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Does a national industrial policy promote financial market stability? A study based on stock price crash risk

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ABSTRACT

Whether the implementation of a national industrial policy can maintain stability in the financial market is a question of theoretical and practical significance. Using data from China's non-financial listed firms from 2007 to 2020, we find that a national industrial policy lowers stock price crash risk. We find that the effect of an industrial policy on lowering stock price crash risk is more pronounced in regions with low levels of regional marketization and if firms have high external uncertainty, low total asset turnover, greater earnings management and receive small increments of long-term loans and fewer government subsidies, suggesting that industrial policies lower stock price crash risk by improving firm fundamentals and reducing external uncertainty, agency costs and information asymmetry.

1. Introduction

There are obvious theoretical and practical reasons for maintaining stability in the financial market to enable the financial system to better serve the real economy and achieve sustained and stable economic growth. On 22 February2019, at the 13th collective study of the Political Bureau of the Central Committee

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of the Communist Party of China (CCP), the general secretary stressed that "preventing and resolving financial risks, especially systemic financial risks, is the fundamental task of financial work".[2]The report of the 19th National Congress of the CCP also states "we should improve the financial supervision system and keep the bottom line against systemic financial risk".[3] Most studies on financial stability take the banking system as their main object of analysis, arguing that banks play a vital role in maintaining stability in the financial system (Mishkin, 1992; Padoa-Schioppa, 2003; Haldane et al., 2005). With the development of financial markets, the connotation of financial stability is no longer limited to stability in the banking system. The stable operations of the stock, futures, bonds and other markets also play a key role in financial stability (Shi et al., 2011; Peng et al., 2018). In recent years, China's financial markets have experienced several stock price crashes caused by a sharp fall in stock prices. A stock price crash not only harms the interests of shareholders but also undermines investor confidence in capital markets and endangers the healthy development of China's capital markets (Wang et al., 2015; Ye et al., 2015; Peng et al., 2018). Therefore, both policymakers and academics are concerned about reducing stock price crash risk and maintaining financial market stability.

A stock price crash refers to the phenomenon of a sudden and sharp drop in stock prices. The literature studies the factors that cause stock price crash risk from the perspective of firms and markets. Many studies discuss the efficient markets hypothesis and behavioral finance theory, yielding a wealth of research conclusions. Many scholars use the perspective of information asymmetry and agency problem to test the effect of top executives' gender(Li and Liu, 2012), stock option incentives (Kim et al., 2011; Yu et al., 2020), behavior of major shareholders (Wu and Li, 2015; Wang et al., 2015), analyst optimism (Xu et al., 2012), external audits (Callen and Fang, 2012; Chu and Fang, 2017), institutional investors (Xu et al., 2013; Ma and Tian, 2020), management tax avoidance (Jiang, 2013), convergence of international accounting standards (Defond et al., 2015), CEO overconfidence (Kim et al., 2016), religious tradition (Li and Cai, 2016), social trust (Li et al., 2017), corporate innovation strategy (Jia, 2018), managerial labor market (Chen et al.,2018) and administrative audit supervision (Wen et al., 2020) on stock price crash risk. According to the capital asset pricing model, firm fundamentals and information quality are key factors of stock price volatility and stock returns (Banz, 1981; Bhandari, 1988; Fama and French, 1992).

An industrial policy guides the upgrading of a country's industrial structure, optimizes the allocation of economic resources and promotes economic growth by formulating economic plans. Since the start of its economic reform and opening up policy in the late 1970s, China has used successive industrial policies covering almost all aspects of the national economy to achieve systematic economic growth (Chen et al., 2016). However, one question remains: Have the industrial policies pursued by China achieved their goal, and what has been the effect of their implementation? The answer to this question is related to the transformation of China's economic development mode, industrial upgrading and industrial structure adjustment and has important theoretical and practical ramifications. There is an ongoing debate about the effectiveness of industrial policies. Some studies find that industrial policies help to make up for market failures and rationalize regional industrial structures (Han et al., 2017), improve resource allocation efficiency (Lin, 2002; Song and Wang, 2013) and promote industrial development (Shu, 2013). Others find that industrial policies considerably hinder the endogenous dynamic evolution of a country's industrial structure and subsidizes upstream industries while increasing costs for downstream industries, thereby reducing their market competitiveness (Jiang and Li, 2010). From a microeconomic perspective, Chen et al. (2010) find that industrial policies help firms obtain more initial public offering(IPO) financing and refinancing opportunities, providing preliminary empirical evidence for the effect of national industrial policies on firm behavior. Follow-up studies show that industrial policies help firms obtain credit support (Zhu et al., 2015) and improve the innovation efficiency of microenterprises (Peters et al., 2012), enterprise technological innovation (Yu et al., 2016) and total factor productivity (Aghion et al., 2015). However, other studies find that industrial policies reduce investment efficiency (Li and Li, 2014; Zhu et al., 2015). Policy support only increases the quantity of innovation but not the quality (Li and Zheng, 2016).Therefore, the research findings on this topic, whether based on the macro perspective or the micro perspective, are mixed and require further in-depth exploration. Although there is a rich literature on

[2] https://www.gov.cn/xinwen/2019-02/23/content_5367953.htm.
[3] https://www.gov.cn/zhuanti/2017-10/27/content_5234876.htm.

the economic consequences of industrial policies, very few studies examine the impact of industrial policies on stock price crash risk by analyzing firm fundamentals. Deng and Zhan (2020) discuss the effect of industrial policies on stock price crash risk and argue that the implementation of national industrial policies induces a "herd effect" among investors and that they "blindly" follow investment trends, which leads to an overheating in the stock market and eventually to a stock price crash. However, they do not analyze the effect of industrial policies on stock price crash risk using firm-level elements, such as firm fundamentals, agency problems and information asymmetry. We believe that it is necessary to further examine the capital market effects of industrial policy implementation in terms of stock price crash risk.

We study the role of industrial policies on stock price volatility from the perspective of stock price crash risk, analyze the effect of industrial policies on the stability of China's financial markets and delve into the channels and mechanisms through which industrial policies affect the stability of financial markets.We examine the effect of national industrial policies on financial market stability from the perspective of stock price crash risk, using a sample of non-financial A-share listed firms in China from 2007 to 2020. We find that firms supported by national industrial policies have significantly lower stock price crash risk than those not covered by the policies, which indicates the stabilizing effect of national industrial policies on financial markets. Moreover, this relationship is more pronounced in regions with low levels of regional marketization than in regions with high levels of regional marketization. Furthermore, our results show that industrial policy implementation lowers stock price crash risk more significantly when firms have high external uncertainty, receive a small increase in long-term loans, receive fewer government subsidies and have low total asset turnover and a high level of earnings management, indicating that national industrial policies reduce stock price crash risk by reducing external uncertainty, agency costs and information asymmetry and improving firm fundamentals.

This study contributes to the literature in the following ways. First, we analyze the effect of national industrial policies on the stability of financial markets from the perspective of stock price crash risk, which enriches the theoretical understanding of the economic consequences of national industrial policies. Second, we link macroeconomic industrial policies with firm stock price crash risk and discuss the mechanism through which industrial policies affect stock price crash risk. We verify that firm fundamentals, agency problems and information asymmetry determine stock price volatility, which enriches the literature on stock price crash risk. Third, our findings have important policy implications. The financial system provides a framework that supports the development of the real economy. Therefore, financial market instability weakens the functioning of the financial system and inhibits the development of the real economy. It is important to understand how to stabilize financial markets. Our study findings provide empirical evidence to support the central government's policy stance that "we should improve the financial supervision system and keep the bottom line against systemic financial risks."Finally, our findings also have obvious practical implications for understanding the relationship between the government and the market and the role of the government during a transition period. As China's financial markets are unstable and provide insufficient support to the real economy at present, the government can control stock price crash risk and stabilize these markets through an appropriate industrial policy.

2. Hypothesis development

French et al. (1987) and Bekaert and Wu (2000) find that there is an "asymmetric" feature in the rise and fall of the stock market; that is, the stock market is more prone to sharp falls in stock prices than to sharp increases. Jin and Myers (2006) explain how a stock price crash occurs using information theory. Following these early studies, many studies show that stock price crash risk is due to the withholding of information by management; that is, management hides adverse internal information about the firm for private interests, such as salary incentives, job promotions and tax evasion, resulting in a lack of transparency in firm information. When the hidden adverse information exceeds a certain threshold, it is released all at once on the stock market, causing a sharp decline in stock prices (Jin and Myers, 2006; Hutton et al., 2009; Kim et al., 2011; Piotroski and Wong, 2012). However, the above studies ignore the important role of firm intrinsic value on stock price volatility. Banz (1981), Bhandari (1988) and Fama and French (1992) point out that firm fundamentals are key factors of stock price volatility and stock returns. The deterioration of firm intrinsic value increases the risk of a leftward deviation of stock prices, which is the internal cause of a stock price crash (Konchitchki et al., 2016). Managers conceal bad news because of opportunistic motives, thus aggravating information asymmetry, which is the direct cause of a stock price crash. Therefore, we consider that a stock price crash is caused mainly by three factors: the possibility of deterioration in the intrinsic value of individual stocks, the motivation and ability of managers to hide bad news and information asymmetry between the firm and external investors.

After the Communist Party of China took over the country, China has implemented many industrial policies through its "Five-Year Plans" formulated by the central government every 5 years. In 1953, China started its first five-year plan for developing heavy industries. Since 1953, China has implemented thirteen five-year plans. Year 2020 marked the last year of the thirteenth Five-Year Plan. China's Five-Year Plans provide a comprehensive long-term plan for major national construction projects, productivity distribution and a major proportion of the national economy, which guides the modernization of industrial structure and provides directions for future economic development. After a Five-Year Plan comes into effect, governments at all levels adopt measures, such as direct intervention and indirect guidance, to implement industrial policies. Direct intervention occurs through market access requirements, project approvals, technology controls, environmental protection controls, production safety controls and other means, while indirect guidance occurs mainly through fiscal and monetary policies (Yu et al., 2016). Government intervention affects the market access threshold, the degree of industrial competition, the financing status of firms, development opportunities and the external business environment, which in turn affect stock price crash risk. We consider that industrial policies affect stock price crash risk through three aspects: firm fundamentals, management agency problem and the information environment.

From the perspective of firm fundamentals, industrial policies reduce external uncertainty and improve firm fundamentals, which then reduce stock price crash risk. However, industrial policies may also aggravate overinvestment and damage firm value, thereby increasing stock price crash risk. Indeed, there is tremendous uncertainty in government behavior under imperfect private property rights, which makes it difficult for investors to predict the future value of a firm (Chen and Yao, 2018); therefore, low external uncertainty is a precondition for investors to use information, such as firm fundamentals, to carry out risk arbitrage. Unlike the traditional view that political intervention increases economic uncertainty (Shleifer and Vishny, 1994; Morck et al., 2000), Chen and Yao (2018) find that China's industrial policies are more of a signal that has a strong guiding effect, thereby reducing firms' external uncertainty. Moreover, while implementing an industrial policy, the government takes measures to promote the development of supported firms. For example, Qian et al. (2015) point out that government subsidies are a direct route for local governments to consciously guide resources to industries, which reduces cash flow pressure for supported firms. In addition, the government guides financial resources to industries through adjustments in bank credit and refinancing policies and other indirect measures, which ease the financing constraints of supported firms (Chen et al., 2010; Yu et al., 2016). Firms need sufficient cash reserves and financial resources to overcome liquidity constraints, increase value-relevant investment such as R&D and improve their intrinsic value, which ultimately reduces stock price crash risk. However, an industrial policy sends a positive message to the market, which raises investor expectations of supported firms. The support of industrial policies greatly increases firm investment opportunities, making firms prone to the "investment wave phenomenon" (Lin, 2007), and leads to overinvestment and an increase in invalid investments, which create new financing constraints (Zhang et al., 2017). Firms' long-term investment in projects with a negative net present value increases operational risks and damages firm value, thereby increasing stock price crash risk.

From the perspective of agency costs, the implementation of an industrial policy affects stock price crash risk through the agency problem. Local governments optimize the business environment by relaxing industrial controls, simplifying administrative approval procedures and reducing industry entry barriers, so as to guide the entry of external capital, eliminate backward firms and improve industry competitiveness (Li and Zheng, 2016; Meng et al., 2016). Improved industrial competition has positive and negative incentive effects on firm managers (Schmidt, 1997). Indeed, managers have an incentive to hide bad news or exaggerate good news (Jin and Myers, 2006; Hutton et al., 2009). Market competition can effectively restrain or supervise managers as an external corporate governance mechanism (Jiang et al., 2009; Liu and Yu, 2009). The higher the degree of market competition, the more likely managers' opportunistic behavior will be discovered by external investors, which reduces the scope of earnings management. Moreover, stakeholders are more likely to require management to adopt a more robust accounting treatment in a competitive market environment, which to some extent reduces the foam component of a firm's stock price, thereby reducing stock price crash risk. However, competition may lead to a reduction in monopoly rent; the decline in excess profits reduces managers' motivation to work hard, which is not conducive to the stability of stock prices.

From the perspective of information asymmetry, the information conveyed through regulation policies is very important for investors and enterprises in the context of China's capital market information environment needs improvement. Indeed, an industrial policy sends signals about the future development prospects of different industries, which directly reduces the information collection costs of investors. Additionally, the industrial policy lowers the market access threshold, improves the degree of industry competition and promotes the disclosure of the business and financial status of firms (Hayes and Lundholm, 1996; Birt et al., 2006; Chen and Wang, 2015). Together, the signaling effect of the policy and the voluntary disclosure of firm information are conducive to reducing the information asymmetry between external investors and firms, thereby enabling the timely release of bad news and reducing stock price crash risk. However, an industrial policy may also aggravate the information asymmetry between external investors and firms. As firms have to compete for government resources, they have an incentive to whitewash their information to obtain government subsidies, which makes them more likely to hide bad news, thereby reducing the quality of firm information. Moreover, investors at an information disadvantage tend to rely heavily on the signals conveyed by industrial policies, resulting in herd behavior and overheating in the stock market. These behaviors will lead to stock price volatility and increase stock price crash risk (Deng and Zhan, 2020).

Therefore, we propose the following hypotheses.

H1a: *Ceteris paribus*, the implementation of a national industrial policy decreases stock price crash risk.
H1b: *Ceteris paribus*, the implementation of a national industrial policy increases stock price crash risk.

3. Research design

3.1. Sample and data

We take all A-share listed firms in China from 2007 to 2020 as our research sample. New Chinese accounting standards were implemented in 2007, which not only supplements the new standard but also revises the general principles of the original accounting. Considering that the financial indicators are comparable within the sample period, we use 2007 as the first year of the sample period. The 13th Five-Year Plan ended in 2020, so we use 2020 as the last year of the sample period. Following the literature (Wang et al., 2015; Ye et al., 2015; Peng et al., 2018; Chen et al., 2018), we exclude financial firms, firms classified as special treatment, firms with less than 30 weeks of stock returns and firms with missing financial data. Our final sample consists of 31,214 firm-year observations. Table 1 shows the sample selection procedure. The financial data are collected from the China Stock Market and Accounting Research (CSMAR) database, and the industrial policy data are identified and sorted according to China's Five-Year Plans. We winsorize all continuous variables at the 1st and 99th percentiles to reduce the influence of outliers.

3.2. Model specification

Following Xu et al. (2012), Xu et al. (2014), Wang et al. (2015)and Chen et al. (2018), we establish regression model (1) to test the effect of China's industrial policies on stock price crash risk.

$$Crash_{i,t+1} = \alpha_0 + \alpha_1 IP_{i,t} + \alpha_2 Control_{i,t} + \varepsilon_{i,t} \tag{1}$$

3.3. Variable definitions

3.3.1. Independent variable: Industrial policy

Our research sample covers the 11th Five-Year Plan (2006–2010), 12th Five-Year Plan (2011–2015) and 13th Five-Year Plan (2015–2020). Following Chen et al. (2010), Li and Li (2014), Chen et al. (2017) and

Table 1
Sample selection procedure for supported firms.

	Firm-year observations	Firms	
Panel A: Sample selection for firms supported by an industrial policy			
All A-share listed firms (2007–2020)	36,736	3,956	
minus: firms with less than 30 weeks of stock returns	2171	150	
minus: financial firms	715	43	
minus: firms classified as special treatment	1,551	86	
minus: firms with missing financial data	1,085	25	
Number of observations after selection	31,214	3,652	
	11thFive-Year Plan (2007–2010)	12thFive-Year Plan (2011–2015)	13thFive-Year Plan (2016–2020)
Panel B: Sample distribution of supported firms			
Number of observations after selection	5,431	10,448	15,335
Supported firms	3,882	5,658	8,525
Proportion (%)	71.48	54.15	55.59

Chen and Yao (2018), the independent variable *IP* represents all industries supported by China's national industrial policies. If an industry is listed as "encouraged," "supported," "actively developed," "vigorously developed" or "key development industry" in the Five-Year Plan documents for that year, then *IP* takes a value of 1 and otherwise 0. The classification of the supported industries in our sample is provided in Appendix A.

3.3.2. Dependent variable: Stock price crash risk

The dependent variable *Crash* represents stock price crash risk, which is measured by *NCSKEW* and *DUVOL*. It is calculated as follows.

First, we use Eq. (2) to calculate market-adjusted stock returns:

$$r_{i,s} = \alpha + \beta_{1,i} \times r_{m,s-2} + \beta_{2,i} \times r_{m,s-1} + \beta_{3,i} \times r_{m,s} + \beta_{4,i} \times r_{m,s+1} + \beta_{5,i} \times r_{m,s+2} + \varepsilon_{i,s} \tag{2}$$

where $r_{i,s}$ is the return of stock *i* in week *s* for each year and $r_{m,s}$ is the average return weighted by the current market value of all stocks in week *s*. At the same time, we add a lagged term ($r_{m,s-1}$, $r_{m,s-2}$) and a super front term ($r_{m,s+1}$, $r_{m,s+2}$) for market return to Eq. (2) considering the effect of nonsynchronous stock trading (Dimson, 1979).

Because the distribution of the residual term obtained by Eq. (2) is highly skewed, to make the residual term assume a standard normal distribution, we carry out logarithmic transformation to obtain the weekly return of stock *i* in week *s* denoted by *Wi,s* calculated by Eq. (3):

$$W_{i,s} = \ln(1 + \varepsilon_{i,s}) \tag{3}$$

The first measure of stock price crash risk is *NCSKEW*, and the calculation method is shown in Eq. (4), where *n* is the number of trading weeks for stock *i* in year *t*. The higher the value of *NCSKEW*, the higher the degree of negative skewness of the stock return and the greater the stock price crash risk.

$$NCSKEW_{i,t} = -\left[n(n-1)^{3/2}\sum W_{i,s}^{3}\right] / \left[(n-1)(n-2)\left(\sum W_{i,s}^{2}\right)^{3/2}\right] \tag{4}$$

The second measure of stock price crash risk is *DUVOL*. According to whether *Wi, s* is higher than the average annual stock return, the stock return data are divided into two subsamples, up weeks and down weeks, and then calculated using Eq. (5),where *nu* (*nd*) is the number of weeks and $W_{i,\ s}$ is above (below) the average stock return. The higher the value of *DUVOL*, the greater the leftward deviation of the stock return and the greater the stock price crash risk.

$$DUVOL_{i,t} = \ln\left\{\left[(n_u - 1)\sum_{down} W_{i,s}^{2}\right] / \left[(n_d - 1)\sum_{up} W_{i,s}^{2}\right]\right\} \tag{5}$$

3.3.3. Control variables

Following Xu et al. (2013), Xu et al. (2014)and Wang et al. (2014), we control for several variables: monthly excess stock turnover (*Turnover*), standard deviation of weekly stock returns in a year (*Sigma*), average weekly stock return in a year (*Ret*), firm size (*Size*), firm leverage (*Lev*), return on assets (*ROA*), book-to-market ratio (*BM*), cash flow ratio (*PCF*), analyst following (*Ana*) and shareholding ratio of institutional investors (*Hinshold*). Last, we control for industry fixed effects (*Industry*) and year fixed effects (*Year*). The definitions of the variables are provided in Appendix B.

4. Empirical results

4.1. Descriptive statistics

The descriptive statistics of the main variables are shown in Table 2. The means of *NCSKEW_F* and *DUVOL_F* are –0.289 and –0.190, respectively, which are roughly similar to the values of–0.248 and –0.218 reported by Xu et al. (2012), and the standard deviations are 0.712 and 0.478, respectively, indicating that there are differences in stock price crash risk among the firms in our sample. The mean *IP* is 0.579, indicating that about 57.9% of the firms in the sample are supported by an industrial policy, slightly lower than the 60.3% reported by Li and Li (2014) and 61.2% reported by Chen and Yao (2018). The descriptive statistics of other control variables are detailed in Table 2 which are generally consistent with existing studies.

4.2. Baseline regression results

Table 3 reports the regression results for the effect of China's industrial policies on stock price crash risk. Columns (1) and (2) show the results after controlling for year and industry fixed effects, and columns (3) and (4) show the results after further controlling for firm fixed effects. Table 3 shows that the coefficients on *IP* are significant and negative at the 1% level, indicating that an industrial policy has a significant inhibitory effect on stock price crash risk, which facilitates stability in financial markets. Thus, H1a is supported.

The regression results of the control variables show that the coefficient on *Turnover* is significant and negative at the 1% level, indicating that the higher the firm's stock trading liquidity, the lower the stock price crash risk. The coefficient on *Size* is significant and negative at the 1% level, indicating that large firms have a greater ability to withstand risk than small firms, so their stock price crash risk is lower. The coefficient on *ROA* is significant and negative at the 1% level, indicating that the better the performance of the firm, the lower its stock price crash risk. These results are consistent with our expectations.

Table 2
Descriptive statistics.

	N	Mean	Std. Dev.	*P*1	Median	P99
NCSKEW_F	31,214	–0.289	0.712	–2.415	–0.250	1.702
DUVOL_F	31,214	–0.190	0.478	–1.354	–0.189	1.057
IP	31,214	0.579	0.494	0	1	1
NCSKEW	31,214	–0.291	0.705	–2.398	–0.255	1.679
DUVOL	31,214	–0.194	0.474	–1.349	–0.194	1.049
Sigma	31,214	0.065	0.024	0.026	0.060	0.146
Ret	31,214	0.003	0.011	–0.020	0.002	0.037
Turnover	31,214	–0.104	0.478	–1.952	–0.034	0.993
Size	31,214	22.240	1.421	19.730	22.010	27.290
Lev	31,214	0.451	0.211	0.057	0.446	0.940
ROA	31,214	0.034	0.066	–0.323	0.034	0.193
BM	31,214	0.628	0.248	0.116	0.627	1.156
PCF	31,214	0.086	0.261	–1.335	0.082	1.009
Ana	31,214	1.462	1.194	0	1.386	3.807
Hinshold	31,214	0.063	0.074	0	0.036	0.348

Table 3
Baseline regression results for industrial policy and stock price crash risk.

	(1) *NCSKEW_F*	(2) *DUVOL_F*	(3) *NCSKEW_F*	(4) *DUVOL_F*
IP	–0.042***	–0.032***	–0.063***	–0.049***
	(–2.79)	(–3.10)	(–3.20)	(–3.72)
NCSKEW	0.055***		–0.076***	
	(9.13)		(–11.33)	
DUVOL		0.049***		–0.077***
		(8.13)		(–11.51)
Sigma	–0.272	–0.514***	0.052	–0.283
	(–0.98)	(–2.76)	(0.15)	(–1.22)
Ret	8.088***	5.416***	5.743***	4.079***
	(12.09)	(11.84)	(7.45)	(7.78)
Turnover	–0.046***	–0.030***	–0.052***	–0.036***
	(–4.63)	(–4.45)	(–4.23)	(–4.36)
Size	–0.044***	–0.041***	0.022	–0.003
	(–7.67)	(–10.29)	(1.59)	(–0.30)
Lev	–0.024	–0.012	–0.116**	–0.067**
	(–0.90)	(–0.68)	(–2.33)	(–2.01)
ROA	–0.470***	–0.317***	–0.372***	–0.268***
	(–6.16)	(–6.14)	(–3.84)	(–4.13)
BM	–0.052*	–0.005	–0.262***	–0.148***
	(–1.81)	(–0.27)	(–5.76)	(–4.94)
PCF	–0.004	–0.008	–0.032*	–0.024**
	(–0.24)	(–0.74)	(–1.71)	(–2.00)
Ana	0.039***	0.022***	0.013*	0.008
	(7.73)	(6.64)	(1.75)	(1.59)
Hinshold	0.743***	0.473***	0.737***	0.461***
	(11.43)	(10.45)	(7.52)	(6.95)
Constant	0.747***	0.786***	–0.482	0.068
	(6.27)	(9.31)	(-1.64)	(0.33)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	No	No
Firm FE	No	No	Yes	Yes
N	31,214	31,214	31,214	31,214
Adj. R^2	0.066	0.071	0.095	0.099

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

4.3. Cross-sectional effects in different regions with different marketization levels

External risks and uncertainty lead to difficulties in firm operations, a decline in firms' internal value and a decline in share prices. Compared with firms that are not supported by an industrial policy, those that are supported by such a policy experience reduced external risks and uncertainty; that is, when a firm is in trouble, it can obtain financing through industrial policy support, reduce its financing constraints and cash flow risk and enhance its internal value, leading to a reduction in stock price crash risk.

Regional marketization is an important source of operational risk and uncertainty. In areas with a high level of marketization, the market environment is relatively perfect, the legal system is sound, law enforcement efficiency is high, financial markets are more developed and the external environment of firms is favorable. Shen et al. (2010a, 2010b) find that an improvement in the marketization level helps reduce financing risks and constraints. In areas with a high level of marketization, there is strong protection of property rights, a more robust regulatory system and higher firm information disclosure quality (Cheng et al., 2011). The perfect market environment helps commercial banks safeguard their legitimate rights and reduce credit risk by relying on the system. However, areas with a low level of marketization have weak property rights protection and a weak judicial system and high credit risk. Credit institutions reduce their scale of credit to protect their own rights and interests (Chen and Wang, 2015). Furthermore, the financial market in areas with a low level of marketization is underdeveloped, firms have fewer external financing channels and transaction costs are high; thus, the external business environment of firms is unfavorable. Firms have difficulty obtaining financing, leading to financing constraints. An industrial policy can reduce operational risk and uncertainty in areas with a low level of marketization. The information and resource effects of a country's industrial policy can effectively reduce firms' financing constraints in areas with a low level of marketization, managers' opportunistic behavior and motivation for earnings manipulation, which reduce noise in stock pricing, improve the information content of stock prices and further reduce stock price crash risk. Therefore, the inhibitory effect of an industrial policy on stock price crash risk is more obvious for firms in regions with low levels of marketization than for those in regions with high levels of marketization.

We use the marketization index from China's Provincial Marketization Index Report (Wang et al., 2019) to examine the effect of the marketization level on industrial policy and stock price crash risk. The higher the regional marketization index, the higher the level of regional marketization. Furthermore, based on the annual industry median of the regional marketization index, the sample is divided into two groups: high and low levelsof regional marketization. The regression results are reported in Table 4. In columns (1) and (2), *NCSKEW_F* is used to measure stock price crash risk; the coefficient on *IP* in the low level of marketization subsample is –0.074, significant at the 1% level, while the coefficient on *IP* in the high level of marketization subsample is not significant. In columns (3) and (4), the coefficient on *IP* in the low level of marketization subsample is –0.056, significant at the 1% level, while the coefficient on *IP* in the high level of marketization subsample is –0.008, but is not significant. The above results show that in regions with low levels of marketization, firms face more external operational risks and uncertainty. Therefore, in this environment, the role of national industrial policies in reducing stock price crash risk is more obvious.

5. Robustness tests

5.1. Alternative measure of stock price crash risk

Following Luo and Du (2014), we use weekly stock returns (*Wi,t*) as an alternative variable for stock price crash risk (*Crashrisk*):

$$W_{i,t} \leqslant Average(W_{i,t}) - 3.09\sigma_{i,t} \tag{6}$$

where $Average\ (W_{i,t})$ refers to the average weekly stock return that year, $\sigma_{i,t}$ is the standard deviation of weekly stock returns that year and 3.09 standard deviations correspond to the probability interval of 0.1% under the standard normal distribution. If $W_{i,t}$ meets the condition of Formula (6) at least once a year, it means that the firm experienced a stock price crash that year. In this case, *Crashrisk* takes a value of 1 and 0 otherwise. Table 5 shows that the coefficient on *IP* is still significant and negative at the 1% level, indicating that industrial policy implementation reduces stock price crash risk, proving that our findings are robust.

5.2. Heckman two-stage model

The design of a national industrial policy and the industries it supports may not be fully exogenous, leading to self-selection bias. The Heckman two-stage model is used to reduce the endogeneity problem caused by self-selection bias. Song and Wang (2013) find that the relative importance of an industry to the national economy and livelihoods determines whether that industry is listed as a supported industry, withits future growth prospects, profitability and contribution to social employment being specific criteria for judging its relative importance. Therefore, in the first stage, we take industry development capacity (*Ind_DC*), industry profitability (*Ind_ROE*) and social employment contribution (*Ind_EC*) as independent variables to determine whether an industry is supported by an industrial policy[4] and then estimate the inverse Mills ratio (*IMR*). The regres-

[4] Ind_DC = (Industry operating income in the current year – Industry operating income in the previous year)/Industry operating income in the previous year.Ind_ROE = Total net profit of firms in the industry/Total owners' equity of firms in the industry.Ind_EC = (Number of employees in the industry in the current year – Number of employees in the industry in the previous year)/Number of employees in the industry in the previous year.

Table 4
Effect of the marketization level on industrial policy and stock price crash risk.

	(1) High	(2) Low	(3) High	(4) Low
	NCSKEW_F		*DUVOL_F*	
IP	–0.014	–0.074***	–0.008	–0.056***
	(0.67)	(–2.95)	(–0.58)	(–3.32)
NCSKEW	0.053***	0.054***		
	(5.77)	(6.67)		
DUVOL			0.048***	0.047***
			(5.47)	(5.83)
Sigma	0.095	–0.625*	–0.337	–0.711***
	(0.22)	(–1.74)	(–1.18)	(–2.89)
Ret	5.468***	10.097***	4.231***	6.491***
	(5.15)	(11.15)	(6.01)	(10.24)
Turnover	–0.042**	–0.047***	–0.027**	–0.031***
	(–2.57)	(–3.70)	(–2.47)	(–3.59)
Size	–0.038***	–0.051***	–0.032***	–0.050***
	(–4.23)	(–6.89)	(–5.14)	(–9.48)
Lev	0.019	–0.047	–0.000	–0.014
	(0.48)	(–1.28)	(–0.00)	(–0.57)
ROA	–0.424***	–0.517***	–0.303***	–0.338***
	(–3.48)	(–5.22)	(–3.72)	(–5.03)
BM	–0.139***	0.018	–0.074**	0.048*
	(–3.25)	(0.46)	(–2.55)	(1.86)
PCF	–0.013	0.007	–0.018	0.002
	(–0.58)	(0.32)	(–1.19)	(0.12)
Ana	0.041***	0.038***	0.023***	0.023***
	(5.29)	(5.59)	(4.37)	(5.16)
Hinshold	0.746***	0.719***	0.498***	0.421***
	(8.09)	(7.63)	(7.79)	(6.47)
Constant	0.632***	0.915***	0.601***	0.971***
	(3.44)	(5.69)	(4.68)	(8.42)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	13,988	17,226	13,988	17,226
Adj.R^2	0.079	0.058	0.083	0.063

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

sion results are reported in column (1) of Table 6. Furthermore, the *IMR* estimate from the first stage is added to the second-stage regression, and the results are shown in columns (2) and (3) of Table 6. The coefficient on *IMR* in the second-stage regression is positive but not significant, and the coefficient on *IP* is still significant and negative at the 1% level. These results show that after controlling for self-selection bias, our main conclusion remains robust.

5.3. Propensity score matching method and difference-in-differences

We use propensity score matching and the difference-in-differences model (PSM-DID) to further control for the endogeneity of the time-series effect of stock price crash risk and other factors that may lead to a difference in stock price fluctuations between industries supported by an industrial policy and industries not supported by such a policy. Following Yu et al. (2016), we divide the sample into two parts, the implementation period of the 11th and 12th Five-Year Plans and the implementation period of the 12th and 13th Five-Year Plans, and set Eq. (7) for the regression.

$$Crash_{i,t+1} = \mu_0 + \mu_1 Treated_{i,t} + \mu_2 Post_{i,t} + \mu_3 Treated_{i,t} \times Post_{i,t} + \mu_4 Control_{i,t} + \varepsilon_{i,t} \quad (7)$$

Table 5
Using an alternative measure to calculate stock price crash risk.

	Crashrisk_F	
	Coefficient	Z-statistics
IP	−0.071***	−3.03
Crashrisk	0.023	0.79
Sigma	−2.543***	−3.74
Ret	4.471**	2.51
Turnover	−0.035	−1.52
Size	−0.056***	−4.02
Lev	−0.473***	−2.71
ROA	0.046	0.75
BM	−0.103	−1.60
PCF	−0.013	−0.34
Ana	−0.033***	−2.89
Hinshold	0.545***	3.39
Constant	2.517***	3.31
Year FE	Yes	
Industry FE	Yes	
N	31,214	
Pseudo R^2	0.0269	

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

When the sample period is the implementation period of the 11th and 12th Five-Year Plans, *Treated* takes a value of 1 if both Five-Year Plans list an industry as supported and a value of 0 if an industry is supported by the industrial policy of the 11th Five-Year Plan but not supported by the industrial policy of the 12th Five-Year Plan. The shock event is 2011, the year the 12th Five-Year Plan came into effect; after 2011, *Post* takes a value of 1 and 0 otherwise. Similarly, when the sample period is the implementation period of the 12th and 13th Five-Year Plans, *Treated* takes a value of 1 if both Five-Year Plans list an industry as supported and a value of 0 if an industry is supported by the industrial policy of the 12th Five-Year Plan but not supported by the industrial policy of the 13th Five-Year Plan. The shock event is 2016, the year the 13th Five-Year Plan came into effect; after 2016, *Post* takes a value of 1 and 0 otherwise. The control variables are the same as in the baseline regression. The main coefficient here is μ_3; if μ_3 is significant and negative, indicating that stock price crash risk is lower in industries supported by an industrial policy than in industries not supported by such a policy. That is, an industrial policy has a significant inhibitory effect on stock price crash risk.

Furthermore, we adopt PSM to avoid differences in firm characteristics between the treated and control groups on the effectiveness of the DID model. Taking the control variables of Model (1) as covariates, the firms in the control group are one-to-one matched with firms with the most similar firm characteristics in the treated group. The regression results of the matched sample are shown in Table 7. The coefficient on *Post* × *Treated* is significant and negative at the 1% level, indicating that the regression results for the inhibitory effect of an industrial policy on stock price crash risk are robust (Table 7).

6. Mechanism test

6.1. Reducing external uncertainty and improving firm fundamentals

Firm fundamentals are key to asset pricing (Banz, 1981; Bhandari, 1988; Fama and French, 1992). Through industrial policy support, firms can obtain more credit financing, thereby mitigating their financing constraints (Chen et al., 2010), and obtain government subsidies to supplement their cash flow (Qian et al., 2015). An industrial policy reduces external uncertainty, improves firms' ability to withstand systemic risk, enhances their internal value and improves firm fundamentals, which decrease stock price crash risk. We follow Shen et al. (2010a, 2010b) and measure external uncertainty (*EU*) based on changes in firms' sales revenue to test the mechanism for reducing external uncertainty. This indicator accurately reflects the effect of a firm's external environment (Tosi et al., 1973; Shen et al., 2010a, 2010b; Zhang et al., 2010). Based on the annual industry average of *EU*, we divide the sample into two groups, high and low *EU*, and show the results in Table 8. Columns (1) and (2) show the results taking *NCSKEW_F* as the dependent variable; the coefficient on *IP* in the low *EU* group is not significant, while the coefficient on *IP* in the high *EU* group is –0.057, which is significant at the 1% level. Columns (3) and (4) are the results taking *DUVOL_F* as the dependent variable; the coefficient on *IP* in the low *EU* group is not significant, while the coefficient on *IP* in the high *EU* group is –0.039, which is significant at the 1% level. The above results show that an industrial policy decreases stock price crash risk by reducing external uncertainty.

Table 6
Regression results of the Heckman two-stage model.

	(1)	(2)	(3)
	First-stage regression	Second-stage regression	
	IP	*NCSKEW_F*	*DUVOL_F*
Ind_DC	0.001***		
	(12.84)		
Ind_ROE	0.183***		
	(7.59)		
Ind_EC	0.323***		
	(18.29)		
IP		–0.042***	–0.032***
		(–2.79)	(–3.09)
IMR		0.004	–0.020
		(0.05)	(–0.40)
NCSKEW		0.055***	
		(9.13)	
DUVOL			0.049***
			(8.13)
Sigma		–0.272	–0.515***
		(–0.98)	(–2.77)
Ret		8.087***	5.420***
		(12.09)	(11.85)
Turnover		–0.046***	–0.030***
		(–4.63)	(–4.45)
Size		–0.044***	–0.041***
		(–7.66)	(–10.30)
Lev		–0.024	–0.012
		(–0.90)	(–0.68)
ROA		–0.470***	–0.317***
		(–6.15)	(–6.14)
BM		–0.004	–0.008
		(–0.23)	(–0.74)
PCF		–0.052*	–0.005
		(–1.81)	(–0.26)
Ana		0.039***	0.022***
		(7.73)	(6.65)
Hinshold		0.743***	0.473***
		(11.43)	(10.45)
Constant	–1.803***	0.743***	0.804***
	(–13.57)	(5.30)	(8.37)
Year FE	Yes	Yes	Yes
Industry FE	No	Yes	Yes
N	31,214	31,214	31,214
Pseudo R^2	0.071		
Adj. R^2		0.066	0.071

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7
Regression results of PSM-DID.

	(1)	(2)	(3)	(4)
	11th and 12th Five-Year Plan		12th and 13th Five-Year Plan	
	NCSKEW_F	*DUVOL_F*	*NCSKEW_F*	*DUVOL_F*
Treated	0.150*	0.109*	0.123*	0.081*
	(1.73)	(1.77)	(1.78)	(1.78)
Post	–0.384***	–0.247***	0.217***	0.184***
	(–5.24)	(–4.62)	(3.51)	(4.57)
Post × *Treated*	–0.184***	–0.097**	–0.122***	–0.090***
	(–2.81)	(–2.17)	(–2.59)	(–2.89)
NCSKEW	0.001		0.057***	
	(0.07)		(3.39)	
DUVOL		0.017		0.057***
		(0.81)		(3.46)
Sigma	–0.204	–0.476	1.549*	0.369
	(–0.19)	(–0.66)	(1.85)	(0.65)
Ret	4.866*	4.884***	8.572***	6.299***
	(1.93)	(2.97)	(4.18)	(4.53)
Turnover	0.022	0.035	–0.106***	–0.062**
	(0.61)	(1.37)	(–2.72)	(–2.36)
Size	–0.065***	–0.050***	–0.033*	–0.040***
	(–3.38)	(–3.80)	(–1.93)	(–3.61)
Lev	–0.051	–0.080	–0.012	–0.005
	(–0.51)	(–1.16)	(–0.15)	(–0.09)
ROA	–0.223	–0.247	–0.363*	–0.307**
	(–0.73)	(–1.17)	(–1.76)	(–2.29)
BM	0.009	0.022	–0.010	–0.009
	(0.27)	(0.91)	(–0.24)	(–0.35)
PCF	0.085	0.137*	–0.103	0.001
	(0.82)	(1.93)	(–1.23)	(0.01)
Ana	0.076***	0.045***	0.046***	0.027***
	(4.25)	(3.69)	(3.06)	(2.83)
Hinshold	0.821***	0.545***	0.907***	0.568***
	(4.40)	(4.06)	(4.15)	(3.86)
Constant	0.922**	0.778***	0.271	0.618***
	(2.29)	(2.90)	(0.79)	(2.74)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	2,428	2,428	4,170	4,170
Adj. R^2	0.073	0.076	0.064	0.064

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Furthermore, we study the mechanism for the effect of an industrial policy on reducing stock price crash risk by improving firm fundamentals. The implementation of an industrial policy can improve firm fundamentals directly and indirectly. The government can directly implement an industrial policy through subsidies, which supplement firms' cash flow. The total amount of government subsidies received by a firm divided by its operating income is used as a proxy for improvement in firm fundamentals, and the sample is divided into two groups based on the annual industry average of government subsidies. The results are shown in columns (1)–(4) of Table 9. The coefficient on *IP* is significant and negative at the 1% level for firms receiving fewer subsidies, while the coefficient on *IP* is not significant for firms receiving more subsidies, which shows that an industrial policy improves firm fundamentals directly by increasing government subsidies, thus reducing stock price crash risk.

The government can also indirectly improve firm fundamentals through bank credit policies, refinancing policies and other financial policies to increase firms' credit scale and reduce their financing constraints. An increase in long-term loans leads to a greater improvement in credit capacity than an increase in short-term

Table 8
Industrial policy, external uncertainty and stock price crash risk.

	(1) High	(2) Low	(3) High	(4) Low
	NCSKEW_F		*DUVOL_F*	
IP	–0.057***	–0.013	–0.039***	–0.018
	(–2.85)	(–0.55)	(–2.91)	(–1.05)
NCSKEW	0.049***	0.063***		
	(6.40)	(6.12)		
DUVOL			0.042***	0.059***
			(5.50)	(5.77)
Sigma	–0.604*	0.204	–0.791***	–0.110
	(–1.76)	(0.42)	(–3.43)	(–0.35)
Ret	7.426***	9.261***	5.065***	6.095***
	(8.98)	(7.57)	(8.90)	(7.47)
Turnover	–0.048***	–0.038**	–0.032***	–0.023*
	(–4.13)	(–2.02)	(–4.06)	(–1.79)
Size	–0.040***	–0.050***	–0.040***	–0.042***
	(–5.77)	(–5.12)	(–8.35)	(–6.34)
Lev	–0.025	–0.008	–0.016	0.004
	(–0.78)	(–0.18)	(–0.74)	(0.13)
ROA	–0.458***	–0.462***	–0.322***	–0.292***
	(–4.99)	(–3.22)	(–5.14)	(–3.12)
BM	–0.067*	–0.026	–0.011	0.005
	(–1.92)	(–0.56)	(–0.45)	(0.16)
PCF	0.004	–0.020	–0.004	–0.016
	(0.19)	(–0.74)	(–0.32)	(–0.87)
Ana	0.035***	0.044***	0.022***	0.023***
	(5.62)	(5.16)	(5.12)	(4.17)
Hinshold	0.811***	0.646***	0.499***	0.435***
	(9.48)	(6.64)	(8.42)	(6.39)
Constant	0.740***	0.635***	0.830***	0.629***
	(5.25)	(3.02)	(8.26)	(4.39)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	19,635	11,579	19,635	11,579
Adj.R^2	0.063	0.070	0.070	0.072

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

loans and is more aligned with the objective of supporting the long-term development of firms. Following Yu et al. (2016), we take the difference in long-term loans between this year and the preceding year divided by total assets as a proxy for improvement in firm fundamentals through an industrial policy. Based on the average industry annual increase in long-term loans, the sample is divided into two groups: small increments and large increments. Columns (5)–(8) of Table 9 report the regression results. The inhibitory effect of an industrial policy on stock price crash risk is more significant in the small increment subsample, indicating that an industrial policy improves firm fundamentals by increasing firms' credit scale, which decreases stock price crash risk.

6.2. Reducing agency costs

In a modern corporate system with separation of powers, agency problems create room for management to act in its own interests and prevent the integration of firm-specific information into stock prices. As mentioned, to implement an industrial policy, the government lowers market access restrictions in supported industries, which allows more firms to enter a given industry and increases the level of industry competition. Industry competition, as an important external governance mechanism (Allen and Gale, 2000), reduces the agency costs of shareholders and management, discourages earnings management and allows investors access

Table 9
Industrial policy, firm fundamentals and stock price crash risk.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Government subsidies				Long-term loans			
	More	Less	More	Less	Large	Small	Large	Small
	NCSKEW_F		*DUVOL_F*		*NCSKEW_F*		*DUVOL_F*	
IP	–0.032	–0.048***	–0.020	–0.038***	–0.024	–0.055**	–0.020	–0.043***
	(–1.20)	(–2.59)	(–1.09)	(–3.00)	(–0.99)	(–2.39)	(–1.20)	(–2.74)
NCSKEW	0.044***	0.061***			0.047***	0.060***		
	(4.13)	(8.12)			(5.65)	(6.79)		
DUVOL			0.043***	0.052***			0.040***	0.055***
			(4.04)	(7.02)			(4.89)	(6.40)
Sigma	0.526	–0.655*	–0.091	–0.719***	–0.458	–0.136	–0.533**	–0.558*
	(1.12)	(–1.94)	(–0.29)	(–3.17)	(–1.24)	(–0.31)	(–2.16)	(–1.91)
Ret	5.404***	9.423***	3.688***	6.279***	9.672***	6.404***	6.492***	4.188***
	(4.57)	(11.45)	(4.65)	(10.92)	(10.09)	(6.48)	(9.99)	(6.13)
Turnover	–0.064***	–0.036***	–0.035***	–0.027***	–0.050***	–0.038*	–0.036***	–0.016
	(–4.01)	(–2.81)	(–3.16)	(–3.17)	(–4.29)	(–1.91)	(–4.61)	(–1.16)
Size	–0.043***	–0.045***	–0.041***	–0.041***	–0.046***	–0.045***	–0.042***	–0.041***
	(–4.13)	(–6.68)	(–5.71)	(–8.57)	(–5.80)	(–5.31)	(–7.65)	(–7.25)
Lev	0.043	–0.058*	0.026	–0.031	–0.007	–0.034	–0.005	–0.012
	(0.93)	(–1.77)	(0.84)	(–1.38)	(–0.18)	(–0.89)	(–0.18)	(–0.48)
ROA	–0.394***	–0.508***	–0.264***	–0.348***	–0.527***	–0.401***	–0.378***	–0.246***
	(–3.24)	(–5.14)	(–3.19)	(–5.30)	(–5.19)	(–3.44)	(–5.52)	(–3.19)
BM	–0.086*	–0.036	–0.032	0.007	–0.080**	–0.035	–0.018	–0.004
	(–1.74)	(–1.03)	(–0.96)	(0.29)	(–2.05)	(–0.85)	(–0.68)	(–0.15)
PCF	–0.015	0.004	–0.023	0.007	–0.008	–0.019	–0.008	–0.017
	(–0.68)	(0.17)	(–1.56)	(0.45)	(–0.36)	(–0.86)	(–0.56)	(–1.12)
Ana	0.039***	0.038***	0.026***	0.020***	0.037***	0.039***	0.022***	0.021***
	(4.48)	(6.25)	(4.38)	(5.00)	(5.35)	(5.35)	(4.91)	(4.32)
Hinshold	0.858***	0.694***	0.512***	0.458***	0.647***	0.824***	0.418***	0.521***
	(7.69)	(8.78)	(6.55)	(8.48)	(6.65)	(9.29)	(6.35)	(8.41)
Constant	0.605***	0.824***	0.726***	0.811***	0.734***	0.737***	0.677***	0.799***
	(2.91)	(5.85)	(4.94)	(8.02)	(4.30)	(4.17)	(5.58)	(6.69)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	10,251	20,963	10,251	20,963	16,536	14,678	16,536	14,678
Adj. R^2	0.067	0.066	0.072	0.070	0.062	0.074	0.066	0.078

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

to accurate firm financials. Hence, stock prices reflect the true value of firms more fairly, which decreases stock price crash risk. Accordingly, we expect the inhibitory effect of a national industrial policy on stock price crash risk to be more pronounced in firms with high agency costs.

Following Jiang et al. (2009), we use the asset turnover ratio to measure firm agency costs and divide the sample into two groups (high and low agency costs) based on the average annual industry turnover ratio. The results are shown in columns (1)–(4) of Table 10,where the coefficient on *IP* is –0.044 and is statistically significant at the 1% level in the low asset turnover subsample when measuring stock price crash risk with *NCSKEW_F*, while the coefficient on *IP* is not statistically significant in the high asset turnover subsample. The results using *DUVOL_F* as the measure of stock price crash risk show that the coefficient on *IP* is significant and negative only in the low asset turnover subsample, while it is not significant in the high turnover subsample.

Jensen and Meckling (1976) point out that external audits reduce information asymmetry and the agency problem of firms. Moreover, when the legal system is weak, external audits can partially replace the judicial system (Fan and Wong, 2005). Studies find that the "Big Four" audit firms provide higher audit quality based on their reputation and professionalism than smaller audit firms (Lang and Maffett, 2010; Xin et al., 2014).

Table 10
Industrial policy, agency costs and stock price crash risk.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total asset turnover				Audit firms			
	High	Low	High	Low	Large	Small	Large	Small
	NCSKEW_F		*DUVOL_F*		*NCSKEW_F*		*DUVOL_F*	
IP	−0.016	−0.044***	−0.016	−0.030***	0.062	−0.049***	0.038	−0.036***
	(−1.03)	(−3.37)	(−1.63)	(−3.52)	(1.56)	(−3.01)	(1.37)	(−3.21)
NCSKEW	0.046***	0.060***			0.048*	0.054***		
	(4.65)	(7.89)			(1.84)	(8.60)		
DUVOL			0.048***	0.050***			0.029	0.047***
			(4.78)	(6.62)			(1.20)	(7.57)
Sigma	−1.774***	0.410	−1.486***	−0.045	−1.064	−0.150	−1.261	−0.415**
	(−3.97)	(1.16)	(−4.85)	(−0.19)	(−0.93)	(−0.52)	(−1.53)	(−2.17)
Ret	9.851***	7.342***	6.775***	4.723***	6.080**	7.962***	6.188***	5.144***
	(9.22)	(8.50)	(9.27)	(8.00)	(2.28)	(11.38)	(3.19)	(10.89)
Turnover	−0.027*	−0.058***	−0.017	−0.038***	0.002	−0.050***	−0.005	−0.032***
	(−1.71)	(−4.49)	(−1.54)	(−4.46)	(0.04)	(−4.86)	(−0.15)	(−4.70)
Size	−0.059***	−0.042***	−0.047***	−0.043***	−0.016	−0.047***	−0.022	−0.043***
	(−7.06)	(−5.59)	(−8.08)	(−8.06)	(−0.81)	(−6.99)	(−1.56)	(−9.37)
Lev	−0.000	−0.016	−0.003	−0.007	−0.024	−0.020	0.036	−0.011
	(−0.01)	(−0.46)	(−0.11)	(−0.32)	(−0.19)	(−0.74)	(0.39)	(−0.58)
ROA	−0.079	−0.566***	−0.078	−0.373***	0.019	−0.469***	0.236	−0.320***
	(−0.55)	(−6.00)	(−0.80)	(−5.86)	(0.05)	(−5.97)	(0.90)	(−6.04)
BM	−0.026	−0.002	−0.028	−0.006	−0.051	−0.049	−0.048	0.001
	(−0.60)	(−0.13)	(−1.03)	(−0.50)	(−0.43)	(−1.61)	(−0.60)	(0.05)
PCF	−0.097**	−0.016	−0.043	0.017	0.042	−0.013	0.012	−0.012
	(−2.28)	(−0.45)	(−1.49)	(0.70)	(1.18)	(−0.74)	(0.48)	(−1.04)
Ana	0.033***	0.044***	0.016***	0.027***	0.026	0.038***	0.016	0.021***
	(4.23)	(6.76)	(3.04)	(6.22)	(1.15)	(7.30)	(1.01)	(6.17)
Hinshold	0.600***	0.849***	0.385***	0.540***	0.353*	0.791***	0.137	0.513***
	(6.34)	(9.95)	(5.94)	(8.85)	(1.71)	(11.46)	(0.94)	(10.80)
Constant	1.125***	0.638***	0.936***	0.781***	0.511	0.789***	0.794***	0.815***
	(6.51)	(4.07)	(7.69)	(7.00)	(1.25)	(5.76)	(2.78)	(8.52)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12,156	19,058	12,156	19,058	2,185	29,029	2,185	29,029
Adj.R^2	0.067	0.067	0.072	0.071	0.109	0.064	0.123	0.069

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Financial reports audited by the Big Four are also more reliable, which reflects the financial status of firms more accurately, helps external investors better understand internal firm information and reduces the information disparity between firms and external investors. Therefore, we consider audit firms as another indicator to measure agency costs and divide the sample into two groups for the regression: audits by small firms and audits by large firms. The results are reported in columns (5)–(8) of Table 10. The inhibitory effect of an industrial policy on stock price crash risk is more significant for firms audited by small firms than for those audited by larger firms. The above results show that a national industrial policy decreases stock price crash risk by improving the corporate governance level of firms and reducing agency costs.

6.3. Mitigating information asymmetry

Information asymmetry prevents the full integration of firm information into stock prices and allows management to hide bad news. When all of the bad news accumulated reaches a threshold and is released to the capital market at once, it easily triggers a sudden drastic drop in stock prices or a stock price crash. An industrial policy is a signal of government support for industrial development and reflects the future direction of that development. It provides additional information to firms and reduces the information asymmetry between firms and external investors. Moreover, the lowering of industry entry barriers through an industrial policy facilitates more intense market competition, forcing firms to disclose more information, which helps reduce the internal and external information asymmetry of firms. Investors get a more accurate representation of a firm's internal conditions, which decreases stock price crash risk. Therefore, we expect the inhibitory effect of a national industrial policy on stock price crash risk to be more significant for firms with a high level of information asymmetry.

High-quality accounting information reflects firm characteristics more accurately and helps investors accurately assess firms' operating conditions, which reduces the gap between future market expectations and actual firm conditions, thus reducing future stock price fluctuations (Healy et al., 1999; Dasgupta et al., 2010). In contrast, low-quality accounting information increases information asymmetry between firms and investors, which leads to large deviations between future market expectations and actual operating conditions,thereby increasing stock price crash risk. The level of earnings management reflects the transparency of a firm's accounting information and affects the level of information asymmetry (Dechow et al., 1995). Following Dechow et al. (1995), we use the absolute value of the residuals of the modified Jones model as a proxy for

Table 11
Industrial policy, information asymmetry and stock price crash risk.

	(1) High	(2) Low	(3) High	(4) Low	(5) High	(6) Low	(7) High	(8) Low
	Earnings management				Analyst following			
	NCSKEW_F		*DUVOL_F*		*NCSKEW_F*		*DUVOL_F*	
IP	–0.054**	–0.029	–0.047***	–0.020	–0.020	–0.040***	–0.022	–0.046***
	(–2.11)	(–1.40)	(–2.63)	(–1.41)	(–1.54)	(–2.76)	(–1.64)	(–2.92)
NCSKEW	0.033***	0.063***			0.046***	0.061***		
	(2.93)	(8.71)			(5.02)	(7.45)		
DUVOL			0.046***	0.048***			0.035***	0.051***
			(4.26)	(6.68)			(3.97)	(6.18)
Sigma	–0.334	–0.278	–0.712**	–0.432*	–0.521	0.071	–0.586**	–0.258
	(–0.69)	(–0.82)	(–2.24)	(–1.89)	(–1.23)	(0.19)	(–1.97)	(–1.05)
Ret	6.352***	9.110***	4.550***	5.887***	7.527***	8.949***	6.006***	5.145***
	(5.43)	(10.74)	(5.87)	(10.08)	(8.35)	(8.36)	(9.37)	(7.43)
Turnover	–0.028	–0.055***	–0.022*	–0.034***	–0.036**	–0.055***	–0.026***	–0.034***
	(–1.55)	(–4.53)	(–1.78)	(–4.16)	(–2.45)	(–4.04)	(–2.59)	(–3.83)
Size	–0.044***	–0.045***	–0.034***	–0.045***	–0.035***	–0.071***	–0.031***	–0.057***
	(–4.19)	(–6.39)	(–4.70)	(–9.09)	(–5.04)	(–7.31)	(–5.94)	(–8.81)
Lev	0.007	–0.036	–0.003	–0.012	–0.123***	0.039	–0.082***	0.035
	(0.15)	(–1.08)	(–0.11)	(–0.53)	(–3.09)	(1.13)	(–2.91)	(1.59)
ROA	–0.508***	–0.214	–0.367***	–0.109	–0.359***	–0.511***	–0.215**	–0.356***
	(–5.24)	(–1.43)	(–5.67)	(–1.11)	(–2.63)	(–5.56)	(–2.20)	(–5.81)
BM	–0.124**	–0.001	–0.074**	0.034	–0.111***	0.073*	–0.027	0.069**
	(–2.44)	(–0.03)	(–2.16)	(1.43)	(–2.81)	(1.74)	(–0.94)	(2.51)
PCF	–0.022	0.018	–0.020*	0.007	–0.005	–0.009	–0.011	–0.012
	(–1.18)	(0.49)	(–1.66)	(0.28)	(–0.23)	(–0.47)	(–0.65)	(–0.94)
Ana	0.036***	0.036***	0.017***	0.021***	0.053***	0.011	0.035***	0.002
	(3.96)	(5.80)	(2.80)	(5.19)	(4.66)	(0.99)	(4.29)	(0.30)
Hinshold	0.742***	0.752***	0.476***	0.471***	0.740***	0.612***	0.461***	0.298***
	(6.33)	(9.63)	(6.03)	(8.53)	(9.54)	(4.91)	(8.47)	(3.57)
Constant	0.680***	0.766***	0.606***	0.844***	0.628***	1.178***	0.578***	1.066***
	(3.13)	(5.01)	(4.01)	(7.86)	(4.19)	(6.05)	(5.18)	(8.05)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	9,805	21,409	9,805	21,409	14,808	16,406	14,635	16,579
Adj. R^2	0.059	0.071	0.063	0.076	0.084	0.052	0.092	0.060

Note: The numbers in parentheses are *t*-statistics. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

the transparency of a firm's accounting information. The higher the value, the higher the degree of earnings management and the more serious the information asymmetry. Furthermore, we divide the sample into two groups (low and high earnings management) based on the annual industry average of the absolute value of the residuals of the modified Jones model for the regression. Columns (1)–(4) of Table 11 show that when stock price crash risk is measured using *NCSKEW_F*, the coefficient on *IP* is –0.054 and is significant at the 5% level in the high earnings management subsample. Similarly, when stock price crash risk is measured using *DUVOL_F*, *IP* is significant only in the high earnings management subsample.

In addition, Studies find that analysts, as information intermediaries, help reduce the information asymmetry between firms and external stakeholders (Pan et al., 2011; Ren et al., 2020). Compared with ordinary investors, analysts have professional advantages in collecting and processing information, which is conducive to providing more information about firm value to the capital market (Zhu et al., 2007; Li and Xiao, 2015). We use the analyst following as another proxy for the information asymmetry, and divide the sample into two groups (low and high analysts following) based on the annual industry average of the analyst following. Columns (5)–(8) of Table 11 show that when stock price crash risk is measured using *NCSKEW_F*, the coefficient on *IP* is –0.040 and is significant at the 1% level in the low analyst following subsample. Similarly, when stock price crash risk is measured using *DUVOL_F*, *IP* is significant only in the low analyst following subsample. The above results show that a national industrial policy can lower stock price crash risk by reducing information asymmetry of supported firms.

7. Conclusion

Stock price crash risk harms investors' interests, undermines their confidence and inhibits their participation in the market; it is also detrimental to the stability of financial markets. However, the literature on the causes of stock price crash risk does not investigate whether and how a country's industrial policy affects stock price crash risk. We use data from A-share listed firms in China between 2007 and 2020 to theoretically analyze and empirically test the effect of an industrial policy on stock price crash risk and its mechanism. We find that an industrial policy reduces stock price crash risk, and this finding remains robust after several robustness tests. Further analyses show that in regions with low levels of regional marketization, the inhibitory effect of an industrial policy on stock price crash risk is more pronounced. Furthermore, the inhibitory effect of an industrial policy is more significant when firms have high external uncertainty, receive small increments in long-term loans, receive fewer government subsidies and have low asset turnover and a high level of earnings management, indicating that an industrial policy reduces external uncertainty, improves corporate fundamentals and reduces agency costs and information asymmetry, all of which reduce stock price crash risk. This study adds to the literature on the economic consequences of industrial policies by providing new evidence for the effect of an industrial policy on financial market stability and enriches the literature on industrial policies and stock price crash risk.

Furthermore, our study findings have important policy implications. First, the relationship between the government and the market should be handled reasonably. While allowing the market mechanism to play a decisive role in the allocation of resources, the government should not neglect its regulatory role, especially when the market mechanism is dysfunctional. The government should use industrial policy instruments to support the development of the real economy. Second, China's industrial policy plays an important role in capital markets because of its role in lowering stock price crash risk, reducing systemic financial risk, promoting the healthy development of capital markets and providing a policy basis for the central government. Third, the government should deepen its reform process, improve the external business environment of firms and reduce external uncertainty. It is also important to lower the market access threshold, make institutional mechanisms more flexible, strengthen the financial system and eliminate obstacles to firm financing. Fourth, listed firms should actively use industrial policy support to implement industrial and technology upgrading, improve firm fundamentals and enhance their competitive advantage.

Our study has some limitations: First, we discuss the effect of an industrial policy on financial market stability from the perspective of stock price crash risk. However, stock price crash risk is only one of the angles to judge financial market stability. In addition to the stock price, the price fluctuation of other financial assets is also an important factor affecting financial market stability. Future research can supplement empirical evidence based on more perspectives. Second, Industry development prospects, macroeconomic cycle and other factors may affect the formulation process of national industrial policies and stock price fluctuations. Although we try to use some methods to control, it may not be able to solve this endogeneity problem well. How to overcome the interference of missing variables in macroeconomic policy research and better identify the causal relationship between industrial policies and financial market stability is the direction of further research.

Appendix A. Detailed list of supported industries in the 11th, 12th and 13th Five-Year Plans

Industry code	11th Five-Year Plan (2006–2010)	12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)
A01	√	√	
A03	√	√	
A05	√	√	
A07	√	√	√
A09	√	√	√
B03	√	√	
C01	√	√	√
C03	√		
C05	√		
C14	√		
C35		√	
C37		√	
C43	√	√	√
C47	√	√	√
C49	√		√
C51	√	√	√
C57		√	
C61	√		√
C67	√		√
C71	√	√	
C73	√	√	√
C75	√	√	√
C76	√	√	√
C78	√		√
C81	√	√	
C85	√	√	√
D01	√	√	
D05			√
E01	√		√
F01	√	√	√
F03	√	√	√
F05	√	√	√
F07	√	√	√
F09	√	√	√
F11	√	√	√
F19	√	√	√
F21	√	√	√
G81	√	√	√

G83	√	√	√
G85	√	√	√
G87	√	√	√
H01	√	√	
H03	√	√	
H09	√	√	
H11	√	√	
H21	√	√	
K01	√	√	√
K10	√	√	√
K20		√	√
K30		√	
K32		√	
K34	√	√	√
K36		√	√
K37	√	√	√
K99	√	√	√
L01		√	√
L05		√	√
L10	√	√	√
L15	√	√	√
L20	√		√
L99	√	√	√

Data source: Following Chen et al. (2010), Li and Li (2014), Chen et al. (2017) and Chen and Yao (2018), we classify supported industries in accordance with the 11th, 12th and 13th Five-Year Plans.

Note: The industries are classified according to the three-digit Industry Classification code for listed firms issued by the CSRC in 2001.

Appendix B. Variable definitions

Variable	Definition
NCSKEW_F	According to Eq. (4), this variable captures the negative conditional skewness of stock returns in year $t+1$.
DUVOL_F	According to Eq. (5), this variable captures the ratio of stock return fluctuations in year $t+1$.
IP	A dummy variable that takes a value of1 if a firm's industry is supported by the national industrial policy and otherwise 0.
NCSKEW	According to Eq. (4), this variable captures the negative conditional skewness of stock returns in year *t*.
DUVOL	According to Eq. (5), this variable captures the ratio of stock return fluctuations in year *t*.
Turnover	Monthly excess stock turnover, average monthly stock turnover rate in year *t* minus average monthly stock turnover rate in year *t*–1.
Sigma	Standard deviation of weekly stock returns in year *t*.
Ret	Average value of weekly stock returns in year *t*.
Size	Firm size, logarithm of total assets in year *t*.
Lev	Firm leverage, ratio of total debt to total assets in year *t*.
ROA	Return on assets, ratio of net profit to total assets in year *t*.
BM	Book-to-market ratio, ratio of a firm's book value to its market value in year *t*.
PCF	Proportion of cash flow, ratio of operating cash flow to sales revenue in year *t*.
Ana	Analyst following, logarithm of the number of analysts + 1 in year *t*.

Hinshold	Shareholding ratio of institutional investors, ratio of shares held by institutional investors to total shares in year *t*.
Industry	A dummy variable that takes a value of1 if the observation is from this industry and otherwise 0.
Year	A dummy variable that takes a value of1 if the observation is from this year and otherwise 0.

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