Earnings Management as a Response to the Threat of Exchange Delisting

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ABSTRACT

Firms are at risk of delisting if they violate stock exchange’s minimum stock price requirement. This paper investigates the extent and prevalence of opportunistic actions firms take in response to this threat. I focus on accruals and real earnings management in the form of discretionary R&D spending and asset sales. The empirical evidence is consistent with firms responding to the threat of delisting by adopting either reverse stock splits or accruals management (but not both). As hypothesized, the subgroup of firms demonstrating significantly positive discretionary accruals (the Non-RSS group) has higher stock price, better subsequent performance, and appears to be shifting earnings from the near future to the reduced stock price year. Because firms with relatively better performance manage accruals rather than implement reverse stock splits (RSS) to boost stock price, results in this paper advance the understanding of the negative market response to RSS news. Firms undertaking reverse stock splits (the RSS group) cut R&D spending in the reduced stock price year. However, the R&D reduction seems to reflect RSS firms’ response to financial distress. Further, as hypothesized, RSS firms and Non-RSS firms enjoy higher listing benefits compared to delisted firms (the Delisted group).

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1. Introduction

In order to continue listing, among other requirements, firms listed on stock exchanges have to satisfy a set of minimum standards related to market capitalization, the number of shareholders, and stock price. Listed firms that violate one or more of these standards face the possibility of delisting. Being delisted is not a trivial event for affected firms. The literature on delistings from stock exchanges documents high costs incurred by firms upon involuntary delistings, including a significant stock price decline, a decrease in stock liquidity, and an increase in stock return volatility (e.g., Sanger and Peterson 1990; Baker and Meeks 1991; Shumway 1997; and Macey et al. 2004). Given the significant costs associated with delisting, the affected firms have incentives to avoid this outcome.

Firms at risk of delisting due to violating the stock exchange’s minimum stock price requirement have incentives to boost their stock price to prevent delisting. Prior research suggests that opportunistic actions, such as accruals and real earnings management, are successful in increasing the stock price, at least in the short term (Bens et al. 2002, Darrough and Rangan 2004, Rangan 1998, and Teoh et al. 1998a&b). Affected firms can also implement reverse stock splits (hereafter, RSS) to increase stock prices, i.e., exchange one new share for more than one outstanding share. However, prior literature finds significantly negative stock market responses to RSS announcements (West and Brouillette 1970, Radcliffe and Gillespie 1979, Peterson and Peterson 1992, Han 1995, and Kim et al. 2003). Peterson and Peterson (1992) suggest that RSS may reflect management’s pessimism about a stock’s ability to reach an attractive trading range and a negative stock market response is therefore justified.¹

¹ However, Peterson and Peterson (1992) do not examine this argument further.
I investigate firm reactions to the threat of being delisted due to low stock price. I also examine the prevalence of each type of response. I focus on accrual earnings management, RSS, and real earnings management in the form of estimated reductions in discretionary R&D spending and increased gains from asset sales. In addition, based on prior literature and an analytical analysis described in Appendix B, I formulate hypotheses about reasons for firms’ differential reactions to the threat of delisting and empirically test these hypotheses. Results from the analytical model lead to two main predictions. First, firms’ reactions to the threat differ as a function of their characteristics. The likelihood of managing accrual earnings, instead of undertaking RSS, to avoid delisting increases with expected future earnings, current earnings, and current stock price. Second, compared to firms that are delisted due to violating the minimum stock price criterion, those undertaking RSS or managing earnings are expected to have higher financing needs and liquidity, and lower listing, proprietary, and information production costs.

The empirical analyses are based on 849 firms whose stock price is below $1.50 for over 40 continuous trading days between 1992 and 2002. Among the sample firms, I observe three outcomes: being delisted without doing a reverse stock split (the Delisted group); continued listing through the implementation of a reverse stock split (the RSS group); and continued listing without engaging in a reverse stock split (the Non-RSS group).

I examine the extent to which firms engage in accruals management in years when they are in danger of being delisted and find evidence consistent with income-increasing accruals management in the Non-RSS group. To mitigate mis-specification inherent in previous discretionary accruals models for firms with extreme performance, I measure accruals management using performance-matched accruals (Kothari et al. 2005). Second, I analyze the characteristics of firms that manage accrual earnings to avoid delisting. As predicted, the
likelihood of accruals management instead of RSS implementation increases with expected
future performance (measured as actual return on assets in the year subsequent to the reduced
stock price year) and current premanaged stock price. Thus, the empirical evidence supports the
signaling explanation for accruals management and the negative market response to RSS news.
Further, the trend in the average stock price of affected firms is consistent with the expectation of
improved future financial performance for the Non-RSS group. Starting from the last month of
reduced stock price (the event month) until at least two years subsequent to it, the average stock
price of the Non-RSS group climbs to the level attained two years prior to the event month. I do
not observe this for the RSS group. Third, I explore firms’ discretionary R&D spending and
abnormal gains from asset sales in the fiscal year of the low stock price (hereafter, the event
year). The empirical evidence suggests that RSS firms cut R&D investment in the event year. I
find that this behavior is more likely a reaction to financial distress rather than opportunistic real
earnings management. Last, the empirical results show that, as compared to Delisted firms, the
remaining sample firms enjoy higher listing benefits.

This study contributes to the literature in the following ways. First, Healy and Wahlen
(1999) suggest that future research examine why some firms appear to manage earnings whereas
others with seemingly similar incentives do not. All firms whose stock price has fallen below the
required minimum level have incentives to boost their stock price given that they did not opt out
of the stock exchange earlier. By examining whether and why some firms utilize earnings
management to achieve this objective, this study can contribute to a more comprehensive
understanding of earnings management behavior and its stock market implications. Second, by
investigating firms that implement RSS and those that do not under similar circumstances, this
study can advance our understanding of the negative market response to RSS news. To my
knowledge, prior research has not formally investigated this phenomenon. In particular, since
affected firms expecting relatively better future performance manage accruals instead of implementing RSS, the market views a RSS announcement as a signal of unfavorable future performance. Third, it improves our understanding of firms’ behavior when strong incentives to avoid adverse delisting outcomes are present. Fourth, the study contributes to the literature on the decision to go public by analyzing the relation between firms’ characteristics and their responses to the possibility of being delisted. Finally, this study attempts to link the research on RSS and delistings by explaining why some firms execute RSS to continue listing while others delist.

The rest of the paper is organized as below. The next section describes the background and motivation. Section 3 develops hypotheses, followed by section 4 that describes research designs and variable measurements. Section 5 describes the data and section 6 presents. Section 7 concludes. Appendix A describes the evolution of the minimum stock price rule at NASDAQ. Appendix B presents an analytical model that motivates the hypotheses.

2. Background and motivation

Stock exchanges require that listed firms satisfy a set of criteria to continue listing. For example, the NYSE evaluates the appropriateness of a firm’s continued listing if the firm does not meet the minimum market capitalization requirement, closing stock price, or other criteria. The AMEX considers such factors as financial performance and market value in reviewing continued listing. Firms listed on the NASDAQ market have to meet a minimum bid price, market capitalization, net tangible assets/net income, public float, and public round lot shareholders², among other requirements. Firms that violate one or more standards face the possibility of being delisted. For firms listed on NASDAQ and NYSE, deficiency in the

² NASDAQ defines public float as total shares outstanding less any shares held by officers, directors, or beneficial owners of 10% or more, and round lot holders as holders of 100 shares or more.
minimum bid price is determined to occur if an issuer’s stock price falls below $1 for 30 consecutive trading days. Compliance is achieved if its stock price is above $1 for 10 and 30 consecutive trading days for a NASDAQ and a NYSE issuer, respectively. AMEX does not have explicit specifications for deficiency and compliance. Under current requirements of the NYSE and NASDAQ, affected firms can have a period from 90 days to over one year in order to comply with the minimum stock price requirement. Appendix A lists, in more detail, the evolution of this rule at NASDAQ.

The NASDAQ and AMEX suggest RSS as one way to increase the stock price for firms delinquent in the minimum bid price criterion. Management typically justifies implementation of RSS with reasons that include attracting institutional investors, increasing stock liquidity and receiving future benefits associated with the listing status. However, none of these reasons can explain the overall negative stock market response documented in prior research to RSS announcements. A rational and shareholder-incentive-acting management team would only use RSS when less costly alternatives are not feasible or are unavailable.\(^3\)

Examples of alternative actions that can increase stock price include reporting improved earnings performance through accruals management or real earnings management (such as R&D reduction, or sale of valuable assets), disclosure of favorable news, streamlining operations through company restructuring or replacing the current management team with a more capable one, and signaling to the market that the stock is undervalued. However, analysis of information disclosure and management turnover is constrained by data availability, especially for small firms that have limited media coverage. Concerns about damage to competitiveness may

\(^3\) According to WSJ.com and Macey et al. (2004), Barry Siegel, chairman and chief executive of Driversshield.com, commented that a reverse split is a desperate attempt by management to lift the stock price after all other means have failed.
constrain these firms in publicly disclosing favorable news early. Firms are likely to have streamlined their operations before it becomes urgent for them to boost stock price. Therefore, it is less likely to find restructuring activities in an event year. For these reasons, I focus on signaling of stock undervaluation as a means to boost stock price. Even at a low price, some of the issues are overvalued, while others are undervalued and would prefer to correct this mispricing. Thus, signaling is a feasible response for affected firms. The traditional means by which firms signal positive private information (such as share repurchases, dividend initiations or increases, and debt issues) are likely to be infeasible for these issuers. Because of their financial frailty, these firms typically do not have cash available for stock repurchases or dividend distribution (Healy and Palepu 1993). In addition, they will have difficulty raising debt capital because the severity of the debt overhang problem increases dramatically for firms nearing financial distress (Myers 1977). For these reasons, I further limit my focus to accruals management and real earnings management.

Prior literature on earnings management argues that when it is costly to assess the degree of distortion in financial reports, or to eliminate the tendency for managers to engage in earnings management, mispricing is possible even in an efficient capital market (Dye 1988, Healy and Palepu 1993, and Slezak 2003). Empirical evidence supports the effectiveness of income-increasing discretionary accruals in temporarily boosting stock prices (Sloan 1996, Bens et al. 2002, Darrough and Rangan 2004, Rangan 1998, and Teoh et al. 1998a&b). Thus, managers of firms facing delisting may be able to temporarily boost their firms’ stock price by inflating accrual earnings. Alternatively, by reporting inflated earnings, management signals their favorable expectation of the firm’s future performance (Subramanyam 1996, and DeFond and Park 1997). If this “signaling theory” is accurate, I expect to observe better future performance and a permanent increase in the stock price of firms that manage accruals. In addition, the
signaling theory may explain the negative stock market response to RSS firms that do not manage earnings.

I choose to examine firms that have violated the minimum bid price requirement, or are close to violating it, for the following reasons. First, Macey et al. (2004) show that violation of the minimum stock price standard is the most common cause of involuntary delisting from stock exchanges. Second, conditions that trigger violation of the minimum bid price rule are clearly specified by stock exchanges and are easily observable. This provides management with sufficient time to evaluate the costs and benefits associated with the available options. Studying of firms’ responses can shed light on management’s assessment of these costs and benefits. Lastly, significant costs associated with delisting are likely to induce firms in danger of violating the minimum stock price rule to take corrective actions, such as RSS, to avoid being delisted. The fact that not all affected firms pursue RSS suggests differential responses by these firms. Given information asymmetry, management’s action reveals private information about the future prospects of the firm (Myers and Majluf 1984). For example, management of a growing firm with high financing needs will try to prevent delisting if public financing is cheaper than private financing. Therefore, the existence of different responses facilitates investigation of the cross-sectional variation in expected costs and benefits associated with each response.

3. Hypothesis development

Firms have incentives to avoid delisting when benefits exceed costs associated with listing. In order to avoid delisting, firms in danger of being delisted due to a low stock price need to boost their stock price above the required minimum. To increase the stock price, the affected firm can, among other means, implement RSS, or signal an improvement in its financial performance through accruals management or real earnings management.
Accrual earnings manipulation uses the accrual flexibility allowed within GAAP to more favorably reflect the firm’s operating results than is implied by the underlying economic activities. Prior literature suggests that inflated earnings can temporarily or permanently boost stock prices (e.g., Darrough and Rangan 2004, Rangan 1998, Sloan 1996, Xie 2001, Teoh et al. 1998a&b, Beneish and Vargus 2002, Rosner 2003, and Subramanyam 1996). On the other hand, some firms with low performance may not try to portray themselves as less troubled through earnings inflation (Healy and Palepu 1990, and DeAngelo et al. 1994). Thus, whether firms with low stock prices manage accrual earnings remains an empirical question. Further, if they do manage accruals in an attempt to increase stock price, they could utilize it as either a substitute or complement to RSS. This leads to Hypothesis 1a and 1b (stated in alternate form):

**H1a:** Firms that face the threat of delisting due to a low stock price engage in accrual earnings management.

**H1b:** Firms that face the threat of delisting due to a low stock price engage in accrual earnings management as a substitute for RSS in boosting stock price.

On the other hand, accrual earnings management is not a feasible option for all firms. If the abnormal positive accruals reverse in later periods without corresponding improvement in underlying performance, reported financial performance will likely disappoint investors. Earnings management may entail the risk of shareholder litigation and reputation costs to the firm and the management team if such management is discovered. Presumably, firms with poor performance in future periods are more likely to incur these costs. Therefore, if management has inside information about the firm’s likely performance in the near future (Lakonishok and Lee 2001, Beneish and Vargus 2002, Ke et al. 2003), they will weigh net benefits of continued listing against costs of earnings management, costs of RSS, and costs of other actions to decide the appropriate response to the threat of being delisted. Only when the net costs related with earnings
management are the lowest among these choices, will management engage in earnings management to boost the stock price.

Appendix B analytically derives characteristics of firms that opt to manage earnings instead of implementing RSS. The model in Appendix B is based on the following assumptions: 1) abnormal accruals will reverse in the near future; 2) stock price varies with earnings changes; and 3) management has inside information about the future performance of the firm. The model predicts that among firms with stock prices lower than the level required by stock exchanges, the probability of earnings management increases with anticipated performance in the near future, current unmanaged stock price and current financial performance. The predictions on stock price and current period earnings are intuitive. Firms whose stock price is far below the minimum level need a significant increase in stock price to avoid delisting. However, earnings increases have a limited impact on stock prices. Firms with very low current period earnings need to shift a significant amount of earnings from the future to report earnings improvement. I use Hypothesis 2a through 2c below (all stated in alternate forms) to test these predictions.

**H2a:** Among firms that avoid being delisted, *ceteris paribus*, firms that expect better short-term premanaged financial performance are more likely to manage earnings upward.

**H2b:** Among firms that avoid being delisted, *ceteris paribus*, firms that have better current period premanaged financial performance are more likely to manage earnings upward.

**H2c:** Among firms that avoid being delisted, *ceteris paribus*, firms that have relatively higher unmanaged stock price are more likely to manage earnings upward.

Examination of **H2a** can further our understanding of the significantly negative market response to RSS documented in the literature. No prior research has formally investigated causes underlying the negative market response. By analyzing all firms facing possible delisting, we can gain a better understanding of this phenomenon. Specifically, evidence supporting **H2a** is consistent with the explanation that the market regards firms’ reactions to the threat of delisting
as a signal of their growth potential. Observing firms’ reactions to low stock prices might enable the market to differentiate firms with low growth potential from those with only temporary price declines. This is especially likely for small firms with sparse analyst following, low media coverage, and limited institutional interest. Given that managing earnings upward is more costly for firms with lower expected earnings growth rates, the market may infer a lower growth rate for firms announcing RSS and adjusts their stock prices downward to reflect the lower expected growth rate. This argument is also consistent with the conjecture that management is pessimistic about a stock’s ability to reach a higher trading range (Peterson and Peterson 1992) and uses RSS as a “last resort” to increase the stock price.

Firms that have been inflating earnings through accruals manipulation in prior years may lack additional latitude to do so and are thus compelled to look for other means to boost earnings (Barton and Simko 2002, Ewert and Wagenhofer 2004, and Gunny 2005). Prior studies provide evidence that firms opportunistically sell assets or adjust R&D spending to manipulate earnings (Baber et al. 1991, and Bartov 1993). In addition, firms that engage in real earnings management experience declining performance in subsequent years (Bens et al. 2002). Among all types of real earnings management documented in prior literature, the stock market appears to efficiently anticipate the negative implications of abnormal decreases in SG&A expense, product selling price, and COGS due to overproduction; but not abnormal R&D decreases and gains on asset sales (Gunny 2005). Hence, I only focus on the last two types of real earnings management as mechanisms to boost stock prices. Since real earnings management has operating implications that affect future performance, I expect firms to engage in this action only after exhausting their capacity for accruals management. In addition, if real earnings management entails a negative impact on earnings in the same period it is undertaken, stock prices may not reach the desired level. Affected firms will either be delisted or employ other mechanisms that can definitely boost
stock price. Thus, I expect that Delisted and RSS firms are more likely to have engaged in real earnings management prior to their delisting or RSS.

It is possible that management may cut R&D spending or dispose of assets as a response to current financial distress or when they expect declining return on investments. Therefore, in examining firms’ R&D spending or asset sales as opportunistic behaviors, I need to control for their current financial situation and prospective performance. The above arguments lead to the following hypotheses.

**H3a: Ceteris paribus**, firms constrained in accruals management are more likely to cut R&D investment or sell long-term assets to increase reported earnings in the event year.

**H3b: Ceteris paribus**, Delisted and RSS firms are more likely to cut R&D investment or sell long-term assets to increase reported earnings in the event year.

Firms that lack the capacity to manage earnings upward or that fail to boost their stock price high enough through inflating earnings can pursue RSS to avoid delisting as long as its implementation is less costly than delisting.⁴ As Prediction 2 in Appendix B suggests, when net benefits associated with listing are lower than both costs associated with RSS and those associated with earnings management, the affected firm will choose delisting.

The capacity to manage earnings is likely to be reflected by the level of net operating assets (Barton and Simko 2002). Costs associated with RSS increase in shares outstanding and the number of shareholders, and decrease in the stock price immediately prior to when RSS is undertaken. To a delisted firm, costs are the forgone net benefits associated with a public firm. Benefits enjoyed by a public company include the following: lower barriers to obtaining financing in the public equity market (Leland and Pyle 1977); higher liquidity of common stock (Amihud and Mendelson 1988); higher public recognition (Merton 1987), opportunities to use

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⁴ Another criterion for the implementation of RSS is that RSS will not cause violation of other exchange requirements, such as the public float and round lot shareholders provisions.
stock price for performance evaluation of managers; better information for value-enhancing monitoring by outside investors (Holmstrom and Tirole 1993; Bolton and Von Thadden 1998); portfolio diversification by investors (Chemmanur and Fulghieri 1999); easier access by the market for corporate control (Zingales 1995); and the ability to use shares as acquisition currency. At the same time, a public firm bears listing costs that include both fixed costs and costs proportionate with the firm’s market value (Ritter 1987). Proprietary costs of disclosure are another concern for a public firm, especially for an innovative firm (Campbell 1979, Yosha 1995). After delisting to the Pink Sheets or becoming a privately-held entity, a firm can save direct listing costs as well as avoid disclosing sensitive information to the public (DeAngelo and DeAngelo 1987).

H4 summarizes the above arguments.

**H4:** Compared to firms that are delisted due to violating the minimum stock price criterion, those undertaking RSS or accruals management have higher net benefits from continued listing.

4. Research design and variable measurement

4.1 Tests of H1a and H1b

To test H1a and H1b, I first investigate accruals management behavior of the three subgroups of firms individually in the event year. The RSS group includes firms that are able to continue listing through the implementation of RSS. Firms that continue listing without undertaking RSS are in the Non-RSS group. The Delisted group includes firms that are delisted because of an extended period with a low stock price. Using model (1) below, I further analyze the relationship between the magnitude of discretionary accruals and subgroup classification of firms after controlling for financial distress, accruals management constraints, and net listing benefits.
Finding accruals management in the sample firms supports $H1a$, i.e., firms engage in accruals management to boost stock prices so as to avoid delisting. Evidence of management in the Non-RSS group ($\alpha_1 > 0$), and not in the RSS group ($\alpha_2 = 0$), would support $H1b$, i.e., accruals management is an alternative means to RSS in avoiding delisting.

$$DADIFF_t = \alpha_0 + \alpha_1 D_{NONRSS} + \alpha_2 D_{RSS} + \alpha_3 ALTMANZ_{t-1} + \alpha_4 R_{NOA}_{t-1} + \alpha_5 VOLAT_{t-1} + \lambda_1 \times m LB_{m \times 1} + \gamma_1 \times n LC_{n \times 1} + \varepsilon$$ (1)

Where (Compustat item numbers in parentheses):

- $DADIFF$ = the performance-matched discretionary accruals, computed as the difference of total assets-scaled discretionary accruals [based on Jones’ (1991) model] between a sample firm and a control firm matched on industry, year, and return on assets.
- $t$ = the period when stock price drops to a low level and increases the risk that the firm violates the minimum stock price rule.
- $D_{NONRSS} = 1$ for Non-RSS firms, and 0 otherwise.
- $D_{RSS} = 1$ for RSS firms, and 0 otherwise.
- $ALTMANZ$ = Altman’s (1968) Z-score.$^5$
- $VOLAT$ = the volatility of stock price in the 36-month period prior to the event month, measured as $\sqrt{\frac{1}{N-1} \sum_{i=-N}^{1} \left( \log \left( \frac{P_i}{P_{i-1}} \right) - \log \left( \frac{P_i}{P_{i-1}} \right) \right)^2}$, where $N$ is the first month with available stock price data in this period, and -1 is the month immediately before the event month, $P_i$ is the closing stock price for month $i$.
- $LB$ = the matrix of $m$ variables that proxy for benefits associated with the listing status, including financing needs, stock liquidity, outside monitoring, chances to transfer control of a firm, and the use of stock in merger and acquisition.
- $LC$ = the matrix of $n$ variables that proxy for direct and indirect costs associated with the listing status.
- $R_{NOA}$ = percentile of net operating assets (NOA) with the sample firms at the beginning of the year, converted to be between 0 and 1 by dividing the percentile of each observation with 99. NOA is measured as [shareholders’ equity (#199 × #25) - cash and marketable securities (#1) + total debt (#9 + #34)] / sales (#12). All are measured in prior year except sales, which is measured in two years before the event year.$^6$

$^5$ Altman’s Z-score is measured as $[1.2 \cdot \text{net working capital} / \text{total assets (data179 / data6)} + 1.4 \cdot \text{retained earnings} / \text{total assets (data36 / data6)} + 3.3 \cdot \text{earnings before interest and taxes} / \text{total assets (data170 / data6)} + 0.6 \cdot \text{market value of equity} / \text{book value of liability (data199 data25 / data181)} + 1.0 \cdot \text{sales} / \text{total assets (data12 / data6)}]$. 

$^6$ I also use the percentile within industry and year to measure $R_{NOA}$. Results are not changed by this modification.
I use discretionary accruals to gauge the level of earnings management using accruals. Results in Dechow et al. (1995) show that models previously used to measure discretionary accruals (e.g., Healy 1985, DeAngelo 1986, Jones 1991, and Dechow and Sloan 1991) and a modified Jones’ model developed in their paper bias discretionary accruals measurement downward for firms with poor performance, which is likely for my sample firms. To mitigate this problem, I use the performance-matched discretionary accruals model proposed in Kothari et al. (2005) to measure the magnitude of accruals management. I calculate discretionary accruals based on the cross-sectional Jones (1991) model and then adjust the discretionary accruals of each sample firm for a performance-matched firm’s discretionary accruals to get DADIFF. Since Kothari et al. (2005) find that Jones’ (1991) model augmented with an intercept is the least misspecified, I use that form of the model:

$$\frac{\text{Total accruals}_{i,t}}{\text{Total assets}_{i,t}} = \alpha_0 + \alpha_1 \frac{1}{\text{Total assets}_{i,t}} + \alpha_2 \frac{\Delta Sales_i}{\text{Total assets}_{i,t}} + \alpha_3 \frac{PPE_i}{\text{Total assets}_{i,t}} + \epsilon.$$  

The match between sample firms and control firms is made on year, industry membership based on the two-digit SIC, and return on assets. To mitigate the contamination caused by similar incentives to boost stock price among firms with low stock prices, the control group only includes firms whose stock price is higher than ten dollars.

Firms in financial distress may differ from other firms in their incentives or ability to manage accruals relative to other firms. For example, they may have stronger incentives to increase cash than earnings so as not to inflate accruals. I include Altman’s Z-score (Altman 1968) to control for financial health. Affected firms may lack the capacity to manage accruals if they are constrained in their accruals management flexibility, as reflected by accumulated accruals management from previous years. Following Barton and Simko (2002), I use the
percentile of the beginning balance of net operating assets (NOA) scaled by lagged sales to measure accumulated accruals management. Larger NOA implies smaller accruals management flexibility. I include volatility of stock price (VOLAT) to control for the impact of volatility on firms’ responses to stock price decline. When the stock price is more volatile, the decline in it is more likely to be temporary. Therefore, firms with higher volatility in their stock prices are less likely to take actions to boost stock price. Thus, I expect a negative relation between the magnitude of volatility and discretionary accruals.

*LB* and *LC* are included to control for differential listing benefits and costs associated with sample firms. If net listing benefits (*LB* - *LC*) are lower than costs associated with accruals management, affected firms would not manage accruals. Detailed definitions of *LB* and *LC* variables are described below and in Table 1.

Since low barriers to public financing are more important for firms with higher financing needs (DeAngelo and DeAngelo 1987), I use financing needs as measured by leverage and capital intensity to proxy for this type of listing benefit (Bushee and Leuz 2005). Firms with greater leverage may also have covenants that require exchange listing. These firms will want to remain listed in order to avoid costs of violating these covenants.

One outcome of delisting is a significant deterioration in stock liquidity, as reflected in smaller trading volume and higher trading spread (Macey et al. 2004; Angel et al. 2004). Firms with higher liquidity have stronger incentives to avoid delisting. I use the turnover of outstanding shares in the year prior to the stock price decline, natural logarithm of the number of common shares outstanding, and the presence / absence of financial analysts following a firm to proxy for liquidity. In addition, I follow Bushee and Leuz (2005) in using the number of shareholders to
measure concentration of ownership, and thus liquidity. These variables also proxy for the value of outside monitoring, access of the market for corporate control, and the ease of using shares in mergers and acquisitions.

A public firm incurs significant direct and indirect costs to maintain listing. Examples of direct costs are SEC filing costs, audit fees, and legal fees. Macey and O’Hara (2002) note that the listing fees imposed by NYSE forces some firms to stay off the exchange. Ritter (1987) notes that fixed listing costs are disproportionately high for small firms. NYSE, AMEX and NASDAQ all state listing fees that have a step-wise relation with the number of outstanding shares. I use firm size, measured by total assets, and the number of outstanding shares to control for fixed and variable listing costs, respectively.

Indirect costs include proprietary costs of public disclosure and information production costs (Chemmnur and Fulghieri 1999). I expect firms in industries with higher competition to incur higher proprietary costs of public disclosure. I use the Herfindahl Index to measure industry competition. Information production costs refer to the costs of producing information to convince investors about the quality of the issuing company. Presumably, smaller firms, development stage enterprises, and firms with low analyst coverage face higher information production costs. Thus, I use total assets, the number of years that the firm has listed on a stock exchange, and the number of financial analysts following the firm to measure information production costs.

4.2 Tests of $H2a$ through $H2c$

Model (2A) below is used to test $H2a$ through $H2c$.

$$DADIFF_t = \alpha_0 + \alpha_1 R\_ROA_{t+1} + \alpha_2 R\_ROAADJ_t + \alpha_3 P_t + \alpha_4 D\_NONRSS +$$

7 Ideally, I should use the ownership of outside shareholders to proxy for both liquidity and outside monitoring. However, these data are not readily available.
Where (Compustat item numbers in parentheses):

\[ R\text{\_ROAADJ}_t = \text{percentile of premanaged return on assets, converted to be between 0 and 1 by dividing the percentile with } 99. \text{ Return on assets is measured as } \frac{\text{earnings before extraordinary items (#18)} - \text{DADIFF} \times \text{total assets at the beginning of the period (#6)}}{\text{total assets at the beginning of the period (#6)}}. \]

\[ R\text{\_ROA}_{t+1} = \text{percentile of return on assets for year } t+1. \text{ It is measured in a similar way to } R\text{\_ROAADJ}_t \text{ except that return on assets is not adjusted for discretionary accruals.}^8 \]

\( P = \text{stock price on the last day of the event month.} \)

The definitions of other variables and the rationales of controlling for them are the same as in model (1).

Significantly positive \( \alpha_1, \alpha_2, \) and \( \alpha_3 \) support \( H2a, H2b \) and \( H2c \), respectively.

Alternatively, if a subgroup of my sample firms has relatively high current period earnings \( (R\text{\_ROAADJ}) \) and considers the stock price decline as temporary, they do not manage accruals. The absence of accruals management in this group of firms will bias downward the coefficient on the percentile of current period premanaged performance, \( \alpha_2 \). In addition, DeFond and Park (1996) document evidence of earnings smoothing for a group of relatively healthy firms. If my sample firms also engage in earnings smoothing behavior, \( \alpha_2 \), is biased downward.

I also use a logistic regression model to test \( H2a \) and \( H2b \).

\[
EM_t = \alpha_0 + \alpha_1 R\text{\_ROA}_{t+1} + \alpha_2 R\text{\_ROAADJ}_t + \alpha_3 P_t + \alpha_4 D\text{\_NONRSS} + \alpha_5 D\text{\_RSS} + \alpha_6 ALTMANZ_{t-1} + \alpha_7 R\text{\_NOA}_{t-1} + \alpha_8 VOLAT_{t-1} + \lambda_{1\times m}LB_{m\times 1} + \gamma_{1\times n}LC_{n\times 1} + \epsilon \]  

(2B)

Where:

\( EM = 1 \) for all firms in the group with significantly positive DADIFF, and 0 otherwise.

This test is conditional on finding evidence supporting \( H1b \). It is utilized to mitigate

---

\(^8\) I do not adjust \( R\text{\_ROA}_{t+1} \) for discretionary accruals due to the difficulty of estimating accruals reversal from year \( t \). This will bias against finding a positive coefficient on \( R\text{\_ROA}_{t+1} \).
measurement error inherent in firm-level DADIFF by focusing on accruals management behavior of a group of firms.

4.3 Tests of H3a and H3b

To test H3a and H3b, I separately investigate abnormal R&D spending and recognizing gains from selling long-term assets and investments for firms with high and low accruals management constraints within each subgroup of the sample. Firms with scaled NOA above the median scaled NOA level among all sample firms are considered as having less accruals management flexibility. Evidences of an abnormal decrease of R&D spending and heightened recognition of gains from asset sales in firms with higher accruals management constraint, but not in those with lower constraint are consistent with H3a. Finding those evidences in Delisted firms and RSS firms, but not in Non-RSS firms, is consistent with H3b. However, abnormal R&D reduction and/or increased recognition of gains from asset sales could result from opportunistic behaviors or optimal responses to financial distress or declining return on investment in R&D or assets. Hence, to distinguish between these explanations, I also use multivariate tests below to analyze the relationship between the likelihood of engaging in real earnings management and the accruals management constraints or listing status, with controls for listing benefits and costs, and financial health and prospective performance. Model (3A) and (3B) test H3a and H3b, respectively.

\[
RM_i = \psi_0 + \psi_1 R\_NOA_{t-1} + \psi_2 R\_ROA_{t+1} + \Psi_3 ALTMANZ_{t-1} + \\
\psi_4 P_t + \psi_5 VOlAT_{t-1} + \lambda_{1 \times m} LB_{m \times 1} + \gamma_{1 \times n} LC_{n \times 1} + \epsilon \quad \text{(3A)}
\]

\[
RM_i = \psi_0 + \psi_1 D\_DELIST + \psi_2 D\_RSS + \psi_3 R\_ROA_{t+1} + \Psi_4 ALTMANZ_{t-1} + \\
\psi_4 P_t + \psi_5 VOlAT_{t-1} + \lambda_{1 \times m} LB_{m \times 1} + \gamma_{1 \times n} LC_{n \times 1} + \epsilon \quad \text{(3B)}
\]

where:

\(RM\) = 1 if abnormal R&D investment is negative or abnormal gains from asset sales are positive, and 0 otherwise.

\(D\_DELIST\) = 1 for firms that are delisted due to low stock price.

Other variables are defined the same as in model (1) and (2).
The percentile of assets-scaled net operating assets at the beginning of the year \((R_{NOA})\) proxies for accruals management constraint. Altman’s Z-score (Altman 1968) controls for financial distress and return on assets in the subsequent year \((R_{ROAt+1})\) controls for prospective performance. A significantly positive coefficient on accruals management constraint, \(\psi_1\) in (3A), would support \(H3a\). Significantly positive coefficients on the dummy variables for the Delisting and RSS group, \(\psi_1\) and \(\psi_2\) in (3B), would support \(H3b\). A significantly negative coefficient on Altman’s Z-score reflects affected firms’ optimal responses as described above.

Based on Berger (1993), I use the following model to estimate normal R&D spending.

\[
\frac{RD_t}{SALES_t} = \beta_0 + \beta_1 \frac{RD_{t-1}}{SALES_{t-1}} + \beta_2 \frac{INT_t}{SALES_t} + \beta_3 Q_t + \varepsilon \tag{4}
\]

Where (Compustat item numbers in parentheses):

\(INT\) = internal funds available for R&D investment, measured by the sum of earnings before extraordinary items (#18), R&D expense (#46), and depreciation and amortization expense (#14).

\(Q\) = Tobin’s Q, defined as \[market value of common shares (#199 × #25) + book value of preferred stock (#130) + book value of both long-term (#9) and short-term debts (#34) ] / total assets (#6).

Following Gunny (2005), to control for coefficient variations by year and industry, I estimate parameters in model (4) for each industry (classified by Fama and French 1997) and year. Abnormal R&D investment is measured by the difference between actual and the estimated R&D spending in the event year.

Model (5) below is based on Bartov (1993) and Gunny (2005) and estimates normal level of gains on the sale of assets and investments.

\[
\frac{GAINA_t}{MV_{t-1}} = \theta_0 + \theta_1 \frac{ASALES_t}{MV_{t-1}} + \theta_2 \frac{ISALES_t}{MV_{t-1}} + \theta_3 LOGSALES_t + \theta_4 SALES_{GRt} + \varepsilon \tag{5}
\]

Where:

\(GAINA\) = gains or losses from sale of assets and investments (- #213).

\(MV\) = market value of common shares at the beginning of the period (#199 × #25).
Asales = sales of long-term assets (#107).
Isales = sales of investments (#109).
Logsales = the natural log of sales (#12).
Sales_gr = sales growth rate, defined as change in sales revenue divided by sales in prior year.

Estimation procedures for abnormal gains from asset sales are similar to those for abnormal R&D spending. Given that asset sales are peripheral to a firm’s operation, I only calculate abnormal gains on asset sales for firms that report non-zero asset sales.9

4.4 Tests of H4

The following logistic regressions are used to test H4, which suggests that RSS and Non-RSS firms enjoy greater benefits from listing than do Delisted firms.

\[
D_{RSS_t} = \varphi_0 + \varphi_1P_t + \varphi_2ALTMANZ_{t-1} + \varphi_3R\_NOA_{t-1} + \varphi_4VOLAT_{t-1} + \lambda_{1\times m}LB_{m \times 1} + \gamma_{1\times n}LC_{n \times 1} + \varepsilon
\]  

(6)

\[
D_{NONRSS_t} = \varphi_0 + \varphi_1P_t + \varphi_2ALTMANZ_{t-1} + \varphi_3R\_NOA_{t-1} + \varphi_4VOLAT_{t-1} + \lambda_{1\times m}LB_{m \times 1} + \gamma_{1\times n}LC_{n \times 1} + \varepsilon
\]  

(7)

All variables are as defined in model (1) and (2).

Model (6) is estimated among RSS and Delisted firms. Model (7) is estimated among Non-RSS and Delisted firms. Positive \( \lambda \) and negative \( \gamma \) support H4.

To implement RSS, firms have to incur costs, including time, effort, and money spent on designing the RSS scheme and exchanging shares. Presumably, firms with more outstanding shares and more shareholders have higher implementation costs. Since these variables also proxy for listing benefits, signs on estimated coefficients will depend on which effect dominates. Costs of accruals management or RSS implementation are likely to increase with the stock price increase needed to avoid delisting. I include the stock price on the last day of the event month to control for this effect. In addition, if distressed firms are incapable of increasing their stock price in the event year or unable to maintain listing status in the future after successfully avoiding

9 Based on model (5), when Asales and Isales are zero, the estimated normal level of gains on assets sales is positive. Therefore, including firms that do not sell assets in a given year will bias downward the estimation of abnormal gains from asset sales.
delisting in the event year, they would be more likely to choose delisting. I use Altman’s Z-score at the beginning of the event year to control for financial distress. I include the percentile of NOA to control for the impact of accruals management constraint on affected firms’ responses.

5. Data

I consider firms to be facing the possibility of delisting when their stock price has been below $1.50 for over 40 more consecutive trading days between 1992 and 2002. The choice of price level and period length is based on current exchange requirements. Both NYSE and NASDAQ specify $1 as the minimum bid price. AMEX’s minimum stock price rule only stipulates a sufficiently low price for a sufficiently long period. Both NASDAQ and NYSE state that firms will be notified of the possibility of delisting if their stock price has been below $1 for 30 consecutive trading days.\(^{10}\) For firms meeting this criterion more than once, I use the last incidence.\(^{11}\) If a firm implements RSS more than once, based on the distribution codes in CRSP, I select the stock price drop period immediately prior to the first RSS. The sample period starts in 1992 since NASDAQ implemented the minimum stock price rule from September 1991. I choose 2002 instead of 2004 as the end of the sample period to correctly identify the last period of reduced stock price if there are a series of observations.

I identify firms’ listing status based on delisting codes provided by CRSP. Issues with code 100 (552) are still traded on one of the stock exchanges (delisted due to low stock price). I

\(^{10}\) I also select $1.50 to maximize the power of my tests. Presumably, firms have the strongest incentive to boost a stock price when it is close to but above $1. Firms with much higher stock prices will not have this incentive and firms with stock prices below $1 will find it either too late or too costly to manage accruals. In addition, firms with high stock prices may have already managed accruals in previous years. I also investigate accruals management of firms using $1.40 and $1.60 as the cutoffs. When I use $1.40, results of accruals managed by subgroups are qualitatively the same as those reported in the tables. When I use $1.60, I find accruals management by the Non-RSS group in the prior year, but not in the event year.

\(^{11}\) When management of a subgroup of firms knows that a stock price drop is temporary, a situation more likely for the first or middle incidence, they may not take actions to boost the stock price. This will reduce the power of the tests on discretionary accruals. Consistent with this conjecture, using the same sample firms, I find no evidence of accruals management for the first incidence.
classify firms with code 100 and no record of RSS as Non-RSS firms, those with code 552 as Delisted firms, and those with one or more RSS records as RSS firms.  

Among 1,109 firm observations from CRSP that meet these criteria, 260 lack sufficient data in COMPUSTAT to estimate discretionary accruals. Analyst following information comes from I/B/E/S. The final sample has 849 firms, including 57 listed on NYSE, 59 listed on AMEX, and 733 listed on NASDAQ. Among the sample, 277 are in the Non-RSS group, 297 in the Delisted group, and 275 in the RSS group. Due to differences in data availability, the number of observations varies in each analysis.

Figure 1 graphs the trend in the mean stock price around the last month of reduced stock price (month 0) separately for Non-RSS, Delisted and RSS firms. The stock price is adjusted for RSS firms to eliminate the impact of the reverse stock split on the stock price. The figure shows that the stock prices of Non-RSS and RSS firms are similar before the event month but diverge dramatically afterwards, with the average stock price of the Non-RSS firms climbing steadily and that of the RSS firms increasing only slightly.

Table 2 presents descriptive statistics on firms in each subgroup. Among all sample firms, Non-RSS firms have the highest stock price, longest listing history, highest return on assets the year subsequent to the event year, the highest Altman’s Z-score (least distressed), and lowest stock price volatility. Delisted firms have the lowest stock price and shortest listing history. RSS firms have the highest turnover of outstanding common shares and the greatest number of outstanding shares.  

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12 Among the 275 RSS firms, 89 are subsequently delisted. I constrain my sample of Delisted firms to those without a RSS during the sample period. 
13 Since multicollinearity can be a serious problem when the explanatory variables have low variation, I examine Pearson correlations among variables used in the estimations (See Maddala, pp278-291, or Green, pp255-259). The highest correlation between explanatory variables is only 0.48 (between the stock price and the dummy variable for the Non-RSS group) and 0.47 (between the logarithm of common shares and analyst following). To diagnose any
To estimate the performance-matched discretionary accruals, I match each sample firm with a control firm. Table 3 describes differences between these two groups. The difference in return on assets between these two groups is not significant, suggesting that the matching process yields pairs comparable in performance. Overall, the sample firms are significantly smaller, less leveraged and have been listed on a stock exchange for a shorter period. In addition, they have lower number of common shares outstanding, and sparser analyst coverage than their matches. Sample firms have lower capital intensity and lower Altman’s Z-score, and less trading activities in their common stock. These last three differences are statistically significant in a Wilcoxon test, but not in a t-test of means.14

6. Results

6.1 Tests of $H_{1a}$ and $H_{1b}$

Panel A in Table 4 describes the performance-matched discretionary accruals for the total sample and for the three subgroups (Non-RSS, Delisted and RSS groups) based on annual data in the event year. Tabulated results are based on discretionary accruals that are winsorized at the 1% level.15 Discretionary accruals are positive ($p=0.09$) for the Non-RSS group, but not for the other two groups. Since the minimum stock price rule is different for firms listed on the different exchanges, I further examine accruals for firms listed on each of the major stock exchanges within each subgroup. Only firms listed on NASDAQ demonstrate evidence of upward accrual earnings management within the Non-RSS group ($p=0.02$).16 RSS and Delisted firms listed on NASDAQ, “erroneous” coefficient estimates caused by potential multicollinearity, I omit the dummy variable for the Non-RSS group and the logarithm of common shares for the first and the second case, respectively, and report the results after the omission when they differ from the complete specification.

14 To address the possible impact of these differences on the estimated performance-matched discretionary accruals, I further match each firm within the sample and report the results after the omission when they differ from the complete specification.

15 Results without winsorization or based on 2% winsorization are qualitatively similar.

16 Insignificance of the performance-matched discretionary accruals for RSS firms listed on NYSE and AMEX could be due to lack of power given the small number of observations, 24 and 43, respectively.
and Non-RSS firms listed on NYSE appear to have negative accruals, suggesting the possibility that these firms take a bath in a bad year. However, caution is warranted in interpreting the results for Non-RSS firms listed on NYSE given the small number of observations.

To investigate whether the discretionary accruals in the event year are caused by systematic measurement error in the discretionary accruals or by omitted variables, I also examine accruals in the one and two-year period prior to the event year. There is no evidence of accruals management in either year. For simplicity, I only present abnormal accruals in the year prior to the event year in Panel B of Table 4. These results corroborate my conclusion based on Panel A, i.e., Non-RSS firms inflate earnings in the event year as a response to the threat of being delisted.

To calculate the performance-matched discretionary accruals, I match each sample firm with a firm on return on assets. However, the sample firm and control firm have different incentives to manage accruals, and also differ in size and development stage. To investigate whether these differences systematically bias the discretionary accruals measurement upward, I match each Non-RSS firm separately with a Delisted and a RSS firm on industry, year and total assets. To increase the number of the matched pairs, I classify industries based on Fama and French (1997). Presumably, these firms all have incentives to boost stock price and, are of similar size and at the same stage of development. Discretionary accruals are measured as the difference in the performance-matched discretionary accruals between a Non-RSS firm and a matching firm. As described in Panel C of Table 4, the event-year discretionary accruals for the Non-RSS group are significant independent of matching with Delisted or RSS firms.

Panel A of Table 5 presents estimation results of model (1). D_NONRSS is positive and significant while D_RSS is not significant. Overall, the empirical evidence supports both $H1a$ and $H1b$, i.e., firms inflate earnings in the event year and use accruals management as an
alternative to RSS to boost stock prices. The evidence is the strongest for NASDAQ firms where most sample firms are listed. In addition, firms with higher Altman’s Z-score, lower leverage, no analyst coverage, lower accruals management constraint and stock price volatility have higher discretionary accruals.

6.2 Tests of $H2a$ through $H2c$

Estimated coefficients of model (2A) in Panel B of Table 5 indicate that higher subsequent return on assets, higher Altman’s Z-score, larger firm size, lower NOA level and stock price volatility, the absence of analyst following, and that belonging to the Non-RSS group are associated with higher discretionary accruals. Thus, $H2a$, but not $H2b$ or $H2c$, are supported. There appears to be a negative relation between current performance and the tendency to manage accrual earnings upward. A possible explanation for this finding is the absence of accruals management for firms that have relatively high performance in the event year and anticipate their stock price decline to be temporary. An alternative explanation is the earnings smoothing behavior documented in DeFond and Park (1997).17

Given the results of tests of $H1a$ and $H1b$, the left-hand binary variable in model (2B) equals 1 for all firms in the Non-RSS group, which shows significantly positive mean discretionary accruals. Estimation results are presented in Panel C of Table 5 and support both $H2a$ and $H2c$, but not $H2b$. The likelihood of being in a group with higher accruals management increases in subsequent return on assets, stock price, Altman’s Z-score, firm size, and the presence of analyst following, and decreases in the number of shares outstanding. Overall, the results seem to support the story that firms use accruals to signal that they expect a better future.

17 The insignificance of the coefficient on $P$ could be due to the significant correlation of $P$ with $D_{NONRSS}$. In a regression omitting $D_{NONRSS}$, the coefficient on $P$ is positive and significant at 0.055 in the one-tailed test.
To further test the sensitivity of the results to the measurement of discretionary accruals, I code $EM$ as 1 for firms with positive $DADIFF$ and 0 otherwise. The results are qualitatively similar to those in Panel B except that the coefficients on $D\_NONRSS$, $1/ASSETS$, $D\_FOLLOW$, $R\_NOA$, and $VOLAT$ are not significant. Results are similar when I code $EM$ as 1 for firms with higher-than-median level of $DADIFF$ within the sample firms.\textsuperscript{18, 19}

6.3 Tests of $H3a$ and $H3b$

Table 6 presents descriptive statistics on event-year abnormal R&D investment and gains on asset sales for each sample subgroups. There is no evidence of abnormal gains on asset sales in any subgroup. Among the three subgroups, only the RSS group shows abnormally low R&D investment. However, the abnormal R&D decrease does not appear to be related to the accruals management constraint. Estimation results of model (3A) presented in Panel A of Table 7 further show that, contrary to $H3a$, the likelihood of cutting R&D investment or selling assets at gains decreases in the accruals management constraints. Panel B of Table 7 presents estimation results of model (3B). Inconsistent with $H3b$, R&D reductions are not more likely for firms in the RSS and Delisting subgroups. In addition, the likelihood of cutting R&D investment or selling assets at gains decreases in Altman’s $Z$-score, leverage, and the Herfindahl index, and increases in size. Coefficients on other variables are insignificant. The results are consistent with firms cutting R&D spending or selling assets as a response to financial distress rather than as a means to increase earnings.

\textsuperscript{18} I also investigate the relation between the likelihood of meeting/beating an earnings threshold and firm characteristics. I use zero and prior year’s earnings before discontinued and extraordinary items as the threshold. The results are consistent with those in Panel B of Table 5 in that firms with anticipated strong future performance are more likely to exceed an earnings threshold.

\textsuperscript{19} Since NASDAQ eliminated exceptions to the minimum stock price rule in 1997 and temporarily suspended it in 2001 (see Appendix A for more detail), I add two time period dummies in the tests of $H2a$ through $H2c$, one for the period before 1997 and the other for 2001. Results in Table 5 are unchanged. The dummy variable for 2001 is significantly negative, consistent with less accruals management in that year.
To further investigate motivations behind reductions in R&D spending and asset sales, I examine these behaviors in the year prior to the event year. An absence of R&D reductions in the prior year is consistent with an opportunistic decrease of R&D as a response to the threat of delisting. Both Delisted firms and RSS firms show evidence of abnormal R&D reductions but show no evidence of abnormal asset sale gains. In summary, RSS and Delisted firms, but not Non-RSS firms, seem to be decreasing R&D as a response to financial distress around the period of low stock price. I find no evidence that this behavior is driven by constrained accruals management.

6.4 Tests of $H4$

Table 2 presents data on the differences between the Delisted group and the other two groups. Firms in the other two groups have higher stock prices, longer listing history, and are larger, implying lower information production costs and low direct listing costs relative to assets. Compared to Delisted firms, RSS firms have greater number of shareholders and more outstanding shares, and their common shares are more actively traded, implying higher liquidity in their outstanding shares; Non-RSS firms are more capital intensive, and have higher current and future return on assets, suggesting higher financing needs and stronger incentives to withhold information from their competitors.

The multivariate logistic analysis in Table 8 based on Model (5) highlights the major factors associated with firms’ decisions to undertake actions that reduce the probability of delisting. Firms that have a relatively higher stock price are more likely to take actions in order to avoid delisting. A higher stock price implies a smaller reverse split factor or relatively less accruals management in order to boost stock price to the desired level, and therefore, lower costs associated with either action. Consistent with $H4$, the results in Pane A of Table 8 indicate that firms with more common shares outstanding are more likely to select RSS over delisting. Further,
firms with lower stock price volatility are more likely to implement RSS than delist. Contrary to $H4$, the results suggest that smaller firms and those with no analyst following are more likely to undertake RSS than delisting. Also consistent with $H4$, the comparison of Delisted and Non-RSS groups in Panel B of Table 8 indicates that larger firms with higher turnover of outstanding shares and greater number of shareholders are more likely to engage in income-increasing earnings management. As suggested in the literature, the number of shareholders and outstanding shares, and the turnover of outstanding shares are positively associated with liquidity, which increases the value from outside monitoring (Holmstrom and Tirole 1993, Pagano and Roell 1998, Bushee and Leuz 2005). Hence, the above results are consistent with the hypothesis that firms strive to maintain listing when benefits associated with liquidity and outside monitoring are higher.20,21

7. Conclusions and avenues for future research

This study investigates reactions of firms with low stock prices to the prospect of violating the minimum stock price rule enforced by stock exchanges. I find evidence consistent with income-increasing accruals management in the event year. The accrual earnings management is statistically significant only in the Non-RSS group. The results are robust to winsorizing at different levels and alternative matching criteria. I also develop an analytical model to demonstrate that accruals management, as an inter-temporal earnings transfer, is more

20 An alternative explanation for firms choosing to delist rather than engage in a reverse stock split is that firms in the Delisted group may violate the requirements of public float and round lot shareholders if they engage in a reverse stock split. Although I cannot rule out this possibility without investigating each affected firm in more detail, the number of outstanding common shares and shareholders of an average Delisted firm as described in Table 2 mitigate this concern. An average Delisted firm has over ten million shares and close to two thousand shareholders, which are much more than the required one million shares and four hundred shareholders, respectively.
21 I also investigate $H4$ using a multinomial logit model. The results are similar to those presented in the text except that the likelihood of being in the Non-RSS group relative to being in the Delist group is not related to the turnover of outstanding shares or the number of shareholders, but increases with the number of shares outstanding and decreases in stock price volatility.
likely for firms with anticipated stronger future performance, higher current performance, and/or higher stock price. Empirical evidence supports the above analytical predictions except for the relation between the likelihood to engage in accruals management and current performance. The negative relationship between these variables might be due to the absence of accruals management in firms that have high current earnings and anticipate the stock price decline to be temporary. Alternatively, it could be due to the confounding effect of firms’ earnings smoothing behavior (DeFond and Park 1996).

Further, I provide weak evidence of RSS firms cutting R&D investment in the event year. However, upon further investigation, I find that this behavior is more consistent with efficient decisions in response to financial distress rather than opportunistic real earnings management. I further investigate reasons why approximately one-third of the sample firms opt out of stock exchanges, mainly the NASDAQ, instead of managing earnings or pursuing reverse stock splits, as reverse stock splits seem feasible for most firms. I find that, on average, these firms have lower stock prices and Altman’s Z-scores than firms that take actions to avoid delisting. Compared to Delisted firms, RSS firms have more outstanding common shares; Non-RSS firms are larger, healthier, have greater number of shareholders, and enjoy higher liquidity in their common stock. If the number of shareholders correctly proxies for liquidity (Bushee and Leuz 2005), information production costs decrease in size (Chemmanur and Fulghieri 1999), and trading liquidity increases with the number of outstanding shares, the results support the hypothesis that firms with higher net listing benefits are more likely to take actions to avoid delisting. However, I cannot completely rule out the possibility that Delisted firms’ ability to implement RSS is constrained by other exchange requirements, such as public float and the number of round lot shareholders. Given the small number of observations from NYSE and
AMEX, caution is warranted in generalizing the results to firms listed on these two stock exchanges.

Results in this paper raise several questions for future research. First, what causes the decline in stock price that starts at least twenty-four months before the event month? Are the reasons different for each subgroup of firms? Second, as shown in Figure 1, stock prices of Non-RSS firms climb sharply immediately after the event month. This suggests that the market has favorable information about this subgroup at that time, such as the anticipation of positive future performance. However, definitive conclusions will have to await future research. Further, my study relies on the cross-sectional examination of the tools used by affected firms to boost stock price. Future research can apply a time-series analysis of firms’ behavior in the same context. A time-series study will help to answer the following questions. Why do Non-RSS firms not take actions to avoid a decline in stock price at earlier times? Do these firms repeatedly apply accruals management or does the evidence I document reflect a one-time action?
Appendix A: Changes in the minimum bid price rule at NASDAQ

September 1991 (SR-NASD-90-18)
To continue listing on the NASDAQ, issuers need to meet the $1 minimum bid price except for certain issuers. Exceptions to this rule are allowed: for the SmallCap Market (hereafter, SCM), an issuer is exempt if the market value of its public float is at least $1M and it has capital and surplus of at least $2M. For the National Market (hereafter, NM), an issuer is exempt if the market value of its public float is at least $3M and its capital and surplus is at least $4M.

The compliance period is 90 days for both the NM issuers and the SCM issuers.

August 1997 (SR-NASD-97-16)
Eliminate exceptions to the minimum bid price rule.

September 2001 (SR-NASD-2001-61)
Temporarily suspend the application of the continued inclusion requirements on bid price and market value of public float from September 2001 to January 2002.

June 2001 (SR-NASD-2001-61)
Revise the minimum bid price rule for the continued inclusion in the NASDAQ NM. For firms using the entry standard 3, i.e., market capitalization standard (market value of listed securities at $75M, or total assets at $75M or total revenue at $75M), the minimum bid price for continued listing is revised from $5 to $3.

February 2002- December 2003 (SR-NASD-2002-13 on a pilot basis)
A SCM issuer can get a 2nd 180-calendar-day grace period if, at the end of the 1st 180 days, the issuer meets ONE of the initial quantitative listing standards set forth in Rule 4310 (c)(2)(A), including stockholders’ equity, market value of publicly held shares and net income from continuing operations (in the latest fiscal year or 2 of the last 3 fiscal years).

A NM issuer can phase down to the SCM and later phase up to the NM pursuant the maintenance criteria of NM.

December 2002 (SR-NASD-2002-89)
Compliance is achieved if the issuer’s stock price is above $1 for 10 consecutive business days. This rule clarifies the 10-day period.

March 2003 (SR-NASD-2003-34)
For SCM issuers, if they again meet ONE of the three initial quantitative listing standards in 4310(c)(2)(A), issuers can get another 90 calendar days.

The grace period for a NM issuer is extended from 90 to 180 calendar days.
- For NM issuers using the maintenance standard 2, the minimum bid price is changed from $3 to $1.
- The compliance period is extended from 90 to 180 calendar days.
- Eliminate the provision which permitted certain companies that transferred to the SCM to return to the National Market under the continued inclusion criteria.

December 2003 (SR-NASD-2003-44)
For the SCM issuers, at the end of the 1st 180 calendar days, if they meet ALL initial listing standards, they can get a 2nd 180-calendar-day grace period.

At the end of the 2nd 180 days, the issuer can have a grace period that lasts up to the next shareholder meeting, provided the following 4 requirements are met:

1) all initial listing requirements except the bid price test;
2) the shareholder meeting is scheduled to occur no later than 2 years from the original notification of the bid price deficiency;
3) the issuer obtains shareholder approval at the meeting to carry out a reverse stock split; and
4) the issuer executes the reverse stock split promptly after the meeting.

So, theoretically, the SCM issuers can have as long as 2 years grace period depending on when the next shareholder meeting will be held.

The NM issuers are granted a 2nd 180-calendar-day grace period, conditional on meeting all initial listing standards except the bid price test at the end of the 1st 180 calendar days.
Appendix B: Analysis of firms’ decisions in response to the threat of being delisted

Listed firms need to keep their stock price above $1 in order to satisfy the continued listing requirement of the NASDAQ and NYSE (the AMEX only states “a low price per share”). Once a listed firm’s stock price drops below $1 for a sufficiently long period of time, the firm is in danger of being delisted. The affected firm can either implement RSS or signal to the market about its optimistic growth potential to increase its stock price. Management has inside information about the firm’s growth potential and chooses what action to take and/or what information to disclose to the market. The market infers the firm’s growth potential from the firm’s reaction to stock price drop and the firm’s reported earnings, and updates stock price.

Specifically, at time -1, the stock price of a listed firm drops to $P_{-1}$, which is less than $1$. The firm is in danger of being delisted. Once delisted at time 0, the firm remains unlisted at time 1. To be able to continue listing, the firm has to boost the stock price. Among the possible means to do this, I will focus on accruals and real earnings management, and RSS. In the following two kinds of situations, the firm may not take any actions: 1) The firm is confident that the stock price drop is temporary and will increase soon. 2) The firm decides that it is not feasible or economically beneficial to remain listed. Figure 2 summarizes outcomes under each scenario and related probabilities.

As long as RSS does not cause violations of other exchange requirements, such as public float or round lot shareholders, affected firms with any level of earnings performance can implement RSS. When the firm implements RSS at time 0, it remains listed at time 1. For a firm that avoids delisting at time 0 through upward earnings management, its listing status at time 1 depends on its earnings performance at time 1. I use $Pr_1$ to denote the probability that stock price at time 1 drops below $1$ and the firm is delisted.
I assume that stock price increases in observed earning surprise by a positive constant factor, i.e., \( \frac{dP}{d\Delta E} = b \), and \( P_t = P_{t-1} + b \cdot \Delta E_t \), where \( b \) is referred to as the earnings response coefficient in the literature\(^{22}\). Earnings surprise, \( \Delta E_t \), represents observed earnings change from period \( t-1 \) to \( t \). Further, if reported earnings for one period are inflated by \( m \), a portion of \( \delta \) will reverse in the next period and \( \delta \geq 0 \). \( \delta \cdot m \) can also be regarded as the damage caused by earnings management on future performance, for example, in the case of real earnings management. I further assume that it is costly for investors to verify \( m \) and they respond to reported earnings changes. In addition, earnings management consumes time and effort, increases the risk of lawsuits related with inflated reported earnings, and may cause damage to the firm’s reputation among customers. I use \( \theta \cdot m \) to represent the above costs associated with earnings manipulation of magnitude \( m \).

\(^{22}\) The assumed relationship between stock price and earnings can also be derived from Feltham and Ohlson’s (1995) model when abnormal earnings are 100% persistent, accounting is unbiased, accounting data are sufficient to value the firm, and there is zero dividend distribution.
From the relation between stock price and observed earnings surprise as described above,

\[ P_0 = P_{-1} + b \cdot (\Delta E_0 + m) \]

and

\[ \tilde{P}_1 = P_0 + b \cdot (\Delta \tilde{E}_1 - (1 + \delta) \cdot m) \]

Where, \( \Delta E_0 \) and \( \Delta \tilde{E}_1 \) are true earnings performances without the effect of earnings management. Management knows the realization of earnings change for period 0, \( \Delta E_0 \), but only knows the distribution of earnings change for period 1, \( \Delta \tilde{E}_1 \sim N (\mu, \sigma^2) \). Therefore, \( Pr_{1} \), the probability that stock price is at or above $1 and continues listing at time 1 is \( Pr(\tilde{P}_1 \geq 1) = Pr(\Delta \tilde{E}_1 \geq (1 + \delta) \cdot m) \). From the distribution of \( \Delta \tilde{E}_1 \), \( Pr_1 = \int_{(1+\delta)m}^{\infty} f(\Delta \tilde{E}_1) d\Delta \tilde{E}_1 = 1 - F\left(\frac{(1+\delta) m - \mu}{\sigma}\right) \). Further, \( \theta \) is an increasing function of the probability that earnings management is discovered. Presumably, prior earnings management is more likely to be revealed when earnings surprise in later period is negative.

Therefore, \( \frac{d\theta(Pr_1)}{dPr_1} < 0 \).

I assume that a listed firm receives benefits of \( LB \) and incurs costs of \( LC \) associated with its listing status. \( Net \) represents the net benefits of listing, i.e., \( LB - LC \). Once delisted, it gets zero benefits and incurs no costs associated with being listed. From the fact that the firm did not delist voluntarily at earlier times, I infer that \( Net \geq 0 \).

\[
E[U] = E[Net_0] + E[Net_1] - \text{costs of action taken to avoid delisting}
\]

For firms that resatisfy the requirement of minimum stock price by time 0 without taking any action, \( E[U] = Net_0 + Net_1 \). (B1)

For firms that are delisted without taking any action, \( E[U] = 0 \). (B2)

For firms that avoid delisting through implementing RSS, \( E[U] = Net_0 + Net_1 - C(RSS) \). (B3)

For firms that avoid delisting through managing earnings at time 0,

\[
E[U] = Net_0 + Pr_1 \cdot Net_1 - \theta(Pr_2) \cdot m
\]

(B4)

Where:
\( U \) is management’s objective function, representing benefits a firm receives from listing net of costs associated with the firm’s reaction to the threat of delisting.

\( \text{Net}_0 \) and \( \text{Net}_1 \) are net benefits the firm receives from time 0 through time 1, and thereafter, respectively. Alternatively, \( \text{Net}_0 \) and \( \text{Net}_1 \) represent short-term and long-term benefits, respectively. \( \text{Net}_0 + \text{Net}_1 = \text{Net} > 0. \) By assumption, \( \text{Net}_0, \text{Net}_1 > 0. \)

\( C(\text{RSS}) \) represents costs associated with RSS. It increases in outstanding shares and the number of shareholders, and decreases in \( P_{-1}. \)

In the case of earnings management, management selects the magnitude of earnings manipulation that maximizes \( E[U] \) in equation (B4). Clearly, at the minimal level of \( m \) required to boost stock price to \$1, \( E[U] \) reaches its maximum. Thus, \( m^* = \frac{1 - P_{-1} - \Delta E_0}{b}. \) At \( m^* \), the probability of the firm’s continued-listing at time 1 is \( \text{Pr}_{1}^* = 1 - \Phi \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \), and \( E[U^*] = \text{Net}_0 + \text{Pr}_{1}^* \cdot \text{Net}_1 - \theta(\text{Pr}_{1}^*) \cdot m^*. \)

Although \( E[U] \) in scenario (B1) dominates among all four situations, management that is not very confident about the firm’s future listing status can only choose among (B2) through (B4) to maximize \( E[U]. \) (a) and (b) below are conditions based on which management makes their decisions. When condition (a) holds, management would prefer RSS, and when condition (b) holds, they would manage earnings.

(a) \( C(\text{RSS}) < \min \{ L, \text{Net}_0 + \text{Net}_1 \}, \text{i.e.,} \text{Net}_0 + \text{Net}_1 > C(\text{RSS}) \text{ and } L > C(\text{RSS}). \)

(b) \( L < \min \{ C(\text{RSS}), \text{Net}_0 + \text{Net}_1 \}, \text{i.e.,} \text{Net}_0 + \text{Net}_1 > L \text{ and } C(\text{RSS}) > L. \)

Where: \( L = \Phi \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \cdot \text{Net}_1 + \theta \left( 1 - \Phi \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \right) \cdot m^* \) and can be interpreted as costs associated with earnings management.
\( L \) has the following relations with each of the variables:

\[
\frac{\partial L}{\partial \mu} = f \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \cdot \frac{1}{\sigma} \cdot \left( -\text{Net}_1 + \frac{d\theta}{d\text{Pr}^*_i} \cdot m^* \right) < 0
\]

\[
\frac{\partial L}{\partial m^*} = f \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \cdot \left( \frac{(1 + \delta)}{\sigma} \cdot \text{Net}_1 - \frac{d\theta}{d\text{Pr}^*_i} \cdot m^* \right) + \theta \left( 1 - F \left( \frac{(1 + \delta) \cdot m^* - \mu}{\sigma} \right) \right) > 0.
\]

Where: \( f(\cdot) \) is the probability distribution of a normally distributed variable.

From the function of \( m^* \), I can further derive the following partial derivatives.

\[
\frac{\partial L}{\partial P_{-1}} = \frac{\partial L}{\partial m^*} \cdot \frac{\partial m^*}{\partial P_{-1}} < 0
\]

\[
\frac{\partial L}{\partial \Delta E_0} = \frac{\partial L}{\partial m^*} \cdot \frac{\partial m^*}{\partial \Delta E_0} < 0
\]

\[
\frac{\partial L}{\partial b} = \frac{\partial L}{\partial m^*} \cdot \frac{\partial m^*}{\partial b} < 0
\]

From condition (a) and (b), and the first derivatives described above, I infer that a firm adopts RSS or manages earnings to increase stock price when net benefits associated with listing are sufficiently high. In addition, the likelihood of earnings management (instead of RSS) increases with expected earnings at time 1, stock price at time -1, earnings for period 0, and earnings response coefficient, and decreases in the magnitude of required earnings management \( m^* \). The above results lead to the two predictions below.

**Prediction 1:** The likelihood of selecting earnings management over RSS increases with expected future earnings, current premanaged earnings, current premanaged stock price, and the earnings response coefficient.

**Prediction 2:** Compared to firms that are delisted due to violating the minimum stock price criterion, those undertaking RSS or managing earnings have higher net benefits from continued listing.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Measurement (notation and relation with the variable)</th>
<th>Definition (Compustat item)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings management ((EM))</td>
<td>Performance-matched discretionary accruals ((EM_{t,+}))</td>
<td>Difference of discretionary accruals based on Jones’ (1991) model between sample firm and control firm matched on industry, year, and return on assets</td>
<td>Jones (1991), Kothari et al. (2005)</td>
</tr>
<tr>
<td></td>
<td>Abnormal R&amp;D investment ((RD_RM_{t,+}))</td>
<td>Residual R&amp;D spending from model (4)</td>
<td>Berger (1993), Gunny (2005)</td>
</tr>
<tr>
<td></td>
<td>Gains from asset sales ((GAINA_RM_{t,+}))</td>
<td>Residual gains from sale of assets and investments from model (5)</td>
<td>Bartov (1993), Gunny (2005)</td>
</tr>
<tr>
<td>Constraint on (EM)</td>
<td>Percentile of net operating assets at the beginning of the year within the sample, converted to be between 0 and 1 ((R_NOA_{t-1,+}))</td>
<td>(NOA) is measured as (Shareholders’ equity - cash and marketable securities + total debt) in previous year / sales in two years before ((#199 \cdot #25 - #1 + #9 + #34)/(#12))</td>
<td>Barton and Simko (2002), Gunny (2005)</td>
</tr>
<tr>
<td>1. Financing needs:</td>
<td>Leverage ((LEV_{t-1,+}))</td>
<td>Long-term debt / total assets ((#9)/(#6))</td>
<td>Bushee and Leuz (2005)</td>
</tr>
<tr>
<td></td>
<td>Capital intensity ((PPE_{t-1,+}))</td>
<td>PPE assets / total assets ((#7/#6))</td>
<td></td>
</tr>
<tr>
<td>2. Liquidity of common stock in previous year and/or the value of outside monitoring:</td>
<td>Turnover of outstanding stocks ((TURN_{t-1,+}))</td>
<td>Number of common shares traded in previous year / number of common shares outstanding ((#28)/(#25))</td>
<td>Merton (1987), Pagano (1993), Amihud and Mendelson (1988), Pagano and Röell (1998), Chemmanur and Fulghieri (1999), Bushee and Leuz (2005)</td>
</tr>
<tr>
<td></td>
<td>Number of shareholders ((OWNERS_{t-1,+}))</td>
<td>((#100))</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Natural log of the number of common shares outstanding ((LOGCSOUT_{t-1,+}))</td>
<td>Log((#25))</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of financial analyst following ((D_FOLLOW_{t-1,+}))</td>
<td>Whether a firm is followed by at least one analyst based on I/B/E/S ((D_FOLLOW_{t-1,+} = 1) for firms with analyst following, and 0 otherwise)</td>
<td>Merton (1987), Pagano (1993), Amihud and Mendelson (1988), Pagano and Röell (1998), Chemmanur and Fulghieri (1999), Bushee and Leuz (2005)</td>
</tr>
<tr>
<td>3. Avoidance of violating debt covenants that require exchange listing. Leverage ((LEV_{t-1,+}))</td>
<td></td>
<td>Long-term debt / total assets ((#9)/(#6))</td>
<td>Westenberg and Whalen (2001), Angel et al. (2005)</td>
</tr>
<tr>
<td>Listing costs (LC)</td>
<td>1. Fixed direct costs: Total assets ($ASSET_{t-1}$ -)</td>
<td>(#6)</td>
<td>Ritter (1987), Exchanges’ specifications on listing fees</td>
</tr>
<tr>
<td></td>
<td>2. Variable direct costs: Number of shares outstanding ($LOGCSOUT_{t-1}$ +)</td>
<td>log(#25)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Proprietary costs: Herfindahl index ($HERF_{t-1}$ -)</td>
<td>Sum of square of each firm’s market share within one industry. Market share is measured with sales of a firm as a percentage of total sales in the same industry.</td>
<td>Campbell (1979), Yosha (1995)</td>
</tr>
<tr>
<td></td>
<td>Number of years the firm has listed on an exchange ($AGE_{t-1}$ -)</td>
<td>Number of years between the first year a firm has price information on CRSP and the event year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of financial analyst following ($D_FOLLOW_{t-1}$ -)</td>
<td>Whether a firm is followed by at least one analyst based on I/B/E/S ($D_FOLLOW_{t-1} = 1$ for firms with analyst following, and 0 otherwise)</td>
<td></td>
</tr>
</tbody>
</table>

| RSS costs (CSS) | Implementation costs: Natural log of the number of shares outstanding ($LOGCSOUT_{t-1}$ +) | log(#25) | |
| Number of shareholders ($OWNERS_{t-1}$ +) | (#100) | |

| Distress | Altman’s Z-score ($ALTMANZ_{t-1}$ -) | $1.2 \cdot$ net working capital / total assets ($data_{179} / data_{6}$) + $1.4 \cdot$ retained earnings / total assets ($data_{36} / data_{6}$) + $3.3 \cdot$ earnings before interest and taxes / total assets ($data_{170} / data_{6}$) + $0.6 \cdot$ market value of equity / book value of liability ($data_{199} \cdot data_{25} / data_{181}$) + $1.0 \cdot$ sales / total assets ($data_{12} / data_{6}$). | Altman (1968) |
Table 2: Descriptive statistics by subgroups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-RSS</th>
<th></th>
<th></th>
<th></th>
<th>Delisted</th>
<th></th>
<th></th>
<th>RSS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
<td>N</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>$P_{t-1}$</td>
<td>277</td>
<td>1.12</td>
<td>1.38</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>0.63</td>
<td>0.38</td>
<td>297</td>
<td>0.43</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>$\text{AGE}_{t}$</td>
<td>277</td>
<td>9.86</td>
<td>7.00</td>
<td>0.001</td>
<td>0.000</td>
<td>0.52</td>
<td>0.50</td>
<td>297</td>
<td>7.75</td>
<td>0.886</td>
</tr>
<tr>
<td>$\text{ASSET}_{t-1}$</td>
<td>277</td>
<td>344.53</td>
<td>31.70</td>
<td>0.125</td>
<td>&lt;.0001</td>
<td>0.417</td>
<td>0.014</td>
<td>297</td>
<td>1.23</td>
<td>0.355</td>
</tr>
<tr>
<td>$\text{LEV}_{t-1}$</td>
<td>277</td>
<td>0.19</td>
<td>0.08</td>
<td>0.297</td>
<td>0.117</td>
<td>0.281</td>
<td>0.580</td>
<td>297</td>
<td>0.17</td>
<td>0.972</td>
</tr>
<tr>
<td>$\text{PPE}_{t-1}$</td>
<td>277</td>
<td>0.59</td>
<td>0.38</td>
<td>0.317</td>
<td>0.090</td>
<td>0.305</td>
<td>0.185</td>
<td>292</td>
<td>0.52</td>
<td>0.881</td>
</tr>
<tr>
<td>$\text{TURN}_{t-1}$</td>
<td>266</td>
<td>0.95</td>
<td>0.54</td>
<td>0.712</td>
<td>0.617</td>
<td>0.020</td>
<td>0.007</td>
<td>296</td>
<td>0.99</td>
<td>0.032</td>
</tr>
<tr>
<td>$\text{HERF}_{t-1}$</td>
<td>277</td>
<td>0.06</td>
<td>0.04</td>
<td>0.014</td>
<td>0.014</td>
<td>0.740</td>
<td>0.216</td>
<td>297</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>$\text{OWNER}_{t-1}$</td>
<td>248</td>
<td>5.10</td>
<td>0.76</td>
<td>0.136</td>
<td>0.207</td>
<td>0.493</td>
<td>0.000</td>
<td>270</td>
<td>1.84</td>
<td>0.69</td>
</tr>
<tr>
<td>$\text{LOGCSOUT}_{t-1}$</td>
<td>277</td>
<td>2.46</td>
<td>2.36</td>
<td>0.168</td>
<td>0.379</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>297</td>
<td>2.34</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>$\text{D_FOLLOW}_{t-1}$</td>
<td>277</td>
<td>0.35</td>
<td>0.00</td>
<td>0.231</td>
<td>0.230</td>
<td>0.039</td>
<td>0.039</td>
<td>297</td>
<td>0.30</td>
<td>0.365</td>
</tr>
<tr>
<td>$\text{ROAADJ}_{t}$</td>
<td>277</td>
<td>-0.13</td>
<td>-0.02</td>
<td>0.076</td>
<td>0.001</td>
<td>0.398</td>
<td>0.004</td>
<td>297</td>
<td>-0.16</td>
<td>0.697</td>
</tr>
<tr>
<td>$\text{ROA}_{t+1}$</td>
<td>277</td>
<td>-0.02</td>
<td>0.04</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>0.000</td>
<td>&lt;.0001</td>
<td>227</td>
<td>-0.23</td>
<td>0.598</td>
</tr>
<tr>
<td>$\text{ALTMANZ}_{t-1}$</td>
<td>241</td>
<td>7.00</td>
<td>2.37</td>
<td>0.001</td>
<td>&lt;.0001</td>
<td>0.048</td>
<td>&lt;.0001</td>
<td>255</td>
<td>1.87</td>
<td>0.006</td>
</tr>
<tr>
<td>$\text{VOLAT}_{t-1}$</td>
<td>226</td>
<td>0.25</td>
<td>0.23</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>&lt;.0001</td>
<td>297</td>
<td>0.29</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Note: Non-RSS = the group of firms that continue listing without implementing a reverse stock split. Delisted = the group of firms that are delisted due to low stock price. RSS = the group of firms that implement a reverse stock split after stock price drop. $P_{t-1}$ = stock price on the last day of the period with stock price lower than $1.50. $D\_FOLLOW = 1$ for firms with analyst following, and 0 otherwise. $\text{ROAADJ}_{t}$ = reported return on assets adjusted for discretionary accruals in the event year. It equals the sum of earnings before extraordinary items (#18) and the performance-matched discretionary accruals ($\text{DADIFF}$). Both are scaled by lagged year total assets (#6). $\text{ROA}_{t+1}$ = reported return on assets in the year after. $\text{VOLAT} = $ the volatility of stock price in the 36-month period prior to the event month, measured as $\sqrt{\frac{1}{N-1} \sum_{i=-N}^{-1} \log \left( \frac{P_{i}}{P_{i-1}} \right) - \log \left( \frac{P_{i}}{P_{i-1}} \right)^2}$, where $N$ is the first month with available stock price data in this period, and -1 is the month immediately before the event month, $P_{i}$ is the closing stock price for month $i$. 


Table 3: Comparison of characteristics between sample and control firms in the year of low price

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample firms</th>
<th>Control firms</th>
<th>p value of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>N</td>
</tr>
<tr>
<td>ASSETS</td>
<td>198.00</td>
<td>20.48</td>
<td>849</td>
</tr>
<tr>
<td>LEV</td>
<td>0.18</td>
<td>0.05</td>
<td>848</td>
</tr>
<tr>
<td>OWNERS</td>
<td>3.99</td>
<td>0.78</td>
<td>763</td>
</tr>
<tr>
<td>ROA_NI</td>
<td>-0.20</td>
<td>-0.10</td>
<td>849</td>
</tr>
<tr>
<td>PPE</td>
<td>0.64</td>
<td>0.34</td>
<td>849</td>
</tr>
<tr>
<td>TURN</td>
<td>1.26</td>
<td>0.56</td>
<td>842</td>
</tr>
<tr>
<td>LOGCSOUT</td>
<td>2.25</td>
<td>2.16</td>
<td>848</td>
</tr>
<tr>
<td>D_FOLLOW</td>
<td>0.30</td>
<td>0</td>
<td>849</td>
</tr>
<tr>
<td>AGE</td>
<td>8.46</td>
<td>6</td>
<td>849</td>
</tr>
<tr>
<td>ALTMANZ_{t-1}</td>
<td>2.10</td>
<td>0.85</td>
<td>737</td>
</tr>
</tbody>
</table>

Note:
This table compares characteristics between the sample and the control firms. Control firms are from all firms included in CRSP whose stock prices never drop below ten dollars in the year of matching. A sample firm is matched with a control firm on the 2-digit SIC code, year, and return on assets. 
ROA_NI = net income (#172) scaled by lagged total assets (#6).
Other variables are defined in Table 1.
Table 4: The performance-matched discretionary accruals for the whole sample and by subgroups

<table>
<thead>
<tr>
<th>Sample</th>
<th>Stock exchange</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A:</strong> The performance-matched discretionary accruals in the event year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>849</td>
<td>-0.05</td>
<td>-0.01</td>
<td>-1.58</td>
<td>0.11</td>
</tr>
<tr>
<td>Non-RSS</td>
<td></td>
<td>277</td>
<td>0.07</td>
<td>0.02</td>
<td>1.70</td>
<td>0.09</td>
</tr>
<tr>
<td>Delisted</td>
<td></td>
<td>297</td>
<td>-0.15</td>
<td>-0.02</td>
<td>-2.64</td>
<td>0.01</td>
</tr>
<tr>
<td>RSS</td>
<td></td>
<td>275</td>
<td>-0.06</td>
<td>-0.01</td>
<td>-1.06</td>
<td>0.29</td>
</tr>
<tr>
<td>NYSE</td>
<td></td>
<td>24</td>
<td>-0.22</td>
<td>-0.07</td>
<td>-2.00</td>
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<td><strong>Panel B:</strong> The performance-matched discretionary accruals in the year prior to the event year</td>
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<td>-1.41</td>
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<td>0.00</td>
<td>-0.97</td>
<td>0.33</td>
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<td><strong>Panel C:</strong> Discretionary accruals in the event year – matching within the sample firms</td>
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<td>Matching pair</td>
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<td>Non-RSS and RSS</td>
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<td>0.03</td>
<td>1.86</td>
<td>0.06</td>
</tr>
</tbody>
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*Note:* Non-RSS is the group of firms that continue listing without implementing a reverse stock split. Delisted is the group of firms that are delisted due to low stock price. RSS is the group of firms that implement a reverse stock split after stock price decline. Event year is the year that the stock price falls below $1.50 for over 40 consecutive trading days.
Table 5: Earnings management and firm characteristics

<table>
<thead>
<tr>
<th>Panel A – OLS</th>
<th>Panel B – OLS</th>
<th>Panel C - Logit</th>
</tr>
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<tr>
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</tr>
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<td>DADIFF as dependent variable</td>
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<tr>
<td>INTERCEPT</td>
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<td>1.810</td>
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<td>R_ROAt+1</td>
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<td>D_NONRSS</td>
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<td>0.780</td>
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<td>AGEt</td>
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<td>-1.210</td>
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<td>PPEt-1</td>
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<td>TURNt-1</td>
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<td>1.160</td>
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<td>HERFt-1</td>
<td>-0.353</td>
<td>-0.540</td>
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<td>OWNERt-1</td>
<td>0.000</td>
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<td>LOGCSOUTt-1</td>
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<td>D_FOLLOWt-1</td>
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<td>R_NOAt-1</td>
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<td>VOLATt-1</td>
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<tr>
<td>N</td>
<td>558</td>
<td>500</td>
</tr>
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</table>

Likelihood Ratio / R² | R²=3.6% | R²=45.4% | 260.23 | <0.0001 |

Note:
Panel A presents OLS regression results for:
\[ DADIFF_t = \alpha_0 + \alpha_1 D_{NONRSS} + \alpha_2 D_{RSS} + \alpha_3 ALTMANZ_{t-1} + \alpha_4 R_{NOA_{t-1}} + \alpha_5 VOLAT_{t-1} + \lambda_1 \times mLB_{m \times 1} + \gamma_1 \times nLC_{n \times 1} + \epsilon \] (1)

Panel B presents OLS regression results for:
\[ DADIFF_t = \alpha_0 + \alpha_1 D_{NOA_{t+1}} + \alpha_2 D_{RSS} + \alpha_3 R_{ROAADJ_t} + \alpha_4 P_t + \alpha_5 D_{NONRSS} + \alpha_6 D_{RSS} + \alpha_7 ALTMANZ_{t-1} + \alpha_8 R_{NOA_{t-1}} + \alpha_9 VOLAT_{t-1} + \lambda_1 \times mLB_{m \times 1} + \gamma_1 \times nLC_{n \times 1} + \epsilon \] (2A)

Panel C presents logistic regression results for:
\[ EM = \alpha_0 + \alpha_1 D_{NOA_{t+1}} + \alpha_2 D_{RSS} + \alpha_3 R_{ROAADJ_t} + \alpha_4 P_t + \alpha_5 ALTMANZ_{t-1} + \alpha_6 R_{NOA_{t-1}} + \alpha_7 VOLAT_{t-1} + \lambda_1 \times mLB_{m \times 1} + \gamma_1 \times nLC_{n \times 1} + \epsilon \] (2B)

\[ D_{NONRSS} (D_{RSS}) = 1 \text{ for firms in the Non-RSS (RSS) group, and 0 otherwise.} \]
\[ R_{ROAADJ_t} (R_{NOA_{t+1}}) = \text{percentile of premanaged return on assets (reported return on assets) in the event year (the year after), converted to be between 0 and 1. Other variables are as defined in Table 1.} \]
Table 6: Abnormal R&D investment and gains from asset sales in the event year

<table>
<thead>
<tr>
<th>Firm group</th>
<th>Whole sample</th>
<th></th>
<th></th>
<th>Non-RSS</th>
<th></th>
<th></th>
<th></th>
<th>Delisted</th>
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<th>RSS</th>
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<tbody>
<tr>
<td></td>
<td>total</td>
<td>low NOA</td>
<td>high NOA</td>
<td>total</td>
<td>low NOA</td>
<td>high NOA</td>
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<td>low NOA</td>
<td>high NOA</td>
<td>total</td>
<td>low NOA</td>
<td>high NOA</td>
<td></td>
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<td>Panel A: Abnormal R&amp;D spending</td>
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</tr>
<tr>
<td>N</td>
<td>447</td>
<td>254</td>
<td>193</td>
<td>162</td>
<td>96</td>
<td>66</td>
<td>137</td>
<td>82</td>
<td>55</td>
<td>148</td>
<td>76</td>
<td>72</td>
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<tr>
<td>Mean</td>
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<td>-0.27</td>
<td>-0.25</td>
<td>0.05</td>
<td>-0.25</td>
<td>0.50</td>
<td>-0.20</td>
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<td>-0.66</td>
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<td>-0.01</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.01</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.01</td>
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<td>-0.03</td>
<td>-0.03</td>
<td>-0.02</td>
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<tr>
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<td>Panel B: Gains from asset sales</td>
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<td>0.04</td>
<td>0.00</td>
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<td>-0.002</td>
<td>-0.005</td>
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<td>-0.003</td>
<td>-0.005</td>
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<td>0.77</td>
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</table>

**Note:** This table presents abnormal R&D investment and asset sales behaviors for the whole sample and subgroups in the event year. Event year is the year that the stock price falls below $1.50 for over 40 consecutive trading days. **Non-RSS** is the group of firms that continue listing without implementing a reverse stock split. **Delisted** is the group of firms that are delisted due to low stock price. **RSS** is the group of firms that implement a reverse stock split after stock price drop. A firm is classified into the high **NOA** group if its percentile of **NOA** is above the sample median. Abnormal R&D spending is based on: \[ \frac{RD}{Sales_i} = \beta_0 + \beta_1 \frac{RD_{t-1}}{Sales_{t-1}} + \beta_2 \frac{INT}{Sales_i} + \beta_3 Q_i + \epsilon, \]
and abnormal gain on asset sales is from: \[ \frac{GAIN_{t}}{MV_{t-1}} = \theta_0 + \theta_1 \frac{ASALES_{t}}{MV_{t-1}} + \theta_2 \frac{ISALES_{t}}{MV_{t-1}} + \theta_3 LOGSALES_i + \theta_4 SALES_{GR} + \epsilon. \]
Table 7: The likelihood of reductions in R&D spending or increases in gains from assets sales and firm characteristics

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<tr>
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<th>Panel A</th>
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<th>Panel B</th>
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<tr>
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<td>ChiSq</td>
<td>p</td>
<td>Coeff</td>
<td>ChiSq</td>
<td>p</td>
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<td>0.946</td>
<td>0.184</td>
<td>0.275</td>
<td>0.600</td>
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<td>-0.025</td>
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<td>0.020</td>
<td>0.007</td>
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<td>500</td>
<td>514</td>
<td></td>
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</table>

Note:
Panel A presents logistic regression results of
\[ RM_t = \psi_0 + \psi_1 R_{NOA_{t-1}} + \psi_2 R_{ROA_{t+1}} + \psi_3 ALTMANZ_{t-1} + \psi_4 P_t + \psi_5 VOLAT_{t-1} + \lambda_1 LB_{m-1} + \gamma_1 LC_{n-1} + \varepsilon \] (3a)

Panel B presents logistic regression results of
\[ RM_t = \psi_0 + \psi_1 D_{DELIST} + \psi_2 D_{RSS} + \psi_3 R_{ROA_{t+1}} + \psi_4 ALTMANZ_{t-1} + \psi_5 P_t + \psi_5 VOLAT_{t-1} + \lambda_1 LB_{m-1} + \gamma_1 LC_{n-1} + \varepsilon \] (3b)

\( RM = 1 \) if abnormal R&D investment is negative or abnormal gains on asset sales are positive, and 0 otherwise. Abnormal R&D spending is the residual term based on
\[ \frac{RD_{t}}{Sales_{t}} = \beta_0 + \beta_1 \frac{RD_{t-1}}{Sales_{t-1}} + \beta_2 \frac{INT_{t}}{Sales_{t}} + \beta_3 Q_t + \varepsilon. \]

Abnormal gains on asset sales are measured as the residual term from
\[ \frac{GAINA_{t}}{MV_{t-1}} = \theta_0 + \theta_1 \frac{ASALES_{t}}{MV_{t-1}} + \theta_2 \frac{ISALES_{t}}{MV_{t-1}} + \theta_3 LOGSALES_{t} + \theta_4 SALES_{GR} + \varepsilon. \]

\( D_{DELIST} = 1 \) for firms that are delisted due to low stock price, \( D_{RSS} = 1 \) for firms that implement RSS after stock price decline.

\( R_{ROAADJ_{t}}(R_{ROA_{t+1}}) \) = percentile of premanaged return on assets (reported return on assets) in the event year (the year after), converted to be between 0 and 1. Other variables are defined in Table 1.
Table 8: The likelihood of avoiding delisting and firm characteristics

<table>
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<th></th>
<th>Panel B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D_RSS as dependent variable</td>
<td>D_NONRSS as dependent variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coeff</td>
<td>ChiSq</td>
<td>p</td>
<td>Coeff</td>
</tr>
<tr>
<td>INTERCEPT</td>
<td>-5.186</td>
<td>38.267</td>
<td>&lt;.0001</td>
<td>-3.244</td>
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<td>&lt;.0001</td>
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<td>1/ASSETSt-1</td>
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<td>4.638</td>
<td>0.031</td>
<td>-7.011</td>
</tr>
<tr>
<td>AGEt</td>
<td>-0.020</td>
<td>0.798</td>
<td>0.372</td>
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<tr>
<td>LEVt-1</td>
<td>0.117</td>
<td>0.040</td>
<td>0.842</td>
<td>1.156</td>
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<td>PPEt-1</td>
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<td>0.036</td>
<td>0.850</td>
<td>-0.163</td>
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<td>TURNt-1</td>
<td>0.090</td>
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<tr>
<td>HERFt-1</td>
<td>1.764</td>
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<td>0.324</td>
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<tr>
<td>OWNERt-1</td>
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<td>0.084</td>
<td>0.772</td>
<td>0.085</td>
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<td>LOGCSOUTt-1</td>
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<td>64.941</td>
<td>&lt;.0001</td>
<td>-0.061</td>
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<td>D_FOLLOWt-1</td>
<td>-1.120</td>
<td>11.133</td>
<td>0.001</td>
<td>-0.327</td>
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<td>ALTMANZt-1</td>
<td>0.039</td>
<td>2.426</td>
<td>0.119</td>
<td>0.181</td>
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<td>R_NOAt-1</td>
<td>-0.043</td>
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<td>VOLATt-1</td>
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<td>Likelihood Ratio</td>
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<tr>
<td>N</td>
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Note:  
**Panel A** presents logistic regression results of  
\[ D_{RSS} = \phi_0 + \phi_1P_{t-1} + \phi_2ALTMANZ_{t-1} + \phi_3R\_NOA_{t-1} + \phi_4VOLAT_{t-1} + \lambda_{1 \times m}LB_{m \times 1} + \gamma_{1 \times n}LC_{n \times 1} + \varepsilon \]  
where,  
\[ D_{RSS} = 1 \text{ for firms that implement a reverse stock split after stock price drop, and 0 otherwise.} \]  
\[ P_{t-1} = \text{the stock price on the last day of the period with stock price lower than $1.50.} \]  
Other variables as defined in Table 1.

**Panel B** presents logistic regression results of  
\[ D_{NONRSS} = \phi_0 + \phi_1P_{t-1} + \phi_2ALTMANZ_{t-1} + \phi_3R\_NOA_{t-1} + \phi_4VOLAT_{t-1} + \lambda_{1 \times m}LB_{m \times 1} + \gamma_{1 \times n}LC_{n \times 1} + \varepsilon. \]  
Where,  
\[ D_{NONRSS} = 1 \text{ for firms that continue listing without implementing a reverse stock split, and 0 otherwise.} \]  
\[ D_{RSS} = 1 \text{ for firms that implement a reverse stock split after stock price drop, and 0 otherwise.} \]
Figure 1: The trend in the mean stock price around the month of reduced stock price

Note:

For the RSS group, I use the number of outstanding shares before the implementation of RSS to eliminate the impact of a reverse stock split on stock price. Month 0 is the last month before the stock price increases above $1.50. Stock price for each month is the mean of all firms in each subgroup.
References


