Insider sales and future stock price crash risk: Firm-level analysis

Abstract: This study investigates whether insiders trade on future stock price crash risk. We find that insider sales are positively associated with future stock price crash risk. This evidence is consistent with the view that insiders are able to assess and anticipate future crash risk and to exploit this information advantage to fulfil personal trading incentives. We also find that the positive association between insider sales and future crash risk is stronger for firms that have high information opacity but weaker for firms that are in financial constraints or in the post SOX period. Additional analysis reveals that insider sales can predict future crash risk as far as 39 months ahead. Our findings have important practical implications. Market participants can use insider sales in ex ante assessing future stock price crash risk, and in appraising the likelihood and extent of insiders' bad news hoarding which results in the crash risk. Our study should be of particular interest to (i) investors that make portfolio investment decisions, (ii) suppliers and creditors who are concerned about their clients' creditworthiness, (iii) boards of directors contemplating the design of optimal equity incentive compensation schemes for insiders, and (iv) policymakers regulating insider trading and corporate disclosure transparency.

***Keywords*:** insider sales; stock price crash risk; financial constraints; information asymmetry; SOX

***JEL Classifications*:** M41 G14 G30

1. Introduction

A vast literature documents that insiders tend to trade on advance knowledge of bad news events such as bankruptcies (Gosnell et al., 1992; Syhun and Bradley, 1997), dividend initiations (John and Lang, 1991), disclosures of internal control weaknesses (Skaife et al., 2013), SEC enforcement actions (Beneish, 1999; Johnson et al., 2009; Thevenot, 2012), accounting restatements (Badertscher et al., 2011; Agrawal and Cooper, 2015), public disclosures of negative SEC comment letters (Dechow et al., 2016), negative earnings surprises (e.g., Ke et al., 2003) or reversals of inflated earnings (e.g., Beneish and Vargus, 2002; Darrough and Rangan, 2005). The insiders' motivation behind these information-based sales is to avoid losses from a stock price drop that is attributed to the bad news events, whereby securing monetary benefits at the expense of uninformed outside investors. This issue is important because such opportunistic insider sales engender resource misallocation in the financial marketplace, reduce investors' willingness to trade, and lower market liquidity.

Our departure from the prior research is to conduct a firm-level analysis of the association between insider sales and future stock price crash risk. Stock price crash risk is documented by prior studies (e.g., Jin and Myers, 2006; Hutton et al., 2009) to be attributed to managers' hoarding bad news inside a firm. In particular, due to career and short-term compensation concerns, managers in general have incentives to hide bad news (Graham et al., 2005; Jin and Myers, 2006; Kothari et al., 2009). Nonetheless, there exists an upper limit where it becomes too costly or difficult for managers to further withhold the bad news, and managers usually cannot anticipate when the upper limit point will arrive (He, 2015). Once the threshold point is reached,

all of the stockpiled bad news will come out at once, resulting in an abrupt, drastic decline in stock price, that is, a stock price crash (Chen et al., 2001; Jin and Myers, 2006; Hutton et al., 2009). Accordingly, stock price crash risk refers to the likelihood of a stock price crash that is attributed to the bad news hoarding. The bad news withheld could be of any kind that, once released, would bring about a drop in stock price. Hence, compared with other corporate bad news events studied by the prior insider trading literature, stock price crash risk offers a more powerful, generalized setting for us to examine the opportunistic insider sales. This constitutes the major motivation of our study.

Though managers often cannot anticipate the point at which stock price would crash (to be discussed in Section 2), it is still reasonable to expect that managers can assess and anticipate the likelihood of a future stock price crash, because insiders are in charge of corporate decision making and in possession of varied sorts of private information. So the aim of our study is to link insider sales to future stock price crash risk, rather than to the unforeseen future stock price crashes. In so doing, we investigate whether insiders' anticipation of future stock price crash risk incentivizes the insiders to sell stocks beforehand.

Insider sales could be driven by insiders' liquidity needs or investment diversification objectives (Frankel and Li, 2004; Lustgarten and Mande, 1995; Carpenter and Remmers, 2001; Seyhun, 1990). It is usually hard for investors to discern and authenticate information-motivated sales from liquidity- or diversification-motivated sales (Beneish and Vargus, 2002). This provides insiders with incentives to engage in opportunistic stock sales. Therefore, we posit that in securing personal benefits, insiders have an incentive to sell their stocks in anticipation of high

future crash risk, despite the potential litigation risk associated with insider sales.

We next carry out a couple of cross-sectional analyses of the positive association between insider sales and future stock price crash risk. Insider sales by themselves could signal insiders' gloomy expectations about firms' future prospects. If firms in financial constraints involve in insider sales, they will find it more difficult to finance their investments and operations, thereby making the firms suffer from even more severe financial constraints. Thus, financial constrained firms should be less likely to engage in insider sales based on future crash risk. This results in the positive association between insider sales and future crash risk being weaker for firms that face financial constraints.

Theories and empirical evidence (Huddart and Ke, 2007; Grossman and Stiglitz, 1980; Glosten and Milgrom, 1985; Kyle, 1985) both show that the profitability of insider trades increases with the degree of information asymmetry between insider and outsiders. If a firm has high information asymmetry with outsiders, its insiders should have a stronger incentive to sell stocks on the basis of their assessed future stock price crash risk. Therefore, we expect that the positive association between insider sales and future crash risk is stronger for firms that have high information asymmetry between insiders and outsiders.

The Sarbanes-Oxley Act (SOX) was enforced in 2002 with an aim of improving corporate governance and financial reporting process. Stronger corporate governance and high information transparency limit opportunistic insider trades that are to the detriment of shareholders (e.g., Gunny et al., 2008; Ravina and Sapienza, 2010; Jagolinzer et al., 2011; Dai et al., 2015). Furthermore, SOX required insiders to report their trades to the SEC within two business days,

which replaces the old provision that had allowed insiders to wait till the tenth day of the next calendar month. As such, SOX made all the insider trade transactions disclosed more timely to market participants, which imposed a curb on opportunistic insider trades (Brochet, 2010). In this vein, insiders should abstain from trading on their appraised future crash risk. Therefore, we expect that the positive association between insider sales and future crash risk becomes less pronounced after the implementation of SOX.

Our empirical analysis is conducted based on a sample of 32,085 firm-year observations over a sample period of 1992-2013. While we use different measures of crash risk in the robustness checks, our main tests are based on the one developed by Hutton et al. (2009). As expected, we find that inside sales are significantly, positively associated with future crash risk, and that this positive association is more pronounced for firms that have high information asymmetry between insiders and outsiders but less pronounced for firms that are in financial constraints or in the post SOX period. All our regressions include a comprehensive list of variables that are likely correlated with both insider sales and crash risk, and the results are insensitive to the use of firm-fixed effect model to mitigate potential omitted variable bias.

Our study's objective is to test whether insiders' anticipation of future crash risk incentivizes the insiders to sell stocks in advance. The direction of causality is that future crash risk impacts insider sales decisions. But insider selling might by itself affect stock price crash risk in the cross-section. In particular, insider sales accelerate the speed of bad news being impounded in stock prices and move prices towards fundamental value, thereby mitigating stock price crash risk. However, this negative, contemporaneous association between insider sales and

crash risk is unlikely to explain the positive association between insider sales and future crash risk. Hence, the reverse causality issue would not pose a threat against our empirical analysis. Furthermore, our results for the cross-sectional analysis also help rule out the reverse causality possibility. In particular, we would be unlikely to observe that the association between insider sales and future stock price crash risk varies systematically with financial constraints or information asymmetry if insider sales cause stock price crash risk.

One might argue that some regulatory events as to insider trades could be used as a natural experiment to conduct a cross-country analysis of the association between insider sales and stock price crash risk. But this cross-country study only allows us to test the contemporaneous association between insider sales and crash risk (i.e., whether insider selling has a negative, causal impact on crash risk in the contemporaneity),[1] which is beyond the scope of our study.[2] What's more, any regulatory restriction on insider trades applies to both insider sales and insider purchases. So the use of the enactments or enforcements of insider trading laws in a natural experiment cannot disentangle insider purchasing versus insider selling incentives. Hence, we maintain our analysis at the firm-level context in this study.

Our study contributes to the literature in several ways. First, the insider trading literature finds that insiders tend to trade on foreknowledge of bad news corporate events including bankruptcies (Gosnell et al., 1992; Syhun and Bradley, 1997), dividend announcements (John

[1] If the hypothesis that insider sales decrease stock price crash risk in the cross-section holds, then one would expect to find that stock price crash risk increases following the regulatory restrictions on insider sales. Nevertheless, the objective of our study is to examine the lead-lag association between insider sales and stock price crash risk, which is hypothetically positive.

[2] Prior research has already documented that insider trading per se accelerates price discovery process and increases the efficiency of stock prices (e.g., Manne, 1966; Carlton and Fischel, 1983; Leland, 1992; Piotroski and Roulstone, 2005). Thus, the contemporaneous relationship between insider sales and stock price crash risk is not the focus of interest in our study.

and Lang, 1991), disclosures of internal control weaknesses (Skaife et al., 2013), SEC enforcement actions (Beneish, 1999; Johnson et al., 2009; Thevenot, 2012), announcements of accounting misstatements (Badertscher et al., 2011; Agrawal and Cooper, 2015), disclosures of negative SEC comment letters (Dechow et al., 2016), breaks in a series of consecutive increases in quarterly earnings (Ke et al., 2003), and earnings disappointments (e.g., Beneish and Vargus, 2002; Darrough and Rangan, 2005). Their evidence suggests that insider sales are informative, which runs contrast with another view that insider sales are driven by insiders' needs for personal liquidity and diversifications. Our study extends this strand of literature by linking insider sales with future stock price crash risk that results from bad news hoarding. Because firm-specific stock price crash risk is a result of managers' withholding of varied sorts of bad news, it provides a more powerful, generalized setting for us to examine the informativeness of insider sales. By showing that insider sales are positively, significantly associated with future crash risk, we corroborate the information role of insider sales.

Second, the crash risk literature (e.g., Chen et al., 2001; Jin and Myers, 2006; Hutton et al., 2009; Kim et al., 2011a, 2011b; Kim and Zhang, 2015; He, 2015; DeFond et al., 2015) focuses predominantly on the determinants of stock price crash risk. Nevertheless, little research attention has been paid to the consequences of crash-risk exposures on managers' decision-making. We fill this gap in the literature by showing that crash risk exposures incite insiders to sell stocks beforehand to extract private benefits.

Last but not least, our study has important practical implications. Our results suggest that insider sales could forecast future stock price crash risk as far as three years ahead. Thus, market

participants can use insider sales in ex ante assessing the likelihood of a future stock price crash, and in therein appraising the likelihood and extent of insiders' bad news hoarding. This is in particular relevant to investors for their portfolio investment decisions, and to suppliers and creditors who monitor the creditworthiness of their clients. Also, our evidence which suggests that insiders tend to exploit foreknowledge of future crash risk should be of particular interest to (i) boards of directors contemplating the design of optimal equity incentive compensation schemes for executives, and (ii) policymakers and regulators regulating insider trading and corporate disclosure transparency. We further amplify and enrich these practical implications by showing that the predictive power of insider sales for future crash risk varies on financial constraints, information opacity, and regulatory regime changes as to SOX, which is yet another important, new feature of our study to the practitioners.

The rest of the paper proceeds as follows. In Section 2, we review the related literature and develop the testable hypotheses. Section 3 describes the data sources and variable measures. Section 4 presents the research design. Section 5 discusses the results. Section 6 conducts the additional tests, and Section 7 concludes.

2. Literature review and hypothesis development

2.1. The association between insider sales and future stock price crash risk

With separation of ownership and control, managers have incentives to expropriate wealth from shareholders (Jensen and Meckling, 1976), and to withhold corporate bad news that is associated with the wealth expropriation. Even if managers do not have the incentive to

deliberately extract rents from shareholders, they might operate corporate business in ways that induce adverse operating outcomes for their firms. In such case, incentives also arise for the managers to conceal bad news on account of compensation and career concerns (Graham et al., 2005; Ball, 2009; Kothari et al., 2009). Moreover, nondisclosure occurs either because information sender is not informed of any news or because the sender is hiding bad news (Dye, 1985; Jung and Kwon, 1988), whereby making it difficult for outsiders to unravel a firm's bad news hoarding. This further strengthens managers' incentives to withhold bad news to secure their private benefits.

However, when the withheld bad news accumulates and reaches a tipping point, managers cannot withhold it any longer. At that point, all the bad news would come out at once, resulting in a stock price crash (e.g., Jin and Myers et al., 2006; Hutton et al., 2009). Once the stock price crash of a firm occurs, outsiders would realize that the firm has withheld bad news, most likely, opportunistically. As such, insiders would not only be penalized by the bad news per se, but also be subject to high litigation risk and great reputational losses for having hoarded the bad news (e.g., Skinner, 1994; Skinner, 1997; Field et al., 2005). So presumably, managers are not willing to see a stock price crash happening. Provided that managers are able to anticipate the maximum amount of bad news they can withhold, they would take actions (e.g., releasing some good news, optimistically biasing information disclosures, or stopping further withholding bad news) to prevent the occurrence of a stock price crash when the accumulated bad news approaches the upper threshold point. However, it is usually difficult for managers to foresee such threshold point (He, 2015), because the maximum level of bad news that managers can withhold varies

unforeseeably at different points in time, depending on a firm's changing external environments and internal business. This explains why stock price crashes, albeit attracting high regulatory scrutiny and litigation, still happen quite often in practice.

Though insiders often cannot foresee the threshold point at which stock price would crash, it is still reasonable to expect that insiders, who run corporate business all the way and are in possession of varied kinds of private information, are able to appraise and anticipate the likelihood of a future stock price crash --- stock price crash risk. This presumption is built on the prior research which finds that insiders actively trade on their foreknowledge of future bad news events. For instance, Seyhun and Bradley (1997) find significant amount of insider sales that occurs prior to the filing date of bankruptcy petitions. John and Lang (1991) document that a dividend announcement is bad news for growth firms since it signals lack of profitable investment opportunities, and insiders in such firms tend to sell shares prior to the announcements of dividend initiations. Skaife et al. (2013) find that the profitability of insider selling is particularly high in the years leading up to disclosures of material internal control weaknesses. Beneish (1999), Johnson et al. (2009), Thevenot (2012), and Agrawal and Cooper (2015) find that insiders sell substantially more stocks before revelations of accounting irregularities. Dechow et al. (2016) show that insider sales are significantly higher than normal levels prior to the public releases of SEC comment letters relating to aggressive revenue recognition, and that the higher pre-disclosure sales are associated with a stronger negative drift following the comment letter release date. Ke et al. (2003) find that insider sales increase three to nine quarters prior to a break in a string of consecutive increases in quarterly earnings.

Collectively, this strand of literature suggests that insiders can foresee future bad news events and trade intensively to exploit their information advantage. Since stock price crash is an outcome of insiders' bad news hoarding (e.g., Hutton et al., 2009), we posit that insiders can appraise the likelihood of a future stock price crash and are inclined to sell stocks on the basis of their crash risk appraisals to secure personal monetary benefits.

Insider selling can be attributed either to insiders' exploitation of negative private information (e.g., Lakonishok and Lee, 2001) or to their liquidity needs or investment portfolio diversifications (Frankel and Li, 2004; Lustgarten and Mande, 1995; Carpenter and Remmers, 2001; Seyhun, 1990). In the latter case, insiders should not be blamed or charged for their stock sales. But it is often difficult for investors to distinguish information-driven sales from liquidity- or diversification-driven sales (Beneish and Vargus, 2002). Even if investors could manage to distinguish out the two, insiders could defend themselves from litigation risk in a way that information-driven sales are argued to be non-informational motivated. This heightens managers' incentives to engage in insider sales based on appraised future crash risk, notwithstanding the potential litigation risk associated with this strategic behavior. The discussion above leads to our first hypothesis stated in the alternative form as follows.

H1: *Insider sales are positively associated with future stock price crash risk.*

A potential countervailing force that plausibly weakens H1 is litigation risk associated with insider sales. In a narrow circumstance, trading immediately (e.g., within one quarter or shorter) before price-relevant corporate events would trigger substantive litigation risk (e.g., Garfinkel, 1997; Huddart et al., 2007), compared with trading relatively long beforehand. To

alleviate this concern, we allow for a 3-month interval between the measurement window of insider selling and of crash risk in our research design. Even if this concern is not eliminated, it would only create bias towards H1. Hence, we maintain H1 as a directional hypothesis for our empirical analysis.

2.2. Cross-sectional variations of the association between insider sales and future stock price crash risk

Per Lamont et al. (2001), financial constraints refer to frictions that prevent a firm from funding its desired investments. Prior studies (e.g., Lakonishok and Lee, 2001; Jeng et al., 2003; Fidrmuc et al., 2006) document that insider selling could by itself convey unfavorable information to the market and that share prices decrease in response to insider sales. Because of the information effect of insider sales, financial constrained firms, if involved in insider sales, would find it more difficult to raise external capital for investments and operations (Campello et al., 2010; Ataullah et al., 2014), and consequently, their financial constraints would be further exacerbated. Thus, confronted with financial constraints for firms, insiders should refrain from trading on future stock price crash risk. This leads to our second hypothesis as follows.

H2: *The positive association between insider sales and future stock price crash risk is less pronounced for firms that face financial constraints.*

Insider trading is fundamentally driven by insiders' information advantage over outside investors. Theories suggest (Grossman and Stiglitz, 1980; Glosten and Milgrom, 1985; Kyle, 1985; Huddart and Ke, 2007) that the larger the magnitude of information asymmetry between

insiders and outsiders, the higher trading profits insiders could reap from their stock trades. Consistent with this notion, Frankel and Li (2004) find some evidence that the association between insider sales and subsequent returns, which is used as a proxy for the profitability of insider trades, is weaker for firms that experience an increase in financial statement informativeness and in analyst following. Lakonishok and Lee (2001) find that firm size, an inverse measure of information asymmetry, is negatively associated with the extent to which insider trades predict future stock returns. Aboody and Lev (2000) predict and find that an increase in information asymmetry between insiders and outsiders, which results from R&D activities, allows insiders to gain higher profits from stock trades. Given the higher trading profitability insiders can obtain from firms with high information asymmetry, insiders in such firms should have stronger motives to trade aggressively in anticipation of high future crash risk. We therefore have the third hypothesis as follows.

H3: *The positive association between insider sales and future stock price crash risk is more salient for firms that have high information asymmetry between insiders and outsiders.*

The Sarbanes-Oxley Act was implemented in 2002 with the objective of improving corporate governance and financial reporting quality. A number of studies provide supportive evidence that SOX achieved this objective. For example, Arping and Sautner (2013) find that analyst earnings forecasts become more accurate and less dispersed after the passage of SOX, suggesting that SOX made firms less opaque. Iliev (2010) finds evidence that SOX increased earnings quality for both domestic and foreign firms. Skaife et al. (2009) document that by mandating management evaluation and independent audits of internal control effectiveness, SOX

could lower information risk and cost of equity for firms.

We expect that SOX reduced opportunistic crash-risk-based insider sales for three reasons. First, separation of ownership and control induces incentive misalignment between managers and shareholders and thereby drives managers' motives to extract rents from shareholders (Jensen and Meckling, 1976). One way for the managerial rent extraction is insider trades whereby insiders (i.e., informed traders) profit at the expense of shareholders (i.e., uninformed traders) (e.g., Seyhun, 1986; Fishman and Hagerty, 1992; Bettis et al., 2000; Jagolinzer et al., 2011). Given that corporate governance is intended to align managers' interests with those of shareholders, it follows that strong corporate governance should mitigate opportunistic insider sales that are detrimental to shareholders. In this vein, if SOX ameliorated corporate governance for firms, insiders should be less likely to trade on future crash risk after the enforcement of SOX.

Second, prior studies (e.g., Kyle, 1985; Huddart and Ke, 2007) show that low information opacity reduces the profitability of insider trades. Provided that SOX improved disclosure transparency and the quality of financial reporting for firms, information asymmetry between insiders and outsiders would become lower. As such, insiders would profit less from their informed trades, and accordingly, have smaller incentives to sell stocks on the basis of their appraised future crash risk.

Third, before the passage of SOX, insiders could opt to report to the SEC their stock transactions by the tenth day of the next calendar month. But in the post SOX era, insiders are required to report all their trades to the SEC within two business days. This made the insider

trading information being disclosed more promptly to the public. Consequently, insiders would be less likely to sell stocks before negative stock returns so as to avoid a potential legal jeopardy (Brochet, 2010). In this respect, we also expect that SOX weaken insiders' incentives to trade on future stock price crash risk. Based on the above discussion, we have the fourth hypothesis as follows.

H4: *The positive association between insider sales and future stock price crash risk is weaker after the implementation of SOX.*

3. Data and variable measurement

3.1. Data sources and sample

Our empirical analysis is based on data collected primarily from I/B/E/S, CRSP, Compustat, and Thomson Financial. Insider trading data are obtained from Thomson Financial Insider Research Services Historical Files. Consistent with Huddart and Ke (2007) and Huddart et al. (2007), insider trading transactions used in our empirical tests are restricted to open market trades, exclusive of non-open market trades such as option grants, option exercises, dividend reinvestments, stock transfers among family members, and pension transactions. We further limit the insider trading transactions to those by officers and directors only, excluding those by lower-tier officers or non-officer insiders who are unlikely to impact major corporate decisions.[3] To

[3] Our results remain qualitatively unchanged if we use the insider trades by CEOs, CFOs, and chairmen of board (namely, senior insiders) only.

focus on the aggregate influence of the management team, we sum the purchases and sales by all top managers of the same firm in the fiscal years of interest.[4]

We obtain financial analyst data from I/B/E/S. Other data are taken from CRSP and Compustat. Our sample period ranges from 1992 to 2013. We require that firms have necessary data from CRSP, Compustat, I/B/E/S, and Thomson Financial to construct the variables of interest for our empirical tests. The final sample for testing the association between insider sales and future stock price crash risk comprises 32,085 firm-year observations for 7,213 unique firms. Table 1 reports the summary statistics of all the variables used in our hypothesis tests.

3.2. Measures of firm-specific stock price crash risk

Following Chen et al. (2001), Hutton et al. (2009), Kim et al. (2011a, b), and Defond et al. (2014), among others, we employ four measures of stock price crash risk. First is the likelihood of negative, extreme firm-specific weekly returns over a fiscal year (namely, *crashrisk*) as per Hutton et al. (2009). *Crashrisk* equals 1 if a firm experiences one or more firm-specific weekly returns falling 3.2 standard deviations below the mean firm-specific weekly returns over a fiscal year and 0 otherwise.[5] Our second crash risk measure (namely, *ncskew*) follows Chen et al. (2001) and is the negative third moment of each stock's firm-specific weekly returns. The third measure of crash risk (namely, *ncskew*) is the down-to-up variance of firm-specific weekly returns as per Chen et al. (2001). *Duvol* equals the standard deviation of down-week firm-

[4] For a given firm in a fiscal year, some insiders might be selling while others might be buying. In this case, insider purchases will be subtracted from insider sales to reflect the net direction of insider sales in that fiscal year.

[5] We obtain similar results using the number of crash weeks over a fiscal year to measure crash risk.

specific weekly returns (scaled by the number of down-weeks minus one), divided by the standard deviation of up-week firm-specific weekly returns (scaled by the number of up-weeks minus one) over a fiscal year. The fourth measure, *minreturn*, is calculated as the minimum value of firm-specific weekly returns over a fiscal year, times (-1), less the mean firm-specific weekly returns, divided by the standard deviation of firm-specific weekly returns over the fiscal year. The firm-specific weekly returns measure used for calculating *crashrisk*, *ncskew*, *duvol*, and *minreturn* follows Kim et al. (2011a). High values of *crashrisk*, *ncskew*, *duvol*, and *minreturn* represent high stock price crash risk for a firm. The correlation matrix (results not tabulated in Table 2 for parsimony) reveals that *crashrisk* is highly, positively correlated with *ncskew*, *duvol*, and *minreturn* (0.3801, 0.3665, and 0.5885), respectively.

Among the four crash risk measures, *crashrisk*, by its definition, is a direct measure of a firm's crash risk and is most frequently used in the crash risk literature. The other three measures might contain some measurement errors in some cases. Suppose that a firm releases gradually its bad news to the public such that its stock price declines slowly to a much low point, and then at that point, the stock price is maintained continually low for extended periods. In such case, the firm does not actually experience a stock price crash, but still exhibits nontrivial negative conditional return skewness, high down-to-up return volatility, and extreme low returns, as reflected by high values of *ncskew*, *duvol*, and *minreturn*, respectively, in the return distribution for a fiscal year. Given that *ncskew*, *duvol*, and *minreturn* are less powerful than *crashrisk* in capturing a firm's stock price crash risk, our main tests are based primarily on the *crashrisk* measure. This is consistent with Hutton et al. (2009) that use *crashrisk* as their sole measure of

crash risk. As reported in Table 1, the mean value of *crashrisk* is 0.1793, indicating that firm-specific stock price crash risk for a year amount to 17.93%. This is close to that of Hutton et al. (2009) though they use a shorter sample period than ours.

3.3. Measures of insider sales

Insiders risk an established legal jeopardy for selling immediately (e.g., within one quarter or shorter) before price-relevant events (e.g., Garfinkel, 1997; Noe, 1999; Huddart et al., 2007). So conceptually, the link between insider sales and future crash risk as predicted in H1 might be weaker due to the litigation risk associated with insider sales. But this concern only induces bias towards our prediction so long as we can find significant results consistent with H1. Still, to mitigate this problem and strengthen our hypothesis tests, we measure insider selling in a way that its measurement window ends three months prior to the beginning of the year for which the crash risk variable (*crashrisk*) is measured.[6] In particular, the insider sales variable (namely, *insidersell*) equals the natural logarithm of 1 plus volume amount of net insider sales (i.e., insider sales minus insider purchases) made by all the directors and officers over a year ending three months prior to the beginning of year for which the crash risk variables are measured.[7] Part (a) of Figure 1 portrays the timeline for our measurement windows of the crash risk and insider selling variables.

4. Research methodology

[6] All the inferences for the tests of H1-H4 remain the same if we remove the three-month interval to look at the association between insider sales and 1-year-ahead crash risk.

[7] All our results hold if we use dollar amount of inside sales to construct our insider selling variables.

4.1. Multivariate test of H1

To test H1, we employ the following pooled OLS regression model.

$$\begin{aligned}\ln etsales = {} & \alpha_0 + \alpha_1 crashrisk + \alpha_2 changeroa + \alpha_3 roa + \alpha_4 retvol + \\ & \alpha_5 salesgrowth + \alpha_6 optiong + \alpha_7 qtrret + \alpha_8 size + \alpha_9 btm + \alpha_{10} tradevol \\ & + \alpha_{11} ana\cov + \alpha_{12} lag \ln etsales + \alpha_{13} stdearnings + \alpha_{14} ww + \alpha_{15} dedi + \\ & \alpha_{16} SOX + \alpha_{17} year\ fixed\ effects + \alpha_{18} industry\ fixed\ effects + \varepsilon\end{aligned} \tag{1}$$

The theme of the hypothesis test is to look at how insiders' anticipation of future crash risk motivates the insiders to sell stocks in advance. The causality flow runs from future crash risk to insider sales. Thus, the dependent variable is *lnetsales* and the treatment variable is *crashrisk*,[8] both of which are as defined previously. Based on H1, the coefficient on *crashrisk* should be positive and statistically significant at the conventional level.

We include a broad set of control variables in the regression to mitigate potential correlated omitted variable bias. As discussed in Section 2, information asymmetry between insider and outsiders induces more insider sales, whilst financial constraint and the enforcement of SOX reduce insider sales. Therefore, we control for information asymmetry (*stdearnings*), financial constraint (*ww*), and SOX (*sox*) in the regression. Earnings volatility (*stdearnings*) is used as the proxy for information asymmetry and is expected to be positively correlated with insider sales. Regarding the measure of financial constraint, we construct ww index following Whited and Wu (2006). High ww index (*ww*) represents high degree of financial constraints and hence should be associated with lesser extent of insider sales.

Because high return volatility provides insiders with more room to exploit their information

[8] Prior studies (e.g., Ke et al., 2003; Piotroski and Roulstone, 2005; Agrawal and Cooper, 2015; Dechow et al., 2015) that examine information-driven insider sales conduct multivariate analyses in which the dependent variable is insider sales and the treatment variable is future bad news events. Our regression model specification is akin to theirs.

advantage and to profit from their stock trades, we include return volatility (*retvol*) and expect it to be positively related to insider sales. Strong external monitoring restrains opportunistic informed trades, so we control for analyst coverage (*anacov*) and dedicated institutional ownership (*dedi*). Presumably, large analyst coverage and high dedicated institutional ownership are associated with more intense external monitoring (e.g., Chen et al., 2007; Chen et al., 2015) and thus with less informed insider sales. We control for firm size (*size*) because insiders in large firms sell more stocks (Lakonishok and Lee, 2001). We include the number of option grants (*optiong*), as Ofek and Yermack (2000) find that insiders sell more shares when granted more stock options. We include sales growth (*salesgrowth*), since Rozeff and Zaman (1998) find that insiders in growth firms sell more stocks.

Piotroski and Roulstone (2005) find that insider trades are positively related to future earnings performance (a proxy for insiders' superior knowledge about future cash flow realizations), positively associated with book-to-market ratio, and negatively related to recent returns (proxies for insiders' contrarian beliefs). Hence, we control for returns on assets (*roa*), change in returns on assets (*changeroa*), book-to-market ratio (*btm*), and buy-and-hold stock returns (*qtrret*). High trading volume is associated with a great difference in opinions among investors (Chen et al., 2001) and hence with a high likelihood of mispricing. Since insiders have incentives to trade against mispricing, trading volume should be positively associated with insider trades. We therefore include trading volume (*tradevol*) and expect it to be positively related to insider sales. The controls of *tradvol* and *qtrret* also reduce correlated omitted variable bias induced by potential fundamental-related events. Following Cheng and Lo (2006), we also

include lagged insider sales to further control for unobserved factors that drive insider sales. All the control variables are defined in the appendix. Last, we include industry and year fixed effects in the regression model to control for any systematic variation in insider sales across industries and over years.

4.2. Tests of H2-H4

For ease of interpretation of the coefficients and to mitigate measurement problems, we adopt subsample analyses to test H2-H4. In testing H2, we use four proxies for financial constraints: (i) ww index developed by Whited and Wu (2006); (ii) hp index developed by Hadlock and Pierce (2010); (iii) kz index developed by Kaplan and Zingales (1997); (iv) dividend payout ratio used by Denis and Sibikov (2010). Ww index, hp index, and kz index are coded in a way that higher values represent higher financial constraints. Dividend payout ratio runs the opposite: high dividend payout indicates less financial constraints (Fazzari et al., 1988). The detailed definitions of these variables are defined in the appendix. We partition the full sample into two subsamples based on the sample median of ww index, hp index, and kz index respectively, and on an indicator variable for whether a firm has dividend payout for a fiscal year. Then we estimate model (1) separately for the two subsamples that are created based on the four financial constraint indicators, respectively. If H2 holds, the coefficient on *crashrisk* should be incrementally less positive for the high financial constraint subsample than for the low financial constraint subsample.

To test H3, we first split the full sample into two subsamples based on the sample median of

the measures of information asymmetry. Two information asymmetry proxies are used. First is earnings volatility (*stdearnings*). The second proxy is financial opacity (*opacity*) measured using Hutton et al.'s (2009) approach. Both proxies are defined in the appendix. High values of earnings volatility and of financial opacity indicate high information asymmetry. We estimated model (1) separately for the two subsamples. H3 predicts that the coefficient on *crashrisk* for the high information asymmetry subsample is incrementally positive than that for the low information asymmetry subsample.

To test H4, we divide the full sample into two subsamples based on an indicator variable for whether a firm is in the post or pre-SOX period, and run model (1) separately for these two subsamples. In supporting H4, *crashrisk* should have an incrementally positive coefficient in the pre-SOX subsample than in the post SOX subsample.

If we find results consistent with H2-H4, we can tease out the endogeneity concern ascribed to reverse causality. Insider trading by itself helps push stock prices towards fundamental value (Piotroski and Roulstone, 2005), thus reverse causality might arise in a way that insider sales reduce stock price crash risk. Unlike the predictions in H2-H4 that are related to managerial opportunism, the underlying rationale for the reverse causality has nothing to do with managerial opportunistic incentives. Thus, if insider sales are the cause of stock price crash risk, then we would not find that the positive association between insider sales and future crash risk varies with information asymmetry, financial constraints, or SOX implementation. In this regard, the cross-sectional variation analysis serves as a falsification test that helps rule out the reverse causality possibility. Furthermore, because the reverse causality pertains to a negative,

contemporaneous association between insider sales and crash risk, it is unlikely to explain the positive, lead-lagged association between insider sales and crash risk as predicted in H1.

5. Empirical results

As shown in Table 2, the Pearson (Spearman) correlation between *lnetsales* and *crashrisk* is positive (0.0547 (0.0605)) and statistically significant at less than 1% level, which provides initial support for H1. All the variables in Table 2 are not highly correlated with each other, indicating no multicollinearity arising should these variables be used for the multivariate tests of our hypotheses.

Table 3 reports the regression results for the test of the association between insider sales and future stock price crash risk. The coefficient for *crashrisk* is positive and statistically significant at the 0.1% level. One unit change in *crashrisk* leads to change of 0.3716 in *letsales*, which accounts for 9.8% of the mean value of *lnetsales* for our sample and is economically significant. This result supports H1 that insider sales are positively correlated with future crash risk. This suggests that insiders are able to assess and anticipate the likelihood of a future stock price crash that results from bad news hoarding, and that this motivates the insiders to sell stocks in anticipation of high future crash risk. We check the robustness of the main results using alternative measures of crash risk, namely, *duvol*, *ncskew*, and *minreturn* that are mentioned in Section 3.2. Results are reported in Columns (2)-(4), and our inferences remain unchanged.

Table 4 reports the regression results for model (1) that is estimated separately for two subsamples comprising firms with high versus low financial constraints, respectively. The

coefficient on *crashrisk* is positive and statistically significant across all the low financial constraint subsamples (which are represented by *dww*=0, *dhp*=0, *dkz*=0, and *dpayout*=1, respectively). By contrast, the coefficient for *crashrisk*, albeit positive, is not statistically significant for the high financial constraint subsamples (represented by *dww*=1, *dhp*=1, *dkz*=1, and *dpayout*=0, respectively). These results indicate that the positive association between insider selling and future crash risk is evident only for firms that are in low financial constraints, which thereby lends support to H2.

Table 5 presents the regression results for model (1) that is run separately for subsample firms with high versus low information asymmetry between insiders and outsiders. *Dstdearnings* =1 (0) and *dopacity*=1 (0) represent the high (low) information asymmetry subsample with above- (below-) median value of *stdearnings* and of *opacity*, respectively. The coefficient for *crashrisk* is positive and statistically significant (p=0.008) in the high *stdearnings* (*dstdearnings* =1) subsample but is only marginally significant (p=0.090) in the low *stdearnings* (*dstdearnings* =0) subsample. *Crashrisk* takes on a highly significant, positive coefficient in the high *opacity* (*dopacity*=1) subsample but a statistically insignificant coefficient (p=0.860) in the low *opacity (dopacity*=0*)* subsample. Taken together, these results suggest that the positive link between insider sales and future crash risk is more evident for firms that have high information asymmetry, thus consistent with H3.

Table 6 reports the regression results for the test of H4. The subsamples are formed based on whether firms are in the post SOX or in the pre-SOX period. The coefficient for *crashrisk* in the post SOX (*sox*=1) subsample is positive and highly significant (p=0.006), whereas the

coefficient for *crashrisk* in the pre-SOX (*sox*=0) subsample is not statistically significant (p= 0.414).[9] This finding is consistent with H4 that inside sales are more strongly positively associated with future crash risk before the implementation of SOX.

For all the multivariate tests we carried out thus far, we control not only for an extensive set of variables that are potentially correlated with both insider sales and future crash risk, but also for industry-fixed effects. But we could not completely exclude the possibility that our regression analysis still omits some variables that might determine both insider sales and crash risk. To address this possibility, we re-estimate model (1) using firm-fixed effect regression technique which allows us to control for the effects of any unobserved firm characteristics (Wooldrige, 2000; Amir et al., 2015). The firm-fixed effect regression results (not tabulated for brevity) still hold in support of our hypotheses.

6. Additional tests

In the main test, we link insider sales with future crash risk on a 15-month-ahead horizon. We now move forward the measurement window of future crash risk into longer horizons, and re-test H1. This enables us to obtain insight into how far out insiders can assess and anticipate future crash risk, and into whether insiders would base stock sales on their longer-term forecast of future crash risk. This additional analysis also alleviates the potential correlated omitted variables concern for our main results.

[9] The option grant data in Compustat are missing for almost all firm-year observations for the years before the passage of SOX. Hence, we do not include the *optiong* variable in the multivariate test of H4.

We link insider sales to 27-month-ahead and 39-month-ahead crash risk, respectively.[10] Part (b) ((c)) of Figure 1 presents the timeline for our measurement windows of insider sales and of 27-month-ahead (39-month-ahead) crash risk.[11] There are two grounds on which we choose these forecast windows for the additional tests. First, Hutton et al. (2009) and Kim et al. (2011a) show that insiders conceal bad news up to a time horizon of around three years, and that crash risk could persist for an at least three-year period. Second, insiders tend to sell stocks well in advance of corporate bad news to avoid the appearance of taking advantage of insider information and to mitigate the litigation risk associated with insider sales (Ke et al., 2003).

To test the association between insider sales and 27-month-ahead (39-month-ahead) crash risk, we replace *lnetsales* with *laglnetsale* (*llaglnetsales*) on the left hand side of Equation (1), substitute *laglnetsales* for *llaglnetsales* (*lllaglnetsales*) on the right hand side of the equation, and re-run the regression. Table 7 reports the regression results. The coefficient on *crashrisk* in Column (1) is marginally significant (p=0.063) and in the predicted positive sign. This offers some evidence that insiders sell stocks on the basis of 27-month-ahead crash risk. The coefficient for *crashrisk* in Column (2) is positive and highly significant at the 0.1% level, which indicates strong evidence that insiders sell stocks based on 39-month-ahead crash risk. Taken together, these findings suggest that insiders can forecast crash risk as far as 39 months ahead and that they trade actively to profit from this informational forecast.

[10] Related to footnote 7, we also find evidence (results not tabulated for brevity) that insider sales are positively associated with 2-year-ahead and 3-year-ahead stock price crash risk, respectively.

[11] In untabulated tests, we expand our measurement interval of future crash risk from one-year to two-year and three-year, respectively. As such, future crash risk is measured in the two-year and three-year windows, respectively, which are preceded three months by the measurement window of insider sales. Our inferences remain similar for using this alternative measure of future crash risk.

7. Conclusion

This study examines whether insiders sell stocks based on their information advantage as to future stock price crash risk. We find that insider sales are positively associated with future crash risk. This evidence is consistent with the view that insiders are able to assess and anticipate future crash risk and to exploit this information advantage to fulfil personal trading incentives. We also find that the positive association between insider sales and future crash risk is more evident for firms that have high information opacity but less evident for firms that are in financial constraints or in the post SOX era. Our additional analysis further shows that insider sales are positively correlated with 39-month-ahead stock price crash risk. This suggests that insiders can predict future crash risk as far as 39 months ahead, and are inclined to trade intensively to profit from the long-term crash risk forecast.

Our findings have important practical implications. Market participants can use insider sales in ex ante assessing future stock price crash risk, and in gauging the likelihood and extent of insiders' bad news hoarding which results in the crash risk. In suggesting that outsiders can make more powerful inferences about future crash risk by relating insider sales, our study should be of particular interest to investors that make portfolio investment decisions, and to suppliers and creditors who are concerned with the creditworthiness of their clients. Furthermore, executive equity compensation is intended to align managerial incentives with shareholders' interests (Jensen and Meckling, 1976). However, high executive equity holdings could cause managers to pursue short termism at the expense of shareholders (e.g., Bergstresser and Philippon, 2006). One typical instance is that managers engage in strategic disclosures and in informed stock

trades in order to reap private benefits from shareholders. Therefore, our empirical evidence should also be relevant to (i) boards of directors contemplating the design of optimal equity incentive compensation schemes for insiders, and (ii) policymakers that are charged with regulating insider trading and corporate disclosure transparency.

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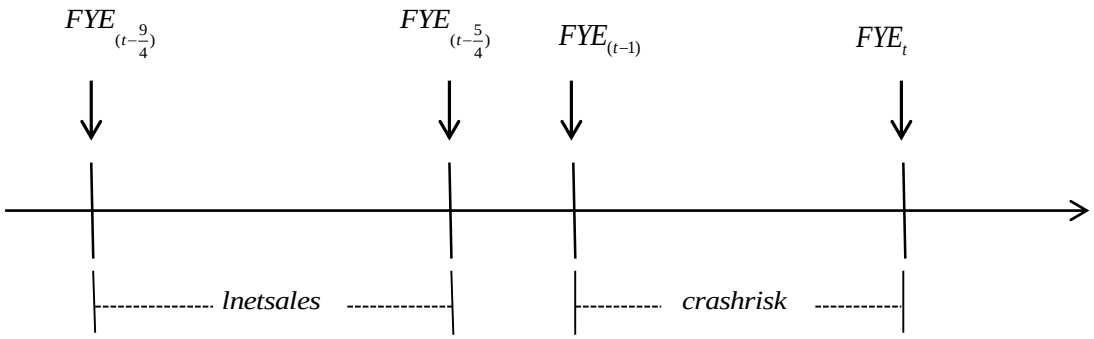
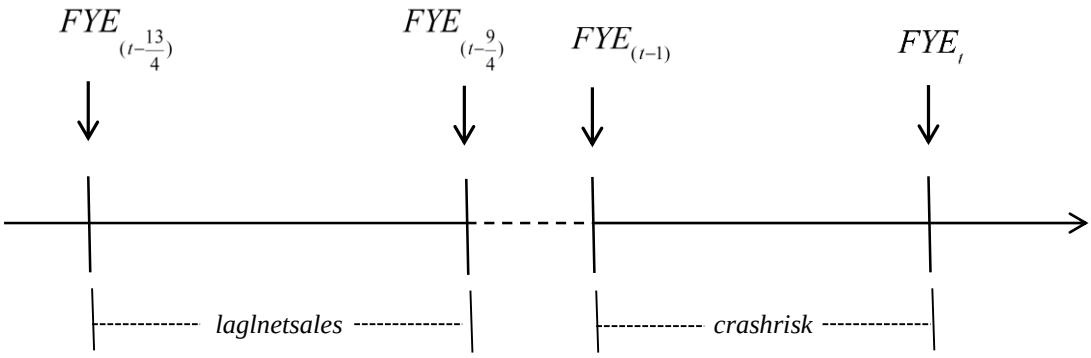
Figure 1 Timeline for the insider sales and crash risk measures

(a) The association between insider sales and 15-month-ahead crash risk



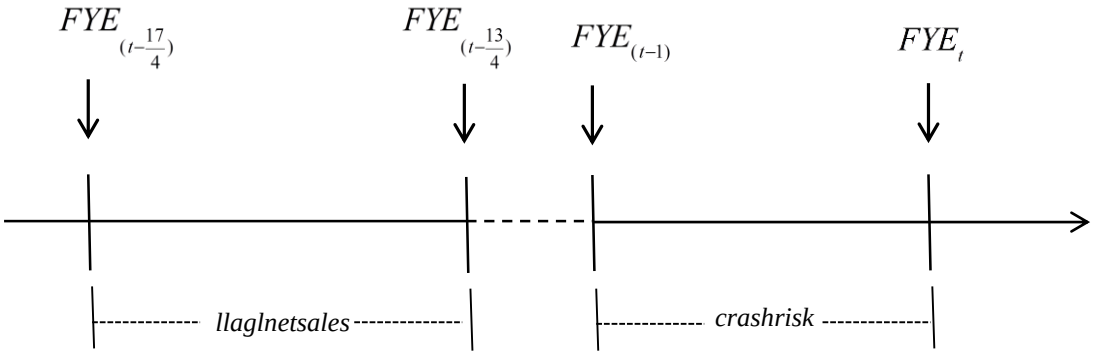
Notes: Figure (a) shows the timeline for measurements of the dependent variable (i.e., *crashrisk*) and treatment variable (i.e., *lnetsales*) that are used for the multivariate tests of H1-H4. Both the crash risk variable and insider selling variable are defined in the appendix.

(b) The association between insider sales and 27-month-ahead crash risk



Notes: Figure (b) shows the timeline for measurements of the dependent variable (i.e., *crashrisk*) and treatment variable (i.e., *laglnetsales*) that are used for the test of the association between insider sales and 27-month-ahead crash risk. Both the crash risk variable and insider selling variable are defined in the appendix.

(c) The association between insider sales and 39-month-ahead crash risk



Notes: Figure (c) shows the timeline for measurements of the dependent variable (i.e., *crashrisk*) and treatment variable (i.e., *llaglnetsales*) that are used for the test of the association between insider sales and 39-month-ahead crash risk. Both the crash risk variable and insider selling variable are defined in the appendix.

Table 1 Summary statistics

Variables	Num. of firm-years	Num. of unique firms	Mean	Std.dev.	25th	Median	75th
lnetsales	32,085	7,213	3.8080	8.9861	0	7.3883	11.9023
laglnetsales	32,085	7,213	3.5259	8.6696	0	0	11.6953
llaglnetsales	32,085	7,213	3.2423	8.3289	0	0	11.4809
lllaglnetsales	32,085	7,213	2.9758	7.9803	0	0	11.1781
crashrisk	32,085	7,213	0.1793	0.3836	0	0	0
ncskew	32,085	7,213	-5.0506	18.0012	-12.2537	-4.4593	3.0896
duvol	32,085	7,213	-0.1774	0.4340	-0.4123	-0.1524	0.0850
minreturn	32,085	7,213	2.4544	0.6930	1.9846	2.3363	2.7943
changeroa	32,085	7,213	-0.0216	1.3634	-0.0318	-0.0011	0.0205
roa	32,085	7,213	0.0248	1.9725	-0.0055	0.0355	0.0734
retvol	32,085	7,213	0.1311	0.0989	0.0727	0.1069	0.1579
salesgrowth	32,085	7,213	0.6256	66.4744	-0.0450	0.0689	0.2086
optiong	32,085	7,213	2.5379	8.0312	0	0	1.3000
qtrret	32,085	7,213	0.0248	0.7432	-0.3062	-0.0588	0.1990
size	32,085	7,213	6.1094	2.0903	4.6813	6.1915	7.5089
btm	32,085	7,213	0.9076	8.9150	0.3113	0.5368	0.8843
tradvol	32,085	7,213	1.4437	2.4259	0.4107	0.9005	1.8498
anacov	32,085	7,213	31.9791	43.1388	1	17	44
hp	32,085	7,213	-998.76	1179.722	-1535.6700	-412.4612	-103.0395
kz	23,338	5,996	1.0803	11.3091	0.4347	0.8257	1.2609
ww	32,085	7,213	-0.2351	2.3434	-0.2881	-0.2190	-0.1497
payout	10,909	3,229	0.0783	27.6156	0	0.1438	0.4092
stdearnings	32,085	7,213	93.8537	946.4302	3.4092	11.1605	40.6381
opacity	23,094	5,725	18.7623	336.4236	0.0529	0.1325	0.4666
dedi	32,085	7,213	0.0581	0.0847	0	0.0243	0.0919
sox	32,085	7,213	0.5430	0.4982	0	1	1

Notes: This table tabulates the descriptive statistics of all the variables used for the hypothesis tests. The sample period ranges from 1992 to 2013. All the variables are defined in the appendix.

Table 2 Pearson (Spearman) correlation in the lower (upper) triangle

Variables	*lnetsales*	*crashrisk*	*changeroa*	*roa*	*retvol*	*salesgrowth*	*optiong*	*qtrret*	*size*	*btm*	*tradevol*	*anacov*	*laglnetsales*	*stdearnings*	*ww*	*dedi*	*sox*
lnetsales	1	0.0605	-0.0307	0.2895	-0.1189	0.1317	0.2007	0.1363	0.4074	-0.2868	0.3438	0.3916	0.5112	0.2265	-0.2084	0.2750	0.1978
		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
crashrisk	0.0547	1	-0.0911	0.0325	0.0086	0.0295	0.0723	0.0284	0.0515	-0.0819	0.0946	0.0500	0.0486	0.0192	0.0071	0.0259	0.0774
	(<0.001)		(<0.001)	(<0.001)	(0.124)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.205)	(<0.001)	(<0.001
changeroa	-0.0012	-0.0015	1	-0.2431	-0.0229	-0.0664	-0.0009	0.0491	0.0191	-0.0306	-0.0447	0.0176	-0.0163	0.0433	-0.0453	0.0265	0.0101
	(0.836)	(0.791)		(<0.001)	(<0.001)	(<0.001)	(0.866)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.002)	(0.003)	(<0.001)	(<0.001)	(<0.001)	(0.071)
roa	0.0124	0.0056	-0.0508	1	-0.3341	0.2211	0.0642	0.2993	0.3624	-0.2845	0.0587	0.2083	0.2259	0.0915	-0.1786	0.1433	0.0428
	(0.027)	(0.317)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
retvol	-0.1224	-0.0111	-0.0226	-0.0506	1	-0.0126	0.0385	-0.0988	-0.3830	0.0192	0.2780	-0.1525	-0.0931	-0.1228	0.3718	-0.1314	0.0510
	(<0.001)	(0.046)	(<0.001)	(<0.001)		(0.024)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
salesgrowth	-0.0101	0.0126	-0.0042	0.0006	0.0028	1	-0.0183	0.1999	0.1187	-0.2153	0.1009	0.0358	0.0452	-0.0981	-0.0271	0.0401	-0.0243
	(0.070)	(0.024)	(0.455)	(0.908)	(0.616)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
optiong	0.1773	0.0450	-0.0004	0.0047	-0.0585	-0.0006	1	0.0682	0.2301	-0.1151	0.3823	0.2679	0.2134	0.2112	-0.0688	0.1820	0.5519
	(<0.001)	(<0.001)	(0.941)	(0.404)	(<0.001)	(0.910)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
qtrret	0.0537	0.0243	0.0082	0.0171	0.1837	-0.0027	0.0217	1	0.2663	-0.3247	0.0746	0.0762	0.0305	0.0683	-0.0993	0.1045	0.0704
	(<0.001)	(<0.001)	(0.143)	(0.002)	(<0.001)	(0.623)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
size	0.3651	0.0505	0.0184	0.0419	-0.3300	-0.0049	0.2477	0.1444	1	-0.3878	0.4021	0.7342	0.3618	0.7156	-0.7696	0.3865	0.1804
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.378)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
btm	-0.0278	-0.0107	-0.0010	-0.0027	0.0146	-0.0007	-0.0121	-0.0283	-0.0754	1	-0.2584	-0.2593	-0.2046	-0.1057	0.0112	-0.1205	-0.1240
	(<0.001)	-0.0560	(0.851)	(0.632)	(0.009)	(0.902)	(0.030)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.045)	(<0.001)	(<0.001
tradevol	0.1468	0.0373	-0.0058	-0.0039	0.1905	-0.0003	0.1617	0.0714	0.1676	0.3044	1	0.5468	0.3309	0.3770	-0.1670	0.2872	0.4490
	(<0.001)	(<0.001)	(0.300)	(0.489)	(<0.001)	(0.962)	(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
anacov	0.2957	0.0114	0.0065	0.0036	-0.1367	-0.0045	0.2714	0.0023	0.6393	-0.0277	0.2574	1	0.3907	0.6016	-0.5749	0.3808	0.2173
	(<0.001)	(0.041)	(0.242)	(0.518)	(<0.001)	(0.415)	(<0.001)	(0.679)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001
laglnetsales	0.4561	0.0434	0.0026	0.0060	-0.1117	-0.0032	0.1809	-0.0264	0.3268	-0.0216	0.1456	0.3052	1	0.2236	-0.2076	0.2647	0.2112
	(<0.001)	(<0.001)	(0.638)	(0.286)	(<0.001)	(0.572)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001)	(<0.001
stdearnings	0.0219	-0.0107	0.0012	0.0007	-0.0171	-0.0008	0.0573	0.0010	0.1427	0.0017	0.0264	0.1381	0.0185	1	-0.6784	0.2992	0.1985
	(<0.001)	(0.055)	(0.823)	(0.901)	(0.002)	(0.883)	(<0.001)	(0.859)	(<0.001)	(0.755)	(<0.001)	(<0.001)	(<0.001)		(<0.001)	(<0.001)	(<0.001
ww	0.0018	-0.0123	0.0030	0.0000	0.0086	-0.9920	-0.0046	0.0042	-0.0284	0.0003	-0.0019	-0.0185	-0.0055	-0.0055	1	-0.2854	0.0494
	(0.744)	(0.028)	(0.586)	(0.999)	(0.124)	(<0.001)	(0.411)	(0.456)	(<0.001)	(0.959)	(0.735)	(<0.001)	(0.322)	(0.326)		(<0.001)	(<0.001
dedi	0.1373	0.0090	0.0052	-0.0018	-0.0832	0.0005	0.0965	0.0248	0.2282	-0.0150	0.0716	0.1783	0.1372	0.0153	-0.0087	1	0.1675
	(<0.001)	(0.106)	(0.351)	(0.748)	(<0.001)	(0.925)	(<0.001)	(<0.001)	(<0.001)	(0.007)	(<0.001)	(<0.001)	(<0.001)	(0.006)	(0.121)		(<0.001
sox	0.1764	0.0774	0.0051	0.0155	-0.0155	0.0049	0.2899	0.0366	0.1862	-0.0205	0.2321	0.1921	0.1905	0.0316	-0.0026	0.1166	1
	(<0.001)	(<0.001)	(0.362)	(0.006)	(0.006)	(0.378)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.645)	(<0.001)	

Notes: This table presents the results for the Pearson (Spearman) correlation tests in the lower (upper) triangle. The correlation matrix involves all the variables used for the main hypothesis tests. The sample consists of 32,085 firm-year observations which cover the years of 1992-2013. All the variables are defined in the appendix. The *p*-values are provided in parentheses.

TABLE 3 Test of H1: The association between insider sales and future stock price crash risk

Variables		Dependent variable = *lnetsales*			
	Pred. Sign	(1)	(2)	(3)	(4)
Intercept	?	-2.6137	-2.4585	-2.3681	-2.8178
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
crashrisk	+	0.3716			
		(0.001)***			
ncskew	+		0.0075		
			(0.001)***		
duvol	+			0.4420	
				(<0.001)***	
minreturn	+				0.1117
					(0.074)*
changeroa	-	-0.0348	-0.0350	-0.0372	-0.0353
		(0.151)	(0.152)	(0.141)	(0.155)
roa	-	-0.0012	-0.0012	-0.0024	-0.0016
		(0.955)	(0.954)	(0.903)	(0.938)
retvol	+	-0.5785	-0.6152	-0.3551	-0.5105
		(0.380)	(0.352)	(0.593)	(0.442)
salesgrowth	+	0.0179	0.0179	0.0180	0.0180
		(0.219)	(0.217)	(0.217)	(0.217)
optiong	+	0.0423	0.0428	0.0428	0.0426
		(0.001)***	(0.001)***	(0.001)***	(0.001)***
qtrret	+	0.3379	0.3381	0.3232	0.3363
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
size	+	0.8279	0.8204	0.8042	0.8255
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
btm	-	-0.0148	-0.0147	-0.0148	-0.0149
		(0.150)	(0.156)	(0.150)	(0.148)
tradevol	+	0.1692	0.1701	0.1696	0.1704
		(0.008)***	(0.008)***	(0.008)***	(0.008)***
anacov	-	0.0096	0.0095	0.0097	0.0096
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
laglnetsales	+	0.3702	0.3703	0.3705	0.3705
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
stdearnings	+	-0.0002	-0.0002	-0.0002	-0.0002
		(0.088)*	(0.088)*	(0.090)*	(0.088)*
ww	-	0.5448	0.5457	0.5477	0.5474
		(0.190)	(0.189)	(0.188)	(0.188)
dedi	-	2.7955	2.7939	2.7737	2.7798
		(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
sox	-	0.6885	0.7216	0.7279	0.7258

	(0.063)*	(0.051)*	(0.049)*	(0.050)*
Year-fixed effects	included	included	included	included
Industry-fixed effects	included	included	included	included
R-squared	0.2848	0.2848	0.2850	0.2847
Num. of observations	32,085	32,085	32,085	32,085

Notes: This table reports the OLS regression results for the tests of the association between insider sales and future stock price crash risk. The sample period covers the years of 1992-2013. The dependent variable is *lnetsales*. The treatment variables are *crashrisk*, *ncskew*, *duvol*, and *minreturn*, four distinct proxies for stock price crash risk. All the variables in the table are defined in the appendix. Year- and industry-fixed effects are included in regressions but not reported for simplicity. The *p*-values in parentheses are based on robust standard errors clustered by firm. ***, **, * represent the 1%, 5%, and 10% statistical significance levels (two-tailed), respectively.

TABLE 4 Test of H2: The moderating effect of financial constraint

Variables	Dependent variable = lnetsales							
	dww=0	dww=1	dhp=0	dhp=1	dkz=0	dkz=1	dpayout=0	dpayout=1
intercept	-1.6157	-3.9124	-1.6626	-3.7963	-3.5444	-3.6960	-3.2332	-2.0085
	(0.009)***	(<0.001)***	(0.017)**	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(0.023)**
crashrisk	0.5914	0.0304	0.4178	0.1472	0.5073	0.2110	0.4652	0.6765
	(<0.001)***	(0.850)	(0.006)***	(0.370)	(0.005)***	(0.250)	(0.113)	(0.011)**
changeroa	-0.0508	-0.0130	-0.1351	-0.0203	-0.0053	-0.0353	-0.2992	1.5145
	(0.590)	(0.307)	(0.004)***	(0.165)	(0.907)	(0.266)	(0.087)*	(0.279)
roa	0.2852	-0.0127	5.9433	-0.0077	1.6756	-0.0170	0.2132	1.5942
	(0.228)	(0.228)	(<0.001)***	(0.612)	(<0.001)***	(0.045)**	(0.571)	(0.087)*
retvol	-4.2712	0.4695	-2.4327	-0.9506	1.5606	-2.8735	0.6710	5.4997
	(0.001)***	(0.535)	(0.085)*	(0.165)	(0.103)	(0.004)***	(0.552)	(0.057)*
salesgrowth	-0.0011	0.0461	0.0052	-0.0012	-0.0086	-0.0011	-0.0710	-0.0947
	(<0.001)***	(0.013)**	(0.591)	(<0.001)***	(0.800)	(<0.001)***	(0.182)	(0.095)*
optiong	0.0260	0.1167	0.0210	0.1500	0.0554	0.0376	0.0932	0.0386
	(0.005)***	(<0.001)***	(0.017)**	(<0.001)***	(<0.001)***	(0.001)***	(0.006)***	(0.153)
qtrret	0.4960	0.1711	0.4010	0.1591	-0.0248	0.4111	0.3368	1.0126
	(0.001)***	(0.063)*	(0.013)**	(0.072)**	(0.851)	(<0.001)***	(0.022)**	(0.001)***
size	0.7732	1.0847	0.7055	1.0785	0.9964	1.0147	0.7172	0.4994
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
btm	-0.0284	0.0058	-0.0144	0.0061	-0.0144	-0.0282	-0.0328	-0.0397
	(0.018)**	(0.002)***	(0.059)*	(0.001)***	(0.139)	(0.238)	(0.410)	(0.090)*
tradevol	0.1950	0.1429	0.0950	0.3540	0.1036	0.3645	0.1807	0.2802
	(0.012)**	(0.083)*	(0.049)**	(<0.001)***	(0.090)*	(<0.001)***	(0.181)	(0.072)*
anacov	0.0098	0.0310	0.0113	0.0321	0.0077	0.0063	0.0163	0.0152
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(0.002)***	(0.005)***	(<0.001)***	(<0.001)***
laglnetsales	0.3939	0.3312	0.3978	0.3155	0.3461	0.3398	0.3635	0.4290
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
stdearnings	-0.0002	-0.0033	-0.0002	-0.0008	-0.0002	-0.0010	-0.0006	-0.0003

	(0.108)	(0.037)**	(0.128)	(0.236)	(0.099)*	(<0.001)***	(0.041)**	(0.160)
dedi	3.3101	1.4873	3.2805	1.5977	0.6664	1.5965	3.6240	6.8428
	(<0.001)***	(0.083)*	(<0.001)***	(0.087)*	(0.506)	(0.077)*	(0.027)**	(<0.001)***
sox	-1.2806	-0.5411	-1.2949	-0.7781	-0.1702	1.1507	2.3372	-0.0099
	(0.025)**	(0.337)	(0.038)**	(0.177)	(0.749)	(0.036)**	(0.317)	(0.996)
Year-fixed effects	included	included	included	included	included	included	included	included
Industry-fixed effects	included	included	included	included	included	included	included	included
R-squared	0.2946	0.2572	0.2972	0.2384	0.3045	0.3076	0.2625	0.3123
Num. of observations	16,043	16,042	16,043	16,042	11,669	11,669	5,454	5,455

Notes: This table reports the OLS regression results for the tests of H2 as regards the moderating effect of financial constraint on the association between insider sales and future stock price crash risk. The sample period ranges from 1992 to 2013. The dependent variable is *lnetsales*. The treatment variable is *crashrisk*. The moderator variable pertains to financial constraint which is proxied by *hp*, *ww*, *kz*, and *payout*, respectively. The full sample is split into two subsamples based on *dhp*, *dww*, *dkz*, and *dpayout*, respectively. *Dhp*, *dww*, and *dkz* are the sample median of *hp*, *ww*, and *kz*, respectively. *Dpayout* equals 1 if a firm has dividend payout for a fiscal year and 0 otherwise. *dhp*, *dww*, and *dkz* equal 1 for the high financial constraint subsample and 0 for the low financial constraint subsample. By contrast, *dpayout* equals 1 for the low financial constraint subsample and 0 for the high financial constraint subsample. All the variables in the table are defined in the appendix. Year and industry dummies are included but not reported for simplicity. The *p*-values in parentheses are based on robust standard errors clustered by firm. ***, **, * represent the 1%, 5%, and 10% statistical significance levels (two-tailed), respectively.

Table 5 Test of H3: The moderating effect of information asymmetry

Variables	Dependent variable = *lnetsales*			
	dstdearnings=0	*dstdearnings*=1	*dopacity*=0	*dopacity*=1
Intercept	-2.9820	-2.7547	-2.0268	-1.8961
	(<0.001)***	(<0.001)***	(0.001)***	(<0.001)***
crashrisk	0.2714	0.4139	0.0349	0.6522
	(0.090)*	(0.008)***	(0.860)	(<0.001)***
changeroa	0.0427	-0.0228	0.0015	-0.0161
	(0.555)	(0.284)	(0.973)	(0.239)
roa	0.3428	-0.0171	0.2787	-0.0246
	(0.009)***	(0.004)***	(0.020)**	(0.005)***
retvol	1.3453	-3.5396	-2.7147	-0.5209
	(0.098)*	(0.004)***	(0.026)**	(0.554)
sales_growth	0.0474	0.0139	0.1153	0.2481
	(<0.001)***	(0.287)	(0.214)	(<0.001)***
optiong	0.1420	0.0283	0.0627	0.0332
	(<0.001)***	(0.006)***	(<0.001)***	(0.076)*
qtrret	0.2779	0.3422	0.3562	0.2655
	(0.005)***	(0.006)***	(0.015)**	(0.009)***
size	0.8658	0.8143	0.8249	1.1868
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
btm	-0.0649	-0.0153	0.0052	-0.0154
	(0.027)**	(0.161)	(0.064)*	(0.135)
tradevol	0.1290	0.1989	0.3321	0.1277
	(0.147)	(0.006)***	(<0.001)***	(0.057)*
anacov	0.0320	0.0085	0.0103	0.0107
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
laglnetsales	0.3452	0.3809	0.3817	0.3530
	(<0.001)***	(<0.001)***	(<0.001)***	(<0.001)***
ww	1.3901	0.2901	5.7184	7.1246
	(<0.001)***	(0.326)	(0.036)**	(<0.001)***
dedi	3.2760	2.6723	3.1637	3.7422
	(<0.001)***	(0.001)***	(<0.001)***	(0.001)***
sox	-0.4948	1.4684	2.0415	-1.2381
	(0.315)	(0.004)***	(0.004)***	(0.058)*
Year-fixed effects	included	included	included	included
Industry-fixed effects	included	included	included	included
R-squared	0.2495	0.2887	0.2867	0.2925
Num. of observations	16,043	16,042	11,700	11,700

Notes: This table reports the OLS regression results for the tests of H3 as regards the moderating effect of information asymmetry on the association between insider sales and future crash risk. The sample period ranges from 1992 to 2013. The dependent variable is *lnetsales*. The treatment variable is *crashrisk*. The moderator variable pertains to information asymmetry which is proxied by *opacity* and *stdearnings*, respectively. The full sample is split into two subsamples based on *dopacity* and *dstdearnings*, the sample median of *opacity* and *stdearnings*, respectively. All the variables in the table are defined in the appendix. Year and industry dummies are included but not reported for brevity. The *p*-values in brackets are based on robust standard errors clustered by firm. ***, **, * represent the 1%, 5%, and 10% statistical significance levels (two-tailed), respectively.

Table 6 Test of H4: The moderating effect of Sarbanes–Oxley Act of 2002 (SOX)

Variables	Dependent variable = *lnetsales*	
	sox=0	*sox*=1
Intercept	-4.2535	-4.7470
	(<0.001)***	(<0.001)***
crashrisk	0.4413	0.1167
	(0.012)**	(0.414)
changeroa	-0.0024	-0.0469
	(0.987)	(0.047)**
roa	0.2200	-0.0284
	(0.209)	(0.011)**
retvol	3.5147	-5.7947
	(<0.001)***	(<0.001)***
salesgrowth	-0.0494	-0.0011
	(<0.001)***	(<0.001)***
qtrret	0.1230	0.2929
	(0.213)	(0.010)***
size	0.9835	1.5960
	(<0.001)***	(<0.001)***
btm	-0.0100	0.0701
	(0.306)	(0.047)**
tradevol	0.1676	0.1654
	(0.081)*	(0.042)**
anacov	0.0253	0.0101
	(<0.001)***	(<0.001)***
laglnetsales	0.3449	0.3561
	(<0.001)***	(<0.001)***
hp	0.0010	0.0013
	(<0.001)***	(<0.001)***
stdearnings	-1.59E-05	-0.0004
	(0.550)	(<0.001)***
dedi	5.9533	0.9152
	(<0.001)***	(0.233)
Year-fixed effects	included	included
Industry-fixed effects	included	included
R-squared	0.2266	0.3119
Num. of observations	14,662	17,423

Notes: This table reports the OLS regression results for the tests of H4 as regards the moderating effect of Sarbanes-Oxley (SOX) on the association between insider sales and future stock price crash risk. The sample period ranges from 1992 to 2013. The dependent variable is *lnetsales*. The treatment variable is *crashrisk*. The moderator variable is *sox*. The full sample is split into two subsamples based on *sox*. All the variables in the table are defined in the appendix. Year and industry dummies are included but not reported for brevity. The *p*-values in parentheses are based on robust standard errors clustered by firm. ***, **, * represent the 1%, 5%, and 10% statistical significance levels (two-tailed), respectively.

Table 7 Additional test: The association between insider sales and 27-month-ahead & 39-month-ahead stock price crash risk

Variables	(1) Dependent variable = *laglnetsales*	(2) Dependent variable = *llaglnetsales*
Intercept	-2.4757	-3.3644
	(<0.001)***	(<0.001)***
crashrisk	0.2040	0.3942
	(0.063)*	(<0.001)***
changeroa	-0.0105	-0.0004
	(0.196)	(0.976)
roa	-0.0105	-0.0098
	(0.199)	(0.074)*
retvol	-0.8448	-0.2550
	(0.186)	(0.635)
salesgrowth	0.0121	0.0015
	(0.217)	(0.684)
optiong	0.0415	0.0295
	(0.001)***	(0.001)***
qtrret	-0.5259	-0.3131
	(<0.001)***	(<0.001)***
size	0.5984	0.4311
	(<0.001)***	(<0.001)***
btm	-0.0140	-0.0037
	(0.126)	(0.383)
tradevol	0.1616	0.0528
	(0.006)***	(0.162)
anacov	0.0161	0.0196
	(<0.001)***	(<0.001)***
llaglnetsales	0.3814	
	(<0.001)***	
lllaglnetsales		0.4004
		(<0.001)***
stdearnings	-0.0002	-0.0001
	(0.044)**	(0.304)
ww	2.9913	0.0521
	(<0.001)***	(0.628)
dedi	0.3503	2.9246
	(0.209)	(<0.001)***
sox	0.8175	3.3102
	(0.030)**	(<0.001)***
Year-fixed effects	included	included
Industry-fixed effects	included	included
R-squared	0.2859	0.2956
Num. of observations	32,085	32,085

Notes: Column (1) ((2)) of this table shows the OLS regression result for the test of the association between insider sales and 27-month-ahead (39-month-ahead) stock price crash risk, and the sample period covers the

years of 1992-2012 (1992-2011). In Column (1) ((2)), the dependent variable is *laglnetsales* (*llaglnetsales*), and the treatment variable is *crashrisk*. All the variables in the table are defined in the appendix. Year- and industry-fixed effects are included in regressions but not reported for brevity. The *p*-values in parentheses are based on robust standard errors clustered by firm. ***, **, * represent the 1%, 5%, and 10% statistical significance levels (two-tailed), respectively.

Appendix Summary of variable definitions

Variables	Definitions
crashrisk	1 if a firm experiences one or more firm-specific weekly returns falling 3.2 standard deviations below the mean firm-specific weekly returns over a fiscal year, and 0 otherwise. The firm-specific weekly returns measure follows Kim et al. (2011a).
ncskew	The negative of the third moment of each stock's firm-specific daily returns following Chen et al. (2001).
duvol	The standard deviation of down-week firm-specific weekly returns (scaled by the number of down-weeks minus one), divided by the standard deviation of up-week firm-specific weekly returns (scaled by the number of up-weeks minus one) over a fiscal year. The firm-specific weekly returns measure follows Kim et al. (2011a).
minreturn	The minimum value of firm-specific weekly returns over a fiscal year, times (-1), less the mean firm-specific weekly returns, divided by the standard deviation of firm-specific weekly returns over the fiscal year. The firm-specific weekly returns measure follows Kim et al. (2011a).
lnetsales	The natural logarithm of 1 plus volume amount of net insider sales (i.e., insider sales minus insider purchases) made by all the directors and officers over a year ending 3 months prior to the beginning of year for which *crashrisk1*, *crashrisk2*, and *crashrisk3* are measured.
laglnetsales	The natural logarithm of 1 plus volume amount of net insider sales (i.e., insider sales minus insider purchases) made by all the directors and officers over a year ending 15 months prior to the beginning of year for which *crashrisk1*, *crashrisk2*, and *crashrisk3* are measured.
llaglnetsales	The natural logarithm of 1 plus volume amount of net insider sales (i.e., insider sales minus insider purchases) made by all the directors and officers over a year ending 27 months prior to the beginning of year for which *crashrisk1*, *crashrisk2*, and *crashrisk3* are measured.
lllaglnetsales	The natural logarithm of 1 plus volume amount of net insider sales (i.e., insider sales minus insider purchases) made by all the directors and officers over a year ending 39 months prior to the beginning of year for which *crashrisk1*, *crashrisk2*, and *crashrisk3* are measured.
hp	A financial constraint index (*hp*) developed by Hadlock and Pierce (2010). *Hp*=-0.737**size*+0.043**size*^2-0.040**age*, where *size* is the natural logarithm of total assets capped at $4.5 billion, and *age* is the number of years a firm has been listed.
ww	A financial constraint index (*ww*) developed by Whited and Wu (2006). *ww*=-0.091**cash_flow*/*ta*-0.062**dividend_dummy*+0.021**ltd*/*ta*-0.044**size*+0.102* *industry_sales_growth*-0.035**sales_growth*, where *cash_flow* is cash flows from operations divided by lagged total assets, *dividend_dummy* equals 1 if a firm has dividend payout and 0 otherwise, *ltd*/*ta* is the ratio of long-term debt to lagged total assets, *size* is the natural logarithm of lagged total assets, *industry_sales_growth* is annual growth of industry sales at three-digit SIC level, and *sales_growth* is annual change in sales divided by lagged sales.
kz	A financial constraint index (*kz*) developed by Kaplan and Zingales (1997). *kz*=-1.002*(*cf/ta*)-39.368*(*div/ta*)-1.315*(*ca/ta*)+3.139**lev*+0.283**mtb*, where *cf/ta* is the ratio of cash flow to lagged book assets, *div/ta* is the ratio of cash dividends to lagged book assets, *ca/ta* is the ratio of cash balance to lagged book assets, *lev* is the ratio of total debt to book assets, and *mtb* is market-to-book ratio.
payout	The dividend payout ratio, which equals dividend payout divided by earnings before interests and taxes.
changeroa	Return on assets for the next fiscal year divided by that for the current fiscal year.
roa	Return on assets at the end of the next fiscal year.
salesgrowth	Sales revenues for the current fiscal year minus sales revenues for the previous

	fiscal year, scaled by sales revenues for the previous fiscal year.
optiong	The number of options grants at the end of a fiscal year.
qtrret	Buy-and-hold abnormal stock returns of a firm for a fiscal year.
size	The natural logarithm of market value of a firm's equity at the end of the fiscal year.
btm	The book value of firm equity divided by the market value of firm equity at the end of the fiscal year.
tradevol	Dollar trading volume over a fiscal year for a firm.
anacov	The natural logarithm of 1 plus the number of analysts that make at least one earnings forecast for a fiscal year.
dedi	Dedicated institutional investors' stock ownership as a percentage of the outstanding shares for a firm at the end of a fiscal year.
sox	1 if a firm is in the pre-SOX period (i.e., years of 1992-2001) and 0 if a firm is in the post SOX period (i.e., years of 2002-2013).
retvol	The standard deviation of daily market excess return over a 12-month period ending at the end of the fiscal year.
opacity	The three-year moving sum of the absolute value of annual discretionary accruals, a measure of financial opacity developed by Hutton et al. (2009).
stdearnings	The standard deviation of income before extraordinary items in the current and previous four fiscal years.