# The Causal Effect of Improved Readability of Financial Reporting on Stock Price Crash Risk: Evidence from the Plain Writing Act of 2010

Shiyan Yin* Thanaset Chevapatrakul† Kai Yao‡

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**Abstract**

This paper shows that obfuscating financial reports leads to an increase in the risk of stock price crash. Exploiting the Plain Writing Act of 2010 (PWA) as the exogenous source of variation, the results of the difference-in-differences (DID) estimation show that improved readability of 10-Ks, as a result of the PWA, caused the stock price crash risk to fall. Our results survive the falsification check and are robust under different measures of readability and crash risk.

**JEL classification:** C3; G38; M40

**Keywords:** Crash risk; financial reporting; readability; textual analysis

*Nottingham University Business School, Jubilee Campus, University of Nottingham, Nottingham, United Kingdom, NG8 1BB. Email: Shiyan.Yin@nottingham.ac.uk

†Nottingham University Business School, Jubilee Campus, University of Nottingham, Nottingham, United Kingdom, NG8 1BB. Email: Thanaset.Chevapatrakul@nottingham.ac.uk.

‡Corresponding author at Southwestern University of Finance and Economics, 555 Liutai Avenue, Chengdu, 611130, China. Email: yaokai@swufe.edu.cn

# 1 Introduction

Most US public firms are required by law to produce a 10-K and submit it to the US Securities and Exchange Commission (SEC) every year. The report contains detailed disclosure about the firm's operating and financial results as well as its business risks. By law, companies are prohibited from making false statements or omitting value relevant information from their 10-K.

Some managers are motivated to withhold bad news about their firm from investors by making their 10-Ks less transparent for reasons such as compensation contracts, career concerns, and desires to capture a portion of firm's cash flow. Bad news hoarding by obfuscating financial reports could lead to a violent drop in stock price when the accumulation of bad news reaches a tipping point and can no longer be contained. Firms with difficult-to-read 10-Ks are therefore prone to the risk of stock price crash. This paper demonstrates that firms can reduce the risk of stock price crash by ensuring that their 10-Ks are easy to read.

Our paper connects literature on stock price crash risk (Andreou et al. 2017, Chang et al. 2017, Jia 2018, Wu & Lai 2020) to that on textual analysis of financial reports (Boudoukh et al. 2013, Loughran & Mcdonald 2011, 2014, Bodnaruk et al. 2015, Ertugrul et al. 2017, Del Gaudio et al. 2020, Choi et al. 2021, Rjiba et al. 2021). Measuring the causal effect of financial report's readability on crash risk is empirically challenging due to self selection bias. Companies that are prone to crash risk are likely to hide bad news by obfuscating financial reports. To address endogeneity, we employ difference-in-differences (DID) as the main identification strategy and exploit the Plain Writing Act of 2010 (PWA) as an external shock to the readability of 10-K. While this paper is closely related to Kim et al. (2019), our empirical approach sets our work apart from theirs.

The PWA was conceived out of a desire to make documents produced by the government or government agencies easier to read by the general public.[1] Its passage marked the first time that plain writing was legislated at the federal level in the US. The use of the PWA as an exogenous shock to readability is appealing because, as stated in Hwang & Kim (2017), this piece of legislation was not motivated by or primarily designed for making financial disclosures easier to read but rather represents the results of broader efforts to make government transparent.[2]

We hypothesise that while the PWA had an incremental positive impact on the readability of 10-K in general, the effect was particularly stronger among firms with difficult-to-read 10-Ks than firms whose 10-Ks were easy to read. We expect the risk of stock price crash of the former to decline disproportionately compared to that of the latter after the bill was passed by Congress in 2010.

Our empirical results confirm the hypothesis. We find that, after the bill became law, readability of 10-Ks filed by firms with the lowest (i.e., poorest) readability scores improved disproportionately compared to that of 10-Ks submitted by firms with the highest (i.e., most excellent) readability

[1]Public Law 111–274, 111th Congress, October 13, 2010

[2]See Cheek (2011) for more information about the passage of the PWA.

scores. We can also report that firms with difficult-to-read 10-Ks experienced disproportionately larger drops in the risk of crash compared to those with easy-to-read 10-Ks during the same period.

## 2 Data and Sample

We measure readability of 10-K using the Fog Index, the Flesch-Kincaid Index, and 10-K file size. The Fog Index, denoted *FOG*, indicates the number of years of formal education required by the reader to understand the document on a first reading and is calculated as follows:

$$FOG = 0.4 \times \left[\text{Average number of words per sentence} + \left(\frac{\text{Number of complex words}}{\text{Total number of words}}\right) \times 100\right] \quad (1)$$

where complex words are defined as words with three or more syllables. The index value of 18 or higher indicates that the text is unreadable; 14–18 difficult; 12–14 ideal; 10–12 acceptable; and 8–10 childish (Li 2008).

The Flesch-Kincaid Index, denoted *FLESCH_KINCAID*, also rates text by a US grade school level but, unlike the Fog Index, uses the average number of syllables per word as the second term. It is computed as follows:

$$\begin{aligned} FLESCH\_KINCAID = 0.39 \times \left(\frac{\text{Total number of words}}{\text{Total number of sentences}}\right) \\ + 11.8 \times \left(\frac{\text{Total number of syllables}}{\text{Total number of words}}\right) - 15.59. \end{aligned} \quad (2)$$

As an example, a Flesch-Kincaid score of 6 means that the document could be understood by an average six grader.

Following Loughran & Mcdonald (2014), we use 10-K file size (in logarithm of bytes), denoted *10K_SIZE*, as the third readability measure. A smaller 10-K is considered easier to read than a larger 10-K. Loughran & Mcdonald (2014) showed that file size provides a simple readability metric that outperforms the Fog Index, does not require text parsing, allows for replication, and is correlated with other readability measures. The authors argued that managers are more likely to bury firm financial results in longer documents in their attempts to obscure performance-related information than using complex words in their reports.

We employ three crash risk measures in the analysis. The first measure, $NUMCRASH_{j,t}$, is the number of stock price crashes, experienced by firm $j$ in fiscal year $t$ (Wu & Lai 2020). A crash is defined as a tail event where the firm-specific weekly return in week $w$, $W_{j,w}$, drops below 3.09 standard deviations from the mean weekly return computed over fiscal year $t$ where

$$W_{j,w} = \ln\left(1 + \hat{\varepsilon}_{j,w}\right) \quad (3)$$

where $\hat{\varepsilon}_{j,w}$ is the residual, estimated from the following expanded market model:

$$r_{j,w} = \alpha_j + \beta_{1,j} r_{m,w-1} + \beta_{2,j} r_{i,w-1} + \beta_{3,j} r_{m,w} + \beta_{4,j} r_{i,w} + \beta_{5,j} r_{m,w+1} + \beta_{6,j} r_{i,w+1} + \varepsilon_{j,w} \quad (4)$$

where $r_{j,w}$ is the return on stock $j$, $r_{m,w}$ is the return on the CRSP value-weighted market index, and $r_{i,w}$ is the return on Fama-French's value-weighted index of industry $i$.[3]

We employ the negative coefficient of skewness of $W_{j,w}$ over fiscal year $t$,

$$NCSKEW_{j,t} = \frac{-\left[n\,(n-1)^{\frac{3}{2}} \sum W_{j,w}^3\right]}{(n-1)\,(n-2)\left(\sum W_{j,w}^2\right)^{\frac{1}{2}}}, \quad (5)$$

as our second measure of crash risk following Chen et al. (2001), Kim et al. (2011*a*,*b*) where $n$ is the number of weekly return observations during fiscal year $t$.[4]

The third measure of stock price crash risk is the down-to-up volatility,

$$DUVOL_{j,t} = \ln\left[\frac{(n_u - 1)\sum_{\text{Down}} W_{j,w}^2}{(n_d - 1)\sum_{\text{Up}} W_{j,w}^2}\right], \quad (6)$$

where $n_u$ and ($n_d$) is the number of "up" ("down") weeks observed during fiscal year $t$. "Up" ("Down") weeks are defined as weeks when returns rise (fall) above (below) the annual mean firm-specific return (Chen et al. 2001).

Our sample covers a period between 2004 and 2011. Data for 2009–2011 are used in the estimation of the casual effect of readability on crash risk while data for 2004–2009 are employed in the falsification tests. We download the Fog and the Flesch-Kincaid Indices from Feng Li's website, all the 10-Ks from the SEC's EDGAR database, data on individual stock prices and the market index from CRSP, Fama-French's value-weighted industry index returns from Kenneth R. French's Data Library, and the firm characteristics from Compustat.[5]

## 3 Empirical Analysis

We classify firms in our sample into those with the most difficult-to-read 10-Ks (treated) and those with the easiest-to-read 10-Ks (control). Specifically, for each readability measure, we sort firms into five quintile portfolios based on their 10-Ks' readability scores in 2009. Treated (control)

[3] We include the lead and the lag terms of the market and the industry returns to capture the effects of nonsynchronous trading (Dimson 1979, Hutton et al. 2009).

[4] The *NCSKEW* measure normalises the negative value of the third moment of firm-specific weekly returns using the standard deviation firm-specific weekly returns raised to the third power.

[5] Feng Li's website: https://webuser.bus.umich.edu/feng/ (retrieved on October 8, 2021); the SEC's EDGAR database: https://www.sec.gov/edgar/searchedgar/companysearch.html; and Kenneth R. French's Data Library: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

firms are those with the most difficult-to-read (easiest-to-read) 10-Ks and are assigned to the top (bottom) quintile portfolio. After discarding firms in the intermediate quintile portfolios, we match treated firms to control firms using propensity score matching (PSM). We employ the following covariates in the estimation of propensity scores: firm size ($FIRM\_SIZE$), the book-to-market ratio ($B/M$), leverage ($LEV$), return on equity ($ROE$), return skewness ($SKEW$), return kurtosis ($KURT$), and the measure of opacity of financial statement ($OPAQUE$), computed following Hutton et al. (2009).[6,7]

We report the descriptive statistics in Table 1. Consistent with Li (2008), average 10-Ks in our sample appear to be very difficult to read. The mean Fog Index of 18.900 indicates that an average annual report in the sample is "unreadable". The average Flesch-Kincaid Index of 15.230 suggests that at least a bachelor degree is required to understand the document. The distributions of $NUMCRASH$, $NCSKEW$, and $DUVOL$ are all consistent with those reported in Hutton et al. (2009), An & Zhang (2013), Chang et al. (2017), Andreou et al. (2017).

We first investigate if the PWA led to improved 10-Ks' readability after the bill became law in 2010 by estimating the following model:

$$READABILITY_{j,t} = \beta_0 + \beta_1 TREAT_j + \beta_2 POST_t + \beta_3 \left(TREAT_j \times POST_t\right) + \varepsilon_{j,t} \qquad (7)$$

where $TREAT_j = 0$ if firm $j$ is a control firm and $TREAT_j = 1$ if firm $j$ is a treated firm in 2009. $POST_{2009} = 0$ and $POST_{2010} = POST_{2011} = 1$. $READABILITY_{j,t}$ is proxied by $FOG_{j,t}$, $FLESCH\_KINCAID_{j,t}$, and $FILE\_SIZE_{j,t}$. We hypothesise that after the bill was passed by Congress, requiring the government to write more clearly, firms with difficult-to-read 10-Ks saw a permanent and disproportionate improvement in their 10-Ks' readability scores compared to firms with easy-to-read 10-Ks.

As expected, the estimates of $\beta_3$, reported in Table 2, are all negative and statistically significant at the 1% significance level, indicating that, after 2010, the readability of difficult-to-read 10-Ks improved significantly and disproportionately compared to that of easy-to-read 10-Ks. The estimates of $\beta_3$ of $-3.083$ and $-2.865$ suggest that the Fog and the Flesch-Kincaid Indices of the treated firms declined by approximately 3 points more than those of the control firms, respectively. During the same period, file size of an average difficult-to-read 10-K fell by about 38% compared to that of an easy-to-read 10-K based on the estimate of $\beta_3$ of $-0.380$.

To examine the casual effect of improved readability on the risk of stock price crash, we estimate

[6] Firm size is computed using the logarithm of total assets. Leverage is calculated as the ratio of long-term debt to the book value of total assets. The measure of opacity is calculated as the three-year moving sum of the absolute values of annual discretionary accrual.

[7] Tests of covariate balance between the two groups show no statistical differences in the means of the covariates between observations in the treated and the control groups across the three readability measures.

the following model using data for 2009–2011:

$$CRASH_{j,t} = \gamma_0 + \gamma_1 TREAT_j + \gamma_2 POST_t + \gamma_3 \left( TREAT_j \times POST_t \right) + \varepsilon_{j,t} \tag{8}$$

using samples of firms, constructed using the different readability measures where $CRASH_{j,t}$ is proxied by $NUMCRASH_{j,t}$, $NCSKEW_{j,t}$, and $DUVOL_{j,t}$. We expect the estimates of $\gamma_3$ to be negative and statistically significant.

Panels A–C in Table 3 report the estimation results. Except for the specification where 10-Ks are classified by *10K_SIZE* and the dependent variable is *NUMCRASH*, the estimates of $\gamma_3$ are all negative and statistically significant at the conventional levels, indicating that after the commencement of the PWA, improved readability caused the risk of stock price crash among firms with difficult-to-read 10-Ks to fall disproportionately compared to the risk of crash among firms with easy-to-read 10-Ks.[8]

To ensure that our results are not sensitive to the number of portfolios employed in the classification of treated and control firms, we conduct a robustness check where, for each readability measure, we sort firms into four quartile portfolios based on the values of the readability measure. We match treated firms in the top quartile portfolio to control firms in the bottom quartile portfolio using PSM. After discarding observations in the second and the third quartile portfolios, we estimate Eq. (8) for *NUMCRASH*, *NCSKEW*, and *DUVOL*. The results, reported in Table A1 in the Appendix, remain qualitatively unchanged. The estimates of $\gamma_3$ are negative and statistically significant except when treated and control firms are classified based on *10K_SIZE* and when crash risk is measured using *NUMCRASH* and *NCSKEW*.

Finally, we conduct falsification checks using data for periods preceding the enforcement of the PWA to ensure that our results reported above are valid. Specifically, we estimate Eq. (8) using observations for the following periods: 2005–2006, 2006–2007, 2007–2008, and 2008–2009. For each period, similar to the sample construction for the main analysis, firms are sorted into five quintile portfolios and assigned to the treated and the control groups based on their readability scores. We expect to find no policy impact on the risk of crash before the commencement of the PWA. Thus we anticipate that the estimates of $\gamma_3$ are all indistinguishable from zero.

Results of the falsification checks are presented in Table 4. For brevity, for each readability measure, we only report the estimates of $\gamma_3$ for each estimation period and measure of crash risk under investigation. None of the estimates of $\gamma_3$ are statistically different from zero, indicating the absence of meaningful difference in crash risk between firms with difficult-to-read 10Ks and firms with easy-to-read 10Ks during the periods preceding the PWA.

[8] We also estimate Eq. (8) including the control variables. The results remain qualitatively unchanged and are consistent with those reported in Table 3. These results are available upon request from the corresponding author.

## 4 Conclusions

This paper shows that firms can reduce the risk of stock price crash by writing financial reports that are easy to read. Using DID as the identification strategy and exploiting the PWA as the exogenous source of variation, our results suggest that after the PWA, the readability of difficult-to-read 10-Ks improved markedly compared to that of easy-to-read 10-Ks. The improvement in readability of 10-Ks brought about a disproportionate decline in crash risk among firms with difficult-to-read 10-Ks compared to that of firms with easy-to-read 10-Ks. Our attempt to falsify the main findings fail to detect any meaningful impact on crash risk in the absence of policy impact during periods prior to the commencement of PWA. Our paper provides strong evidence that obfuscating financial reports to withhold bad news from investors increases the risk of stock price crash and should be avoided by managers.

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## Table 1

### Summary Statistics

This table reports the numbers of observations, averages, standard deviations, minima, medians, and maxima of all the variables employed in the empirical analysis during 2009–2011. *FOG* denotes the Fog Index and is calculated following Eq. (1). *FLESCH_KINCAID* is the Flesch-Kincaid Index and is estimated using Eq. (2). *FILE_SIZE* is the 10-K file size (in logarithm of bytes). *NUMCRASH* is the number of stock price crashes in the fiscal year. *NCSKEW* is the negative coefficient of skewness of weekly returns in the fiscal year, estimated following Eq. (5). *DUVOL* is the down-to-up volatility, computed using Eq. (6). *FIRM_SIZE* is the logarithm of total assets. *B/M* is the book-to-market ratio. *LEV* is the leverage. *ROE* is the return on equity. *SKEW* is the return skewness. *KURT* is the return kurtosis. *OPAQUE* is the measure of opacity of financial statement, estimated following Hutton et al. (2009).

| | Observations | Mean | Std Dev | Min | Median | Max |
|---|---|---|---|---|---|---|
| *FOG* | 4,719 | 18.900 | 4.741 | 0.000 | 19.751 | 34.114 |
| *FLESCH_KINCAID* | 4,719 | 15.230 | 3.981 | 0.000 | 15.763 | 34.146 |
| *10K_SIZE* | 4,719 | 14.819 | 0.963 | 11.760 | 14.575 | 18.388 |
| *NUMCRASH* | 4,719 | 0.203 | 0.413 | 0.000 | 0.000 | 6.000 |
| *NCSKEW* | 4,719 | −0.058 | 0.787 | −2.237 | −0.081 | 2.523 |
| *DUVOL* | 4,719 | −0.179 | 0.720 | −1.904 | −0.203 | 1.655 |
| *FIRM_SIZE* | 4,719 | 6.323 | 2.035 | 1.762 | 6.361 | 11.116 |
| *M/B* | 4,719 | 2.546 | 3.624 | −10.426 | 1.829 | 23.242 |
| *LEV* | 4,719 | 0.492 | 0.276 | 0.005 | 0.472 | 4.352 |
| *ROE* | 4,719 | −0.010 | 0.654 | −4.243 | 0.081 | 2.560 |
| *OPAQUE* | 4,719 | 0.228 | 0.390 | 0.001 | 0.176 | 21.390 |
| *SKEW* | 4,719 | 0.594 | 0.559 | 0.007 | 0.432 | 2.862 |
| *KURT* | 4,719 | 1.743 | 2.571 | −0.775 | 0.970 | 13.992 |

## Table 2

## The Estimates of the Effects of the Plain Writing Act of 2010 on 10-K Readability during 2009–2011

This table reports the estimation results of the difference-in-differences model as specified in Eq. (7) using a sample of the readability measures during 2009–2011. The measures of readability are the Fog Index (*FOG*), the Flesch-Kincaid Index (*FLESCH_KINCAID*), and 10-K file size (*10K_SIZE*). Standard errors are clustered at the firm level and are reported in the parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | *FOG* | *FLESCH_KINCAID* | *10K_SIZE* |
|---|---|---|---|
| *TREAT* | −9.158*** | −8.187*** | −1.786*** |
| | (0.808) | (0.659) | (0.150) |
| *POST* | 0.257 | 0.191 | 0.493*** |
| | (0.412) | (0.338) | (0.119) |
| *TREAT* × *POST* | −3.083*** | −2.865*** | −0.380*** |
| | (0.551) | (0.467) | (0.120) |
| Observations | 1,849 | 1,844 | 1,589 |
| R-squared | 0.348 | 0.413 | 0.808 |
| Firms | 1,323 | 1,329 | 1,027 |

## Table 3

## The Estimates of the Effects of the Plain Writing Act of 2010 on Stock Price Crash Risk during 2009–2011

This table reports the estimation results of the difference-in-differences model as specified in Eq. (8) using the sample of crash risk and readability measures for period 2009–2011. The crash risk measures are *NUMCRASH*, *NCSKEW*, and *DUVOL*. For each readability measure, we sort firms into five quintile portfolios based on the values of the measure. We match treated firms in the top quintile portfolio to control firms in the bottom quintile portfolio using propensity score matching. Panel A, B, and C show the estimation results where *FOG*, *FLESCH_KINCAID*, and *10K_SIZE* are employed in the sorting, respectively. Standard errors are clustered at the firm level and are reported in the parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | *NUMCRASH* | *NCSKEW* | *DUVOL* |
|---|---|---|---|
| *Panel A: Fog Index (FOG)* | | | |
| *TREAT* | 0.137 | 0.217 | 0.094 |
| | (0.094) | (0.185) | (0.114) |
| *POST* | 0.107 | 0.174 | 0.083 |
| | (0.073) | (0.156) | (0.094) |
| *TREAT* × *POST* | −0.126* | −0.256* | −0.159* |
| | (0.070) | (0.149) | (0.089) |
| Observations | 1,382 | 1,384 | 1,382 |
| R-squared | 0.016 | 0.001 | 0.001 |
| Firms | 1,092 | 1,036 | 1,040 |
| *Panel B: Flesch-Kincaid Index (FLESCH_KINCAID)* | | | |
| *TREAT* | 0.079 | 0.398** | 0.063 |
| | (0.090) | (0.175) | (0.068) |
| *POST* | 0.123* | 0.364*** | 0.116* |
| | (0.072) | (0.139) | (0.065) |
| *TREAT* × *POST* | −0.164** | −0.289** | −0.117* |
| | (0.081) | (0.138) | (0.066) |
| Observations | 1,384 | 1,386 | 2,148 |
| R-squared | 0.017 | 0.029 | 0.002 |
| Firms | 1,095 | 1,026 | 1,502 |
| *Panel C: 10-K File Size (10K_SIZE)* | | | |
| *TREAT* | 0.188 | 0.702** | 0.272** |
| | (0.186) | (0.297) | (0.110) |
| *POST* | 0.080 | −0.008 | 0.201** |
| | (0.093) | (0.090) | (0.092) |
| *TREAT* × *POST* | −0.108 | −0.255* | −0.145* |
| | (0.088) | (0.142) | (0.086) |
| Observations | 1,044 | 1,050 | 1,292 |
| R-squared | 0.027 | 0.042 | 0.026 |
| Firms | 813 | 817 | 945 |

## Table 4

## The Estimates of the Effects of the Plain Writing Act of 2010 on Stock Price Crash Risk during 2005–2008

This table reports results of the falsification test where the difference-in-differences model as specified in Eq. (8) are estimated using a sample of the crash risk and the readability measures for periods 2005–2006, 2006–2007, 2007–2008, and 2008–2009. The crash risk measures are *NUMCRASH*, *NCSKEW*, and *DUVOL*. For each readability measure, we sort firms into five quintile portfolios based on the values of the measure. We match treated firms in the top quintile portfolio to control firms in the bottom quintile portfolio using propensity score matching. Statistics reported in Panel A, B, and C are the estimates of $\gamma_3$ along with their standard errors where *FOG*, *FLESCH_KINCAID*, and *10K_SIZE* are employed in the sorting, respectively. Standard errors are clustered at the firm level and are reported in the parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | *NUMCRASH* | *NCSKEW* | *DUVOL* |
|---|---|---|---|
| *Panel A: Fog Index (FOG)* | | | |
| 2005–2006 | −0.060 | 0.268 | 0.269 |
| | (0.117) | (0.227) | (0.212) |
| 2006–2007 | −0.031 | −0.009 | −0.023 |
| | (0.054) | (0.199) | (0.106) |
| 2007–2008 | −0.002 | 0.299 | 0.217 |
| | (0.187) | (0.317) | (0.310) |
| 2008–2009 | −0.040 | 0.081 | 0.026 |
| | (0.037) | (0.081) | (0.063) |
| *Panel B: Flesch-Kincaid Index (FLESCH_KINCAID)* | | | |
| 2005–2006 | −0.076 | −0.012 | 0.038 |
| | (0.125) | (0.229) | (0.211) |
| 2006–2007 | −0.031 | 0.072 | −0.023 |
| | (0.054) | (0.147) | (0.106) |
| 2007–2008 | −0.002 | 0.299 | 0.217 |
| | (0.187) | (0.317) | (0.310) |
| 2008–2009 | −0.054 | 0.071 | 0.032 |
| | (0.035) | (0.078) | (0.061) |
| *Panel C: 10-K File Size (10K_SIZE)* | | | |
| 2005–2006 | 0.057 | −0.023 | 0.047 |
| | (0.163) | (0.282) | (0.265) |
| 2006–2007 | 0.004 | −0.097 | −0.051 |
| | (0.061) | (0.124) | (0.108) |
| 2007–2008 | −0.037 | −0.149 | 0.084 |
| | (0.173) | (0.368) | (0.319) |
| 2008–2009 | −0.007 | −0.014 | 0.128 |
| | (0.049) | (0.101) | (0.083) |

# Appendix

**Table A1**

**The Estimates of the Effects of the Plain Writing Act of 2010 on Stock Price Crash Risk during 2009–2011**

This table reports the estimation results of the difference-in-differences model as specified in Eq. (8) using a sample of the crash risk and the readability measures for period 2009–2011. The crash risk measures are *NUMCRASH*, *NCSKEW*, and *DUVOL*. For each readability measure, we sort firms into four quartile portfolios based on the values of the measure. We match treated firms in the top quartile portfolio to control firms in the bottom quartile portfolio using propensity score matching. Panel A, B, and C show the estimation results where *FOG*, *FLESCH_KINCAID*, and *10K_SIZE* are employed in the sorting, respectively. Standard errors are clustered at the firm level and are reported in the parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | *NUMCRASH* | *NCSKEW* | *DUVOL* |
|---|---|---|---|
| *Panel A: Fog Index (FOG)* | | | |
| *TREAT* | 0.061 | 0.459*** | 0.092 |
| | (0.057) | (0.149) | (0.103) |
| *POST* | 0.192*** | 0.110 | 0.090 |
| | (0.058) | (0.092) | (0.062) |
| *TREAT* × *POST* | −0.121** | −0.308** | −0.147* |
| | (0.057) | (0.144) | (0.088) |
| Observations | 2,780 | 1,362 | 1,422 |
| R-squared | 0.013 | 0.028 | 0.008 |
| Firms | 1,711 | 1,087 | 1,052 |
| *Panel B: Flesch-Kincaid Index (FLESCH_KINCAID)* | | | |
| *TREAT* | 0.139 | 0.083 | 0.052 |
| | (0.085) | (0.159) | (0.086) |
| *POST* | 0.287*** | 0.260** | 0.156* |
| | (0.075) | (0.128) | (0.079) |
| *TREAT* × *POST* | −0.233*** | −0.217* | −0.179** |
| | (0.078) | (0.124) | (0.078) |
| Observations | 1,426 | 1,612 | 1,614 |
| R-squared | 0.065 | 0.015 | 0.016 |
| Firms | 1,105 | 1,139 | 1,148 |
| *Panel C: 10-K File Size (10K_SIZE)* | | | |
| *TREAT* | −0.092 | 0.367* | 0.162 |
| | (0.117) | (0.193) | (0.112) |
| *POST* | 0.159* | 0.069 | 0.175** |
| | (0.083) | (0.159) | (0.087) |
| *TREAT* × *POST* | −0.080 | −0.144 | −0.137* |
| | (0.090) | (0.155) | (0.083) |
| Observations | 1,150 | 1,078 | 1,362 |
| R-squared | 0.039 | 0.013 | 0.018 |
| Firms | 893 | 826 | 962 |