The stock price crash risk measures are estimated from the firm-specific daily returns. Following Hutton et al. (2009), we calculate the firm-specific stock returns as follows:

Where *Rit*is the stock return for firm *i* in day *t*. *Rmt* is the return of the market index at day *t*. We have included the lead and lag terms to consider the nonsynchronous trading (Dimson, 1979). The firm-specific return is estimated by taking the natural logarithm of one plus residual, which we get from the equation mentioned above:

NCSKEW is the inverse of the third moment, which is divided by the standard deviation of firm-specific returns, which is raised to the third power (Kim et al., 2011b). We can estimate NCSKEW as:

Where *Wi,t* is thefirm-specific return is estimated by taking the natural logarithm of one plus residual. *n* is the number of daily observations. A higher value of the NCSKEW indicates a more negatively skewed return distribution. Therefore, a higher value of the NCSKEW means a higher stock price crash risk (Chen et al., 2001).

We consider down to up volatility (DUVOL) as our second stock price crash risk proxy. It is estimated by taking the natural logarithm of the standard deviation of the daily firm-specific return that is *Wi,t* when it is lower than its mean over the standard deviation of the daily firm-specific return that is *Wi,t* when it is higher than its mean (Callen and Fang, 2015 ). We can estimate DUVOL as:

Where *Wi,t* is thefirm-specific return is estimated by taking the natural logarithm of one plus residual. *nu* is the number of daily observations when the daily firm-specific return that is *Wi,t* when it is lower than its mean. *nd* is the number of daily observations when the daily firm-specific return that is *Wi,t* when it is higher than its mean. A higher value of the DUVOL indicates a more negatively skewed return distribution. Therefore, a higher value of the DUVOL means a higher stock price crash risk (Chen et al., 2001).

Finally, we use the third proxy of the stock price crash risk, which is COUNT. COUNT is estimated by deducting the stock crashes from the stock jumps. Here, stock jumps (crashes) are the firm-specific daily returns positively (negatively) that exceed the 3.09 standard deviation of the mean value, which indicates the tail event (Jin and Myers, 2006; Hutton et al., 2009).