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Economic policy uncertainty, non-financial enterprises' shadow banking activities and stock price crash risk

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ABSTRACT

At present, the structural contradiction between Economic Financialization and the real economy's long-term weakness has become increasingly prominent. As China enters a "new normal" stage of economic growth, the real investment rate drops, non-financial enterprises continuously allocate resources to the shadow banking system. The financial economy becomes increasingly divorced from reality. This leads us to the questions: will the shadow banking behavior of non-financial companies exacerbate the risk of stock price crash risk? How does the increase in economic policy uncertainty affect the relationship between non-financial companies' shadow banking activities and stock price crash risk?

This article uses non-financial listed companies' data from 2007 to 2017 and conducts empirical analysis to answer this question. The study finds that companies engaged in high-leverage, high-risk shadow banking business exacerbate stock crash risk. This effect is only pronounced in non-state-owned enterprises and low social trust regions. The increase in the degree of economic policy uncertainty positively impacts the relationship between non-financial companies' shadow banking business and stock price crash risk. The theoretical mechanism is as follows: the rise in economic policy uncertainty amplifies the positive relationship between shadow banking activities of non-financial companies and stock price crashes by increasing bank loans, investors' sensitivity to external information, risk cross-contagion, and inefficient investment mechanisms. Various robustness tests do not change the research conclusion. This paper has important theoretical and policy guidance significance for reviewing the existing diversified shadow banking system and preventing systemic risks.

1. Introduction

As China's economy transitions from high-speed growth to the "new normal" stage of lower growth, the problems resulting from the early extensive growth model, such as highly leveraged companies, zombie companies, and systemic risk agglomeration, have mounted. In recent years, firms' investment rates have declined, non-financial companies' willingness to engage in main business production and operation activities has weakened, resources have been continuously allocated to the financial system, and the trend of economic financialization has been enhanced. The corporate sector assumes the functions of material production, technological

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innovation, and employment absorption. The investment of excessive resources and energy into financial profit-seeking activities will inevitably hurt economic output and financial market stability, increasing the possibility of "Grey Rhino" and "Black Swan" incidents.

At present, not only do formal financial institutions such as banks, securities, and trust companies conduct shadow banking business through off-balance sheet business, buy-back resale, and channel business, but various quasi-financial institutions such as small loan companies, financing guarantee companies, pawnshops, and internet finance also participate in credit creation activities outside of supervision. More and more companies with advantages in financing have begun to participate in shadow credit market investment activities by acting as physical intermediaries and purchasing shadow banking products. According to Wind statistics, as of December 2018, a total of 1234 listed companies have purchased similar shadow credit products such as bank wealth management, structured deposits, notice deposits, securities company wealth management products, investment company wealth management products, trust plans, fund accounts, and reverse repurchase agreements. The total amount of these products is as high as 1.546 trillion yuan. Fig. 1 reports the time trend of the scale of shadow banking activities of non-financial listed companies in Shanghai and Shenzhen stocks as a percentage of total assets. From 2007 to 2017, the proportion of shadow banking activities of non-financial enterprises in total assets increased from 3.52% to 10.94%, and the overall trend was rising. The trend reached a maximum at the end of 2016 and then declined significantly. To prevent and resolve the risks in the asset management business, on November 17, 2017, the People's Bank of China, China Banking Regulatory Commission, China Securities Regulatory Commission, China Insurance Regulatory Commission, and State Administration of Foreign Exchange issued the Guiding Opinions on Regulating the Asset Management Business of Financial Institutions. The contents of the regulatory policy include breaking rigid payments, prohibiting capital pooling, solving asset maturity mismatches, limiting leverage, and other measures, thus inhibiting the scale of the shadow banking system. Therefore, since 2017, the scale of China's shadow banking business has shrunk significantly.

The engagement in shadow banking with high leverage, high risk, and a high degree of information asymmetry will inhibit enterprises' production and investment activities, aggravate the risk contagion effect within the corporate sector, between corporate sectors and the financial market, and increase the possibility of the occurrence of systemic financial risks. (Li and Han, 2018). In 2015, China's stock market experienced bouts of skyrocketing and plummeting. The stock price crash risk reflects, to a certain extent, the extreme volatility and contagion effect of the capital market, which is not conducive to the stability of the financial market. The shadow banking behavior of non-financial companies allows funds to flow to the financial market, aggravates the formation of asset price bubbles, strengthens the risk linkage between the physical sector and the financial system, and increases systemic financial risks. At the 2018 Central Economic Conference, General Secretary Xi Jinping stated that China should "innovate and complete macro-control, coordinate the promotion of stable growth, promote reform, adjust the structure, benefit the people's livelihood, prevent risks, and maintain economic operations within a reasonable range." The Report of the 19th National Congress of the Party also proposes to "deepen the reform of the financial system, strengthen the ability of financial services to the real economy, increase the proportion of direct financing, and promote the healthy development of the multi-level capital market. [China must] improve the two-pillar control framework for currency and macro-prudential policies, deepen the reform of interest rates and exchange rates, improve the financial supervision system and keep the bottom line of systemic financial risks." Therefore, exploring the impact of shadow banking activities of non-financial enterprises on the capital market's stability has important theoretical and practical significance for restraining the economy from becoming divorced from reality, discouraging structural deleveraging, and preventing systemic financial risks.

At present, little literature focuses on the shadow banking activities of non-financial companies. Existing literature has concentrated chiefly on the traditional shadow banking system composed of various quasi-financial institutions, including the shadow business of banks and small loan companies, financing guarantee companies, and wealth management companies. The research in this area focuses mainly on the definition of the shadow banking system, scale measurement, influencing factors, effectiveness of monetary policy, and efficiency of credit resource allocation, output, and consumption (Gorton and Metrick, 2010; Qiu and Zhou, 2014; Chen et al., 2017; Hu, 2016). Few articles pay attention to the shadow banking behavior of non-financial companies. Even though some of the literature focuses on the shadow banking business of the corporate sector, the focus is mostly on the identification of business mechanisms, the impact on the efficiency of credit resource allocation, and the level of social welfare in this area (Liu et al., 2014; Wang et al., 2015), There is scant literature on the topic of non-financial firms' shadow banking activities on financial market stability. The healthy development of the capital market is the key to ensuring financial stability. The sharp rise and fall of stock prices will erode

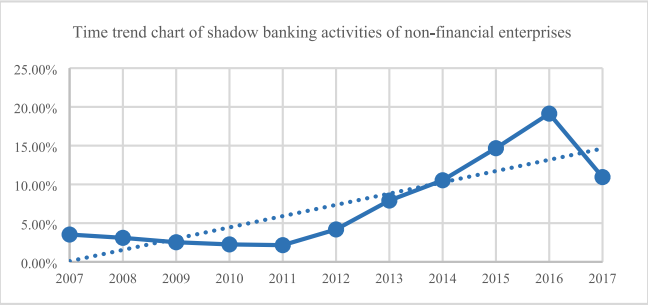

Fig. 1. Time trend chart of shadow banking of non-financial enterprises.
Data source: Manual calculation by the authors.

investors' wealth, damage the capital market's healthy development, and even induce the outbreak of a financial crisis (Jegadeesh and Kim, 2010).

The research on stock price crashes is relatively rich. Domestic and foreign literature has analyzed the formation mechanism of stock price crashes from the perspectives of information asymmetry, short-selling restrictions, heterogeneous investor beliefs, and investor herd behavior (Hutton et al., 2009). There have been studies from the perspective of institutional investor behavior, financial information transparency, accounting conservatism, independence of independent directors, analyst optimism bias, inefficient corporate investment, and regional trust as influencing factors. (Chen et al., 2011; Kim and Zhang, 2016a; Xu et al., 2012; Jiang and Xu, 2015).

For example, Peng et al. (2018) analyzed the impact mechanism of corporate financial asset investment on stock price crash risk, finding that management's motivation to hide negative news results in a positive relationship between corporate financialization and stock price crash risk. Corporate shadow banking differs from R & D innovation behavior, and its degree of external information disclosure and return rate on investment are less transparent. Therefore, the shadow banking business of non-financial companies has a higher degree of information asymmetry than physical investment projects. The existing literature ignores the possibility that the corporate sector's shadow banking business can play a role in whitewashing financial statements in the short term. However, in the long run, the high leverage, high risk, and high degree of information asymmetry among shadow bank borrowers means that the shadow banking activities of non-financial companies will increase the agency costs among managers, shareholders, and external investors and increase the possibility of a liquidity crisis due to the inability to recover the investment cash, leading to a concentrated outbreak of negative news. This article fills a gap in the existing literature and systematically and deeply analyzes non-financial corporate shadow banking's impact on stock price crash risk.

With the advancement of supply-side reforms, the deepening of interest rate market-oriented reforms, and the continuous changes in foreign trade policies, as well as the production, investment, and consumption behaviors of microeconomic entities such as China's enterprises and residential sectors are also facing greater policy uncertainty. Policy uncertainty refers to the risk that market players cannot accurately predict the direction, frequency, intensity, implementation, and expected effects of policy changes caused by the government's unclear future economic policies (Gulen and Ion, 2016; Baker et al., 2016). Domestic and foreign research analyzes the impact of economic policy uncertainty on enterprise productive investment, investment efficiency, innovation input, financial asset allocation, capital structure adjustment, and tax avoidance behavior. (Julio and Yook, 2012; Wang et al., 2014; Zhang and Liu, 2018; Bloom et al., 2007). The increase in economic policy uncertainty will affect the relationship between the shadow banking activities of non-financial companies and the risk of stock price crashes by affecting banks' reluctance to lend, the scale of physical investment, and investors' sensitivity to risks. However, scant literature explores the relationship between the shadow banking activities of non-financial companies and stock price crash risk, analyzing the mechanism by which economic policy uncertainty adjusts to risk. Given this, this article will examine this issue to make a valuable supplement to the existing research.

This article uses data from non-financial listed companies in Shanghai and Shenzhen from 2007 to 2017 to empirically test the impact of shadow banking activities of non-financial firms' stock price crash risk, and the rise in economic policy uncertainty on the shadow banking and stock prices of non-financial companies, looking at the dynamic relationship between crash risks. The results show that companies engaging in high-leverage, high-risk shadow banking business will amplify the stock price crash risk. This effect is more pronounced in non-state-owned enterprises, non-political enterprises, and regions with low social trust. The increase in economic policy uncertainty plays a positive role in regulating the relationship between the shadow banking activities of non-financial companies and stock price crash risk by exacerbating bank loan reluctance, investors' sensitivity to external information, risk cross-contagion, and inefficient investment channels. A series of robustness tests prove the findings of this article.

This paper's contribution to the existing research is that, first, it provides a new theoretical basis for the factors that increase stock price crash risk and reveals an additional influencing factor–the shadow banking behavior of non-financial companies. Second, it further explores the adjustment effect and influence mechanism of rising economic policy uncertainty on the dynamic relationship between shadow banking activities of non-financial enterprises and stock price crash risk, thereby enriching existing research on macroeconomic policies and micro-firm behavior. Third, this paper shows that companies engaging in shadow banking activities with high leverage and high levels of information asymmetry aggravate financial market volatility. It provides strong policy guidelines for re-examining the diversified shadow banking system, preventing the economy from becoming divorced from reality, and avoiding systemic financial risks.

This article's remaining structure is as follows: The second part contains the theoretical analysis and the introduction of research hypotheses based on the relevant literature on stock price crash risk, shadow banking activities of non-financial enterprises, and the uncertainty of economic policy. The third part provides the research design, which introduces the sample selection, data sources, variable definitions, and model settings. The fourth part conducts an empirical test on the relationship between the shadow banking activities of non-financial companies and stock price crash risk. It explores the adjustment mechanism of economic policy uncertainty on this relationship. The fifth part further analyzes how rising economic policy uncertainty affects the dynamic relationship between shadow banking activities of non-financial companies and stock price crash risk. The last part provides the conclusion and policy recommendations.

2. Theoretical analysis and research hypothesis

2.1. Shadow banking of non-financial companies and stock price crash risk

The collapse or plunge of stock prices is not conducive to financial stability. It even induces the occurrence of financial crises, which

has become a hot topic for academic and industry experts. Based on the theory of information asymmetry and moral hazard, the existing literature analyzes the formation of stock price crash risk from three aspects: hiding information or reducing the degree of information disclosure by management, the cognitive bias of external investors, and imperfect short-selling mechanisms (Hutton et al., 2009; Kothari et al., 2009).

Management may selectively disclose information to external investors for self-interested motives such as option compensation, position promotion, and political consideration. That is, management may be more inclined to hide or delay negative news releases and accelerate the disclosure of good news (Jin and Myers, 2004). Companies use tax avoidance, excessive investment, financial asset allocation, and other methods to whitewash financial statements and hide unfavorable news (Piotroski et al., 2015; Jiang and Xu, 2015; Kim et al., 2011; Peng et al., 2018). However, managers may also reduce the disclosure of external information to avoid internal information leakage, which increases the degree of information asymmetry between management and investors, thereby exacerbating the possibility of stock price crash. Kim and Zhang (2016b) find that companies with R & D and innovation activities have a lower degree of internal innovation disclosure, often accompanied by a higher stock price crash risk.

In terms of the irrational behavior of market participants, the information asymmetry between management and external investors results in investors' heterogeneous beliefs, analyst optimism bias, and market participants' herding, which all lead to differences in external investors' perception and the company's actual value, thereby increasing the likelihood of a stock price crash (Jegadeesh and Kim, 2010; Xu et al., 2012; Brown et al., 2014). Also, short-selling restrictions prevent investors from expressing negative views on a company's stock price through effective trading behaviors, which result in the concentrated release of negative information when the market declines, along with a sharp drop in stock prices (Hong and Stein, 2003).

With the development of China's diversified shadow credit market, Companies with financing advantages use their external financing capabilities to incorporate funds from financial intermediaries and financial markets that exceed their production and operation needs and turn to develop shadow banking business through entrusted loans, entrusted financial management, and private lending. The corporate sector has become another notable and relatively low-profile participant following banks' shadow business, as well as the shadow activities of non-bank financial institutions, various quasi-financial institutions, and private financial institutions. (Liu et al., 2014). Compared with the shadow banking business of formal financial institutions and quasi-financial institutions, shadow banking activities represented by financing advantageous enterprises obtain low-interest loans from banks and capital markets, and instead lend to small and medium-sized enterprises through bridge loans. This kind of financial leakage between enterprises will reduce the motivation of enterprises to engage in production and business activities and increase the problems of rent-seeking and high shadow interest rates in the secondary allocation of credit resources. In addition, enterprises undertake the functions of material production and R&D innovation, and their excessive resources and energy are engaged in shadow credit market investment activities, which will inevitably have an adverse impact on the long-term and stable development of the real economy.

The shadow banking activities of non-financial enterprises can be reflected in the increasing proportion of investment in the shadow credit market as a source of profit; such activities are also reflected in the gradual increase in the ratio of shadow credit assets to total assets. Currently, non-financial enterprises can conduct shadow banking business by acting as substantive credit intermediaries and indirect shadow credit market participants (Li and Han, 2018). The weakening of the real economy, the widening gap between financial and physical returns, the mismatch of credit resources, and the absence of supervision provide the external conditions and space for credit creation activities of the real sector beyond supervision (Han et al., 2017). The corporate sector is different from the shadow banking system of financial institutions. It plays an important role in promoting R&D and innovation activities, promoting output growth, and absorbing employment. However, the shadow banking system's characteristics, such as high returns, high risks, and high information asymmetry, inhibit corporate investment and increase the possibility of liquidity crises, thereby hurting the long-term stable development of the real economy. (Han et al., 2019; Li and Han, 2018).

Shadow banking in the corporate sector also affects the risk of stock price crashes. Specifically, stock price crash risk stems from the overvaluation of stock prices and the concentrated release of negative news (Chang et al., 2017). At present, due to the economic downturn in China's real economy and the increasing financialization of the economy, the gap between the return on investment in the financial and real industries has gradually widened. Based on monetary compensation, political promotion, and career development considerations, management is more inclined to allocate funds to the shadow credit market with short investment periods and higher rates of return to make up for production losses and whitewash financial statements. The opacity of information disclosure in listed companies' financial statements provides management space to hide negative news about the poor operation of the main business. As a result, companies engaging in shadow banking activities that obtain a high yield spread to hide unfavorable news will exacerbate the possibility of a stock price crash. The literature on the release of negative news finds that shadow banking characteristics such as high leverage, excessive product nesting, and risk cross-contagion combined with financial market volatility or fund integrator defaults, resulting in lost funds invested in the shadow credit market, will inevitably lead to a concentrated release of negative news and a cliff-like decline in stock prices. Besides, shadow banking will restrain physical investment, worsen operating income, and increase the risk of a financial crisis. There is a high degree of information asymmetry between shadow banking borrowers and lenders, and it is difficult for external investors to effectively identify the impact of shadow banking on the operating risks of companies, which in turn leads to overvalued stock prices. Therefore, external investors' cognitive bias that stock prices are caused by information asymmetry and investor heterogeneity will also increase the stock price crash risk. Given this, this article proposes the first research hypothesis.

H1. There is a positive correlation between the shadow banking activities of non-financial companies and stock price crash risk.

The theoretical analysis of this paper shows that management's hidden information caused by the shadow banking activities of non-financial companies, the concentrated release of negative news, and the discernment of stock prices by external investors under asymmetric information will increase the possibility of stock prices crashing. However, this effect may also have heterogeneous effects

in companies with different ownership and political connections. Specifically, the oligopolistic financial system structure dominated by financial intermediaries and state-owned banks results in a misallocation of resources; state-owned enterprises can obtain low-interest and high-quality credit resources from banks, while private enterprises have long been under budget constraints (Lin and Li, 2001). In terms of industry priority, China's petroleum, chemical, railway, coal, and finance industries that determine the economy's lifeline are all controlled by state-owned capital. The government has obvious policy bias and implicit bankruptcy protection for such enterprises. The implicit guarantee from government departments means that state-owned enterprises are less likely to go bankrupt because of poor internal operations, insufficient funds, external macroeconomic environment shocks, and changes in industry policies than private enterprises. Therefore, the shadow banking behavior of non-financial companies positively impacts stock price crash risk due to the concealment and concentrated release of negative news and the deviation of investors' perception of the company's internal value. There is a heterogeneous impact on companies with different ownership structures. In theory, it has a more substantial influence on private enterprises.

H2. Compared with state-owned enterprises, the positive impact of non-financial enterprises' shadow banking activities on stock price crash risk is only significant in non-state-owned enterprises.

The impact of non-financial companies' shadow banking activities on stock price crash risk is also heterogeneous in different regions. As an informal institutional arrangement, social trust can weaken management's opportunistic behavior of hiding bad news to a certain extent, thereby reducing the possibility of a stock price plummet (Liu et al., 2014). In areas with high social trust, the management's deliberate deception and concealment will be subject to more severe social sanctions and moral pressure. As an informal institutional arrangement, locations with high social trust create an environment in which management's opportunistic behavior has a more substantial negative impact on its reputation, career development, and relationship network. As a result, in regions with a higher degree of social trust, management has a weaker incentive to whitewash financial statements and hide actual profits through shadow banking, which weakens the positive relationship between shadow banking of non-financial companies and stock price crash risk. Furthermore, the non-financial companies' shadow banking business will increase information asymmetry between management and external investors. In contrast, the increase in social trust will increase information sharing among enterprises and between enterprises and investors, thereby reducing the risk of stock price crash caused by investors' cognitive bias. Therefore, we propose the third research hypothesis.

H3. Compared to regions with high social trust, the positive impact of the shadow banking activities of non-financial companies on stock price crash risk is only significant in areas with low social trust.

2.2. Economic policy uncertainty, shadow banking activities of non-financial companies, and stock price crash risk

Rising economic policy uncertainty will impact corporate production innovation, investment and financing decisions, capital allocation, and stock asset pricing (Gulen and Ion, 2016; Baker et al., 2016). The rising uncertainty of economic policy means that the uncertainty of enterprises' future cash flow has increased, and banks' reluctance to borrow money rises. The high leverage, high risk, and pro-cyclical characteristics of shadow banking will cause deterioration and volatility in the external financing environment to quickly spread to companies that carry out shadow banking business, increasing the possibility of a stock price crash due to insufficient liquidity. Therefore, financing constraints caused by banks' reluctance to lend in the face of rising economic policy uncertainty will magnify the positive relationship between the scale of non-financial companies' shadow banking activities and stock price crash. According to real options theory, when an investment is irreversible, the increase in economic policy uncertainty will cause companies to delay investment in fixed assets (Bloom et al., 2007; Bernanke, 1983) and exacerbates the stock price decline by reducing investment efficiency. The increase in economic policy uncertainty also means that investors are more sensitive to external information, and risks are more contagious among different economic entities. Once negative information about companies engaging in the shadow banking business is released, stock prices also show an accelerated downward trend due to external investors' herd effect, triggering a stock price crash. Therefore, we propose the fourth research hypothesis of this article.

H4. Rising economic policy uncertainty will magnify the positive correlation between non-financial companies' shadow banking activities and stock price crash risk.

3. Research design

3.1. Sample selection and data sources

This paper uses data from A-share listed companies on the Shanghai and Shenzhen stock exchanges between 2006–2017 as a research sample. The listed company data comes from the CSMAR database and Wind database. We manually collected the entrusted loan data according to the public announcements issued by companies in Shanghai and Shenzhen. The entrusted wealth management data comes from the foreign investment database of CSMAR. The data of uncertain economic policy comes from an index obtained by Baker et al. (2016) based on a keyword search in the South China Morning Post. This article deals with the data by eliminating samples of financial and insurance companies, samples with ST, PT, and missing data, samples with less than 30 trading weeks, and samples with missing data.

3.2. Variable measurement

3.2.1. Risk of a stock price crash

Drawing lessons from existing studies (Hutton et al., 2009), this article uses two methods to measure the risk of listed company stock price crash risk.

First, the weekly return rate of individual stocks is used to regress the weighted average return rate of the weekly market value, and the specific return rate W_(i,t) of stock i aftermarket adjustment in week t is estimated. The calculation method is as follows:

$$r_{i,t} = \alpha_0 + \beta_1 r_{M,t-2} + \beta_2 r_{M,t-1} + \beta_3 r_{M,t} + \beta_4 r_{M,t+1} + \beta_5 r_{M,t+2} + \varepsilon_{i,t} \quad (1)$$

Among them, $r_{i,\,t}$ is the return rate of stock i in week t, $r_{M,\,t}$ is the market return rate weighted by the value of the circulating stock market in week t, and the lag and lead terms of market return are added to the model to control the impact of asynchronous transactions. According to the residual items of the regression above, the unique rate of return of stock i in week t can be obtained. Specifically, $W_{i,\,t} = \ln(1 + \varepsilon_{i,\,t})$. After that, we use the inverse of the ratio of the third moment of the annual weekly return of a listed company to the cubic standard deviation of the weekly return as a measure of stock price crash risk, where n represents the number of trading weeks, and the calculation method is as follows:

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

The second method to measure stock price crash risk is to use the rise and fall in the weekly rate of return, which is recorded as DUVOL. The specific calculation method is as follows: First, we calculate the average value of the specific rate of return for all weeks of the stock i year, divide it into samples higher and lower than the average annual specific return rate, and calculate the standard deviation of the specific rate of return of the two sample types respectively. The calculation is as follows:

Table 1
Main variable definitions and descriptive statistics.

Variable symbol	Variable define	Variable measure	Sample size	Standard deviation	Medium	Mean	Max	Min
NCSKEW	Stock price crash risk	Negative return skewness coefficient, the larger the NCSKEW, the higher stock price crash risk, the calculation method is detailed in the text.	16,872	0.9728	−0.2186	−0.2456	2.0238	−3.0091
DUVOL	Stock price crash risk	The ratio of the fluctuation of income up and down, the larger the DUVOL, the higher stock price crash risk, the calculation method is detailed in the text.	16,872	0.7791	−0.1542	−0.1488	1.8080	−2.1752
Sbscale	Corporate shadow banking scale	Percentage ratio of the sum of the scale of entrusted loans, entrusted wealth management, private lending and various shadow credit products to total assets (%).	16,872	19.5543	1.604528	8.5640	120.4597	0.0000
EPU	Economic policy uncertainty	Average monthly economic policy uncertainty of the year.	17,290	99.3728	179.0405	208.0558	364.8328	98.8882
Turnover	Average monthly excess turnover rate	The difference between the average turnover rate of stock i in year t and the average monthly turnover rate in year t-1.	16,871	37.5430	−6.1950	−7.8303	98.9575	−185.0845
Sigma	Standard deviation of stock returns	The standard deviation of the unique rate of return of stock i in the week of t year.	16,872	0.0186	0.0470	0.0501	0.1219	0.0201
Ret	Average stock return	The average weekly rate of return of stock i in year t.	16,872	0.0068	−0.0020	−0.0017	0.0214	−0.0191
Size	Company Size	Natural logarithm of total assets.	16,872	1.3049	21.9654	22.1257	27.0404	19.1204
ROA	Profitability	The ratio of net profit to total assets.	16,872	0.0535	0.0333	0.0369	−0.1921	0.2127
Lev	Corporate leverage ratio	Total liabilities/Total assets.	16,872	0.2111	0.4594	0.4598	1.0160	0.0467
Mgshare	Ratio of management	The Percentage of the number of shares held by executives to the total number of shares.	16,502	0.1153	0.0001	0.0475	0.6138	0.000
Indshare	Independent director ratio	The ratio of the number of independent directors to the number of board members.	16,814	0.0530	0.3333	0.3714	0.5714	0.3000
SOE	Nature of actual controller	State-owned enterprise is 1, otherwise 0.	16,860	0.4942	0.0000	0.4238	1.0000	0.0000
BM	Market value to book value ratio	The ratio of the end-of-period market value to the book value of shareholders' equity.	16,472	1.9130	1.5298	2.0755	6.5164	0.0807

$$DUVOL_{i,t} = -log\left\{\left[(n_u-1)\sum_{Down}W_{i,t}^2\right]\Big/(n_d-1)\sum_{Up}W_{i,t}^2\right\} \quad (3)$$

Among them, n_u and n_d, respectively represent the number of weeks in which the specific annual stock return is greater than the annual average return and less than the annual average return.

3.2.2. Shadow banking activities of non-financial companies

Non-financial enterprises conduct shadow banking business through a substantial credit intermediary or through participating indirectly in shadow credit activities. An enterprise conducts shadow banking business as an intermediary through an entrusted agency, using private lending and equity innovation, then horizontally aggregates the scales of entrusted loans, entrusted wealth management, and private lending. The entrusted loan data is manually collected and sorted according to the announcements of entrusted loans issued by listed companies in Shanghai and Shenzhen. Entrusted financial management data comes from the foreign investment database in CSMAR. Since private lending is often concealed, referring to Jiang et al. (2010) research, we adopt "other receivables" as the proxy indicator for the scale of private loans. If an enterprise participates in shadow credit market investment activities by purchasing financial products such as bank wealth management products, brokerage wealth management products, trust products, and structured deposits, the corresponding data can be uncovered within the detailed account of "other current assets" in the notes of listed companies' financial statements. We use the percentage ratio of two types of shadow banking scale and total assets as proxy indicators for the shadow banking activities of non-financial enterprises.

3.2.3. Economic policy uncertainty

We use the China economic policy uncertainty index constructed by Baker et al. (2016) based on the South China Morning Post to reflect this. The index takes the proportion of the number of relevant reports that also include the four keywords of "China," "Economy," "Uncertainty," and "Policy" and the monthly article reviews of the month as a proxy indicator of economic policy uncertainty. Considering that this indicator is monthly data, this paper uses the monthly economic policy uncertainty index's simple weighted average to measure the uncertainty of China's economic policy in the current year.

3.2.4. Control variables

Combined with previous research (Hutton et al., 2009; Xu et al., 2012; Kim et al., 2011), this paper further controls for the lagging period of stock price crash risk NCSEW (DUVOL), the average monthly excess turnover rate of individual stocks (Turnover), stock volatility (Sigma), stock return (Ret), company size (Size), profitability (ROA), leverage ratio (Lev), executive shareholding ratio (Mgshare), the proportion of independent directors (Idratio), the nature of the actual controller (SOE), and the market-to-book ratio (BM). The variable definitions and descriptive statistical results of this article are shown in Table 1.

3.3. Model setting and variable definition

In order to explore the relationship between the shadow banking activities of non-financial companies and stock price crash risk, the following regression model is constructed:

$$CrashRisk_{i,t} = \delta_0 + \delta_1 Sbscale_{i,t-1} + \varphi ControlVar_{i,t-1} + u_i + \tau_t + \varepsilon_{i,t} \quad (4)$$

Among them, $CrashRisk_{i,\,t}$ represents the stock price crash risk of stock i in year t, measured by NCSKEW and DUVOL respectively, and $Sbscale_{i,\,t-1}$ represents the scale of shadow banking of non-financial enterprises lagging one step behind, $ControlVar_{i,\,t-1}$ represents the control variable that affects stock price crash risk. The model controls the firm's individual fixed effects and year's fixed effects, and standard errors are clustered to the firm level. If the δ_1 coefficient is significantly positive, then the shadow banking activities of non-financial companies will aggravate stock price crash risk; that is, hypothesis 1 holds.

To further examine the moderating effect of economic policy uncertainty on the relationship between the shadow banking activities of non-financial companies and stock price crash risk, based on model (4), we introduce the interaction term between the scale of corporate shadow banking and the uncertainty of economic policy for empirical testing.

$$CrashRisk_{i,t} = \theta_0 + \theta_1 Sbscale_{i,t-1} * EPU_{i,t-1} + \theta_2 Sbscale_{i,t-1} + \theta_3 EPU_{i,t-1} + \varphi ControlVar_{i,t-1} + u_i + \tau_t + \varepsilon_{i,t} \quad (5)$$

In the model, $EPU_{i,\,t-1}$ represents the uncertainty of economic policy. If the coefficient θ_1 is significantly positive, then economic policy uncertainty will magnify the positive relationship between the shadow banking activities of non-financial companies and stock price crash risk; the previous research hypothesis is valid.

4. Analysis of empirical results

4.1. Benchmark regression results

Table 2 shows the regression results of the relationship between non-financial companies' shadow banking activities and stock price crash risk. The explained variable in the first and second columns of the table is NCSKEW. Considering all information sets, controlling for individual fixed effects and year fixed effects, the shadow banking coefficient (Sbscale) of non-financial companies is 0.0004, which

is significantly positive at the 1% level. DUVOL is used in the third and fourth columns to measure the stock price crash risk after replacing the stock price crash risk index. The results show that the Sbscale coefficient is still significantly positive at the 1% level, and the previous hypothesis 1 holds. From the view of economic significance, on average, each standard deviation increase in non-financial enterprises' shadow banking scale will increase the negative return skewness coefficient (*NCSKEW*) and the fluctuation ratio (*DUVOL*) in the next period equal to 1% of the sample standard deviation. This impact is comparable to some important firm financial indicators (such as *Lev* and *ROA*), indicating that companies engaging in shadow banking business will increase stock price crash risk both from a statistical and economic view. Some enterprises invest a lot of energy and resources in the shadow banking business, which will enhance the motivation of management to hide negative news, thus increasing the possibility of stock price crash risk.

To further examine the corporate shadow banking scale's heterogeneous impact on stock price crash risk among companies with different ownership types, we divide the sample into state-owned enterprises and non-state-owned enterprises for empirical analysis. The results are shown in Panel A of Table 3. The first and second columns of the table use the negative return skewness coefficient NCSKEW as a proxy indicator of stock price crash risk.

The regression results show that in state-owned enterprises, the shadow banking coefficient (Sbscale) of non-financial enterprises is not significant. By contrast, in private enterprises, the scale of corporate shadow banking (Sbscale) is significantly positive at the 1% level. After replacing the measure of stock price crash risk, the empirical results are still valid. On average, each standard deviation increase in non-financial enterprises' shadow banking scale will make the increase of *NCSKEW* and *DUVOL* in the next period equal to 1% of the sample standard deviation, which is economically significant.The government's implicit guarantees and the allocation of credit tendencies result in a lower risk of stock price declines among state-owned enterprises due to the release of negative news. Compared with private enterprises, there are generally political connections between the state-owned enterprises' executives and local government departments. Therefore, state-owned enterprise executives will more actively disclose the relevant information to prevent possible litigation risks from adversely affecting the promotion of senior executives. Therefore, the positive impact of shadow banking activities of non-financial enterprises on stock price crash risk may only exist in private enterprises.

We now examine the regional heterogeneity of non-financial corporate shadow banking's impact on stock price crash risk. We use two methods to classify areas with high and low levels of social trust. Regional Social Trust is measured based on the enterprise trust environment in the “Chinese Entrepreneurs Survey System 2015” in various regions of the country (Wu et al., 2014; Chen and Liu, 2018). Specifically, if the degree of trust in the region by all managers in the province where the company is located is higher than the median level of all regions, it is deemed to have a high degree of regional social trust; if, on the contrary, it belongs to areas with low social trust.

The regression results show that no matter whether NCSKEW or DUVOL is used to reflect stock price crash risk of listed companies,

Table 2
Shadow Banking Activities of Non-financial Enterprises and Risk of Stock Price Crash.

	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*		*DUVOLt*	
Sbscalet-1	0.0005***	0.0004***	0.0005***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
NCSKEWt-1	−0.0917***	−0.0918***		
	(0.011)	(0.011)		
DUVOLt-1			−0.0977***	−0.0981***
			(0.012)	(0.012)
Turnovert-1	−0.0006***	−0.0006***	−0.0004**	−0.0005**
	(0.000)	(0.000)	(0.000)	(0.000)
Rett-1	3.8116***	3.6727**	1.5411	1.5575
	(1.473)	(1.505)	(1.314)	(1.340)
Sigmat-1	5.0253***	5.0311***	4.1937***	4.1572***
	(0.705)	(0.717)	(0.570)	(0.579)
Sizet-1	0.0952***	0.1014***	0.1047***	0.1089***
	(0.022)	(0.023)	(0.018)	(0.018)
ROAt-1	0.3845*	0.3985*	0.3013*	0.2779
	(0.213)	(0.221)	(0.179)	(0.185)
Levt-1	−0.0942	−0.1399	−0.1512**	−0.1895***
	(0.086)	(0.089)	(0.070)	(0.072)
Mgsharet-1	−0.1041	−0.1093	−0.0788	−0.0858
	(0.164)	(0.167)	(0.130)	(0.132)
Indsharet-1	0.4084	0.4029	0.3174	0.3136
	(0.253)	(0.256)	(0.201)	(0.205)
SOEt-1		−0.0807*		−0.0451
		(0.044)		(0.035)
BMt-1		0.0000***		0.0000***
		(0.000)		(0.000)
N	17,290	16,872	17,290	16,872
adj-R2	0.054	0.054	0.050	0.050
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Table 3
Shadow Banking Activities of Non-financial Enterprises and Risk of Stock Price Crash: heterogeneity analysis.

Panel A: Ownership heterogeneity.				
	State-owned enterprise	Non-state-owned enterprise	State-owned enterprise	Non-state-owned enterprise
	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*		*DUVOLt*	
Sbscalet$_{-1}$	0.0444	0.0004***	0.0359	0.0004***
	(0.073)	(0.000)	(0.058)	(0.000)
Controls	Y	Y	Y	Y
N	7146	9714	7146	9714
adj-R2	0.074	0.063	0.070	0.066
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Panel B: Regional heterogeneity: Social Trust				
	High Social trust	Low Social trust	High Social trust	Low Social trust
	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*	*DUVOLt*	*NCSKEWt*	*DUVOLt*
Sbscalet$_{-1}$	0.0351	0.0004***	0.0449	0.0004***
	(0.046)	(0.000)	(0.038)	(0.000)
Controls	*Y*	*Y*	*Y*	*Y*
N	11,927	4329	11,927	4329
adj-R2	0.059	0.056	0.055	0.054
Year FE	*Y*	*Y*	*Y*	*Y*
Firm FE	*Y*	*Y*	*Y*	*Y*

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

the positive correlation between shadow banking activities of non-financial companies and stock price crash risk is only significant in areas with low social trust. However, this effect is not significant in areas with high levels of social trust, research hypothesis 3 is established.

4.2. Economic policy uncertainty, shadow banking of non-financial companies, and stock price crash risk

Table 4 shows the adjustment mechanism of rising economic policy uncertainty on the relationship between shadow banking activities of non-financial companies and stock price crash risk. The results show that the interaction coefficient ($Sbscale_{t-1}EPU_{t-1}$) of the shadow banking activities of non-financial enterprises and the uncertainty of economic policy is significantly positive at the 1% level, indicating that the increase in economic policy uncertainty will magnify the positive relationship between the shadow banking activities of non-financial companies and stock price crash risk. Using DUVOL to replace NCSKEW as a proxy indicator for stock price crash risk, the regression results show that after adding all control variables, the Sbscalet-1EPUt-1 interaction coefficient is 0.0007, which is still significantly positive. After economic policy uncertainty (EPU) is added, the average impact of enterprises' shadow banking scale on stock price crash risk is greater than 0, which indicates that the shadow banking activities of non-financial enterprises will increase stock price crash risk on the whole. The impact of economic policy uncertainty on stock price crash risk is also positive, indicating that the increase of economic policy uncertainty has a positive effect on the stock price crash risk, which supports the view of Jin et al. (2019). Therefore, the increase in economic policy uncertainty plays a positive role in regulating the relationship between the shadow banking activities of non-financial companies and stock price crash risk. The previous research hypothesis 4 has been verified.

Table 4
Economic policy uncertainty, shadow banking activities of non-financial companies and stock price crash risk.

	(1)	(2)
Explained variable	*NCSKEWt*	*DUVOLt*
$Sbscale_{t-1}EPU_{t-1}$	0.0012***	0.0007***
	(0.000)	(0.000)
Controls	Y	Y
N	16,872	16,872
adj-R^2	0.026	0.026
Year FE	N	N
Firm FE	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

4.3. Robustness test

Du et al. (2015) focus on "other receivables" as the account reflecting re-lending activities for the analysis. In the robustness test, we change the measurement method of shadow banking activities and use the ratio of "other receivables" to sales as the proxy index of the re-lending activities of enterprises to do the empirical analysis. The regression results are shown in Table 5. Table 5 shows the regression results of the relationship between non-financial enterprises' shadow banking activities and stock price crash risk after changing the measurement method of enterprises' shadow banking activities. The explained variable in the first column of the table is NCSKEW. Controlling for individual fixed effects and year fixed effects, the shadow banking coefficient (Sbscale2) is 0.0124, which is significantly positive at the 5% level. DUVOL is used in the second column to measure the stock price crash risk after replacing the stock price crash risk index. The results show that the coefficient of non-financial enterprises' shadow banking scale is still significantly positive at the 1% level, and the previous conclusion of the paper is still stable.

Endogeneity problems. Considering that there may be endogeneity problems caused by missing variables or reverse causality in the model, we use instrumental variables (IV) to regress the benchmark model. Specifically, we refer to Quan et al. (2015) instrumental variable construction and select the corporate shadow banking scale's mean value in the same year as the instrumental variable. The reason is that the company's industry and overall annual shadow banking scale will impact its own shadow banking scale. Still, the company's industry and annual shadow banking trend will not directly affect a single company's stock price crash risk. The IV regression results are shown in Table 6. The Anderson test (*p*-value) and Cragg-Donald Wald test (F value) show that the instrumental variables selected in this paper are valid. The results show that after considering the potential endogeneity problems of the model, the Sbscalet-1 coefficient is still significantly positive at the 1% level, indicating that the shadow banking activities of non-financial companies will aggravate stock price crash risk; that is, the previous conclusion is still valid.

Referring to the method of existing literature, we also control for other possible influencing factors for robustness testing (Chen et al., 2022; Guan et al., 2021; Agarwal et al., 2020; Dyck et al., 2019). We consider other possible influential factors that may affect stock price crash risk, adding these to the benchmark regression model to mitigate omitted variables' impact on the empirical results. Panel A in Table 7 reports the regression results after controlling for the source of auditors. Among them, columns (1) and (2) add dummy variables of whether the auditors are from the Big Four accounting firms. Columns (3) and (4) in the table further control for whether the auditor is from an overseas accounting firm. The results show that after controlling for the source of auditors, regardless of whether NCSKEW or DUVOL is used to measure stock price crash risk, the coefficient Sbscalet-1 of the scale of shadow banking activities of non-financial companies is significantly positive at the 1% level.

Xu et al. (2012) and Wang et al. (2015) found that analysts' optimism bias and management rights also affect stock price crash risk. Therefore, columns (1) and (2) of Panel B in Table 7 have added the mean value of all analysts' optimism deviation in the enterprise. Among them, each analyst's optimistic deviation is reflected by the EPS of the stock forecast minus the actual EPS of the year divided by the forecasted closing price of the stock on the previous trading day. After adding analyst optimism bias, the $Sbscale_{t-1}$ coefficient is still significantly positive at the 1% level under the two stock price crash risk measures.

Columns (3) and (4) of Panel B in Table 7 add dummy variables of management rights. Specifically, if the two management positions and chairman position are concurrent, the dummy variable of management is 1; otherwise, it is set to 0. It can be seen that after adding the management rights dummy variable, the results of the benchmark regression have not changed. Kim et al. (2014) proposed that the effect of social responsibility information disclosure on information and reputation insurance also affects stock price crash risk. Therefore, this article further controls for the level of social responsibility in Panel C. Referring to the selection method of indicators in the existing literature, the first two columns and the last two columns of Panel C in Table 7, respectively, use the Runling Global Index and the quality of social responsibility information disclosure of listed companies as proxy indicators for social responsibility commitment. In the second method, the sub-item dummy variable is set according to whether the company discloses 12 aspects of information. If it is disclosed, it is assigned a value of 1; otherwise, it is 0, and the values of the 12 sub-indices are added together and standardized.

Finally, we use the social responsibility indicator. The larger the indicator is, the higher the degree of corporate social responsibility information disclosure. The results show that the positive relationship between the shadow banking activities of non-financial companies and the stock price crash risk has not changed after adding in the social responsibility assumption variable. Therefore, after adding other control variables, the empirical results of this article are still valid.

Next, we replace the core indicators. For the empirical test of the relationship between economic policy uncertainty, shadow

Table 5
Robustness Test: Change the measurement of enterprises' shadow banking activities.

	(1)	(2)
Explained variable	*NCSKEWt*	*DUVOLt*
Sbscale2t-1	0.0124**	0.0147***
	(0.005)	(0.006)
Controls	Y	Y
N	17,741	17,741
adj-R^2	0.051	0.048
Year FE	Y	Y
Firm FE	Y	Y

Table 6
Robustness Test: IV instrumental variable regression.

	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*	*NCSKEWt*	*DUVOLt*	*DUVOLt*
Sbscalet-1	0.0274***	0.0332***	0.0234***	0.0288***
	(0.009)	(0.009)	(0.008)	(0.008)
Controls	Y	Y	Y	Y
Year FE	N	Y	N	Y
Firm FE	Y	Y	Y	Y
Anderson canon. Corr. LM statistic	42.540	44.581	42.753	44.686
Cragg-Donald Wald F statistic	42.632	44.655	42.846	44.761

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Table 7
Robustness test: adding other control variables.

Panel A: Control the source of auditors

	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Sbscale_{t-1}$	0.0004***	0.0004***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	16,872	16,872	16,872	16,872
adj-R^2	0.054	0.050	0.054	0.050
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

Panel B: Control analyst optimism bias and management rights

	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Sbscale_{t-1}$	0.0003***	0.0002***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	13,078	13,078	16,656	16,656
adj-R^2	0.064	0.065	0.054	0.051
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

Panel C: Control social responsibility

	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$	$DUVOL_t$	$NCSKEW_t$	$DUVOL_t$
$Sbscale_{t-1}$	0.0004***	0.0004***	0.0004***	0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	16,872	16,872	16,872	16,872
adj-R^2	0.054	0.051	0.055	0.052
Year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Table 8
Robustness test: Replace core indicators.

	(1)	(2)
Explained variable	NCSKEWt	DUVOLt
Sbscalet-1EPUt-1	0.0048***	0.0036***
	(0.002)	(0.001)
Controls	Y	Y
N	16,872	16,872
adj-R2	0.026	0.026
Year FE	N	N
Firm FE	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

banking activities of non-financial companies, and stock price crash risk in the robustness test, we adopt the Chinese economic policy uncertainty index compiled by Davis and others based on keywords in the People's Daily and Guangming Daily. The index calculates the number of articles, including keywords such as "financial," "currency," "CSRC," "CBRC," "People's Bank of China," "Development and Reform Commission." It then divides by the number of articles with relevant reports by the total number of articles in the current month, obtaining the specific value of the policy uncertainty in that month and using January 1995 as the benchmark to calculate China's economic uncertainty. Table 8 shows that after changing the core indicator calculation method, under different stock price crash risk indicators, the Sbscalet-1EPUt-1 interaction coefficient is still significantly positive at the 1% level, and the conclusions obtained above are still valid.

Consider other possible regional policy uncertainties. The previous research found that the increase in economic policy uncertainty at the macro level plays a positive role in regulating the relationship between shadow banking activities of non-financial companies and operating risks. It has been found in the literature that changes in local officials will also lead to greater uncertainty in the direction and intensity of previously implemented policies. This article refers to existing methods to measure regional policy discontinuity. It conducts a robustness test based on whether the provincial party committee secretary and governor have changed as a proxy indicator of regional policy discontinuity (Cen and Chen, 2018). For example, if the Provincial Party Committee (Governor) secretary at the place where the company was registered was changed and transferred from another location, the assignment is 2. If the officials changed and the provincial party committee's secretary was transferred locally, the value is 1. If the Provincial Party Committee Secretary did not change that year, the value is 0. The two columns on the left in Table 9 show whether the provincial party committee secretary has changed and whether it has been changed in another place to reflect the uncertainty of regional policy. The results show that after adding the interactive item of regional policy uncertainty and non-financial corporate shadow banking activities, the Sbscalet-1EPUt-1 coefficient is still significantly positive at the 1% statistical level. That is, the previous conclusion is still valid. If we change the measurement method of regional policy uncertainty, in which case the intensity of policy uncertainty is set according to whether the governor has a remote variable, the results have not changed substantially. It can be seen that the conclusion of this article is robust.

5. Further discussion: Analysis of influence mechanism

The increase in economic policy uncertainty plays a positive role in regulating the relationship between the shadow banking activities of non-financial companies and stock price crash risk. What are the channels for the impact of rising economic policy uncertainty on the dynamic relationship between the shadow banking activities of non-financial companies and stock price crash risk? This article will conduct an in-depth analysis of the four transmission paths from theoretical and empirical levels.

5.1. Financing constraints and the increasing difficulty of financing caused by banks' loan reluctance

Increasing uncertainty in economic policies, on the one hand, will increase the possibility of liquidity shortages in enterprises (Han and Qiu, 2007); on the other hand, it will also lead to the phenomenon of banks' borrowing reluctance, raising the external financing costs of enterprises and the equity risk premium, thereby increasing the difficulty of external financing (Zhang and Liu, 2018). The shadow banking behavior of non-financial enterprises differs from financial asset allocation activities. Its characteristics, such as product over-nesting, high risk, and uncertainty of the payback period, mean that it does not have the liquidity savings function of traditional financial assets such as cash, stocks, and bonds. Even in the face of considerable fluctuations in the financial market, it will further increase the fund party's default risk. Therefore, banks' loan-grasping behavior caused by the increase in economic policy uncertainty makes it more difficult for companies to obtain external financing. The degree of financing constraints has increased, leading to a rise in the possibility of liquidity crises due to high-risk shadow banking business and enhanced risk of a stock price crash.

To prove the existence of the financing constraint mechanism, we draw on the indicator selection ideas of Han et al. (2017) to measure enterprises' financing constraints and external financing capabilities. Specifically, for the measurement of financing

Table 9
Robustness test: Consider regional policy uncertainty.

	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*	*DUVOLt*	*NCSKEWt*	*DUVOLt*
Sbscalet-1EPUt-1	0.0016***	0.0010***	0.0017***	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)
Sbscalet-1Changesjt-1	0.0423	0.0064		
	(0.043)	(0.037)		
Sbscalet-1Changeszt-1			0.9764*	0.9406***
			(0.575)	(0.363)
Controls	Y	Y	Y	Y
N	14,596	14,596	13,344	13,344
adj-R2	0.026	0.024	0.026	0.023
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

constraint indicators, multiple quantitative indicators are used to construct scoring indicators to comprehensively measure the degree of corporate financing constraints. We select nine indicators to construct the financing constraint mechanism, including the ratio of cash stock to total assets, the ratio of accounts receivable to total assets, the size of the company, the ratio of tangible assets to total assets, the liquidated ratio, the liquidity ratio, the ratio of Hong Kong, Macao, and Taiwan investment and foreign investment to paid-in capital, return on total assets, and net sales margin. We define each sub-indicator in the same industry as 0–20%, 20%–40%, 40%–60%, 60%–80%, 80%–100%–converted into a scale of 5–1. We then sum up the corresponding values of each sub-indicator to obtain a comprehensive index of corporate financing constraints. The higher the value of this indicator, the higher the degree of financing constraints to which the enterprise is subject. The external financing structure is reflected in the ratio of equity financing and debt financing to total assets.

Panel A and Panel B in Table 10, respectively, report the regression results of the samples divided according to the median level higher than the industry's annual financing constraints (external financing capabilities). The results show that if NCSKEW is used as a proxy indicator of stock price crash risk, the Sbscalet-1EPUt-1 interaction coefficient is 0.0016 for companies with a high degree of financing constraints is significantly positive at the 1% level. However, it is 0.0008 for companies with fewer financing constraints, which is only significant at the 10% level. Both the coefficient size and significance are smaller than those of enterprises subject to a higher degree of financing constraints. The regression results show that the positive adjustment effect of economic policy uncertainty on the shadow banking of non-financial companies and stock price crash risk is more significant in companies subject to higher financing constraints. After replacing the proxy indicators of stock price crash risk, the regression results are listed in columns (3) and (4).

The Sbscalet-1EPUt-1 interaction coefficient is only significant in companies with high financing constraints. The effect does not exist in companies with low financing constraints.

Panel B in Table 10 further divides the full sample into companies with strong external financing capabilities and weak external financing capabilities. The results show that whether using NCSKEW or DUVOL to measure stock price crash risk, the Sbscalet-1EPUt-1 interaction coefficient in companies with weak external financing capabilities is more significant and larger than that of companies with strong external financing capabilities. Therefore, the phenomenon of banks' loan reluctance caused by the increase in economic policy uncertainty will aggravate the positive relationship between the trend of corporate shadow banking participation and stock price crash risk by increasing the degree of financing constraints and the difficulty of external financing; this means that channel one is established.

5.2. Investors' increased sensitivity to information under media attention

Policy uncertainty will also have an impact on the allocation of entrepreneurial activities. Specifically, entrepreneurs' investment

Table 10
Mechanism 1: Bank loan regarding mechanism.

Panel A: Distinguish the degree of financing constraints

	High degree of financing constraints	Low degree of financing constraints	High degree of financing constraints	Low degree of financing constraints
	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$		$DUVOL_t$	
$Sbscale_{t-1}EPU_{t-1}$	0.0016***	0.0008*	0.0012**	0.0004
	(0.001)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	8496	6980	8496	6980
adj-R^2	0.031	0.052	0.033	0.050
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Panel B: Distinguish between strong and weak external financing capabilities

	Strong external financing capabilities (1)	Weak external financing capabilities (2)	Strong external financing capabilities (3)	Weak external financing capabilities (4)
Explained variable	$NCSKEW_t$		*DUVOL*	
$Sbscale_{t-1}EPU_{t-1}$	0.0010**	0.0016***	0.0005	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	7867	8726	7867	8726
adj-R^2	0.031	0.051	0.033	0.050
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

and financing behaviors are more cautious. Their grasp and expectations of future markets, industries, and business directions are also more unstable, leading to short-term and frequent fluctuations in the configuration of entrepreneurs' activities (Lv, 2018). Similarly, various unpredictable components in economic policy changes will also impact capital market fluctuations, causing investors to be more sensitive to the disclosure of external information, resulting in an excessive adjustment of stock price fluctuations. In China's capital market, media reports play an information intermediary role in collecting, disclosing, and disseminating information (Fang and Peress, 2009). Investors' limited attention makes media reports an important channel for investors to obtain information. However, in a period of high economic policy uncertainty, for companies that have received a high degree of media attention, once there is a release of negative news that is not conducive to the production and operation of the company, under the influence of the herd effect, external investors will sell their stocks sharply, which will cause the stock price to plummet. Based on the above analysis, we believe that the increase in economic policy uncertainty for companies that have received high media attention has a more significant positive impact on the relationship between the scale of shadow banking activities and stock price crash risk.

To further verify the existence of this mechanism, we refer to Nguyen (2015) and Liang (2017) and use the natural logarithm of the company's current news report data plus 1 as the proxy variable for the degree of media attention, and further subdivide media attention into policy-oriented media attention and market-oriented media attention. Specifically, we define “China Securities Journal,” “Security Daily,” “Security Times,” “Shanghai Security News” as policy-oriented media, and define “China Business Journal,” “The Economic Observer,” “21st Century Business Herald”, “China Business News” as market-oriented media. Data were collected manually by the authors. Table 11 shows the regression results. If NCSKEW is used to reflect stock price crash risk, after introducing economic policy uncertainty, shadow banking scale, and market-oriented media attention in model (5), Sbscalet-1EPUt-1*MediMat-1 interaction coefficient is 0.0030, which is significantly positive at the 5% statistical level. Sbscalet-1EPUt-1*MediaPt-1, the corresponding interaction coefficient of policy-oriented media attention, is 0.0033. Significance and coefficient size are both higher than the interaction term coefficient of market-oriented media attention and policy uncertainty and the scale of shadow banking. After replacing the proxy indicator of stock price crash risk with DUVOL, the results show that the increase in media attention will magnify the positive relationship of economic policy uncertainty between the scale of corporate shadow banking and stock price crash risk. Policy-oriented media attention has a stronger influence on the above mechanism than market-oriented media attention. This shows that the increase in economic policy uncertainty has caused companies with a high degree of media attention to release negative news such as hidden management misoperations caused by shadow banking business, which will lead to a herd effect of investors collectively selling stocks. This intensifies stock price crash risk. That is, mechanism two is verified.

The agency conflict between management and shareholders means that management has a stronger motivation to hide negative news, which intensifies the possibility of a stock price crash. With the increase in the shareholding ratio of major shareholders, agency conflicts between management and shareholders will be eased, and stock price crash risk will be reduced through the supervisory effect and decline in hollowing-out effect (Li et al., 2021). Agency conflicts between management and shareholders will also inhibit the timeliness of managers' adjustment to external information such as changes in the industry and market environment and investor behavior. Therefore, in companies with lower entrusted agency costs, management can respond quickly to external information and stock price fluctuations, thereby restraining the positive impact of the stock price crash risk of investors' collective dumping of stocks caused by companies' high-risk shadow banking behavior under the situation of rising economic policy uncertainty. In addition, analysts have advantages in information acquisition, financial literacy, and professional analysis compared with external investors. Therefore, analysts can alleviate the degree of information asymmetry between managers and shareholders to a certain extent to more accurately and objectively analyze and evaluate the company's future value and potential risks. Companies with a high degree of analyst attention and research report disclosure can alleviate the impact of investors' insufficient information processing capabilities and opinion analysis on stock price fluctuations, thereby suppressing the positive impact of investors' perception of stock price bias and overreaction to the shadow banking activities of non-financial companies and the stock price crash in the context of rising economic policy uncertainty.

Panel A in Table 12 reports the results of the full sample's group regression according to whether it is higher than the median level of the industry's annual major shareholder holding ratio. The results show that under the two different stock price crash risk measures, the

Table 11
Mechanism 2: Investor information sensitivity mechanism.

	Market-oriented media attention	Policy-oriented media attention	Market-oriented media attention	Policy-oriented media attention
	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*		*DUVOLt*	
Sbscalet-1EPUt-1MediaPt-1	0.0030**	0.0033***	0.0012	0.0027**
	(0.001)	(0.001)	(0.001)	(0.001)
Controls	Y	Y	Y	Y
N	4181	4181	4181	4181
adj-R2	0.100	0.098	0.100	0.096
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Sbscalet-1EPUt-1 interaction coefficient is significantly positive in companies with higher principal-agent costs. Still, it is not significant in companies with lower agency costs. This means that the positive adjustment effect of rising economic policy uncertainty on the shadow banking activities of non-financial companies and stock price crash risk is only significant in companies with high agency conflicts. Panel B and Panel C in the table respectively report the results of sub-sample regression based on analyst attention and the level of research report attention. The degree of analyst attention and research report attention are respectively measured by how many analysts (teams) and research reports that have conducted tracking analysis on the company in the year, and the data is from CSMAR database. The results show that companies with a high degree of attention from analysts and research reports will weaken the positive adjustment effect of economic policy uncertainty on the relationship between the scale of corporate shadow banking and stock price crash risk. Therefore, in companies with low agency conflicts, management can respond and adjust in time to stock price fluctuations and policy changes. The improvement in the level of analysts and research reports will also help external investors to more accurately and rationally grasp the company's operating conditions, thereby to a certain degree suppressing the positive impact of corporate shadow banking activities on stock price crash risk caused by investor herding effects in the context of rising economic policy uncertainty.

5.3. Risk cross-infection mechanism under business association

When businesses act as an entity intermediary or participate in the indirect shadow credit market, the potential repayment risk of borrowers and the financial system's volatility will be transmitted to the corporate sector through accounting transmission or systematic risk linkage, exacerbating firms' operating risks (Li and Han, 2018). The high leverage of shadow banking, excessive product nesting, and pro-cyclical characteristics mean that investors will collectively sell stocks once negative news is released. Stock prices will plummet. Increased economic policy uncertainty will cause substantial fluctuations in the stock market, increase risk premiums, and increase the possibility of systemic financial risks. Therefore, increased economic policy uncertainty means that the corporate sector's risk contagion effect has increased between corporate sectors and the financial system. As a result, companies cannot recover funds on schedule due to high-risk, high-leverage, and information-asymmetric shadow banking, and the risk of liquidity crisis and

Table 12
Mechanism 2: investor information sensitivity mechanism.

Panel A: Distinguish the degree of agency cost				
	High cost of agency	Low cost of agency	High cost of agency	Low cost of agency
	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$		$DUVOL_t$	
$Sbscale_{t-1}EPU_{t-1}$	0.0017***	0.0005	0.0010***	0.0003
	(0.000)	(0.001)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	9815	6858	9815	6858
adj-R^2	0.029	0.049	0.028	0.053
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y
Panel B: Distinguish the degree of attention of analysts				
	High analyst attention	Low analyst attention	High analyst attention	Low analyst attention
	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$		$DUVOL_t$	
$Sbscale_{t-1}EPU_{t-1}$	0.0007*	0.0021***	0.0003	0.0014***
	(0.000)	(0.001)	(0.000)	(0.001)
Controls	Y	Y	Y	Y
N	9929	5939	9929	5939
adj-R^2	0.031	0.043	0.030	0.048
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y
Panel C: Distinguish the degree of attention of the researched report				
	High research report attention	Low research report attention	High research report attention	Low research report attention
	(1)	(2)	(3)	(4)
Explained variable	$NCSKEW_t$		$DUVOL_t$	
$Sbscale_{t-1}EPU_{t-1}$	0.0004	0.0026***	0.0000	0.0020***
	(0.000)	(0.001)	(0.000)	(0.001)
Controls	Y	Y	Y	Y
N	10,110	6036	10,110	6036
adj-R^2	0.032	0.040	0.032	0.046
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

even stock price crash increases. Therefore, in the context of increased economic policy uncertainty, companies with a higher degree of business diversification will have a more substantial cross-contagion effect from other corporate risks due to business crossover and balance sheet connections.

To test the existence of the risk interaction mechanism under the shadow banking business association, we divide the full sample into companies with high diversification of internal operations and low diversification of internal operations according to whether the number of businesses based on the company's main business income is higher or lower than the industry's annual median. The regression results are listed in Table 13. The results show that in companies with a high degree of diversification, the increase in economic policy uncertainty will magnify the positive relationship between the shadow banking activities of non-financial companies and the stock price crash risk. However, this effect is not significant in companies with low diversification, proving the existence of the risk interaction mechanism.

5.4. Inefficient investment under the effect of "real options"

The increase in economic policy uncertainty makes micro-enterprises more cautious. When the investment is irreversible, enterprises are more inclined to delay investment based on the real options theory (Bloom et al., 2007; Bernanke, 1983). Increasing uncertainty in economic policies will also increase financing costs and equity risk premiums, resulting in companies facing liquidity constraints and reducing physical investment. The increase in economic policy uncertainty will reduce the size and efficiency of investment in entities and harm operating performance. The release of negative news about companies' improper participation in shadow banking activities will increase the risk that their stock prices will plummet, and the decline in investment efficiency caused by rising economic policy uncertainty will further aggravate the positive relationship between the scale of corporate shadow banking and stock price crash risk. To test the investment efficiency mechanism's existence, we refer to Richardson (2006) research to construct a normal corporate investment model. Then, the deviation from the normal investment level is regarded as an inefficient investment. The absolute value of the residual error is used to reflect the enterprise's inefficient investment.

Table 14 reports the results of sub-sample regression according to the high and low levels of inefficiency investment. If NCSKEW is used to measure stock price crash risk, among the companies with higher inefficiency investment, Sbscalet-1EPUt-1 interaction term coefficient is 0.0015, which is significantly positive at the 1% level. However, the Sbscalet-1EPUt-1 interaction coefficient is not significant in companies with low inefficiency investment. After changing the measure of stock price crash risk, the conclusion has not changed. Therefore, rising economic policy uncertainty affects the interaction between the size of corporate shadow banking and stock price crash risk by reducing corporate investment efficiency.

6. Conclusions and policy recommendations

At this stage, the problems of China's divorce from the real economy and the accumulation of systemic financial risks have become increasingly prominent. This article uses the data of non-financial listed companies from 2007 to 2017 to explore the theoretical and empirical aspects of the impact of shadow banking activities of non-financial companies on stock price crash risk and the impact of rising economic policy uncertainty on the size of corporate shadow banking activities and a stock price crash. The study results show that the shadow banking activities of non-financial companies will exacerbate stock price crash risk. This effect is more significant in non-state-owned companies and regions with low social trust. The increase in economic policy uncertainty plays a positive role in regulating the relationship between the shadow banking activities of non-financial companies and stock price crash risk. The impact mechanism is that the increase in economic policy uncertainty magnifies the positive relationship between the shadow banking activities of non-financial companies and the stock price crash through banks' loan reluctance, investor sensitivity to information, risk interaction mechanisms, and inefficient investment.

This research has important theoretical and practical significance for re-examining the diversified shadow banking system, preventing the hollowing out of the industry, and maintaining the financial market's stability:

(1) The policy recommendations are to strengthen the disclosure mechanism of corporate financial statements and the functional supervision of corporate underground financing activities by regulatory authorities, thereby curbing the trend of excessive shadow banking by non-financial companies.
(2) China should improve the capital market system and laws, give ful play to analysts' information intermediary role, and the supervisory effect of major shareholders to improve the capital market information environment and reduce stock market volatility.
(3) Policymakers must avoid substantial adjustments in economic policies and enhance the continuity and readability of policies to stabilize the expectations of micro-participants.

Author declaration

The authors assert that this work is an equal collaboration and is not under consideration elsewhere.

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Table 13
Mechanism 3: Risk cross-infection mechanism.

	High degree of business diversification	Low degree of business diversification	High degree of business diversification	Low degree of business diversification
	(1)	(2)	(3)	(4)
Explained variable	*NCSKEWt*		*DUVOLt*	
Sbscalet-1EPUt-1	0.0013***	0.0012	0.0008***	0.0010
	(0.000)	(0.001)	(0.000)	(0.001)
Controls	Y	Y	Y	Y
N	10,339	2980	10,339	2980
adj-R2	0.035	0.052	0.034	0.047
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Table 14
Mechanism 4: Inefficient investment mechanism.

	High degree of inefficient	Low degree of inefficient investment	High degree of inefficient	Low degree of inefficient investment
	(1)	(2)	(3)	(4)
Explained variable	*NCSKEW_Hresid*	*NCSKEW_Lresid*	*DUVOL_Hresid*	*DUVOL_Lresid*
Sbscalet-1EPUt-1	0.0015***	0.0006	0.0009**	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	Y	Y	Y	Y
N	8095	8465	8095	8465
adj-R2	0.030	0.037	0.030	0.037
Year FE	N	N	N	N
Firm FE	Y	Y	Y	Y

Notes: ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. *t* statistics are in parentheses.

Data availability

Data will be made available on request.

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