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Firm Crash Risk, Information Environment, and Speed of Leverage Adjustment *†

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Abstract

This paper examines the effect of a firm's crash-risk exposure on its speed of leverage adjustment (SOA), and how this effect is influenced by the information environment of the country in which the firm is located. We employ a panel of 19,247 firms across 41 countries from 1989 to 2013, and we find that firms with a higher crash-risk exposure tend to adjust their financial leverages more slowly toward their targets. This evidence supports the dynamic trade-off theory that firms with larger transaction costs adjust their capital structures less often. Equally important, we document that the negative link between crash-risk exposure and SOA is less pronounced in countries with a more transparent information environment.

JEL Classifications: G32, G15.

Keywords: Capital structure dynamics, Information asymmetry, Crash risk, Information environment.

1 Introduction

Existing capital structure theories demonstrate that information asymmetry is an important determinant of optimal leverage. For example, Myers (1984) and Myers and Majluf (1984) show that firms with high information asymmetry face large external financing costs. The signaling theory of capital structure suggests that the stock market positively (negatively) reacts to an announcement of debt (equity) issuance (Ross (1977) and Noe (1988)). Moreover, the dynamic trade-off theory allows firms to take into account a trade-off between a suboptimal financial structure and leverage adjustment costs (Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), and Strebulaev (2007)). Therefore, it predicts that firms with higher transaction costs tend to adjust their leverage ratios more slowly toward their targets.

One anecdotal example is the stock-price crash of Olympus in 2011 caused by its accounting scandal. The Japanese company paid inflated advisory fees to takeover advisers in order to hide investment losses in the 1990s. After its former president and CEO, Michael C. Woodford, questioned the fees of the Gyrus acquisition, Olympus' stock fell 70% within three weeks (from mid-October to November 8, 2011), reflecting investors' concerns about the company's actual prospects. In particular, Olympus' shareholders were worried about the company being delisted from the Tokyo Stock Exchange, which could restrict access to external equity financing. In addition, the company's credit rating was downgraded, suggesting that its creditworthiness had deteriorated considerably. In this case, reactions from capital-market participants were in accord with the prediction that external financing costs increase crash risk (The Wall Street Journal, December 6, 2011).

In this paper, we investigate how a firm's crash-risk exposure affects its leverage adjustment decision. We argue that firms exposed to a high crash risk are presumably those with extreme information asymmetry between inside managers and outside investors, which is consistent with the evidence of a significant positive relationship between crash risk and extreme information asymmetry in the existing literature (Jin and Myers (2006), Hutton, Marcus, and Tehranian (2009), and Kim, Li, and Zhang (2011a)). Thus, we hypothesize that a firm's crash-risk exposure tends to decrease its speed of leverage adjustment (SOA).

More importantly, we expect that the negative crash-risk effect on leverage adjustment is attenuated by a transparent information environment because the impact of the macro information environment on different aspects of financial markets, including institutional shareholding (Li, Moshirian, Pham, and Zein (2006)), foreign investor shareholding (Haw, Hu, Hwang, and Wu (2004), Gelos and Wei (2005), and Leuz, Lins, and Warnock (2009)), and leverage adjustment (Oztekin and Flannery (2012)), has been well documented. To test our hypotheses, we employ an international sample of 41 countries from 1989 to 2013. Using international data has two advantages. First, our sample includes a large number of crash events. Second, multi-country data allows us to examine the effect of information environments on the relationship between crash risk and capital structure adjustment.

We have three main empirical findings. First, we show that crash-risk exposure is significantly and negatively correlated with a firm's speed of capital-structure adjustment toward their targets. Combined with the notion that a firm's crash-risk exposure reflects the opaqueness of its accounting information (Hutton, Marcus, and Tehranian (2009) and Kim, Li, and Zhang (2011a)), this finding is consistent with capital structure theories based the information asymmetry, which posit that opaque firms face the high transaction costs of issuing external funds (Myers (1984) and Myers and Majluf (1984)). Furthermore, the documented slow SOA confirms that firms with larger transaction costs tend to adjust their capital structures less frequently (Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), and Strebulaev (2007)). Second, we find that a transparent information environment significantly attenuates the negative relationship between crash-risk exposure and SOA. This result is consistent with the view that the information environment encourages transparent stock prices and reduces external financing costs (La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) and Bushman, Piotroski, and Smith (2004)). Third, we find that the effect of crash-risk exposure on SOA is negative among over-leveraged firms and mixed among under-leveraged firms. One explanation for the asymmetric effect is that under-leveraged firms with high crash-risk exposure may strategically use debt issuance (as a good signal) to hide bad news.

This paper fits into the empirical literature on dynamic capital structure adjustment. The literature starts from assuming a constant SOA across all firms (Fama and French (2002) and Flannery and Rangan (2006)). Recent studies have advanced the understanding of cross-section variational in SOA. Our paper is mostly related to Oztekin and Flannery (2012) and Faulkender, Flannery, Hankins, and Smith (2012), which employ dynamic partial adjustment models of capital structure to analyze the determinants of SOA. Adding to this strand of research, we introduce crash-risk exposure as an important factor that explains the heterogeneity in SOA. This is because the existing crash-risk literature suggests a positive relationship between crash risk and extreme information asymmetry (Hutton, Marcus, and Tehranian (2009) and Kim, Li, and Zhang (2011a)). Specifically, we use crash risk as a proxy for extreme information asymmetry, and examine its effect on SOA.

Furthermore, this paper sheds insight on the impact of corporate governance on capital structure. For example, Antoniou, Guney, and Paudyal (2008) find that macro-level corporate governance and investor protection are important determinants of leverage ratios. Fan, Titman, and Twite (2012) show that firms in countries with a poor institutional environment are more likely to have high leverage, while Oztekin and Flannery (2012) argue that a better institutional environment lowers the transaction costs of external financing and hence increases SOA. In this paper, we focus on the specific information environment rather than the legal regime and investor protection. We find that a transparent information environment significantly mitigates the (adverse) effect of crash-risk exposure on SOA.

This paper is related to the literature on crash risk. Prior studies (Jin and Myers (2006), Hutton, Marcus, and Tehranian (2009), Kim, Li, and Zhang (2011a), Kim, Li, and Zhang (2011b), An and Zhang (2013), Kim, Li, and Li (2014), Kim and Zhang (2014), and Kim and Zhang (forthcoming)) focus on the determinants of crash risk but do not analyze the consequences of crash-risk exposure on corporate policies. We show that crash-risk exposure can influence a firm's ability to raise capital and adjust capital structure.

This paper also contributes to the study of the impact of macro information environments on financial markets. For example, Gelos and Wei (2005) provide evidence that international funds hold fewer assets in markets with a less transparent (or more opaque) financial information environment. Li, Moshirian, Pham, and Zein (2006) find that the variations of financial institutional large shareholdings are determined by country level corporate information disclosure requirements. They argue that the strengthened monitoring ability of a strong macro corporate governance environment encourages financial institutions to hold concentrated equity positions. Leuz, Lins, and Warnock (2009) show that country-level poor information disclosure rules and weak investor protection deter foreign investment, especially for firms with more earnings management. This paper shows that the macro information environment additionally influences leverage adjustment by firms across the world.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and develops our hypotheses. Section 3 describes our empirical methodology. Section 4 discusses data and sample. Section 5 presents the empirical results and robustness tests. Section 6 concludes the paper.

2 Hypotheses Development

Our hypotheses rest on three strands of research. First, there is a rapidly growing body of research on the significant positive relationship between crash risk and extreme information asymmetry (Jin and Myers (2006), Hutton, Marcus, and Tehranian (2009), Kim, Li, and Zhang (2011a), Kim, Li, and Zhang (2011b), An and Zhang (2013), Kim, Li, and Li (2014), Kim and Zhang (2014), and Kim and Zhang (forthcoming)). One explanation is that firm managers tend to keep bad news from capital markets by manipulating accounting information. However, negative information can no longer be hidden once the accumulated bad news reaches a certain threshold. In such cases, adverse information is suddenly released to financial markets, resulting in a share-price collapse. Therefore, firms exposed to a high crash risk are presumably those with extreme information asymmetry between inside managers and outside investors.

Second, Myers (1984) and Myers and Majluf (1984) show that firms with a high degree of information asymmetry may incur large transaction costs and, hence, become reluctant to issue risky securities (risky debt and outside equity).

Third, the dynamic trade-off theory of capital structure predicts that firms take into account a trade-off between transaction costs and a suboptimal leverage ratio when they adjust their leverages toward their targets (Fischer, Heinkel, and Zechner (1989), Goldstein, Ju, and Leland (2001), and Strebulaev (2007)). When the benefits of an immediate adjustment are outweighed by transaction costs, it becomes optimal for a firm to wait until the accumulated adjustment benefits are large enough to cover recapitalization costs. Several empirical studies provide evidence to support this theory (Fama and French (2002), Leary and Roberts (2005), Flannery and Rangan (2006), Warr, Elliott, Koter-Kant, and Oztekin (2012), and Oztekin and Flannery (2012)).

Taken all together, we hypothesize that firms exposed to a higher crash risk tend to have lower SOA. This forms our first hypothesis.

H1: *Firms with higher crash-risk exposure are expected to adjust their corporate leverage more slowly.*

Nevertheless, in countries with a more transparent information environment, firm-level information tends to be released to the market in a more accurate and timely manner. Consistent with this view, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) show that financial markets are more efficient and robust in countries with a more transparent information environment. Giannetti (2003) finds that better institutional settings could promote debt financing. Oztekin and Flannery (2012) find that the transaction costs of external financing are lower and the SOA is higher in countries with a better institutional environment. Hence, we posit that a transparent macro-level information environment may mitigate the negative association between crash-risk exposure and SOA.

H2: *The negative relationship between crash-risk exposure and SOA is less pronounced among firms in countries with a more transparent information environment.*

Furthermore, the signaling theory of capital structure demonstrates that the stock market may react positively to announcements of debt issuances and negatively to announcements of equity issuances.[1] This implies that the effect of information asymmetry on SOA may depend upon whether firms are over- or under-leveraged relative to their target leverage ratios. When adjusting capital structure, over-leveraged firms usually need to substitute equity for debt, and market participants interpret such an adjustment as a bad signal. To hide bad information, over-leveraged firms with high crash-risk exposure will be more reluctant to adjust capital structure. Conversely, under-leveraged firms usually need to substitute debt for equity when making leverage adjustments. Under-leveraged firms that are exposed to a high crash risk may be willing to use debt issuances as a good signal and keep bad news from being released to outside investors. Thus, their leverage adjustments may be smoother.

In sum, the existing capital structure theories imply that there is an unambiguous negative link between crash-risk exposure and SOA for over-leveraged firms. However, theoretical predictions of the relationship between crash-risk exposure and SOA for under-leveraged firms are mixed. Finally, following Hypothesis 2, we conjecture that a transparent information environment reduces the transaction costs of both equity and debt issuances. Consequently, a transparent information environment tends to attenuate the negative relationship between SOA and crash-risk exposure for both over- and under-leveraged firms. We sum-

[1] See Ross (1977) and Noe (1988) for theoretical justification and Masulis (1980) and Masulis (1983) for empirical evidence.

marize these considerations in the following two hypotheses.

H3: *Among over-leveraged firms, those with higher crash-risk exposure are expected to adjust their corporate leverage more slowly, and, this impact is mitigated by a transparent information environment.*

H4: *Among under-leveraged firms, a transparent information environment enables firms with high crash-risk exposure to adjust their capital structures.*

3 Empirical Design

In the literature, both one-step (Flannery and Rangan (2006)) and two-step approaches (Hovakimian, Opler, and Titman (2001), Fama and French (2002), and Hovakimian and Li (2011)) are used to estimate partial adjustment models. In this paper, which aims to analyze the effect of crash-risk exposure on SOA, as well as the influence of the information environment on this effect, we use the two-step regression framework because it is flexible and allows us to control for other firm and country characteristics.

In the first step, we regress observed leverage on a set of leverage determinants and use the fitted value as a proxy for the unobservable target leverage. At this stage, we also run a crash-risk predictive regression and extract its fitted value as a proxy for the unobservable expected crash risk (crash-risk exposure). In the second step, we use both the target leverage and the crash-risk exposure obtained in the first step to estimate a partial adjustment model. We focus on the effect of crash-risk exposure on SOA and how this effect interacts with the information environment. The two-step approach is more appropriate in our empirical framework because it can serve to jointly test and distinguish the effects of crash-risk exposure and information environment on SOA.

3.1 Target Leverage

Empirical capital structure research suggests that the target leverage ratio is a function of time-varying firm and industry characteristics (Titman and Wessels (1988), Rajan and Zingales (1995) Fama and French (2002), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), and Frank and Goyal (2009)). We regress the observed leverage ratio (L) on a set of leverage factors, estimating the target for both book leverage ratio (BL) and market leverage ratio (ML):

$$L_{j,i,t} = \alpha_j + \boldsymbol{\gamma}_j \mathbf{X}_{j,i,t-1} + f_{j,i} + y_{j,t} + e_{j,i,t}, \quad L \in \{BL, ML\} \tag{1}$$

where country is indexed by j, firm by i, and time by t. $\mathbf{X}_{j,i,t-1}$ is a vector of firm and industry variables, including firm size ($Size^a$), tangibility ($Tang$), market-to-book ratio (MTB^a), profitability ($Prof$), depreciation (Dep), research and development expenses ($R\&D$), $R\&D$

dummy (*R&D_dum*), and industry median leverage ratio (*IndMed*).[2] Definitions of the variable are provided in Appendix A.

In addition, we control for year fixed effects $y_{j,t}$ and firm fixed effects $f_{j,i}$ in equation (1) to capture the unobserved heterogeneity across time and firm. We estimate equation (1) by country to allow heterogeneous coefficient estimators across the 41 countries in our sample. Finally, we extract the fitted value of equation (1) as a proxy for the target leverage ratio (TL):

$$TL_{j,i,t} = \hat{\alpha}_j + \hat{\boldsymbol{\gamma}}_j \mathbf{X}_{j,i,t-1} + \hat{f}_{j,i} + \hat{y}_{j,t}. \tag{2}$$

3.2 Crash-risk Measures

In this paper, we consider three commonly used crash-risk measures in the literature, $CR \in \{CRASH, NCSKEW, DUVOL\}$, where *CRASH* is a crash-event dummy and *NCSKEW* and *DUVOL* are measures of stock-return asymmetry. To construct these three measures, we

[2] In a standard leverage regression model, firm size and market-to-book ratio are measured based on total assets, but it becomes clear later that they are measured based on equity in the existing crash-risk predictive models. To avoid confusion, we add the superscript a to the variables based on total assets and the superscript e to those based on equity.

first run an expanded market model (Jin and Myers (2006)):

$$
\begin{aligned}
r_{i,t} = & \alpha_i + \beta_{1,i} r_{m,j,t} + \beta_{2,i}[r_{U.S.,t} + EX_{j,t}] \\
& + \beta_{3,i} r_{m,j,t-1} + \beta_{4,i}[r_{U.S.,t-1} + EX_{j,t-1}] \\
& + \beta_{5,i} r_{m,j,t-2} + \beta_{6,i}[r_{U.S.,t-2} + EX_{j,t-2}] \\
& + \beta_{7,i} r_{m,j,t+1} + \beta_{8,i}[r_{U.S.,t+1} + EX_{j,t+1}] \\
& + \beta_{9,i} r_{m,j,t+2} + \beta_{10,i}[r_{U.S.,t+2} + EX_{j,t+2}] + e_{i,t},
\end{aligned} \tag{3}
$$

where $r_{i,t}$ is the stock return for firm i in week t, $r_{m,j,t}$ is the local market return for country j in week t, $r_{U.S.,t}$ is the U.S. market return in week t to proxy global market return, and $EX_{j,t}$ is the change in exchange rate for the currency of country j against the U.S. dollar in week t. Two lead and two lag terms are included to correct the nonsynchronous trading for both the local and U.S. market returns (Dimson (1979)). We then calculate firm-specific weekly returns $W_{i,t}$ as the natural logarithm of one plus the residual from the expanded market model (equation (3)), that is, $W_{i,t} = \log(1 + e_{i,t})$.

Next, following Hutton, Marcus, and Tehranian (2009), a firm week is defined as a crash week if the computed firm-specific weekly return, $W_{i,t}$, is 3.09 standard deviations below the mean return for firm i in a given year.[3] We set the dummy variable $CRASH$ to one if firm i experiences at least one crash week during year t, and zero otherwise. The same procedure

[3]Note that 3.09 is roughly the 0.1 percentile of a standard normal distribution. In a non-normal distribution of weekly returns, a crash week is less likely to be identified, whereas in a normal distribution, it is always identified (Hutton, Marcus, and Tehranian (2009)).

is applied to firms in all countries.

The second crash-risk measure ($NCSKEW$) is the negative skewness of the firm-specific weekly return over the year. For each firm in a given year, $NCSKEW$ is calculated by taking the negative of the third moment of firm-specific weekly return, and dividing it by the standard deviation of firm-specific weekly return raised to the third power (Kim, Li, and Zhang (2011a) and Chen, Hong, and Stein (2001)). Specifically, $NCSKEW$ is computed as:

$$NCSKEW_{i,t} = -[n(n-1)^{3/2}\sum W_{i,t}^3]/[(n-1)(n-2)(\sum W_{i,t}^2)^{3/2}] \tag{4}$$

where $W_{i,t}$ is the firm-specific weekly return derived above, and n is the number of weekly observations of the year.

The third crash-risk measure ($DUVOL$) is calculated as the natural logarithm of the ratio of the standard deviations of down-week and up-week firm-specific weekly returns (Chen, Hong, and Stein (2001)). A firm-week is defined as a down (up)-week if the firm-specific weekly return is below (above) the yearly mean. Specifically, $DUVOL$ is computed as:

$$DUVOL_{i,t} = log[(n_u-1)\sum W_{i_d,t}^2/((n_d-1)\sum W_{i_u,t}^2)] \tag{5}$$

where $W_{i_d,t}$ and $W_{i_u,t}$ are the firm-specific returns for down- and up-weeks, respectively, and n_d and n_u are the numbers of down-and-up weeks, respectively. Higher values of $NCSKEW$ and $DUVOL$ indicate higher levels of crash risk.

3.3 Crash-risk Exposure

The recent literature on crash risk suggests that firm-specific crash events can be predicted by firm-level accounting variables (Kim, Li, and Zhang (2011a)). To measure a firm's exposure to crash risk, we regress its crash-risk measure on a set of lagged factors:

$$CR_{j,i,t} = \alpha_j + \boldsymbol{\delta}_j \mathbf{Z}_{j,i,t-1} + y_{j,t} + e_{j,i,t}, \tag{6}$$

where $\mathbf{Z}_{j,i,t-1}$ is a vector of firm-level characteristics, including detrend turnover ($Dturn$), negative skewness ($NCSKEW$), standard deviation and mean of the firm-specific weekly return ($Sigma$ and Ret), firm size ($Size^e$), market-to-book ratio (MTB^e), long-term debt ratio (LD), return on asset (ROA), and earning opacity ($ACCM$).

We use a logit model to estimate future crash event probability ($CRASH$) and linear models to predict future return asymmetry ($NCSKEW$ and $DVUOL$). Equation (6) is estimated by country to allow heterogeneous coefficient estimators across countries. We denote the fitted value of equation (6) by $\hat{CR}_{j,i,t+1}$ and use it as a proxy for a firm's exposure to crash risk:

$$\hat{CR}_{j,i,t} = \hat{\alpha}_j + \hat{\boldsymbol{\delta}} \mathbf{Z}_{j,i,t-1} + \hat{y}_{j,t}. \tag{7}$$

3.4 Partial Adjustment Toward Target

Finally, we estimate a partial adjustment model of capital structure:

$$L_{j,i,t} - L_{j,i,t-1} = \alpha_0 + \lambda_{j,i,t-1}\left(TL_{j,i,t} - L_{j,i,t-1}\right) + u_{j,i,t}, \tag{8}$$

where $\lambda_{j,i,t-1}$ is a measure of SOA and depends upon crash-risk exposure:

$$\lambda_{j,i,t-1} = \beta_0 + \beta_1 \hat{CR}_{j,i,t} + \boldsymbol{\gamma}\mathbf{X}_{j,i,t-1} + \boldsymbol{\eta}\mathbf{Y}_{j,t-1}. \tag{9}$$

Our first hypothesis suggests that $\beta_1 < 0$.

Oztekin and Flannery (2012) show that a firm's accounting variables may affect both target leverage and SOA. Therefore, we include in equation (9) the control variables that are used in target leverage estimation (the $\mathbf{X}$ vector). In addition, we control for country characteristics that account for the heterogeneous development of capital markets across countries. Specifically, $\mathbf{Y}_{j,t-1}$ is a vector of country controls including GDP per capita ($GDPC$), market capitalization per capita ($MCAP$), and GDP growth ($GGDP$). Standard errors are robust to heteroskedasticity.

Our second hypothesis argues that a transparent information environment (IE_j) may attenuate the negative link between crash-risk exposure and SOA. This is because, as we argued before, firm-level information tends to be released to the market in a more accurate and timely manner in countries with a more transparent information environment. To test this hypothesis, we include information environment variables (IE_j) and their interaction with crash-risk exposure ($\hat{CR}_{j,i,t} \times IE_j$) in our empirical setting:

$$\begin{aligned}\lambda_{j,i,t-1} = \beta_0 + \beta_1 \hat{CR}_{j,i,t} + \beta_2 IE_j + \beta_3 \hat{CR}_{j,i,t} \times IE_j \\ + \boldsymbol{\gamma} \mathbf{X}_{j,i,t-1} + \boldsymbol{\eta} \mathbf{Y}_{j,t-1},\end{aligned} \tag{10}$$

If the second hypothesis holds, then we should expect $\beta_3 > 0$.

Finally, to test the third and fourth hypotheses, we estimate equations (8) and (10) for the over-leveraged and under-leveraged subsamples separately. For the over-leveraged subsample, we expect that $\beta_1 < 0$ and $\beta_3 > 0$. For the under-leveraged subsample, we hypothesize that $\beta_3 > 0$.

4 Data and Sample

We obtain data from several sources. First, we follow Jin and Myers (2006) to collect the total return index (RI) from Datastream in order to construct the crash-risk measures. Ince and Porter (2006) highlight the need for screening and correcting RI from Datastream. Similar to their practice, we set RI to be missing if it is less than 0.01 as Datastream rounds RI to the nearest tenth, which could exaggerate the proportion of zero-return. In addition, we delete an observation if the weekly stock return (Ret) is above 200% and reverses within one week,[4] and truncate the absolute value of Ret at 0.5 for unusually large weekly returns.[5] Second, we obtain firm-level accounting balance items from Worldscope. Third, we extract macro-level information environment variables from Bushman, Piotroski, and Smith (2004) and the Financial Development Report of the World Economic Forum. We elaborate on the information environment variables later. Finally, country-level control variables are obtained from World Development Indicators (WDI).[6]

Following the literature, we apply standard filters to remove firm-year observations according to the following criteria:

1. if there are fewer than 26 weekly stock returns available in a firm-year,
2. if there are fewer than 25 stocks available for a given country in a given year,
3. if a firm is considered as American Depository Receipts (ADRs) or Global Depository Receipts (GDRs), and
4. if a firm is a financial or utility firm.

In addition, all variables are winsorized at the 1st and 99th percentiles.

Finally, there are 120,764 firm-year observations left in the sample, which contains 19,247 firms across 41 countries spanning the period from 1989 to 2013. Panel A of Table 1 provides

[4]If Ret_t or Ret_{t-1} is greater than 200% and $(1 + Ret_t)(1 + Ret_{t-1}) - 1$ is less than 50%, then Ret_t and Ret_{t-1} are set to be missing.

[5]To our knowledge, weekly stock returns larger than 0.5 are likely to be due to non-adjusted stock splits. In subsequent sections, we also run our empirical tests with different cut-off values, such as 0.25 or 0.75. Our results are qualitatively unchanged.

[6]Except for the data of Taiwan, which is collected from the websites of National Statistic of Taiwan and Taiwan Stock Exchange.

a sample description that reports the number of years, the number of firms, and the number of firm-year observations of each country. It shows that the sample coverage is fairly different across countries. In general, developed countries tend to have a longer sample period and larger data coverage than developing countries. In addition, Panel B of Table 1 lists the stock price crash frequency for each year from 1989 to 2013. The number of firms in our sample increases over time (686 firms in 1989 and 10,509 firms in 2013). In general, the number of crashed firms also increases over time (95 crashed firms in 1989 and 1,224 crashed firms in 2013). On average, about 13% of firms experience at least one crash week in each year.

[Insert Table 1]

Table 2 reports the summary statistics of our key variables. In general, the key dependent variables and explanatory variables resemble those in the literature. For example, our sample mean of book leverage ratio (*BL*) is 0.21 compared to 0.24 in Oztekin and Flannery (2012). Using the crash-dummy variable (*CRASH*), we find that about 13% of the sample are (realized) crash observations, indicating the likelihood of stock price crash is small but not negligible. The crash frequency is slightly lower than that documented in Hutton, Marcus, and Tehranian (2009) and Kim, Li, and Zhang (2011a), which is 16%. However, Hutton, Marcus, and Tehranian (2009) and Kim, Li, and Zhang (2011a) focus on U.S. firms and we include international firms from 41 countries. Thus, the slight difference may be attributed to different samples. In addition, Table 2 shows that the means of *NCSKEW* and *DUVOL* are -0.16 and -0.10, respectively. The magnitudes are consistent with those in An and Zhang (2013) that also study international firms.

[Insert Table 2]

Panel A of Table 3 presents the correlation coefficients between financial leverage and its determinants in the target leverage model (equation (1)). There is no evidence to suggest that independent variables are highly correlated. Moreover, it shows how financial leverage is correlated with firm- and industry-level characteristics. Specifically, it is positively associated with $Size^a$, *Tang*, *Dep*, *R&D_dum*, and *IndMed*, but negatively related to MTB^a, *Prof*, and *R&D*. In addition, Panel B of Table 3 provides the correlation matrix for pairs of crash-risk measures and their determinants in the crash prediction model (equation (6)). We find that the three crash-risk measures are highly correlated. For instance, the correlation coefficient between $CRASH$ and $NCSKEW$ ($DUVOL$) is 0.55 (0.50) and that between $NCSKEW$ and $DUVOL$ is 0.95.

[Insert Table 3]

5 Empirical Results

Our empirical model has two steps. In the first step, we estimate target leverage using equation (1) for each country. In the same step, we also run equation (6) for each country and use the fitted value as a proxy for crash-risk exposure.[7]

In the second step, we estimate a partial adjustment model using equation (8). We start our analysis with a model without the interaction of crash risk and information environment (equation (9)). This simple model allows us to test the first hypothesis and quantify the average (across all countries) effect of crash risk on leverage adjustment. Next, we add an information environment variable and its interaction with crash-risk exposure to our empirical model (equation (10)). This specification tests the second hypothesis of whether a transparent information environment mitigates the negative impact of crash-risk exposure on SOA. Country-level information environment variables are collected from Bushman, Piotroski, and Smith (2004) and the Financial Development Report of the World Economic Forum, including accounting standards (*AccStd*), analyst following (*Analyst*), financial transparency (*FinTra*), auditing practices (*Audit*), and information disclosure (*InfDis*).[8] Finally, for the third and fourth hypotheses, we split the full sample into over- and under-leveraged subsamples and repeat our analysis for each subsample.

5.1 The Effect of Crash-risk Exposure on SOA

Table 4 presents the results from estimating the partial adjustment model (equations (8) and (9)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Key explanatory variables are three crash-risk exposure measures: $\widehat{CRASH}$, $\widehat{NCSKEW}$,

[7]The first-stage estimation results are omitted for brevity but available from the authors upon request.
[8]Definitions of the information environment variables are provided in Appendix A.

and $DU\hat{V}OL$. From the first three rows of the table, we find that the coefficients of all three crash-risk exposure measures are negative and almost all of them (five out of six cases) are significant. These results imply that firms with high crash-risk exposure tend to adjust their leverage ratios slowly.

[Insert Table 4]

Equation (8) indicates that a firm's SOA ($\lambda_{j,i,t-1}$) multiplied by 100 measures the average percentage of the deviation between its target and its observed leverage ratio being closed per year. To see the magnitude of the effect, we take $NCS\hat{K}EW$ and the market leverage adjustment (ML) as an example. If a firm's $NCSKEW$ increases by one standard deviation, then there will be a 1.22% (= 0.18 × 0.068) decrease in SOA, where 0.068 is the coefficient (in absolute value) of $NCS\hat{K}EW$ and 0.18 is the sample standard deviation of $NCS\hat{K}EW$.

In summary, we find that crash-risk exposure discourages leverage adjustment, which supports our first hypothesis. Firms with higher crash-risk exposure are those with more severe information asymmetry problems, which implies they face larger transaction costs in issuing external funds. Consequently they adjust their leverage ratios more slowly toward their targets.

5.2 The Role of the Information Environment

In this section, we examine whether the negative micro-level information externality can be internalized by a strong macro information environment. Our second hypothesis predicts that the negative association between crash-risk exposure and SOA is attenuated in countries with a transparent information environment. Using equation (10), we test whether the coefficient of the interaction between information environment and crash-risk exposure ($\hat{CR}_{j,i,t} \times IE_j$) is positive.

Our first information environment proxy is accounting standards (*AcctStd*), collected from Bushman, Piotroski, and Smith (2004). By examining the 1995 annual reports of the companies, *AcctStd* reports the average inclusion or omission of the 90 accounting and non-accounting items. The larger the *AcctStd* is, the more transparent the corporate reporting environment is. As shown in Table 2, *AcctStd*'s country-average is 71.86 and standard deviation is 8.17 in our sample.

The first, third, and fifth rows of Table 5 show that all crash-risk exposure measures remain negatively correlated with SOA. More importantly, the coefficients of the interaction terms in the second, fourth, and sixth rows capture the role of *AcctStd* in reshaping the effect of crash-risk exposure on SOA. We find that all six coefficients of the interaction terms are significantly positive. This set of results is consistent with our second hypothesis that the negative impact of crash-risk exposure on capital-structure adjustment is weaker in the countries with transparent accounting standards.

To see the economic magnitude, we take $NCS\hat{K}EW$ and the market leverage adjustment

(ML) as an example. The average effect of $NCS\hat{K}EW$ across all countries is:

$$-0.931 + 0.012 \times 71.86 = -0.069 \text{ or } -6.9\%$$

where -0.931 is the coefficient of $NCS\hat{K}EW$, 0.012 is the coefficient of $NCS\hat{K}EW \times$ *AcctStd*, and 71.86 is the country-average *AcctStd* reported in Table 2. We note that the magnitude of the average affect is fairly close to the coefficient of $NCS\hat{K}EW$ reported in Table 4 where we do not include interaction terms. Moreover, one standard deviation increase in *AcctStd* attenuates the negative effect of $NCS\hat{K}EW$ on the market leverage adjustment by:

$$0.012 \times 8.17 = 0.098 \text{ or } 9.8\%.$$

where 8.17 is the standard deviation of *AcctStd* reported in Table 2.

[Insert Table 5]

In addition, we examine four other proxies of the information environment. First, analyst coverage (*Analyst*) measures the number of analysts following the largest 30 companies in 1996. Second, financial transparency (*FinTra*) measures the relative financial information availability to those outside the firms due to financial information disclosure, interpretation, and dissemination by firms, financial analysts, and media reporters. Third, auditing practices (*Audit*) indicate whether a high percentage of firms in a country are audited by the big five accounting firms. *Audit* ranges from 1 to 4. A high value is associated with a transparent information environment. Fourth, information disclosure (*InfDis*) measures the state of financial information disclosure of a country. The first three variables are obtained from Bushman, Piotroski, and Smith (2004) and the fourth is from the Financial Development Report of the World Economic Forum.

We estimate equations (8) and (10) for each information environment variable separately. Results are summarized in Tables 6 to 9. In general, using the four alternative information environment measures delivers consistent results with those associated with *AcctStd* in Table 5. We find that crash-risk exposure measures have negative coefficients and their interactions with the four information environment measures have positive coefficients. In summary, there is fairly strong evidence that a transparent information environment plays a positive role in alleviating the negative crash-risk effect on SOA.

[Insert Table 6]

[Insert Table 7]

[Insert Table 8]

[Insert Table 9]

5.3 Over- and Under-leveraged Subsamples

Our third and fourth hypotheses imply that the effect of crash-risk exposure on a firm's SOA may depend upon whether the firm has to issue equity or debt. This motivates us to split our sample into subsamples of over- and under-leveraged firms to investigate the effect of crash-risk exposure and the role of information environment in them separately.

Three interesting findings emerge from the results regarding *AcctStd* in Table 10. First, the absolute value of the $\hat{CR}$ coefficients captures the magnitude of the effect of the crash-risk exposure on SOA. We find that the magnitude is greater among over-leveraged firms than among under-leveraged firms. Second, the coefficients of the interactions between crash-risk exposure measures and *AcctStd* are positive. Third, the coefficients of crash-risk exposure variables are negative.

[Insert Table 10]

Then, we extend our analysis to use the four alternative information environment measures. We summarize the estimation results in Tables 11 to 14. In general, we note that the first and second observations can be found in all four information environment measures. However, the third observation depends upon which information environment variables are used. When information environment is measured by *Analyst* and *Audit*, the coefficients of crash-risk exposure measures are negative, indicating a negative effect of crash-risk exposure on SOA for countries with an opaque information environment. Conversely, we obtain much weaker evidence when *FinTra* is used and mixed evidence when *InfDis* is analyzed.

[Insert Table 11]

[Insert Table 12]

[Insert Table 13]

[Insert Table 14]

In sum, we show that among over-leveraged firms crash-risk exposure has an unambiguous negative effect on SOA, but among under-leveraged firms the effect of crash-risk exposure on SOA is mixed. These results are consistent with our third and fourth hypotheses. Specifically, the results identify two important considerations for the leverage adjustment decisions of firms with asymmetric information. First, high information asymmetry may lead to large transaction costs in capital structure adjustment. Thus, firm SOA decreases when facing information asymmetry. Second, high information asymmetry may encourage upward leverage adjustment as debt issuance is usually interpreted as a good signal and hence is appreciated by firms that want to hide bad information. This is particularly true for under-leveraged firms.

Next, we find that the coefficients of the interactions between crash-risk exposure and information environment are always positive for both over- and under-leveraged firms. This evidence is consistent with the second parts of the third and fourth hypotheses because a transparent environment reduces the transaction costs of both equity and debt issuances.

5.4 Robustness Tests

We perform three robustness checks in this section. First, there is a concern that leverage adjustment can be (partially) driven by passive movements in the leverage ratio rather than active capital structure changes. To focus on active leverage adjustment, we follow Faulkender, Flannery, Hankins, and Smith (2012) to decompose a firm's leverage adjustment into passive and active components. Specifically, we estimate a dynamic partial-adjustment model:

$$L_{j,i,t} - L^{p}_{j,i,t-1} = \alpha_0 + \lambda_{j,i,t-1}\left(TL_{j,i,t} - L^{p}_{j,i,t-1}\right) + u_{j,i,t}, \tag{11}$$

where

$$\lambda_{j,i,t-1} = \beta_0 + \beta_1 \hat{CR}_{j,i,t} + \boldsymbol{\gamma}\mathbf{X}_{j,i,t-1} + \boldsymbol{\eta}\mathbf{Y}_{j,t-1}, \tag{12}$$

and

$$L^{p}_{j,i,t-1} = \frac{D_{j,i,t-1}}{A_{j,i,t-1} + NI_{j,i,t}}. \tag{13}$$

where D is the firm's outstanding book debt, A is the outstanding book assets, and NI is net income. In other words, we subtract the passive leverage adjustment $L^{p}_{j,i,t} - L_{j,i,t}$ from the total movement $L_{j,i,t+1} - L_{j,i,t}$ to get the active capital-structure adjustment $L_{j,i,t+1} - L^{p}_{j,i,t}$. We obtain qualitatively consistent results using the active leverage adjustment.

Second, we check whether our results remain robust if we remove the U.S. firm-years as U.S. firms account for approximately 20% of the full sample with 23,778 firm-year observations. Thus, our country-level results could potentially be driven by U.S. specific characteristics rather than a transparent information environment. To address this issue, we construct a subsample of non-U.S. firms, and repeat our analysis for different crash-risk measures and information environment variables. Again, we obtain qualitatively similar results.

Third, given the panel data structure of our observations, we estimate our models by clustering the standard errors by firm-year. We still find qualitatively consistent results.[9]

6 Conclusion

In this paper, we provide new evidence on firms' dynamic capital structure decisions using a large sample of firms across 41 countries spanning a period from 1989 to 2013. We focus on the cross-section variation in leverage adjustment. In particular, we analyze the relationship between crash-risk exposure on SOA and the role of information environment in reshaping this relationship. Three interesting results may shed light on how dynamic capital structure decisions are made.

First, we find robust evidence that corporations exposed to a higher crash risk adjust their leverage ratios more slowly toward target leverage ratios. Our explanation for this result is that firms with a higher crash-risk exposure face larger transaction costs in leverage adjustment. Recent crash-risk literature shows that crash risk is closely tied to extreme information asymmetry between insiders and outsiders. Thus, according to the dynamic trade-off theory, firms facing larger transaction costs are more tolerant of suboptimal leverage choices and wait longer before they recapitalize toward their targets.

Second, the negative relationship between crash-risk exposure and capital structure adjustment is attenuated in countries with a transparent information environment. This finding

[9]These results are omitted for brevity but available from the authors upon request.

highlights the importance of the institutional setting for capital structure decisions. A transparent information environment promotes accurate accounting information and encourages free information dissemination. These functions appear to reduce the transaction costs of external financing for firms with severe information asymmetry.

Third, we show that the effect of crash-risk exposure on SOA depends upon whether firms are over- or under-leveraged. Our interpretation of this result rests on the signaling theory of capital structure predicting that stock price usually increases (decreases) following an announcement of debt (equity) issuance. Therefore, for over-leveraged firms it is unambiguously clear that SOA decreases in crash-risk exposure as they usually need to issue equity. Nevertheless, for under-leveraged firms the relationship becomes blurred as debt issuance could help them hide bad news.

There are various policy implications of this study. Governments may use regulations to encourage high corporate transparency and a good-quality information environment. More specifically, firm-level bad news should be released in a timely manner to the public and crash-risk exposure should be identified as early as possible to reduce its negative effect on SOA.

Table 1: **The Sample and Stock Price Crash Distribution**: Panel A provides a description of the sample. Number of years, number of firms, and number of firm-year observations of each country are reported in Columns 1-3, respectively. Panel B reports the annual sampling distribution of stock price crash risk from 1989 to 2013. Number of firms, number of crashed firms, and percentage of crashed firms of each year are reported in Columns 1-3, respectively. The firm is recored as a crashed firm if *CRASH* equals to one in given firm year (i.e., the firm experiences one or more than one crash weeks during the year.), and zero otherwise.

Panel A: The Sample

Market	N.O. of years [1]	N.O. of firms [2]	N.O. of firm-year observations [3]
Austria	14	33	173
Belgium	14	70	501
Brazil	14	71	263
Canada	25	1,038	3,917
China	14	86	527
Chile	17	38	197
Denmark	24	90	676
Ireland	18	40	252
Finland	14	84	624
France	14	503	3,607
Germany	14	475	3,338
Greece	14	133	842
Hong Kong	24	800	4,543
Indonesia	17	200	1,118
India	17	1,586	5,636
Israel	16	144	504
Italy	14	187	1,200
Japan	22	2,034	22,440
South Korea	23	1,169	6,748
Sri Lanka	6	54	128
Malaysia	25	603	4,204
Mexico	19	54	285
Netherlands	16	121	916
Norway	24	120	686
New Zealand	22	41	269
Pakistan	16	64	366
Poland	9	124	477
Portugal	14	26	177
Philippines	17	71	431
Russian	11	65	221
South Africa	22	171	1,169
Singapore	25	423	2,475
Spain	14	93	644
Sweden	25	200	1,503
Switzerland	21	168	1,483

Panel A: The Sample Cont.

Thailand	19	273	2,047
Turkey	17	193	1,250
Taiwan	17	592	4,604
United Kingdom	25	1,839	12,179
United States	25	4,317	23,778
Total		19,247	120,764

Panel B: Stock Price Crash Distribution

Year	N.O. of firms [1]	N.O. of crashed firms [2]	% of crashed firms [3]
1989	686	95	13.85%
1990	743	123	16.55%
1991	806	104	12.90%
1992	1,065	149	13.99%
1993	1,458	203	13.92%
1994	1,747	209	11.96%
1995	1,966	274	13.94%
1996	2,218	267	12.04%
1997	2,576	422	16.38%
1998	2,610	305	11.69%
1999	2,805	279	9.95%
2000	3,677	438	11.91%
2001	3,810	505	13.25%
2002	4,220	622	14.74%
2003	4,806	496	10.32%
2004	5,933	750	12.64%
2005	6,662	863	12.95%
2006	7,676	1,066	13.89%
2007	8,409	1,085	12.90%
2008	8,169	1,349	16.51%
2009	8,407	798	9.49%
2010	9,022	988	10.95%
2011	10,009	1,346	13.45%
2012	10,775	1,311	12.17%
2013	10,509	1,224	11.65%
Mean	4,831	611	12.96%

Table 2: **Descriptive Statistics**: This table presents the descriptive statistics of firm- and industry-level variables (Panel A), information environment variables (Panel B), and country-level variables (Panel C). The sample period is from 1989 to 2013. Summary statistics in Panel A are based on a panel of firm-year observations, in Panel B based on a cross section of countries, and in Panel C based on a panel of country-year observations. All the variables are defined in Appendix A.

Panel A: Firm- and industry- level variables

	N [1]	Mean [2]	Std. Dev. [3]	Min. [4]	Max. [5]
Leverage and crash-risk measures:					
BL	120,764	0.21	0.18	0.00	1.00
ML	120,764	0.26	0.25	0.00	1.00
BL_P	106,336	0.22	0.20	-2.68	2.46
CRASH	120,764	0.13	0.33	0.00	1.00
NCSKEW	120,744	-0.16	0.72	-6.59	6.45
DUVOL	120,744	-0.10	0.35	-2.42	2.46
Firm- and industry-level variables used in equation (1):					
$Size^a$	120,764	12.90	1.88	5.49	18.96
Tang	120,764	0.31	0.22	0.00	0.99
MTB^a	120,764	1.28	1.31	0.08	45.91
Prof	120,764	0.09	0.14	-0.89	0.68
Dep	120,764	0.04	0.03	0.00	0.35
Rd	120,764	0.02	0.05	0.00	0.58
Rd_dum	120,764	0.45	0.50	0.00	1.00
IndMed(B)	120,764	0.19	0.11	0.00	0.79
IndMed(M)	120,764	0.23	0.16	0.00	0.97
IndMed(B_P)	120,764	0.18	0.11	0.00	0.99
Firm-level variables used in equation (6):					
Dturn	120,764	0.00	0.13	-37.53	0.46
Sigma	120,764	0.05	0.02	0.00	0.27
Ret	120,764	-0.14	0.16	-3.29	0.00
$Size^e$	120,764	12.48	1.96	4.83	18.15
MTB^e	120,764	2.30	3.46	0.08	110.65
LD	120,764	0.12	0.14	0.00	0.78
ROA	120,764	0.03	0.13	-0.91	0.73
ACCM	120,764	0.80	2.59	0.02	84.72

Panel B: Information nvironment variables

	N	Mean	Std. Dev.	Min.	Max.
AccStd	37	71.86	8.17	56.00	85.00
Analyst	37	14.44	7.99	2.40	32.40
FinTra	36	0.25	0.76	-1.39	1.62
Audit	36	3.22	1.02	1.00	4.00
InfDis	36	3.06	1.16	1.20	6.40

Panel C: Country-level variables

	N	Mean	Std. Dev.	Min.	Max.
GDPC	743	9.58	1.23	6.21	11.12
MCAP	743	87.40	72.57	6.84	606.00
GGDP	743	3.31	3.40	-13.13	15.24

Table 3: **Correlation Matrix**: Panel A provides the correlation matrix for pairs of firm-, industry-level variables in the target leverage model (i.e., equation (1)). Panel B provides the correlation matrix for pairs of firm-level variables in the crash prediction model (i.e., equation (6)). All variables are defined in Appendix A.

Panel A: Target Leverage Model

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
BL	[1]	1.00												
ML	[2]	0.83	1.00											
BL_P	[3]	0.91	0.76	1.00										
$Size^a$	[4]	0.26	0.22	0.21	1.00									
Tang	[5]	0.29	0.24	0.25	0.12	1.00								
MTB^a	[6]	-0.17	-0.34	-0.16	-0.12	-0.12	1.00							
Prof	[7]	-0.04	-0.09	-0.08	0.24	0.09	0.06	1.00						
Dep	[8]	0.05	-0.02	0.04	-0.02	0.26	0.02	0.13	1.00					
R&D	[9]	-0.18	-0.23	-0.14	-0.13	-0.24	0.28	-0.32	0.08	1.00				
R&D_dum	[10]	0.09	0.11	0.09	-0.10	0.16	-0.08	0.03	-0.04	-0.35	1.00			
IndMed(B)	[11]	0.40	0.41	0.34	0.20	0.27	-0.21	0.15	-0.02	-0.32	0.14	1.00		
IndMed(M)	[12]	0.34	0.46	0.30	0.18	0.23	-0.30	0.07	-0.07	-0.29	0.09	0.84	1.00	
IndMed(B_P)	[13]	0.40	0.43	0.35	0.19	0.27	-0.23	0.14	-0.02	-0.33	0.15	0.98	0.85	1.00

Panel B: Crash Prediction Model

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
CRASH	[1]	1.00										
NCSKEW	[2]	0.55	1.00									
DUVOL	[3]	0.50	0.95	1.00								
Dturn	[4]	0.00	0.00	0.00	1.00							
Sigma	[5]	0.00	0.00	-0.01	0.00	1.00						
Ret	[6]	0.00	-0.01	0.00	-0.01	-0.96	1.00					
$Size^e$	[7]	0.03	0.13	0.14	0.00	-0.42	0.37	1.00				
MTB^e	[8]	0.05	0.06	0.06	0.00	0.06	-0.07	0.21	1.00			
LD	[9]	0.00	0.02	0.02	0.00	-0.04	0.04	0.18	0.06	1.00		
ROA	[10]	0.01	0.02	0.03	0.00	-0.35	0.34	0.28	0.01	-0.05	1.00	
ACCM	[11]	0.03	0.02	0.02	0.00	0.15	-0.16	-0.03	0.07	0.00	-0.06	1.00

Table 4: : **The Effect of Crash Risk on Speed of Leverage Adjustment:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm- and industry-level variables including $Size^a$, *Tang, MTB*^{a}, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.001	-0.010***				
	(-0.372)	(-6.857)				
$NCS\hat{K}EW$			-0.026**	-0.068***		
			(-2.007)	(-5.313)		
$DU\hat{V}OL$					-0.070***	-0.173***
					(-2.788)	(-6.941)
$Size^a$	-0.015***	-0.012***	-0.014***	-0.009***	-0.013***	-0.008***
	(-14.266)	(-12.635)	(-11.803)	(-8.488)	(-11.501)	(-7.656)
Tang	-0.008	0.001	-0.009	0.001	-0.009	0.001
	(-0.824)	(0.062)	(-0.880)	(0.118)	(-0.897)	(0.127)
MTB^a	0.015***	-0.019***	0.016***	-0.017***	0.017***	-0.017***
	(6.256)	(-10.973)	(6.496)	(-10.010)	(6.653)	(-9.799)
Prof	-0.057**	-0.260***	-0.057**	-0.260***	-0.056**	-0.259***
	(-2.362)	(-11.599)	(-2.345)	(-11.636)	(-2.320)	(-11.589)
Dep	0.241***	0.585***	0.246***	0.583***	0.248***	0.583***
	(3.041)	(7.976)	(3.118)	(7.956)	(3.133)	(7.956)
R&D	-0.018	0.007	-0.013	0.015	-0.013	0.015
	(-0.228)	(0.113)	(-0.167)	(0.237)	(-0.163)	(0.230)
R&D_dum	0.008*	0.012***	0.008*	0.012***	0.008*	0.012***
	(1.944)	(3.067)	(1.913)	(2.979)	(1.926)	(3.007)
IndMed(B)	-0.068***		-0.071***		-0.072***	
	(-3.304)		(-3.419)		(-3.457)	
IndMed(M)		-0.024*		-0.025**		-0.029**
		(-1.903)		(-2.022)		(-2.312)
GDPC	0.005**	-0.000	0.006***	0.000	0.006***	0.001
	(2.401)	(-0.078)	(2.877)	(0.175)	(3.126)	(0.691)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(7.081)	(8.057)	(7.087)	(7.741)	(7.072)	(7.585)
GGDP	0.001	-0.001	0.001*	-0.000	0.001**	0.000
	(1.522)	(-1.307)	(1.914)	(-0.153)	(2.096)	(0.212)
Adj. R^2	0.049	0.079	0.049	0.078	0.049	0.079
N	120,764	120,764	120,764	120,764	120,764	120,764

Table 5: : **The Role of Information Environment - Accounting Standard:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm- and industry-level variables including *Size*^{a}, *Tang, MTB*^{a}, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.038***	-0.093***				
	(-2.841)	(-5.519)				
$CR\hat{A}SH$ ×*AccStd*	0.001***	0.001***				
	(2.767)	(4.943)				
$NCS\hat{K}EW$			-0.236**	-0.931***		
			(-2.197)	(-9.085)		
$NCS\hat{K}EW$ ×*AccStd*			0.003*	0.012***		
			(1.919)	(8.413)		
$DU\hat{V}OL$					-0.424**	-1.716***
					(-2.122)	(-9.055)
$DU\hat{V}OL$ ×*AccStd*					0.005*	0.021***
					(1.728)	(8.114)
AccStd	0.002***	0.002***	0.002***	0.002***	0.002***	0.003***
	(3.613)	(3.703)	(3.489)	(5.461)	(3.438)	(5.556)
Size^a	-0.015***	-0.012***	-0.014***	-0.010***	-0.013***	-0.009***
	(-13.910)	(-12.767)	(-11.399)	(-8.710)	(-11.092)	(-7.883)
Tang	-0.010	0.001	-0.011	-0.001	-0.011	-0.001
	(-0.955)	(0.108)	(-1.102)	(-0.140)	(-1.123)	(-0.154)
MTB^a	0.015***	-0.020***	0.016***	-0.019***	0.016***	-0.018***
	(6.017)	(-11.301)	(6.204)	(-10.427)	(6.381)	(-10.235)
Prof	-0.060**	-0.259***	-0.059**	-0.255***	-0.058**	-0.254***
	(-2.426)	(-11.392)	(-2.381)	(-11.248)	(-2.357)	(-11.209)
Dep	0.243***	0.580***	0.252***	0.598***	0.254***	0.599***
	(3.045)	(7.875)	(3.166)	(8.118)	(3.189)	(8.134)
R&D	-0.034	0.004	-0.029	0.001	-0.029	-0.000
	(-0.443)	(0.069)	(-0.381)	(0.018)	(-0.378)	(-0.003)
R&D_dum	0.004	0.009**	0.004	0.009**	0.004	0.009**
	(1.007)	(2.318)	(0.905)	(2.193)	(0.916)	(2.221)
IndMed(B)	-0.070***		-0.070***		-0.071***	
	(-3.298)		(-3.262)		(-3.304)	
IndMed(M)		-0.026**		-0.023*		-0.027**
		(-1.997)		(-1.773)		(-2.078)
GDPC	0.004*	0.005**	0.005**	0.006***	0.005**	0.007***
	(1.835)	(2.195)	(2.252)	(2.593)	(2.451)	(3.070)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(6.694)	(8.507)	(6.704)	(8.396)	(6.656)	(8.153)
GGDP	0.001*	-0.001	0.002**	-0.000	0.002**	0.000
	(1.803)	(-1.182)	(2.171)	(-0.110)	(2.366)	(0.305)
Adj. R^2	0.050	0.079	0.050	0.079	0.050	0.079
N	118,421	118,421	118,421	118,421	118,421	118,421

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Table 6: : **The Role of Information Environment - Analyst:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm and industry-level variables including *Size*^{a}, *Tang, MTB*^{a}, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.008***	-0.023***				
	(-2.988)	(-7.372)				
$CR\hat{A}SH$ ×*Analyst*	0.001***	0.001***				
	(3.395)	(5.269)				
$NCS\hat{K}EW$			-0.097***	-0.286***		
			(-3.672)	(-11.012)		
$NCS\hat{K}EW$ ×*Analyst*			0.004***	0.012***		
			(3.055)	(9.749)		
$DU\hat{V}OL$					-0.198***	-0.586***
					(-4.010)	(-12.023)
$DU\hat{V}OL$ ×*Analyst*					0.008***	0.024***
					(2.951)	(9.705)
Analyst	0.001*	0.001**	0.000	0.001**	0.000	0.001***
	(1.804)	(2.282)	(0.797)	(2.206)	(1.037)	(2.995)
Size^a	-0.015***	-0.013***	-0.014***	-0.011***	-0.014***	-0.010***
	(-14.174)	(-13.206)	(-11.915)	(-9.505)	(-11.620)	(-8.731)
Tang	-0.009	-0.002	-0.010	-0.004	-0.010	-0.004
	(-0.884)	(-0.230)	(-0.967)	(-0.431)	(-0.975)	(-0.411)
MTB^a	0.015***	-0.021***	0.016***	-0.020***	0.016***	-0.019***
	(5.911)	(-11.478)	(6.015)	(-10.775)	(6.210)	(-10.531)
Prof	-0.058**	-0.258***	-0.056**	-0.253***	-0.055**	-0.253***
	(-2.364)	(-11.337)	(-2.262)	(-11.037)	(-2.258)	(-11.059)
Dep	0.255***	0.606***	0.268***	0.636***	0.269***	0.635***
	(3.171)	(8.193)	(3.334)	(8.633)	(3.350)	(8.618)
R&D	-0.030	0.006	-0.028	-0.008	-0.026	-0.010
	(-0.387)	(0.100)	(-0.365)	(-0.122)	(-0.341)	(-0.150)
R&D_dum	0.007	0.010**	0.007*	0.011***	0.007*	0.011***
	(1.644)	(2.472)	(1.679)	(2.720)	(1.674)	(2.692)
IndMed(B)	-0.080***		-0.083***		-0.083***	
	(-3.813)		(-3.914)		(-3.938)	
IndMed(M)		-0.025*		-0.032**		-0.035***
		(-1.929)		(-2.489)		(-2.789)
GDPC	0.007***	0.005**	0.009***	0.009***	0.010***	0.010***
	(3.475)	(2.513)	(4.248)	(4.105)	(4.423)	(4.550)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(7.548)	(9.481)	(7.423)	(9.502)	(7.405)	(9.364)
GGDP	0.001*	-0.001	0.001**	-0.000	0.002**	0.000
	(1.710)	(-1.439)	(2.116)	(-0.262)	(2.293)	(0.122)
Adj. R^2	0.049	0.079	0.050	0.079	0.050	0.080
N	118,421	118,421	118,421	118,421	118,421	118,421

Table 7: : **The Role of Information Environment - Financial Transparency:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm and industry-level variables including $Size^a$, *Tang*, MTB^a, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.001	-0.008***				
	(-0.576)	(-5.478)				
$CR\hat{A}SH \times FinTra$	0.009***	0.010***				
	(4.020)	(3.882)				
$NCS\hat{K}EW$			-0.043***	-0.081***		
			(-2.587)	(-5.051)		
$NCS\hat{K}EW \times FinTra$			0.039**	0.075***		
			(2.507)	(5.147)		
$DU\hat{V}OL$					-0.096***	-0.185***
					(-3.081)	(-6.173)
$DU\hat{V}OL \times FinTra$					0.068**	0.135***
					(2.311)	(4.901)
FinTra	0.005	-0.003	-0.005	-0.013***	-0.004	-0.012***
	(0.907)	(-0.439)	(-1.035)	(-2.891)	(-0.868)	(-2.592)
$Size^a$	-0.014***	-0.012***	-0.014***	-0.011***	-0.014***	-0.010***
	(-13.643)	(-12.336)	(-11.652)	(-9.633)	(-11.353)	(-8.929)
Tang	-0.009	-0.004	-0.010	-0.005	-0.010	-0.004
	(-0.896)	(-0.420)	(-0.977)	(-0.499)	(-0.977)	(-0.461)
MTB^a	0.015***	-0.020***	0.016***	-0.019***	0.016***	-0.018***
	(5.820)	(-11.183)	(6.075)	(-10.499)	(6.265)	(-10.290)
Prof	-0.062**	-0.261***	-0.060**	-0.260***	-0.059**	-0.260***
	(-2.518)	(-11.289)	(-2.405)	(-11.252)	(-2.397)	(-11.272)
Dep	0.258***	0.575***	0.270***	0.592***	0.271***	0.592***
	(3.163)	(7.640)	(3.312)	(7.882)	(3.326)	(7.885)
R&D	-0.025	0.034	-0.022	0.023	-0.020	0.024
	(-0.323)	(0.520)	(-0.279)	(0.353)	(-0.254)	(0.370)
R&D_dum	0.007	0.013***	0.006	0.013***	0.006	0.013***
	(1.602)	(3.288)	(1.545)	(3.303)	(1.543)	(3.287)
IndMed(B)	-0.083***		-0.086***		-0.087***	
	(-3.883)		(-4.012)		(-4.060)	
IndMed(M)		-0.033***		-0.036***		-0.040***
		(-2.585)		(-2.830)		(-3.115)
GDPC	0.013***	0.014***	0.014***	0.017***	0.014***	0.017***
	(4.903)	(5.726)	(5.050)	(6.360)	(5.106)	(6.537)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(7.432)	(8.439)	(7.355)	(8.189)	(7.346)	(8.084)
GGDP	0.001*	-0.001	0.002**	-0.000	0.002**	-0.000
	(1.796)	(-1.256)	(2.336)	(-0.449)	(2.504)	(-0.148)
Adj. R^2	0.050	0.076	0.050	0.076	0.050	0.076
N	113,817	113,817	113,817	113,817	113,817	113,817

Table 8: : **The Role of Information Environment - Audit:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm and industry-level variables including *Size*^{a}, *Tang, MTB*^{a}, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.009	-0.013**				
	(-1.490)	(-2.002)				
$CR\hat{A}SH \times Audit$	0.003	0.001				
	(1.442)	(0.433)				
$NCS\hat{K}EW$			-0.106**	-0.139***		
			(-2.392)	(-3.365)		
$NCS\hat{K}EW \times Audit$			0.024**	0.021*		
			(1.976)	(1.884)		
$DU\hat{V}OL$					-0.177**	-0.268***
					(-2.166)	(-3.608)
$DU\hat{V}OL \times Audit$					0.033	0.029
					(1.456)	(1.440)
Audit	0.001	-0.029***	0.001	-0.025***	-0.000	-0.025***
	(0.153)	(-4.865)	(0.142)	(-6.106)	(-0.051)	(-6.008)
Size^a	-0.015***	-0.012***	-0.014***	-0.009***	-0.014***	-0.009***
	(-13.981)	(-12.544)	(-11.688)	(-8.549)	(-11.420)	(-7.795)
Tang	-0.008	0.003	-0.009	0.003	-0.009	0.003
	(-0.788)	(0.298)	(-0.883)	(0.289)	(-0.892)	(0.292)
MTB^a	0.015***	-0.021***	0.016***	-0.019***	0.016***	-0.018***
	(6.055)	(-11.292)	(6.235)	(-10.348)	(6.418)	(-10.202)
Prof	-0.057**	-0.259***	-0.057**	-0.260***	-0.056**	-0.258***
	(-2.337)	(-11.425)	(-2.309)	(-11.453)	(-2.283)	(-11.408)
Dep	0.248***	0.591***	0.255***	0.591***	0.257***	0.591***
	(3.107)	(8.010)	(3.204)	(8.005)	(3.230)	(8.015)
R&D	-0.030	-0.000	-0.027	0.003	-0.026	0.003
	(-0.391)	(-0.002)	(-0.351)	(0.044)	(-0.335)	(0.052)
R&D_dum	0.007*	0.013***	0.007*	0.013***	0.007*	0.013***
	(1.702)	(3.325)	(1.679)	(3.221)	(1.670)	(3.213)
IndMed(B)	-0.081***		-0.082***		-0.083***	
	(-3.826)		(-3.867)		(-3.929)	
IndMed(M)		-0.032**		-0.032**		-0.036***
		(-2.543)		(-2.571)		(-2.867)
GDPC	0.010***	0.024***	0.011***	0.024***	0.011***	0.025***
	(3.302)	(7.856)	(3.574)	(7.914)	(3.650)	(8.036)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(7.347)	(9.390)	(7.405)	(9.182)	(7.355)	(8.967)
GGDP	0.001	-0.002**	0.001*	-0.001	0.001**	-0.001
	(1.574)	(-2.429)	(1.902)	(-1.311)	(2.094)	(-0.889)
Adj. R^2	0.049	0.079	0.049	0.079	0.050	0.079
N	118,293	118,293	118,293	118,293	118,293	118,293

Table 9: : **The Role of Information Environment - Information Disclosure:** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6). Firm and industry-level variables including $Size^a$, *Tang*, MTB^a, *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.017***	-0.017***				
	(-4.441)	(-4.091)				
$\widehat{CRASH}$ ×*InfDis*	0.005***	0.002**				
	(5.624)	(2.508)				
$\widehat{NCSKEW}$			-0.143***	-0.200***		
			(-4.058)	(-5.914)		
$\widehat{NCSKEW}$ ×*InfDis*			0.035***	0.046***		
			(3.641)	(5.088)		
$\widehat{DUVOL}$					-0.275***	-0.368***
					(-4.154)	(-5.759)
$\widehat{DUVOL}$ ×*InfDis*					0.062***	0.074***
					(3.399)	(4.312)
InfDis	0.010***	0.002	0.006**	0.008***	0.006*	0.007**
	(3.179)	(0.797)	(1.995)	(2.845)	(1.923)	(2.383)
$Size^a$	-0.014***	-0.012***	-0.014***	-0.010***	-0.013***	-0.009***
	(-13.728)	(-12.075)	(-11.304)	(-8.527)	(-11.023)	(-7.930)
Tang	-0.007	0.001	-0.009	0.000	-0.009	0.000
	(-0.728)	(0.070)	(-0.873)	(0.016)	(-0.890)	(0.030)
MTB^a	0.015***	-0.019***	0.016***	-0.018***	0.016***	-0.018***
	(5.998)	(-10.845)	(6.071)	(-10.205)	(6.265)	(-10.003)
Prof	-0.061**	-0.261***	-0.059**	-0.260***	-0.059**	-0.261***
	(-2.455)	(-11.397)	(-2.409)	(-11.356)	(-2.408)	(-11.388)
Dep	0.230***	0.535***	0.237***	0.528***	0.240***	0.532***
	(2.830)	(7.124)	(2.920)	(7.043)	(2.961)	(7.094)
R&D	-0.019	0.028	-0.015	0.032	-0.014	0.031
	(-0.240)	(0.434)	(-0.188)	(0.500)	(-0.178)	(0.475)
R&D_dum	0.007	0.015***	0.007	0.014***	0.007	0.014***
	(1.640)	(3.701)	(1.582)	(3.648)	(1.581)	(3.627)
IndMed(B)	-0.074***		-0.073***		-0.074***	
	(-3.428)		(-3.403)		(-3.443)	
IndMed(M)		-0.029**		-0.026**		-0.030**
		(-2.207)		(-2.002)		(-2.264)
GDPC	0.005**	0.002	0.006***	0.002	0.007***	0.003
	(2.416)	(0.909)	(2.816)	(0.706)	(3.140)	(1.182)
MCAP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(7.302)	(7.962)	(7.381)	(7.974)	(7.326)	(7.782)
GGDP	0.001*	-0.000	0.001*	0.000	0.001**	0.000
	(1.751)	(-0.381)	(1.798)	(0.080)	(1.999)	(0.384)
Adj. R^2	0.050	0.076	0.050	0.076	0.050	0.076
N	114,744	114,744	114,744	114,744	114,744	114,744

Table 10: : **The Role of Information Environment - Accounting Standard (Over- and Under-leveraged Subsamples):** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6) in over- (Panel A) and under-leveraged (Panel B) subsamples. Firm and industry-level variables including *Size*[a], *Tang, MTB*[a]*, Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression but their coefficients are omitted for brevity. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

Panel A: Over-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.015	-0.145***				
	(-0.584)	(-4.047)				
$\widehat{CRASH} \times AccStd$	0.000	0.002***				
	(0.153)	(3.126)				
$\widehat{NCSKEW}$			-0.352*	-1.730***		
			(-1.885)	(-7.943)		
$\widehat{NCSKEW} \times AccStd$			0.003	0.018***		
			(1.250)	(6.000)		
$\widehat{DUVOL}$					-0.709**	-3.115***
					(-1.965)	(-7.591)
$\widehat{DUVOL} \times AccStd$					0.006	0.031***
					(1.287)	(5.386)
AccStd	0.002**	0.006***	0.003***	0.009***	0.003***	0.009***
	(2.110)	(4.804)	(3.367)	(7.970)	(3.385)	(7.805)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.042	0.099	0.043	0.108	0.043	0.110
N	42,003	40,350	42,003	40,350	42,003	40,350

Panel B: Under-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.049***	-0.117***				
	(-3.300)	(-5.506)				
$\widehat{CRASH} \times AccStd$	0.001***	0.002***				
	(3.745)	(5.649)				
$\widehat{NCSKEW}$			-0.161	-0.739***		
			(-1.310)	(-5.465)		
$\widehat{NCSKEW} \times AccStd$			0.003*	0.014***		
			(1.890)	(7.710)		
$\widehat{DUVOL}$					-0.383*	-1.578***
					(-1.687)	(-6.241)
$\widehat{DUVOL} \times AccStd$					0.007**	0.029***
					(2.184)	(8.453)
AccStd	0.002***	0.002**	0.001	-0.001	0.001*	-0.000
	(2.971)	(2.132)	(1.452)	(-1.375)	(1.765)	(-0.407)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.031	0.075	0.031	0.083	0.031	0.083
N	53,587	55,240	53,587	55,240	53,587	55,240

Table 11: : **The Role of Information Environment - Analyst (Over- and Under-leveraged Subsamples):** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6) in over- (Panel A) and under-leveraged (Panel B) subsamples. Firm and industry-level variables including *Size*[a], *Tang, MTB*[a], *Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression but their coefficients are omitted for brevity. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

Panel A: Over-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.008	-0.023***				
	(-1.562)	(-3.300)				
$\widehat{CRASH} \times Analyst$	-0.000	-0.001				
	(-0.081)	(-1.331)				
$\widehat{NCSKEW}$			-0.107**	-0.596***		
			(-2.343)	(-12.083)		
$\widehat{NCSKEW} \times Analyst$			-0.000	0.012***		
			(-0.004)	(4.568)		
$\widehat{DUVOL}$					-0.225***	-1.149***
					(-2.591)	(-12.167)
$\widehat{DUVOL} \times Analyst$					0.000	0.018***
					(0.069)	(3.586)
Analyst	-0.000	-0.002	-0.000	0.003***	-0.000	0.003***
	(-0.309)	(-1.551)	(-0.129)	(3.748)	(-0.068)	(3.330)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.041	0.098	0.042	0.106	0.042	0.108
N	42,003	40,350	42,003	40,350	42,003	40,350

Panel B: Under-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.009***	-0.026***				
	(-2.695)	(-7.086)				
$\widehat{CRASH} \times Analyst$	0.001***	0.003***				
	(4.666)	(10.986)				
$\widehat{NCSKEW}$			-0.008	-0.013		
			(-0.251)	(-0.344)		
$\widehat{NCSKEW} \times Analyst$			0.004***	0.017***		
			(2.608)	(9.225)		
$\widehat{DUVOL}$					-0.036	-0.101
					(-0.614)	(-1.441)
$\widehat{DUVOL} \times Analyst$					0.008**	0.036***
					(2.524)	(10.173)
Analyst	0.002***	0.004***	0.001***	0.000	0.001***	0.001**
	(4.803)	(7.253)	(3.549)	(1.039)	(3.735)	(2.187)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.031	0.076	0.031	0.083	0.031	0.083
N	53,587	55,240	53,587	55,240	53,587	55,240

Table 12: : **The Role of Information Environment - Financial Transparency (Over- and Under-leveraged Subsamples):** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6) in over- (Panel A) and under-leveraged (Panel B) subsamples. Firm and industry-level variables including $Size^a$, *Tang, MTB*^{a}*, Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression but their coefficients are omitted for brevity. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

Panel A: Over-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	-0.008***	-0.024***				
	(-2.659)	(-6.785)				
$CR\hat{A}SH \times FinTra$	0.001	-0.004				
	(0.303)	(-0.753)				
$NCS\hat{K}EW$			-0.100***	-0.441***		
			(-3.393)	(-14.363)		
$NCS\hat{K}EW \times FinTra$			-0.002	0.128***		
			(-0.064)	(4.325)		
$DU\hat{V}OL$					-0.205***	-0.907***
					(-3.563)	(-15.284)
$DU\hat{V}OL \times FinTra$					-0.008	0.202***
					(-0.139)	(3.446)
FinTra	-0.005	-0.035***	-0.005	0.013	-0.006	0.011
	(-0.452)	(-2.893)	(-0.620)	(1.298)	(-0.614)	(1.109)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.042	0.093	0.043	0.101	0.043	0.102
N	40,109	38,613	40,109	38,613	40,109	38,613

Panel B: Under-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$CR\hat{A}SH$	0.003*	0.004**				
	(1.904)	(2.071)				
$CR\hat{A}SH \times FinTra$	0.015***	0.029***				
	(5.486)	(9.230)				
$NCS\hat{K}EW$			0.033*	0.261***		
			(1.821)	(13.215)		
$NCS\hat{K}EW \times FinTra$			0.057***	0.109***		
			(3.192)	(5.546)		
$DU\hat{V}OL$					0.039	0.481***
					(1.153)	(13.133)
$DU\hat{V}OL \times FinTra$					0.117***	0.236***
					(3.403)	(6.358)
FinTra	0.025***	0.049***	0.004	-0.004	0.006	-0.001
	(3.695)	(6.154)	(0.972)	(-0.852)	(1.379)	(-0.251)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.031	0.069	0.031	0.076	0.031	0.076
N	51,490	52,986	51,490	52,986	51,490	52,986

Table 13: : **The Role of Information Environment - Audit (Over- and Under-leveraged Subsamples):** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6) in over- (Panel A) and under-leveraged (Panel B) subsamples. Firm and industry-level variables including *Size*^{a}*, Tang, MTB*^{a}*, Prof, Dep, Rd, Rd_dum*, and *IndMed*, and country-level variables including *GDPC, MCAP*, and *GGDP* are controlled in each regression but their coefficients are omitted for brevity. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

Panel A: Over-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.008	-0.027**				
	(-0.645)	(-2.096)				
$\widehat{CRASH}$ ×*Audit*	-0.000	-0.000				
	(-0.068)	(-0.114)				
$\widehat{NCSKEW}$			-0.263***	-0.688***		
			(-2.864)	(-7.386)		
$\widehat{NCSKEW}$ ×*Audit*			0.044*	0.087***		
			(1.808)	(3.391)		
$\widehat{DUVOL}$					-0.456**	-1.240***
					(-2.554)	(-6.954)
$\widehat{DUVOL}$ ×*Audit*					0.068	0.119**
					(1.414)	(2.418)
Audit	-0.001	-0.014	0.012	0.022**	0.012	0.022*
	(-0.081)	(-1.228)	(1.199)	(2.066)	(1.075)	(1.949)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.041	0.097	0.042	0.106	0.042	0.108
N	41,965	40,310	41,965	40,310	41,965	40,310

Panel B: Under-leveraged subsample

$\widehat{CRASH}$	-0.010	-0.027***				
	(-1.581)	(-3.292)				
$\widehat{CRASH}$ ×*Audit*	0.005**	0.010***				
	(2.530)	(3.558)				
$\widehat{NCSKEW}$			-0.031	-0.010		
			(-0.621)	(-0.185)		
$\widehat{NCSKEW}$ ×*Audit*			0.031**	0.089***		
			(2.247)	(6.219)		
$\widehat{DUVOL}$					-0.085	-0.071
					(-0.929)	(-0.742)
$\widehat{DUVOL}$ ×*Audit*					0.060**	0.182***
					(2.394)	(6.930)
Audit	-0.004	-0.025***	-0.011**	-0.039***	-0.011**	-0.037***
	(-0.655)	(-3.135)	(-2.462)	(-8.217)	(-2.290)	(-7.794)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.031	0.077	0.032	0.085	0.031	0.085
N	53,552	55,207	53,552	55,207	53,552	55,207

Table 14: : **The Role of Information Environment - Information Disclosure (Over- and Under-leveraged Subsamples):** This table presents the results from estimating the partial adjustment model (equation (8)) for book leverage (Columns 1, 3, and 5) and market leverage (Columns 2, 4, and 6) in over- (Panel A) and under-leveraged (Panel B) subsamples. Firm and industry-level variables including $Size^a$, *Tang*, MTB^a, *Prof*, *Dep*, *Rd*, *Rd_dum*, and *IndMed*, and country-level variables including *GDPC*, *MCAP*, and *GGDP* are controlled in each regression but their coefficients are omitted for brevity. Standard errors are robust to heteroskedasticity. Variable definitions are given in Appendix A. ***, ** or * next to coefficients indicate that coefficients are significantly different from zero at the 1%, 5%, or 10% levels, respectively.

Panel A: Over-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.032***	-0.008				
	(-3.159)	(-0.794)				
$\widehat{CRASH}$ ×*InfDis*	0.008***	-0.005				
	(2.579)	(-1.516)				
$\widehat{NCSKEW}$			-0.251***	-0.611***		
			(-3.441)	(-7.264)		
$\widehat{NCSKEW}$ ×*InfDis*			0.042**	0.074***		
			(2.059)	(3.223)		
$\widehat{DUVOL}$					-0.528***	-1.265***
					(-3.741)	(-7.647)
$\widehat{DUVOL}$ ×*InfDis*					0.090**	0.141***
					(2.256)	(3.122)
InfDis	0.018**	-0.004	0.012*	0.036***	0.014**	0.038***
	(2.126)	(-0.416)	(1.755)	(4.350)	(1.985)	(4.427)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.042	0.093	0.042	0.101	0.043	0.103
N	40,335	38,868	40,335	38,868	40,335	38,868

Panel B: Under-leveraged subsample

	BL [1]	*ML* [2]	*BL* [3]	*ML* [4]	*BL* [5]	*ML* [6]
$\widehat{CRASH}$	-0.010***	-0.008**				
	(-2.810)	(-2.025)				
$\widehat{CRASH}$ ×*InfDis*	0.004***	0.004***				
	(5.131)	(4.527)				
$\widehat{NCSKEW}$			-0.038	0.137***		
			(-1.016)	(3.445)		
$\widehat{NCSKEW}$ ×*InfDis*			0.031***	0.048***		
			(3.195)	(4.591)		
$\widehat{DUVOL}$					-0.087	0.276***
					(-1.262)	(3.817)
$\widehat{DUVOL}$ ×*InfDis*					0.059***	0.090***
					(3.193)	(4.610)
InfDis	0.006**	-0.006**	0.003	-0.005	0.003	-0.006*
	(2.097)	(-2.105)	(0.988)	(-1.622)	(0.941)	(-1.852)
Control variabls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.031	0.069	0.031	0.077	0.031	0.077
N	51,904	53,371	51,904	53,371	51,904	53,371

A Variable Definitions

A.1 Firm- and Industry-level Variables

A.1.1 Leverage measures

- Book leverage (*BL*): Book value of debt divided by book value of assets, (Worldscope)
- Market leverage (*ML*): Book value of debt divided by the sum of market value of equity and book value of debt, (Worldscope)
- Passive leverage (BL_P): Book value of debt divided by book value of assets plus one year lead term of net income, (Worldscope)

A.1.2 Crash-risk measures

- Stock price crash risk (*CRASH*): A firm week is defined as a crash week if the computed firm-idiosyncratic weekly return is 3.09 standard deviations below the mean return for firm i in a given year (Hutton, Marcus, and Tehranian (2009)). To measure a firm i's exposure to stock price crash risk in year t, we set the dummy variable $CRASH_{i,t}$ to one if firm i experiences one or more than one crash weeks during year t, and zero otherwise, (Datastream)
- Negative skewness (*NCSKEW*): The negative skewness of the firm-specific weekly return over the year, (Datastream)

- Return asymmetries (*DUVOL*): Natural logarithm of the ratio of the standard deviations of down-week to up-week firm-specific returns, (Datastream)

A.1.3 Firm- and industry-level control variables

1. Target leverage model (equation (1))

- Size ($Size^a$): Natural logarithm of book value of assets that are deflated to 2005 U.S. dollars by using the U.S. GDP deflator, (Worldscope)
- Tangibility (*Tang*): Net property, plant and equipment dividend by book value of assets, (Worldscope)
- Growth opportunity (MTB^a): Ratio of book value of assets less book value of equity plus market value of equity to book value of assets, (Worldscope)
- Profitability (*Prof*): Earnings before interest, taxes, depreciation and amortization divided by book value of assets, (Worldscope)
- Depreciation (*Dep*): Depreciation and amortization divided by book value of assets, (Worldscope)
- Research and development (*R&D*): Research and development expenses divided by book value of assets, (Worldscope)

- Research and development dummy (*R&D_dum*): A dummy equals to one if research and development expenses are not reported, and zero otherwise, (Worldscope)

- Industry median of book leverage (*IndMed(B)*): The median book leverage ratio of an industry to which a firm belongs. Industry is classified based on the Industry Classification Benchmark, (Worldscope)

- Industry median of market leverage (*IndMed(M)*): The median market leverage ratio of an industry to which a firm belongs. Industry is classified based on the Industry Classification Benchmark, (Worldscope)

- Industry median of market leverage (*IndMed(B_P)*): The median passive leverage ratio of an industry to which a firm belongs. Industry is classified based on the Industry Classification Benchmark, (Worldscope)

2. Crash prediction model (equation (6))

- Detrend turnover (*Dturn*): The average monthly share turnover over the current year minus the average monthly share turnover over the previous year, where monthly share turnover is calculated as the monthly trading volume divided by the total number of shares outstanding, (Datastream)

- Sigma (*Sigma*): The standard deviation of firm-specific weekly returns, (Datastream)

- Ret (*Ret*): The mean of firm-specific weekly returns, (Datastream)

- Size ($Size^e$): Natural logarithm of market value of equity which deflated to 2005 U.S. dollars by using the U.S. GDP deflator, (Worldscope)
- Growth opportunity (MTB^e): Ratio of market value of equity to book value of equity, (Worldscope)
- Long-term debt ratio (LD): Book value of long-term debt divided by book value of assets, (Worldscope)
- Return on asset (ROA): Income before extraordinary items divided by lagged book value of total assets, (Worldscope)
- Earning opacity ($ACCM$): The moving sum of the prior three years' absolute value of discretionary accruals, where discretionary accruals are estimated from the Modified Jones Model.

A.2 Information Environment Variables

- Accounting standards ($AccStd$): Average inclusion or omission of the 90 accounting and non-accounting items by examining the 1995 annual reports of the firms, (Bushman, Piotroski, and Smith (2004))
- Analyst following ($Analyst$): Number of analysts following the largest 30 companies in 1996, (Bushman, Piotroski, and Smith (2004))

- Financial transparency (*FinTra*): Relative financial information availability to those outside the firm due to financial information disclosure, interpretation, and dissemination by firms, financial analysts, and media reporters, (Bushman, Piotroski, and Smith (2004))

- Auditing practices (*Audit*): *Audit* equals 1, 2, 3 or 4 if the percentage of firms in the country audited by the big five accounting firms ranges between [0, 25%], (25%, 50%], (50%, 75%] and (75%, 100%], respectively, (Bushman, Piotroski, and Smith (2004))

- Information disclosure (*InfDis*): The state of financial information disclosure of the country. The index is scaled from 1 (opaque) to 7 (transparent), (Financial Development Report)

A.3 Country-level Control Variables

- GDP per capita (*GDPC*): Natural logarithm of GDP per capita measured in U.S. dollars, (World development indicator)

- Stock market cap to GDP (*MCAP*): Stock market capitalization scaled by GDP, (World development indicator)

- GDP growth (*GGDP*): Annual GDP growth rate, (World development indicator)

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Highlights

- We examine the effect of crash-risk exposure on the speed of leverage adjustment.
- We investigate the role of information environment in reshaping the effect.
- Our sample includes 19,247 firms across 41 countries from 1989 to 2013.
- Increasing crash-risk exposure tends to reduce the speed of leverage adjustment.
- This negative relation is mitigated by a transparent information environment.