Who is Responsible for Stock Price Crash Risk: Sentiment or Policy Uncertainty?

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Abstract:

The objective of this study is to examine the effect of policy uncertainty and investor sentiments on the firm-specific stock price crash risk in Indian markets during the Covid-19 pandemic. An investor sentiment index was constructed using the firm-specific technical indicators over the period from 2020 to 2021. The daily closing price of individual firms was collected from the official site of bseindia.com while the monthly index of news-based policy uncertainty was extracted from policyuncertainty.com. For the proxy for firm-specific stock price crash risk, Monthly negative-skewness and Down-to-up volatility ratios are determined from the firm-specific daily return. A linear regression model was employed to examine the association between investor sentiment and policy uncertainty towards stock price crash risk. The result did not found any significant impact from the firm-specific investor sentiment while the EPU index was found to be negatively associated with the stock price crash risk which indicates the higher EPU helps to control the future stock price crash risk over the pandemic period. The result of this study will help the retail investor as well as the regulator to make their strategy in a similar pandemic situation in the future.

Keywords: Stock Price Crash Risk, Emerging Markets, Policy Uncertainty, Investor Sentiment

1 Introduction

In theoretical prospects, the firm-specific managers have significant control over the declaration of negative news. Indeed, after a certain point, the manager may not be able to control that anymore and the accumulated negative news released at once causes the stock price crash risk. Stock price crash risk is not new in the field of financial literature, but the gap in the study is that the researcher generally focused on the activity of the corporate/ policy announcement and its impact on future stock price crash such as CEO power (*Harper et al., 2020*), Language in annual report (*Kong et al., 2021*), employee welfare policy (*Nasr and Ghouma. 2018*), social trust (*Li et al., 2017*), consumer concentration (*Ma et al., 2020; Lee et al., 2020*), FII and Institutional Investor attention (*Fan and Fu 2019; Huang et al., 2020; Xiang et al., 2020*), Analyst coverage (*He et al., 2019*) and so on. Second, the majority of the study examining the stock price crash risk focused on the Chinese stock market. In addition to that, very few studies were observed during the pandemic period. Thus the objective of the present study is to investigate the impact of firm-specific investor sentiment and the Economic Policy Uncertainty (EPU) on the stock price crash risk during the Covid period. For the empirical analysis, we considered the list of top 30 companies listed in the Indian stock market and did not found any significant impact from firm-specific investor sentiments to future stock price crash risk. It also found the EPU index negatively affects the future crash risk as well as the sentiment index over the study period, which implies that the policy uncertainty index helps to control the investor sentiment as well as the stock price crash risk in the Indian market.

The remaining session is organized as section 2 which deals with the past literature review on stock price crash risk. Section 3 and 4 discussed the methodology employed and the result

discussion respectively. Finally, section 5 reported the valuable findings, future scope and the practical implication of the results.

2 Theoretical Framework

The present section discussed the recent works which have been done on stock price crash risk as follows:

2.1 Crash Risk and Investor Sentiment

Yin and Tian (2017) investigated the interaction of financial reporting quality and short-selling constraint, in the association between investor sentiment and stock price crash risk over the Chinese firm. The study found a positive association of sentiment with the future crash risk. It also identifies the short-selling constraint and the poor reporting quality have a significant role to magnify that association. *Fu et al., (2020)* examined the impact of firm-specific investor sentiment on the stock price crash in the Chinese market from 2005 to 2021 and found a positive and significant impact of sentiment on future crash risk. The researcher segregates the stocks based on their liquidity and reported a stronger effect of sentiment on crash risk in the case of low liquidity stocks. *Cui and Zhang (2020)* considered a large sample period from 1991 to 2014, to examine the impact of sentiment on future crash risk in USA stock markets. They observed a higher degree of association with the high sentiment period due to the high levels of firm-specific negative information withheld. And suggest the firm with a higher leverage ratio, greater default risk and large forecast disagreement strengthen the probability of Future crash risk. *Liu et al., (2021)* examined the stock price crash risk in the Chinese market using conditional skewness from the GARCH-S model. The results show, the daily observation of conditional coefficient negatively associated with the growth of confirmed cases, implies the crash risk increased over the Covid period. It also argued that where the sentiment was high, the crash risk was strongly increased by the pandemic. From the above decision we can formulate the hypothesis as follow:

Hypothesis 1: There is a positive and significant relationship between firm-specific investor sentiment and stock price crash risk.

2.2 Crash Risk and EPU

Jin et al., (2019) examine the role of EPU on crash risk employing panel regression on quarterly observation of 2670 Chinese firms. The result found positive impact of EPU on crash over the study period while the degree of association was comparatively higher for the state-owned firm. *Kim et al., (2020)* taken the assumption as the increasing EPU helps to reduce the future crash risk in the USA market. The results fail to reject the hypothesis and found negative association of policy uncertainty over the study period. *Luo and Zhang (2020)* investigated whether the crash risk increased with the fluctuation of EPU among 2745 Chinese firms by using the portfolio construction strategy. The study employed a three-factor CAPM model including the EPU as an external factor of monthly stock return and formulate two separate portfolios based on EPU beta. The result reported a positive impact of EPU on the crash risk while the degree of association was

quite higher with the firm having a higher EPU beta. *Dai et al., (2021)* used conditional skewness as the proxy for stock price crash risk and the log difference of daily confirmed Covid cases over the pandemic period (i.e., 2017-2020) in the USA. They observed negative correlation of EPU with conditional skewness and argued the EPU plays a significant role in the increase of crash risk with the Covid breakdown. *Azam (2021)* considered the non-financial firm from the Pakistan stock exchange to examine the role of policy uncertainty on the stock price crash risk over ten years i.e., from 2010-2020. The result of Flexible-GLS (FGLS) found a positive and significant relationship between EPU to crash risk over the study period. It also suggested that the greater investor disagreement and state-owned enterprises (due to uncertainty in political policy) are more likely to crash risk. *Huang and Liu (2021)* focused on the impact of the post-Covid pandemic on the crash risk in the Chinese energy market stocks and reported decrease in stock price crash risk during the post Covid period. It shows that as CSR activities increased during the post-Covid period it helps to control the crash risk and the state-owned firm was found to be less affected during the post-Covid. Based on the above discussion regarding the association between stock price crash risk and EPU, this study uses the following hypothesis:

Hypothesis 2: There is a negative and significant relationship between EPU and stock price crash risk.

In addition to that, it can be assumed as the policy uncertainty increased, it might influence the fears of investors due to the Covid cases. Thus the present study examined the association of investor sentiment index and EPU during the Covid period and the respective hypothesis is stated as follow:

Hypothesis 3: There is a positive and significant relationship between firm-specific investor sentiment and EPU.

3 Data and Variables

3.1 Sample and Data Sources

The final sample consists of monthly firm-specific observations for the crash risk model. Initially, the daily observation of firm-specific stock price, quaterly company performance and annual report were extracted from the official site of Bombay Stock Exchange (BSE) while monthly EPU index was collected from https://www.policyuncertainty.com/india_monthly.html. The period of the study ranges from January 2020 to August 2021 which covers the first as well as the second phase of the Covid-19 pandemic. The top 30 selected BSE companies are used as a proxy for the Indian market performance.

3.2 Investor Sentiment Index

Following various past literature, we used Principal Component Analysis (PCA) to construct the firm-specific sentiment index based on six sentiment proxies: Relative Strengthen Index (RSI),

Psychological Index (PI), Bull and Bear Index (BBI), Average True Range (ATR), Natural log of Trading Volume (TV) and Average Directional Index (ADX). Generally, we determine daily observation for each of the sentiment proxies, which is discussed as follows.

Relative Strengthen Index (RSI): RSI helps to identify the overbought and oversold situation in the stock price. Kim and Ha (2010), Yang and Zhou (2015) and Yang and Chi (2020) considered the RSI as the proxy for investor sentiment. If the RSI is on or above 80, it implies the market is overbought while if it is on or below 20 it indicate the oversold condition.

Psychological Index (PI): following the work of Kim and Ha (2010) and Yang and Chi (2020), the present study also uses the PI as the second proxy for the sentiment. Like the RSI, PI also indicates that the market is overbought (if PI is 75) and oversold (if PI 25).

Bull and Bear Index (BBI): Yang and Chi (2020) employed a new proxy for investor sentiment as BBI. It is a composite index of a list of moving average indexes. This study used 3-6-12-24 days simple moving average and then cross-sectional average used as the final BBI. When the stock price is below the BBI it indicates the more optimistic investor and vice versa in the marketplace.

Average True Range (ATR): As the market volatility plays an important role in the mind of an investor; we follow 14 days simple moving average of true range taken as a proxy for overall market volatility.

Natural log of Trading Volume (TV): Trading volume use as the indicator of market liquidity. High TV provides evidence of higher liquidity and assumes the investors are more informative. Following the work of *Liao et al., (2021), Yang and Zhou (2015) and Yang and Chi (2020)* we considered the natural log of trading volume as the proxy for investor sentiment.

Average Directional Index (ADX): The final proxy for the sentiment index indicates the existence of trend or side-way market movement based on the stock price. The index ranges from zero to hundred; the value higher than 25 implies a strong trend in the stock price.

All the market proxy is determined based on the daily observation of the firm-specific stocks. The monthly sentiment proxy determines simple taking the average of daily observation during a particular month. We collected the monthly Consumer Price Index (CPI) from the official site of RBI and employed linear regression on each monthly proxy as the dependent variable to overcome the orthogonal issue. The composite sentiment is constructed by taking the first PCA[1] of the residual from the simple regression. We also standardize the composite sentiment index to mean zero and unit variance.

[1] First the PCA run by considering the raw residual as well as lagged residual. Then we compare the correlation of first PCA with the raw as well as lagged residual. Out of which correlation is higher taken for run the PCA second time and the first PCA use as the composite Sentiment Index.

3.3 Set of Control Variables

Following the past literature, we use a list of control variables such as average daily return in a month (Ret), the standard deviation of daily return in a month (Sig.), Leverage (LEV) Return on Asset (ROA), Size of the Firm (Size) and the lag value of Crash Index. In addition to that the dummy variable for Industry (Ind.) and Period (Month) was also taken to validate the impact of sentiment and EPU on the firm-specific crash risk.

3.4 Proxy for Stock Price Crash Risk

Following the past literature in stock price crash risk, this paper employed NCSKEW and DUVOL to measure the stock price crash risk (*Cheng et al., 2020; Fu et al. 2020 and Luo and Zhang 2020)*. As both the measure based on the weekly return, this study use the following regression to estimate the idiosyncratic weekly return (*Zhu et al., 2017; Fu et al. 2020*):

$$r_{i,t} = \alpha_i + \beta_1 r_{m,t-2} + \beta_2 r_{m,t-1} + \beta_3 r_m + \beta_4 r_{m,t+1} + \beta_5 r_{m,t+2} + \epsilon_t \dots\dots\dots (1)$$

Where $r_{i,t}$ is the daily return of stock i at day t while r_m is the return of the market in the same day, then the firm-specific return of day t calculated by $w_{i,t}$: $w_{i,t} = \ln(1 + \epsilon_t)$. Following *Chen et al., (2001)* the probability of stock price crash risk is calculated as follow:

$$NSCKEW_{i,m} = -\left[n(n-1)^{\frac{2}{3}}\sum w_{i,t}^3\right] / \left[(n-1)(n-2)\left(\sum w_{i,t}^2\right)^{\frac{2}{3}}\right] \dots\dots\dots (2)$$

$NSCKEW_{i,m}$ is the firm-specific negative coefficient of skewness in month m while n is the total number of trading days in that month m. The second alternative measure for crash risk is Down-to Up Volatility (DUVOL) of firm-specific weekly return. To calculate this, the firm-specific trading week will divide into up and down based on the monthly mean of the daily return. If the firm-specific weekly returns are above the annual mean, called up-week, otherwise down-week. Then the standard deviation of the up & down week will be calculated separately. Finally, the ratio of $DUTVOL_{i,m}$ will be the log of the ratio of down-week standard deviation to the up-week standard deviation.

$$DUVOL_{i,m} = \log\left\{\left[(n_u - 1)\sum_{down} w_{i,t}^2\right]\left[(n_d - 1)\sum_{up} w_{i,t}^2\right]\right\} \dots\dots\dots\dots\dots\dots (3)$$

Where n_u & n_d represent the numbers of up and down daily returns in the month m. Generally, higher the NSCKEW and DUVOL indicate higher the probability of stock market crash risk.

3.5 Summary Statistics

Table 1 reports the descriptive statistics of major variables which are used for the analysis. The average of the two crash risk measures NCSKEW and DUVOL are 0.0095 and -0.009 respectively. The standard deviation is comparatively higher in the case of DUVOL. The normality assumption

is not satisfied for most of the variables except NCSKEW, LEV and Firm Size. On the other hand, the condition of stationarity was fulfilled by all the variables with 1% levels of significance.

4 Empirical Analysis

To examine the firm-specific investor sentiment and EPU on the future stock price crash risk, we employee the following regression:

$$Crash_{t+1} = \alpha + \beta_1 \, (SI_t \text{ or } EPU_t) + \beta_2 CV + \epsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

The dependent variable $Crash_{t+1}$ represents the monthly NSCKEW and DUVOL while CV represents the set of the control variable. If the result of β_1 is positive and significant, it implies that the SI/EPU will cause the future stock price crash risk. On the other hand, if the coefficient is significant but negative, it indicates the investor rationality during the period of market fall. First, we run the regression (model-4) by considering only the dependent variable and target variable i.e., SI & EPU. To avoid the problem of endogeneity, we added the list of firm-specific control variables and finally run the model adding the dummy variable for the period and the industry-specific. In addition to that, this paper employed a Newey-West estimator in the OLS regression to overcome the problem of autocorrelation and heteroscedasticity in the model residuals.

4.1 Result of Firm-Specific Sentiment and EPU on Stock Price Crash risk (NSCKEW)

The result of NSCKEW is presented in Table 2. First, two-panel of the table reported the result of OLS without any control variable and found there was a significant and negative impact of EPU on the future stock price crash risk. On the other hand, the sentiment index was not able to explain any effect over the sample period. But it can observe the coefficient of the sentiment index was found to be positive, which implies although the effect is not significant, there was a direct relationship between the firm-specific sentiments and the probability of a future stock price crash. The next two panels of the table, shows a similar result after adding the firm-specific control variable in the given model. Irrespective of the individual firm, the period and the sector-specific issue might cause the market fall. Thus, the final two panels of the table reported the result after considering the dummy variable for Period and Industry in the given model. Indeed, the result shows consistency with the first model. The coefficient of Durbin-Watson (DW) also satisfies the condition of OLS regression.

4.2 Result of Firm-Specific Sentiment and EPU on Stock Price Crash risk (DUVOL)

DUVOL provides a robust conclusion compare to NSEKEW (Fu et al. 2020) and the results are reported in Table 3. It also provided similar evidence as in the case of NSEKEW. The EPU negatively affect the future crash risk while the sentiment index had no impact over the study period. Although the size of the effect from EPU to crash was stronger in NSEKEW, but the evidence of strong evidence was observed from DUVOL with a high degree of levels of significance.

4.3 Role of EPU on Firm-Specific Sentiment Index

The above discussion reveals that the future stock price crash risk is neither affected by firm-specific sentiment nor from overall EPU over the pandemic period. Thus the present session try to investigate the effect of EPU on future investor sentiment i.e., SI_{t+1}; the regression might as follow:

$$SI_{t+1} = \alpha + \beta_1 EPU_t + \beta_2 Crash_t + \beta_3 CV + \epsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

In the above model, a positive and significant EPU coefficient would report the significant impact of overall news sentiment on the firm-specific investor sentiment. While the negative coefficient implies the indication of investor conciseness towards the economic specific news and the investor is well informed in the market, which is presented in Table 4.

The same analysis procedure was followed to examine the impact of EPU on the firm-specific crash risk. The first panel of the table observed the negative and significant impact of EPU (-0.557) on investor sentiment. A similar pattern of EPU to sentiment was also found, after including the other control variable in the model (5). Panel 2 & 3 of the table shows a significant and positive effect of lagged sentiment index but when we added the crash risk as to the control variable (in panels 4 & 5) the lag coefficient was found to be insignificant and both the crash measure positively affects the investor sentiment. After all, the consistent behavior of EPU was observed from the different specifications of the model (5). The coefficient of the DW test is assumed to be not satisfying the condition of OLS regression, thus the present study follows the Newey-West estimator to test the efficiency of the coefficient.

Whether it was the case of future crash risk or sentiment index, EPU were negatively affected, which implies a change in policy during the Covid period, the investors were not in rush towards financial herding rather they try to defend the situation. When they found the situation is quite good, they tried to actively work in the market. On the other hand, we can conclude that the investors followed the contrarian strategy to control the future crash risk as well as the market sentiment based on the information available in the market.

5 Conclusion

This study examines the impact of firm-specific investor sentiment and EPU on future stock price crash risk throughout the Covid pandemic. Using the monthly observation of the Indian stock market over the period from Jan. 2020 to Aug. 2021, we did not find that the firm-specific investor sentiment or EPU could be able to predict the future crash risk. On the contrary, the past month EPU helps to control the future stock price crash over the study period. Similarly, the results were also observed in the case of the sentiment index which showed that the EPU negatively affects the Firm-specific sentiment. Overall the result supports the contrarian strategy over the pandemic as the policy uncertainty increases the investor wait for the future opportunity and when the EPU decrease, the investors aggressively works in the market.

The result of this study will help the retail as well as the institutional investor to rebalance their portfolio based on the EPU and firm-specific sentiment index. The main limitation of the present

study is the small sample period. Thus, it can be extended by using high-frequency data or by using conditional skewness on the daily observation.

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Appendix: List of Variable Details

Variable	Particulars
$Crash_{t-1}$	Lag value of Crash Index
Ret	Average daily return in a month
Sig	Standard deviation of daily return in a month
LEV	Leverage: Total Liability/Total Asset
ROA	Return on Asset: Net Profit/Total Asset
Size	Size of the Firm: Natural log of Total Asset
Ind.	dummy variable for Industry
Month	dummy variable for months over the sample period

Table 1: Descriptive Statistics

Variables (Monthly)	Mean	Max.	Min.	SD	Skewness	Kurtosis	JB	ADF	PP	Obs.
$NCSKEW_t$	0.0059	1.1	-1.1	0.37	0.055	-0.058	0.32	-7.1***	-580***	540
$DUVOL_t$	-0.009	1.2	-1.7	0.5	-0.23	-0.034	4.8*	-7.9***	-520***	540
SI_t	0.016	5.1	-4.2	1.4	-0.14	0.34	4.5*	-11***	-270***	540
EPU_t	0.026	0.66	-0.8	0.37	-0.23	-0.32	7.1**	-11***	-540***	540
RET_t	0.075	2.3	-5.5	0.65	-1.9	13	4100***	-12***	-560***	540
SGM_t	2.3	13	0.59	1.3	2.6	11	3200***	-8***	-270***	540
LEV_t	0.52	0.98	-0.0043	0.28	-0.057	-1.2	33	-4.5***	-37***	540
ROA_t	0.026	0.53	-0.055	0.05	6.8	64	96000***	-5.2***	-110***	540
$Size_t$	12	16	8.9	1.7	0.38	-0.75	26	-4***	-28**	540

Notes: ***, ** & * represent statistical significance at 1%, 5% and 10% level of significance respectively.
For the notation of variables follow the appendix at the end.

Table 2: Result of SI_t and EPU_t on $NCSKEW_t$

	SI_t		EPU_t		SI_t		EPU_t		SI_t		EPU_t	
	Est.	p-value	Est.	p-value	Est.	p-value	Est.	p-value	Est.	p-value	Est.	p-value
Intercept	0.00832	[0.601]	0.0107	[0.485]	0.122	[0.344]	0.12	[0.346]	0.0715	[0.67]	0.075	[0.646]
	[0.0159]		[0.0153]		[0.129]		[0.128]		[0.167]		[0.163]	
SI_t	0.0115	[0.365]			0.01	[0.427]			0.0103	[0.422]		
	[0.0127]				[0.0126]				[0.0128]			
EPU_t			-0.0834*	[0.0623]			-0.0786*	[0.0798]			-0.0801*	[0.0714]
			[0.0447]				[0.0448]				[0.0444]	
$NCSKEW_t$					-0.0482	[0.213]	-0.0494	[0.203]	-0.0489	[0.204]	-0.0503	[0.196]
					[0.0387]		[0.0388]		[0.0384]		[0.0389]	
Control Variable					yes	yes	yes	yes	yes	yes	yes	yes
Period									yes	yes	yes	yes
Industry									yes	yes	yes	yes
DW	2.06	[0.766]	2.07	[0.784]	1.98	[0.334]	1.97	[0.338]	1.98	[0.318]	1.98	[0.32]
BIC	489.767		487.0036		524.4412		521.9315		536.5084		533.9469	

Notes: The Standard error from Newely-West estimator of reported in square bracket.
***, ** & * represent statistical significance at 1%, 5% and 10% level of significance respectively.

Table 3: Result of SI_t and EPU_t on $DUVOL_{t+1}$

	SI_t		EPU_t		SI_t		EPU_t		SI_t		EPU_t	
	Est.	**p-value**	**Est.**	**p-value**	**Est.**	**p-value**	**Est.**	**p-value**	**Est.**	**p-value**	**Est.**	**p-value**
Intercept	-0.00193	[0.929]	0.00124	[0.954]	-0.0903	[0.601]	-0.0945	[0.578]	-0.125	[0.579]	-0.121	[0.587]
	[0.0218]		[0.0215]		[0.173]		[0.17]		[0.225]	NA	[0.222]	
SI_t	0.0125	[0.458]			0.0112	[0.521]			0.0128	[0.459]		
	[0.0169]				[0.0175]				[0.0173]			
EPU_t			-0.114**	[0.0445]			-0.11**	[0.0484]			-0.117**	[0.0355]
			[0.0568]				[0.0555]				[0.0555]	
$DUVOL_t$					0.0127	[0.758]	0.0107	[0.798]	0.0106	[0.799]	0.00845	[0.842]
					[0.0412]		[0.0419]		[0.0416]		[0.0424]	
Control Variable					yes	yes	yes	yes	yes	yes	yes	yes
Period									yes	yes	yes	yes
Industry									yes	yes	yes	yes
DW	1.94	[0.252]	1.95	[0.272]	1.97	[0.331]	1.97	[0.333]	1.98	[0.321]	1.98	[0.319]
BIC	792.6287		789.2717		828.37		825.3094		839.5646		836.2155	

Notes: The Standard error from Newely-West estimator of reported in square bracket.
***, ** & * represent statistical significance at 1%, 5% and 10% level of significance respectively.

Table 4: The impact of EPU_t of SI_{t+1}

	Est.	p-value	Est.	p-value	Est.	p-value	Est.	p-value	Est.	p-value
Intercept	0.0678	[0.431]	-0.00701	[0.981]	0.096	[0.764]	0.0934	[0.774]	0.103	[0.749]
	[0.0861]		[0.295]		[0.32]		[0.325]		[0.32]	
EPU_t	-0.557***	[9.93e-05]	-0.256*	[0.0503]	-0.266**	[0.0392]	-0.265**	[0.0427]	-0.263**	[0.0423]
	[0.142]		[0.131]		[0.129]		[0.13]		[0.129]	
SI_t			0.372***	[1.56e-30]	0.375***	[5.39e-31]	0.0466	[0.745]	0.0565	[0.593]
			[0.0304]		[0.0303]		[0.143]		[0.106]	
$NCSKEW_t$							0.375***	[1.17e-30]		
							[0.0305]			
$DUVOL_t$									0.374***	[1.28e-31]
									[0.0299]	
Control Variable			yes	yes	yes	yes	yes	yes	yes	yes
Period					yes	yes	yes	yes	yes	yes
Industry					yes	yes	yes	yes	yes	yes
DW	1.24***	[7.09e-19]	1.82**	[0.0136]	1.83**	[0.0157]	1.83**	[0.0155]	1.83**	[0.0156]
BIC	1846.138		1760.415		1772.528		1778.702		1778.504	

Notes: The Standard error from Newely-West estimator of reported in square bracket.
***, ** & * represent statistical significance at 1%, 5% and 10% level of significance respectively.