9510	0.7434	0.7837	0.0548	3.9755
Ac	16926	0.0882	0.0708	0.0685	0.0088	0.4124

0.883, indicating that some enterprises in the sample have greater financial risks; The maximum value of *Dturn* is 1.107 and the minimum value is -2.151, indicating that the stock liquidity of different enterprises is quite different; The average value of *Size* is 22.312, indicating that the companies in the sample have a large scale as a whole; The mean value of *AbAcc* is 0.062 and the standard deviation is 0.063, indicating that there is no obvious difference in earnings management degree among the sample enterprises; The mean value of *InHold* of institutional investors is 0.415, the maximum value is 0.967, and the minimum value is 0.001, the difference is large, indicating that the preference of institutional investors is widely differentiated; The standard deviation of *Balance* is 0.784, indicating that there is a large difference in the degree of equity balance among different companies; The median *Ac* is 0.071, indicating that most enterprises have low agency costs.

#### 4.2. Correlation analysis

Table 4 shows the Pearson correlation of variables. It can be seen from the results that the correlation coefficient of *NCSKEW* and *DUVOL* is 0.877, and there is a significant positive correlation between them at the level of 1%, indicating strong synchronisation between the two indicators. *LP* and stock price crash risk variables ( $NCSKEW_{i,t+1}$ ,  $DUVOL_{i,t+1}$ ,  $Iscrash_{i,t+1}$ ) are significantly negatively correlated at the level of 5%, indicating that compared with listed companies without *LP* agreement structure, listed companies with *LP* agreement structure have lower

**Table 4.** Pearson correlation.

Variables	$NCSKEW_{i,t+1}$	$DUVOL_{i,t+1}$	$Iscrash_{i,t+1}$	LP
$NCSKEW_{i,t+1}$	1			
$DUVOL_{i,t+1}$	0.877***	1		
$Iscrash_{i,t+1}$	0.549***	0.556***	1	
LP	-0.003**	-0.002**	-0.017**	1

\*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

risk of stock price crash in the future. It provides the preliminary empirical evidence for LP agreement structure to alleviate the stock price crash risk of listed companies. In addition, in order to avoid the influence of multicollinearity on the regression results, we calculate the VIF value of each variable. The results show that the mean value of VIF is less than 2, and the maximum value is 2.37, which is far less than 10, suggesting that there is no serious multicollinearity problem in the model.

### 4.3. Empirical results

Table 5 shows the regression results of the benchmark model, which are significant on the whole. According to the result, compared with enterprises without LP agreement

**Table 5.** LP and stock price crash risk.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
LP	-0.1572*** (-2.88)	-0.0946*** (-2.69)
Ret	-7.6212 (-1.04)	-7.4244 (-1.55)
Sigma	-0.7837 (-0.54)	-1.3299 (-1.40)
BM	-0.9948*** (-11.23)	-0.6684*** (-11.43)
Roe	-0.1060* (-1.82)	-0.0793** (-2.10)
Lev	-0.8998*** (-9.42)	-0.5499*** (-8.67)
Dturn	-0.0336** (-2.18)	-0.0248** (-2.46)
Size	0.1092*** (4.65)	0.0527*** (3.22)
AbsAcc	0.1695 (1.56)	0.1084 (1.52)
InHold	0.2325*** (2.91)	0.1462*** (2.65)
Big4	0.0153 (0.22)	0.0162 (0.34)
Hold	0.1778 (1.50)	0.1433* (1.86)
Balance	0.0306 (1.45)	0.0326** (2.25)
Ac	0.3465* (1.93)	0.2390** (1.98)
NCSKEW	-0.1515*** (-18.19)	
DUVOL		-0.1480*** (-17.74)
_cons	-2.0558*** (-4.16)	-0.9414*** (-2.72)
Year	Yes	Yes
Firm	Yes	Yes
N	16926	16926
R2_adj	0.0800	0.0880
F	59.0535	64.1589

The  $t$  value is in parentheses. All standard errors in this study are clustered by the company. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

structure, the future stock price crash risk of enterprises with LP agreement structure is significantly lower at the level of 1%, indicating that the establishment of LP agreement structure can restrict the hollowing behaviour of actual controllers, exert the supervision effect of minority shareholders and the incentive effect of employee incentives, reduce the hoarding behaviour of bad news and ultimately reduce the risk of future stock price crash. The findings support Hypothesis 1. From the perspective of economic significance, the standard deviation of *LP* is 0.249, the mean values of  $NCSKEW_{t+1}$  and  $DUVOL_{t+1}$  were  $-0.288$  and  $-0.189$ , respectively, and the regression coefficients of independent and dependent variables were  $-0.1577$  and  $-0.0955$ , respectively; the economic significance of LP agreement structure for  $NCSKEW_{t+1}$  and  $DUVOL_{t+1}$  is 13.6% and 12.6% respectively, which is higher than the economic significance margin of 5%. Therefore, it can be found that the impact of LP agreement structure on the stock price crash risk of listed companies is economically significant.

In terms of the control variables, book-to-market ratio (*BM*) is negatively correlated with stock price crash risk, indicating that companies with promising future returns have lower stock price crash risk. Business performance (*RoE*) is negatively correlated with stock price crash risk, indicating that the better the profitability of the company, the lower the risk of stock price crash in the future. Asset-liability ratio (*Lev*) is negatively correlated with the risk of stock price crash, indicating that when the asset-liability ratio is high, the possibility of stock price crash is small. The possible reason is that enterprises with high debt ratio have good financing ability, which can ensure the good operation of the company and reduce the risk of stock price crash. The regression coefficient of company Size is significantly positive, indicating that the larger the company size, the greater the possibility of stock price crash risk. The agency cost (*Ac*) is positively correlated with the stock price crash risk, indicating that the more serious the agency problem, the greater the stock price crash risk. The regression coefficient of *lnHold* of institutional investors is significantly positive, indicating that the higher the proportion of institutional investors, the higher the risk of stock price crash in the future. Excess stock turnover rate (*Dturn*) is significantly negatively correlated with stock price crash risk, indicating that the higher the turnover rate of listed companies, the negative information will be timely released and reacted to in the current period, and the future stock price crash risk can also be reduced. Overall, the regression results are consistent with previous studies (Dou et al., 2022; Wang & Liu, 2020; Yang et al., 2020b), which confirmed the reliability of the study design in this study.

#### 4.4. Robustness test

##### 4.4.1. Using alternative measure of stock price crash risk

Refer to the existing literature (Piotroski et al., 2015), the frequency of a firm experiencing stock price crashes was used as a proxy variable for crash risk. Specifically,  $Ret_{i,t}$  is the average of a given weekly return on a stock, and  $\Sigma_{i,t}$  is the standard deviation of a stock's weekly specific return. The dummy variable in the week *m* of year *t* of listed company *i* is 1 if  $W_{i,t,m}$  meets the following formula:

$$W_{i,t,m} \leq Ret_{i,t} - 2\Sigma_{i,t} \quad (6)$$

$Iscrash_{i,t}$  refers to the proportion of the number of weeks that the listed company meets the above conditions in the total number of weeks that the company trades in the year. The greater the value of this indicator, the greater the frequency of stock price crash, which means the greater the risk of stock price crash. The results are shown in the first column of Table 6.  $LP$  and  $Iscrash_{t+1}$  are significantly negatively correlated at the level of 1%, which indicates that the establishment of LP framework in a company can restrict the hollowing behaviour of actual controllers, exert the supervision effect of minority shareholders and the incentive effect of employee incentives, reduce the hoarding behaviour of bad news, and thus reduce the risk of future stock price crash. The main results remain robust.

**Table 6.** Robustness test: using alternative measure of variables.

Variables	Dep. Var.: $Iscrash_{t+1}$ (1)	Dep. Var.: $NCSKEW_{t+1}$ (2)	Dep. Var.: $DUVOL_{t+1}$ (3)
LP	-0.0039*** (-3.54)		
LPS		-0.0598** (-2.13)	-0.0374** (-2.05)
Ret	-0.6966 (-1.46)	-7.4561 (-1.07)	-7.9216 (-1.59)
Sigma	-0.0559* (-1.80)	-0.8354 (-0.58)	-1.3602 (-1.43)
BM	-0.0130*** (-6.67)	-0.9928*** (-11.20)	-0.6672*** (-11.40)
Roe	-0.0035*** (-2.76)	-0.1053* (-1.81)	-0.0788** (-2.09)
Lev	-0.0088*** (-3.91)	-0.8987*** (-9.42)	-0.5493*** (-8.67)
Dturn	-0.0010*** (-3.03)	-0.0337** (-2.19)	-0.0249** (-2.47)
Size	0.0005 (0.95)	0.1102*** (4.69)	0.0533*** (3.26)
AbsAcc	0.0014 (0.57)	0.1681 (1.55)	0.1076 (1.51)
InHold	0.0066*** (3.57)	0.2293*** (2.87)	0.1445*** (2.62)
Big4	0.0017 (0.96)	0.0153 (0.22)	0.0162 (0.34)
Hold	0.0011 (0.40)	0.1758 (1.48)	0.1419* (1.84)
Balance	0.0008* (1.67)	0.0276 (1.30)	0.0309** (2.13)
Ac	0.0105*** (2.73)	0.3439* (1.91)	0.2375** (1.97)
Iscrash	-0.1533*** (-19.83)		
NCSKEW		-0.1515*** (-18.17)	
DUVOL			-0.1479*** (-17.71)
_cons	0.0175 (1.55)	-2.0750*** (-4.20)	-0.9539*** (-2.75)
Year	Yes	Yes	Yes
Firm	Yes	Yes	Yes
N	16926	16926	16926
R2_adj	0.0377	0.0797	0.0878
F	30.2430	59.0104	64.1504

#### 4.4.2. Using alternative measure of LP agreement structure

Based on the practice of Zheng et al. (2022), the number of limited partnerships (LPS) under the LP agreement framework of listed companies is adopted as the proxy variable of the LP. The results are shown in columns (2) and (3) of Table 6. LPS and dependent variables are significantly negatively correlated at the level of 5%, indicating that setting LP agreement framework can indeed reduce the risk of future stock price crash. The main results still hold.

#### 4.4.3. Change sample criteria

Considering that the LP agreement structure of some companies is formed at the time of IPO or before IPO, and the sample of companies with LP agreement structure in the year of listing or before may interfere with the results, we excluded this part of the company's sample before regression. The regression results are shown in Table 7. LP and dependent variables are significantly negatively correlated at the level of 1%, indicating that setting

**Table 7.** Robustness test: change sample criteria.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
LP	-0.1696*** (-3.01)	-0.1004*** (-2.77)
Ret	-7.4886 (-1.16)	-7.7258* (-1.70)
Sigma	-0.9073 (-0.62)	-1.4534 (-1.52)
BM	-1.0009*** (-11.15)	-0.6780*** (-11.45)
Roe	-0.1005* (-1.71)	-0.0783** (-2.06)
Lev	-0.8935*** (-9.25)	-0.5494*** (-8.56)
Dturn	-0.0359** (-2.25)	-0.0240** (-2.29)
Size	0.1116*** (4.70)	0.0533*** (3.23)
AbsAcc	0.1761 (1.61)	0.1077 (1.50)
InHold	0.2261*** (2.81)	0.1433*** (2.58)
Big4	0.0142 (0.21)	0.0158 (0.33)
Hold	0.1969* (1.67)	0.1656** (2.13)
Balance	0.0302 (1.42)	0.0326** (2.24)
Ac	0.3617** (2.00)	0.2492** (2.06)
NCSKEW	-0.1454*** (-17.26)	
DUVOL		-0.1431*** (-16.95)
_cons	-2.1128*** (-4.24)	-0.9535*** (-2.73)
Year	Yes	Yes
Firm	Yes	Yes
N	16436	16436
R2_adj	0.0800	0.0884
F	56.9426	62.4039

LP agreement structure can indeed reduce the risk of future stock price crash, and confirming the robustness of the main results.

#### 4.4.4. High-order fixed effects

Considering the different policy effects of different industries in different years and the influence of policy effects released by different provinces in different years on the stock price crash risk, we constructs the high-order fixed effects of year-industry and year-province to further control the influence of possible missing variables on the research results. The results are shown in Table 8, columns (1) and (2) are the regression results after controlling the interactive fixed effect of industry-year, show that independent variable and dependent variables are significantly negatively correlated at the level of 1% and 5%, respectively, which is consistent with the previous research results. Columns

**Table 8.** Robustness test: high-order fixed effects.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)	(3)	(4)
LP	-0.1478*** (-2.67)	-0.0879** (-2.46)	-0.1501*** (-2.74)	-0.0849** (-2.40)
Ret	-7.6145 (-0.12)	-7.0182 (-0.74)	-7.0699 (-1.085)	-7.5721* (-1.68)
Sigma	0.3638 (0.25)	-0.7214 (-0.74)	-0.9541 (-0.65)	-1.4738 (-1.53)
BM	-0.9856*** (-10.91)	-0.6587*** (-11.06)	-1.0120*** (-11.29)	-0.6785*** (-11.42)
Roe	-0.1222** (-2.06)	-0.0898** (-2.33)	-0.1064* (-1.80)	-0.0798** (-2.09)
Lev	-0.8869*** (-9.25)	-0.5290*** (-8.32)	-0.8897*** (-9.23)	-0.5401*** (-8.43)
Dturn	-0.0304** (-1.97)	-0.0225** (-2.21)	-0.0283* (-1.83)	-0.0217** (-2.13)
Size	0.1123*** (4.67)	0.0552*** (3.32)	0.1167*** (4.94)	0.0558*** (3.42)
AbsAcc	0.1646 (1.47)	0.0960 (1.31)	0.1471 (1.35)	0.0939 (1.31)
InHold	0.2215*** (2.74)	0.1357** (2.44)	0.2238*** (2.82)	0.1395** (2.55)
Big4	0.0136 (0.21)	0.0133 (0.29)	0.0015 (0.02)	0.0076 (0.16)
Hold	0.0833 (0.69)	0.0788 (1.01)	0.1805 (1.52)	0.1478* (1.92)
Balance	0.0232 (1.10)	0.0295** (2.02)	0.0351* (1.67)	0.0366** (2.54)
Ac	0.1611 (0.84)	0.1071 (0.83)	0.3728** (2.04)	0.2609** (2.15)
NCSKEW	-0.1558*** (-18.63)		-0.1516*** (-18.11)	
DUVOL		-0.1530*** (-18.36)		-0.1471*** (-17.50)
_cons	-2.3764*** (-4.31)	-1.2478*** (-2.97)	-2.2079*** (-4.38)	-1.0220*** (-2.93)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Year*Ind	Yes	Yes	No	No
Year*ProvNum	No	No	Yes	Yes
N	16926	16926	16926	16926
R2_adj	0.0925	0.1007	0.0844	0.0934
F	39.48	37.49	8.0119	8.8062

(3) and (4) are the regression results after controlling the interactive fixed effect of provincial-year, and the results show that *LP* and stock price crash risk are significantly negatively correlated at 1% and 5% levels, further verifying the conclusion that LP agreement structure can reduce stock price crash risk.

#### 4.4.5. Endogeneity

**4.4.5.1. PSM.** In order to further control the influence of possible missing variables on the research results, the propensity score matching method (PSM) was used in this study. We first constructs the Logit selection model according to whether the enterprise has LP agreement structure, and matches the samples of listed companies with limited partnership agreement structure with the closest matching characteristics for the listed companies without limited partnership agreement structure. Through the method of nearest neighbour matching, variables that significantly affect the formation of LP architecture (the control variables in this study) are selected as matching variables, and 1:1 non-return matching is conducted by year and industry. The matching variables selected in this study include return on net assets (*Roe*), the average of a given weekly return (*Ret*), the debt-to-assets ratio (*Lev*), firm size (*Size*), equity balance degree (*Balance*), book-to-market ratio (*BM*), monthly excess turnover rate (*Dturn*), standard deviation of a stock's weekly specific return (*Sigma*), agency cost (*Ac*), Big4 audits (*Big4*), institutional shareholding (*InHold*). The main basis for selecting control variables as matching covariables is that we believe listed companies with low stock return, small scale, high equity balance, low book-to-market ratio and low turnover rate are more likely to set up LP agreement structure. Listed companies with low stock return rate, high standard deviation of specific weekly stock return rate and low turnover rate are more inclined to implement employee stock ownership plans through the framework of limited partnership agreement, so as to convey positive signals to external investors to trade company stocks and reduce stock risks. At the same time, the improvement of equity balance will reduce the shareholding ratio of the largest shareholder and threaten the control status of the largest shareholder. Therefore, listed companies with high equity balance tend to use LP agreement structure to stabilise the control right. Besides, listed companies with high asset-liability ratio, small scale and low book-to-market ratio are also willing to use the LP agreement structure to attract more external investors to provide more financial support for the enterprise, while companies with high agency costs may be more willing to use the limited partners of the LP agreement structure to supervise the management and actual controllers of the company. The final results are shown in Table 9. It can be seen that the LP agreement structure is significantly negatively correlated with the stock price crash risk indicators at the level of 5%, indicating that after controlling the possible missing variables in this study, compared with the listed companies that do not set the LP agreement structure, the listed companies that set the LP agreement structure are more able to constrain the actual controller's tunnelling behaviour, and can give full play to the supervision effect of small and medium shareholders and the incentive effect of employee incentives, and further reduce the hoarding behaviour of bad news, thereby reducing the risk of stock price crash. The main conclusion still hold.

**4.4.5.2. Treatment effect.** There may be a self-selection problem in setting LP agreement structure in listed companies, that is, whether the company sets LP agreement

**Table 9.** Endogeneity: PSM.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	PSM matching effect test
	(1)	(2)	(3)
LP	-0.3644** (-2.28)	-0.2224** (-2.37)	
Ret	-6.6877*** (-2.89)	-7.0992** (-2.47)	0.0000 (0.40)
Sigma	16.8334*** (2.60)	8.9561** (2.15)	-0.0012 (-1.49)
BM	-1.3483*** (-4.34)	-0.7589*** (-3.57)	0.0014 (0.21)
Roe	-0.0541 (-0.34)	0.0141 (0.14)	-0.0032 (-0.47)
Lev	-0.7610** (-2.23)	-0.2012 (-0.93)	-0.0067 (-0.83)
Dturn	0.0352 (0.70)	-0.0009 (-0.03)	-0.0299 (-1.14)
Size	0.2149** (2.58)	0.1509*** (2.92)	-0.0498 (-1.10)
AbsAcc	0.2668 (0.67)	0.2115 (0.79)	-0.0032 (-1.10)
InHold	0.1348 (0.39)	0.2783 (1.22)	-0.0475*** (-4.48)
Big4	0.1738 (0.57)	-0.0336 (-0.17)	0.0057 (0.65)
Hold	0.1176 (0.26)	-0.0337 (-0.13)	-0.0099 (-1.55)
Balance	-0.0024 (-0.03)	-0.0331 (-0.61)	-0.0566 (-1.53)
Ac	0.1299 (0.27)	-0.0022 (-0.01)	0.0008 (0.25)
NCSKEW	-0.2853*** (-7.76)		
DUVOL		-0.2691*** (-8.78)	
_cons	-4.3730** (-2.46)	-3.1758*** (-2.92)	
Year	Yes	Yes	
Firm	Yes	Yes	
N	2110	2110	
R2_adj	0.1321	0.1356	
F	7.0134	7.6808	

structure is not random. Previously, PSM has been used to alleviate the impact of missing variables on the research conclusion. In order to alleviate the self-selection bias caused by unobservable factors, we adopt the processing effect model to conduct robustness test. At the same time, considering that the LP agreement structure of individual companies is formed at the time of IPO or before IPO, and theoretically, the performance of companies in the years after IPO will not affect the formation of LP agreement structure (Zheng et al., 2022), we excluded this part of the sample. Then conduct Probit regression on whether the listed company has set up limited partnership framework LP. All control variables of model (3–5) and  $SL(\ln(\text{the number of listed companies with LP agreement structure in the same industry in the same year} + 1))$  are added to the model as control variables. The regression results are shown in Table 10. It can be found that  $LAMBDA$  is significantly positively correlated with stock price crash risk at the level of 5%, indicating that there is indeed a self-selection problem. Besides, the coefficient of  $LP$  is significantly negative at the level of 1%, indicating that after

**Table 10.** Endogeneity: treatment effect.

Variables	Dep. Var.: <i>LP</i> (1)	Dep. Var.: <i>NCSKEW</i> <sub><i>t</i>+1</sub> (2)	Dep. Var.: <i>DUVOL</i> <sub><i>t</i>+1</sub> (3)
SL	0.6015*** (4.15)		
LP		-0.8882*** (-3.07)	-0.5562*** (-3.03)
Ret	5.5608*** (2.83)	-7.0811 (-0.72)	-7.7171 (-1.29)
Sigma	14.8802*** (3.26)	-0.4436 (-0.28)	-1.1596 (-1.15)
BM	-0.5106*** (-3.07)	-1.1163*** (-11.52)	-0.7446*** (-12.03)
Roe	-0.0530 (-0.40)	-0.1281** (-2.11)	-0.0893** (-2.28)
Lev	-0.1437 (-1.00)	-0.9983*** (-9.72)	-0.5985*** (-9.04)
Dturn	0.0849* (1.82)	-0.0296* (-1.72)	-0.0217** (-1.97)
Size	-0.0520** (-2.25)	0.1212*** (4.86)	0.0571*** (3.34)
AbsAcc	0.5981** (2.04)	0.2187* (1.87)	0.1396* (1.84)
InHold	0.5486*** (5.28)	0.2561*** (3.05)	0.1571*** (2.76)
Big4	-0.0245 (-0.26)	0.0104 (0.14)	0.0132 (0.27)
Hold	-0.8223*** (-4.02)	0.1697 (1.35)	0.1458* (1.80)
Balance	0.3024*** (13.88)	0.0534** (2.21)	0.0525*** (3.22)
Ac	0.9828*** (3.35)	0.3627* (1.86)	0.2765** (2.18)
LAMBDA		0.3378** (2.56)	0.2137** (2.58)
NCSKEW		-0.1510*** (-16.94)	
DUVOL			-0.1487*** (-17.01)
_cons	-2.5421*** (-4.54)	-2.2749*** (-4.35)	-1.0209*** (-2.81)
Ind	Yes	No	No
Year	Yes	Yes	Yes
Firm	No	Yes	Yes
N	16436	16436	16436
Pseudo R2/R2_adj	0.0957	0.0778	0.0886
LR chi/F	529.12	52.1886	59.4580

further controlling the endogenous problem of self-selection bias, compared with listed companies without LP agreement structure, listed companies with LP agreement structure are better able to restrain the hollowing behaviour of actual controllers, exert the supervision effect of minority shareholders and the incentive effect of employee incentives, and ultimately better alleviate the risk of stock price crash, confirming the robustness of the main results.

**4.4.5.3. Two-way cluster.** Since the data in this study are panel data, there may be sequence autocorrelation problems. Although we used company clustering to solve the problem of inter-group correlation at the company level, it still could not alleviate the problem of sequence autocorrelation. In order to alleviate the inter-group and intra-group

**Table 11.** Endogeneity: two-way cluster.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
LP	-0.1572*** (-3.14)	-0.0946*** (-2.86)
Ret	-7.6212 (-1.01)	-7.4244 (-1.53)
Sigma	-0.7837 (-0.54)	-1.3299 (-1.40)
BM	-0.9948*** (-11.66)	-0.6684*** (-11.84)
Roe	-0.1060* (-1.84)	-0.0793** (-2.08)
Lev	-0.8998*** (-9.74)	-0.5499*** (-9.02)
Dturn	-0.0336** (-2.25)	-0.0248** (-2.54)
Size	0.1092*** (4.94)	0.0527*** (3.51)
AbsAcc	0.1695 (1.56)	0.1084 (1.51)
InHold	0.2325*** (2.96)	0.1462*** (2.73)
Big4	0.0153 (0.23)	0.0162 (0.36)
Hold	0.1778 (1.57)	0.1433* (1.93)
Balance	0.0306 (1.47)	0.0326** (2.35)
Ac	0.3465** (2.00)	0.2390** (2.12)
NCSKEW	-0.1515*** (-16.18)	
DUVOL		-0.1480*** (-16.59)
_cons	-2.0558*** (-4.39)	-0.9414*** (-2.96)
Year	Yes	Yes
Firm	Yes	Yes
N	16926	16926
R2_adj	0.0933	0.0979
F	54.1681	61.8754

correlation problems at the same time, we adopts the Two-way cluster method for re-testing (company-year). The results are shown in Table 11, LP is significantly negatively correlated with *NCSKEW* and *DUVOL* at the level of 1%, indicating that after further controlling the possible autocorrelation problems in the sample time series, the listed companies with LP agreement structure are more able to restrain the actual controller's emptying behaviour than the listed companies without LP agreement structure, and the supervision effect of minority shareholders and incentive effect of employees can be brought into play, thus the risk of stock price crash can be alleviated. The main conclusion still hold.

**4.4.5.4. Difference-in-difference test.** We mainly study the impact of LP agreement structure on stock price crash risk of listed companies, and it is found that the setting of LP agreement structure can reduce the stock price crash risk, but the conclusion may also have the endogenous problem of reverse causation. In order

to alleviate the influence of endogenous problem caused by reverse causality, we use the method of difference-difference test. First, we manually screened companies that had an LP agreement structure in place since it was first set up during the sample period (the treatment group) and companies that had never set up an LP agreement structure during the sample period (the control group). Secondly, we construct variables *Treat* and *Post*. *Treat* equals to 1 at and after the company sets LP agreement structure, otherwise it is 0. *Post* equals to 1 at and after the first LP architecture is set, otherwise it is 0. At the same time, considering that the LP agreement structure of individual companies was formed at or before IPO, we excluded this part of the sample. The results in Table 12 show that the coefficients of *Treat\*Post* are all significantly negative, indicating that after companies start to set up LP agreement structure, the stock price crash risk of these companies decreases compared with companies that never set up LP agreement structure, confirming the robustness of the main results.

**Table 12.** Endogeneity: difference-in-difference test.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
<i>Ttreat*Post</i>	-0.2320*** (-3.44)	-0.1558*** (-3.58)
<i>Ret</i>	-7.5783 (-0.97)	-7.8437 (-1.63)
<i>Sigma</i>	-0.6911 (-0.47)	-1.4026 (-1.45)
<i>BM</i>	-1.0204*** (-11.27)	-0.6893*** (-11.56)
<i>Roe</i>	-0.0856 (-1.43)	-0.0708* (-1.82)
<i>Lev</i>	-0.9028*** (-9.11)	-0.5545*** (-8.44)
<i>Dturn</i>	-0.0360** (-2.22)	-0.0241** (-2.28)
<i>Size</i>	0.1093*** (4.48)	0.0535*** (3.15)
<i>AbsAcc</i>	0.1788 (1.61)	0.1144 (1.58)
<i>InHold</i>	0.2152*** (2.63)	0.1309** (2.32)
<i>Big4</i>	-0.0067 (-0.10)	0.0039 (0.08)
<i>Hold</i>	0.1806 (1.52)	0.1643** (2.09)
<i>Balance</i>	0.0360* (1.68)	0.0375** (2.55)
<i>Ac</i>	0.4110** (2.22)	0.2903** (2.35)
<i>NCSKEW</i>	-0.1470*** (-17.32)	
<i>DUVOL</i>		-0.1445*** (-16.97)
<i>_cons</i>	-2.0634*** (-4.02)	-0.9570*** (-2.66)
<i>Year</i>	Yes	Yes
<i>Firm</i>	Yes	Yes
<i>N</i>	16173	16173
<i>R2_adj</i>	0.0806	0.0893
<i>F</i>	56.4546	61.7680

**4.4.5.5. Placebo test.** The conclusion that LP agreement structure can reduce the risk of stock price crash obtained may be the result of random production. Then, can we still get the same conclusion if we randomly assign all listed companies with the same number of samples as the companies with LP agreement structure? Refer to existing literature (Dou et al., 2022; Xu & Li, 2016), placebo test was conducted in this study to test the above conjecture. The specific steps are as follows: 1) Each company is randomly assigned LP agreement structure sample; 2) The randomly assigned LP proxy variable is regress with *NSCKEW* and *DUVOL* of corresponding companies; 3) Repeat steps 1 and 2 10,000 times. The regression results are shown in Figure 2, The coefficients of the baseline regression are  $-0.1577$  and  $-0.0955$ , respectively. And the  $t$  values of the main regression are  $-2.891$  and  $-2.720$ , respectively. These results are small probability event in randomised trials. The above results show that the virtual processing effect constructed in this study does not exist, indicating that the existence of LP agreement structure is indeed conducive to reducing the risk of company stock price crash, which verifies the robustness of the main conclusions of this study once again.

## 5. Further analysis

### 5.1. Mechanism test

#### 5.1.1. Mechanism test 1: restrain the hollowing out behaviour of major shareholders

According to the above, we find that the LP agreement structure of listed companies can restrain the hollowing behaviour of actual controllers and alleviate

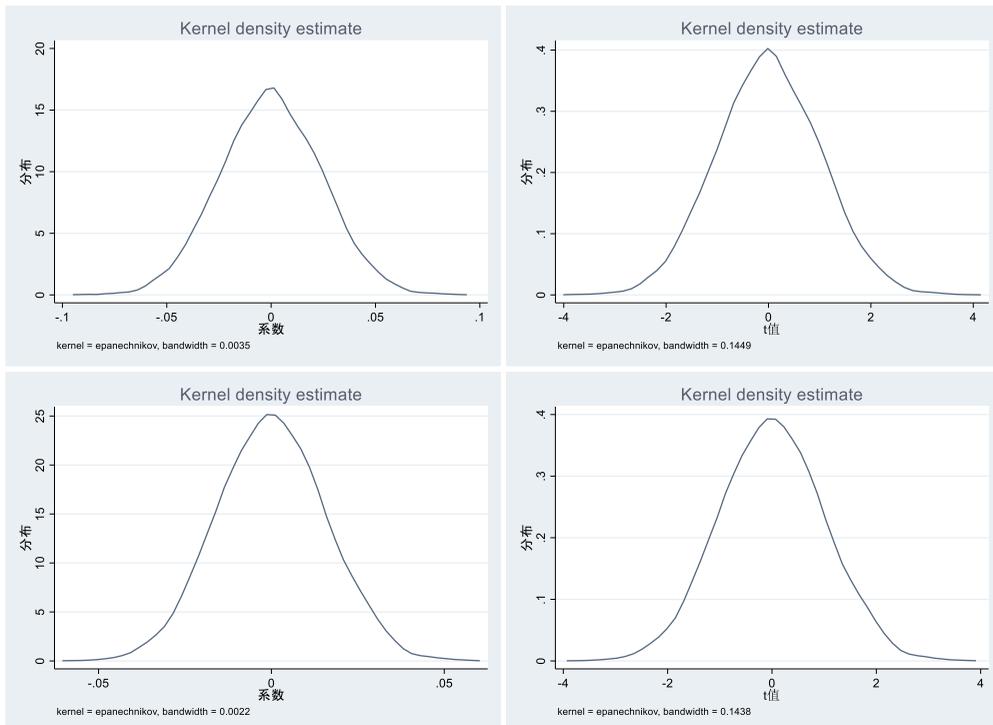


Figure 2. Regression results of the placebo test.

the second type of agency problem. In order to test whether the LP agreement structure can restrain the actual controller's evasive behaviour, we use the net occupied funds adjusted by the total assets of listed companies at the end of the year (other receivables minus other payables) to measure the evasive degree of the actual controller by referring to previous studies (Ye et al., 2007). Then, according to the median of the degree of hollowing out in the samples, the samples were divided into two sub-samples: the group with high degree of hollowing out and the group with low degree of hollowing out. As can be seen from Table 13, the coefficient of LP is significantly negative in the subsamples with high degree of hollowing out, while the coefficient is not significant in the subsamples with low degree of hollowing out. The results show that LP agreement structure can effectively restrain the actual controller of listed companies, exert supervision effect, reduce the actual controller's encroachment on the resources of listed companies, and thus reduce the risk of stock price crash.

**Table 13.** Mechanism test 1: Restrain the hollowing out behaviour of major shareholders.

Variables	High	Low	High	Low
	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)	(3)	(4)
LP	-0.2058*** (-2.64)	-0.1076 (-1.22)	-0.1295** (-2.37)	-0.0681 (-1.19)
Ret	-7.1324 (-0.92)	-7.1102 (-1.20)	-7.2342 (-1.56)	-7.8950 (-1.46)
Sigma	-0.9029 (-0.40)	-2.5105 (-1.16)	-2.1482 (-1.45)	-2.1456 (-1.51)
BM	-1.1649*** (-8.84)	-0.9047*** (-6.19)	-0.7776*** (-8.62)	-0.5828*** (-6.36)
Roe	-0.0349 (-0.36)	-0.0931 (-1.20)	-0.0250 (-0.40)	-0.0696 (-1.33)
Lev	-0.9401*** (-6.32)	-0.8225*** (-5.29)	-0.6134*** (-5.94)	-0.4524*** (-4.50)
Dturn	-0.0379* (-1.67)	-0.0277 (-1.09)	-0.0169 (-1.14)	-0.0288* (-1.75)
Size	0.1329*** (3.47)	0.0967*** (2.75)	0.0850*** (3.12)	0.0432* (1.79)
AbsAcc	0.1692 (0.98)	0.3120** (2.02)	0.1764 (1.59)	0.1573 (1.53)
InHold	0.3410*** (2.68)	0.1499 (1.18)	0.2092** (2.31)	0.1433* (1.68)
Big4	-0.0322 (-0.32)	0.0253 (0.27)	-0.0698 (-1.00)	0.0671 (1.03)
Hold	0.0374 (0.22)	0.3667* (1.91)	0.0546 (0.49)	0.2408** (2.03)
Balance	0.0474 (1.42)	0.0330 (0.99)	0.0477** (2.16)	0.0242 (1.02)
Ac	0.7099** (2.50)	0.1366 (0.51)	0.4685** (2.53)	0.0408 (0.22)
NCSKEW	-0.1649*** (-12.98)	-0.1717*** (-13.00)		
DUVOL			-0.1523*** (-11.95)	-0.1825*** (-14.39)
_cons	-2.5534*** (-3.14)	-1.8136** (-2.47)	-1.5840*** (-2.73)	-0.8094 (-1.60)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
N	8463	8463	8463	8463
R2_adj	0.0919	0.0816	0.1022	0.0933
F	30.2152	26.4593	32.2464	30.8156
Coefficient difference test		$p=0.065^*$		$p=0.063^*$

### 5.1.2. Mechanism test 2: improve the transparency of corporate accounting information

According to the theory of information asymmetry, the bad news of listed companies is hidden, which is the cause of stock price crash. The management conceals bad news through earnings management for personal gain, which leads to the deterioration of the quality of information disclosed by listed companies. Investors cannot fully understand the company's situation, and may make wrong judgements about the company. Most existing studies on earnings management use the modified Jones model to estimate discretionary accruals. It is more likely to manipulate earnings if a company's discretionary accruals fluctuate greatly and its absolute value is high, and the information is more opaque (Wang et al., 2009). Referring to the research of Li and Kong (2013), the revised DD model is used to measure the earnings management level of enterprises, and the absolute residual value calculated by this method is used to measure the transparency of enterprise information. The greater the index, the lower the transparency of enterprise information. In this study, according to the median of information transparency in the samples, the samples are divided into two sub-samples: the group with higher information transparency and the group with lower information transparency, and the regression is carried out respectively. As can be seen from Table 14, the coefficient of *LP* is significantly negative in the sub-samples with low information transparency, while the coefficient is not significant in the sub-samples with high information transparency. The results show that LP agreement structure can reduce the earnings management behaviour of management, reduce the bad news concealment, improve the transparency of corporate information, and reduce the risk of stock price crash.

### 5.1.3. Mechanism test 3: supervision effect of minority shareholders

After the actual controller stabilises the control through the LP agreement structure, its motivation to hollow out through the separation of cash flow rights and control rights is further strengthened, and the second type of agency problem is aggravated. Only when small and medium-sized investors do not 'vote with their feet' can they actively participate in corporate governance to reduce the possibility of interest damage (Kong et al., 2013). Therefore, small and medium-sized shareholders will more actively participate in the process of shareholders' meeting and corporate governance. On the one hand, they will supervise the behaviour of the actual controller, and on the other hand, they will urge the management to disclose information, reduce the conceals of bad news, and reduce the degree of information asymmetry. Thereby reducing the risk of stock price crash (Zhai et al., 2022). In order to test this mechanism, we extract the data of minority shareholders' attendance at the annual general meeting of listed companies, divides them into groups with high minority shareholders' attendance at the annual general meeting and low minority shareholders' attendance at the annual general meeting by using the median proportion of minority shareholders' attendance at the annual general meeting of listed companies. The regression results are shown in Table 15. In the group with a low proportion of minority shareholders attending the annual shareholders' meeting, the *LP* coefficient is significantly negative, indicating that after the LP agreement structure is set up in the listed company, minority shareholders have a stronger sense of crisis and will more actively participate in the shareholders' meeting, resulting in a supervisory effect and thus reducing the risk of stock price crash of the listed company.

**Table 14.** Mechanism test 2: Improve the transparency of corporate accounting information.

Variables	High	Low	High	Low
	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)	(3)	(4)
LP	-0.1274 (-1.38)	-0.1942** (-2.35)	-0.0967 (-1.57)	-0.1211** (-2.23)
Ret	4.6216 (0.13)	-52.4695 (-1.50)	-3.3429 (-0.14)	-37.8334 (-1.64)
Sigma	0.5644 (0.24)	-2.8871 (-1.26)	-0.4338 (-0.28)	-2.6568* (-1.75)
BM	-1.1094*** (-7.28)	-0.9084*** (-6.77)	-0.7474*** (-7.57)	-0.6455*** (-7.09)
Roe	-0.2161* (-1.75)	-0.0609 (-0.70)	-0.1320* (-1.71)	-0.0666 (-1.15)
Lev	-0.9072*** (-5.49)	-0.8441*** (-5.64)	-0.5101*** (-4.65)	-0.5687*** (-5.84)
Dturn	-0.0603* (-1.86)	-0.0169 (-0.75)	-0.0405** (-1.98)	-0.0091 (-0.61)
Size	0.1078** (2.40)	0.1056*** (3.14)	0.0291 (0.93)	0.0671*** (3.03)
AbsAcc	0.1342 (0.60)	0.2912* (1.89)	-0.0482 (-0.34)	0.2069** (2.05)
InHold	0.3133** (2.26)	0.2550** (2.02)	0.2133** (2.23)	0.1198 (1.41)
Big4	0.1875* (1.65)	-0.0079 (-0.08)	0.1067 (1.42)	0.0165 (0.27)
Hold	0.5732*** (3.02)	-0.0909 (-0.47)	0.4342*** (3.22)	-0.0513 (-0.42)
Balance	0.0585* (1.73)	0.0297 (0.87)	0.0537** (2.32)	0.0321 (1.40)
Ac	0.5471* (1.66)	0.5244** (2.00)	0.4245* (1.88)	0.3177* (1.85)
NCSKEW	-0.1443*** (-10.68)	-0.1671*** (-11.45)		
DUVOL			-0.1297*** (-9.50)	-0.1599*** (-11.37)
_cons	-2.1903** (-2.27)	-1.9430*** (-2.80)	-0.5560 (-0.83)	-1.1699** (-2.56)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
N	8062	8063	8062	8063
R2_adj	0.0766	0.0898	0.0830	0.0983
F	22.0356	23.5183	23.8607	26.2622
Coefficient difference test		$p=0.091^*$		$p=0.085^*$

#### 5.1.4. Mechanism test 4: realize effective employee equity incentive

It can be learned from the analysis above that the actual controller may be more willing to implement the employee incentive plan and control in order to further obtain the control of the listed company. At the same time, the consideration of their own reputation and job compensation is an important factor affecting employee behaviour. Different from the traditional salary incentive, the LP agreement structure closely binds employees with the company, so that employees are related to the interests of the company, and listed companies can retain the intellectual capital needed for development. As 'insiders' who understand the production and operation of enterprises and shareholders who share the interests of the company, shareholding employees will give full play to their talents in order to maximise their own interests, strengthen the communication within employees and

**Table 15.** Mechanism test 3: Supervision effect of minority shareholders.

Variables	High	Low	High	Low
	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)	(3)	(4)
LP	-0.1266 (-1.35)	-0.1544** (-2.07)	-0.0669 (-1.17)	-0.0946* (-1.91)
Sigma	-2.4297 (-1.13)	1.3153 (0.62)	-2.3775* (-1.65)	0.1759 (0.13)
Ret	-39.2159 (-1.18)	-3.9472 (-0.13)	-29.8356 (-1.34)	-8.7309 (-0.42)
BM	-0.9291*** (-6.95)	-0.9688*** (-7.01)	-0.7067*** (-8.11)	-0.6479*** (-7.11)
Roe	-0.1780 (-1.58)	-0.0712 (-0.93)	-0.1620** (-2.34)	-0.0447 (-0.88)
Lev	-0.8363*** (-5.11)	-0.8802*** (-6.48)	-0.6029*** (-5.73)	-0.5204*** (-5.76)
Dturn	-0.0287 (-1.45)	-0.0337 (-1.12)	-0.0244* (-1.88)	-0.0151 (-0.76)
Size	0.0368 (0.92)	0.1921*** (5.67)	0.0089 (0.31)	0.1104*** (4.86)
AbsAcc	0.2065 (1.20)	0.2056 (1.36)	0.1345 (1.18)	0.1156 (1.18)
InHold	0.2421* (1.72)	0.3406*** (2.61)	0.1737* (1.71)	0.2150** (2.52)
Big4	-0.0063 (-0.06)	0.0981 (0.94)	-0.0003 (-0.00)	0.0880 (1.20)
Hold	0.0698 (0.40)	0.2236 (1.28)	0.1020 (0.89)	0.1456 (1.22)
Balance	0.0528 (1.21)	0.0129 (0.47)	0.0471 (1.59)	0.0102 (0.55)
Ac	-0.0698 (-0.21)	0.5491** (2.28)	-0.0799 (-0.36)	0.4015** (2.48)
NCSKEW	-0.1885*** (-14.69)	-0.1627*** (-13.49)		
DUVOL			-0.1834*** (-14.74)	-0.1564*** (-13.01)
_cons	-0.4847 (-0.57)	-3.9540*** (-5.65)	0.0703 (0.12)	-2.2627*** (-4.77)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
N	8461	8455	8461	8455
r2_a	0.0867	0.0860	0.0985	0.0933
F	29.0183	31.5213	32.8710	34.1416
Coefficient difference test		$p=0.001$ ***		$p=0.004$ ***

between employees and shareholders, and thus help improve the level of corporate governance and reduce the risk of stock price crash (Zhai et al., 2022). In order to test this mechanism, we collates the data of companies with employee stock ownership plans during the sample period. Then the samples are divided into two sub-samples with high employee stock ownership plan and low employee stock ownership plan according to the proportion of employee stock ownership in total shares. The regression results are shown in Table 16. In the subsample of the group with low implementation of the employee stock ownership plan, the coefficient of LP is significantly negative, while it is not significant in the subsample of the group with high implementation of the employee stock ownership plan, indicating that the LP agreement structure with the role of employee equity incentive can effectively motivate employees, improve their work enthusiasm and internal information transparency, and reduce the risk of stock price crash of listed companies.

**Table 16.** Mechanism test 4: Realise effective employee equity incentive.

Variables	Low	High	Low	High
	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)	(3)	(4)
LP	-0.1804*** (-2.99)	-0.0219 (-0.37)	-0.1091*** (-2.85)	-0.0142 (-0.34)
Ret	-31.1586 (-1.31)	122.0062** (2.23)	-24.9922 (-1.60)	40.6731 (1.17)
Sigma	-1.4114 (-0.89)	8.8280** (2.56)	-1.5623 (-1.51)	3.1159 (1.40)
BM	-0.9460*** (-9.61)	-0.5986*** (-4.49)	-0.6305*** (-9.78)	-0.3435*** (-3.94)
Roe	-0.1422** (-2.28)	0.2074 (1.62)	-0.0935** (-2.31)	0.0547 (0.60)
Lev	-0.8619*** (-8.13)	-0.2554** (-2.18)	-0.5214*** (-7.39)	-0.1050 (-1.34)
Dturn	-0.0303* (-1.85)	-0.0295 (-0.67)	-0.0229** (-2.13)	-0.0154 (-0.52)
Size	0.0991*** (3.92)	0.0192 (1.00)	0.0426** (2.39)	-0.0052 (-0.41)
AbsAcc	0.1339 (1.14)	0.3475 (1.27)	0.0937 (1.21)	0.1684 (0.97)
InHold	0.2716*** (3.17)	0.0875 (1.19)	0.1717*** (2.87)	0.0409 (0.82)
Big4	-0.0046 (-0.06)	-0.0465 (-0.54)	0.0078 (0.15)	-0.0195 (-0.36)
Hold	0.2589* (1.87)	0.1673 (1.64)	0.1461* (1.66)	0.1298* (1.72)
Balance	0.0337 (1.48)	0.0225 (0.99)	0.0266* (1.69)	0.0275** (1.97)
Ac	0.2648 (1.33)	0.0590 (0.24)	0.1806 (1.36)	-0.0303 (-0.17)
NCSKEW	-0.1561*** (-17.10)	0.0082 (0.40)		
DUVOL			-0.1531*** (-16.89)	-0.0024 (-0.11)
_cons	-1.8635*** (-3.51)	-0.7801* (-1.77)	-0.7391** (-1.97)	-0.0342 (-0.12)
Year	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
N	14771	2155	14771	2155
R2_adj	0.0780	0.1342	0.0859	0.1419
F	48.1425	14.2080	51.9932	14.3981
Coefficient difference test		$p=0.000***$		$p=0.002***$

## 5.2. Heterogeneity analysis

### 5.2.1. Proportion of voting rights, limited partnership agreement structure and stock price crash risk

The asymmetrical cost and benefit of supervision by minority shareholders of listed companies make minority shareholders less motivated to participate in supervision and governance, and there is a general behaviour of 'voting with their feet' (Ang et al., 2000), which leads to insufficient supervision of management. The more concentrated voting rights enable the largest shareholder to enjoy greater benefit-sharing rights of listed companies and encourage the largest shareholder to supervise (Grossman & Hart, 1980; Wang et al., 2015), restrain the opportunistic behaviour of management, form the convergence of interests between shareholders and management, reduce the degree of information asymmetry, and then help to reduce the risk of stock price crash (Wang

et al., 2015). The decentralised ownership structure will cause the phenomenon of 'free riding' and reduce the enthusiasm of shareholders to supervise management (Grossman & Hart, 1980). According to the provisions of the Company Law of our country, the resolutions of the shareholders' meeting to amend the articles of association of the company, increase or decrease the registered capital, as well as the resolutions of the merger, division, dissolution or change of the company form must be passed by the shareholders representing more than two-thirds of the voting rights. If the proportion of voting rights of the largest shareholder is less than one-third, the shareholder loses the right to veto the above-mentioned key issues, forming a phenomenon of relatively dispersed voting rights, which will lead to more time for controlling shareholders to pay attention to the stability of control rights, and the supervision of management will be reduced. Small and medium-sized investors need to play the role of shareholders to supervise the management and reduce the tendency of 'free riding', so as to reduce the agency cost between shareholders and management, and the reduction of agency cost will further reduce the probability of stock price crash of listed companies. Therefore, we expect that LP agreement structure can make up for the deficiency of supervision effect of major shareholders, reduce the occurrence of 'free riding' behaviour of minority shareholders, effectively constrain management opportunism and encourage active governance, improve corporate performance, reduce information asymmetry, and thus reduce the risk of stock price crash in companies with low ownership concentration and dispersed voting rights.

Therefore, according to the proportion of voting rights required by the Company Law for major matters such as amendment of articles of association, change of registered capital, merger, division, dissolution or change of company form, we construct a dummy variable *Index*. *Index* equal to 1 when the proportion of the voting rights of the largest shareholder of the listed company is less than one-third of the total voting rights, otherwise 0. The variable and its cross-product with *LP*,  $LP*Index$ , were added to the benchmark model for regression. The regression results are presented in Table 17. The results show that LP structure can effectively reduce the risk of stock price crash in listed companies with relatively dispersed voting rights when the voting proportion of the largest shareholder is less than one-third.

### **5.2.2. Legal environment, limited partnership agreement structure and stock price crash risk**

Shleifer and Vishny (1997) pointed out that the separation of cash flow rights and control rights within listed companies will aggravate the 'hollowing out' behaviour of major shareholders and realise the encroachment of major shareholders on the interests of minority shareholders. Some studies have shown (La Porta et al., 2000) that the degree of encroachment of major shareholders' control on minority shareholders' interests is significantly affected by the intensity of investor protection in the legal environment. In the LP agreement structure, the actual controller of the general partner bears unlimited joint and several liability. For the actual controller, all the mechanisms for external supervision of the company can play an effective role in an area with a good legal environment (Wang, 2019). The actual controller is subject to greater external constraints, and the punishment for self-serving behaviour is also greater after it is discovered. While in areas with poor legal environment, the actual controller's cost of violating the law is low, and

**Table 17.** Proportion of voting rights, limited partnership agreement structure and stock price crash risk.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
LP	-0.0417 (-0.45)	-0.0191 (-0.33)
Index	0.0210 (0.63)	0.0213 (0.93)
LP*Index	-0.1568* (-1.67)	-0.1091* (-1.71)
Ret	-7.6099 (-1.03)	-7.2601* (-1.69)
Sigma	-0.7687 (-0.53)	-1.5883 (-1.61)
BM	-0.9913*** (-11.18)	-0.7100*** (-11.66)
Roe	-0.1071* (-1.84)	-0.0831** (-2.15)
Lev	-0.8957*** (-9.36)	-0.5919*** (-9.01)
Dturn	-0.0339** (-2.20)	-0.0253** (-2.39)
Size	0.1085*** (4.63)	0.0578*** (3.41)
AbsAcc	0.1687 (1.56)	0.1150 (1.54)
InHold	0.2387*** (2.92)	0.1538*** (2.68)
Big4	0.0180 (0.26)	0.0155 (0.31)
Hold	0.1760 (1.49)	0.1528* (1.92)
Balance	0.0283 (1.24)	0.0343** (2.10)
Ac	0.3371* (1.88)	0.2230* (1.79)
NCSKEW	-0.1517*** (-18.21)	
DUVOL		-0.1532*** (-17.69)
_cons	-2.0548*** (-4.16)	-1.0274*** (-2.85)
Year	Yes	Yes
Firm	Yes	Yes
N	16926	16926
R2_adj	0.0801	0.0879
F	54.1444	57.9868

the agreement that the actual controller bears unlimited joint and several liability brings weak restraint to the actual controller. Therefore, we expect that the actual controller will reduce the selfish behaviour to more effectively reduce the stock price crash risk of the listed company when the listed company is in a good legal environment.

With reference to existing literature (Wang, 2019), we select the development of market intermediary organisations and the score of legal system environment of each region in the China Marketization index compiled by Wang Xiaolu and Fan Gang over the years as proxy variables. The higher the score, the better the local legal environment. The scoring variable  $Mkt$  and its cross-multiplying term  $LP*Mkt$  with  $LP$  were added to the benchmark model for regression. As can be seen from Table 18, the coefficients of the

cross-multiplication term LP\*Mkt are all significantly negative, indicating that the better the legal environment of the enterprise, the stronger the deterrent effect on the actual controller, and the more effective the restriction of LP agreement structure on the actual controller, thus strengthening the negative correlation between LP and stock price crash risk.

## 6. Conclusion and enlightenment

This study takes the data of listed companies from 2014 to 2021 as research samples to study the limited partnership structure of listed companies in China. Examining whether the limited partnership structure can effectively reduce the stock price crash risk.

**Table 18.** Legal environment, limited partnership agreement structure and stock price crash risk.

Variables	Dep. Var.: $NCSKEW_{t+1}$	Dep. Var.: $DUVOL_{t+1}$
	(1)	(2)
LP	-0.3664** (-2.37)	-0.2067** (-2.06)
Mkt	-0.0040 (-0.52)	-0.0009 (-0.19)
LP*Mkt	-0.0449*** (-3.42)	-0.0259*** (-3.13)
Ret	-6.8005 (-1.00)	-6.9737 (-1.52)
Sigma	-0.7716 (-0.53)	-1.3211 (-1.39)
BM	-1.0006*** (-11.30)	-0.6718*** (-11.48)
Roe	-0.1091* (-1.88)	-0.0807** (-2.14)
Lev	-0.9049*** (-9.48)	-0.5531*** (-8.73)
Dturn	-0.0321** (-2.09)	-0.0241** (-2.38)
Size	0.1124*** (4.79)	0.0544*** (3.33)
AbsAcc	0.1685 (1.56)	0.1079 (1.52)
InHold	0.2283*** (2.85)	0.1439*** (2.61)
Big4	0.0177 (0.25)	0.0173 (0.37)
Hold	0.1711 (1.44)	0.1395* (1.81)
Balance	0.0296 (1.40)	0.0320** (2.21)
Ac	0.3414* (1.91)	0.2366** (1.97)
NCSKEW	-0.1520*** (-18.28)	
DUVOL		-0.1484*** (-17.78)
_cons	-2.1547*** (-4.33)	-0.9845*** (-2.82)
Year	Yes	Yes
Firm	Yes	Yes
N	16926	16926
R2_adj	0.0807	0.0886
F	54.6618	59.0032

risk of listed companies by verifying the relationship between the stock price crash risk and the limited partnership structure of listed companies from the perspective of stock price crash risk. The results show that limited partnership structure can reduce the risk of stock price crash. At the same time, this paper further verifies the validity of the conclusions by robustness test and solving the endogeneity problem. The mechanism test found that the LP agreement structure can inhibit the tunnelling behaviour of the actual controller, promote the minority shareholders to play a supervisory role, achieve effective incentives for employees and improve the transparency of corporate information to reduce the risk of stock price crash of listed companies. Heterogeneity analysis shows that LP structure has a more significant inhibitory effect on stock price crash risk when voting rights are relatively dispersed and external legal environment is better.

The results of this study are not only helpful to reveal the advantages of the limited partnership framework in listed companies in our country, but also to expand the research on the influencing factors of stock price crash risk. In order to promote the good development of the capital market, this study puts forward the following policy suggestions based on the above-mentioned research results:

First, deepen the reform of equity structure and appropriately encourage listed companies to adopt LP agreement structure. According to the conclusion of this study, LP agreement structure can inhibit the stock price crash risk, it can reduce the stock price crash risk of listed companies by improving the information transparency of listed companies and inhibiting the hollowing behaviour of actual controllers, which is of great significance for resolving the corporate crash risk. Therefore, China's relevant departments should continue to promote and appropriately encourage high-tech enterprises, green innovation enterprises, and unicorn enterprises that have high technical content, large initial capital investment, and actual controllers who lack sufficient self-owned funds but want to consolidate their control rights to adopt LP agreement structure according to their own development, and provide policy support for the limited partnership system to give full play to its corporate governance function, which has important reference value for resolving systemic risks.

Second, set up the supervision and information disclosure mechanism of LP framework shareholders' decisions. The LP agreement structure gives the actual controller of the listed company a higher decision-making power than the equity. The stability of the control right may aggravate the separation of the two rights of the actual controller, which will further improve the external doubts about the actual controller's hollowing out. Therefore, the listed companies adopting the LP agreement structure need to make detailed provisions on the institutional arrangements such as the exercise of the voting rights of shareholders of general partners, and establish a unique corporate governance mechanism and information disclosure mechanism under the LP agreement structure. For example, the listed companies adopting the LP agreement structure can set up a limited partner committee for limited partners, establish a mechanism for maintaining the rights of limited partners, and fully supervise the exercise of the equity of major shareholders as general partners to fully protect the rights and interests of limited partners. In addition, it is necessary to establish an information disclosure mechanism of LP agreement structure, including information disclosure mechanism of decision-making framework of LP agreement structure, limited partner power exercise and objection disclosure, internal sharing

of partners rights and interests, and compatibility of partners' decisions with decisions of shareholders' meeting, so as to effectively improve information transparency.

Third, further improve the partner benefit sharing and risk sharing mechanism under the LP agreement structure. According to the research of this study, compared with the listed companies that do not adopt LP agreement structure, the listed companies that adopt LP framework have a lower risk of stock price crash, which is based on the partnership mechanism of LP agreement structure. Therefore, in order to fully play the partnership mechanism of LP agreement structure, it is necessary to further improve the benefit sharing mechanism and risk sharing mechanism of partners, including the best benefit sharing mechanism suitable for a particular enterprise between shareholders as general partners and employees as limited partners. In addition, compared with the limited risks borne by limited partners (employees), as general partners, controlling shareholders bear the reputation risk of the partnership and the residual risk of the enterprise. This dual risk-taking requires additional income compensation mechanism. Therefore, the listed companies under the LP agreement structure need to further improve the partners' benefit sharing and risk sharing mechanism.

Fourth, further clarify and improve partner qualifications examination, entry and exit mechanisms. The LP agreement structure plays an important role through the partnership mechanism, including the shareholders as general partners and the employees as limited partners. It is necessary to straighten out the qualification examination, entry and exit mechanism of partners under the LP agreement structure, which may include but not limited to the qualification examination mechanism of general partners and limited partners, the identity conversion mechanism of general partners and limited partners, the exit of partners and the property settlement mechanism, the entry of partners and the asset confirmation mechanism, the relief of partners' rights and interests and the guarantee mechanism of company's interests.

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