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Voluntary disclosure of pandemic exposure and stock price crash risk

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ARTICLE INFO

JEL Classification:
E44
G12
G14
G32
I18

Keywords:
Voluntary disclosure
Pandemic exposure
COVID-19
Stock price crash risk

ABSTRACT

We examine whether a firm’s voluntary disclosure of pandemic exposure increases stock price crash risk in a turbulent stock market caused by the spread of COVID-19 and other epidemic diseases. Pandemic risk is an unprecedented type of economic shock that alters the firm’s stock price. Using an innovative firm-level pandemic exposure dataset based on the textual analysis of earnings conference calls, we show that there is a strong positive correlation between firm-level disclosure of pandemic exposure and one-quarter-ahead stock price crash risk.

1. Introduction

The economic crisis caused by the COVID-19 pandemic is unlike any previous crisis. As of December 2020, more than 200 countries have been affected and over 79 million cases and 1.7 million deaths have been reported globally. Most governments enacted restrictions on individual and commercial activities, and there were mass unemployment and business failures. From the end of February 2020 until early April, global stock markets became extremely volatile and erased $15 trillion in value within five weeks (Zweig, 2020). The circuit breaker in the U.S. stock market, which had been tripped only once in 1997, was tripped four times in 10 days in March 2020 (Zhang et al., 2020). Wall Street suffered its third-worst Black Monday on March 16, 2020 (Valetkevitch, 2020). The frequent tripping of circuit breakers and a record drop in price indicate an abnormally high risk of stock price crash during the COVID-19 pandemic. Therefore, a study of pandemic exposure and stock price crash risk would shed more light on the condition of today’s stock market condition.

Although COVID-19 is not the first epidemic to disrupt economic life, it is the most extreme (Adda 2016; Barro et al., 2020a; Hassan et al., 2020). Empirical evidence reveals that no previous disease outbreak has caused as much stock market uncertainty as the COVID-19 pandemic (Baker et al., 2020).

To convey the impact of the pandemic on their prospects, public companies have used earnings conference calls to comment on matters pertaining to COVID-19. According to Hassan et al. (2020), about 40% of conference calls discussed the COVID-19 outbreak, a
much larger percentage than all prior disease outbreaks including SARS, which was discussed at just above 20% of conference calls. We build on concurrent studies to investigate the impact of firm disclosure of the pandemic exposure on stock market behavior.

We predict that the voluntary disclosure of pandemic exposure is associated with higher risk of stock price crash. Greater pandemic exposure suggests a possible bottleneck in the supply chain, reduced demand, and forced layoffs in certain industries, leading to a sharp decline in investors’ confidence in the market (Park et al., 2020; del Rio-Chanona et al., 2020). When adverse news is released to the market, especially if it exceeds the tipping point that investors can bear, they sell their stocks. At the same time, further stock sales are induced by investors’ short-term horizons and information asymmetry (Chang et al., 2017). As stock selling occurs, the share price will drop.

Consistent with our prediction, we discover a significantly positive association between a firm’s disclosure of pandemic exposure and one-quarter-ahead stock price crash risk, measured by the negatively skewed return distribution (NCSKEW), the down-to-up volatility of stock returns (DUVOL), and the stock price crash count (Crash Count). More specifically, we find that one standard deviation in pandemic exposure is associated with an increase in the net count of crash days equal to 6.12% of the sample mean in the following quarter. Our evidence suggests that the unfavorable COVID-19 related disclosure has a devastating impact on future stock prices. However, we do not observe a significant effect of pandemic exposure on future crash risk over forecasting windows longer than a quarter. This is consistent with the unpredictable feature of the COVID-19 pandemic as the genetic mutations of the virus and corresponding policies change dramatically over time, which could lead to previous disclosure irrelevant.

Moreover, we find that as stock price crash risk grows, companies will reduce the amount of disclosure about their pandemic exposure to restore investors’ confidence and defend their stock prices.

Our research contributes to the empirical evidence of the consequences of pandemic disclosure for the economy. So far, there has been ample evidence that focuses on the feverish stock market reaction to the COVID-19. For instance, Mazur et al. (2021) documented that petroleum, real estate, entertainment, and hospitality stocks fell drastically, and these loser stocks exhibit extreme asymmetric volatility Ding et al. (2021). demonstrate that pandemic-induced decline in stock returns was stronger among firms with weaker pre-2020 finances, more exposure to COVID-19 through global supply chains, and customer locations, fewer CSR activities, and more entrenched executives. Our research is distinct in that we concentrate on corporate voluntary disclosure strategy with respect to the pandemic and how such a strategy can be used to influence future stock price performance. We find that when the fear of the disease and the pessimistic economic prospect dominates the market, disclosure of bad news can easily burst the bubble.

The rest of the paper is organized as follows. In Section 2, we develop our hypothesis. In Section 3, we introduce the firm-level pandemic exposure dataset and summarize both crash risk measures and control variables. The research design and baseline empirical results with robustness checks are presented in Section 4 Section 5 concludes.

2. Hypothesis development

Hassan et al. (2020) show that pandemic risk is a long-standing economic shock, but it has not drawn much attention until the economic slowdown caused by COVID-19. To convey the impact of the pandemic on firms’ prospects, public companies have used earnings conference calls, such as management presentations and Q&A sessions, to comment on matters related to COVID-19. Pandemic risk has affected firms in many ways: supply chains were bottlenecked, manufacturing facilities had to be shut down, industries were forced to lay off or furlough employees, companies disproportionately faced greater financial constraints, and containment policies (e.g., various social distancing measures) were introduced by governments. The firm-level pandemic risk raises the magnitude of the uncertainty of the intrinsic value of the firm. When adverse news is released to the market, especially if it exceeds investor’s tipping point, stock selling will occur. At the same time, stock selling is induced by investors’ short-termism and lack of confidence in future economic recovery (Chang et al., 2017). As more investors sell their shares, stock price collapse will follow.

In addition, the COVID-19 hit the labor market a hard way. According to the Current Population Survey (CPS)1, the unemployment rate in the U.S. stood at 3.5% as early as February 2020, a record low since December 1969. However, when Covid-19 struck out of the blue, with unprecedented ferocity and speed, the U.S. unemployment rate spiked to 14.7% in April and maintained at 6.7% by December (Lee et al., 2021). Amongst the unemployed, many were reluctant to return to the workplace, casting a shadow over economic recovery.

Given the discretionary government policies, the decreased purchasing power arising from widespread unemployment, and new waves of the pandemic, firms’ disclosure of pandemic risk would corroborate investors’ negative sentiment, leading to further stock price crashes. These arguments lead to our hypothesis.

Hypothesis: The stock price crash risk is higher when the firm discloses pandemic risk.

3. Data and sample

Our research focuses on pandemic disclosure and stock price crash risk of U.S. publicly traded firms. The firm-level pandemic risk disclosure is obtained from Hassan et al. (2020).2 The authors use the textual analysis of quarterly earnings conference calls to identify words related to COVID-19 and other epidemics (i.e., SARS, H1N1, Ebola, and Zika) from the World Health Organization starting in 2002. The algorithm then searches for words that appear within 10 words of other phrases commonly associated with “risk” or

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1 CPS Survey is accessible at https://data.bls.gov/timeseries/LNS14000000.
2 The data is available for downloading at https://www.firmlevelrisk.com/download.
“uncertainty,” and tallies the frequency of occurrence in the earnings conference calls to create the variable for firm-level pandemic risk disclosure. In our study, we use the quarterly data of firm-level risk exposure to the diseases mentioned above from 2002Q1 to 2020Q4.

We measure stock crash risk with three approaches widely used in the literature (e.g., Hutton et al., 2009; Kim et al., 2011; Callen and Fang 2015): the negative skewness of stock returns (NCSKEW), the down-to-up volatility (DUVOL), and the net count of actual occurrences of stock price crashes (Crash Count). We compute the crash risk measures using daily stock returns from CRSP for each quarter with at least 25 available daily stock price observations.

Specifically, we estimate the following regression to calculate systematic and firm-specific components after introducing the lead and lag returns to account for non-synchronous trading.

$$R_{it} = \alpha + \beta_1 R_{mt} + \beta_2 R_{mt-1} + \beta_3 R_{mt-2} + \beta_4 R_{mt+1} + \beta_5 R_{mt+2} + E_{it}$$

(1)

where $R_{it}$ and $R_{mt}$ are the stock return of firm $i$ and industry-wide market return at time $t$. The natural logarithm of 1 plus the residual in Eq. (1), $\log(1 + E_{it})$, proxies for firm-specific daily return ($D_{it}$) for firm $i$ on day $t$.

We calculate NCSKEW by taking the negative of the third moment of firm-specific daily returns, $NCSKEW_{it}$, for each sample quarter divided by the standard deviation of firm-specific daily returns raised to the third power. Specifically, we calculate $NCSKEW$ for each firm $i$ in quarter $t$ as:

$$NCSKEW_{it} = -\left[\frac{n(n-1)^2}{n[(n-1)(n-2)]^{3/2}} \sum D_{it}^3 \right] / \left[\left( \sum D_{it}^2 \right)^{3/2} \right]$$

(2)

where a higher negatively skewed return distribution (i.e., a higher value for $NCSKEW$) indicates a higher crash risk.

The second stock price crash proxy, DUVOL, is calculated as the natural logarithm of the standard deviation of daily stock returns, $D_U$, for the days in which $D_U$ is lower than its quarterly means (“down” days) over the standard deviation of daily stock returns, $D_L$, for the days in which $D_U$ is higher than its quarterly means (“up” days). Specifically, DUVOL for each firm $i$ in quarter $t$ is calculated as:

$$DUVOL_{it} = \log \left[ \left( \frac{n_D - 1}{n_D} \sum D_{it}^2 \right)^{1/2} / \left( \frac{n_U - 1}{n_U} \sum D_{it}^2 \right)^{1/2} \right]$$

(3)

where $n_D$ is the number of “up” days and $n_U$ is the number of “down” days. A higher value for DUVOL indicates a higher crash risk.

The third proxy for stock price crashes, Crash Count, uses a data-driven (model-free) approach. We first count the number of daily stock returns exceeding 3.2 standard deviations below and above the average quarterly return. The threshold 3.2 is selected to generate the frequency of 0.1% in the normal distribution. The stock price crash count is defined as the net of the downside and upside frequencies, comparing the occurrence of price crashes to price jumps.

The selection of control variables for firm’s stock price crash risk follows prior literature (Chen et al., 2001; Kim et al., 2011). As the dependent variable is one-quarter-ahead crash risk, we first include current period crash risk as a control to address the serial correlation of the crash risk behavior. We also employ stock market variables and firm fundamentals computed using CRSP and Compustat data to control for the possible determinants of the crash risk. For stock market variables, we select stock return, stock volatility, and detrended average stock turnover (Dturnover), all of which were found to be positively related to future crash risk by Chen et al. (2001). In addition, firm size (Log Asset), leverage ratio, market-to-book ratio, ROA, and the magnitude of discretionary accruals (ACCM) are incorporated into the regression analysis to control for the firm fundamental characteristics. Specifically, we control for discretionary accruals. Prior research finds that high accruals predict a higher stock price crash probability (Hutton et al., 2009; Zhu, 2016) Zhu (2016). argues that managers can manipulate income-increasing accrual estimates to hoard negative information. But once accumulated negative information passes a threshold, it is released to the market all at once, resulting in a stock price collapse. Detailed definitions of the variables are provided in the Appendix.

| Variable          | N     | Mean   | Std. Dev. | 5%     | 25%     | 50%     | 75%     | 95%     |
|-------------------|-------|--------|-----------|--------|---------|---------|---------|---------|
| NCSKEW            | 205,205 | -0.262 | 1.311     | -2.759 | -0.822  | -0.224  | 0.304   | 2.168   |
| DUVOL             | 205,252 | -0.195 | 0.822     | -1.656 | -0.693  | -0.182  | 0.272   | 1.317   |
| Crash Count       | 205,252 | -0.125 | 0.770     | -1.000 | -1.000  | 0.000   | 0.000   | 1.000   |
| Pandemic Exposure | 160,343 | 0.098  | 0.464     | 0.000  | 0.000   | 0.000   | 0.000   | 0.608   |
| Log Assets        | 199,265 | 6.578  | 2.035     | 3.309  | 5.153   | 6.544   | 7.933   | 10.034  |
| Leverage          | 193,113 | 0.231  | 0.232     | 0.000  | 0.014   | 0.185   | 0.356   | 0.685   |
| Market-to-Book    | 198,896 | 2.228  | 1.722     | 0.827  | 1.195   | 1.648   | 2.558   | 5.838   |
| Stock Return      | 205,252 | 0.001  | 0.013     | -0.006 | -0.001  | 0.001   | 0.003   | 0.008   |
| ROA               | 199,253 | -0.007 | 0.061     | -0.133 | -0.008  | 0.009   | 0.021   | 0.049   |
| Volatility        | 205,252 | 0.031  | 0.019     | 0.011  | 0.018   | 0.026   | 0.037   | 0.067   |
| Dturnover         | 196,718 | 0.006  | 0.245     | -0.351 | -0.078  | -0.003  | 0.078   | 0.394   |
| ACCM              | 203,228 | 0.626  | 0.773     | 0.014  | 0.185   | 0.402   | 0.740   | 2.048   |

Summary Statistics, This table presents the summary statistics for stock crash risk measures, firm-level pandemic exposure, and control variables. The sample contains U.S. publicly listed firms spanning from 2002Q1 to 2020Q4. Continuous financial variables are winsorized at the 1st and 99th percentiles. Detailed variable definitions appear in the Appendix.
Table 2
Correlation Matrix, This table presents the Pearson Correlation Matrix for stock crash risk measures, firm-level pandemic exposure, and control variables. The sample contains U.S. publicly listed firms spanning from 2002Q1 to 2020Q4. Continuous financial variables are winsorized at the 1st and 99th percentiles. Bold numbers are significant at the 10% level. Detailed variable definitions appear in the Appendix.

| Variable                      | (1) NCSEW, t-1 | (2) DUVOl, t-1 | (3) Crash Count, t-1 |
|-------------------------------|----------------|----------------|----------------------|
| Pandemic Exposure, t           | 0.353***       | 0.173***       | 0.132***             |
|                               | [3.93]         | [3.81]         | [3.32]               |
| NCSEW, t                       | -0.026***      | -0.026***      | -0.020***            |
|                               | [-5.40]        | [-4.76]        | [-4.28]              |
| DUVOL, t                       | -0.026***      | -0.026***      | -0.020***            |
|                               | [-4.76]        |                | [-4.28]              |
| Crash Count, t                 |                |                |                      |
| LogAssets, t                   | 0.106***       | 0.065***       | 0.068***             |
|                               | [8.27]         | [8.02]         | [10.32]              |
| Leverage, t                    | -0.118***      | -0.057**       | -0.058***            |
|                               | [-3.04]        | [-2.27]        | [-2.81]              |
| Market-to-Book, t              | 0.048***       | 0.032***       | 0.027***             |
|                               | [5.20]         | [5.54]         | [5.24]               |
| Stock Return, t                | -1.456***      | -0.718***      | -0.651***            |
|                               | [-15.69]       | [-13.35]       | [-15.92]             |
| ROA, t                        | 0.258***       | 0.025          | 0.040                |
|                               | [2.97]         | [0.59]         | [0.86]               |
| Volatility, t                  | 2.684***       | 0.922**        | 0.350                |
|                               | [4.39]         | [2.24]         | [1.31]               |
| Dturnover, t                   | 0.045**        | 0.036***       | 0.021*               |
|                               | [2.24]         | [3.31]         | [1.84]               |
| ACCM, t                       | 0.015          | 0.011          | 0.008                |
|                               | [0.84]         | [1.41]         | [0.96]               |
| Intercept                     | -0.874***      | -0.509***      | -0.601***            |
|                               | [-9.07]        | [-8.78]        | [-10.94]             |
| N                             | 146,724        | 146,727        | 146,727              |
| Adj. R²                       | 0.190          | 0.122          | 0.122                |
| Firm FE                       | Yes            | Yes            | Yes                  |
| Time FE                       | Yes            | Yes            | Yes                  |
| Cluster SE                    | Yes            | Yes            | Yes                  |

Table 1 presents the summary statistics of the dependent variables, non-zero firm-level disclosure of pandemic exposure, and control variables. The data panel has firm-quarter granularity, and all variables are evaluated on a quarterly basis. Both NCSEW and DUVOL have negative mean with large variations, similar to the statistics reported in Chen et al. (2001). The quarterly Crash Count variable has a mean closer to zero and smaller standard deviation, comparable to those reported in Callen and Fang (2015) that use the yearly data. At the same time, the mean and median values of Pandemic Exposure are 0.098 and 0, respectively, suggesting low level of discussion about the COVID-19 and other epidemic diseases in corporate earnings calls. After merging different data sources, we obtain 5237 unique U.S. publicly traded firms from 2002Q1 to 2020Q4.

Table 2 shows the Pearson correlation matrix. As expected, all future crash risk variables are significantly and positively correlated.
with each other. More importantly, Pandemic Exposure has correlation coefficients of 0.008 with NCSKEW and 0.011 with DUVOL, both of which are significant at the 1% level. Pandemic Exposure is also significantly and positively correlated with Crash Count. The univariate results are consistent with our prediction that firms with greater pandemic risk exposure display higher future stock price crash probability.

4. Research design and empirical results

To disentangle firm-level disclosure of pandemic exposure from stock price crash risk, we perform the baseline regression with robustness checks. We use the following model specification in the baseline regression:

\[ \text{Crash Risk}_{i,t+1} = \alpha + \beta_1 \text{Pandemic Exposure}_{i,t} + \beta_2 \text{Controls}_{i,t} + \gamma D_i + \delta D_t + \epsilon_{i,t} \]  

where Pandemic Exposure is the firm’s disclosure of pandemic risk, our main variable of interest; Controls are an array of control variables as described in Section 3; and \( D_i \) and \( D_t \) are firm- and time-fixed effects, respectively. Standard errors are clustered at the firm level. The dependent variables are one-quarter-ahead crash risk measures, including NCSKEW, DUVOL, and Crash Count. We expect coefficient \( \beta_1 \) to be positive.

Table 3 shows the empirical results from the baseline regression. The coefficients on Pandemic Exposure are positive with strong statistical significance, for all future stock price crash measures. For example, when the crash risk measure is NCSKEW, the coefficient of Pandemic Exposure is 0.353 with t-statistic of 3.93. As for economic significance, we find that each standard deviation of increase in pandemic exposure corresponds to 12.5% and 9.8% standard deviation of increase in NCSKEW and DUVOL, respectively. And as pandemic exposure increases by one standard deviation, Crash Count increases by 6.12%. Therefore, adverse news associated with COVID-19 disclosure has a devastating impact on investors’ confidence that it leads to rapid stock selling and price collapse in the following quarter.

As for the control variables, the quarterly crash risk measures demonstrate a mean-reverting pattern (negative coefficient), which is different from the yearly frequency in the common stock crash risk literature. We keep the quarter-by-quarter pace to better track the dynamics of the pandemic risk exposure on the firm level. Consistent with the literature (Kim et al., 2011), firm size, market-to-book ratio, stock volatility, and detrended stock turnover ratio are positively related to stock price crash risk, whereas leverage ratio and the stock return are negatively related to the measures of crash risk. We perform the variance inflation factor (VIF) analysis to detect
Table 5
Robustness Test Using Alternative Measure of Pandemic Exposure; This table presents the robustness test results for baseline regression using an alternative measure of pandemic exposure. The sample contains U.S. publicly listed firms spanning from 2002Q1 to 2020Q4. The dependent variables are one-quarter-ahead NCSKEW, DUVOL, and Crash Count. The key independent variable is Has Exposure. Continuous financial variables are winsorized at the 1st and 99th percentiles. “Yes” indicates the inclusion of firm- and time-fixed effects in all regressions, with standard errors clustered at the firm level. The t-statistics are reported in parenthesis. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Detailed variable definitions appear in the Appendix.

| Variable | (1)NCSKEW t+1 | (2)DUVOL t+1 | (3)CrashCount t+1 |
|----------|---------------|---------------|------------------|
| HasExposure t | 0.375*** | 0.157*** | 0.143*** |
| | [14.91] | [9.83] | [12.50] |
| NCSKEW t | −0.025*** | −0.025*** | −0.020*** |
| | [−5.44] | [−4.80] | |
| DUVOL t | 0.006*** | 0.065*** | 0.067*** |
| | [0.87] | [7.92] | [10.16] |
| Crash Count t | 0.015 | 0.011 | 0.008 |
| | [2.98] | [0.58] | [0.86] |
| Stock Return t | 0.024 | 0.004 | |
| | [2.98] | [0.58] | |
| Volatility t | 0.046** | 0.037*** | 0.022* |
| | [2.35] | [3.41] | [1.25] |
| DTurnover t | 0.001 | 0.011 | 0.008 |
| | [0.84] | [1.43] | [0.95] |
| Intercept t | −0.872*** | −0.509*** | −0.600*** |
| | [−8.77] | [−8.57] | [−10.63] |
| N | 146,724 | 146,727 | 146,727 |
| Adj. R² | 0.190 | 0.122 | 0.122 |
| Firm FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |
| Cluster SE | Yes | Yes | Yes |

potential multicollinearity issues. For all the three baseline regressions in Table 3, the VIFs are 3.23, which are less than the threshold of 10. Thus, our main regression analysis is not affected by the multicollinearity problem. Overall, the empirical results support our hypothesis that the firm-level disclosure of pandemic exposure raises the firm’s future stock price crash risk.

The baseline regression may suffer from an endogeneity issue of reverse causality. That is, Companies may manipulate the disclosure of their pandemic exposure risk to defend their stock price following the incidence of a crash. To shed light on the causal relationship between corporate disclosure of pandemic exposure and stock price crash, we re-estimate the multivariate regression model by employing one-quarter-ahead pandemic exposure as the dependent variable and current crash risk measures as the main variables of interest, while controlling for other market and firm fundamental variables.

We provide the results of the reverse causality test in Table 4. Unlike in the baseline regression, we find that all crash risk measures (NCSKEW, DUVOL, and Crash Count) are significantly associated with lower levels of pandemic exposure in quarter \( t+1 \) (t-statistics = −6.03, −4.98, and −3.40, respectively). We argue that after companies experience stock price collapse, managers may intentionally hoard bad news disclosure of their pandemic risk to restore the confidence of investors and stabilize their corporate stock prices. The opposite coefficient signs arising from the reverse causality test further confirm the interrelationship between voluntary disclosure of pandemic exposure and stock price crash risk.

We perform a set of additional robustness tests to ensure that our main results still hold after considering an alternative measure of pandemic exposure and various sample periods. For example, we define a dummy variable, Has Pandemic, which takes the value of 1 if a company reported any exposure to COVID, SARS, H1N1, Zika, and Ebola in their earnings conference calls, and 0 otherwise. We then use it as the main variable of interest in the multivariate regression to test our hypothesis. The results in Table 5 are consistent with our main findings. The coefficients on Has Pandemic remain positive and significant at the 1% level. We also consider the validity of our results using the sample periods ended at 2020Q2, 2020Q3, and 2020Q4, respectively. Our main results (untabulated) remain robust, suggesting that the stock price crash risk to pandemic exposure is prominent both at the inception and well into the swing of the COVID-19 pandemic.

Finally, we investigate the impact of disclosing pandemic exposure on future stock price crash risk for different forecast windows. As shown in Table 6, when the dependent variables are two-quarter-ahead or three-quarter-ahead crash risk measures, we observe a positive but insignificant effect of pandemic exposure on these longer-forecasting-window crash risk measures. Therefore, the stock
Table 6  
Effect of Disclosure of Pandemic Exposure on Stock Price Crash Risk with Longer Forecasting Windows; This table presents the regression results for the effect of disclosure of pandemic exposure on stock price crash risk during the next two-quarter and three-quarter windows. The sample contains U. S. publicly listed firms spanning from 2002Q1 to 2020Q4. The dependent variables are two-quarter-ahead or three-quarter-ahead NCSKEW, DUVOL and Crash Count. The key independent variable is Pandemic Exposure. Continuous financial variables are winsorized at the 1st and 99th percentiles. “Yes” indicates the inclusion of firm- and time-fixed effects in all regressions, with standard errors clustered at the firm level. The t-statistics are reported in parenthesis. ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Detailed variable definitions appear in the Appendix.

| Panel A: Two-Quarter Forecasting Window | (1) NCSKEW_t + 2 | (2) DUVOL_t + 2 | (3) CrashCount_t + 2 |
|----------------------------------------|------------------|-----------------|----------------------|
| PandemicExposure_t                    | 0.087            | 0.051           | 0.017                |
|                                       | [1.55]           | [1.42]          | [0.57]               |
| NCSKEW_t                              | −0.021***        | −0.019***       |                      |
|                                       | [−6.74]          | [−5.30]         |                      |
| DUVOL_t                               | −0.019***        | −0.020***       |                      |
|                                       | [−6.74]          | [−8.95]         |                      |
| CrashCount_t                          | 0.137***         | 0.075***        | 0.079***             |
|                                       | [6.16]           | [5.70]          | [6.38]               |
| LogAssets_t                           | −0.179***        | −0.075***       | −0.088***            |
|                                       | [−4.88]          | [−2.91]         | [−4.58]              |
| Leverage_t                            | 0.071***         | 0.039***        | 0.036***             |
|                                       | [5.37]           | [4.99]          |                     |
| Market-to-Book_t                      | −0.941***        | −0.454***       | −0.418***            |
|                                       | [−4.69]          | [−4.59]         | [−4.69]              |
| StockReturn_t                         | 0.051***         | 0.636***        | 0.433***             |
|                                       | [6.15]           | [7.20]          | [6.29]               |
| LogAssets_t                           | −0.469           | −0.231          | −0.490               |
|                                       | [−0.69]          | [−0.56]         | [−1.45]              |
| Leverage_t                            | 0.025*           | 0.025***        | 0.010                |
|                                       | [1.81]           | [2.61]          | [1.13]               |
| ACCM_t                                | −0.001           | 0.003           | 0.003                |
|                                       | [−0.06]          | [0.56]          | [0.36]               |
| Intercept                             | −0.844***        | −0.472***       | −0.588***            |
|                                       | [−4.92]          | [−5.15]         | [−6.14]              |
| N                                      | 139,133          | 139,136         | 139,136              |
| Adj. R²                               | 0.129            | 0.082           | 0.085                |
| Firm FE                               | Yes              | Yes             | Yes                  |
| Time FE                               | Yes              | Yes             | Yes                  |
| Cluster SE                            | Yes              | Yes             | Yes                  |
| Panel B: Three-Quarter Forecasting Window | (1) NCSKEW_t + 3 | (2) DUVOL_t + 3 | (3) CrashCount_t + 3 |
| PandemicExposure_t                    | 0.068            | 0.044           | −0.003               |
|                                       | [1.58]           | [1.43]          | [−0.16]              |
| NCSKEW_t                              | −0.023***        | −0.019***       |                      |
|                                       | [−9.13]          | [−6.022]        |                      |
| DUVOL_t                               | −0.019***        | −0.020***       |                      |
|                                       | [−6.74]          | [−8.95]         |                      |
| CrashCount_t                          | 0.149***         | 0.080***        | 0.081***             |
|                                       | [7.05]           | [5.87]          | [6.86]               |
| LogAssets_t                           | −0.153***        | −0.04           | −0.066***            |
|                                       | [−4.25]          | [−1.55]         | [−3.89]              |
| Leverage_t                            | 0.078***         | 0.043***        | 0.039***             |
|                                       | [5.80]           | [6.45]          | [5.68]               |
| Market-to-Book_t                      | −0.573***        | −0.279***       | −0.253***            |
|                                       | [−3.189]         | [−3.12]         | [−3.18]              |
| StockReturn_t                         | 0.928***         | 0.505***        | 0.454***             |
|                                       | [6.56]           | [5.36]          | [5.32]               |
| ROA_t                                 | −1.244**         | −0.964***       | −1.007***            |
|                                       | [−2.02]          | [−2.64]         | [−3.54]              |
| Volatility_t                          | −0.010           | −0.002          | −0.002               |
| Dturnover_t                           | −0.010           | −0.002          | −0.002               |
| ACCM_t                                | −0.001           | 0.004           | 0.003                |
|                                       | [−0.14]          | [0.95]          | [0.45]               |
| Intercept                             | −1.006***        | −0.539***       | −0.600***            |
|                                       | [−6.13]          | [−6.06]         | [−6.30]              |
| N                                      | 136,321          | 136,324         | 136,324              |

(continued on next page)
market manifests a prompt and acute reaction to corporate disclosure of pandemic risk, and this reaction is only observable within a short time interval. This is consistent with the fact that, due to the complexity of the pandemic, new information such as virus mutation and government policy constantly updates the market’s expectations. As a result, the information contained in previous disclosure will soon fade away, generating short-term stock price movement.

5. Conclusions

Considering the recent stock market turbulence triggered by the COVID-19 pandemic, we use the innovative firm-level pandemic risk disclosure data and examine the effect of voluntary disclosure of pandemic exposure through earnings conference calls on stock price crash risk. The pandemic risk disclosure, especially the COVID-19 disclosure, has a strong impact on the future stock price crash risk during the one-quarter forecasting window. The positive and significant relation between pandemic exposure and stock price crash risk in the following quarter suggests that a firm’s disclosure of pandemic risk has a prompt and devastating effect on investors’ confidence. Consequently, companies can potentially manipulate the pandemic disclosure to influence short-term future stock price performance. In addition, we do not observe a significant relationship between pandemic exposure and future crash risk over longer forecasting windows (e.g., two quarters or three quarters ahead). This is consistent with the fact that, with the complexity of the pandemic, new information constantly updates investors’ expectations, making the past disclosures irrelevant to stock pricing.

CRediT authorship contribution statement

Justin Jin: Supervision, Writing – review & editing. Yi Liu: Writing – review & editing, Formal analysis. Zehua Zhang: Conceptualization, Writing – original draft. Ran Zhao: Methodology, Software, Formal analysis.

Appendix

Variable Definitions

| Variable                  | Definition                                                                 |
|--------------------------|---------------------------------------------------------------------------|
| NCSKEW                   | Negative conditional of daily stock return skewness in a quarter. Specifically, we take $E_i,t$ from the regression in Eq. (1), take $D_i,t = \log(1 + E_i,t)$, and calculate the variable using the formula: $-\frac{3}{n(n-1)(\sum D_{i,t}^{3})/\left[(n-1)(\sum D_{i,t}^{2})^{3/2}\right]}$. A higher negatively skewed return distribution indicates a higher crash risk. |
| DUVOL                    | Natural logarithm of the standard deviation ratio of daily stock returns between below-average and above-average days in a quarter. We calculate the variable using the formula: $\log\left(\frac{\left(n_u - 1\right)\sum D_{i,t}^{2}^{uv}}{\left(n_d - 1\right)\sum D_{i,t}^{2}^{uv}}\right)$. A higher value for DUVOL indicates a higher crash risk. |
| Crash Count              | The number of days of daily stock returns exceeding 3.2 standard deviations (0.1% in standard normal distribution) below the mean of firm-specific daily returns over a quarter, minus the number of days of daily stock returns exceeding 3.2 standard deviations above the mean of firm-specific daily returns over a quarter. |
| Pandemic Exposure        | The firm-level disclosure of pandemic exposure in quarterly earnings conference calls from Hassan et al. (2020), including the corporate risk exposure to COVID, SARS, H1N1, Zika, and Ebola. |
| Has Exposure             | A dummy variable that takes 1 if Pandemic Exposure > 0 and 0 otherwise. |
| Log Assets               | The natural logarithm of firm’s market value of equity in million-dollar unit in a quarter. |
| Leverage                 | The sum of long-term debt scaled by total assets at the end of the quarter. |
| Market-to-Book           | Market value of equity scaled by book value of equity at the end of the quarter. |
| Stock Return             | The arithmetic average of firm-specific daily return in a quarter. |
| ROA                      | Income before extraordinary items scaled by lagged total assets in a quarter. |
| Volatility               | The standard deviation of firm-specific daily returns over a quarter. |
| Dturnover                | The detrended average monthly turnover ratio in a quarter. |
| ACCM                     | The financial reporting opacity calculated as the absolute value of the modified discretionary accruals in a quarter (Dechow and Dichev 2002). |
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