Nexus Between Financial Crises, Corporate Governance and Future Stock Price Crash Risk

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Abstract

We aim to investigate the impact of corporate governance attributes on future stock price crash risk in stable and crisis periods. We used Dynamic Panel Generalized Method of Movements (DPGMM) and Principal Component Analysis (PCA) to generate the factors for the individual attribute to capture the accuracy of the results. Ownership concentration and board structure have a significant negative while audit quality has no association with the stock price crash risk. However, the financial crisis has a positive association with stock crash risk. Furthermore, the study provides a potential screening methodology for investors to mitigate future risk as to price crash risk for portfolios that cannot be dealt with diversification.

Keywords

financial crises, ownership structure, board structure, audit quality, future stock price crash risk

Introduction

Hoarding theory supports the concept of stock price crash risk. Managers in high-risk companies focus on their interests and work for their motives and not for the company's betterment (Jin & Myers, 2006). Managers convey asymmetric information to cover the negative information and for short-sighted price maximization to protect their interests and rights, impacting stock prices (Stein, 1989). This conflict has attained the attention of investors, shareholders, and regulators as it is derived from systemic instability (Sunder, 2010). This issue can be handled with a strong corporate governance mechanism. The firm's management, board of directors, investors, and shareholders rely on an effective corporate governance system (Bhasin & Shaikh, 2013). It's led to high transparency in the financial reports and improved ways to get finances (Claessens & Yurtoglu, 2013). In developing countries, the functions of corporate governance are not efficient which leads to a high level of stock price crash risk (Hunjra et al., 2020). Further, they are facing the problem of weak corporate governance due to high inflation and financial imbalances and searching the ways to develop an effective corporate governance

system to attract investors (Boubaker & Nguyen, 2014). Effective corporate governance reduces the agency risks and managerial actions that decrease the shareholder's wealth and stock price crash risk while CEO duality and board size have a significant negative relationship with stock price crash risk (Hunjra et al., 2020).

Strong corporate governance lead to high performance and fewer chances of future stock price crash risk. Its attributes are an important determinant of the stock price crash risk (Habib et al., 2018). Previous literature recognized that strong corporate governance relates to the high value of firms and low chances of risk (Bebchuk & Stole, 1993). Strong governance mechanisms help in designing efficient policies of operations, minimizing costs and stock prices (see for example Asghar et al.,

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2011; Iftikhar et al., 2017). Stock price crash risk is the conditional slope of return distribution due to asymmetric information causing a higher crash risk for stocks (Kim et al., 2014). Firms with weak corporate governance lead to stock price crash risk which increases during the crisis period. With weak ownership, board structure, and low level of audit quality the managers and directors focus on their benefits (Lemmon & Lins, 2003). There is a strong relationship between weak corporate governance and stock price crash risk (Mitton, 2002). Companies with less effective ownership structure, poor audit quality, and ineffective board structure have more chances of stock price crash risk and managers of companies have opportunities to get out of responsibilities in the direction of shareholders without being monitored (Kim & Zhang, 2016). If the managers hold negative information for an extended period then the distribution of stock return will be based on asymmetric information of bad news leading to a large negative drop in the stock prices. In this way, the financial reports do not present a true and fair picture and are prone to stock crash risk (Francis et al., 2016).

Information asymmetry among investors, shareholders, and business management creates conflict of interest and agency problems. Good corporate governance practices alleviate the risk of suboptimal decisions (Masulis et al., 2007). These mechanisms diminish the agency risk and mitigate the pervasiveness of negative information spread (Xie et al., 2003). Effective ownership, board structure, and audit quality reduces the agency cost (Jin & Myers, 2006), relieves business process risk and consequently price crash risk (Yeung & Lento, 2018). Moreover, practitioners, researchers, and regulators are shifting their focus to studying price crash risk in advent of global financial crises (see Fu et al., 2021; Shleifer & Vishny, 1997), as the timing of price crash is unpredictable with an amplified risk to markets going through a financial crisis (Moradzadehfard et al., 2011).

Yeung and Lento (2018) argued that it is important to investigate stock price crash risk in developing countries because firms' ownership structures and corporate governance mechanisms vary from country to country. Therefore, the study is going to fill up the gap by evaluating the impact of audit quality, ownership structure, and board structure on future stock price crash risk in Pakistan. This study is an attempt to add to the scarce literature on the corporate governance attributes and future stock price crash risk. The study is important to evaluate the future performance of the companies because it identifies the future price crash risk

Chen et al. (2017), have considered a single attribute of corporate governance and argued that future research may consider different attributes to inspect the future stock price crash risk. Furthermore, Al-Gamrh et al. (2018) concluded in their study that Corporate

governance strength impacts a firm's indicators in crises and stable periods differently. So, to fill the gap our study is considering different attributes of corporate governance such as ownership structure, audit quality, and board structure on future stock price crash risk during the financial crisis period in Pakistan. The study has implications for investors, shareholders, and regulators who impart their investments to reform the ownership. The rest of the study is designed as section two provides the detailed literature review, section three presents the research methodology, section four shows results and discussion and section five concludes the study along with limitations and future research directions.

Literature Review

Effective corporate governance reduces agency risks (Masulis et al., 2007). Therefore, the probability of stock price crash risk can be decreased through an efficient corporate governance system. The ineffective ownership structure and less efficient board structure will lead to high agency costs (Jensen & Meckling, 1979). The chances of crash risk also increase with the higher agency risk of companies (Callen & Fang, 2015; Yeung & Lento, 2018). Agency theory suggests that effective corporate governance mechanisms control sub-optimal decision-making by managers (Karamanou & Vafeas, 2005). Furthermore from agency theory perspective higher levels of corporate governance mitigate the risk of a price crash (Wang, Li et al., 2021).

Ownership Structure and Stock Price Crash Risk

The ownership structure is a backbone of corporate governance and an important component for the firms because it has a multipart lawful system, organizational and economic forces through which all firms are controlled (Berle & Means, 1991). Ownership structure explains the allocation or division of equity and rights of owners in terms of voting powers, allocation of capital and identifies the owner's equity. It is an important mechanism of corporate governance (Barbosa & Louri, 2002). Effective and efficient corporate governance provides the better performance of the company and the external and internal standards of the firm lead to high growth and reduces the chances of stock price crash risk (Kouaib & Jarboi, 2014). The chances of stock price crashes reduce due to the ownership concentration as they have more control and cash flow rights (Gul et al., 2012). Some studies show high ownership concentration will show fewer chances of stock price crash risk which means we cannot hypothesize the direction of the relationship. However, there is a significant relationship between ownership concentration and stock price crash

risk. Ownership concentration positively affects the performance of the firm which leads to fewer chances of stock price crash risk (Bonilla et al., 2010). It is negatively associated with stock price crash risk. Family owners actively performing judge the management system to minimize stock price crash risk can be reduced (Hunjra et al., 2020). Some practitioners and researchers argue that the impact of ownership concentration is negative on the value of the firm. The main reason is that they control the board structure. However, due to a lack of expertise, new skills, less diversity, and knowledge, there are more chances of stock price crash risk (Shah et al., 2011). Major "shareholder tunneling" and "supervision" effects come from imbalances in ownership concentration and lesser internal controls increase the crash price risk (Li, Wang, Zhou, et al., 2021). Based on the above arguments, the study hypothesizes that:

> **Hypothesis 1**: *Ownership structure has a significant relationship with the stock price crash risk.*

Audit Quality and Stock Price Crash Risk

From a theoretical perspective higher quality of audit reduces the opportunistic motivation level of managers. It reduces the management's ability to show unrealistic performance; as a result, the chances of a stock price crash risk reduce (Kim & Zhang, 2016). The high audit quality is associated with the audit by larger firms (BIG 4 firms) because they provide the best audit quality reports (DeAngelo, 1981). High-quality audits provide the true information and disclose the negative information at the right time as management does not disclose the unfavorable information (Ball et al., 2012). Therefore, effective and high-quality audits are negatively associated with the stock price crash risk. Superior audit quality can assist to decrease the probability of stock price crash risk (Yeung & Lento, 2018). The specialized high audit quality with expertise, resources, motivation, and high incentives are available for detecting errors and irregularities (Piot & Janin, 2005). The audit fee is paid by the client to check and analyze the financial statements (Yuniarti, 2011). Even the quality of the audit depends on the audit fee high audit fee ensures a high-quality audit (Simunic & Stein, 1996). Therefore, professional auditors have high incentives and increase the expectations for high-quality audits (Chen, Chen et al., 2011). In competitive environment audit firms also focus on their quality services to reduce the chances of stock price crash risk (Hassas & Azinfar, 2010). Audit quality ensures the detection of errors and frauds and prevents negative information and lowers the chances of stock price crash risk. High audit fees compel the auditors to properly analyzed the information in detail to provide a better quality of audit which

reduces the chances of a stock price crash risk (Callen & Fang, 2013; Chae et al., 2020). According to the study by Tyrone et al. (2008) (as cited in Kaawaase et al., 2016) firms engage larger audit firms to get superior audit quality to control the stock price crash risk. Effective audit quality is defined as a specialized and experienced auditor. It means the auditor should be experienced, specialized in their field and they should have technology capabilities and competencies to detect misdeeds and errors. When financial statements provide a true and fair view the chances of a stock price crash risk reduce (Yeung & Lento, 2018). Audit quality as an external control mechanism can ward off the insiders holding the bad news and make the information announcement process healthy and unbiased (Dang & Nguyen, 2021), which prevents sudden price falls. Therefore, there is a negative association between audit quality and stock price crash risk. The study hypothesizes that:

> **Hypothesis 2**: *Audit quality has a negative impact on the stock price crash risk.*

Board Structure and Stock Price Crash Risk

The efficiency and effectiveness of the board structure depend on its size, CEO duality, and board independence. Board size performs a vital role to make important decisions and maintain a balance in the board structure of the company (Andreou et al., 2016). Efficient board performance impacts the performance of the company and lowers the chances of a stock price crash risk (Jensen & Meckling, 1979). Board effectiveness depends on its size as the CEO of the firm and enhances the level of communication, coordination, and unity (Yeung & Lento, 2018). The motivation level of employees is high to perform well on the small board as compared to the large board (Lipton & Lorsch, 1992). Small boards are connected with the low cost while the large size of boards is connected with a high cost to increase the skills of management of the firm (Jensen & Meckling, 1979). On the other side, smaller boards also affect the performance of the company because it is more efficient in attaining higher control of management (Hermalin & Weisbach, 1991). The board size is also affected by the form of the organization so the board size can be measured through the number of persons in the board structure (Ni & Purda, 2012). The board of directors should have unique skills and expertise to monitor all operations of the management of the firm in this way the chances of the crash risk will become low (Yasser et al., 2015). Previous literature shows that the board composition is the important key to monitoring the regulatory environment (Jeon, 2019; Yeung & Lento, 2018). According to the agency's

point of view, the board should be controlled by independent directors (Dalton et al., 1998).

The board structure should be based on independent directors because they have more experience and a high level of skills and knowledge to manage the management of corporations (Farinha, 2003). If the board structure is based on independent directors, then the quality of the financial statements will be enhanced, and the firm's information environment will get better which leads to less chance of crash risk (Yeung & Lento, 2018). Effective board structures reduce the agency cost and control the uncertainties of the operational environment of the company which leads to fewer chances of a stock price crash risk (Kim & Zhang, 2016). A strong board is a vital attribute of internal corporate Governance mechanisms that can impact stock price crash risk (Dang & Nguyen, 2021). Therefore, based on previous literature, the study also expects that a stronger and more effective board structure has a negative association with stock price crash risk (Yeung & Lento, 2018). The study hypothesizes that:

> **Hypothesis 3**: *High level of board independence negatively impact the stock price crash risk.*

Financial Crisis and Stock Price Crash Risk

When the economy faces an unexpected loss period, crashes in prices, current account deficits, and insecurity about the financial sector then a financial crisis occurs in the financial system of the country (Habib et al., 2018). Pakistani economy got influenced by the financial crisis of 2008 (Jone, 2009), which was already affected by facing disparity and unexpected losses before the financial crisis period of 2008 (Khawja & Ghani, 2007). According to Latif et al. (2011) (as cited in Nazeer et al., 2015) the world crisis pushed the growth of the economy of Pakistan toward downsizing and poor performance. According to the Pakistan economic survey, the GDP of the economy of Pakistan extremely declined from 5% in 2007 to 0.40% in 2008 due to the crisis. The trade performance has been negatively influenced by the recent financial crisis in Pakistan, so its growth is also affected by the poor performance of the trade sectors of Pakistan (Nazeer et al., 2015). Some researchers suggested the rules and policies after the investigation of the world financial crisis which is suitable and important for the economy of Pakistan (Khawja & Ghani, 2007).

This research also studies the relationship between ownership structure, audit quality, and board structure with future stock crash prices during the crisis period in Pakistan as the financial crisis becomes the reason for crashes (Hutton et al., 2009). The stock market of Pakistan remained unstable by the extreme financial crisis (Mughal et al., 2015). The first crash was observed in March 2005. Secondly, the fall in prices was observed in the year 2006 and the last and most serious bubble crash was detected in the year 2008 and this collapse was continued in 2009 year (Habib et al., 2018). KSE 100index and LSE25 crashed due to this financial crisis; therefore, the board of directors of KSE set the floor due to the quick fall down of prices of shares in 2008 and removed the floor cap in December 2008 (Habib et al., 2018). The performance of the Lahore Stock Exchange was higher and better in the years 2002 to 2004 but it showed negative performance in the year 2008 to 2009. The market capitalization decreased from 3,514.2 billion in 2008 to 1,953.1 billion in 2009 (Yaqoob, 2011).

Another reason is that the financial crisis occurred due to less effective and bad governance—so at that time there was a need to evaluate the performance of the stock market and understand the economic factors which were important to make the policy that could protect the investors of the stock market (Beenish, 2013). So there is a strong relationship between the financial crisis and stock price crash risk. The crises occur in different ways like textile sectors are affected by the financial crisis in Pakistan from 2007 to 2010, the performance of firms is low and the chances of stock price crash risk become high (Beenish, 2013).

A firm with a weak corporate governance system leads to more chances of stock price crash risk during the crisis period. In a weak corporate governance system, managers and directors focus their benefits and interest due to the weak ownership structure, board structure, and low level of audit quality (Lemmon & Lins, 2003). Therefore, weak and poor corporate governance systems direct the sign of bad news in the market that can negatively influence the stock prices and value of the performance. So there is a strong relationship between weak and poor corporate governance systems with the stock price crash risk (Mitton, 2002). Effective and efficient corporate systems control the problem of earning management which may cause the prevailing bad news and negative information in the market (Xie et al., 2003). This can prevent suboptimal decisions about investment through effective corporate governance systems (Masulis et al., 2007). Al-Gamrh et al. (2018) while studying the impact of strong corporate governance in crises and non-crises period describes that more regulations in crises period do worsen the risk and leverage effects, so it's important to check many other factors in crises period. When firms face a crisis period with a less efficient and poor corporate governance system then the chances of crashes in prices become higher. The crash in prices means a negative movement that suddenly occurs in the stock prices due to the period of the financial crisis (Moradzadehfard et al., 2011). There is a shortage of evidential and credible research studies on developing countries in uncertain economic

times like global financial crises, which hinders the policymakers to take regulatory steps in reforming corporate governance mechanisms (Orazalin & Mahmood, 2019). Companies with less effective ownership structure, poor audit quality, and ineffective board structure lead to a crisis period in this way the more chances of stock price crashes occur. The above argument provides sufficient arguments to hypothesize that:

> **Hypothesis 4**: *Financial crisis has a significant impact on the future price crash risk.*

Method and Data

Sample and Design

Yeung and Lento (2018) argued that the study on stock price crash risk is more important in developing countries because corporate governance attributes vary from country to country and different firms based on different ownership structures and corporate governance. Therefore, the study is going to evaluate the impact of audit quality, ownership structure, and board structure on future stock price crash risk in non-financial sectors of Pakistan. The economy of Pakistan has already been affected by the imbalances and unexpected losses before the financial crisis period of 2008 so that's the reason this study has been conducted during the crisis period of 2008. The world crisis pushed the growth of the economy of Pakistan toward downsizing and poor performance. To estimate the attributes of corporate governance mechanisms the data was retrieved from non-financial sector firms listed in the KSE-100 index of the Pakistan Stock Exchange (PSE), from 2008 to 2017. There are approximately 60 non-financial sector firms listed in the KSE-100 index. Weekly stock prices, financial reports, audit reports, and governance reports are used to extract and process the data.

We use Panel least square and GMM to estimate the relationship between governance attributes with stock price crash risk. Further, to check the robustness of measures the PCA was estimated on the factor extracted to make the results robust (Yeung & Lento, 2018). PCA is a process of converting large sets of data observations into small sets which contain more information because smaller sets of data are much easier to explore and capture the results (Kaiser, 1960).

Measurement of Variables

Crash price risk: Hutton et al. (2009) reported two measurements of crash price risk, that is, Down to Up volatility (DUV) and Negative Coefficient Skewness (NCSK). The firm's weekly returns have been used to calculate these measures by using the following formula.

$$NCSK_{i,k} = \frac{-(n(n-1)^{3/2} \sum R_{i,t}^3)}{((n-1(n-2)(\sum R_{i,t}^2))^{3/2}}$$

Where n represents the number of observations of firm weekly return during year T. If the value of NCSK will be high, then it will represent the higher crash risk

$$DUV_{i,t} = log \left| \frac{(W_u - 1) \sum_{down} R_{i,t}^2}{(W_d - 1) \sum_{up} R_{i,t}^2} \right|$$

Where, W_U and W_D represent the up week and down week it means if the weekly returns are below the mean value then it will represent the down week while if the weekly returns are above the mean value then it will represent the up week. The firm's weekly returns are categorized into two parts up weeks and down weeks. It is also the same as the negative coefficient skewers which means if the value of down to up volatility will be high, then the crash risk is also high. Yeung and Lento (2018), Yasser et al. (2015), Chae et al. (2020) have also used crash price risk measurements reported by Hutton et al. (2009).

In the current study, 1-year led to negative coefficient skewness ($NCSK_{i\ T+1}$) and 1-year lead (DUV_{iT+1}). We use negative coefficient skewness as our main proxy for analysis and the Down to Up volatility (DUV) proxy as an alternative check measure.

Ownership structure: We employed two proxies to measure ownership structure. First, by concentrated ownership, it represents the percentage of stocks which is owned by the top 10 stockholders of the firm at the end of the year t. Secondly, state ownership is measured by dummy characteristics. We recorded "1" if there is the existence of state-owned stocks and "0" otherwise. The chances of stock price crashes are reduced due to the controlling stockholders or ownership as they have more control and cash flow rights due to the more than half stock (Boubaker et al., 2014).

Board structure: Multiple proxies of board structure have been used, first, by CEO duality. It is a dummy variable, if the CEO holds two positions as a CEO and chairperson of the board of the firm, then it will be recorded as (1) otherwise (0). The second, proxy is board size which represents the total members of directors on the board of the firm. Third, Gender diversity which is measured by dummy character, we recorded (1) if there is a female director on board otherwise (0). Fourth, is board independence which states the presence of independent directors on the board. The board structure should be based on independent directors because they have more experience and a high level of skills and knowledge to manage the management of corporations (Farinha, 2003). If the board structure is based on independent directors, then the quality of the financial

statements will be enhanced, and the firm's information environment will get better which leads to less chance of crash risk (Yeung & Lento, 2018). We calculated this measure by taking the ratio of the total number of independent directors by the total directors on board and multiplying it by 100%.

Audit quality: Audit quality has been measured by taking the natural log of the audit fee. The audit quality is highly influenced by the audit fee if the audit fee is high then the client is more important to the audit firm (auditor), and auditors provide the best audit quality to reduce the stock price crash risk (Karsemeijer, 2012). Secondly, we also used accessed audit quality, if the firm uses services of the big 4 auditing firms which are rated as a dummy variable. If the large firm audits the client firm, then it will be equal to 1 otherwise 0. The high audit quality is associated with the audit by larger firms (BIG4 firms) because larger firms provide the best audit reports and quality (DeAngelo, 1981).

Financial Crises: The financial crisis was used as a dummy variable in the study. As described by Habib et al. (2018), the Pakistani Market saw its worst bubble crash and crises in 2008 and 2009. Therefore, this study takes the Global Financial crisis in crises as two years 2008 and 2009. It will be equal to the 1 for the crises years otherwise 0.

Control variables: The market to book ratio ($MB_{i,t}$), Leverage ratio ($LEV_{i,t}$), and ROE are used as control variables to catch the possible impact of other aspects on stock price crash risk. These aspects can be under control to raise the value of the firm (Andreou et al., 2016).

We devised the following Panel data model to test the relationship between corporate governance attributes and crash price risk;

$$
\begin{aligned}
CrashRisk_{i,t} = {} & \beta_0 + \beta_1 BDSize_{i,t} + \beta_2 BDINED_{i,t} \\
& + \beta_3 CEO_{Duality_{i,t}} + \beta_4 BD\_GED_{i,t} + \beta_5 OWN_{i,t} + \\
& \beta_6 SOE_{i,t} + \beta_7 AQ_{Fee_{i,t}} + \beta_8 AQ_{Big4_{i,t}} + \beta_9 FC_{DUMMY_{i,t}} \\
& + \beta_{10} ROE_{i,t} + \beta_{11} MTB_{i,t} + \beta_{12} LEV_{i,t} + \varepsilon_{i,t}
\end{aligned}
\tag{1}
$$

Where β_0 is constant, $BDSize_{i,t}$ = "Board Size," $BDINED_{i,t}$ = "Board Independence," $CEO\_Duality_{i,t}$ is "CEO duality within-firm," $BD\_GED_{i,t}$ = "Board Gender Diversity," $OWN_{i,t}, SOE_{i,t}$ represents ownership structure which is captured by "Ownership Concentration and State Ownership," $AQ_{Fee_{i,t}}$ = "Audit Quality-Audit Fee," $AQ_{Big4_{i,t}}$ = "Audit quality by using big 4 Audit Firm," $FC_{DUMMY_{i,t}}$ = "Financial crisis dummy," $ROE_{i,t}$, $LEV_{i,t}$, and $MTB_{i,t}$ is a return on equity, leverage, and market to book ratio.

The future stock price crash risk (crash_ risk$_{i,t}$) performs the role of the dependent variable. The attributes of ownership structure are ownership concentration and state ownership ($OWN_{i,t}$ and $SOE_{i,t}$). The board structure is measured by board size, board independent directors, CEO duality, and the last one is board gender diversity (BD_SIZE, $BD\_INED_{i,t}$, $CEO\_DUALITY_{i,t}$ and $BD\_GEN_{i,t}$). The attributes of audit quality are audit feesfeesfee and BIG4 firms. $AQ_{i,t}$ represents the audit quality in the model of the study. The ownership structure, board structure, and audit quality as independent variables in the study. The financial crisis ($FC\_DUMMY_{i,t}$) is used as a dummy variable to analyze the impact on future stock price crash risk. The FC dummy variable presents the global financial crisis. The control variables are the return on equity, leverage, and market to book ratio ($ROE_{i,t}$, $LEV_{i,t}$, and $MTB_{i,t}$).

$$
\begin{aligned}
CrashRisk_{i,t} = {} & \beta_0 + \beta_1 BDS_{i,t} + \beta_2 BDS_{i,t} * FC_{DUMMY_{it}} \\
& + \beta_3 OWN_{i,t} + \beta_4 OWN_{i,t} * \\
& FC_{DUMMY_{it}} + \beta_5 AQ_{i,t} + \beta_6 AQ_{i,t} * FC_{DUMMY_{it}} \\
& + \beta_7 FC_{DUMMY_{it}} + \beta_8 ROE_{i,t} + \beta_9 MTB_{i,t} + \\
& \beta_{10} LEV_{i,t} + \varepsilon_{i,t}
\end{aligned}
\tag{2}
$$

In this model $OWN_{i,t}$, $BDS_{i,t}$, $AQ_{i,t}$ are the PCA factors on the said attributes of Ownership Concentration, Board Structure and Audit quality respectively. The Financial crises dummy is used as an interaction term to understand the difference between crises and non-crises periods.

For robustness analysis and in order to check whether our results are free from endogeneity we also run the following Panel GMM model. Roodman (2009) claimed that GMM can improve the OLS and fixed-effect estimations by accounting fixed-effects and allowing present values of variable effect on historical values by using lag of dependent variable and allowing firm level characteristics and other external factors to be included as instruments. For robustness analysis, we also run the following Panel GMM model

$$
\begin{aligned}
CrashRisk_{i,t} = {} & \alpha + \delta_0 CrashRisk_{i,t} + \delta_0 CrashRisk_{it-1} \\
& + \delta_1 CrashRisk_{it-1} * FC_{DUMMY_{i,t}} + FC_{DUMMY_{i,t}} + \\
& \Sigma \delta_k x_{ki,t} + \eta i + \lambda_{i,t} + \varepsilon_{i,t}
\end{aligned}
\tag{3}
$$

The Crises period's coefficient δ0 is measured through the sum of the coefficient of lagged crash risk and its interaction term and the coefficient δ0 for the stable/non-crises period is determined by lagged CrashRisk.

Table 1. Descriptive Statistics.

Variables	Mean	Standard deviation
$NCSK_{t+1i,t}$	0.1360	1.2760
$DUV_{t+1i,t}$	0.0131	0.4150
$OWN_{i,t}$	0.4163	0.2400
$SOE_{i,t}$	0.1338	0.3407
$BDINED_{i,t}$	0.1966	0.2145
$BDSize_{i,t}$	8.9126	2.3552
$CEO_{Duality_{i,t}}$	0.1040	0.3056
$BD_{GED_{i,t}}$	0.0596	0.1156
$AQ_{Big4_{i,t}}$	0.7211	0.4488
$AQ_{Fee_{i,t}}$	7.1259	1.3364
$FC_{DUMMY_{i,t}}$	0.2211	0.4154
$MTB_{i,t}$	2.7431	4.7740
$LEV_{i,t}$	0.5665	0.6255
$ROE_{i,t}$	18.171	46.7530
$NCSK_{i,t}$	0.0239	1.6949
$DUV_{i,t}$	-0.0063	0.5184

Note. Where, N = 538, $BDSize_{i,t}$ = "Board Size," $BDINED_{i,t}$ = "Board Independence," $CEO\_Duality_{i,t}$ is "CEO duality within-firm," $BD\_GED_{i,t}$ = "Board Gender Diversity," $OWN_{i,t}$, $SOE_{i,t}$ represents ownership structure which is captured by "Ownership Concentration and State Ownership," $AQ_{Fee_{i,t}}$ = "Audit Quality-Audit Fee" $AQ_{Big4_{i,t}}$ = "Audit quality by using big 4 Audit Firm," $FC_{DUMMY_{i,t}}$ = "Financial crisis dummy," $ROE_{i,t}$, $LEV_{i,t}$, and $MTB_{i,t}$ are return on equity, leverage, market to book ratio $NCSK_{i,t}$ = "Negative Coefficient Skewness" and $DUV_{i,t}$ = "Down to Up Volatility."

Results and Discussion

Table 1 reports the summary of all variable's dependent, independent, and control variables. The mean values of crash risk measures, NCSK, and DUV are 13.6%, and 1.3% and the values of standard deviation are 1.2 and 0.4. The descriptive statistics show that the ownership structure is highly concentrated in Pakistan; the findings are in line with the study of Javid and Iqbal (2008). The mean value for the variable of independent board directors is 19.6%, while 10% of the firms have the same persons who are performing dual roles of which 5% are female executives. The financial crisis is used as a dummy variable where the mean value is 22%. The mean value of audit quality measured by audit fee is 72%.

Correlation analysis in Table 2 indicates that there is no sign of multicollinearity, as the association among independent variables is less than .5. The $NCSKEW_{t+1}$ and $DUVOL_{t+1}$ measure the crash risk, and these proxies are positively correlated with each other with a correlation of .86. Confirming that both proxies can be used and vice versa for robustness check. The previous study has also investigated the positive correlation among two measures of crash risk (Andreou et al., 2016). Ownership concentration has a significant negative association with Crash price risk as($r = -.08$). The independent directors have a negative association with

Crash price risk ($r = -.12$). Also, the board size has a negative association with a crash risk ($r = -.8$). Audit quality has a less significant relationship with crash risk. The financial crisis is highly correlated with crash risk. According to the correlation analysis, specific attributes of corporate governance are a significant relationship with crash risk. The attributes of corporate governance are highly correlated with crash risk (Callen & Fang, 2015). The leverage has a negative relationship with crash risk with a correlation value of .01, ROE has a highly significant association with crash risk in both models with a correlation value of .10 and .17.

Panel Regression

Table 3 reports the impact of corporate governance attributes and financial crisis on crash price risk. Model 1 reports the baseline model with $NCSKEW_{t+1}$. Whereas Model 2 reports alternative checks by using $DUV_{t+1}.DUV_{t+1}$.

Model 1 results indicate that ownership structure has a significant negative impact on crash price risk ($\beta = -.541$, $p < .05$), meaning A high ownership concentration leads to high performance and less probability of stock price crash risk (Anderson & Reeb, 2003). State ownership is a dummy variable which is the statistically insignificant relationship with stock price crash risk ($\beta = -.09$, $p =$ not significant), because of 59% firms based on family ownership concentration in the capital market of Pakistan (Javid & Iqbal, 2008). There is a significant negative relationship of independent directors and board size with crash risk in model 1 at the value of ($\beta = -.74$, $p < .05$ and $\beta = -.02$, $p < .05$). A large size board creates diversity; skills and expertise are used to make stronger decisions which leads to the high performance of the company and reduces the chance of a stock price crash risk (Varshney et al., 2012).

There is an insignificant relationship between CEO duality and stock price crash risk ($\beta = .04$, $p > .05$). The findings show that audit fee and BIG4 firms have an insignificant relationship with stock price crash risk ($\beta = .01$, $p > .05$ and $\beta = .02$, $p > .05$). Big 4 auditors are not effective to raise the quality of audits because of the economic bonding of auditors with their clients in the presence of concentrated family ownership; therefore, the policymakers and practitioners suggest that the consistent results of financial statements cannot be achieved by Big4 firms (Abid et al., 2018). The financial crisis has a highly significant relationship with crash risk ($\beta = .51$, $p < .05$). The control variables are causing significant differences in crash price risk. The financial crisis leads to the stock price crash risk and the performance of Pakistani firms, growth rate, and stock prices were affected during the financial crisis. In light of the

Table 2. Correlation Analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
$OWN_{i,t}$	1													
$SOE_{i,t}$	−.13	1												
$BDINED_{i,t}$	.09	.08	1											
$BDSize_{i,t}$	−.11	.31	.10	1										
$CEO_{Duality_{i,t}}$	−.04	−.06	−.01	−.19	1									
$BD_{GED_{i,t}}$	.06	−.07	−0.14	−.09	−.13	1								
$AQ_{Fee_{i,t}}$	−.12	.13	.04	.26	−.09	−.04	1							
$AQ_{Big4_{i,t}}$	−.16	.14	.09	.41	−.32	−.16	.32	1						
$FC_{DUMMY_{i,t}}$	.02	.00	.07	−.02	.08	.04	−.16	.00	1					
$LEV_{i,t}$	−.10	.16	−.02	−.02	−.07	.01	.01	.04	−.03	1				
$MTB_{i,t}$	.01	−.13	.12	.06	−.09	.03	.02	−.01	.02	−.03	1			
$ROE_{i,t}$	−.01	.11	.04	.09	−.15	−.02	.10	.18	−.12	.08	.06	1		
$NCSK_{t+1_{i,t}}$	−.09	.01	−.13	−.8	.01	−.02	.01	.05	.15	−.03	−.06	.07	1	
$DUV_{t+1_{i,t}}$	−.04	.02	.07	.01	−.01	.05	−.05	−.01	.2	−.04	−.06	.05	.86	1

Note. Where, N = 538, $BDSize_{i,t}$ = "Board Size," $BDINED_{i,t}$ = "Board Independence," $CEO\_Duality_{i,t}$ is "CEO duality within the firm," $BD\_GED_{i,t}$ = " Board Gender Diversity," $OWN_{i,t}$, $SOE_{i,t}$ represents ownership structure which is captured by "Ownership Concentration and State Ownership" $AQ_{Fee_{i,t}}$ = "Audit Quality-Audit Fee," $AQ_{Big4_{i,t}}$ = "Audit quality by using big 4 Audit Firm," $FC_{DUMMY_{i,t}}$ = "Financial crisis dummy," $ROE_{i,t}$, $LEV_{i,t}$, and $MTB_{i,t}$ are return on equity, leverage, market to book ratio $NCSK_{i,t}$ = "Negative Coefficient Skewness" and $DUV_{i,t}$ = "Down to Up Volatility" and plus 1 in price risk indicates future crash price.

Table 3. Panel Least Squares Analysis.

	Model 1		Model 2	
	NCK_{t+1}		DUV_{t+1}	
Variables	Coefficient	t-stat	Coefficient	t-stat
$OWN_{i,t}$	−.541**	−2.303	−.106	−1.400
$SOE_{i,t}$	−.091	−0.507	.007	0.130
$BDINED_{i,t}$	−.741***	−2.814	.151*	1.780
$BDSize_{i,t}$	−.025**	−0.854	−.001	−0.147
$CEO_{Duality_{i,t}}$	−.045	−0.234	−.043	−0.693
$BD_{GED_{i,t}}$	.015	0.030	.162	1.023
$AQ_{Fee_{i,t}}$	.018	0.404	−.009	−0.632
$AQ_{Big4_{i,t}}$	.022	0.149	−.024	−0.519
$FC_{DUMMY_{i,t}}$	.515***	3.822	.201***	4.609
$LEV_{i,t}$	−.074**	−0.834	−.030	−1.046
$MTB_{i,t}$	−.023**	−2.048	−.006*	−1.775
$ROE_{i,t}$	.002**	1.952	.0005*	1.840
$NCSK_{i,t}$	.062*	1.929	-	-
$DUV_{i,t}$			.0005	0.016
N	538		N	538
F-Sig	.000		F-Sig	0.001

Note. Where, $BDSize_{i,t}$ = "Board Size," $BDINED_{i,t}$ = "Board Independence," $CEO\_Duality_{i,t}$ is "CEO duality within the firm," $BD\_GED_{i,t}$ = "Board Gender Diversity," $OWN_{i,t}$, $SOE_{i,t}$ represents ownership structure which is captured by "Ownership Concentration and State Ownership" $AQ_{Fee_{i,t}}$ = "Audit Quality-Audit Fee," $AQ_{Big4_{i,t}}$ = "Audit quality by using big 4 Audit Firm," $FC_{DUMMY_{i,t}}$ = "Financial crisis dummy," $ROE_{i,t}$, $LEV_{i,t}$, and $MTB_{i,t}$ are return on equity, leverage, market to book ratio $NCSK_{i,t}$ = "Negative Coefficient Skewness" and $DUV_{i,t}$ = "Down to Up Volatility."
*$p < .10$. **$p < .05$. ***$p < .01$.

literature, the trade growth of Pakistani firms has been affected by the financial crisis, which leads to a higher stock price crash risk (Latif et al., 2011). Considering literature, the trade growth of Pakistani firms has been affected by the financial crisis, which leads to a higher stock price crash risk (Latif et al., 2011). Pakistani firms are influenced by external factors and economic policy plays an important role to reduce the occurrence of the financial crisis because economic management can be improved by the adoption and implementation of the best policies (Yaqoob, 2011). The banking sector of Pakistan has also been affected by the global financial

Table 4. Panel Least Square After PCA Factors and Interaction term.

| Variables | Model 1 | | | Model 2 |
| | NCSKEW$_{t+1}$ | | | DUVOL$_{t+1}$ |
	Coefficient	t-stat	Coefficient	t-stat
OWN$_{i,t}$	.158*	1.714	.0009	0.005
OWN$_{i,t}$*FC$_{DUMMY\ i,t}$	−.085	−0.439	.0065	0.143
BDS$_{i,t}$	−1.717**	−2.859	.068	0.405
BDS$_{i,t}$*FC$_{DUMMY\ i,t}$	.026	0.173	.0116	0.228
AQ$_{i,t}$	.038	0.173	.006	0.417
AQ$_{i,t}$* FC$_{DUMMY\ i,t}$	−.149	−0.752	−.114*	−1.778
FC$_{DUMMY_{i,t}}$	.585***	2.809	.207***	3.831
LEV$_{i,t}$	.049	0.350	.023**	2.039
MTB$_{i,t}$	.004	0.24	.004**	2.029
ROE$_{i,t}$	.001	0.584	.009**	0.012
NCSK$_{i,t}$	.047**	2.272		
DUV$_{i,t}$			.055	0.0881

Note. Where, BDS$_{i,t}$ = "Board Structure," OWN$_{i,t}$ represents ownership structure which is captured by "Ownership Concentration," AQ$_{Fee\ i,t}$ = "Audit Quality-Audit Fee , Firm," FC$_{DUMMY_{i,t}}$ = "Financial crisis dummy," ROE$_{i,t}$, LEV$_{i\ t}$ and MTB$_{i,t}$ are return on equity, leverage, market to book ratio NCSK$_{i,t}$ = "Negative Coefficient Skewness" and DUV$_{i,t}$ = "Down to Up Volatility."
*p < .10. **p < .05. ***p < .01.

crisis; therefore, the low quality of assets and deposits has negatively affected the financial performance of banks (Nazir et al., 2012). According to the best knowledge, the need for more research on stock price crash risk has increased in Pakistan due to the financial crisis (Andreou et al., 2016).

Similarly, model 2 which acts as robustness or alternative check indicates that except for board independence and financial crisis all other proxies have no significant impact on crash price risk. Also, it may be due to a combination of individual corporate governance attributes or due to endogeneity.

To resolve this issue, we first performed PCA to generate the factors to replace the individual corporate governance attributes. PCA is used to reduce the 8 individual attributes of corporate governance into a smaller factor to capture more variation in results (Kaiser, 1960). In this analysis total, 3 PCA factors are generated in which one PCA composite variable of ownership structure is Ownership Structure (OWN), while one PCA composite variable of board structure (BDS) and last one PCA composite variable of audit quality (AQ).

Table 5 presents the comprehensive results of the panel least Square model after PCAs. In the case of NCSKEW$_{t+1}$ as a proxy for crash risk, we can see the Composite variable of Board Structure that is BDS is highly significant at a p-value less than .05 with a negative relationship that infers that stronger the structure of the board there would be fewer chances of crises. Ownership Concentration (OWN) is also significant at .1 and has a positive association which surmises that diverse ownership can have a positive impact on

lowering the future stock price crash risk. Audit Quality is insignificant. Interestingly global financial crises have a positive and highly significant impact on crash price risk. To understand the difference between corporate governance mechanisms in crises and stable periods the interaction term of crises is introduced and we can see that by negative skewness proxy there is no significant change in risk. As an alternative Robustness analysis, we can see Down to up Volatility results. The noteworthy result is the interaction term of Audit Quality with Financial crises is significant. This result is in line with the notion of Lemmon and Lins (2003) and Al-Gamrh et al. (2018) that corporate governance is weak internally and externally, the crises in the economy result in pushing the prices toward a crash.

GMM Based Results

The crash in prices suddenly occurs in the stock prices and it amplifies during the period of the financial crisis (Moradzadehfard et al., 2011). Our study investigates the impact of ownership structure, audit quality, and board structure on future stock price crash risk during the financial crisis period in Pakistan. Table 4 presents the GMM based results for both baseline and robust models. Further, Arellano–Bond test] conform no second-order serial correlation to the residuals. As Zaman et al. (2021) reported that, "In particular, the significant value of AR (1) p < .05 in Panel C of Table 5 confirms the suitability of lags to control the model dynamicity, whereas AR (2) fails to reject the possibility of no serial correlation in second difference." Model 1 indicates Results indicates

Table 5. Panel Generalized Methods of Moments After PCA Factors.

	With financial crises		With interaction term	
	$NCSKEW_{t+1}$ 1	$DUVOL_{t+1}$ 2	$NCSKEW_{t+1}$ 3	$DUVOL_{t+1}$ 4
$OWN_{i,t}$	(0.797)***	(0.902)	(0.692)**	(0.113)
	−2.930	−1.554	−2.367	−0.813
$BDS_{i,t}$	(1.248)***	(0.102)	(1.239)***	(0.09)
	−2.746	−0.742	−3.12	−0.907
$AQ_{i,t}$	0.553	0.181	(0.768)**	0.357*
	1.289	0.961	2.742	1.776
$OWN_{i,t}*FC_{DUMMY\ i,t}$			(0.741)	(0.223)
			−0.236	−0.437
$BDS_{i,t}* FC_{DUMMY\ i,t}$			10859.1	1826.157
			0.016	0.016
$AQ_{i,t}* FC_{DUMMY\ i,t}$			4.155	0.2919
			0.716	0.178
$FC_{DUMMY\ i,t}$	1.006	1.119**		
	1.926	2.181		
$LEV_{i,t}$	(0.310)**	0.038		
	−0.690	0.124		
$MTB_{i,t}$	0.069**	0.019		
	1.685	0.887		
$ROE_{i,t}$	0.002***	0.006*		
	0.338	1.909		
$NCSK_{i,t}$	0.016		(0.047)***	
	0.697		4.36	
$DUV_{i,t}$		(0.061)		0.044
		−0.936		0.897
OBS	478	478	420	420

Note. Where, $BDS_{i,t}$ = "Board Structure," $OWN_{i,t}$ represents ownership structure which is captured by "Ownership Concentration," $AQ_{i,t}$ = "Audit Quality-Audit , Firm," $FC_{DUMMY,i,t}$ = "Financial crisis dummy," $ROE_{i,t}$, $LEV_{i,t}$ and $MTB_{i,t}$ are return on equity, leverage, market to book ratio $NCSK_{i,t}$ = "Negative Coefficient Skewness" and $DUV_{i,t}$ = "Down to Up Volatility."
*p < .10. **p < .05. ***p < .01.

that ownership structure has a significant negative impact on crash price risk ($\beta = -.797$, $p < .05$). Also, Board structure has a significant inverse impact on stock price crash risk ($\beta = -1.24$, $p < .05$). Whereas Audit quality has an insignificant association with the crash risk ($\beta = .5$, $p =$ not significant). Finally, a financial crisis has a significant positive impact on crash price risk. Furthermore, model 2 indicates that only a financial crisis has a significant impact on crash price risk, that is ($\beta = 1.119$, $p < .01$). Means Down to Up Volatility is not a suitable measure in markets that have high family ownership concentration.

Results in model 1 show that ownership structure has a significant negative impact on crash price risk, which leads to support for hypothesis 1. Ownership structure based on high ownership concentration may lead to high performance and reduces the probability of crash price risk (Anderson & Reeb, 2003). 59% of firms in the Pakistani capital market have family ownership concentration (Javid & Iqbal, 2008), which reduces any chances

of the negative flow of information by creating a monopolistic environment.

Practitioners and researchers argue that the impact of ownership concentration reduced the chances of stock price crash risk and increased the value of the firm and its performance (Li & Zeng, 2019; Shah et al., 2011). Audit quality has an insignificant association with the crash risk indicating that hypothesis 2 is not supported. The structure of corporate governance is weak in Pakistan as compared to developed countries; therefore, audit quality is not considered as much an important attribute of corporate governance because of economic bonding auditors depend on their clients to hide the true and fair picture of financial reports (Abid et al., 2018). There is a significant negative relationship between board structure and stock price crash risk (coefficient = -1.24, $p < .05$), indicating hypothesis 3 is supported. There is a significant relationship between the financial crisis and crash risk. The result provides support to hypothesis 4 that the financial crisis has a significant

impact on crash risk. The external factors influence Pakistani firms, and economic policy plays an important role to reduce the occurrence of the financial crisis because economic management can be improved by the adoption and implementation of the best policies (Yaqoob, 2011). So, there is a strong relationship between the financial crisis and stock price crash risk.

Model 3 and 4 incorporate the interaction of financial crises with corporate governance mechanisms. As can be seen, all three interactions are insignificant in both proxies of negative skewness and down to up Volatility, but this result is interesting for individual attributes of corporate governance. In the case of future NSKEW, all the three attributes of ownership structure, Board Structure, and Audit Quality are significant, supporting our first three hypotheses. As per our results, corporate governance is not a channel through which global crises can seep in to cause crash price risk, in other words, the contagion of crises is not supported by corporate governance mechanisms. These results go in line with da Silva (2019) and Andreou et al. (2016) that governance characteristics and stock price crash risk association is channeled in ups and downs of the market/business cycle but governance strength does not mitigate or worsen the risk in case of crises.

Conclusion

The study investigated the corporate governance mechanism's impact on the stock price crash risk in Pakistan. The result showed that the ownership and board structure are negatively associated with stock price crash risk. The dispersed ownership creates agency cost while ownership concentration reduces the problem of agency cost leading to low chances of stock price crash risk. Moreover, 59% of firms are based on family ownership concentration in the capital market of Pakistan (Javid & Iqbal, 2008) which hinders the misinformation to spread. Audit quality does not impact the stock price crash risk in the least-square model setting but audit quality is significantly impacting future crash price risk in GMM dynamic settings. However, the structure of corporate governance is weak in Pakistan as compared to developed countries, therefore; audit quality is not considered an important attribute of corporate governance. The financial crisis is positively associated with stock price crash risk. The financial imbalances and high inflation move the stock price crash risk during the financial crisis. The study established that strong corporate governance leads to low future crash risk. Firms with effective corporate governance have low levels of future stock price crash risk in line with the findings of Jebran et al. (2019). Informal board hierarchy impacts the future crash price risk as board composition can restrict managerial opportunistic behaviors.

We contributed to the literature by empirically adding comprehensive and holistic attributes of corporate governance on crash price risk, furthermore, we checked the impact of global financial crises on crash risk independently and through the channel of corporate governance in Pakistan. The crash risk cannot be minimized with the help of portfolio diversification, as it is an element of that risk that is derived from systematic instability (Sunder, 2010). The current study provides perfect empirical evidence to reduce the future stock price crash risk by looking into corporate governance mechanisms and then adding stocks to the portfolio. This study adds to the literature on minimizing agency issues when the portfolios are already diversified (Lee et al., 2019). Moreover, regulators can monitor firms by adding stocks to the high or low-risk profile and providing an automated guideline to the board and management for the avoidance of future price crash. In a crises situation, special attention can be given to ownership concentration and board structures along with other variables like liquidity and leverage. Future research can investigate the impact of accounting practices on stock price crash risk, which would be an addition to the body of knowledge.

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