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The Impact of Big-Data Analytics Capability on Corporate Risk Identification Efficiency in Capital Market

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SUMMARY: *This study investigates the ways in which the utilisation of big data analytics generates opportunities for financial professionals in China's capital market by improving risk assessment and operational efficiency. Using firm-level panel data from Chinese A-share listed companies, the empirical analysis demonstrates that firms adopting big data analytics experience a significantly lower risk of stock price crashes. This risk-mitigating effect is primarily driven by the informational advantages of big data technologies, which enable management to obtain early warnings about emerging operational and financial challenges. Such timely information allows managers to implement proactive strategies, thereby preventing the escalation of risks that could otherwise culminate in stock price crashes. Further analysis reveals notable ownership and industry heterogeneity. State-owned enterprises (SOEs) exhibit a higher likelihood of stock price crash risk compared with non-SOEs, largely due to stricter regulatory frameworks and procedural decision-making processes that may delay timely managerial responses. In contrast, firms in technology-intensive industries demonstrate greater readiness and infrastructural capacity to deploy big data analytics effectively, thereby achieving stronger risk-reducing outcomes. Traditional industry firms, however, often lack adequate technological infrastructure and managerial expertise in data analytics, which constrains the effective utilisation of big data and increases their exposure to stock price crash risk.*

KEYWORDS: *Big Data Analytics; Stock Price Crash Risk; Chinese A-Share Market; Information Asymmetry; Corporate Risk Management*

1 Introduction

Financial experts utilised a range of financial and non-financial data while making decisions in the capital market, as the majority of decisions entail a high degree of risk [1]. Historically, financial experts were enjoying limited freedom and risk-taking abilities, not only because of limited data availability but also because limited analysis has been blocking financial experts from accessing limited efficiency [2]. However, with the development and advancement of digital technologies across the world, financial experts working in the capital market are accessing greater opportunities [3]. The transformation in the market that has largely taken place because of the advancements in digital technologies has not only resulted in data intensification, but also more effective algorithm-based analysis and intelligent decision-making processes are now widely practised across the industry [4]. Although there are a diverse range of technologies that have been recently developed that have created immense

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opportunities, of particular significance in this regard is the big data that has significantly transformed the capital market decision-making process. Financial experts across the world, including in China, have been relying on big-data analytics to analyse the financial performance of business organisations, analyse and assess the range of present and potential risks, and make timely decisions that magnify their returns [5].

Like other key capital markets of the world, the scale and complexity of the Chinese capital market have also significantly changed during the last many years [6]. The number of companies whose shares have been classified as A-share listed companies has significantly expanded. Furthermore, due to better access to financing, listed companies in the country have been engaged in adopting more robust business models, financial structures and governance processes that have been enhancing their diversification [7]. The changes thus taking place have been creating opportunities; nevertheless, the process has also significantly increased the risks, as financing risks, market risks, and governance risks have now increased manifold. In the changing dynamics, the traditional financial risk assessment and management process that the financial experts were once relying on could not be effectively leveraged, as they are largely based on the periodical financial statements and static ratio analysis [8]. In the view of [9], the traditional risk analysis and assessment process that the financial experts were once using suffered significantly from information lag, which in turn has been affecting the predictive capabilities, thus posing significant challenges to financial experts to make key decisions.

Unlike the traditional risk identification and analysis process, big-data technology has been developed that benefits from the big-data analytics capabilities [10]. Although big-data technology has been used for diverse purposes and objectives, the technology is considered a critical tool as it improves corporate risk identification and efficiency of decisions in the capital market [11]. According to [12], big data could incorporate both structured and unstructured data, which thus goes beyond the traditional financial statements and reports. Some of the unstructured data that big data could incorporate in the process of risk analysis and assessment include textual disclosure, macroeconomic conditions, trends in the stock prices, regulatory information, etc., resulting in a more comprehensive forward-looking risk analysis, enabling financial experts to make more appropriate investment/divestment decisions.

Although big-data technology has been helping financial experts within the global capital market to make efficient and effective decisions, the technology is particularly beneficial for the Chinese capital market due to significant information asymmetry and disclosure quality across different companies. It is believed that the use of big-data technology in the Chinese capital market could bring greater synergies than what has been witnessed in other parts of the world in terms of risk-taking transparency and market efficiency analysis [13]. However, there is a very limited amount of research conducted in the field in the Chinese capital market regarding capital market big-data analysis ability that promotes company risk identification efficiency. Considering the literature gap thus found, this research aims to critically analyse the opportunities that could be accessed by the financial experts in the Chinese capital market in the form of better risk assessment and efficiency through the application of big-data technology. The research investigates the impact of big data analytics capability on corporate risk identification efficiency in China’s capital market using actual firm-level panel data.

2 Materials and Methods

2.1 Research Design

The research design adopted for investigating the impact of big data analytics capability on corporate risk identification efficiency in China’s capital market could be classified as a

quantitative empirical research design. The findings within the research are based on firm-level panel data regarding Chinese A-share listed companies. The analysis has been conducted in the study with the aim to critically analyse how the use of big data could enhance the timeliness and effectiveness of the risk analysis process in the Chinese capital market. Panel data has been collected and analysed in this study with the aim of ensuring the robustness and integrity of the findings of the research. For this purpose, authoritative and publicly verified information has been accessed in this study, which in turn could also add to the validity and reliability of the study.

2.2 Sample Selection

The findings in the current research are based on the analysis of the companies that are classified as A-Share listed companies, listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange. The analysis conducted in this study is based on the data ranging from 2015 to 2024. While collecting data, certain inclusion and exclusion criteria have been observed in this study. Thus, companies that are classified as financial firms have been excluded from the study, as such companies followed a distinct regulatory framework and financial structure from other trading companies. Furthermore, companies for which financial or market data were missing have also been excluded from the study. Additionally, A-Share companies that were having abnormal trading status have also been excluded from the study. Using the screening process, the following Table 1 highlights how the sample has been constructed in this study.

Table 1: Sample Selection for the study

Description	Total Observation
Total number of A-Share Listed Companies (2015 to 2024)	42,318
Less Banks, Insurance and Securities companies excluded	(6742)
Less Companies having incomplete and return data	(3881)
Final Sample used in the analysis	31,695

2.3 Data Sources

There are different data sources that have been accessed for the sake of this study, which include the CSMAR database, which compiles firm-level financial statements, stock return data and ownership structure and governance processes that the Chinese A-share companies are following. A second source that has been used in the study is CNINFO and stock exchange websites that compile annual reports of the Chinese A-Share companies. A third source that has been used in this study is the China Securities Regulatory Commission (CSRC), which compiles data regarding regulatory penalties and risk exposure and disclosure violations of the Chinese A-Share companies.

2.4 Variables and Measures

Different variables that have been analysed while finding out the impact of big data analytics capability on corporate risk identification efficiency in China’s capital market could be categorised into dependent variables, independent variables and control variables. The major dependent variable in this study is corporate risk identification efficiency. For the sake of the current study, market-based and firm-level risk indicators have been used. For the sake of measuring stock price cash risk, negative conditional skewness and down-to-up volatility have been employed in this study. On the other hand, for the sake of measuring the robustness, the Altman Z-score has been employed in this study. Contrary to this, the major independent variable in this study is big-data analytics capabilities, for which the textual analysis approach

has been utilised in this study. The textual analysis of the company's actual disclosure has been thus conducted. In this regard, textual data has been sourced from the management disclosure and analysis section of the annual report and data obtained from the CNINFO. The major control variables in this study include firm size, total leverage used, profitability ratio, firm age, ownership structure, and growth opportunities. Different variables used in this study have been summarised in the following Table 2:

Table 2: Key Variables, definitions and sources

Variable	Definition	Source
NCSKEW	Negative Conditional Skewness of Weekly Returns	CSMAR
DUVOL	Down-to-up volatility	CSMAR
BDAC	Big-Data Keyword frequency	CNINFO
Lev	Leverage measured though total liabilities / total assets	CSMAR
Size	Measured through Total Assets	CSMAR
ROA	Return on Assets measured through net income/ total assets	CSMAR
SOE	State-owned Enterprises	CSMAR
MB	Market-to-book ratio	CSMAR

2.5 Economic Model Specification

For the sake of analysing the risks encountered, baseline regression model has been employed in this study. The following economic model has been employed in this study.

$$Risk_{i,t} = \alpha + \beta BDAC_{i,t-1} + \gamma Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

In the above formula 'Risk i, t' denotes corporate risk identification efficiency, BDAC i,t−1 represents the lagged big-data analytics capability index, Control si, t denotes control variables, while μ i and λ t represent firm and year fixed effects.

3 Results

3.1 Descriptive Statistics

The descriptive statistics regarding the core variables analysed in this study have been summarised in the following Table 3:

Table 3: Descriptive Statistics

Variable	Min	Max	Mean	Standard Deviation
NCSKEW	-3.421	2.987	-0.216	0.843
DUVOL	-0.913	1.204	0.031	0.267
BDAC	0.000	0.284	0.031	0.045
Size	19.02	27.88	22.61	1.34
Lev	0.031	0.921	0.417	0.198
ROA	-.382	0.284	0.046	0.071
MB	0.41	14.26	2.37	1.91

From the descriptive statistics presented in the above Table 3, it is pertinent to note that NCSKEW has been reported negative. This in turn reflects that amongst the A-Share companies analysed in the study, negative stock prices have been witnessed to a greater extreme than the

positive movement that witnessed gradual increase. The trend is in line with the general trends in the capital market, where there are sharper decreases in the stock prices than increases in the prices, which are usually gradual upward movements. Furthermore, greater dispersion could be witnessed in both NCSKEW and DUVOL values, which in turn reflect greater corporate risk exposure that the Chinese A-Share companies have witnessed in the recent past. Furthermore, from the analysis of data pertaining to big-data analysis capabilities, the small numbers reflect that the majority of the firms within the Chinese capital market have not yet adopted big-data analytics, as many firms within the industry have recently adopted the technology, and thus the digital transformation in such companies has been going through its infancy stages. The control variables analysed in this study, including firm size, leverage, return on assets, and market-to-book ratios, are more consistent with the A-Share listed and analysed in different studies, reflecting better representation of the selected sample in the current study.

3.2 Correlation Analysis

The correlation analysis exhibiting relations between different key variables analysed in this study is exhibited in the following Table 4:

Table 4: Correlations Analysis

Variable	NCSKEW	BDAC	Size	Lev	ROA
NCSKEW	1.00	-0.142	0.088	0.231	-0.194
BDAC	-0.142	1.000	0.276	-0.061	0.203
Size	0.088	0.276	1.00	0.419	0.017
Lev	0.231	-0.061	0.419	1.00	-0.366
ROA	-0.194	0.203	0.017	-0.366	1.00

From the correlation analysis exhibited in the above table, it is pertinent to note that the big data analytic capabilities of companies are negatively correlated with the stock price crash risk. This in turn implies that in situations where Chinese A-share companies have been using the big-data analytics, the probability of their stock-market crashes significantly decreases. This in turn provides preliminary evidence regarding the value and strategic benefits of the big-data analytics, as the companies using the technology have been able to avoid stock-price crash risks. The relationship between big-data analytics and corporate risk identification has been graphically exhibited in the following Figure 1:

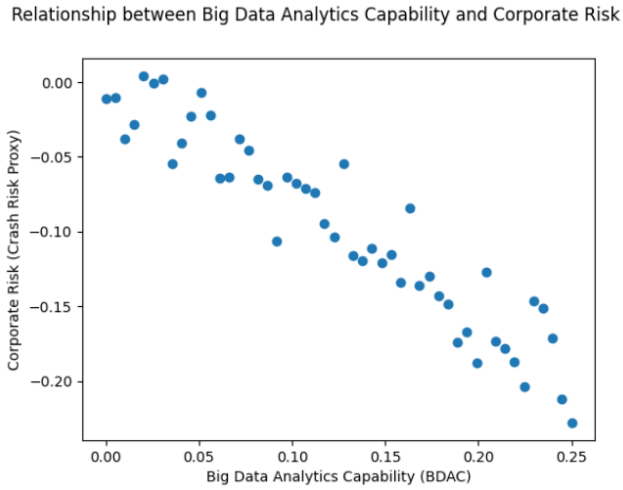

Figure 1: Relationship between Big-Data Analytics Capability and Corporate Risk

Furthermore, from the analysis, it is pertinent to note that the firm's leverage, which exhibits a continued tendency to adopt greater risks for magnifying the firm's return, is positively correlated with the crash risk. This in turn reflects that the companies' management that took greater leverage usually experienced greater stock price risks. Additionally, the analysis also confirms that the profitability is negatively correlated with the crash risks, which aligns well with the financial theory that also stressed that the firms that experience better profitability usually experience lesser risks of stock price crashes.

3.3 Baseline Regression Results

As pointed out earlier in the study, the major dependent variable in this study is stock price crash risk (NCSKEW). The relations between the dependent variable and other core variables analysed in this study could be further analysed through baseline regression, which has been summarised in the following Table 5:

Table 5: Baseline Regression Analysis

Variable	Baseline Panel Regression and t-statistics
BDAC (t-1)	-0.284* (-3.91)
Size	0.062** (2.34)
Lev	0.217*** (4.62)
ROA	-0.392*** (-5.08)
SOE	-0.071* (-1.89)
Firm FE	Yes
Year FE	Yes
Observation	31,695
R^2	0.286

*** p-value <0.01
** p-value <0.05
* p-value <0.10

From the analysis of the above Table 5, it is clear that big-data analytics capabilities are negative and statistically significant. This in turn indicates that the Chinese A-share companies that leverage big-data analytical technology are witnessing significantly lower stock price crash risks, as opposed to the companies that lack such capabilities. From the analysis of the computation, it is thus pertinent to note that big-data analytics could significantly enhance the management opportunities to identify and analyse risks and effectively disclose such information to relevant stakeholders in a timely manner, which in turn helped such stakeholders to better identify risks and more efficiently operate in the stock market.

Furthermore, a range of control variables have also been analysed in the above Table 5. In this regard, firm size and the leverage that the management used for magnifying the firm's return are positively correlated with stock market crashes, implying high risks. This in turn means that as the size of the firm increases as well as the management taking greater leverage, its risks of stock price crashes also increase subsequently. On the other hand, profitability has been negatively correlated with the stock price crash risk, which in turn implies that the Chinese A-share companies that enjoy better profitability experience lesser risks of stock prices crashing due to better financial health. For the state-owned enterprises, due to stronger regulatory and management oversight maintained, one could see that the coefficient is negatively correlated. This in turn reflects that, unlike other companies, SOEs witnessed greater stock price crash

risks, as they have to follow proper mechanisms and procedures to make important decisions, which in turn increases their risks of stock price crashes.

3.4 Heterogeneity Analysis

There are two different heterogeneity factors that could be used to find out whether they have any dominant impact on the analysis conducted. This includes ownership structure and industry digital intensity. The panel data in this regard has been analysed and exhibited in the following Table 6:

Table 6: Heterogeneity Analysis

Variable	Ownership Structure		Industry Digital Intensity	
	SOEs	Non-SOEs	High-Digital	Traditional
BDAC (t-1)	-0.181**	-0.332	-0.361***	-0.192*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12,204	19,491	8,461	23,234

*** p-value <0.01
** p-value <0.05
* p-value <0.10

From the analysis of Table 6, it is very evident that unlike SOEs, the non-SOE firms analysed in the study are confronting lesser risks of stock price crash risks. The primary reason for the tendency thus witnessed could be attributed to the governance structure, as SOEs usually have a strong governance structure, and the management representatives have to follow stated processes and procedures while making key decisions, which in turn work as red tape and potentially delay important decisions, thereby increasing the risks of a stock price crash. Unlike this, non-SOEs lacked such governance structure and associated red tape; thus, the management of the firm was empowered to make timely and urgent decisions. This in turn decreases their risks of stock price crashes. The second panel analyses differences in terms of digital intensiveness. In this regard, high-digital companies have greater capabilities and the desired infrastructure that they leverage for the sake of big-data analytics, which in turn helped them to better face the stock price crashes. Unlike this, the traditional companies lacked the desired readiness needed for the execution of technologies like big data, which in turn has been affecting their ability to leverage the technology for efficiently managing their risks.

4 Discussions

4.1 Big-Data Analytical Capabilities

This study found that the Chinese A-share companies that have adopted the big-data technology are witnessing significantly lower stock price crash risks. The core reason for the lower risks thus encountered could be attributed to the information impact, as big data provide early information to management representatives that the company has been providing certain challenges. As a result, the management representative could adopt better strategies to overcome the risks thus encountered and ultimately avoid bigger challenges that may emerge in the form of stock price crashes. The current study found that the coefficient of regression is negative, which indicates that companies using the big-data technology are able to make key

decisions on the basis of data, rather than mere intuition and superstitions, which in turn significantly decreases the risks that such companies could have been otherwise encountering in the form of stock price crash risks. On the other hand, in companies that lacked such capabilities, the management in such organisations are more likely to use heroics while making decisions, which in turn increases the risks of stock price crashes. The findings of the current study reiterate the significance of information asymmetry and disclosure theories, and the use of big-data analytics could be termed as a step forward that has been empowering management representatives in making better decisions, in turn avoiding the risks of stock price crashes. The findings of the current study stand in line with the findings of [14] and [15], who have also asserted negative correlations between big-data analytics and the risks of stock price crashes.

4.2 Control Variables and Risks

There are a range of control variables that have also been studied in the current study that have important implications. In this regard, the firm size is positively associated with the stock price crash risks, which is understandable considering the fact that as the size of the firm increases, the procedures and processes that such companies follow for making key decisions become complicated, which may delay making key decisions. As a result, timely decisions could not be taken by such a firm that could magnify the risks that such companies encountered in terms of stock price crashes. Unlike this, management in smaller companies could take more urgent decisions, which may help in better managing the risks that they could otherwise encounter. On the other hand, profitability of a firm has been negatively related with stock price crashes, as the Chinese A-class share companies that are enjoying robust profitability are witnessing significantly lower risks of stock price crashes. However, the risks that such companies are encountering increase when such companies are witnessing losses. The findings of this study thus aligned with the findings of [16] and [17], who have also found the relations between stock market price crashes and the range of different control variables analysed in this study.

4.3 Heterogeneity of Ownership Structure

The ownership structure of the Chinese A-Share companies plays an important role in the determination of the risks that they may encounter in the form of stock market crashes. In the case of SEOs, as such companies have to follow a set process and procedure for making important decisions, such processes and procedures tend to delay important decisions, which in turn could increase their risks of stock price crashes. The core reason for this could be the lack of empowerment of the management representatives. Unlike this, the management representatives working in the non-SEO companies operating in the Chinese market are enjoying greater empowerment, as they can make important decisions on an urgent basis. This in turn decreases their risks of stock market price crashes. Similarly, the study also found differences in the industry in which the firm has been operating. As the Chinese A-Share companies that are operating in the technology-related industries are having the desired readiness and infrastructure needed for the execution of big-data analytics, which in turn increases their likelihood to decrease the potential risks that they could have been otherwise encountering. Unlike this, Chinese A-share companies that are operating in the traditional industries are lacking the desired infrastructure; besides, the management representatives also lack the proper training and development to leverage the big-data technology. This in turn worked as a barrier to effectively using the technology for overcoming stock price crashes, in turn decreasing the efficiency of such companies. The findings of the current study in this regard stand in line with the findings of [18], who have also found that the ownership structure plays a dominant role in capturing the potential benefits of big-data technology.

5 Conclusion

This research analysed the opportunities that could be accessed by the financial experts in the Chinese capital market in the form of better risk assessment and efficiency through the application of big-data analytic technology. The findings of the research are based on Chinese A-share companies operating in the country for which actual firm-level panel data has been analysed in this study. This study found that the Chinese A-share companies that have adopted the big-data technology are witnessing significantly lower stock price crash risks. The core reason for the lower risks thus encountered could be attributed to the information impact, as big data provide early information to management representatives that the company has been providing certain challenges. The management representatives in the Chinese A-share companies are able to adopt better strategies to overcome potential risks and ultimately avoid bigger challenges that may emerge in the form of stock price crashes. The study also found that SOEs, due to stronger regulatory and management oversight maintained, are encountering greater risks of stock price crashes, unlike non-SOE firms. In the case of SEOs, as such companies have to follow a set process and procedure for making important decisions, such processes and procedures tend to delay important decisions, which in turn could increase their risks of stock price crashes. Additionally, the research also found that the Chinese A-Share companies operating in the technology-related industries are having the desired readiness and infrastructure needed for the execution of big-data analytics, which in turn increases their likelihood to decrease the potential risks. Unlike this, Chinese A-share companies that are operating in the traditional industries are lacking the desired infrastructure; besides, the management representatives also lacked the proper training and development to leverage the big-data technology, which increased their risks of stock price crashes.

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