Investment Efficiency and Stock Price Crash Risk of China's Listed Companies Under Technical Sanctions

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Abstract

This article studies the investment efficiency and stock price crash risk of listed companies under the background of technical sanctions and their interrelationships. Firstly, using the quasi-natural experimental rules from empirical research, I conduct a DID model to verify whether technical sanctions have an impact on investment efficiency and stock price crash risk. Secondly, further in-depth analysis of the mechanism of the impact of technical sanctions on the risk of stock price crash is a major innovation of this article, adding new empirical evidence of the impact of technical sanctions. This article uses a validated and mature DID model to study the impact of technical sanctions on A-share listed companies, which is a concern for both industry practitioners and academic researchers. The research finds: (1) the investment inefficiency of listed companies has increased after being sanctioned, and this relationship is significant at the 10% level. The Chinese economy has achieved rapid growth in the past few years, primarily driven by investment. Listed companies in the Chinese stock market are leading companies in various industries in China. This indicates that although increasing investment can alleviate the adverse effects of sanctions on enterprises, many investments are not efficient, which can have a negative effect on investment efficiency; (2) After the company was sanctioned, the crash risk of stock price increase, but the correlation coefficient was not significant, so this impact was not statistically significant; (3) the lower the investment efficiency, the greater the risk of crash, but this relationship is not statistically significant. Technical sanctions negatively weaken the relationship between investment efficiency and stock price crash risk, that is, after a company is subject to technical sanctions, the impact of investment efficiency on stock price crash risk becomes weaker. The weakening of this relationship stems from two potential aspects: firstly, the impact of technical sanctions on investment efficiency, which has been partially verified before. Secondly, technical sanctions can also have an impact on the risk of stock price crash. In previous studies, it was found that technical sanctions increase the risk of price crash, but this relationship is not very significant. Therefore, comprehensive analysis shows that technical sanctions weaken the impact of investment inefficiency on the risk of stock price crash, and the mechanism is that the investment inefficiency of listed companies increases after technical sanctions and absorbs some of the impacts on the risk of stock price crash, thus reflecting the reduction of the impact of investment inefficiency on the risk of stock price crash. However, this relationship still lacks sufficient statistical support.

At the same time, this article also studied the impact of technical sanctions on stock prices in the short term based on event study methods, and found that the impact of technical sanctions on stock prices in the short term is very significant. Overall, the abnormal returns calculated in this article are very significant within the [T-30, T+30] time interval. However, by delving into the composition of abnormal returns, it was found that abnormal returns are only significant in a few industries and not significant in most other industries. Secondly, in the four years 2019 to 2022, during the [T, T+5] time period, abnormal returns were more pronounced, indicating that the main source of abnormal return was the overreaction of stock prices at the stylistic level before the technical sanction. From the perspective of different styles, the larger the market value, the higher the P/B, the higher the turnover rate, the greater the positive abnormal return in [T, T+5]. This indirectly indicates that the Chinese stock market is greatly influenced by market sentiment in the short term, and the market is not very mature.

Key Words: Investment Efficiency; Stock Price Crash Risk; Technical Sanctions

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1. Introduction

The United States and China are two major players in the world economy. While China's economic growth has been impressive before and after its accession to the WTO. Despite the increasing trade between the two countries, trade frictions have emerged and are very intense. The trade conflicts between China and the US have been long-standing and are mainly due to the trade imbalance between the two countries. The reasons for the trade conflicts are also related to the convergence of the industrial structures of the two countries.

Numerous studies have been conducted on the investment efficiency of listed companies and the risk of stock price crash. This paper uses the classical research models to empirically analyse whether the mechanism of these classical models has changed under technical sanctions in China.

This exogenous shock can be seen as quasi natural experiment. The goal of this article is to study the net effect of this shock, whether it has an effect among different individuals and the differences in the magnitude of the impact. Therefore, it is easy to conduct research based on all Chinese A-share samples, which is a typical application scenario of the Difference in Differences (DID)model. It can also be understood from another perspective if this event is applicable to all companies, while the impact varies. Therefore, this is a typical scenario for event study at the same time, which generally studies the average effect of an event on stock prices within a specified window period, such as T-30 to T+30 days, or the average impact on individuals with similar characteristics. Based on the cumulative abnormal returns generated by the impact, researcher can test whether the event cause excess returns in stock price. This impact is generally relatively short-term, and in the long run, stock prices will still follow fundamental to form a long-term equilibrium, although this long-term equilibrium is vague.

The idea of this article is to conduct a panel analysis that investigates the impact of event shocks on investment efficiency and stock price crash from a long-term perspective within one financial year. Since I measure them within a natural year, all such research and analysis are effective and place more emphasis on changes in fundamentals. Although stock price crash risk is a technical indicator, it can be combined with fundamental indicators such

as investment efficiency to support the long-term theoretical pricing of stock prices.

In addition to the above analysis, this paper may also discuss the impact of endogenous variables and individual differences, which can add credibility to its conclusions.

2. Literature Review

2.1. Research Related to Investment Efficiency

Non-efficient investment in enterprises has always been a crucial topic of discussion. Enterprise investment is the source of development, and issues such as the choice of investment direction and investment timing decision-making play a decisive role in the capital structure, profitability, and long-term development of enterprises. The investment and financing scale of a single enterprise constitutes the level of investment and financing in society and determines the capital allocation of the entire society. For a long time, Chinese enterprises have generally prioritized fundraising over investment, leading to varying degrees of blind investment and idle funds among various types of enterprises. This not only damages the value of enterprises, but also leads to inefficient allocation of social resources. Therefore, how to improve the efficiency of corporate investment has always been a hot topic in corporate governance research. Extensive research on the impact of agency conflicts, capital structure, financing constraints, free cash flow, major shareholder control, and manager characteristics on inefficient investment behaviour of enterprises based on theories such as principal-agent, information asymmetry, incomplete contracts, and financial behaviour achieved rich results.

There is no complete consensus on the definition of inefficient investment in enterprises currently. Research results can be categorized into two categories:

(1) Definition of investment theory based on the perspective of corporate finance. The net present value (NPV) criterion is used, which means that the enterprise takes into account the cost of capital and considers it comprehensively. All projects with NPV greater than zero are implemented until NPV equals zero. If the net present value is negative. Adding a project with negative present value is called overinvestment (Meckling and Jensen, 1976), and if a company abandons some projects with positive net present value, it is referred to as underinvestment (Myers, 1977).

(2) Empirical concepts based on corporate governance perspective. In the study of industry diversification, the concept of inefficient investment has also been proposed. Research shows that enterprises diversification of industries makes it possible for enterprises to have internal capital markets when there is internal capital under market conditions, companies often invest excessively in sectors with poor returns, resulting in overinvestment in weaker business areas and investment shortcomings in stronger areas.

Investment distortions such as malicious capital increases (Han et al., 2007) are also included in the research of inefficient investment. At present, it tends to define inefficient investment as the investment of the company when not meeting the NPV criteria. And empirical concepts based on corporate governance do not accurately reflect the essence.

The main measurement of inefficient investment in enterprises: (1) using investment cash flow sensitivity to test the financing constraints faced by enterprises. (2) using cash flow, investment opportunity (Tobin's Q), and their interaction terms to test investment. (3) residual term measurement of investment based on the optimal investment model of accounting measurement. Richardson (2006) used accounting measurement to construct model. The model includes investment, asset-liability ratio, cash flow, company size, earnings per share, and newly added investments in the previous year, where the residual term can measure overinvestment (NPV greater than zero) or degree of insufficient investment (NPV less than zero). This method does not take into account the impact of other factors, such as agency conflicts and information asymmetry on investment, and the model lacks sufficient basis for introducing new investments from the previous year. Therefore, if there is overall overinvestment or underinvestment in the sample, there will be systemic errors. Nevertheless, the Richardson residual model has made useful explorations in empirical research on inefficient investment and has been used by scholars (Xin et al., 2007; Zhang and Song, 2009).

Theoretical explanation of inefficient investment of enterprises. The motivation for inefficient investment in enterprises varies depending on the perspective of observation. Researchers have proposed different theoretical explanations. This indirectly indicates the complexity of the driving forces behind inefficient investment in enterprises.

(1) Proxy Issues

Under the framework of modern enterprise systems, due to the separation of ownership and control, the interests of the principal and trustee are not completely consistent. Therefore, in the presence of incomplete contracts, information asymmetry, and moral hazard, conflicts of interest may arise, leading to agency problems. The manifestation of agency problems in corporate investment is that the conflict of interests between shareholders, managers, and creditors leads to inefficient investment. Investment does not maximize the company's value, but only benefits one party, and the external manifestation is inefficient investment (Meckling and Jensen, 1976; Stulz, 1990). The goals of shareholders and managers are not

always the same. Shareholders pursue the maximization of company value, while managers hope to control more resources in their hands to achieve maximum personal benefits, such as extraordinary on-the-job consumption (Meckling and Jensen, 1976; Stulz, 1990). Therefore, managers are motivated to engage in projects with negative NPV and hold a large amount of cash, which increases the chance of overinvestment (Jensen, 1986; 1993; Lamont and Polk, 2002; Dittmar and Thakor, 2007). Of course, conflicts between shareholders and management are not always prone to overinvestment, and underinvestment can also occur in situations where management pursues more leisure time and risk aversion. The study by Grenadier and Wang (2005) shows that managers tend to overinvest when they have private returns, while underinvestment occurs when there are private costs. Under information asymmetry, the investment behaviour of managers is either rapid or delayed. In summary, when incentives between managers and shareholders are incompatible, the relationship between investment behaviour and growth opportunities is not close, and managers may invest in projects that do not maximize value (Shin and Kim, 2002). Research by domestic scholars has also proven that agency issues are the fundamental cause of excessive investment and inefficient capital allocation in enterprises, and this phenomenon is more severe in state-owned enterprises (Yang, 2002; He, 2002).

(2) Information Asymmetry Issues

The information asymmetry in the capital market can lead to moral hazard and adverse selection. To prevent moral hazard, fund providers often demand a higher risk premium by raising interest rates, credit allocation, or adding restrictive clauses, resulting in higher external financing costs than internal financing, often leading to underinvestment. When a company faces internal financial constraints, existing shareholders and managers believe that supporting projects with high cost external financing may result in more losses than abandoning projects, and may abandon projects with positive NPV (Myers and Majluf, 1984). This type of investment shortage caused by differences in internal and external financing costs is called financing constraint theory. Scholars mostly use investment and cash flow sensitivity to measure the degree of financing constraints. Some studies have shown a positive correlation between financing constraints and investment cash flow sensitivity (Hoshi et al., 1991; Whited, 1992; Feng 1999), Zheng et al., 2001), providing support for the theory of corporate financing constraints.

But other empirical research conclusions are not consistent. Research has found that investment cash flow sensitivity is not a necessary condition for companies to be constrained

by financing, and there is a negative correlation between financing constraints and investment cash flow sensitivity (Deshmukh et al., 2005; Whited, 2006). Due to both agency issues and information asymmetry, the sensitivity of investment cash flow can be explained, but the relationship between investment and cash flow is influenced by various complex factors. Therefore, research results on the sensitivity of investment cash flow should be used with caution. However, these issues have also brought new research themes. From a broad perspective, adverse selection caused by information asymmetry is essentially a preventive measure taken by the principal against the potential moral hazard of the trustee, belonging to the joint effect of the principal-agent problem.

(3) Manager Trait Issues

The various theories imply a prerequisite that the enterprise manager is rational. However, this premise is increasingly being questioned by psychology and behavioural finance theories. In addition to being driven by economic interests, corporate investment behaviour is also susceptible to subjective psychological factors such as managers' personality traits and emotions, instincts, feelings, biases, etc. Overconfidence is considered the main manifestation of manager irrationality and one of the management traits that have been extensively studied. Overconfidence refers to the psychological bias in which people tend to overestimate their chances of success and underestimate their chances of failure (Wolosin et al., 1973; Langer, 1975). The research by Weinstein (1980) and Alicke (1985) suggests that people generally exhibit psychological characteristics of overconfidence. The level of overconfidence among business managers is generally higher than that of the general public (Cooper et al., 1988; Landier and Thesmar, 2004). Previous studies often overlooked behavioural assumptions (Barberis and Thaler, 2003), but in recent years, with the rise of behavioral finance theory, people have increasingly recognized that some characteristics of managers have a significant impact on investment decisions. Roll (1986) first proposed the Hubris hypothesis, which suggests that overconfident managers often overestimate the benefits of mergers and acquisitions and believe that mergers and acquisitions can bring synergies, leading to the occurrence of inherently worthless mergers and acquisitions. Heaton (2002) proposed an investment dissimilation model based on manager overconfidence. The research results show that management overconfidence often underestimates project risks and overestimates project returns, resulting in companies actually investing in projects with negative NPV, leading to the occurrence of overinvestment. At the same time, overconfident management believes that investors have

underestimated the company's stock price and are unwilling to issue new shares to raise funds. Therefore, they will abandon projects with a positive NPV, leading to underinvestment.

2.2. Research on the Risk of Stock Price Crash

The phenomenon of stock price skyrocketing and plummeting in the capital market is becoming increasingly prominent, especially the risk of stock price crash caused by stock price skyrocketing. After a few years of development, the global stock market has been relatively mature. However, the capital market still faces problems of low operational efficiency and low information efficiency, with stock prices "skyrocketing and plummeting". For example, in 2001, the American NASDAQ foam rupture, 2011 Shuanghui Group's emergency limit dropped due to the "lean meat powder" incident. Therefore, Exploring the influencing factors of stock price crash risk is of great importance. In the 1970s and 1980s, foreign scholars Black et al. (1976) attempted to explain stock prices using the financial leverage effect hypothesis. They believe that the decline in stock prices will increase the operational and financial leverage of the enterprise, while the operational and financial leverage will further lead to an increase in risk premium. This hypothesis explains why the large fluctuations in stock prices are more inclined to decline, but it does not reasonably explain the large fluctuations in stock prices.

Pindyck et al. (1984) proposed the volatility feedback hypothesis in an efficient market framework, pointing out that an increase in stock price volatility increases investors' expected risk premium, which offsets the positive impact of good news on stock prices and amplifies the negative returns brought by bad news. The number of times stock market returns exhibit a negative skewed distribution and stock prices plummet Greater than the number of significant increases. However, due to the impact of exogenous information on market volatility. The impact of volatility is very brief, and the risk premium is difficult to sustain. The significant impact of sex makes it difficult for this hypothesis to explain the persistence of market returns. Theoretical hypotheses within the continuously asymmetric changes (Poterba and Summers, 1986) framework of an efficient market cannot understand the lack of information support and contagiousness of market level crashes. Therefore, further research has begun to break through the theory of efficient markets, starting from the belief that incomplete symmetry of interest rates and incomplete rationality of investors, stock prices.

Based on incomplete information theory, Jin and Myers (2006) constructed a simplified information model to explain the formation mechanism of stock price crash risk from the perspective of incomplete symmetry of internal information within the enterprise. On this basis, the researcher further subdivided the research perspective into principal-agent theory and information asymmetry theory to provide a new explanation for the risk of stock price crash at the market level. From the perspective of principal-agent, scholars are more inclined to explain agency conflicts. The motivation for the management to hide negative news. In a poor information environment, due to considerations of compensation, career, on-the-job consumption, and political factors, management tends to conceal negative news about company performance through methods such as manipulating accounting earnings (Hutton et al., 2009). When the accumulation of bad news exceeds the limit that the company can tolerate, it is difficult for the company to hide and may result in negative news being immediately released into the market, leading to a significant decline, ultimately triggering stock price crash. Kim and Zhang (2016) took accounting conservatism as the starting point and found that accounting conservatism can reduce the risk of stock price crash at the company level. When management chooses to manipulate accounting data to whitewash earnings to convey positive news about the company's operating performance to the outside world, they will inevitably face stricter recognition standards, thereby increasing the risk of being perceived. Therefore, it can be inferred that accounting conservatism suppresses the motivation of management to cover the market. Research based on the perspective of information asymmetry focuses more on the management's ability to cover the market.

Jin and Myers (2006) argue that the existence of information asymmetry gives management a certain information advantage, which provides the possibility for opportunistic behaviour of hiding bad news for a certain period of time. Through data from more than 40 countries and regions, they found that information transparency has a significant impact on the risk of stock price crashes. Regions with poorer information environments have a greater likelihood of stock market crashes. Hutton et al. (2009) used the absolute value of controllable accrued profits as a measure to examine the relationship between financial reporting transparency and stock return distribution, and found that there is a negative relationship between financial reporting transparency and stock price crash risk. Markets with poor financial reporting quality have higher stock price crash risk, which is basically consistent with the cross-border research conclusions of Jin and Myers (2006). Behavioral finance takes the incomplete rationality of investors as the basic hypothesis, and explains the risk of stock price crash from the perspectives of stock price foam hypothesis

and heterogeneous belief hypothesis. The stock price foam hypothesis (Blanchard & Watson, 1982) says that investors in the capital market are not completely rational, and the speculation of "following the trend" is likely to cause the stock price to be overestimated, thus forming a price foam, and the bursting of the foam will lead to the crash of the stock market. Case and Shiller (1989) compared investor sentiment and basic economic factors in the capital market before and after the 1987 US stock market crash, and found that the important reason for the stock market crash was investor sentiment rather than basic economic factors. The reason was that there was no significant change in basic economic factors before and after the crash, and investor sentiment changed from excessive optimism to abnormally negative afterwards. The Heterogeneous Belief Hypothesis (Hong and Stein, 2003) suggests that overconfidence can lead to different investors holding different judgments about the future returns of the same stock with the same holding period. When the market does not allow short selling, pessimistic investors' market expectations cannot be integrated into the stock price in a timely manner, and the market mostly reflects optimistic investors' optimistic beliefs. Therefore, they believe that the risk of stock price crash at the market level may not necessarily come from the outbreak of a major information event, but may also be the result of a concentrated release of a few pessimistic expectations.

In China, scholars started their research on the risk of stock price crash relatively late, but the research content is more in-depth, and the research scope is broader. In recent years, in addition to conducting research from the perspective of incomplete information asymmetry and incomplete investor rationality, some scholars have further expanded their research scope to external governance mechanisms and other aspects. Shi et al. (2014) found that when management conceals bad news through earnings management, the decrease in accounting earnings transparency further leads to a deterioration in the quality of accounting information, thereby increasing the risk of stock price crash. Jiang (2015) takes the important characteristic of accounting information quality - comparability of accounting information as the starting point, and empirical analysis shows that the comparability of accounting information significantly improves the information of enterprises. Improving the comparability of accounting information helps to reduce opportunistic behaviour by management, thereby reducing the risk of future stock price crashes. On this basis, research with information as the core position has begun to focus more on the perspective of information disclosure.

3. Progress of China-US Trade War and Technical Sanctions

1. International Trade and Commerce

On March 23rd, 2018, the United States officially announced the imposition of punitive tariffs of up to $60 billion on various Chinese goods, the Chinese stock market plummeted significantly when the breaking news was released. In February 2018, the United States imposed anti-dumping tariffs on cast iron sewage pipe fittings and aluminum foil products imported from China. On March 9th, the U.S. government recognized that imported steel and aluminum products pose a threat to the national security of the United States and decided to impose comprehensive taxes on these imports, with tax rates of 25% and 10% respectively. On March 23rd, the U.S. announced the imposition of tariffs on China's $60 billion worth of imported goods and restrictions on Chinese companies' investment and mergers and acquisitions in the United States. On the same day, the Chinese Ministry of Commerce issued a list of products that have been suspended and reduced in response to the 232 measures for steel and aluminum products imported from the United States and solicited public opinion, proposing to impose tariffs on some products imported from the United States. On June 15th, 2018, the US government announced a 25% tariff increase on approximately $50 billion worth of goods imported from China. On the same day, China announced reciprocal countermeasures, escalating trade frictions between China and the United States. After the incident, the market sharply declined until the official landing of tariffs on July 6th. Since the United States announced the imposition of punitive tariffs on some Chinese goods based on the 301 investigations in March 2018 on the one hand, there have been continuous trade frictions between China and the United States. In April, the United States USTR released a list of punitive tariffs (25%) related to $50 billion in "Made in China 2025". On June 15th, the US government released a list of goods subject to additional tariffs, imposing a 25% tariff on approximately $50 billion worth of goods imported from China, and announced the implementation of additional tariffs on approximately $34 billion worth of goods from July 6th.

2. High-Tech Industry

On April 16th, 2018, the US Department of Commerce placed a ban on US companies exporting telecommunications component products to ZTE, a Chinese tech company, for a period of 7 years. The following year, on May 16th, 2019, the US Department of Commerce included Huawei and 70 affiliated enterprises in the "entity list", which prohibited US companies from exporting technology and components to China. In recent years, there have

been concerns about the national security implications of certain Chinese mobile applications such as TikTok and WeChat. In August 2020, the US government ordered a 45-day ban on conducting any transaction with these applications and their Chinese parent companies.

3. Financial Market

On March 8th, 2022, the United States Securities and Exchange Commission (SEC) announced the first batch of listed companies in the United States that did not meet the audit regulatory requirements of the Public Company Accounting Oversight Board (PCAOB) in accordance with the Foreign Company Accountability Act issued at the end of 2020. Five Chinese concept companies were included in the "pre-delisting list" and faced delisting pressure. Starting from March 10th, 2022, the Chinese concept stocks listed in the United States have experienced a complete crash, causing multiple trading days of sharp declines.

Since the initiation of trade frictions in 2018, the frictions between China and the United States have gradually escalated to all fields, such as trade, technology, finance, diplomacy, and geopolitics. The impact of related risk events on global risk appetite is gradually weakening.

4. Research Hypothesis and Mechanism

The sanctions change the existing cooperation pattern among different countries. The Chinese government has introduced a series of supportive policies to help enterprises overcome the difficulties caused by the sanctions. Economic policies have played a positive role in development by overcoming the insufficient allocation of resources, focusing on major tasks, smoothing out cyclical fluctuations in the economy, and guiding and encouraging the development of high-tech industries subject to technical sanctions. However, the constantly changing economy and inaccurate judgments by governments can result in delayed decision-making, leading to a lack of effective incentive mechanisms and distorting resource allocation. Frequent changes in economic policies can lead to increased uncertainty in economic policy, which can have a profound impact on macroeconomic development and corporate behavior.

The impact of economic policy uncertainty on investment decisions can be analyzed from the following three aspects. Firstly, from the perspective of enterprise management, an increase in economic policy uncertainty will increase the difficulty in judging the future economic policy situation, thereby affecting their expectations of economic policies. This economic policy expectation includes three aspects: policy formulation, implementation, and government intervention. Due to the risk aversion of enterprises, increasing economic policy uncertainty will weaken their willingness to invest. Due to the relatively long term of investment, corporate investment is not only related to the current cash flow, but also the maintenance costs of the investment in the future. Therefore, investment is also largely related to future cash flow, and the impact of uncertainty on corporate investment mainly depends on the company's cash flow. When economic policy uncertainty increases, there may be deviations or even errors in the management's predictions regarding future cash flows. Therefore, when economic policy uncertainty increases, corporate management becomes more cautious. Secondly, from the perspective of shareholders, increasing economic policy uncertainty makes it difficult for investors to judge the future growth of enterprises, thereby reducing direct investment in enterprises. The increase in economic policy uncertainty leads to an increase in the volatility of corporate stock prices, thereby affecting investors' judgment of the future of the company. Due to the imperfect investor protection mechanism in China, the corporate governance mechanism to ensure investors' capital recovery is still in the process of improvement. The increasing uncertainty of economic policies makes it difficult for investors to judge the impact of future economic policies on investor protection

mechanisms. Therefore, they will be more cautious when making investments. Finally, from the perspective of creditors, when economic policy uncertainty increases, banks, as the main creditors, become more cautious, reducing the sources of investment obtained by enterprises. Especially when policy uncertainty related to monetary policy increases, creditors become more cautious, leading to a decrease in loan and an increase in loan interest rates. As one of the main sources of investment, a decrease in loans or an increase in loan interest rates leads to a decrease in enterprise investment or an increase in investment maintenance costs. Therefore, the increase in economic policy uncertainty will have a negative impact on corporate investment. The increase in policy uncertainty will weaken their willingness to invest in order to reduce the market and legal risks that enterprises will face in the future.

Technical sanctions increase the uncertainty of the external macro and industrial environment in the company's business process, which in turn has an impact on investment decisions, possibly manifested as a decrease in investment or an increase in investment. The company's investment is influenced by both the external and internal environment. Specifically, the high level of macroeconomic uncertainty weakens the management's ability to accurately predict company-specific information, making it difficult for executives to identify good projects and making them more cautious when making investment decisions.

In fact, the uncertainty of the macro environment may lead to management being more cautious when making investment decisions (Bloom et al., 2007), thereby reducing the company's investment; At the same time, it also increases the difficulty of predicting and supervising management behavior, concealing the responsibility that management needs to bear in case of investment failure, thereby increasing the opportunity for executives to add inefficient investments that bring personal benefits. How micro-environmental uncertainty affects corporate investment depends on the financing constraints of the enterprise. If the company is subject to finely financing constraints, sufficient funds provide support for the management to expand investment, increasing the possibility of excessive investment by companies with high uncertainty. On the contrary, when the company is subject to significant financing constraints, the shortage of funds makes it difficult for executives to expand their investment, reducing the possibility of overinvestment. Moreover, due to the risk of business failure that may affect their future career, companies will be more cautious in choosing investments and tend to reduce their investment. On the one hand, high uncertainty increases the difficulty for management to accurately evaluate investment projects. In order to avoid investment failures as much as possible, management will be more cautious when making

investments (Bloom et al., 2007), rejecting high-risk projects. At the same time, in order to cope with future emergencies caused by uncertainty, the company needs to balance current investments with future expenditures, and more cash will be retained (Almeida et al., 2004). The company does not have sufficient funds for investment, resulting in a decrease in the company's investment. In addition, due to the direct impact of investment failure on the future returns of major shareholders, if the company is controlled by major shareholders, high uncertainty also makes major shareholders cautious in choosing investments and actively responding to the impact of uncertainty. On the other hand, high uncertainty increases the difficulty of predicting and supervising management behaviour, and increases the difficulty of external shareholders evaluating project investment returns. If future investments fail, management is easily attributed to the external objective environment, providing opportunities for management to pursue private gains through inefficient investment.

After the technology sanction, the business uncertainty increases, which disrupts the investment plan of the enterprise, resulting in insufficient investment. At the same time, in order to achieve technical breakthroughs, some enterprises are forced to increase investment, resulting in a certain degree of over-investment. These two situations should coexist, but both are the performance of investment inefficiency. Therefore, based on discussion from multiple perspectives, I put forward the following research assumption:

Hypothesis 1: Under the same condition, technical sanctions significantly reduce investment efficiency.

Stock price crash mainly refers to a sudden and significant drop in stock prices, which causes a negative impact on listed companies. Therefore, the risk of stock price crash is increasingly being widely valued and focused by regulatory agencies, investors, and academia. In China, the stock market has experienced significant volatility in recent years, and the weakening of the RMB exchange rate has triggered expectations of depreciation. In addition, the downward pressure on the economy is significant, and these factors interact with each other.

Overall, the root of the risk of stock price crash is the continuous concealment of negative information by management under information asymmetry, resulting in the concentrated release of accumulated negative information and a significant decline in stock prices (Jin and Myers, 2006; Hutton et al., 2009). The uncertainty of macroeconomic policies

directly affects the investment and financing behaviour of enterprises, which in turn affects the value of listed companies and stock prices.

The Chinese stock market has experienced multiple sharp ups and downs in the past 30 years, and the frequent occurrence of crashes poses a great threat to financial security and stability. On the one hand, the Chinese stock market has a relatively short development time. On the other hand, as China is still in the stage of rapid economic development, external factors such as macroeconomic adjustment, economic cycle, and economic policy uncertainty have a significant impact on the stock market. Economic policy uncertainty often leads to fluctuations in financial market, and this relationship will significantly strengthen with the increase of economic policy uncertainty. If economic policy changes seriously deviate from investors' expectations, it may trigger extreme risks in the financial market. As is well known, short-term fluctuations in the Chinese stock market occur frequently due to policy changes. Early studies on economic policy uncertainty and stock price volatility often believed that stock price volatility itself reflected the uncertainty faced by enterprises. Therefore, scholars generally regarded stock price volatility as a proxy variable for enterprises facing uncertainty and conducted research on their investment and other behaviours. These studies believe that uncertainty is the reason for the increase in stock price volatility. Economic policy uncertainty significantly enhances the risk of the stock market, exacerbates the correlation and volatility between stock returns, and provides the possibility for the outbreak of extreme risks. For export-oriented and labour-intensive enterprises with stronger dependence on contract execution environments, they are more sensitive to policy changes. Higher economic policy uncertainty will increase the volatility of enterprise stock returns. In addition, economic policy uncertainty exacerbates stock price volatility while reducing market returns. At this point, stock price volatility, as an important research perspective, has become one of the focuses of economic policy uncertainty research. From China's experience, during the 2008 economic crisis, the government's series of strong stimulus policies effectively responded to negative international shocks. If frequent policy changes during periods of good macroeconomic performance are more in line with investors' expectations, investors even expect favourable new policies to be introduced as soon as possible. Frequent policy changes also serve the purpose of stabilizing market sentiment and promoting capital market development in a harsh external economic environment. At this point, economic policy uncertainty increases the difficulty for investors to interpret policy information, causing them to make judgments that contradict policy intentions, thereby exacerbating investor disagreements. China's stock market has strong short-selling

constraints, and investors with different opinions are unable to integrate private information into stock prices in a timely manner. Looking back at previous relevant studies, it can be found that existing research on economic policy uncertainty mainly explores the impact of economic policy uncertainty on corporate behaviour, stock returns, and volatility, with little discussion on the relationship between economic policy uncertainty and stock market risk. The risk of stock price crash is "bad news" concealment by management, which includes two core elements: the first is the principal-agent problem, where management will cover up bad news for different motives. These motivations include self-interest motivations such as personal salary, on-the-job consumption, career development, and building a business empire, as well as psychological motivations such as being overconfident and persistently investing in projects with negative net present value and emphasizing individualism in management's overconfidence in high-risk projects. Once such bad news exceeds the maximum capacity of a company and is suddenly released into the market, it can lead to stock price crash. The second issue is information asymmetry. The lack of transparency in information between the internal and external of the enterprise makes it impossible for investors to observe the behavioural motivations concealed by management, and to observe the true performance of the enterprise. Therefore, accurate judgments cannot be made about the true performance of the enterprise. Self-interested management has sufficient motivation to cover up bad news, such as investment failures until the bad news accumulates to the maximum that the company can accommodate and is concentrated in the market, triggering a risk of crash. It is generally believed that differences in investor opinions are an important reason for the risk of crash. There are generally short selling restrictions in the stock market that bearish investors cannot reflect their private information to the stock price in a timely and complete manner through transactions. Therefore, the biased information content in the stock price makes the price falsely high, which will lead to price crash when the price foam bursts. It can be seen that clarifying the formation mechanism of differences of opinion is of great significance for understanding the risk of stock price crash. Economic policy uncertainty means frequent policy changes, which amplify the amount of policy information in the market and increase the complexity of policy-related information. So, the information shock brought about by economic policy uncertainty exacerbates investor disagreements, thereby increasing the risk of a crash.

Based on the above analysis, it can be concluded that the release of economic policies and the occurrence of geopolitical risks can lead to fluctuations in stock prices before and after the event occurs. The higher the sensitivity of individual stock returns to economic

policy uncertainty and geopolitical risks, the more likely the stock prices are to experience sharp rises and falls. Taking the trade friction between China and the United States as an example, it has increased the geopolitical risks of the two countries. In this context, macroeconomic aspects such as tariffs and exchange rates are facing policy adjustments, which in turn have caused macroeconomic and capital market fluctuations. Geopolitical risks have caused macroeconomic policy adjustments, making it difficult for economic entities to judge future trends, exacerbating economic uncertainty exposure, or exacerbating stock price fluctuations.

In summary, scholars have carried out a lot of research since they put forward the information-hiding hypothesis (Jin & Myers,2006). The management team has the motive and ability to hide bad news and cause the stock price crash. Therefore, this paper uses the classical theory of stock price crash risk (information hiding hypothesis and heterogeneity belief hypothesis) to explore the possible impact of technical sanctions on stock price crash risk. The heterogeneous information hypothesis emphasizes that when the market can only accept optimistic expectations and ignore pessimistic expectations, the stock price will crash when the pessimistic expectations gradually accumulate and rush into the market (Hong & Stein, 2003). Therefore, I put forward the following research assumption:

Hypothesis 2: Under the same condition, technical sanctions significantly increase the stock price crash risk.

The inefficient investment caused by incomplete contracts in enterprises is an agency behavior that reduces the value of the enterprise and encroaches on the interests of investors. Negative information feedback, such as deteriorating project operating prospects, will inevitably occur in the process of inefficient investment. Once negative information is known to external investors through channels such as enterprise performance, the enterprise's reputation will be damaged, and the normal operating order will be disrupted. Management team often faces penalties such as reduced salaries, limited authority, and bad personal reputation, which can have a negative impact on their career. Therefore, in order to conceal investment misconduct and avoid external investor supervision, management has the motivation and ability to conceal negative information fed back during the inefficient investment process through methods such as manipulating earnings. In this process, due to the varying degrees of manipulation and distortion of information, the degree of information asymmetry increases. External investors cannot observe the lack of investment caused by defensive management's inaction in facing valuable investment opportunities, nor can they

timely observe management's involvement in investment projects with negative net present value, thus losing the opportunity to force management to abandon the project. Over time, negative news hidden in the inefficient investment process will continue to accumulate and be released when it reaches the limit. Some projects with negative net present value are also likely to incur losses, and even companies may be punished by regulatory authorities for accounting fraud and other violations during the inefficient investment process, leading to a sharp drop in stock prices.

The stock price crash risk comes from two aspects: internal and external governance. Internal and external governance factors have an impact on corporate agency issues and information asymmetry issues, respectively. The agency problem of enterprises mainly stems from the management's pursuit of self-interest and the concealment of bad news, which accumulates in the market and causes stock prices to plummet. Research has shown that the characteristics of executives, earnings management, smooth returns, and the "tunnelling effect" of major shareholders all significantly increase the risk of a company's stock price crash. On the contrary, some studies suggest that the shareholding of major shareholders has a certain supervisory effect, thereby reducing the risk of stock price crash. In response to a series of issues arising from agency issues, existing literature has proposed improving information disclosure of internal control in enterprises, strengthening audit supervision and accounting conservatism. The above measures all contribute to reducing the crash risk of the company through moderating effects. In terms of information asymmetry, existing literature has examined the impact of inefficient investment caused by information asymmetry on the risk of stock price crash from the perspective of securities analysts' predictions. Research has shown that the lower the information transparency of listed companies, the greater the risk of a sharp decline in their stock prices. Based on the above research, the manifestation of agency problems and information asymmetry problems in enterprises is inefficient investment. This inefficient investment further creates the risk of stock price crash. According to the theory of free cash flow, when a company has too much free cash at its disposal, it will exacerbate the agency problem between shareholders and management. Management will invest in projects with negative net present value for personal gain, resulting in excessive investment. In contrast, insufficient investment in enterprises is mainly due to management's aversion to risk and financing constraints. Insufficient investment in enterprises can have an impact on stock price crashes. In summary, the negative impact of inefficient investment behaviour is hidden by enterprise managers. At the same time, the asymmetry of information has significantly increased and affected the

behaviour of external investors. The more severe an inefficient investment, the more negative information it brings. When this information accumulates to a certain extent, the likelihood of being detected by the market also increases, ultimately leading to price crash.

All in all, does investment inefficiency enhance the relationship between technical sanctions and the risk of stock crash? To this end, I put forward the following research assumption:

Hypothesis 3: Under the same condition, investment efficiency negatively moderates the relationship between technical sanctions and the risk of stock price crash.

5. Data Description and Methodology

5.1. Data Source and Variable Definition

The data used in this article comes from Wind, a well-known financial data service provider in China, which involves two large pieces of data: (1) text of listed company's announcements from 2013 to 2022. First, I read typical announcements of listed companies, find different expressions of technical sanctions, and enumerate these expressions, then form a search rule and record whether the announcement content mentions technical sanctions or similar descriptions. A total of 23 expressions with the same or very similar meaning to technical sanctions were found, and they were collectively classified to confirm whether the specific listed company has actively disclosed whether it has been affected by technical sanctions; (2) The financial data of listed companies. The financial data used in this article is the annual report data, China's regulatory authorities require listed companies to uniformly disclose the annual report based on the natural year, so the annual data in major financial statements can be easily compared; (3) Stock price data of listed companies. Indicators like dividend reinvestment return on stocks in one year are useful in modelling.

The research focuses on all listed companies, and all listed companies can be divided into categories that have been exposed to technical sanctions and categories that have not been subjected to technical sanctions, forming more scientific research conclusions. The following introduces the core variables used in this article.

1. Technical Sanction

Technical sanction is a variable of 0 and 1. If a listed company publishes an announcement that mentions the impact of technical sanctions in one day, the next trading day corresponding to that day is day T. That is, if the announcement date is not a trading day or if the individual stock is suspended from trading for some reason, it will be postponed until the next trading day. The maximum extension time may not exceed one year as the company's stock price may also be affected by other events, and the information reflected through the data is not very effective if the time span is too long.

2. Investment Efficiency

This article adopts the classical investment efficiency measurement and measures the effectiveness of investment based on the regression residual of the Richardson model. If the residual is greater than 0, it indicates over-investment. The larger the value, the greater the

degree of over-investment. If the residual is less than 0, it indicates under-investment, and the smaller the value, the greater the degree of under-investment. The investment efficiency is the absolute residual value, and the larger the value, the lower the investment efficiency. The variables also involved are the control variables: *Growth, D2ASSET, Cash, Age, Size, Ret*, which represent the growth rate of operating revenue, asset liability ratio, cash holdings, listing years, total assets, and the annual return rate of stocks considering dividend reinvestment respectively.

3. Stock Price Crash Risk

This article uses the negative return skewness coefficient ($NCSKEW$) and the Upward volatility to Downward volatility ratio of stock returns ($DUVOL$) to measure the risk of stock price crash. The control variables refer to Cao et al. (2019), which controlled for company size, financial leverage (*D2ASSET*), total asset return (*ROA*), daily idiosyncratic return (*Ret*), volatility of stock daily returns (*Sigma*), excess daily turnover rate (*DTURN*), top shareholder shareholding ratio (*Top1*), and institutional shareholding ratio (*InsRatio*). In addition, it also controls the firm's fixed effect (Firm) and time fixed effect (Year).

Table 1 Variable Definition and Explanation

Variable	*Statement and Explanation*	*Unit*
Inv	*The newly added investment by the enterprise in one year， Inv at year t is (Cash paid for the purchase of fixed assets, intangible assets, other long-term assets- Cash obtained from selling fixed assets, intangible assets, and other long-term assets in year t)/ total assets at the beginning of year t*	*1*
Growth	*Annual revenue growth rate in one year*	*%*
D2ASSET	*Asset liability ratio at the end of the year*	*1*
Cash	*cash holdings at the end of the year*	*yuan*
Age	*Listing period until the end of the year*	*year*
Size	*total assets at the end of the year*	*yuan*
Ret	*Dividend reinvestment return on stocks in one year*	*1*
residual	*Investment efficiency: if the value is less than 0, it indicates insufficient investment; if it is greater than 0, it indicates excessive investment*	*1*
Residualabs	*The higher the value, the lower the investment efficiency, absolute value of residual*	*1*
NCSKEW	*Negative return skewness coefficient*	*1*

Variable	*Statement and Explanation*	*Unit*
DUVOL	*Upward volatility to Downward volatility ratio of stock returns*	*1*
ROA	*Return on Total Assets, ROA at year t is net income at year t/ average total assets at year t where average total assets is (total assets at the beginning of year t +total assets at the end of year t) /2*	*%*
Meanresidual	*Average daily idiosyncratic rate of return*	*1*
sigma	*The volatility of daily returns on individual stocks*	*1*
DTURN	*DTURN at year t is excess daily average turnover rate in year t, the daily average turnover rate in year t - the daily average turnover rate in year t-1*	*%*
Top1	*The shareholding ratio of the largest shareholder*	*%*
InsRatio	*Institutional stock holding ratio*	*%*
treat	*1 if the stock is subject to sanctions, otherwise 0*	*1*
Post	*If sanctioned, it is 1, and before sanction, it is 0*	*1*

5.2. Data Descriptive Statistics

The data in this study is panel data and time series ranges from 2013 to 2022. Panel data provides information about within-groups and between-groups comparisons and gives an expounded explanation of the study.

Table 2 Descriptive Statistics on Variables.

	(1)	(2)	(3)	(4)	(5)
	N	mean	sd	min	max
NCSKEW	*27,577*	*-0.539*	*0.574*	*-5.828*	*8.435*
DUVOL	*27,577*	*-0.603*	*0.534*	*-3.875*	*3.169*
DTURN	*27,577*	*-0.233*	*2.051*	*-17.06*	*13.48*
ROA	*27,572*	*3.389*	*14.10*	*-911.7*	*1,221*
Meanresidual	*27,577*	*-0.000*	*0.021*	*-1.691*	*0.391*
sigma	*27,577*	*2.918*	*0.892*	*0.715*	*7.307*
size	*27,577*	*22.40*	*1.347*	*15.98*	*28.64*
Top1	*27,577*	*33.50*	*15.14*	*0.290*	*90*
InsRatio	*27,577*	*28.87*	*25.98*	*0*	*93.8*
Growth	*27,577*	*40.48*	*2,680*	*-488.8*	*437,434*
D2ASSET	*27,577*	*43.89*	*111.5*	*-19.47*	*17,835*

	(1) N	(2) mean	(3) sd	(4) min	(5) max
cash	*27,577*	*0.211*	*1.443*	*0*	*204.1*
Ret	*27,577*	*0.183*	*0.682*	*-0.826*	*25.15*
inv	*27,577*	*0.0595*	*0.415*	*-10.18*	*60.97*
age	*27,577*	*2.184*	*0.810*	*0*	*3.466*
treat	*27,577*	*0.736*	*0.441*	*0*	*1*
Post	*27,577*	*0.852*	*0.356*	*0*	*1*
residual	*27,572*	*-5.73e-11*	*0.381*	*-2.402*	*60.73*
residualabs	*27,572*	*0.0470*	*0.379*	*3.07e-07*	*60.73*

There are a total of 19 variables, including the control variables, and the correlation coefficients are shown in the table below. It can be seen that the absolute values of the correlation coefficients between variables are not too high overall, and the influence of variable collinearity on the regression is relatively small.

Table 3 Correlation Matrix

	residual	*residualabs*	*Post*	*treat*	*NCSKEW*	*DUVOL*	*Growth*
residual	*1.000*						
residualabs	*0.978****	*1.000*					
Post	*0.000*	*-0.010**	*1.000*				
treat	*0.016****	*0.005*	*-0.004*	*1.000*			
NCSKEW	*-0.002*	*0.003*	*0.023****	*0.008*	*1.000*		
DUVOL	*-0.010*	*0.000*	*0.009*	*-0.015***	*0.868****	*1.000*	
Growth	*0.000*	*-0.001*	*-0.019****	*0.004*	*0.011**	*0.009*	*1.000*
D2ASSET	*0.000*	*0.003*	*0.021****	*-0.004*	*-0.010*	*-0.016****	*-0.001*
cash	*0.000*	*0.002*	*-0.023****	*-0.010*	*0.012***	*0.012***	*0.002*
age	*0.000*	*-0.004*	*0.428****	*-0.058****	*-0.058****	*-0.077****	*-0.018****
size2	*0.000*	*-0.056****	*0.201****	*0.045****	*-0.126****	*-0.156****	*-0.004*
Ret	*0.000*	*0.014***	*-0.050****	*0.032****	*0.067****	*0.000*	*0.001*
inv	*0.000*	*0.018****	*-0.027****	*0.017****	*0.009*	*0.004*	*0.003*
DTURN	*0.001*	*-0.002*	*0.221****	*-0.013***	*-0.009*	*-0.099****	*-0.010**
ROA	*-0.001*	*0.033****	*-0.057****	*-0.003*	*0.013***	*-0.008*	*0.001*
Meanresidual	*-0.024****	*-0.024****	*0.003*	*-0.004*	*-0.034****	*-0.003*	*-0.002*
sigma	*-0.006*	*0.004*	*0.005*	*0.049****	*0.052****	*-0.100****	*0.001*
Top1	*0.006*	*-0.004*	*-0.074****	*-0.046****	*-0.054****	*-0.043****	*0.000*
InsRatio	*0.007*	*-0.016****	*0.208****	*-0.023****	*-0.090****	*-0.115****	*0.002*

	D2ASSET	*cash*	*age*	*size2*	*Ret*	*inv*	*DTURN*
D2ASSET	*1.000*						
cash	*-0.007*	*1.000*					
age	*0.065****	*-0.011**	*1.000*				
size	*0.063****	*-0.006*	*0.389****	*1.000*			
Ret	*-0.021****	*0.024****	*-0.134****	*-0.061****	*1.000*		

	residual	*residualabs*	*Post*	*treat*	*NCSKEW*	*DUVOL*	*Growth*
inv	*-0.001*	*0.184****	*-0.034****	*0.009*	*0.021****	*1.000*	
DTURN	*0.013***	*-0.016****	*0.286****	*0.086****	*-0.198****	*-0.010*	*1.000*
ROA	*-0.448****	*0.019****	*-0.082****	*-0.013***	*0.105****	*0.014***	*-0.039****
Meanresidual	*-0.001*	*-0.005*	*-0.005*	*0.000*	*0.006*	*-0.009*	*-0.014***
sigma	*-0.005*	*0.002*	*-0.144****	*-0.264****	*0.273****	*0.008*	*0.313****
Top1	*0.015***	*0.002*	*-0.031****	*0.235****	*-0.005*	*0.004*	*-0.044****
InsRatio	*0.015***	*-0.018****	*0.224****	*0.352****	*-0.071****	*-0.013***	*0.028****

	ROA	*Meanresidual*	*sigma*	*Top1*	*InsRatio*
ROA	*1.000*				
Meanresidual	*0.005*	*1.000*			
sigma	*-0.027****	*-0.015***	*1.000*		
Top1	*0.076****	*0.005*	*-0.111****	*1.000*	
InsRatio	*0.029****	*0.004*	*-0.162****	*0.288****	*1.000*

Note： *** p<0.01, ** p<0.05, * p<0.1*

5.3. Methodology

1. Technical Sanctions

This paper takes whether there are statements representing technical sanctions in the announcement of listed companies as the standard. These statements may be enumerated by experience, such as Sino-US relations, trade sanctions, restrictions on China, etc. Listed companies do not formally mention technical sanctions in the announcement will be treated as control group (treat = 0), with others treated as treatment group (treat = 1). At that same time, for treatment group listed companies, post = 0 before the technical sanctions and post = 1 after the technical sanctions.

2. Investment Efficiency

Based on the Richardson (2006) model, the residual obtained from the least squared regression is used to measure the investment efficiency. The residual greater than 0 indicates over-investment, and the greater the value, the greater the degree of over-investment. The residual less than 0 indicates under-investment, and the smaller the value, the greater degree of underinvestment. The investment efficiency is the absolute value of the residual, and the larger the value is, the lower the investment efficiency is. For particular company i :

$$Inv_t = \alpha_0 + \alpha_1 Growth_{t-1} + \alpha_2 D2ASSET_{t-1} + \alpha_3 Cash_{t-1} + \alpha_4 Age_{t-1} + \alpha_5 Size_{t-1} + \alpha_6 Ret_{t-1} + \alpha_7 Inv_{t-1} + \sum Industry + \sum Year + \varepsilon_t \quad \ldots (1)$$

Where Inv_t is the actual new investment of the listed company in year t, Inv_{t-1} is the

amount of new investment in year t-1, and the residual represents the deviation between expectation and reality in investment, $Growth_{t-1}$, $D2ASSET_{t-1}$, $Cash_{t-1}$, Age_{t-1}, $Size_{t-1}$, Ret_{t-1} respectively represents the growth of revenue, asset-liability ratio, cash, years of listing, total assets, and annual yield of stocks considering dividend reinvestment in year t-1. It also controls the impact of industry and year. ε_t is the calculated investment efficiency, which is distinguished and represented by *residual* in the following.

3. Stock Price Crash Risk

This paper takes the announcements of all Chinese A-share listed companies in 2013 to 2022 as a sample. Refers to Kim et al. (2011) ; Mamun et al. (2020) ; Callen et al. (2013) ; Xu et al. (2014), the stock price crash risk is measured by the negative return skewness coefficient ($NCSKEW$) and the upward volatility to downward volatility ratio of stock returns ($DUVOL$). Control variables are *Size, Leverage, ROA, Ret, Sigma, DTURN*, The largest shareholder's shareholding ratio (*Top1*) and the institutional shareholding ratio (*InsRatio*). In addition, the regression controls firm fixed effect and year fixed effect. The following regression is performed on the daily return of stock i in every natural year from 2013 to 2022.

$$R_{i,t} = \alpha_i + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{i,t} \quad \ldots (2)$$

The return rate of stock *i* in the *t*-th trading day, $R_{i,t}$ considers the reinvestment of cash dividends, and $R_{m,t}$ refers to the average return rate weighted by the market value of all A-share stocks in the t-th trading day. The yearly idiosyncratic return of individual stocks is defined as:

$$W_{i,t} = \ln(1+\varepsilon_{i,t}) \quad \ldots (3)$$

Then, I construct two indicators to measure the risk of stock price crash on the company's daily idiosyncratic return. First, the risk of stock price crash is measured by the skewness coefficient of negative returns ($NCSKEW$).

$$\mathrm{NCSKEW}_{i,t} = -\frac{n(n-1)^{3/2}\sum W_{i,t}^{3}}{(n-1)(n-2)(\sum W_{i,t}^{2})^{3/2}} \quad \ldots (4)$$

Where n is the number of trading days of stock i in year t. The larger the negative return skewness coefficient, the higher the stock price crash risk.

As an alternative choice, the stock price crash risk is measured by the volatility of stock returns. For each company i and year t, I first define the day when the idiosyncratic return is less than the mean of idiosyncratic return as the falling day, and the day when the idiosyncratic return is higher than the mean as the rising day. Then calculate the standard deviation of the idiosyncratic return on the falling day and the rising day respectively, and obtain the downward volatility and the upward volatility. Finally, the downward volatility is divided by the upward volatility, and the natural logarithm is taken to obtain the indicator each year. The calculation formula is as follows:

$$\mathrm{DUVOL}_{i,t}=\log\frac{(n_u-1)\sum_{down}W_{i,t}{}^2}{(n_d-1)\sum_{up}W_{i,t}{}^2} \quad \ldots (5)$$

Where n_u and n_d represent the number of days in which the daily idiosyncratic return of a company's stock price is greater than and less than its annual average idiosyncratic return. The larger the value of $\mathrm{DUVOL}_{i,t}$, the more leftward the distribution of returns is, and the greater the risk of stock price crash.

In order to study the impact of technical sanctions on the stock price crash risk, the following model is constructed:

$$NCSKEW_{i,t} = \alpha_0 + \alpha_1 Sanction_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 MB_{i,t} + \alpha_6 Ret_{i,t} + \alpha_7 Sigma_{i,t} + \alpha_8 DTURN_{i,t} + \alpha_9 Top1_{i,t} + \alpha_{10} InsRatio_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \quad \ldots (6)$$

Among them, $NCSKEW_{i,t}$ is the company's stock price crash risk, and $Sanction_{i,t}$ is the listed company's technical sanction variable. μ_i is company fixed effect, and η_t is time fixed effect.

(1) Technology Sanctions and Investment Efficiency

The difference-in-differences model (DID) can be used to study the impact of technical sanctions. Technical sanctions are usually exogenous. Grouping the companies by whether they are sanctioned or not and further divided them into two groups according to the sanction year, so as to study the net impact of technical sanctions.

When studying the relationship between technical sanctions and investment efficiency, the samples are divided into the control group and the treatment group according to whether they are subject to technical sanctions. The samples subject to sanctions are set as the treatment group with treat = 1, while the samples without sanctions are set as the control

group with treat = 0. Meanwhile, group after sanction is set as post=1, and the value of the post is 0 before the sanction. The control variables in this section remain the same as those mentioned previously. Therefore, the DID model is constructed as follows:

$$residualabs_{i,t} = \alpha_0 + \beta_1 post * \text{treat} + \beta_2 post + \beta_3 \text{treat} + \sum \phi X_{i,t} + \vartheta \text{ year} + \mu_{i,t} \quad \ldots (8)$$

(2) Technical Sanctions and the Stock Price Crash Risk

Similarly, the difference-in-differences model (DID) can be used to study the impact of technical sanctions on the risk of stock price crash. The samples are divided into the control group and the treatment group according to whether they are subject to technical sanctions. The samples subject to sanctions are set as the treatment group with treat = 1, while the samples without sanctions are set as the control group with treat = 0. Meanwhile, the value of the post is 1 after the sanction, and the value of the post is 0 before the sanction. The control variables in this section remain the same as those previously. Therefore, the DID model is constructed as follows:

$$NCSKEW_{i,t} = \alpha_0 + \beta_1 post * treat + \beta_2 post + \beta_3 treat + \sum \phi X_{i,t} + \vartheta \, year + \mu_{i,t} \quad \ldots (9)$$

(3) The Moderating Effect of Investment Efficiency on Technical Sanctions and Stock Price Crash Risk.

Furthermore, does investment inefficiency enhance the relationship between technical sanctions and the risk of crash? The control variables in this section remain the same as those previously. Therefore, the model is constructed as follows:

$$NCSKEW_{i,t} = \alpha_0 + \beta_1 residualabs_{i,t} + \beta_2 post + \beta_3 treat + \beta_4 post * treat * residualabs_{i,t} + \sum \phi X_{i,t} + \vartheta \, year + \mu_{i,t} \quad \ldots (10)$$

6. Empirical Analysis: DID Model

Difference in Differences（DID）model is increasingly accepted and applied in the study of policy effects. The essence of the model is panel data fixed effects estimation. In summary, there are several advantages: (1) Policies are generally exogenous compared to microeconomic entities and it can avoid endogeneity, so there is no reverse causality problem. In addition, using fixed effects estimation also alleviates the problem of missing variable bias. (2) The traditional method of studying policy effects mainly involves setting a dummy variable for the occurrence of policies and then conducting regression. The Difference in Differences model is more scientific and can accurately estimate policy effects. (3) The principle and model setting of the Difference in Difference model is simple and easy to understand compared to spatial metrology.

6.1. Technical Sanctions and Investment Efficiency

As can be seen from the regression, the investment inefficiency of listed companies has increased after being sanctioned, and this relationship is significant at the 10% level. The Chinese economy has achieved rapid growth in the past few years, largely driven by investment. Listed companies in the Chinese stock market are leading companies in various industries in China. This indicates that although increasing investment can alleviate the adverse effects of sanctions on enterprises, many investments are not efficient, which can have a negative effect on investment efficiency.

Table 4 Technical Sanctions and Investment Efficiency

	(1)
	residualabs
Post	*-0.009*
	(-1.19)
treat	*-0.004*
	(-0.31)
c.Post#c.treat	*0.020**
	(1.70)
Growth	*-0.000*
	(-0.69)
D2ASSET	*-0.000***
	(-2.48)
cash	*0.003*
	(1.58)

	(1)
	residualabs
age	0.055
	(1.53)
size	-0.135
	(-1.56)
Ret	0.002
	(0.59)
inv	-0.080***
	(-4.04)
Constant	2.898
	(1.60)
Observations	27,572
N Company	4,094
R2	0.029
Company FE	YES
Year FE	YES
R2_a	0.0288
F	11.14

*Note：Robust t-statistics in parentheses and *** p<0.01, ** p<0.05, * p<0.*1

6.1.1 Robustness

The above main effect regression reflects the relationship between technical sanctions and investment. In this section's robustness check, inefficient investment is divided into over-investment (Residual>=0) and under-investment (Residual<0). It can be seen that the regression results are all positively correlated, indicating that companies subject to technical sanctions will promote inefficiency of investment. For listed companies with under-investment, sanctions further enhance their under-investment, and this inefficiency reflects consistency in over investment.

Table 5 Technical Sanctions and Overinvestment or Underinvestment

	(1)	(2)
	Residual>=0	Residual<0
	residualabs	residualabs
Post	-0.011	-0.006
	(-0.39)	(-1.41)
treat	-0.005	-0.006***
	(-0.14)	(-3.12)
c.Post#c.treat	0.010	0.003

	(1) Residual>=0 residualabs	(2) Residual<0 residualabs
	(0.34)	(0.68)
Growth	0.000	-0.000
	(1.16)	(-0.91)
D2ASSET	0.001**	-0.000***
	(2.46)	(-18.08)
cash	0.008	-0.002**
	(1.20)	(-2.30)
age	0.177	0.010***
	(1.32)	(5.38)
size	-0.405	-0.015***
	(-1.61)	(-3.03)
Ret	-0.021	0.007***
	(-0.98)	(9.72)
inv	0.007	0.013***
	(0.06)	(17.85)
Constant	8.634	0.361***
	(1.63)	(3.34)
Observations	10,353	17,219
R2	0.066	0.114
N Company	2,905	3,534
Company FE	YES	YES
Year FE	YES	YES
R2_a	0.0645	0.113
F	3.055	297.5

*Note：Robust t-statistics in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

6.2. Technical Sanctions and Stock Price Crash Risk

After the company was sanctioned, the crash risk of stock price did increase, but the correlation coefficient was not significant, and this impact was not statistically significant.

Table 6 Technical Sanctions and Stock Price Crash Risk

	(1)
	NCSKEW
Post	0.053**
	(2.37)
treat	0.006
	(0.28)
c.Post#c.treat	0.027
	(1.22)
Growth	0.000***
	(11.27)
D2ASSET	0.000***
	(5.25)
cash	0.000
	(0.65)
age	-0.217***
	(-10.74)
size	0.001
	(0.11)
Ret	0.090***
	(10.10)
inv	0.006*
	(1.76)
Constant	-0.342*
	(-1.70)
Observations	27,572
N Company	4,094
R2	0.139
Company FE	YES
Year FE	YES
R2_a	0.139
F	221.3

*Note：Robust t-statistics in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

6.2.1 Robustness

This section conducts a robustness check by replacing the indicator used to measure stock price crash. It is found that the risk of stock price crash does increase after listed companies are sanctioned, but this relationship is not statistically significant.

Table 7 Technical Sanctions and Stock Price Crash Risk-2

	(1) DUVOL
Post	0.065***
	(3.25)
treat	-0.029*
	(-1.66)
c.Post#c.treat	0.018
	(0.95)
Growth	0.000***
	(5.55)
D2ASSET	0.000**
	(2.06)
cash	-0.000
	(-0.13)
age	-0.243***
	(-12.98)
size	0.006
	(0.71)
Ret	0.061***
	(8.66)
inv	0.007*
	(1.82)
Constant	-0.474**
	(-2.56)
Observations	27,572
N Company	4,094
R2	0.204
Company FE	YES
Year FE	YES
R2_a	0.203
F	271.5

*Note：Robust t-statistics in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

6.3. Technical Sanctions & Stock Price Crash Risk & Investment Efficiency

This section empirically researches the relationship between technical sanctions, stock price crash risk, and investment efficiency. The research focuses on stock price crash risk. Regression (1) studies the impact of investment efficiency on stock price crash risk. It can

be found that the lower the investment efficiency, the greater the risk of crash, but this relationship is not statistically significant. Regression (2) studied the impact of technical sanctions on the relationship between investment efficiency and stock crash risk. It can be seen that technical sanctions negatively weaken the relationship between investment efficiency and stock price crash risk, that is, after a company is subject to technical sanctions, the impact of investment efficiency on stock price crash risk becomes weaker. The weakening of this relationship stems from two potential aspects: firstly, the impact of technical sanctions on investment efficiency, which has been partially verified before. Secondly, technical sanctions can also have an impact on the risk of stock price crash. In previous studies, it was found that technical sanctions increase the risk of price crash, but this relationship is not very significant. Therefore, comprehensive analysis shows that technical sanctions weaken the impact of investment inefficiency on the risk of stock price crash, and the mechanism is that the investment inefficiency of listed companies increases after technical sanctions and absorbs some of the impacts on the risk of stock price crash, thus reflecting the reduction of the impact of investment inefficiency on the risk of stock price crash. However, this relationship still lacks sufficient statistical support.

Table 8 Technical Sanctions and Stock Price Crash Risk and Investment Efficiency

	(1)	(2)
	NCSKEW	*NCSKEW*
residualabs	*0.008*	*0.091*
	(1.41)	*(1.17)*
Post		*0.076****
		(4.39)
treat		*0.0118*
		(1.06)
c.Post#c.treat#c.residualabs		*-0.086*
		(-1.11)
Growth	*0.000****	*0.000****
	(11.15)	*(11.27)*
D2ASSET	*0.000****	*0.000****
	(5.13)	*(5.03)*
cash	*0.000*	*0.000*
	(0.44)	*(0.61)*
age	*-0.176****	*-0.217****
	(-10.24)	*(-10.85)*
size	*0.003*	*0.004*
	(0.38)	*(0.48)*

	(1)	(2)
	NCSKEW	*NCSKEW*
Ret	*0.089****	*0.090****
	(9.94)	*(10.09)*
inv	*0.007***	*0.007**
	(2.16)	*(1.84)*
Constant	*-0.468***	*-0.420***
	(-2.38)	*(-2.09)*
Observations	*27,572*	*27,572*
R2	*0.139*	*0.139*
N Company	*4,094*	*4,094*
Company FE	*YES*	*YES*
Year FE	*YES*	*YES*
R2_a	*0.138*	*0.139*
F	*235.3*	*210.8*

*Note：Robust t-statistics in parentheses and *** p<0.01, ** p<0.05, * p<0.1*

7. Empirical Analysis: Event Study of Technical Sanctions

This section analyses the short-term event impact of technical sanctions and the event impact is the impact on the stock price of all listed companies mentioned technical sanctions in the announcement. This differs significantly from DID analysis in two aspects: firstly, the sample is different. The DID model distinguishes between companies that are subject to technical sanctions and those not mentioned in the announcement and research on whether technical sanctions have an impact on companies. Secondly, there are differences in target. The DID model focuses on analysing the long-term fundamental impact based on the company's changes over a long period of time. The time range for event analysis is much shorter, usually not exceeding 30 trading days, and the impact of events is greatly influenced by market sentiment in the short term, gradually returning to equilibrium in the long term.

The following table shows the abnormal returns of all companies for the 30 trading days before and after the announcement of technical sanctions (trading day T) from 2013 to 2022. The abnormal returns are the excess returns of individual stocks relative to the Shanghai-Shenzhen 300 Index, and the dispersion of abnormal returns (std) and the t-value of the difference between abnormal returns and 0 for all samples from T-30 to T+30 are calculated. Only 7 trading days had an average abnormal return of less than 0, but these 7 abnormal returns are not significant, indicating a lack of statistical evidence. Among the remaining 54 average returns above 0, 48 of them have t-values bigger than 1.64, and 39 sections have t-values bigger than 2.58. Overall, within the range of 30 trading days before and after the announcement of technical sanctions by listed companies, the excess returns of the samples subject to technical sanctions are very significant. Technical sanctions tend to have a negative impact, indicating that the stock prices of these companies had already pre and excessively reflected the negative impact of technical sanctions 30 trading days prior to the announcement of such sanctions and excess returns rebound when reaching the T-30 to T+30 time range as a whole.

Table 9 Technical Sanctions and Abnormal Return

T	*ab_return*	*count*	*std*	*t*
-30	*0.06%*	*18318*	*2.96%*	*2.81*
-29	*0.04%*	*18324*	*3.05%*	*1.60*
-28	*0.06%*	*18324*	*3.32%*	*2.28*
-27	*0.08%*	*18324*	*3.03%*	*3.70*
-26	*0.07%*	*18324*	*3.55%*	*2.59*
-25	*0.05%*	*18324*	*3.05%*	*2.04*
-24	*0.06%*	*18325*	*3.02%*	*2.71*
-23	*0.04%*	*18325*	*3.09%*	*1.65*
-22	*0.07%*	*18325*	*3.85%*	*2.37*
-21	*0.06%*	*18325*	*3.46%*	*2.18*
-20	*-0.01%*	*18325*	*3.02%*	*-0.25*
-19	*-0.03%*	*18325*	*3.06%*	*-1.47*
-18	*-0.03%*	*18325*	*3.16%*	*-1.08*
-17	*0.04%*	*18326*	*3.10%*	*1.77*
-16	*0.07%*	*18326*	*3.59%*	*2.59*
-15	*0.05%*	*18327*	*3.20%*	*2.32*
-14	*0.08%*	*18327*	*2.96%*	*3.45*
-13	*0.03%*	*18327*	*3.06%*	*1.36*
-12	*0.05%*	*18327*	*3.29%*	*1.99*
-11	*0.04%*	*18328*	*4.83%*	*1.06*
-10	*-0.01%*	*18328*	*3.38%*	*-0.56*
-9	*-0.03%*	*18329*	*3.13%*	*-1.49*
-8	*-0.01%*	*18329*	*3.10%*	*-0.60*
-7	*0.06%*	*18329*	*3.02%*	*2.81*
-6	*0.06%*	*18329*	*3.05%*	*2.87*
-5	*0.02%*	*18329*	*3.08%*	*0.90*
-4	*0.04%*	*18329*	*3.09%*	*1.61*
-3	*0.07%*	*18329*	*3.36%*	*2.70*
-2	*0.00%*	*18329*	*3.66%*	*-0.12*
-1	*0.02%*	*18329*	*3.36%*	*0.61*
0	*0.46%*	*18329*	*13.43%*	*4.66*
1	*0.16%*	*18329*	*3.43%*	*6.33*
2	*0.21%*	*18327*	*8.54%*	*3.30*
3	*0.11%*	*18325*	*3.66%*	*4.12*
4	*0.14%*	*18322*	*4.34%*	*4.32*
5	*0.13%*	*18320*	*3.81%*	*4.57*
6	*0.16%*	*18318*	*4.77%*	*4.44*
7	*0.08%*	*18310*	*3.09%*	*3.57*
8	*0.16%*	*18308*	*3.69%*	*5.84*

T	*ab_return*	*count*	*std*	*t*
9	*0.09%*	*18304*	*3.66%*	*3.18*
10	*0.13%*	*18301*	*4.77%*	*3.70*
11	*0.13%*	*18296*	*3.47%*	*5.15*
12	*0.14%*	*18292*	*4.62%*	*4.07*
13	*0.08%*	*18285*	*3.25%*	*3.29*
14	*0.15%*	*18279*	*3.95%*	*5.12*
15	*0.12%*	*18277*	*3.65%*	*4.57*
16	*0.17%*	*18271*	*3.67%*	*6.16*
17	*0.17%*	*18267*	*3.23%*	*7.05*
18	*0.20%*	*18264*	*6.75%*	*3.96*
19	*0.09%*	*18260*	*3.65%*	*3.31*
20	*0.12%*	*18258*	*5.74%*	*2.71*
21	*0.09%*	*18252*	*3.70%*	*3.45*
22	*0.11%*	*18247*	*6.64%*	*2.22*
23	*0.12%*	*18246*	*4.24%*	*3.84*
24	*0.13%*	*18239*	*4.28%*	*4.05*
25	*0.17%*	*18236*	*4.33%*	*5.44*
26	*0.19%*	*18233*	*4.89%*	*5.34*
27	*0.17%*	*18228*	*3.50%*	*6.64*
28	*0.16%*	*18225*	*3.45%*	*6.22*
29	*0.19%*	*18221*	*3.48%*	*7.33*
30	*0.16%*	*18216*	*4.82%*	*4.51*

The above analysis is an analysis of the entire sample of announcements subject to technical sanctions. In this section, all samples are distinguished by industry to study the differences in the impact of technical sanctions among different industries. Due to the length of the article, I only list the results of a total of 11 trading days for [T-5, T+5]. It can be seen that only three industries, Capital equipment, Electrical equipment, and Electronics, have over half of the absolute t-values of abnormal returns on the designated trading days greater than 1.64, which is statistically significant at least at the 10% level. Technical sanctions have an impact on specific industries, but their impact on other industries is relatively limited.

The industry classification used is the industry classification standard launched by SHENWAN HONGYUAN Securities in 2021, which is the most widely used classification standard in the Chinese capital market.

Table 10 Technical Sanctions and Abnormal Return in Different Industries

INDUSTRIES	*Capital equipment*		*Electrical equipment*		*Electronics*	
T	*ab_return*	*t*	*ab_return*	*t*	*ab_return*	*t*
-5	*0.14%*	*1.94*	*-0.01%*	*-0.08*	*-0.07%*	*-1.22*
-4	*0.12%*	*1.77*	*0.12%*	*1.24*	*0.04%*	*0.6*
-3	*0.16%*	*2.19*	*0.30%*	*2.97*	*0.13%*	*1.58*
-2	*-0.03%*	*-0.39*	*0.19%*	*1.76*	*-0.02%*	*-0.31*
-1	*0.15%*	*2.07*	*0.11%*	*1.1*	*0.01%*	*0.17*
0	*0.15%*	*1.52*	*0.17%*	*1.49*	*2.09%*	*3.73*
1	*0.30%*	*3.5*	*0.30%*	*2.67*	*0.18%*	*2.59*
2	*0.22%*	*2.99*	*0.27%*	*2.84*	*0.10%*	*1.66*
3	*0.10%*	*1.43*	*0.34%*	*3.6*	*0.12%*	*1.94*
4	*0.36%*	*1.9*	*0.17%*	*1.79*	*0.19%*	*2.94*
5	*0.23%*	*2.84*	*0.17%*	*1.78*	*0.28%*	*2.58*

Figure 1 Technical Sanctions and abnormal return in different industries

ab_return	Capitalequipment	Electricalequipment	Electronics	Agriculture	Automobiles	Banks	Basicchemicals	Beautycare	Buildingmaterials	Communications	Computer	Conglomerates	Construction&Decoration	Defence	Environmentalprotection	Food&Beverage	Homeappliances	Homeappliances	Homeappliances	Lightindustry	Media	Non-bankingfinancials	Non-ferrousmetals	Petroleumandpetrochemical	Pharmaceuticals&biotech	Realestate	Socialservices	Steel	Textiles&Apparel	Transportation	Utilities
T（-5）	0.14%	-0.01%	-0.07%	0.31%	0.04%	-0.06%	0.03%	0.93%	0.17%	-0.08%	0.01%	-0.38%	-0.08%	-0.04%	0.19%	0.12%	0.11%	0.11%	0.11%	-0.02%	-0.05%	0.01%	0.11%	0.02%	-0.04%	-0.12%	0.28%	-0.02%	-0.20%	0.04%	0.21%
T（-4）	0.12%	0.12%	0.04%	0.08%	-0.11%	0.02%	0.02%	-0.30%	0.05%	-0.25%	-0.09%	-0.04%	-0.09%	-0.03%	-0.20%	0.31%	0.12%	0.12%	0.12%	0.10%	-0.12%	0.11%	0.16%	0.36%	0.11%	0.32%	0.52%	0.16%	-0.10%	0.14%	-0.33%
T（-3）	0.16%	0.30%	0.13%	0.41%	-0.03%	0.15%	0.07%	0.48%	-0.04%	-0.13%	0.27%	-0.37%	-0.25%	0.33%	-0.32%	0.05%	0.12%	0.12%	0.12%	-0.25%	0.02%	0.08%	-0.02%	0.03%	-0.08%	-0.22%	0.06%	0.25%	-0.17%	-0.06%	-0.22%
T（-2）	-0.03%	0.19%	-0.02%	0.03%	-0.02%	-0.12%	0.01%	0.07%	0.01%	0.06%	0.01%	-0.41%	-0.08%	0.03%	-0.58%	0.78%	-0.21%	-0.21%	-0.21%	-0.12%	-0.02%	0.07%	0.16%	-0.12%	-0.12%	-0.33%	0.04%	0.11%	-0.21%	0.12%	0.18%
T（-1）	0.15%	0.11%	0.01%	0.00%	-0.06%	0.09%	0.05%	0.22%	0.40%	0.10%	0.01%	-0.55%	-0.07%	0.11%	-0.79%	0.32%	-0.10%	-0.10%	-0.10%	-0.07%	-0.23%	0.12%	-0.06%	-0.27%	-0.02%	0.05%	-0.18%	0.31%	-0.22%	0.06%	-0.09%
T（0）	0.15%	0.17%	2.09%	0.15%	0.06%	0.31%	0.42%	-0.75%	0.28%	-0.06%	-0.06%	0.82%	0.20%	0.07%	0.20%	3.91%	-0.17%	-0.17%	-0.17%	0.05%	0.01%	-0.13%	-0.13%	0.06%	0.11%	0.15%	0.16%	0.28%	-0.05%	0.29%	-0.38%
T（1）	0.30%	0.30%	0.18%	-0.04%	0.13%	0.08%	0.13%	0.47%	0.42%	0.07%	0.04%	-0.12%	0.13%	0.29%	0.27%	0.31%	0.21%	0.21%	0.21%	-0.05%	-0.18%	0.10%	0.11%	0.11%	0.22%	0.09%	-0.26%	0.16%	0.17%	0.07%	0.25%
T（2）	0.22%	0.27%	0.10%	0.24%	0.12%	0.03%	0.29%	0.34%	0.03%	-0.03%	-0.10%	0.09%	-0.02%	0.21%	0.34%	0.51%	0.21%	0.21%	0.21%	0.13%	0.03%	-0.11%	0.23%	0.06%	1.26%	-0.08%	-0.38%	0.16%	0.26%	0.02%	-0.16%
T（3）	0.10%	0.34%	0.12%	0.14%	0.20%	0.29%	0.17%	1.14%	0.07%	0.15%	0.01%	0.05%	0.05%	0.01%	-0.10%	0.96%	0.14%	0.14%	0.14%	0.00%	-0.10%	-0.13%	-0.03%	-0.04%	0.09%	-0.07%	-0.07%	0.01%	-0.08%	-0.05%	0.05%
T（4）	0.36%	0.17%	0.19%	0.14%	0.10%	-0.19%	0.13%	0.71%	0.12%	-0.07%	0.09%	-0.42%	0.09%	0.23%	-0.35%	0.77%	0.46%	0.46%	0.46%	0.22%	0.19%	-0.22%	-0.17%	0.06%	0.02%	0.12%	0.31%	-0.03%	-0.02%	0.13%	-0.06%
T（5）	0.0023	0.0017	0.0028	-0.0005	0.0005	-0.0019	0.0014	-0.0031	0.0028	0.001	0.0014	0	-0.001	0.0009	0.0048	0.0058	0	0	0	0.0032	0.0023	-0.0005	0.0018	-0.0045	0.0004	0.0001	0.0018	0.0063	-0.0033	0.0013	-0.0024

t-stat	Capitalequipment	Electricalequipment	Electronics	Agriculture	Automobiles	Banks	Basicchemicals	Beautycare	Buildingmaterials	Coal	Commerce&Retailng	Communications	Computer	Conglomerates	Construction&Decoration	Defence	Environmentalprotection	Food&Beverage	Homeappliances	Lightindustry	Media	Non-bankingfinancials	Non-ferrousmetals	Petroleumandpetrochemical	Pharmaceuticals&biotech	Realestate	Socialservices	Steel	Textiles&Apparel	Transportation	Utilities
T（-5）	1.94	-0.08	-1.22	1.68	0.49	-0.61	0.38	1.8	0.82	1	0.13	-0.69	0.07	-1.23	-0.67	-0.23	0.63	0.52	0.6	-0.17	-0.24	0.09	0.9	0.09	-0.5	-0.66	1.02	-0.08	-1.41	0.33	1.02
T（-4）	1.77	1.24	0.6	0.48	-1.38	0.16	0.22	-0.67	0.26	-0.42	0.61	-1.96	-0.96	-0.08	-0.7	-0.22	-0.58	1.38	0.81	0.88	-0.58	0.76	1.21	1.97	1.23	1.55	1.61	0.68	-0.69	1.1	-1.77
T（-3）	2.19	2.97	1.58	2.45	-0.35	1.28	0.92	1.43	-0.2	0.65	-1.61	-1.05	2.54	-0.78	-2.12	2.04	-0.99	0.17	0.81	-2.25	0.12	0.79	-0.18	0.14	-0.86	-1.07	0.22	0.91	-1.13	-0.54	-1.09
T（-2）	-0.39	1.76	-0.31	0.18	-0.21	-0.75	0.07	0.17	0.03	-0.36	-0.18	0.51	0.12	-0.86	-0.54	0.2	-1.77	2.87	-1.15	-0.91	-0.1	0.55	1.27	-0.68	-1.27	-1.44	0.17	0.42	-1.37	0.83	0.77
T（-1）	2.07	1.1	0.17	0.01	-0.66	0.71	0.59	0.5	1.72	0.14	-1.44	0.62	0.09	-1.34	-0.52	0.62	-2.49	1.23	-0.68	-0.52	-0.87	0.9	-0.45	-1.48	-0.22	0.2	-0.75	1.03	-1.52	0.43	-0.36
T（0）	1.52	1.49	3.73	0.72	0.53	2.06	1.55	-1.16	1	0.69	-0.19	-0.35	-0.46	1.25	1.02	0.34	0.56	1.56	-0.84	0.36	0.05	-0.89	-0.93	0.28	0.88	0.56	0.51	0.99	-0.27	1.93	-1.67
T（1）	3.5	2.67	2.59	-0.22	1.52	0.58	1.72	1.16	1.65	1.17	-0.75	0.56	0.35	-0.19	0.93	1.65	1.1	1.21	1.24	-0.34	-0.81	0.77	0.82	0.65	2.31	0.49	-1.04	0.76	1.04	0.6	1.15
T（2）	2.99	2.84	1.66	1.32	1.45	0.25	3.8	0.92	0.13	0.37	1.54	-0.22	-0.97	0.22	-0.19	1.23	1.41	1.38	1.37	1.03	0.13	-0.94	1.89	0.29	1.3	-0.46	-1.41	0.75	1.71	0.12	-0.71
T（3）	1.43	3.6	1.94	0.75	0.89	1.16	2.32	3.06	0.36	0.88	-0.56	1.15	0.1	0.13	0.4	0.07	-0.46	2.75	0.92	-0.01	-0.45	-1.08	-0.21	-0.18	1.12	-0.39	-0.27	0.05	-0.56	-0.43	0.31
T（4）	1.9	1.79	2.94	0.79	1.22	-1.97	1.77	1.95	0.57	-0.91	0.24	-0.58	0.87	-0.82	0.73	1.51	-1.62	2.21	2.19	1.11	0.78	-1.98	-1.56	0.35	0.2	0.71	1.02	-0.15	-0.14	1.13	-0.29
T（5）	2.84	1.78	2.58	-0.36	0.67	-1.6	1.74	-0.81	1.29	-0.33	-1.55	0.76	1.43	0	-0.71	0.6	1.9	1.57	0	1.49	1.05	-0.49	1.56	-2.69	0.41	0.07	0.65	2.46	-2.43	1.17	-1.27

Will technical sanctions exhibit different characteristics in different years? The following table shows the impact in different years. Among them, in 2018, the China US trade frictions officially began and was still in the early stages of technical sanctions. The total number of companies on different trading days affected by the trade war was announced to be 12, and none of them were significant. Since 2019, the number of companies affected by technical sanctions has exploded. From 2019 to 2022, the annual [T, T+5] returns have been positive, with some differences in significance on individual dates. However, in the [T-5, T-1] time period of these four years, returns on different dates may been positive or negative, which cannot reflect stable abnormal returns. This indicates that the probability of [T, T+5] abnormal returns being positive is high in different years, while the uncertainty of [T-5, T-1] abnormal returns is strong.

Table 11 Technical Sanctions and Abnormal Returns in Different Years

	2018 (count12)		*2019 (count1949)*		*2020 (count7271)*		*2021 (count5844)*		*2022 (count3244)*	
T	*ab_return*	*std*	*ab_return*	*std*	*ab_return*	*std*	*ab_return*	*std*	*ab_return*	*std*
-5	*-0.54%*	*2.21%*	*-0.05%*	*2.63%*	*0.03%*	*3.01%*	*0.02%*	*3.29%*	*0.06%*	*3.11%*
	(-0.85)		*(-0.85)*		*(0.76)*		*(0.35)*		*(1.12)*	
-4	*0.20%*	*2.06%*	*-0.01%*	*2.73%*	*-0.03%*	*2.98%*	*0.23%*	*3.33%*	*-0.13%*	*3.09%*
	(0.34)		*(-0.16)*		*(-0.86)*		*(5.23)*		*(-2.44)*	
-3	*0.91%*	*2.74%*	*0.04%*	*2.69%*	*-0.02%*	*3.20%*	*0.21%*	*3.28%*	*0.02%*	*4.12%*
	(1.15)		*(0.71)*		*(-0.56)*		*(4.92)*		*(0.25)*	
-2	*-0.90%*	*2.78%*	*-0.09%*	*2.82%*	*-0.01%*	*3.27%*	*0.07%*	*4.48%*	*-0.06%*	*3.26%*
	(-1.12)		*(-1.44)*		*(-0.27)*		*(1.17)*		*(-1.02)*	
-1	*1.19%*	*3.16%*	*0.14%*	*3.03%*	*-0.09%*	*3.32%*	*0.10%*	*3.60%*	*0.03%*	*3.21%*
	(1.3)		*(2)*		*(-2.39)*		*(2.14)*		*(0.46)*	
0	*0.73%*	*3.11%*	*0.08%*	*4.32%*	*0.38%*	*11.87%*	*0.40%*	*13.16%*	*0.99%*	*19.49%*
	(0.81)		*(0.8)*		*(2.72)*		*(2.32)*		*(2.91)*	
1	*0.11%*	*2.18%*	*0.11%*	*2.93%*	*0.03%*	*3.26%*	*0.27%*	*3.93%*	*0.28%*	*3.05%*
	(0.17)		*(1.71)*		*(0.77)*		*(5.3)*		*(5.15)*	
2	*-0.85%*	*1.67%*	*0.10%*	*2.80%*	*0.14%*	*12.86%*	*0.27%*	*3.94%*	*0.30%*	*2.88%*
	(-1.77)		*(1.58)*		*(0.95)*		*(5.33)*		*(5.97)*	
3	*0.29%*	*3.66%*	*0.01%*	*2.82%*	*0.01%*	*3.05%*	*0.22%*	*4.74%*	*0.21%*	*3.09%*
	(0.28)		*(0.19)*		*(0.23)*		*(3.49)*		*(3.92)*	
4	*0.97%*	*2.81%*	*0.02%*	*2.63%*	*0.07%*	*3.33%*	*0.28%*	*6.13%*	*0.12%*	*3.08%*
	(1.19)		*(0.28)*		*(1.7)*		*(3.48)*		*(2.16)*	
5	*3.78%*	*14.80%*	*0.08%*	*2.67%*	*0.09%*	*4.48%*	*0.17%*	*3.59%*	*0.15%*	*2.90%*
	(0.89)		*(1.27)*		*(0.0448)*		*(0.0017)*		*(3.62)*	

If the market value of a company on the announcement date is larger, the market value group number of the company will be larger, and all companies will be divided into 5 groups based on market value. Distinguishing companies with different market values, it can be seen that companies with higher Group numbers, such as Group=4 or Group=5 have a high probability of positive abnormal returns in the [T, T+5] time range, while there is no similar pattern in the [T-5, T-1] time range.

Table 12 Technical Sanctions and Abnormal Returns with Different Market Value

Group	*T*	*ab_return*	*count*	*std*	*t*
1	*-5*	*-0.46%*	*86*	*3.95%*	*-1.09*
2	*-5*	*0.53%*	*98*	*3.99%*	*1.32*
3	*-5*	*0.08%*	*92*	*4.23%*	*0.19*
4	*-5*	*-0.07%*	*112*	*3.73%*	*-0.21*
5	*-5*	*-0.07%*	*83*	*3.12%*	*-0.22*
1	*-4*	*0.74%*	*77*	*4.26%*	*1.52*
2	*-4*	*1.26%*	*81*	*4.63%*	*2.44*
3	*-4*	*0.36%*	*87*	*4.55%*	*0.74*
4	*-4*	*0.82%*	*94*	*3.53%*	*2.24*
5	*-4*	*0.50%*	*78*	*3.75%*	*1.17*
1	*-3*	*-0.13%*	*65*	*3.12%*	*-0.34*
2	*-3*	*0.09%*	*83*	*3.79%*	*0.21*
3	*-3*	*0.25%*	*85*	*3.97%*	*0.59*
4	*-3*	*0.49%*	*70*	*3.44%*	*1.20*
5	*-3*	*0.50%*	*76*	*3.30%*	*1.33*
1	*-2*	*-0.80%*	*63*	*3.88%*	*-1.64*
2	*-2*	*-0.06%*	*74*	*4.06%*	*-0.13*
3	*-2*	*0.37%*	*79*	*5.25%*	*0.63*
4	*-2*	*0.62%*	*88*	*3.97%*	*1.47*
5	*-2*	*0.19%*	*75*	*3.62%*	*0.46*
1	*-1*	*-0.33%*	*72*	*3.96%*	*-0.71*
2	*-1*	*-0.07%*	*98*	*4.52%*	*-0.15*
3	*-1*	*-0.96%*	*95*	*4.54%*	*-2.07*
4	*-1*	*0.30%*	*86*	*3.29%*	*0.85*
5	*-1*	*0.47%*	*75*	*3.09%*	*1.31*
1	*0*	*-0.07%*	*3677*	*4.14%*	*-1.01*
2	*0*	*-0.08%*	*3680*	*4.06%*	*-1.26*
3	*0*	*0.78%*	*3714*	*11.77%*	*4.06*
4	*0*	*15.67%*	*3806*	*85.64%*	*11.29*
5	*0*	*0.62%*	*3673*	*10.76%*	*3.50*
1	*1*	*0.30%*	*71*	*4.81%*	*0.52*

Group	T	ab_return	count	std	t
2	1	0.54%	100	6.01%	0.89
3	1	0.26%	93	5.12%	0.49
4	1	0.82%	88	4.23%	1.82
5	1	0.13%	74	4.04%	0.28
1	2	0.39%	64	4.78%	0.65
2	2	1.05%	75	5.44%	1.67
3	2	0.25%	80	5.39%	0.41
4	2	1.37%	84	5.54%	2.26
5	2	0.39%	76	3.72%	0.91
1	3	-0.03%	65	3.77%	-0.06
2	3	0.06%	84	5.96%	0.09
3	3	-0.34%	85	4.85%	-0.64
4	3	0.36%	68	4.44%	0.68
5	3	0.94%	76	4.38%	1.87
1	4	1.14%	84	5.81%	1.79
2	4	-0.12%	71	5.16%	-0.19
3	4	-0.45%	89	5.65%	-0.75
4	4	0.99%	97	4.57%	2.14
5	4	0.27%	76	3.28%	0.71
1	5	0.99%	87	4.36%	2.12
2	5	-0.55%	93	4.42%	-1.20
3	5	0.45%	103	5.32%	0.86
4	5	0.62%	104	4.63%	1.36
5	5	0.56%	84	4.76%	1.08

If the company has a higher P/B ratio on the announcement date T, the larger the P/B ratio group number it belongs to, and all companies will be divided into 5 groups based on P/B ratio. Distinguishing companies with different market value to book value. It can be seen that the higher the Group value, the more expensive the stock is. For example, the signal of Group=4 and Group=5 has a high probability of a positive abnormal return rate in the [T, T+5] time range, while there is no similar pattern in the [T-5, T-1] time range.

Table 13 Technical Sanctions and Abnormal Returns with Different Market to Book Value

Group	T	ab_return	count	std	T
1	-5	-1.04%	78	2.54%	-3.63
2	-5	-0.47%	78	2.61%	-1.58
3	-5	-0.45%	94	2.61%	-1.68
4	-5	0.63%	102	4.43%	1.45
5	-5	0.85%	119	5.05%	1.84

Group	*T*	*ab_return*	*count*	*std*	*T*
1	*-4*	*0.08%*	*53*	*3.97%*	*0.15*
2	*-4*	*0.41%*	*74*	*3.22%*	*1.10*
3	*-4*	*0.41%*	*67*	*3.72%*	*0.91*
4	*-4*	*1.03%*	*108*	*4.83%*	*2.22*
5	*-4*	*1.15%*	*115*	*4.30%*	*2.86*
1	*-3*	*-0.48%*	*57*	*2.54%*	*-1.44*
2	*-3*	*0.37%*	*61*	*3.46%*	*0.82*
3	*-3*	*-0.02%*	*67*	*2.78%*	*-0.07*
4	*-3*	*0.81%*	*94*	*3.96%*	*1.99*
5	*-3*	*0.23%*	*100*	*4.11%*	*0.57*
1	*-2*	*-0.51%*	*58*	*3.08%*	*-1.25*
2	*-2*	*-0.61%*	*65*	*3.74%*	*-1.31*
3	*-2*	*0.12%*	*69*	*3.96%*	*0.24*
4	*-2*	*0.03%*	*80*	*5.03%*	*0.04*
5	*-2*	*0.96%*	*107*	*4.42%*	*2.24*
1	*-1*	*-0.96%*	*85*	*3.08%*	*-2.87*
2	*-1*	*-0.12%*	*64*	*3.61%*	*-0.26*
3	*-1*	*0.05%*	*73*	*3.55%*	*0.12*
4	*-1*	*-0.12%*	*83*	*4.51%*	*-0.24*
5	*-1*	*0.28%*	*121*	*4.56%*	*0.68*
1	*0*	*-0.22%*	*3695*	*3.63%*	*-3.64*
2	*0*	*-0.09%*	*3680*	*3.66%*	*-1.51*
3	*0*	*0.08%*	*3672*	*3.86%*	*1.27*
4	*0*	*0.25%*	*3686*	*4.26%*	*3.54*
5	*0*	*16.81%*	*3817*	*86.58%*	*12.00*
1	*1*	*-0.66%*	*86*	*4.01%*	*-1.52*
2	*1*	*-0.26%*	*66*	*3.89%*	*-0.55*
3	*1*	*0.47%*	*73*	*5.35%*	*0.75*
4	*1*	*0.88%*	*82*	*6.01%*	*1.33*
5	*1*	*1.25%*	*119*	*4.89%*	*2.79*
1	*2*	*-0.77%*	*58*	*3.60%*	*-1.62*
2	*2*	*1.44%*	*64*	*5.42%*	*2.13*
3	*2*	*0.34%*	*74*	*4.32%*	*0.68*
4	*2*	*0.54%*	*76*	*4.93%*	*0.95*
5	*2*	*1.44%*	*107*	*5.82%*	*2.56*
1	*3*	*-0.86%*	*58*	*4.33%*	*-1.50*
2	*3*	*-0.06%*	*59*	*3.95%*	*-0.12*
3	*3*	*-0.81%*	*71*	*3.10%*	*-2.19*
4	*3*	*0.81%*	*92*	*5.65%*	*1.37*
5	*3*	*1.09%*	*98*	*5.43%*	*1.99*

Group	*T*	*ab_return*	*count*	*std*	*T*
1	*4*	*0.22%*	*51*	*3.82%*	*0.41*
2	*4*	*0.01%*	*78*	*4.93%*	*0.02*
3	*4*	*0.76%*	*69*	*4.87%*	*1.30*
4	*4*	*0.61%*	*107*	*5.86%*	*1.08*
5	*4*	*0.30%*	*112*	*4.82%*	*0.66*
1	*5*	*-0.91%*	*80*	*4.31%*	*-1.89*
2	*5*	*0.00%*	*76*	*4.71%*	*0.00*
3	*5*	*0.25%*	*96*	*4.38%*	*0.56*
4	*5*	*0.87%*	*106*	*4.17%*	*2.15*
5	*5*	*1.32%*	*113*	*5.58%*	*2.51*

The liquidity factor and size factor, measured by turnover rate and market value respectively, have been proven to be very effective style factors in the Chinese market. The effectiveness of these two factors is significantly stronger than other style factors for a long time, and even dominant in the market style. If the turnover rate of a company on the announcement date T is larger, the turnover rate group number of the company will be larger, and all companies will be divided into 5 groups based on turnover rate. Distinguish companies with different turnover rates. Within the [T-5, T-1] time range, the abnormal returns are all negative, while the [T, T+5] time range abnormal returns are positive. The group with the highest turnover rate has positive abnormal return in the [T-5, T-1] and [T, T+5] time ranges. This indicates that for turnover rates, the group with the highest or lowest turnover rate exhibits different characteristics in [T-5, T-1]. In addition, the group with the highest turnover rate has a positive abnormal return in the [T, T+5] time range, which was not reflected in the previous [T-5, T-1] time range. There is no strong pattern in other turnover rate groups.

Table 14 Technical Sanctions and Abnormal Returns with Different Turnover Rate

Group	*T*	*ab_return*	*count*	*std*	*t*
1	*-5*	*-0.44%*	*71*	*1.56%*	*-2.40*
2	*-5*	*-0.45%*	*102*	*1.92%*	*-2.38*
3	*-5*	*-0.43%*	*106*	*2.78%*	*-1.59*
4	*-5*	*-0.39%*	*79*	*3.38%*	*-1.03*
5	*-5*	*1.41%*	*113*	*6.24%*	*2.41*
1	*-4*	*-0.14%*	*69*	*2.42%*	*-0.49*
2	*-4*	*0.02%*	*95*	*2.19%*	*0.07*
3	*-4*	*0.06%*	*85*	*2.69%*	*0.22*
4	*-4*	*0.84%*	*73*	*4.81%*	*1.49*

Group	*T*	*ab_return*	*count*	*std*	*t*
5	*-4*	*2.60%*	*95*	*6.15%*	*4.12*
1	*-3*	*-0.06%*	*62*	*2.82%*	*-0.17*
2	*-3*	*-0.18%*	*80*	*2.93%*	*-0.56*
3	*-3*	*0.67%*	*73*	*2.70%*	*2.11*
4	*-3*	*0.39%*	*82*	*2.85%*	*1.24*
5	*-3*	*0.37%*	*82*	*5.44%*	*0.62*
1	*-2*	*-0.81%*	*61*	*1.44%*	*-4.36*
2	*-2*	*0.19%*	*53*	*2.76%*	*0.51*
3	*-2*	*-0.05%*	*86*	*2.80%*	*-0.16*
4	*-2*	*0.22%*	*71*	*4.06%*	*0.46*
5	*-2*	*0.65%*	*108*	*6.33%*	*1.07*
1	*-1*	*-0.39%*	*90*	*3.43%*	*-1.07*
2	*-1*	*-0.69%*	*77*	*2.82%*	*-2.14*
3	*-1*	*-0.04%*	*72*	*3.34%*	*-0.11*
4	*-1*	*-0.43%*	*81*	*2.88%*	*-1.34*
5	*-1*	*0.60%*	*106*	*5.83%*	*1.07*
1	*0*	*0.00%*	*3677*	*3.23%*	*0.09*
2	*0*	*-0.16%*	*3678*	*2.58%*	*-3.76*
3	*0*	*-0.03%*	*3688*	*3.22%*	*-0.59*
4	*0*	*0.37%*	*3706*	*5.60%*	*4.06*
5	*0*	*16.72%*	*3801*	*86.79%*	*11.88*
1	*1*	*0.21%*	*82*	*4.15%*	*0.46*
2	*1*	*-0.11%*	*91*	*2.79%*	*-0.37*
3	*1*	*0.48%*	*65*	*4.20%*	*0.93*
4	*1*	*-0.20%*	*85*	*3.59%*	*-0.51*
5	*1*	*1.55%*	*103*	*7.60%*	*2.07*
1	*2*	*1.09%*	*58*	*4.08%*	*2.04*
2	*2*	*-0.28%*	*75*	*3.21%*	*-0.75*
3	*2*	*0.75%*	*64*	*3.89%*	*1.55*
4	*2*	*-0.37%*	*84*	*4.27%*	*-0.79*
5	*2*	*2.12%*	*98*	*7.20%*	*2.92*
1	*3*	*0.58%*	*64*	*3.87%*	*1.20*
2	*3*	*-0.15%*	*78*	*3.59%*	*-0.38*
3	*3*	*0.06%*	*82*	*3.03%*	*0.19*
4	*3*	*-0.03%*	*72*	*4.29%*	*-0.06*
5	*3*	*0.51%*	*82*	*7.57%*	*0.61*
1	*4*	*1.28%*	*69*	*4.95%*	*2.15*
2	*4*	*-0.26%*	*86*	*2.80%*	*-0.85*
3	*4*	*-0.12%*	*94*	*2.99%*	*-0.38*
4	*4*	*-0.32%*	*81*	*4.11%*	*-0.71*

Group	*T*	*ab_return*	*count*	*std*	*t*
5	*4*	*1.55%*	*87*	*8.12%*	*1.78*
1	*5*	*0.45%*	*77*	*3.93%*	*1.01*
2	*5*	*0.23%*	*90*	*2.72%*	*0.79*
3	*5*	*0.25%*	*93*	*3.64%*	*0.66*
4	*5*	*0.35%*	*96*	*4.51%*	*0.76*
5	*5*	*0.70%*	*115*	*6.97%*	*1.08*

8. Conclusion and Discussion

This article studies the investment efficiency and stock price crash risk of listed companies under the background of technical sanctions, as well as their interrelationships. Firstly, using the quasi-natural experimental rules from empirical research, I conduct a DID model to verify whether technical sanctions have an impact on investment efficiency and stock price crash risk. Secondly, further in-depth analysis of the mechanism of the impact of technical sanctions on the risk of stock price crash is a major innovation of this article, adding new empirical evidence of the impact of technical sanctions. This article uses a validated and mature DID model to study the impact of technical sanctions on A-share listed companies, which is a concern for both industry practitioners and academic researchers. The research find: (1) the investment inefficiency of listed companies has increased after being sanctioned, and this relationship is significant at the 10% level. The Chinese economy has achieved rapid growth in the past few years, largely driven by investment. Listed companies in the Chinese stock market are leading companies in various industries in China. This indicates that although increasing investment can alleviate the adverse effects of sanctions on enterprises, many investments are not efficient, which can have a negative effect on investment efficiency; (2) After the company was sanctioned, the crash risk of stock price did increase, but the correlation coefficient was not significant, so this impact was not statistically significant; (3) the lower the investment efficiency, the greater the risk of crash, but this relationship is not statistically significant. Technical sanctions negatively weaken the relationship between investment efficiency and stock price crash risk, that is, after a company is subject to technical sanctions, the impact of investment efficiency on stock price crash risk becomes weaker. The weakening of this relationship stems from two potential aspects: firstly, the impact of technical sanctions on investment efficiency, which has been partially verified before. Secondly, technical sanctions can also have an impact on the risk of stock price crash. In previous studies, it was found that technical sanctions increase the risk of price crash, but this relationship is not very significant. Therefore, comprehensive analysis shows that technical sanctions weaken the impact of investment inefficiency on the risk of stock price crash, and the mechanism is that the investment inefficiency of listed companies increases after technical sanctions and absorb some of the impact on the risk of stock price crash, thus reflecting the reduction of the impact of investment inefficiency on the risk of stock price crash. However, this relationship still lacks sufficient statistical support.

At the same time, this article also studied the impact of technical sanctions on stock prices in the short term based on event study methods, and found that the impact of technical sanctions on stock prices in the short term is very significant. Overall, the abnormal returns calculated in this article are very significant within the [T-30, T+30] time interval. However, by delving into the composition of abnormal returns, it was found that abnormal returns are only significant in a few industries and not significant in most other industries. Secondly, in the four years 2019 to 2022, during the [T, T+5] time period, abnormal returns were more pronounced, indicating that the main source of abnormal return was the overreaction of stock prices at the stylistic level before the technical sanction. From the perspective of different styles, the larger the market value, the higher the P/B, the higher the turnover rate, the greater the positive abnormal return in [T, T+5]. This indirectly indicates that the Chinese stock market is greatly influenced by market sentiment in the short term, and the market is not very mature.

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