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Investor Heterogeneity and Negative Skewness in Stock Returns:

Evidence from Institutional Investors

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Abstract

We examine the relation between the probability of future stock price crash and investors' investment horizons. Using negative skewness as a proxy for firm-specific crash risk, we document a positive association between institutional ownership and stock price crash risk. The relation is, however, driven by short-term institutional investors, while the presence of long-term institutional investors has a negative effect on stock price crash risk. In addition, we find that the presence of short-term institutional investors induces corporate risk-taking behavior. Our results are robust to alternative model specifications, endogeneity concerns, and different measures of crash risk and proxies of investors' horizons.

JEL classification: G12, G14

Keywords: Investors' horizons, Crash risk, Skewness, Institutional Investors

1. Introduction

Stock crashes have become commonplace in the last few decades. Hutton, Marcus and Tehranian (2009), for instance, document that 17.1% of the firm-years in their sample experience at least one crash over the period 1991-2005. The scale and rising frequency of crash in the equity market have attracted much attention with particular emphasis on identifying its causes. In fact, several studies in the finance and accounting literature show that crash risk increases with the lack of transparency and decreases with the level corporate governance.¹ The premise is that managers tend to use the lack of transparency and weak monitoring environment to delay or conceal bad news and accelerate the disclosure of good news to the market. However, such selective disclosure strategy is not sustainable as the accumulated bad news will end up coming out all at once after crossing a tipping point leading to a sharp decline in the stock price.

In this paper, we examine whether and how institutional investors' investment horizon influences the probability of firm-specific stock price crash.² We focus on institutional investors because of their key role in influencing corporate governance and managerial decisions. In fact, given their large shareholdings, in comparison to retail investors, institutional investors tend to monitor managers and discipline those who deviate from the long-term objective of maximizing

¹ See, among others, Jiang, Du, and Chen (2022), Cao et al (2022), Hsu, Wang, and Whipple (2022), Lobo et al (2020), Balachandran et al (2020), Kim and Zhang (2016), Kim and Zhang (2014), DeFond et al (2015), and Hu, Kim and Zhang (2013). Kim, Li and Zhang (2011a, 2011b), and Hutton et al (2009).

² Institutional investors are legal entities that are widely considered as being more sophisticated than retail investors. Institutional investors can include large funds (e.g., mutual fund, hedge fund, VC funds, pension funds) as well as insurance companies, credit unions and banks.

firm's value (e.g., Shleifer and Vishny, 1997; Monks and Minow, 1995). Our emphasis on institutional investors is also motivated by their dominant market share in U.S. equity ownership and trading volume (e.g., Zalewska and Zhang, 2020; Cella, Ellul and Giannetti, 2013; Boehmer and Kelly, 2009). Boehmer and Kelly (2009), for instance, document that the volume of trading by institutional investors account for up to 96% of the total trading in the New York Stock Exchange.

While the importance of institutional investors in the corporate world and financial markets is undeniable, it is inaccurate to assume that they represent a homogeneous group of sophisticated investors. In fact, several studies argue and empirically show that institutional investors are not homogeneous, and they do not have the same incentives to monitor managers. One of the main dimensions that institutional investors differ across is their investment horizon (e.g., Bushee, 1998, 2001; Bushee and Noe, 2000; Gaspar et al. 2005; Derrien et al. 2013). For example, pension funds have a long-term investment horizon as they have long-term liabilities; whereas mutual funds are likely to have a short-term investment horizon, as they may face a large liquidation in the short-term (Derrien et al. 2013). Differences in investment horizons, in turn, are likely to affect institutional investors' governance role and trading strategies. Attig et al. (2013) and Gaspar et al. (2005), among others, show that institutional investors with a short-term horizon have fewer incentives to engage in efficient monitoring because they tend to trade more frequently. On the contrary, long-term institutional investors assume a more active corporate governance role. Burns, Kedia and Lipson (2010) find that, unlike the case of long-term institutional investors, the

presence of short-term institutional investors is associated with lower quality of financial information and weak corporate governance.

As stated above, stock price crash risk tends to increase with financial reporting opacity as the lack of transparency allows managers to withhold bad news from the market. Because short-term (long-term) institutional investors are associated with weaker (stronger) monitoring of corporate information disclosure, we posit that the probability of stock price crash risk would increase (decrease) with the level of ownership by short-term (long-term) institutional investors. Using a large sample of U.S. public firms over the period 1981-2018, we find strong support for our prediction. First, we report that stock price crash risk is positively related to institutional investors ownership. However, we find that this relation is actually driven by short-term institutional investors. Moreover, in contrast to short-term institutional investors, long-term institutional investors' holdings and trading are negatively associated with stock price crash risk.

This paper contributes to the literature in several ways. First, it adds to the growing literature investigating the factors influencing stock crash risk (e.g., Zuo, 2022; Cao et al, 2022; Jiang, Du, and Chen, 2022; Hsu, Wang, and Whipple, 2022; Hutton, Marcus and Tehranian, 2009). For example, crash risk increases with aggressive tax strategy (Kim, Li and Zhang, 2011a), and divergence in ownership and control (Hong, Kim, and Welker, 2014), and decreases with financial reporting transparency (DeFond et al, 2015; Kim and Zhang, 2014) and accounting conservatism (Kim and Zhang 2016). We extend the extant literature by investigating the relation between investment horizon of institutional investors and firm-specific stock price crash risk.

Because we use negative skewness as a proxy for firm-specific crash risk, our paper is also related to the literature on the impact of skewness on asset pricing (e.g., Anghel, 2022; Dong et al., 2022; Harvey and Siddique, 2000). Other studies incorporate the impact of return skewness on investor decision making and show that investors have greater preference for skewness (e.g., Martellini and Ziemann, 2010; Boyer, Mitton and Vorkink, 2010). As a result, skewness is a priced component of security returns and is relevant to optimal or efficient portfolios. A growing set of studies also examines market skewness as a priced risk factor of security returns (e.g., Chang, Christoffersen and Jacob, 2013).

The current paper also contributes to the debate about which type of institutional ownership is more desirable to a firm. Studies such as by Porter (1992), Brancato (1997), and Bushee (2004) suggest that firms benefit from attracting long-term institutional investors rather than short-term ones. Short-term institutional investors are weak monitors (Gaspar, Massa, and Matos, 2005) and pressure managers into short-run objectives, thereby negatively affecting firm value in the long run (Bushee, 1998; 2001). Nevertheless, Yan and Zhang (2009) show that short-term institutional investors are better informed and can predict future stock returns. Yan and Zhang call into question the benefits of attracting only long-term investors since more informative prices facilitate better financing and investment decisions and may reduce cost of capital. More recently, however, Attig et al. (2013) find that holding by long-term institutional investors leads to a lower firm's cost of equity capital than short-term institutional ownership. Moreover, Bushee and Noe (2000) show that firms with short-term (transient) institutional holdings have higher stock return

volatility. More recently, however, Giannetti and Yu (2021) show firms with more short-term investors adapt better to industry shocks that change its competitive environment. Our study shows that the presence of short-term institutional investors is positively associated with crash risk. Thus, our findings are more consistent with the view that firms benefit from attracting long-term institutional investors.

Our paper is also related to an emergent stream of literature examining institutional trading during the 2008 finance crisis (e.g., Zalewska and Zhang, 2020; Cella, Ellul and Giannetti, 2013). For instance, Cella, et al (2013) examine institutional trading during the Lehman Brothers' bankruptcy in September 2008 and find that investors' short horizons amplify the effects of market-wide negative shocks.

Finally, we add to the literature linking investment horizon to corporate behavior, such as capital structure (Boubaker et al, 2019), corporate innovation and R&D investment (Barrot, 2017; Bushee, 1998), corporate social responsibility (Boubaker et al, 2017), corporate payout policy (Amin et al, 2015; Gaspar et al., 2013), mergers and acquisitions (Gaspar, Massa, and Matos, 2005), firm's performance (Elyasiani and Jai, 2010), and investment to cash flow sensitivity (Attig et al. 2012). As noted by Hartzel and Starks (2003), though long-term investors could affect corporate policies by active monitoring, short-term investors could affect corporate policies through their trading strategies and preferences. We augment the existing literature by investigating whether the institutional investment horizon influences corporate risk-taking. Related studies attempt to identify the determinants of corporate risk-taking behavior. For instance, Hilary and Hui (2009)

find that U.S. firms located in more religious counties are less likely to engage in risk-taking behavior. John, Litov and Yeung (2008) find that corporate risk-taking and growth are positively associated with better investor protection.

The remainder of the paper is organized as follows. Section 2 describes the data and variables we use in our empirical analyses. In Section 3, we investigate the impact of the level and the change in short- and long-term institutional investors on return skewness. In Section 4, we conduct robustness checks and endogeneity tests of institutional ownership. In Section 5, we provide additional empirical analyses by examining institutions' holdings and trading behavior around earnings announcements, and by testing the relation between corporate risk-taking behavior and investors' horizons. Section 6 concludes the paper.

2. Data, Variables and Descriptive Statistics

2.1. Data and sample selection

We obtain stock returns, number of shares outstanding, and turnover data from CRSP for all common stocks listed on NYSE, AMEX and Nasdaq. We gather quarterly institutional holdings from Thomson Financial 13 File. We exclude firms that do not have a full quarter of uninterrupted daily price data. To alleviate the concern that our sample is biased towards firms without institutional ownership, we conduct the propensity score matching approach to obtain our baseline sample. Specifically, we match firms with institutional ownership with firms without institutional ownership based on firm size, leverage, and book-to-market ratio in a given year.

We pursue a non-repetitive matching scheme that firms without institutional ownership can be

used only once for the matching. Our post-matched sample has 457,188 observations including the first quarter of 1981 and ends in the fourth quarter of 2018.

2.2. Variables

We follow, among others, Chen, Hong and Stein (2001) and use negative skewness of stock returns as our main measure of crash risk. Skewness, $SKEW_{i,t}$, is defined as the negative third moment of daily returns divided by its standard deviation of daily returns raised to the third power for any stock i over quarter t .

$$SKEW_{i,t} = -(n(n-1)^{3/2} \sum R_{i,t}^3) / ((n-1)(n-2)(\sum R_{i,t}^2)^{3/2}) \quad (1)$$

where $R_{i,t}$ is the sequence of de-meaned daily returns to stock i during quarter t and n is the number of observations on daily returns during quarter t .

The daily returns we use to compute skewness are log changes in stock price. We compute the skewness of an individual stock return based on raw stock returns (i.e., the log changes in price); market-adjusted returns (i.e., the log change in stock i less the log change in the value-weighted CRSP index for that day), and excess returns (i.e., the log change in stock i less the T-bill return). We follow this procedure to compute each stock's past returns as well.

In addition to $SKEW_{i,t}$, we also consider an alternative measure of return asymmetries, which we denote by $SKEW_FF3_{i,t}$, for idiosyncratic skewness. Specifically, we use the Fama-French (1996) model to correct for systematic risk and to better match stock return co-movements.

$$RET_{i,t} = \beta_{0,i,q} + \beta_{1,i,q}MKT_t + \beta_{2,i,q}SMB_t + \beta_{3,i,q}HML_t + \epsilon_{i,t}^{FF} \quad (2)$$

where $RET_{i,t}$ is daily return of stock i on day t , MKT_t is the excess return on the market portfolio, SMB_t is the size factor, HML_t is the value factor, and $\epsilon_{i,t}^{FF}$ is the residual of the regression.

In the robustness check, we use two other proxies for crash risk. The first alternative is defined as volatility ratio (VOLRATIO). Following Bae et al. (2006), we define VOLRATIO as the logarithm of the ratio of the variance from the daily returns below the sample mean to the variance from the daily returns above the sample mean. Our second alternative defines extreme return ratio EXTRATIO as the logarithm of the ratio of the number of negative extreme return days to the number of positive extreme return days, where we define a daily return as the negative (positive) extreme return if the daily stock return is less (larger) than twice of its standard deviation. Based on the above definition, greater negative values in VOLRATIO and EXTRATIO are associated with a more left-skewed return distribution (e.g., higher likelihood of crash risk).

We obtain data on Fama-French factors from Kenneth French's website and estimate the model every quarter with daily data. The idiosyncratic skewness for stock i is the skewness of the residual of the Fama-French regression, $skew(\epsilon_{i,t}^{FF})$.

The other key variable we use in our analysis is institutional ownership. Following several empirical studies such as by Giannetti and Yu (2021), Ke and Ramalingegowda (2005), we measure institutional investor horizon using Bushee's classification of 13F investors (Bushee, 1998, 2001; Bushee and Noe, 2000). In particular, using factor analysis and cluster analysis to

classify institutional ownership into transient, dedicated, and quasi-indexer groups based on their past investment behavior. We first use the portfolio diversification, portfolio turnover, and momentum trading factors to obtain standardized factor scores. We then conduct k-means cluster analysis on the factor scores to assign institutions into three groups. Finally, we calculate the proportion of ownership held by each group of institutions for each firm, identifying the groups as transient (TRA), dedicated (DED), and quasi-indexers (QIX).

Based on the mean factor scores for each cluster, we find that transient institutional investors exhibit the highest portfolio turnover and highest trading sensitivity to current earnings, along with relatively high portfolio diversification. Thus, based on the frequency of portfolio turnover we expect TRAs to have characteristics similar to short-term institutional investors. We identify dedicated institutional investors as having low portfolio turnover with almost no use of momentum trading strategies and high concentration. Thus, we expect DEDs to exhibit characteristics similar to those of long-term institutional investors. Quasi-indexing institutional investors³ are also identified as having low turnover and low use of momentum trading strategies, but high diversification. Our classification of institutional investment horizons is consistent with, among others, Bushee (1998, 2001) and Giannetti and Yu (2021).

³ In this study, we use transient institutional investors to proxy for the short-term institutional investors and dedicated institutional investors to proxy for the long-term institutional investors. Our inference, however, still remains if we classify both dedicated and quasi-indexing institutional investors as the long-term institutional investors as in Giannetti and Yu (2021).

In the robustness check, we use alternative proxies for institutional investors' horizon. Following Gompers and Metrick (2001) and Yan and Zhang (2009), we define aggregate institutional ownership as the ratio of the number of shares held by institutional investors relative to the total number of shares outstanding. We then categorize institutional investors into short- and long-term investors on the basis of how frequently they rotate their positions on all the stocks of their portfolio over the previous four quarters. Specifically, if we denote the set of companies held by investor j by Q , then we define the aggregate buy and sell for each investor as follows:

$$CR_buy_{j,t} = \sum_{i \in Q, N_{j,i,t} > N_{j,i,t-1}} |N_{j,i,t}P_{i,t} - N_{j,i,t-1}P_{i,t-1} - N_{j,i,t-1}\Delta P_{i,t}| \quad (3)$$

$$CR_sell_{j,t} = \sum_{i \in Q, N_{j,i,t} \leq N_{j,i,t-1}} |N_{j,i,t}P_{i,t} - N_{j,i,t-1}P_{i,t-1} - N_{j,i,t-1}\Delta P_{i,t}| \quad (4)$$

where $CR_buy_{j,t}$ is investor j 's aggregate purchase for quarter t , $CR_sell_{j,t}$ is investor j 's aggregate sale for quarter t , $N_{j,i,t}$ is the number of shares of stock i held by investor j at the end of quarter t , and $P_{i,t}$ is the share prices for stock i at the end of quarter t . We also adjust for stock splits and stock dividends by using the CRSP price adjustment factor.

Next we compute investor j 's churn rate for quarter t as in Yan and Zhang's (2009):

$$CR_{j,t} = \frac{\min(CR_buy_{j,t}, CR_sell_{j,t})}{\sum_{i \in Q} \frac{N_{j,i,t}P_{i,t} + N_{j,i,t-1}P_{i,t-1}}{2}} \quad (5)$$

To minimize the impact of investor's cash flows on portfolio turnover, we use the minimum of aggregate purchase and sale. Further, we calculate each institution's average churn rate over the past four quarters as:

$$AVG_CR_{j,t} = \frac{1}{4} \sum_{r=1}^4 CR_{j,t-r+1} \quad (6)$$

Based on the average churn rate, we rank all institutional investors in three tertile portfolios for each quarter. We define short-term institutional investors (SIO) as those with the highest $AVG_CR_{j,t}$ in the top tertile and those in the bottom tertile as long-term institutional investors (LIO). For each stock, we define short-term (long-term) institutional ownership as the ratio of the number of shares held by short-term (long-term) institutional investors to the total number of shares outstanding.

Following Chen, Hong and Stein (2001), our control variables include $RET_{i,t-1}$, defined as the cumulative return on stock i over the one-quarter period $t-1$; $SIZE_{i,t-1}$, measured as the log of firm i 's stock market capitalization at the end period of $t-1$; $BKMKT_{i,t-1}$, defined to firm i 's book-to-market ratio at the end of period $t-1$; $LEVERAGE_{i,t-1}$, defined as firm i 's total liabilities divided by its total asset over period $t-1$; $DTURNOVER_{i,t-1}$, measured as the detrending turnover by subtracting from the turnover variable a moving average of its value over the prior 18 months; and time dummies, defined as an indicator variable that equals 1 if firm i is in quarter t .

2.3. Descriptive statistics

We compute quarterly measures of skewness, institutional ownership, and stock characteristics for the period beginning with the first quarter of 1981 and continuing to the fourth quarter of 2008. Table I provides summary statistics of the main variables used in our study. Panel A reports the mean, median, 25th percentile, 75th percentile, and standard deviations of all variables. For individual stocks, there is positive skewness at the 75th percentile and negative skewness at the

mean, median, and 25th percentiles for all different measures of skewness. The average institutional ownership is 31.3%, which is similar to Yan and Zhang (2009) who report a 25.1% average institutional ownership for the period 1980-2003. On average, transient (short-term) institutional investors hold 6.18% of total shares outstanding and dedicated (long-term) institutional investors hold 5.0% of total shares outstanding. The monthly detrended turnover for the average firm is 0.35% comparable to the 0.1% reported by Chen, Hong and Stein (2001) for the period 1962–1998. All continuous control variables are winsorized at the 1st and 99th percentiles.

Panel B of Table I provides correlations between skewness, institutional ownership, and various firm characteristics. The aggregate institutional ownership (IO) is positively correlated with past skewness, firm size, leverage, detrended turnover, and past returns, but it is negatively related to past volatility and book-to-market ratio.

Insert Table I about here

3. The Impact of Institutional Ownership on Stock Return Skewness

As stated above, we measure the probability of crashes using skewness of returns over quarter t . We use the lagged institutional holdings based on the information available at the end of quarter $t-1$ as our proxy for contemporary demand shocks, and use changes in the institutional holdings over quarter $t-1$ as a proxy for institutional trading.⁴ Because institutional investors trade

⁴ To see whether the effect of institutional ownership is due to contemporary demand shock or to the informational advantage of institutional ownership, Gompers and Metrick (2001) use the lagged

frequently and aggressively in an effort to safeguard their investment, then if institutional investors experience larger demand shock, we would expect IO_{t-1} to lead to large negative return skewness. If institutional investors trade frequently on the basis of information quality, then ΔIO_{t-1} should be positively related to negative skewness (i.e., stock price crash).

3.1. Effect of the level of institutional holdings on skewness

Using skewness as a proxy for crash risk, we examine the extent to which short- and long-term institutional investors influence the probability of a stock's crash risk. Prior studies show that some stock characteristics, such as the market value of equity, detrended average monthly turnover, firm's leverage, and book-to-market ratio, have a strong influence on crash risk (Chen, Hong and Stein, 2001; Hutton, Marcus and Tehranian, 2009). To ensure that the impact of investors' horizons is not driven by their relationship with those stock characteristics, we use the same set of stock characteristics as control variables. Specifically, we regress $SKEW_t$ against institutional ownership: IO_{t-1} , TRA_{t-1} , DED_{t-1} ; various stock characteristics: $SKEW_{t-1}$, $VOLATILITY_{t-1}$, $SIZE_{t-1}$, $LEVERAGE_{t-1}$, $DTURNOVER_{t-1}$, $BKMKT_{t-1}$; and one lag of past returns: RET_{t-1} . We also include time dummy variables for each quarter t .

Table II reports the cross-sectional regression specifications. We measure the dependent variable, $SKEW_t$, on the basis of raw returns. We use Bushee's (1998) classifications of investor horizons: Transient (TRA_{t-1}) and dedicated (DED_{t-1}). In column (1), we include only aggregate institutional

institutional holdings as a proxy for contemporary demand shocks and use changes in the institutional holdings as a proxy for informational advantage.

ownership and the control variables. The coefficient on IO_{t-1} is 0.084 which is statistically significant at the 1% level, indicating that skewness increases with the degree of aggregate institutional ownership. In columns (2) and (3) we refine this finding by considering transient (short-term) and dedicated (long-term) institutional ownership, respectively. The coefficient of TRA_{t-1} is 0.566 and statistically significant at the 1% level, but the coefficient of DED_{t-1} is negative (i.e., -0.043) and significant at the 10% level. Results hold when we include both TRA_{t-1} and DED_{t-1} in the regression (column 4): the coefficient on TRA_{t-1} is positive while the coefficient of DED_{t-1} is negative, and both are significant at the 1% level. The positive sign for TRA_{t-1} suggests that an increase in short-term institutional holdings is associated with the increasing probability of crashes. In contrast, long-term institutional ownership is inversely related to the likelihood of crashes.

Insert Table II about here

3.2. The effect of change in institutional holdings on skewness

To differentiate between institutional holdings and trading on the basis of investment horizon, we include both lagged holdings and changes in holdings of aggregate, short- and long-term investors. We designate these factors as IO_{t-2} , ΔIO_{t-1} , TRA_{t-2} , ΔTRA_{t-1} , DED_{t-2} , and ΔDED_{t-1} , in the cross-sectional regression specifications.

Table III presents the impact on the probability of crashes of lagged holdings and changes in holdings for aggregate, short-, and long-term investors. In column (1) we focus on the effect of

the level and the change in aggregate institutional ownership. In column (2) we examine the effect of the level and the change in short-term investors; in column (3) we address the effect of the level and the change in long-term investors; and in column (4) we consider the combined effect of both short- and long-term investors at the level and the change in ownership. When we include both lagged and changes in aggregate institutional holdings, the coefficients on both IO_{t-2} and ΔIO_{t-1} are significantly positive. This result suggests that increasing the level and magnitude of change in aggregate institutional holdings increases a firm's crash risk.

More importantly, when we include both lagged and changes in short-term institutional holdings (column 2), we find that the coefficients on both TRA_{t-2} and ΔTRA_{t-1} remain significantly positive at the 1% level. However, when we include both lagged and changes in long-term institutional holdings (column 3), we find that the coefficient on ΔTRA_{t-1} is negative and statistically significant. Further, when we consider the level and the change in both short- and long-term institutional investors (column 4), the coefficients on TRA_{t-2} and ΔTRA_{t-1} are positive (i.e., 0.684 and 0.445, respectively) and statistically significant at the 1% level whereas the coefficients on DED_{t-2} and ΔDED_{t-1} are negative (i.e., 0.234 and 0.186, respectively) and statistically significant at the 1% level. These results suggest that short-term institutional investors are the major driver of firms' crash risk.

Insert Table III about here

4. Robustness checks

4.1. *Alternative measures of crash risk*

Table IV provides the regression results for various proxies of negative return skewness. In columns (1) and (2), we use excess returns as the basis for computing the $SKEW_EX_t$ measure. In columns (3) and (4), we use market-adjusted returns for $SKEW_MK_t$. In columns (5) and (6) we use the residual of the regression from the Fama-French three-factor model as the basis for computing idiosyncratic skewness, $SKEW_FF3_t$. By definition, $SKEW_FF3_t$ should have more ability to explain skewness in the purely idiosyncratic component of stock returns.

The results are qualitatively similar for all three measures. The coefficients on short-term institutional stock ownership are positive and strongly statistically significant in each of the three columns. This implies that, all else equal, short-term institutional holdings are more likely to have large negative skewness (i.e., to become more crash-prone). The coefficients on aggregate institutional ownership remain positive and have a smaller effect on the negative skewness than do short-term institutional investors. In contrast, the coefficients on long-term institutional ownership are negative. All the coefficients are statistically significant. The results from Table IV corroborate our previous findings that the positive relation between institutional ownership and crash risk is mainly driven by short-term institutional investors, and that long-term institutional ownership is negatively associated with crash risk.

Insert Table IV about here

Table V presents the regression results by using alternative measures of crash risk. In columns (1) and (2), we use volatility ratio (VOLRATIO) to measure crash risk whereas in columns (3) and (4) we use extreme return ratio (EXTRATIO)⁵ to measure crash risk. The coefficients on aggregate institutional ownership (IO_{t-1}) in columns (1) and (3) are positive at the 1% level. The coefficients on short-term institutional ownership (TRA_{t-1}) in Columns (2) and (4) are positive at the 1% level whereas those on long-term institutional ownership (DED_{t-1}) are negative and significant. Overall, our findings remain qualitatively similar as our main tests by using the alternative measures of crash risk.

Insert Table V about here

4.2. Alternative proxies of institutional investor horizon

In Table VI, we report additional regression specifications to assess the robustness of our results to the use of alternative proxies of institutional investors' investment horizon, which are short-term and long-term institutional holdings (Gompers and Metrick, 2001; Yan and Zhang, 2009). In columns (1)-(3), we respectively examine the effect of the short-term institutional ownership (SIO_{t-1}) and long-term institutional ownership (LIO_{t-1}), as well as the combined effect of the two group of institutions on the probability of crashes. Our results show that, consistent with the effect of transient institutional investors, lagged short-term institutional holdings have a positive

⁵ The reason why observations in models (3) and (4) drop dramatically is that the number of negative (positive) extreme return days can be zero. According to the EXTRATIO definition of $\log(\# \text{ negative extreme return days} / \# \text{ positive extreme return days})$, if any of the number of negative (positive) extreme return days is zero, then the observation will not be incorporated into the regression estimation.

effect on crash risk. We also find that holdings by long-term institutional investors have a negative effect on crash risk, which is also consistent with our results using dedicated institutional investors.

Insert Table VI about here

4.3 Endogeneity of institutional ownership

To eliminate the potential endogeneity concerns of institutional ownership, we further use an instrumental variables approach. The instrumental variables for IO_{t-1} , TRA_{t-1} , and DED_{t-1} are the level of institutional holdings at quarter t-2 (IO_{t-2}), share price at quarter t-1 (PRC_{t-1}), Amihud liquidity measure at t-1 ($Amihud_{t-1}$), skewness of residuals of Fama-French-Carhart four-factor model ($Skew_FF4$), and a set of past five-year returns augmented with RET_{t-2} as the market-adjusted cumulative return in the three-month period of t-2, RET_{t-3} as the market-adjusted cumulative return in the three-month period of t-3, similarly RET_{t-4} , RET_{t-5} , and RET_{t-6} . A first-stage estimation is a regression of IO_{t-1} , TRA_{t-1} , and DED_{t-1} on instrumental variables and on a set of control variables. A second-stage regression is an estimation of future crash risk on fitted values of estimated IO_{t-1} , TRA_{t-1} , and DED_{t-1} from the first-stage regressions and the control variables. Table VII shows that the coefficient on the predicted IO_{t-1} is positive and significant at the 1% level. The coefficients on the predicted TRA_{t-1} , and DED_{t-1} are positive and negative at the 1% level, respectively. The results are consistent with our main tests, suggesting that short-term institutional investors have a positive effect on crash risk.

Insert Table VII about here

5. Additional Analyses

In this section we perform three additional analyses. First, we study institutional investment horizon and trading behavior around earnings announcements. Second, we investigate whether investors' horizons influence corporate risk-taking behavior. Finally, we test whether our main results are sensitive to the current financial crisis.

5.1. Institutions' investment horizon and trading behavior around earnings announcements

Meeting short-term earnings goals induces institutions to buy or sell when there is unexpected earnings news. To better understand how unexpected earnings news affects institutions' trading strategies, we examine the relation between different institutional ownership and earnings surprises.

We obtain data on earnings surprises from the IBES and the CRSP daily database. The sample period spans fiscal years 1996 through 2009 (56 fiscal quarters). Following previous studies on post-earnings-announcement drift (e.g., Bernard and Thomas, 1990; Bartov, Radhakrishnan, and Krinsky, 2000; Ke and Ramalingegowda, 2005; Zhang, 2008), we define standardized unexpected earnings (SUE) as decile-adjusted unexpected earnings. To obtain SUE, we first calculate the firms' raw earnings surprises as the actual earnings per share minus the average of individual analyst forecasts, scaled by the standard deviation of individual analyst forecasts. Next, based on the sample distribution of earnings surprises by quarter, we sort the earnings surprises into ten

deciles indexed from zero to nine, and then scale them by nine to obtain the decile-adjusted unexpected earnings.

Ke and Ramalingegowda (2005) show that earnings surprises have a positive effect on transient institutional investors' ownership changes. To the extent that transient institutions have a short-term focus, we expect positive and negative earnings surprises to have different impacts on institutions' holding and trading behavior.

Table VIII reports the regression results of the level and the change in different institutional ownership for positive and negative earnings surprises. In columns (1) to (3), we focus on the effect of positive and negative earnings surprises on institutions' holdings. In columns (4) to (6), we examine the effect of positive and negative earnings surprises on institutions' trading behavior. Panel A reports aggregate institutions' holdings and trading behavior around earnings announcements. The coefficients on both SUE_{t-1} and positive SUE_{t-1} are significantly positive at the 5% and 10% level, respectively. But the coefficients on negative SUE_{t-1} are insignificant for both the level and change in institutions' holdings. This result suggests that, as a whole, institutions tend to hold their positions around earnings announcements, especially when there is good news.

Insert Table VIII about here

Panel B reports the results for short-term institutional investors' holding and trading behavior around earnings announcements. The coefficients on SUE_{t-1} , positive SUE_{t-1} , and negative SUE_{t-1}

are positive and significant (at the 1% level) for the level of short-term institutional holdings. However, the coefficients on positive SUE_{t-1} and negative SUE_{t-1} are positive and significant at the 10 and 5% level, respectively, for short-term institutional investors' trading behavior. These results suggest that short-term institutional investors are more likely to hold their positions around earnings announcements and are also more likely to trade frequently around earnings announcements if there is either good or bad earnings news. Short-term institutional investors appear to overreact to the information they possess. Thus, meeting short-term earnings goals seems to be the main focus of short-term institutional investors.

Panel C considers long-term institutional investors' holding and trading behavior around earnings announcements. With respect to the level of and changes in long-term institutional holdings, the coefficients on SUE_{t-1} , positive SUE_{t-1} , and negative SUE_{t-1} are not statistically different from zero. This suggests that long-term institutional investors are less likely to trade around the earnings announcements.

Overall, the above findings suggest that earnings news could induce short-term investors to trade frequently, and that long-term investors can be liquidity providers for short-term investors. Moreover, short-term institutional investors could induce managers to maximize short-run earnings at the expense of long-run shareholders' value.

5.2. Corporate risk-taking and investor horizon

We examine whether the presence of short-term institutional investors induces corporate risk-taking behavior by managers. Following studies, such as, by John, Litov and Yeung (2008) and Hilary and Hui (2009), we construct three different measures of corporate risk-taking behavior: (1) StdROA1_t , which we define as the standard deviation of quarterly ROA1 from quarter t to $t+5$, where ROA1 is the log of the ratio of net income to total assets lagged by one quarter; (2) StdROA2_t , measured as the standard deviation of quarterly ROA2 from quarter t to $t+5$, where ROA2 is the log of the ratio of operating income before depreciation to total assets lagged by one quarter; (3) GROWTH_t , which is the log of the ratio of market capitalization to book value of equity. Thus, StdROA1_t and StdROA2_t capture the total risk taken by the corporation and GROWTH_t captures the expected growth rate of the corporation. We control for firm size, book-market-ratio, monthly detrended turnover, leverage and return on equity (ROE_{t-1}) measured as the log of the ratio of net income to the value of equity lagged by one quarter.

The results, reported in Table IX, show that consistent with our prediction, the presence of short-term institutional investors induces corporate-risk taking. The coefficients of IOs are positive for all the three proxies of corporate risk-taking but statistically insignificant for StdROA2_t and GROWTH_t . When we consider investment horizon, all coefficients on TRAs are positive and statistically significant at the 1% level in all regressions. Similarly, all coefficients for DEDs are negative and statistically significant at the 1% level except for StdROA2_t , which is significant at the 10% level.

Insert Tables IX about here

To eliminate the concerns of endogeneity of institutional ownership, we further conduct an instrumental variable two-stage estimation. The instrumental variables for IO_{t-1} , TRA_{t-1} , and DED_{t-1} are the level of institutional holdings at quarter t-2 (IO_{t-2}), share price at quarter t-1 (PRC_{t-1}), Amihud liquidity measure at t-1 ($Amihud_{t-1}$), skewness of residuals of Fama-French-Carhart four-factor model at quarter t-1 ($Skew_FF4_{t-1}$), and a set of past five-year returns augmented with RET_{t-2} as the market-adjusted cumulative return in the three-month period of t-2, RET_{t-3} as the market-adjusted cumulative return in the three-month period of t-3, similarly RET_{t-4} , RET_{t-5} , and RET_{t-6} . A first-stage estimation is a regression of IO_{t-1} , TRA_{t-1} , and DED_{t-1} on instrumental variables and on a set of control variables. A second-stage regression is an estimation of future corporate risk-taking on fitted values of estimated IO_{t-1} , TRA_{t-1} , and DED_{t-1} from the first-stage regressions and the control variables.

The results in Table X are qualitatively similar as in Table IX. In particular, the coefficients on the predicted TRA_{t-1} are statistically significant at the 1% level and positive with magnitude of 0.178, 0.121, and 0.357, respectively. The results support our prediction that the presence of short-term institutional investors induces corporate risk-taking behavior by managers.

Insert Table X about here

5.3 Financial Crises

Crash risk could be more serious in the crisis period in comparison to the non-crisis period. Since our sample covers the 1987, 1997, and 2007-08 financial periods, it allows us to conduct additional

tests of examining whether our main results are sensitive to the financial vs. non-financial crises periods. Models (1) to (4) in Table XI are for non-financial crisis periods whereas model (5) to (8) are for financial crisis periods of 1987, 1997, and 2007-08. Chow statistics for non-financial crisis and financial crisis groups corresponding to model (1) vs. (5), model (2) vs. (6), model (3) vs. (7), and model (4) vs. (8) are $F(9, 457170)=14.95$, $F(9, 457170)=4.95$, $F(9, 457170)=7.40$, and $F(10, 457168)=5.92$, respectively. The null hypothesis of Chow tests, where there is no structural break for non- and financial crisis periods, is rejected at the 1% significant level, suggesting that there is significantly different impacts of non-financial crisis and financial crisis periods on crash risk.

Insert Table XI about here

6. Conclusions

Using negative skewness as a proxy for the probability of crashes, we document a positive relation between institutional investors holding and a stock's crash risk. More importantly, we find strong and robust evidence that the positive relation between institutional ownership and stock price crash is driven by transient (short-term) institutional investors, while the presence of dedicated (long-term) institutional investors is negatively related to stock price crash. We also report that short-term institutional investors' trading is positively related to negative skewness, indicating that short-term institutional investors overact to the information they possess. We also find that short-term institutional investors are positively related to corporate risk-taking behavior while long-term institutional investors are negatively associated with corporate risk-taking.

Our results are consistent with the view that a firm is better off targeting and attracting long-term institutional investors (Porter, 1992; Brancato, 1997; Bushee, 2004). Even though short-term institutional investors are better informed and can better predict future stock returns (Yan and Zhang, 2009), they tend to exacerbate a firm's stock return volatility (Bushee and Noe, 2000) and, as we have shown, increase the likelihood of stock price crash risk.

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TABLE I
Descriptive Statistics

Panel A: Variables statistics

VARIABLES	Mean	Median	25 th Percentile	75 th Percentile	Standard Dev.
$SKEW_t$	-0.0375	-0.1326	-0.5636	0.2673	1.3927
$SKEW_EX_t$	-0.0375	-0.1325	-0.5636	0.2673	1.3927
$SKEW_MK_t$	-0.0372	-0.1345	-0.5609	0.2618	1.3883
$SKEW_FF3_t$	-0.0544	-0.1437	-0.5681	0.2502	1.3538
IO_{t-1}	0.3126	0.2424	0.0181	0.5340	0.2989
TRA_{t-1}	0.0618	0.0123	0.0000	0.0898	0.0979
DED_{t-1}	0.0498	0.0011	0.0000	0.0705	0.0881
QIX_{t-1}	0.1467	0.0629	0.0000	0.2321	0.1936
SIO_{t-1}	0.1656	0.1015	0.0005	0.2761	0.1863
LIO_{t-1}	0.0597	0.0383	0.0002	0.0912	0.0775
$SKEW_{t-1}$	-0.0295	-0.1328	-0.5610	0.2660	1.3727
$VOLATILITY_{t-1}$	0.0343	0.0268	0.0176	0.0425	0.0259
$SIZE_{t-1}$	19.1322	19.0153	17.6037	20.5402	2.0567
$LEVERAGE_{t-1}$	0.1778	0.1320	0.0168	0.2860	0.1802
$DTRUNOVER_{t-1}$	0.0035	-0.0016	-0.0162	0.0139	0.1037
$BKMKT_{t-1}$	0.7388	0.5923	0.3420	0.9299	0.6572
RET_{t-1}	-0.0110	0.0063	-0.1263	0.1263	0.2903

Panel B: Correlation coefficients

VARIABLES	$SKEW_t$	$SKEW_EX_t$	$SKEW_MK_t$	$SKEW_FF3_t$	IO_{t-1}	TRA_{t-1}	DED_{t-1}	QIX_{t-1}
$SKEW_EX_t$	1.0000							
$SKEW_MK_t$	0.9633	0.9633						
$SKEW_FF3_t$	0.9644	0.9644	0.9665					
IO_{t-1}	0.0609	0.0609	0.0568	0.0554				
TRA_{t-1}	0.0606	0.0607	0.0622	0.0594	0.6261			
DED_{t-1}	0.0065	0.0065	0.0089	0.0064	0.4109	0.2197		
QIX_{t-1}	0.0435	0.0435	0.0383	0.0391	0.7719	0.4999	0.2094	
SIO_{t-1}	0.0675	0.0675	0.0642	0.0624	0.9157	0.6927	0.3179	0.7076
LIO_{t-1}	0.0279	0.0279	0.0237	0.0235	0.6436	0.256	0.3822	0.4271
$SKEW_{t-1}$	0.1715	0.1715	0.1575	0.1631	0.0579	0.0429	0.0095	0.0464
$VOLATILITY_{t-1}$	-0.0388	-0.0388	-0.0383	-0.0319	-0.2231	-0.0261	-0.0803	-0.1931
$SIZE_{t-1}$	0.1106	0.1106	0.0999	0.0994	0.5108	0.2461	0.0758	0.402
$LEVERAGE_{t-1}$	-0.0115	-0.0115	-0.0144	-0.0131	0.0418	0.0171	0.0129	0.0125
$DTRUNOVER_{t-1}$	0.0267	0.0267	0.0252	0.0237	0.0541	0.0639	-0.005	0.0393
$BKMKT_{t-1}$	-0.0733	-0.0733	-0.0645	-0.063	-0.134	-0.118	-0.0167	-0.1195
RET_{t-1}	0.0681	0.0681	0.0664	0.0574	0.0155	0.013	0.0122	0.0025
	SIO_{t-1}	LIO_{t-1}	$SKEW_{t-1}$	$VOLATILITY_{t-1}$	$SIZE_{t-1}$	$LEVERAGE_{t-1}$	$DTRUNOVER_{t-1}$	$BKMKT_{t-1}$
LIO_{t-1}	0.4037							
$SKEW_{t-1}$	0.061	0.0286						
$VOLATILITY_{t-1}$	-0.1664	-0.1875	0.1178					
$SIZE_{t-1}$	0.4632	0.3665	0.0888	-0.4321				
$LEVERAGE_{t-1}$	0.0458	0.0282	-0.0086	-0.062	0.0944			
$DTRUNOVER_{t-1}$	0.0643	0.0166	0.0102	0.0993	0.0561	0.0074		
$BKMKT_{t-1}$	-0.1574	-0.0669	-0.0211	0.0709	-0.2924	0.0036	-0.054	
RET_{t-1}	0.0192	0.0053	-0.3594	-0.1412	0.0884	-0.0129	0.1435	-0.1452

Note: This table summarizes the descriptive statistics and correlation coefficients between negative skewness, institutional ownership, and various firm characteristics. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Individual stock characteristics are from the CRSP while institutional ownership is obtained from Thomson Financial 13 File. $SKEW_t$ is the skewness, measured using daily raw returns (log changes in price), excess returns ($SKEW_EX_t$), and market-adjusted returns ($SKEW_MK_t$) in quarter t , respectively. $SKEW_FF3_t$ is idiosyncratic skewness of the residual of the regression, estimated using Fama-French three factors model. IO_{t-1} is total institutional ownership. Bushee's (1998) classifications of investment horizons: Transient (TRA_{t-1}), dedicated (DED_{t-1}), and quasi-indexers (QIX_{t-1}). Institutional investors are categorized as

transient investors (TRA_{t-1}) if they exhibit highest portfolio turnover and highest trading sensitivity to current earnings, along with relatively high portfolio diversification. Institutional investors are categorized as dedicated investors (DED_{t-1}) if they exhibit high concentration, low turnover, and almost no trading sensitivity to current earnings. Institutional investors are categorized as quasi_indexing investors (QIX_{t-1}) if they exhibit high diversification, low turnover, and low trading sensitivity to current earnings. We also use alternative proxies for institutional investment horizon: short-term investors (SIO_{t-1}) if their past four-quarter turnover rate ranks in the top tertile, and long-term investors (LIO_{t-1}) if their past four-quarter turnover rate ranks in the bottom tertile. $VOLATILITY_{t-1}$ is the standard deviation of daily raw returns in quarter $t-1$. $SIZE_{t-1}$ is the log of market capitalization measured at the end of quarter $t-1$. $LEVERAGE_{t-1}$ is the book value of all liabilities scaled by total assets at the end of quarter $t-1$. $DTURNOVER_{t-1}$ is average monthly turnover in quarter $t-1$, detrended by a moving average of turnover in the prior 18 months. $BKMKT_{t-1}$ is the most recently available observation of the book-to-market ratio at the end of quarter $t-1$. RET_{t-1} is the market-adjusted cumulative return in the three-month period of $t-1$. Continuous variables are winsorized at their 1st and 99th percentiles.

TABLE II
Skewness of Raw Stock Returns and Investor Horizons

VARIABLES	(1) SKEW _t	(2) SKEW _t	(3) SKEW _t	(4) SKEW _t
<i>IO</i> _{<i>t-1</i>}	0.084*** (8.66)			
<i>TRA</i> _{<i>t-1</i>}		0.566*** (23.74)		0.621*** (25.23)
<i>DED</i> _{<i>t-1</i>}			-0.043* (-1.85)	-0.219*** (-9.55)
<i>SKEW</i> _{<i>t-1</i>}	0.216*** (39.90)	0.215*** (39.69)	0.216*** (40.03)	0.215*** (39.71)
<i>VOLATILITY</i> _{<i>t-1</i>}	-0.681*** (-5.00)	-0.772*** (-5.64)	-0.734*** (-5.39)	-0.825*** (-6.03)
<i>SIZE</i> _{<i>t-1</i>}	0.042*** (26.77)	0.042*** (28.35)	0.047*** (32.38)	0.042*** (28.82)
<i>LEVERAGE</i> _{<i>t-1</i>}	-0.127*** (-10.08)	-0.126*** (-10.08)	-0.126*** (-10.04)	-0.126*** (-10.08)
<i>DTRUNOVER</i> _{<i>t-1</i>}	0.019 (0.74)	-0.002 (-0.08)	0.025 (0.98)	-0.004 (-0.17)
<i>BKMKT</i> _{<i>t-1</i>}	-0.057*** (-12.41)	-0.050*** (-11.16)	-0.056*** (-12.34)	-0.049*** (-10.99)
<i>RET</i> _{<i>t-1</i>}	0.674*** (47.78)	0.672*** (47.68)	0.673*** (47.68)	0.672*** (47.68)
<i>INTERCEPT</i>	-0.754*** (-11.94)	-0.741*** (-11.88)	-0.833*** (-13.30)	-0.742*** (-11.90)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes
<i>N</i>	457,188	457,188	457,188	457,188
<i>R</i> ²	0.066	0.067	0.066	0.068

Note: This table presents the results of regressions of negative skewness of raw stock return on types of institutional ownership and other stock characteristics. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Individual stock characteristics are from the CRSP while institutional ownership is obtained from Thomson Financial 13 File. All the rest of the dependent and independent variables are as defined in Table I. The independent variables are lagged one period relative to the dependent variable. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE III
Skewness, Institutional Holdings and Trading

VARIABLES	(1) SKEW _t	(2) SKEW _t	(3) SKEW _t	(4) SKEW _t
<i>IO</i> _{<i>t-2</i>}	0.083*** (8.40)			
ΔIO _{<i>t-1</i>}	0.105*** (3.33)			
<i>TRA</i> _{<i>t-2</i>}		0.625*** (24.22)		0.684*** (25.82)
ΔTRA _{<i>t-1</i>}		0.397*** (13.01)		0.445*** (13.70)
<i>DED</i> _{<i>t-2</i>}			-0.036 (-1.29)	-0.234*** (-8.91)
ΔDED _{<i>t-1</i>}			-0.060** (-2.13)	-0.186*** (-6.04)
<i>SKEW</i> _{<i>t-1</i>}	0.216*** (39.90)	0.215*** (39.62)	0.216*** (39.99)	0.215*** (39.63)
<i>VOLATILITY</i> _{<i>t-1</i>}	-0.682*** (-5.00)	-0.778*** (-5.68)	-0.736*** (-5.40)	-0.835*** (-6.10)
<i>SIZE</i> _{<i>t-1</i>}	0.042*** (26.76)	0.041*** (27.61)	0.047*** (32.31)	0.041*** (28.14)
<i>LEVERAGE</i> _{<i>t-1</i>}	-0.127*** (-10.09)	-0.127*** (-10.07)	-0.126*** (-10.04)	-0.126*** (-10.07)
<i>DTRUNOVER</i> _{<i>t-1</i>}	0.019 (0.74)	-0.002 (-0.07)	0.026 (1.02)	-0.004 (-0.16)
<i>BKMKT</i> _{<i>t-1</i>}	-0.056*** (-12.39)	-0.050*** (-11.13)	-0.056*** (-12.34)	-0.049*** (-10.94)
<i>RET</i> _{<i>t-1</i>}	0.674*** (47.64)	0.675*** (47.94)	0.673*** (47.67)	0.675*** (47.93)
<i>INTERCEPT</i>	-0.757*** (-11.95)	-0.723*** (-11.56)	-0.833*** (-13.28)	-0.726*** (-11.62)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes
<i>N</i>	457,188	457,055	457,055	457,055
<i>R</i> ²	0.066	0.067	0.066	0.068

Note: This table presents the results of regressions of negative skewness of raw stock return on the level and the change in types of institutional ownership and other stock characteristics. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Individual stock characteristics are from the CRSP while institutional ownership is obtained from Thomson Financial 13 File. All of the dependent and independent variables are as defined in Table I. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE IV
Skewness Using Different Adjusted-returns

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	SKEW_EX _t		SKEW_MK _t		SKEW_FF3 _t	
<i>IO</i> _{<i>t-1</i>}	0.084*** (8.66)		0.100*** (9.97)		0.084*** (8.43)	
<i>TRA</i> _{<i>t-1</i>}		0.621*** (25.23)		0.648*** (25.19)		0.621*** (24.78)
<i>DED</i> _{<i>t-1</i>}		-0.219*** (-9.56)		-0.175*** (-7.46)		-0.207*** (-9.04)
<i>SKEW</i> _{<i>t-1</i>}	0.216*** (39.90)	0.215*** (39.71)	0.203*** (39.23)	0.202*** (39.01)	0.200*** (39.10)	0.199*** (38.88)
<i>VOLATILITY</i> _{<i>t-1</i>}	-0.682*** (-5.00)	-0.826*** (-6.04)	-1.107*** (-8.27)	-1.251*** (-9.30)	-0.612*** (-4.77)	-0.753*** (-5.84)
<i>SIZE</i> _{<i>t-1</i>}	0.042*** (26.77)	0.042*** (28.82)	0.035*** (21.77)	0.035*** (23.93)	0.037*** (22.59)	0.036*** (24.51)
<i>LEVERAGE</i> _{<i>t-1</i>}	-0.127*** (-10.08)	-0.126*** (-10.08)	-0.141*** (-11.10)	-0.140*** (-11.07)	-0.128*** (-10.11)	-0.127*** (-10.09)
<i>DTRUNOVER</i> _{<i>t-1</i>}	0.019 (0.75)	-0.004 (-0.17)	0.050* (1.89)	0.027 (1.07)	0.020 (0.86)	-0.002 (-0.11)
<i>BKMKT</i> _{<i>t-1</i>}	-0.057*** (-12.41)	-0.049*** (-10.99)	-0.058*** (-13.24)	-0.050*** (-11.72)	-0.053*** (-12.10)	-0.046*** (-10.62)
<i>RET</i> _{<i>t-1</i>}	0.674*** (47.78)	0.672*** (47.68)	0.658*** (46.87)	0.656*** (46.77)	0.606*** (44.81)	0.603*** (44.71)
<i>INTERCEPT</i>	-0.754*** (-11.94)	-0.742*** (-11.90)	-0.608*** (-9.49)	-0.605*** (-9.57)	-0.661*** (-10.76)	-0.649*** (-10.73)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	457,188	457,188	457,188	457,188	457,188	457,188
<i>R</i> ²	0.066	0.068	0.056	0.058	0.055	0.056

Note: This table presents the results of regressions of negative skewness using different adjusted-returns on the level and the change in types of institutional ownership and other stock characteristics. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Individual stock characteristics are from the CRSP while institutional ownership is obtained from Thomson Financial 13 File. All of the dependent and independent variables are as defined in Table I. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE V
Alternative Crash Risk Measures

VARIABLES	(1)	(2)	(3)	(4)
	VOLRATIO _t		EXTRATIO _t	
<i>IO</i> _{<i>t-1</i>}	0.037*** (4.49)		0.178*** (8.70)	
<i>TRA</i> _{<i>t-1</i>}		0.351*** (19.59)		0.709*** (17.03)
<i>DED</i> _{<i>t-1</i>}		-0.180*** (-9.70)		-0.108** (-1.98)
<i>SKEW</i> _{<i>t-1</i>}	0.163*** (42.06)	0.162*** (41.91)	0.023*** (7.88)	0.023*** (8.00)
<i>VOLATILITY</i> _{<i>t-1</i>}	-1.119*** (-10.60)	-1.208*** (-11.37)	0.670* (1.95)	0.423 (1.25)
<i>SIZE</i> _{<i>t-1</i>}	0.032*** (23.71)	0.032*** (25.74)	0.156*** (30.59)	0.160*** (31.86)
<i>LEVERAGE</i> _{<i>t-1</i>}	-0.094*** (-8.71)	-0.093*** (-8.69)	0.181*** (5.28)	0.166*** (4.89)
<i>DTRUNOVER</i> _{<i>t-1</i>}	-0.004 (-0.25)	-0.018 (-1.06)	0.022 (0.94)	0.009 (0.44)
<i>BKMKT</i> _{<i>t-1</i>}	-0.023*** (-6.42)	-0.019*** (-5.31)	-0.054*** (-3.87)	-0.048*** (-3.45)
<i>RET</i> _{<i>t-1</i>}	0.508*** (49.38)	0.507*** (49.28)	0.083*** (5.88)	0.076*** (5.42)
<i>INTERCEPT</i>	-0.716*** (-14.33)	-0.702*** (-14.34)	-3.561*** (-31.46)	-3.612*** (-31.88)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes
<i>N</i>	456,505	456,505	155,228	155,228
<i>R</i> ²	0.069	0.069	0.158	0.161

Note: This table presents the regression results of regressing the alternative measures of crash risk (VOLRATIO and EXTRATIO) on institutional ownership and other controls. Volatility ratio (VOLRATIO) is defined as the logarithm of the ratio of the variance from the daily returns below the sample mean to the variance from the daily returns above the sample mean. Extreme return ratio (EXTRATIO) is defined as the logarithm of the ratio of the number of negative extreme return days to the number of positive extreme return days, where a daily return is defined as the negative (positive) extreme return if the daily stock return is less (larger) than twice of its standard deviation. All of the other variables are as defined in Table I. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE VI
Alternative Proxies of Institutional Investment Horizon

VARIABLES	(1) SKEW _t	(2) SKEW _t	(3) SKEW _t
<i>SIO</i> _{<i>t-1</i>}	0.224*** (15.32)		0.260*** (17.28)
<i>LIO</i> _{<i>t-1</i>}		-0.142*** (-4.00)	-0.292*** (-8.66)
<i>SKEW</i> _{<i>t-1</i>}	0.215*** (39.80)	0.216*** (40.01)	0.215*** (39.75)
<i>VOLATILITY</i> _{<i>t-1</i>}	-0.709*** (-5.20)	-0.741*** (-5.44)	-0.742*** (-5.43)
<i>SIZE</i> _{<i>t-1</i>}	0.040*** (25.59)	0.049*** (32.23)	0.042*** (27.00)
<i>LEVERAGE</i> _{<i>t-1</i>}	-0.129*** (-10.33)	-0.126*** (-10.12)	-0.131*** (-10.50)
<i>DTRUNOVER</i> _{<i>t-1</i>}	0.011 (0.46)	0.025 (0.99)	0.010 (0.40)
<i>BKMKT</i> _{<i>t-1</i>}	-0.055*** (-12.03)	-0.055*** (-12.19)	-0.053*** (-11.67)
<i>RET</i> _{<i>t-1</i>}	0.674*** (47.78)	0.672*** (47.65)	0.673*** (47.69)
<i>INTERCEPT</i>	-0.712*** (-11.33)	-0.859*** (-13.63)	-0.749*** (-11.92)
<i>Quarter Effects</i>	Yes	Yes	Yes
<i>N</i>	457,188	457,188	457,188
<i>R</i> ²	0.067	0.066	0.067

Note: This table presents the results of regressions of negative skewness of raw stock return on alternative proxies of institutional investment horizon and other stock characteristics. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Individual stock characteristics are from the CRSP while institutional ownership is obtained from Thomson Financial 13 File. All the variables are as defined in Table I. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE VII
Influence of Investor Horizon on Skewness: An Instrumental Variables Approach

VARIABLES	(1) SKEW _t	(2) SKEW _t	(3) SKEW _t	(4) SKEW _t
<i>Predicted IO_{t-1}</i>	0.084*** (8.01)			
<i>Predicted TRA_{t-1}</i>		0.741*** (23.22)		0.810*** (24.63)
<i>Predicted DED_{t-1}</i>			-0.408*** (-5.30)	-0.286*** (-7.55)
<i>SKEW_{t-1}</i>	0.218*** (39.56)	0.217*** (39.29)	0.219*** (39.76)	0.217*** (39.32)
<i>VOLATILITY_{t-1}</i>	-0.661*** (-4.75)	-0.768*** (-5.49)	-0.796*** (-5.69)	-0.839*** (-5.99)
<i>SIZE_{t-1}</i>	0.043*** (26.73)	0.041*** (27.04)	0.049*** (32.38)	0.041*** (27.63)
<i>LEVERAGE_{t-1}</i>	-0.126*** (-9.86)	-0.126*** (-9.82)	-0.125*** (-9.76)	-0.126*** (-9.83)
<i>DTRUNOVER_{t-1}</i>	0.016 (0.61)	-0.013 (-0.55)	0.023 (0.87)	-0.016 (-0.66)
<i>BKMKT_{t-1}</i>	-0.054*** (-11.66)	-0.046*** (-9.98)	-0.052*** (-11.52)	-0.044*** (-9.77)
<i>RET_{t-1}</i>	0.685*** (47.14)	0.683*** (47.06)	0.684*** (47.01)	0.682*** (47.06)
<i>INTERCEPT</i>	-0.827*** (-21.13)	-0.808*** (-20.67)	-0.887*** (-22.92)	-0.814*** (-21.00)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes
<i>N</i>	440,970	440,970	440,970	440,970
<i>R²</i>	0.068	0.069	0.067	0.069

Note: This table presents an instrumental variable estimation result. The instrumental variables for IO_{t-1} , TRA_{t-1} , and DED_{t-1} are the level of institutional holdings at quarter $t-2$ (IO_{t-2}), share price at quarter $t-1$ (PRC_{t-1}), Amihud liquidity measure at $t-1$ ($Amihud_{t-1}$), skewness of residuals of Fama-French-Carhart four-factor model ($Skew_FF4_{t-1}$), and a set of past five-year returns augmented with RET_{t-2} as the market-adjusted cumulative return in the three-month period of $t-2$, RET_{t-3} as the market-adjusted cumulative return in the three-month period of $t-3$, similarly RET_{t-4} , RET_{t-5} , and RET_{t-6} . A first-stage estimation is a regression of IO_{t-1} , TRA_{t-1} , and DED_{t-1} on instrumental variables and on a set of control variables. A second-stage regression is an estimation of future stock price skewness on fitted values of estimated IO_{t-1} , TRA_{t-1} , and DED_{t-1} from the first-stage regressions and the control variables. Robust t -statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE VIII

Institutions' Holdings and Trading Behavior around Earnings Announcement

VARIABLES	(1) IO _t	(2) IO _t	(3) IO _t	(4) ΔIO _t	(5) ΔIO _t	(6) ΔIO _t
<i>Panel A: Institutional ownership</i>						
<i>SUE</i> _{t-1}	0.025** (2.49)			0.003 (0.78)		
<i>Positive SUE</i> _{t-1}		0.022* (1.89)			-0.000 (-0.10)	
<i>Negative SUE</i> _{t-1}			-0.013 (-0.84)			0.007 (1.41)
<i>SUE</i> _{t-2}	0.025*** (2.71)	0.033*** (2.75)	0.012 (0.80)	-0.004 (-1.44)	-0.004 (-1.12)	-0.003 (-0.75)
<i>SUE</i> _{t-5}	0.022** (2.04)	0.024* (1.89)	0.016 (1.10)	-0.001 (-0.23)	-0.002 (-0.51)	0.002 (0.44)
<i>SIZE</i> _{t-1}	-0.028*** (-4.59)	-0.032*** (-4.87)	-0.023*** (-3.35)	-0.001 (-1.46)	-0.001 (-1.24)	-0.001 (-0.62)
<i>BKMKT</i> _{t-1}	-0.095*** (-3.36)	-0.103*** (-3.40)	-0.083*** (-2.67)	-0.002 (-0.59)	0.001 (0.27)	-0.004 (-0.80)
<i>CAR</i> [-1,1] _t	0.103*** (2.77)	0.124*** (2.61)	0.059 (1.01)	0.028** (2.24)	0.035** (1.98)	0.010 (0.51)
<i>CAR</i> [-1,1] _{t-1}	0.087** (2.17)	0.065 (1.24)	0.094 (1.53)	0.046*** (3.63)	0.031** (2.07)	0.065*** (2.94)
<i>RET</i> _{t-1}	0.023* (1.89)	0.024 (1.56)	0.012 (0.61)	0.009*** (2.89)	0.008** (1.99)	0.011** (2.15)
<i>INTERCEPT</i>	1.277*** (8.41)	1.158*** (6.74)	1.197*** (7.34)	0.050*** (3.27)	-0.012 (-0.32)	0.007 (0.33)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	14,350	8,811	5,539	14,350	8,811	5,539
<i>R</i> ²	0.191	0.186	0.217	0.074	0.065	0.100

Panel B: Institutional ownership by short-term institutional investors

VARIABLES	TRA _t	TRA _t	TRA _t	ΔTRA _t	ΔTRA _t	ΔTRA _t
<i>SUE</i> _{t-1}	0.017*** (4.88)			0.000 (0.11)		
<i>Positive SUE</i> _{t-1}		0.016*** (3.20)			0.005* (1.92)	
<i>Negative SUE</i> _{t-1}			0.016*** (2.83)			0.007** (2.23)
<i>SUE</i> _{t-2}	0.025*** (7.87)	0.025*** (5.54)	0.024*** (4.58)	-0.004** (-2.28)	-0.005* (-1.86)	-0.005* (-1.70)
<i>SUE</i> _{t-5}	0.022*** (5.91)	0.024*** (4.79)	0.019*** (3.66)	-0.002 (-1.05)	-0.004* (-1.78)	0.001 (0.47)

$SIZE_{t-1}$	-0.035*** (-20.79)	-0.038*** (-20.19)	-0.031*** (-16.32)	-0.002*** (-4.20)	-0.002*** (-3.17)	-0.001* (-1.85)
$BKMKT_{t-1}$	-0.070*** (-6.92)	-0.081*** (-6.21)	-0.054*** (-5.96)	0.009*** (4.29)	0.011*** (3.63)	0.007* (1.93)
$CAR[-1,1]_t$	0.083*** (4.61)	0.080*** (3.41)	0.057** (2.09)	0.041*** (3.98)	0.035*** (2.61)	0.040** (2.48)
$CAR[-1,1]_{t-1}$	0.088*** (4.45)	0.101*** (4.03)	0.065** (2.16)	0.034*** (2.81)	0.035** (2.42)	0.031* (1.69)
RET_{t-1}	0.016*** (3.10)	0.035*** (4.83)	-0.009 (-1.08)	0.005 (1.59)	0.010** (2.40)	-0.001 (-0.24)
<i>INTERCEPT</i>	0.850*** (19.51)	0.921*** (19.28)	0.766*** (15.53)	0.039*** (3.75)	0.005 (0.17)	0.011 (0.45)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	13,921	8,606	5,315	13,921	8,606	5,315
<i>R</i> ²	0.234	0.241	0.234	0.058	0.059	0.064

Panel C: Institutional ownership by long-term institutional investors

VARIABLES	DED_t	DED_t	DED_t	ΔDED_t	ΔDED_t	ΔDED_t
SUE_{t-1}	-0.002 (-0.81)			-0.002 (-0.94)		
<i>Positive SUE_{t-1}</i>		-0.000 (-0.01)			-0.003 (-1.16)	
<i>Negative SUE_{t-1}</i>			-0.001 (-0.30)			0.003 (0.97)
SUE_{t-2}	0.001 (0.31)	0.002 (0.48)	0.000 (0.01)	-0.000 (-0.03)	0.000 (0.05)	0.001 (0.31)
SUE_{t-5}	0.002 (0.77)	0.001 (0.35)	0.003 (0.86)	0.004*** (2.78)	0.004** (2.22)	0.005* (1.76)
$SIZE_{t-1}$	-0.007*** (-7.61)	-0.008*** (-7.64)	-0.006*** (-5.43)	0.001*** (3.99)	0.001** (2.02)	0.001* (1.91)
$BKMKT_{t-1}$	-0.010* (-1.73)	-0.012 (-1.64)	-0.009 (-1.29)	0.002 (1.58)	0.004 (1.58)	-0.000 (-0.12)
$CAR[-1,1]_t$	0.018* (1.82)	0.014 (1.14)	0.024 (1.48)	0.001 (0.14)	0.002 (0.28)	0.000 (0.03)
$CAR[-1,1]_{t-1}$	-0.000 (-0.04)	-0.007 (-0.52)	0.007 (0.43)	-0.011 (-1.55)	-0.014 (-1.50)	-0.002 (-0.15)
RET_{t-1}	0.011*** (3.61)	0.013*** (3.63)	0.009 (1.58)	0.007*** (3.39)	0.008*** (3.04)	0.008** (2.45)
<i>INTERCEPT</i>	0.181*** (7.19)	0.197*** (7.10)	0.160*** (5.40)	-0.027*** (-2.92)	-0.036*** (-2.84)	-0.029** (-2.14)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	13,921	8,606	5,315	13,921	8,606	5,315
<i>R</i> ²	0.150	0.169	0.129	0.145	0.154	0.141

Note: This table presents the results of regressions of the level and the change in investor horizons on the earnings surprises. The sample period is from the first quarter of 1996 to the fourth quarter of 2018.

Individual analyst forecasts and quarterly earnings per share are from I/B/E/S while institutional ownership is obtained from Thomson Financial 13 File. The dependent variables IO_t , TRA_t , and DED_t are as defined in Table I. ΔIO_t , ΔTRA_t , and ΔDED_t are changes in holdings of aggregate, short- and long-term investors, respectively. Independent variable SUE_t is standardized unexpected earnings, defined as decile-adjusted unexpected earnings. Positive SUE_t is standardized unexpected earnings when the raw earnings surprises are positive. Negative SUE_t is standardized unexpected earnings when the raw earnings surprises are negative. $CAR [-1, 1]$ is the cumulative abnormal return around the earnings announcement, where zero represents the announcement date. All the other independent variables are as defined in Table I. Robust t -statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE IX
Corporate Risk-taking and Investor Horizon

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	StdROA1 _t		StdROA2 _t		GROWTH	
<i>IO</i> _{<i>t-1</i>}	0.018* (1.71)		0.002 (0.27)		0.006 (0.56)	
<i>TRA</i> _{<i>t-1</i>}		0.142*** (6.22)		0.093*** (5.67)		0.334*** (13.00)
<i>DED</i> _{<i>t-1</i>}		-0.043* (-1.80)		-0.047*** (-2.78)		-0.130*** (-5.75)
<i>SIZE</i> _{<i>t-1</i>}	-0.044*** (-27.82)	-0.044*** (-29.94)	-0.037*** (-33.00)	-0.038*** (-35.89)	0.020*** (9.47)	0.018*** (9.05)
<i>LEVERAGE</i> _{<i>t-1</i>}	0.356*** (22.09)	0.357*** (22.11)	-0.021* (-1.91)	-0.021* (-1.89)	-0.083*** (-4.80)	-0.084*** (-4.86)
<i>DTRUNOVER</i> _{<i>t-1</i>}	0.112*** (6.54)	0.099*** (5.81)	0.091*** (7.38)	0.082*** (6.73)	0.241*** (10.05)	0.210*** (9.63)
<i>BKMKT</i> _{<i>t-1</i>}	-0.035*** (-7.55)	-0.032*** (-6.92)	-0.018*** (-5.03)	-0.016*** (-4.48)	-0.997*** (-82.06)	-0.991*** (-81.85)
<i>ROE</i> _{<i>t-1</i>}	-0.124*** (-64.06)	-0.124*** (-64.12)	-0.022*** (-14.47)	-0.022*** (-14.48)	0.122*** (40.75)	0.122*** (40.74)
<i>INTERCEPT</i>	0.866*** (25.23)	0.867*** (26.30)	0.983*** (39.60)	0.992*** (41.46)	1.198*** (27.23)	1.235*** (29.79)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	257,907	257,907	239,307	239,307	270,610	270,610
<i>R</i> ²	0.124	0.124	0.065	0.066	0.695	0.697

Note: This table presents the results of regressions of corporate risk-taking measured as StdROA1_{*t*}, StdROA2_{*t*}, and GROWTH_{*t*} on investor horizon. The sample period is from the first quarter of 1981 to the fourth quarter of 2018. Corporate risk-taking variables are from COMPUSTAT while institutional ownership is obtained from Thomson Financial 13 File. The dependent variables are as follows. StdROA1_{*t*} (StdROA2_{*t*}) is the standard deviation of quarterly ROA1 (ROA2) from quarter *t* to *t*+5, where ROA1 is the log of the ratio of net income (COMPUSTAT Fundamentals Quarterly: Item IBQ) to total assets (Item ATQ) lagged by one quarter and ROA2 is the log of the ratio of operating income before depreciation (Item OIBDPQ) to total assets (Item ATQ) lagged by one quarter. GROWTH_{*t*} is the log of the ratio of market capitalization to book value of equity (Item SEQQ). The independent ROE_{*t-1*} is quarterly return on equity defined as the log of the ratio of net income (Item IBQ) to the value of equity (Item SEQQ) lagged by one quarter. All the other independent variables are as defined in Table I. Continuous variables are winsorized at their 1st and 99th percentiles. Robust *t*-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE X

Corporate Risk-taking and Investor Horizon: An Instrumental Variables Approach

VARIABLES	(1)	(2)	(3)	(4)	(7)	(8)
	StdROA1 _t		StdROA2 _t		GROWTH	
<i>Predicted IO</i> _{t-1}	0.022*		0.004		0.001	
	(1.95)		(0.51)		(0.12)	
<i>Predicted TRA</i> _{t-1}		0.178***		0.121***		0.357***
		(6.57)		(6.19)		(11.95)
<i>Predicted DED</i> _{t-1}		-0.062**		-0.065***		-0.157***
		(-2.11)		(-3.10)		(-5.58)
<i>SIZE</i> _{t-1}	-0.044***	-0.044***	-0.037***	-0.038***	0.021***	0.019***
	(-26.93)	(-29.04)	(-31.95)	(-34.90)	(9.72)	(9.18)
<i>LEVERAGE</i> _{t-1}	0.359***	0.359***	-0.021*	-0.020*	-0.082***	-0.083***
	(21.73)	(21.76)	(-1.85)	(-1.81)	(-4.59)	(-4.66)
<i>DTRUNOVER</i> _{t-1}	0.120***	0.103***	0.097***	0.085***	0.248***	0.213***
	(7.44)	(6.29)	(7.55)	(6.66)	(9.53)	(9.10)
<i>BKMKT</i> _{t-1}	-0.034***	-0.030***	-0.017***	-0.015***	-0.992***	-0.984***
	(-7.21)	(-6.42)	(-4.72)	(-4.03)	(-80.49)	(-80.12)
<i>ROE</i> _{t-1}	-0.126***	-0.126***	-0.023***	-0.023***	0.123***	0.123***
	(-63.35)	(-63.41)	(-14.63)	(-14.65)	(39.93)	(39.85)
<i>INTERCEPT</i>	0.908***	0.901***	1.001***	1.001***	1.015***	1.029***
	(26.09)	(26.15)	(40.27)	(40.75)	(22.75)	(23.73)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	249,114	249,114	231,396	231,396	261,452	261,452
<i>R</i> ²	0.126	0.126	0.064	0.065	0.697	0.698

Note: This table presents an instrumental variable estimation result. The instrumental variables for IO_{t-1} , TRA_{t-1} , and DED_{t-1} are the level of institutional holdings at quarter t-2 (IO_{t-2}), share price at quarter t-1 (PRC_{t-1}), Amihud liquidity measure at t-1 ($Amihud_{t-1}$), skewness of residuals of Fama-French-Carhart four-factor model at quarter t-1 ($Skew_FF4_{t-1}$), and a set of past five-year returns augmented with RET_{t-2} as the market-adjusted cumulative return in the three-month period of t-2, RET_{t-3} as the market-adjusted cumulative return in the three-month period of t-3, similarly RET_{t-4} , RET_{t-5} , and RET_{t-6} . A first-stage estimation is a regression of IO_{t-1} , TRA_{t-1} , and DED_{t-1} on instrumental variables and on a set of control variables. A second-stage regression is an estimation of future corporate risk-taking on fitted values of estimated IO_{t-1} , TRA_{t-1} , and DED_{t-1} from the first-stage regressions and the control variables. Robust t-statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE XI
Financial Crisis

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Non-financial crisis periods				Financial crisis periods			
	SKEW _t	SKEW _t	SKEW _t	SKEW _t	SKEW _t	SKEW _t	SKEW _t	SKEW _t
<i>IO_{t-1}</i>	0.082*** (7.84)				0.097*** (3.94)			
<i>TRA_{t-1}</i>		0.581*** (22.55)		0.642*** (23.86)		0.473*** (7.65)		0.495*** (7.95)
<i>DED_{t-1}</i>			-0.028 (-1.15)	-0.220*** (-9.10)			-0.153* (-1.85)	-0.228*** (-2.69)
<i>SKEW_{t-1}</i>	0.221*** (39.61)	0.221*** (39.35)	0.222*** (39.74)	0.221*** (39.37)	0.185*** (21.15)	0.185*** (21.14)	0.185*** (21.20)	0.185*** (21.15)
<i>VOLATILITY_{t-1}</i>	-0.735*** (-5.19)	-0.828*** (-5.82)	-0.783*** (-5.53)	-0.882*** (-6.20)	-0.006 (-0.01)	-0.114 (-0.26)	-0.061 (-0.14)	-0.130 (-0.29)
<i>SIZE_{t-1}</i>	0.041*** (23.83)	0.040*** (24.68)	0.046*** (28.64)	0.040*** (25.19)	0.052*** (12.53)	0.054*** (13.85)	0.057*** (14.57)	0.054*** (13.63)
<i>LEVERAGE_{t-1}</i>	-0.125*** (-9.32)	-0.124*** (-9.28)	-0.125*** (-9.35)	-0.123*** (-9.28)	-0.136*** (-4.03)	-0.136*** (-4.03)	-0.128*** (-3.78)	-0.135*** (-3.99)
<i>DTRUNOVER_{t-1}</i>	0.031 (1.21)	0.008 (0.33)	0.036 (1.39)	0.006 (0.25)	-0.023 (-0.31)	-0.033 (-0.47)	-0.010 (-0.13)	-0.035 (-0.52)
<i>BKMKT_{t-1}</i>	-0.059*** (-12.66)	-0.053*** (-11.51)	-0.058*** (-12.60)	-0.052*** (-11.35)	-0.026* (-1.84)	-0.017 (-1.23)	-0.025* (-1.79)	-0.016 (-1.12)
<i>RET_{t-1}</i>	0.655*** (45.83)	0.653*** (45.74)	0.654*** (45.73)	0.653*** (45.73)	0.858*** (23.06)	0.855*** (23.01)	0.857*** (23.06)	0.855*** (23.02)
<i>INTERCEPT</i>	-0.652*** (-7.93)	-0.626*** (-7.67)	-0.746*** (-9.18)	-0.637*** (-7.81)	-1.046*** (-10.87)	-1.083*** (-11.34)	-1.081*** (-11.25)	-1.067*** (-11.11)
<i>Quarter Effects</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	401,696	401,696	401,696	401,696	55,492	55,492	55,492	55,492

R^2	0.065	0.066	0.064	0.066	0.076	0.077	0.076	0.077
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Note: Models (1) to (4) are for non-financial crisis periods whereas model (5) to (8) are for financial crisis periods of 1987, 1997, 2007, and 2008. Chow statistics for non-financial crisis and financial crisis groups corresponding to model (1) vs (5), model (2) vs (6), model (3) vs (7), and model (4) vs (8) are $F(9, 457170)=14.95$, $F(9, 457170)=4.95$, $F(9, 457170)=7.40$, and $F(10, 457168)=5.92$, respectively. The null hypothesis, where there is no structural break for non- and financial crisis periods, is rejected at the 1% significant level, suggesting that there is significantly different impacts of non-financial crisis and financial crisis periods on crash risk. Robust t -statistics adjusted for clustering by firm are reported inside the parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.