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Stock liquidity, price informativeness, and accruals-based earnings management

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STOCK LIQUIDITY, PRICE INFORMATIVENESS, AND ACCRUALS-BASED EARNINGS MANAGEMENT

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DEDICATION

I dedicate this dissertation to people who stand behind me along my long journey of pursuing a PhD. Especially I want to thank my wife and my son for their sacrifice and patience. I could not imagine how I could finish my PhD study without their love and emotional support. If I have ever made any achievement by now, my wife and my son contribute most to it.

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ABSTRACT

We examine the effect of stock liquidity on accruals-based earnings management. Finance literature suggests that stock liquidity leads to price efficiency. If prices are efficient, more future earnings should be reflected in current prices. Therefore, gain from shifting accruals across periods should be low and managers should have less incentive to manage earnings. We find that higher stock liquidity is associated with higher future earnings response coefficient and lower accruals-based earnings management. Our finding has important implication for the decline in accruals-based earnings management during 2001-2005 documented in prior study. Our additional trend analysis suggests that instead of SOX and other concurrent events, price efficiency improvement resulting from microstructure regime shifting (e.g., reduction in tick size from $1/16 to $1/100) may drive the decline in accruals-based earnings management during the period of 2001-2005.

1. INTRODUCTION

In this study, we examine the effect of stock liquidity on price efficiency and accruals-based earnings management (AEM). In the finance literature, both theories and empirical findings suggest that stock liquidity contributes to stock price efficiency. That is, as stock liquidity increases stock prices become more informative about firms' economic fundamentals. In line with the role of stock liquidity in enhancing price efficiency, we hypothesize that as stock liquidity increases stock prices exhibit greater capability of reflecting future earnings (H1). We argue that the price efficiency-enhancing effect of stock liquidity has important implication for AEM. Specifically we argue that stock liquidity and ensuing price efficiency dampen certain motives for firms and/or their managers to engage in AEM. We hypothesize that as stock liquidity increases and thus stock prices better reflect future earnings, firms will engage in less AEM.

We use the high-low stock liquidity measure proposed in Corwin and Schultz (2012). We choose the high-low stock liquidity measure proposed in Corwin and Schultz (2012) because this high-low stock liquidity measure exhibits several desirable attributes (see Corwin and Schultz 2012). First, this high-low stock liquidity measure has strong theoretical foundation. Corwin and Schultz (2012) developed this high-low liquidity measure on the basis of two simple uncontroversial empirical regularities. Second, Corwin and Schultz (2012) showed that this high-low measure outperforms other popular low-frequency measures in capturing cross-sections of both spread levels and month-to-month changes in spreads. We argue that it is a highly desirable feature for any low-frequency liquidity measure to possess high cross-section correlations with liquidity measures computed from high-frequency intraday transaction level data, especially when the low-frequency liquidity measure is used in cross-section regression. Third, this high-low stock liquidity measure is less computationally complex and demanding, compared than other stock liquidity measures. In our main test, we adopt the modified Jones model proposed in Dechow et al. (1995) to estimate levels of normal and discretionary accruals. Following Hribar and Collins's (2002) suggestion, we adopt the cash-flow approach to the calculation of total accruals.

To test H1, we adopt the model proposed in Gelb and Zarowin (2002) as our main regression model. Because of the panel nature of our data we use two-way clustered standard errors (i.e. clustered on both firm and year) to calculate test statistics. We find that future earnings coefficients increase as stock liquidity increases, suggesting that stock prices exhibit greater capability of reflecting future earnings as stock liquidity increases. In our robustness analysis, we use the model proposed in Lundholm and Myers (2002) and obtain essentially the same result.

To test H2, we adapt the regression model used in Cohen et al. (2008). One important outcome of our study is the provision of a market efficiency-based explanation to the finding that accruals-based earning management increased steadily from 1987 and started to decline after the passage of the Sarbanes-Oxley Act (SOX) in 2002 documented in Cohen et al. (2008). Adoption of the regression model used in Cohen et al. (2008) ensures that our study is directly comparable to Cohen et al. (2008). Robustness analysis shows that our finding about the relationship between stock liquidity and AEM may not be driven by omitted correlated variables and reversal causality.

In our additional analysis, we examine the trends of stock liquidity and discretionary accruals during 1989 – 2010. In line with our cross-sectional finding about the dampening effect of stock liquidity on AEM, we find that variations in the magnitude of AEM over time are closely related to variations in the overall stock liquidity over time as implied in our H2. Our findings suggest that besides SOX and other concurrent events price efficiency improvement resulting from microstructure regime shifting (e.g. reduction in tick size from $1/16 to $1/100) may drive the decline in AEM during the period of 2002-2005 documented in Cohen et al. (2008). In other words, our study provides *a capital market efficiency-based explanation* of the decline in AEM during the period of 2002-2005 documented in Cohen et al., (2008).

Our study contributes to the literature at least in four aspects. First, our study provides direct evidence that stock liquidity and thus price efficiency influence managers' decisions on AEM. It has been long theoretically acknowledged that accounting choices including AEM play no substantive role in a complete and perfect market (see Fields et al. 2001). Our finding about the dampening effect of stock liquidity on AEM lends empirical support to the theoretical acknowledgement of the importance of capital market efficiency in managers' decisions on accounting choices, suggesting that future research on accounting choices may need to explicitly take capital market efficiency into account in research design.

Second, our findings add to research that examines the real effects of capital market efficiency. Existing research on the real effects of capital market efficiency has examined a variety of issues ranging from price discovery and formation to corporate governance (see Bond et al. Forthcoming). For instance, the work of Fama and Jensen (i.e., Fama 1980; Fama and Jensen 1983a,b) suggests that when stock prices timely, un-biasedly reflect the impact of managers' decisions on net cash flows, stock markets together with product markets and managerial labor markets can serve as a governance mechanism for disciplining managers; Ferreira et al. (2011) find that stock price informativeness affects the structure of corporate boards; Edmans et al. (2011) find that stock liquidity encourages the formation of blockholdings and shapes blockholders' governance preference. In our knowledge, our study is among the first empirical work that shows that stock liquidity and thus price efficiency discourage firms and their managers from engaging in AEM.

Third, our study provides a market efficiency explanation of the decline in AEM during the period of 2002-2005 first documented in Cohen et al. (2008). Our finding suggests that the decline in AEM during the period of 2002-2005 may not be driven only by the passage of SOX and other concurrent events but may also be caused by overall improved stock liquidity and thus price efficiency. Given that one of the main purposes of SOX is to curb opportunistic earnings management and compliance with SOX is very costly, our finding suggests that we may need to reevaluate the impact of SOX.

Fourth, our finding that higher stock liquidity is associated with higher FERC lends macro-level support to the positive effect of stock liquidity on price efficiency. Prior studies (e.g. Chordia et al. 2008) infer the effect of liquidity on price efficiency from micro-level price attributes such as short-term return predictability from order flows, proximity to random walk benchmarks, and return autocorrelations. Compared with micro-level evidence, our macro-level evidence is directly in line with theoretical predictions about the effect of liquidity on price efficiency (see Holmstrom and Tirole 1993).

The rest of our paper is organized as follows. In section 2, we first review literature about the effect of stock liquidity on price efficiency. Then we develop our hypotheses. In section 3, we describe our measures of stock liquidity and discretionary accruals, the regression models used to test our hypotheses, and estimation techniques. In section 4, we describe our data sources and sample, and report the summary statistics of variables used to test the effect of stock liquidity on AEM. In section 5, we report and discuss the results of our analyses including robustness, causality, and additional analyses. Section 6 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Stock Liquidity and Price Efficiency

Prices formed through market mechanisms aggregate information possessed by market participants about the value of traded assets (Hayek, 1945). Specifically, in stock markets investors with diverse pieces of information trade with each other and endeavor to profit from their private information. Arising from trades between investors, stock prices aggregate these different pieces of information and reflect investors' overall expectations of the value of firms' stocks (Glosten and Milgrom 1985; Hellwig 1980). Moreover, there exist wide variations, both cross-sectional and inter-temporal, in the efficiency of stock prices (see Boehmer and Kelley 2009; Chordia et al. 2008). Stock price efficiency refers to the extent to which stock prices are informative about the economic fundamentals of traded stocks (Bond et al., Forthcoming). The microstructure of stock markets significantly influences stock price efficiency (Madhavan 2000; O'Hara 2003). Liquidity is among the most important aspects of stock market microstructure that have first-order effects on price efficiency (Holmstrom and Tirole 1993; O'Hara 2003). Liquidity is embodied in investors' capability of trading a large number of stocks quickly at low cost with little price impact (Liu 2006).

The research in economics and finance has identified a variety of closely related channels through which stock liquidity contributes to stock price efficiency. First, improvement in stock liquidity increases the marginal value of information and thus motivates market participants to acquire private information about firms' fundamental value (Holmstrom and Tirole 1993). The most direct effect of improvement in stock liquidity is the reduction in trading costs and hence increases trading profits from private information. Furthermore, improvement in liquidity makes it easier for an informed investor to disguise his private information and profit from it regardless of whether his private information is strategic (i.e. intervention-related) or is simply speculative (i.e. trading-oriented) (Holmstrom and Tirole 1993; Kyle and Vila 1991; Maug 1998). Moreover, improvement in stock liquidity lowers the threshold for the value of information upon which investors can profitably trade. In summary, the improvement in stock liquidity not only results in the increase in trading profits from private information and therefore incites more market participants to become privately informed, but also enlarges the set of information that can be impounded into prices through trading. Grossman and Stiglitz (1980) show that price efficiency increases as the number of informed investors and/or the quality of information increase. In addition, stock liquidity facilitates trading between investors and thus accelerates the impounding of private information into stock prices.

Second, several theoretical papers suggest that stock liquidity encourages the formation of blockholdings (i.e., Kyle and Vila 1991; Edmans 2009; Maug 1998). During takeover bids, blockholders that initiate takeover bids face potential free-ride on the improvement after acquisition from existing shareholders if existing shareholders are aware that they are selling to raiders (Grossman and Hart 1980). Kyle and Vila (1991) show that liquidity allows blockholders to camouflage their purchases by pooling with noise traders and therefore acquire large block of shares at favorable prices. Similarly, Maug (1998) shows that liquidity encourages investors to intervene because a liquid stock market makes it less costly to hold large stakes and makes it easier to purchase additional shares at prices that do not incorporate the full gains from intervention. In a trading model, Edmans (2009) shows that blockholders optimally choose higher initial stakes if stock liquidity is higher because higher stock liquidity offers blockholders greater ability to sell shares upon negative information. The work of Edmans et al. (2011) and Gerken (2011) provides empirical evidence that supports the positive relationship between stock liquidity and formation of blockholdings. Using a sample of U.S. external blockholdings from 1994-2005 Gerken (2011) finds that liquidity increases the likelihood of block formation; focusing on hedge fund blockholders Edmans et al. (2011) find that hedge funds are more likely to acquire blocks in liquid firms than in illiquid firms. [1]

Blockholders generally have superior information. Because of the large amount that blockholders can sell upon negative information, blockholders have incentives to become informed (Edmans 2009). In other words, the utility of information is higher to blockholders because blockholders can make greater use of it. Because quality information acquisition incurs fixed costs such as investment in research databases, blockholders will only acquire information on large ownership stakes (Boehmer and Kelley 2009). Moreover, blockholders have greater access to management and/or have better abilities to acquire information and conduct quality fundamental analysis due to economies of scale and resources at their discretion (Bhushee and Goodman 2007).

Prior studies provide empirical evidence that confirms the information superiority of blockholders. Blockholders are generally institutional investors. Bhushee and Goodman (2007) find that the private information content of trades by institutional investors does increase with institutional investors' stakes in a firm. Event-related studies show that institutional investors sell their stakes in advance of events associated with poor performance such as value-destructive mergers (Chen et al. 2007) and forced CEO turnovers (Parrino et al. 2003). Campbell, et al. (2009) use a sophisticated method to infer daily institutional trading behavior from TAQ database of NYSE and find that institutions anticipate earnings surprises and post-earnings

[1] Both Edmans et al. (2011) and Gerken (2011) adopt the instrument variable approach to ensure the validity of their causality inferences about the positive relationship between stock liquidity and the likelihood of block formation.

announcement drift. In line with Campbell et al. (2009), Ke and Petroni (2004) show that transient institutions predict the break in a string of consecutively earnings increases at least one quarter in advance of the break quarter; Bartov et al. (2000) document a negative relationship between institutional holdings and post-announcement abnormal returns; Ke and Ramalingegowda (2005) find that transient institutional investors exploit the post-earnings announcement drift; Collins et al. (2003) show that the presence of institutional investors mitigates the magnitude of negative returns associated with accruals. More importantly, liquidity enables and even encourages blockholders to trade on their private information (Edmans 2009; Edmans et al. 2011).

Third, liquidity stimulates speculation-based arbitrage. Speculation-based arbitrage involves taking a long-position in undervalued stocks and/or a short-position in overvalued stocks. Arbitrage traders are generally well-informed (Boehmer et al. 2008). For instance, Karpoff and Lou (2010) find that abnormal short interest increases steadily in the nineteen months before financial misrepresentation is publicly revealed, suggesting that short sellers can detect firms that misrepresent their financial statements. Therefore, arbitrage trading contributes to the convergence of prices and fundamental values and improves price efficiency (see Saffi and Sigurdsson 2011; Hirshleifer et al. 2011). However, arbitrage trading is both costly and risky (Shleifer and Vishny 1997; O'Hara 2003). By directly reducing trading costs and enabling investors to change holding positions at prices that do not fully reflect their private information, liquidity increases the profits of arbitrage trading. In practice, taking a short-position in overvalued stocks is generally more costly than taking a long-position in undervalued stocks. By encouraging the formation of blockholdings and thus increasing the availability of shares for borrowing by short arbitrageurs (Nagel 2005; Hirshleifer et al. 2011), liquidity can reduce costs associated with short arbitrage. By facilitating trading and speeding the convergence of stock prices and fundamental values, liquidity can reduce risks associated with arbitrage such as liquidity risk.

Chordia et al. (2008) provide micro-level evidence that stock liquidity contributes to stock price efficiency. Market microstructure research shows that reduction in the minimum tick size leads to improvement in stock liquidity (Bessembinder 2003; Chordia et al. 2005). Using intraday transaction data for stocks that were traded every day at NYSE during the period of 1993 to 2002, Chordia et al. (2008) examine whether stock price efficiency differs across three different liquidity regimes: (i) January 4, 1993 – June 23, 1997 when the minimum tick size is $1/8; (ii) June 24, 1997 – January 28, 2001 when the minimum tick size is $1/16; and (iii) January 29, 2001 – December 3, 2002 when the minimum tick size is $1/100.

Finance research uses two ways for quantifying price efficiency. Consistent with the notion of efficient markets (Fama 1970), the first way uses the lack of return predictability as the criterion for efficiency. However, market microstructure research acknowledges that even when markets are semi-strong prices can reflect varying degrees of private information (Kyle 1985). Therefore, the market microstructure literature uses the amount of information reflected in prices as the criterion for efficiency. Consistent with the first way of measuring price efficiency, Chordia et al. (2008) use short-horizon return predictability from order flows as their measure for price inefficiency and use variance ratio tests to examine the degree to which prices are close to random walk benchmark. Chordia et al. (2008) find that short-horizon return predictability from order flows was lower and prices were closer to random walk benchmarks during more liquid regimes suggesting that liquidity stimulates arbitrage activity. In line with the microstructure way of measuring price efficiency, Chordia et al. (2008) use open-close/close-open return variance ratio and return autocorrelations to measure price efficiency. Chordia et al. (2008) find that open-close/close-open return variance ratios were higher and return autocorrelations were smaller during more liquid regimes, suggesting that more private information is incorporated into prices during more liquid regimes.

To sum up, stock liquidity increases the marginal value of private information and thus motivates market participants to engage in private information production; stock liquidity encourages the formation of blockholdings; and stock liquidity stimulates speculation-based arbitrage. Therefore, stock liquidity enlarges the proportion of investors who are informed, increases both the quality and quantity of information that can be incorporated into prices, and accelerates the impounding of information into prices and thus the convergence of prices and values. All these effects contribute to stock price efficiency (see Grossman and Stiglitz 1980). Moreover, micro-level evidence supports the empirical validity of the positive effect of stock liquidity on stock price efficiency.

2.2 Hypothesis Development

Stock prices reflect future earnings and thus lead current-period earnings (Kothari and Sloan 1992). Both economic and accounting reasons underlie the empirical regularity that price lead earnings: (i) current-period earnings have limited capability of measuring firms' fundamental value simply because operational and strategic decisions made by managers have both short-term and long-term impacts on firms' profitability (Barney 1991); and (ii) earnings lack of timeliness because of objectivity, verifiability, and conservatism conventions underling the accounting measurement process (Collins et al. 1994).

In theory, Ohlson (1995) shows that if there were no market frictions stock prices could be expressed as a function of current book value of equity and future earnings. In reality, stock prices vary widely in their ability to *accurately* reflect the fundamental value of the underlying equity. Evident in our review of the literature on how stock liquidity contributes to stock price efficiency, as stock liquidity improves stock prices will more faithfully capture the fundamental value of the underlying equity (also see Holmstrom and Tirole 2002). Holding everything else (e.g. the required cost of equity capital) equal, the relationship between stock prices and future earnings should increase with stock liquidity. Therefore, we have the following hypothesis:

H1: Ceteris paribus, the higher stock liquidity the stronger the relationship between stock prices and future earnings.

Anecdotal cases, survey of executives, and findings of archival research suggest that managers engage in earnings management (Dechow et al. 2011; Graham et al. 2005; Healy and Palepu 2003). A variety of motives underlie firms' and their managers' earnings management decisions such as avoidance of debt covenant violations, evasion of regulatory intervention, manipulation of market participants' perceptions, communication of inside information, and maximization of management compensations (Fields et al. 2001; Healy and Wahlen 1999). Stock liquidity and ensuing price efficiency have important implication for firms' and their managers' earnings management behavior. We argue that stock liquidity and ensuing stock price efficiency dampen some of these motives underlying firms' and their managers' earnings management decisions and therefore temper firms' and their managers' earnings management behavior.

Among the most often cited motives underlying managers' earnings management decisions is the manipulation of investors' perceptions of firms' economic fundamentals (Fields et al. 2001; Healy and Wahlen 1999). Managers' concerns with investors' perceptions mainly stem from several interrelated regularities. Most importantly, investors' perceptions of firms' economic fundamentals shape their expectations about the magnitude, timing, and risk of firms' future cash flows and thus affect stock prices. Stock prices determine shareholders' wealth. Therefore, stock price performance is a critical input to shareholders' and directors' decisions regarding managers' welfare such as promotion, compensation, and job security. Furthermore, the value and mobility of managers' human capital, especially those of members of top management team, increases with the stock performance of firms for which these managers work. In addition, managers generally hold their firms' equity such as common and restricted stocks and stock options as a result of equity-based compensation and/or voluntary trade of their firms' equity. Therefore, managers' wealth is positively linked to the stock performance of their firms.

The findings of prior studies suggest that, at least to some extent, managers succeed in manipulating investors' perceptions of their firms' economic fundamentals through earnings management. For instance, Bartov et al. (2002) found that firms that resort to earnings management to meet or beat analysts' earnings expectations (MBE) command a valuation premium compared with firms that do not engage in earnings management and fail to MBE. Findings with implications similar to Bartov et al.'s (2002) are provided in Barth et al. (1999), Kasznik and McNichols (2002), and Skinner and Sloan (2002).

We argue that stock liquidity affects the extent to which managers succeed in manipulating investors' perceptions of their firms' economic fundamentals and thus achieving desired stock prices. Evident in our literature review, as stock liquidity improves stock prices will more faithfully capture the fundamental value of underlying equity. In other words, as stock liquidity improves and consequently stock prices become more informative about firms' economic fundamentals, stock prices will become less sensitive to managers' earnings management because investors as a whole will possess higher ability to "see through" accounting choices made by managers. In the absence of stock price responses to their earnings management, managers will have less motivation to engage in earnings management in the first place (Edmans 2009; Fields et al. 2001). Therefore, as stock liquidity improves and consequently stock prices become more informative about the economic fundamentals of firms, managers should engage in less earnings management.

Another channel through which stock liquidity and ensuing stock price efficiency dampen firms' and their managers' incentives for earnings management arises from the effect of stock liquidity and ensuing stock price efficiency on compensation practices and structures. Holmstrom and Tirole (1993) theoretically demonstrated that as liquidity increases and consequently trade prices become more informative regarding the fundamental value of underlying assets at the equilibrium level firms should optimally increase the sensitivity of managers' pay to price levels. Empirical research guided by the theoretical lens of Holmstrom and Tirole (1993) provides evidence consistent the theoretical prediction of Holmstrom and Tirole (1993). For instance, Jayaraman and Milbourn (Forthcoming) found that CEO's pay-for-performance sensitivity with respect to stock prices is increasing in the liquidity of the stock (also see Fang et al. 2009; Kang and Liu 2008). Consistent with prior studies (e.g. Jiang et al. 2010), Jayaraman and Milbourn (Forthcoming) measured pay-for-performance sensitivity as the dollar change in the value of the manager' stock and option holdings arising from a one percentage increase in the company's stock price.

Furthermore, stock liquidity and ensuing stock price efficiency affects the relative weights of accounting-based performance measures and stock returns in firms' and their directors' decisions about top executives' annual compensation. Banker and Datar (1989) theoretically demonstrated that at the optimal level firms and their directors should assign greater weights to performance measures with relatively higher sensitivity-to-noise ratio in their decisions about managers' annual compensation. As stock liquidity increases, stock prices become more responsive to managers' value-creation efforts in a less biased way. Therefore, a direct empirical implication of Banker and Datar's (1989) work is that as stock liquidity increases and consequently stock prices become more efficient firms and their directors should assign greater weights to stock returns in their decisions about managers' annual compensation. Consistent with the theoretical prediction of Banker and Datar (1989) David et al. (2011) documented a positive association between CEO's and top-paid executives' total annual compensation and the interaction term between stock liquidity and stock returns.

In summary, as stock liquidity increases and consequently stock prices become more efficient both managers' "stock" of wealth and "flows" to managers' wealth not only increase with stock price levels but also become more sensitive to stock price levels. Both value-creation and earnings management decisions consume managers' cognition and attention. However, managerial cognition and attention are strategically scarce (Ocasio 1997). Therefore, managers have to optimally allocate their cognition and attention between value creation and earnings management. As stock liquidity increases, stock prices become more responsive to managers' value-creation efforts in a less biased way on the one hand, and become less responsive to managers' earnings management on the other hand. Therefore, we argue that as stock liquidity increases and consequently stock prices become more efficient managers should have less incentive to engage in earnings management, and have greater motivation to put more efforts in value creation (also see Edmans 2009; Edmans and Manso 2011).

Stock liquidity and ensuing price efficiency also affect the demand for communication of private information through earnings management by managers. Managers manage reported earnings to communicate their private information to shareholders and other market participants possibly because institutional and legal constraints and/or lack of a credible channel prevent managers from disclosing such private information (Demski and Sappington 1987; Schipper 1989; Tucker and Zarowin 2006). On the one hand, as stock liquidity increases, stock prices become a good signal that summarizes the implications of managerial decisions for current and future net cash flows more timely in a less biased manner (Fama 1980; Fama and Jensen 1983b). On the other hand, as evident in our literature review, both theoretical work and empirical evidence suggest that stock liquidity encourages the formation of large blockholders and increases the proportion of shares controlled by sophisticated, large institutional investors. Large institutional shareholders generally have greater access to management and/or have greater incentive and better abilities to acquire information and conduct quality fundamental analysis. In summary, as stock liquidity increases, the demand for communication of private information through earnings management by managers should decrease.

To sum up, as stock liquidity increases and consequently stock prices become more efficient, firms and their managers will engage in less earnings management because (i) firms and their managers find it increasingly difficult to manipulate market participants' perceptions of firms' economic fundamentals through earnings management; (ii) both managers' "stock" of wealth and "flow" to managers' wealth increases with the amount of efforts that managers put in value creation; and (iii) there is less demand for communication of managers' private information through earnings management.

Real activities manipulation and accrual-based earnings management are the two prevalent earnings management strategies (Badertscher 2011; Cohen et al. 2008; Zang Forthcoming). AEM involves altering accounting methods or estimates used to present a transaction in financial statements while real activities manipulation involves changing the timing or structuring of an operation, investment or financing transaction (Zang Forthcoming). Compared with real activities manipulation, AEM possesses several characteristics that make its use more sensitive to stock price efficiency. First, AEM has no direct impact on firms' cash flows. Moreover, accruals reverse with respect to their impact on reported earnings. Therefore, presuming that our first hypothesis is supported, we can see that managers will have less incentive to engage in AEM when stock liquidity improves and consequently stock prices have stronger relationship with future earnings. Furthermore, AEM is subject to greater scrutiny by outsiders such as auditors and regulators than real activities manipulation (Cohen et al. 2008; Zang Forthcoming). Accounting fraud cases against managers generally refer to managerial misbehaviors in AEM (see Dechow et al. 2011). In addition, it is very challenging for outsiders to distinguish real activities manipulations from real activities decisions. However, findings of prior studies (e.g., Hirshleifer et al. 2011; Karpoff and Lou 2010) and anecdotal examples (e.g., Einhorn 2008; Schilit and Perler 2010) suggest that short arbitrageurs sometimes could detect AEM. We argue that the negative impact of stock liquidity on earnings management is stronger for AEM than for real activities manipulation. Therefore, we have the following hypothesis:

H2: Ceteris paribus, the higher stock liquidity managers engage in less accruals-based earnings management.

3. RESEARCH DESIGN

3.1 Proxy for AEM

Consistent with existing literature (e.g. Badertscher 2011; Cohen et al. 2008; Zang Forthcoming), we use discretionary accruals to proxy for AEM. Discretionary accruals are the difference between total accruals and normal accruals. We adopt the modified Jones model proposed in Dechow et al., (1995) to estimate normal accruals. The modified Jones model is as follows:

$$\frac{TAC_{i,t}}{A_{i,t-1}} = \alpha_0 * \frac{1}{A_{i,t-1}} + \beta_1 * \frac{\Delta S_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} + \beta_2 * \frac{PPE_{i,t}}{A_{i,t-1}} + \epsilon_{i,t} \quad (1)$$

Where, for fiscal year *t* and firm *i*, *TAC* is the earnings before extraordinary items and discontinued operations (COMPUSTAT: ibc) minus the operating cash flows from continuing operations taken from the statement of cash flows (COMPUSTAT: oancf – COMPUSTAT: xidoc) (see Hribar and Collins 2002); *A* is total assets (COMPUSTAT: at); *S* is net sale (COMPUSTAT: sale); *REC* is the accounts receivable (COMPUSTAT: rect); *PPE* is the gross value of property, plant, and equipment (COMPUSTAT: ppegt); *Δ* standards for change from fiscal year t-1 to fiscal year t.

For each year, we estimate the regression equation (1) for every industry classified by two-digit SIC codes. Therefore, our estimation approach controls for industry-wide changes in economic conditions that affect total accruals while allowing the coefficients to vary across time. Furthermore, we require that the minimal number of observations is fifteen. Our measure of discretionary accruals is the estimated residuals of regression equation (1).

3.2 Stock Liquidity Measure

In our main test of H2, we adopt the stock liquidity measure proposed in Corwin and Schultz (2012). We choose the high-low stock liquidity measure proposed in Corwin and Schultz

(2012) because this high-low stock liquidity measure exhibits several desirable attributes (see Corwin and Schultz 2012). First, this high-low stock liquidity measure has strong theoretical foundation. Corwin and Schultz (2012) developed this high-low liquidity measure on the basis of two simple uncontroversial empirical regularities. Namely, daily high prices are always buyer-initiated while daily low prices are always seller-initiated. Therefore, the ratio of high-to-low prices reflect both the fundamental volatility of the stock and the stock's bid-ask spread. , the component of the high-to-low price ratio attributed to fundamental volatility increase proportionately with the trading interval while the component attributed to bid-ask spreads stay relatively constant over a short period.

Second, Corwin and Schultz (2012) showed that this high-low measure outperforms other popular low-frequency measures in capturing cross-sections of both spread levels and month-to-month changes in spreads (see Table IV of Corwin and Schultz 2012). We argue that it is a highly desirable feature for any low-frequency liquidity measure to possess high cross-section correlations with liquidity measures computed from high-frequency intraday transaction level data, especially when the low-frequency liquidity measure is used in cross-section reression. Third, this high-low stock liquidity measure is less computationally complex and demanding, compared than other stock liquidity measures. Appendix 2 provides brief technical details of Corwin and Schultz's (2012) high-low approach to estimating effective spread and the other two low-frequency liquidity measures used in the robustness tests.

3.3 Regression Model for Testing H1

We follow the method proposed in Gelb and Zarowin (2002) as our main regression model for testing H1. Gelb and Zarowin (2002) adopt this regression model from Collins et al.

(1994). When testing H1, we refer to both the simplified and the complete versions of the regression model. The two versions of the regression model are as follow:

$$RET_{i,t} = \beta_0 + \beta_1 * E/P_{i,t} + \beta_2 * AG_{i,t} + \beta_3 * LMVE_{i,t} + \sum_{j=0}^{j=1} \alpha_j * \Delta E_{i,t+j} + \sum_{j=1}^{j=1} \delta_j * RET_{i,t+j} + \beta_4 * LIQ_{i,t} + \sum_{j=0}^{j=1} \gamma_j * \Delta E_{i,t+j} * LIQ_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$RET_{i,t} = \beta_0 + \beta_1 * E/P_{i,t} + \beta_2 * AG_{i,t} + \beta_3 * LMVE_{i,t} + \sum_{j=0}^{j=3} \alpha_j * \Delta E_{i,t+j} + \sum_{j=1}^{j=3} \delta_j * RET_{i,t+j} + \beta_4 * LIQ_{i,t} + \sum_{j=0}^{j=3} \gamma_j * \Delta E_{i,t+j} * LIQ_{i,t} + \varepsilon_{i,t} \quad (3)$$

Where, for fiscal year *t* and firm *i*,

$RET_{i,t+j}$	=	annualized stock return that starts from the fourth month after the end of fiscal year t+j-1, j=0, 1, 2, 3.
$\Delta E_{i,t+j}$	=	change in income before extraordinary items from fiscal year t+j-1 to fiscal year t+j scaled by the market value of equity at the beginning of fiscal year t+j, j=0, 1, 2, 3.
$E/P_{i,t}$	=	the ratio of income before extraordinary items of fiscal year t to the market value of equity at the beginning of fiscal year t.
$AG_{i,t}$	=	growth rate of total assets from fiscal year t-1 to fiscal year t.
$LMV_{i,t}$	=	the natural log of the market value of equity at the end of fiscal year t.
$LIQ_{i,t}$	=	the natural log of the inverse of the high-low estimate of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 1 provides the details.

Our H1 predicts that $\gamma_j > 0$, j=1, 2, 3. The regression model includes at most three future years' earnings changes because Kothari and Sloan (1992) show that the relation between prices and future earnings is generally not statistically significant when the time lag between prices and earnings is greater than three years. The use of actual future earnings changes introduces measurement error because the theoretically sound regressors should be expected future earnings changes but expected future earnings changes are practically unobservable (Collins et al. 1994). Collins et al. (1994) suggest that inclusion of future returns can mitigate downward bias associated with the use of actual future earnings changes because the dependent variable ($RET_{i,t}$)

are approximately unrelated with future stock returns ($RET_{i,t+j}$) but future stock returns are correlated with unexpected future earnings changes. Inclusion of the earnings-price ratio ($E/P_{i,t}$) and the concurrent asset growth can help further mitigate the measurement error problem because these two constructs serve as expectations for future earnings . Inclusion of firm size ($LMVE_{i,t}$) is to control for the impact of variation in firms' overall information environment because prior studies find that large firms tend to have richer information environment than small firms and thus stock prices of large firms will incorporate future earnings news more timely than those of small firms (Collins and Kothari 1989).

3.4 Regression Model for Testing H2

To test H2, we adapt the regression model used in Cohen et al. (2008). One important implication of our finding about H2 is the provision of a market efficiency-based explanation to the finding that AEM increased steadily from 1987 and started to decline after the passage of the Sarbanes-Oxley Act (SOX) in 2002 first documented in Cohen et al. (2008). Adoption of the regression model used in Cohen et al. (2008) ensures that our study is directly comparable to Cohen et al. (2008). Moreover, our finding regarding H2 still holds after incorporation of a comprehensive list of additional control variables including firm- and industry-fixed effects into the original regression model.

Slightly different from Cohen et al. (2008), in our main test of H2 we use discretionary accruals (DA) as the dependent variable while Cohen et al. (2008) used the absolute value of discretionary accruals (ADA). We believe that the extent to which total accruals deviate from expected normal accruals represents the level of AEM regardless of the direction of deviation. The findings of prior studies suggest that firms and their managers do resort to income-increasing discretionary accruals to manage earnings upward for a variety of reasons such as meeting or beating earnings expectations (e.g. Bartov et al. 2002). Income-decreasing discretionary accruals don't necessarily only reflect the reversal of income-increasing discretionary accruals occurring in prior periods. Under a variety of contexts, firms and/or their managers also have motives to resort to income-decreasing discretionary accruals to manage earnings downward. For instance, Perry and Williams's (1994) finding suggests that managers tended to reduce reported earnings prior to the public announcement of managerial buyout proposal; the findings of a number of research papers suggest that when under regulatory scrutiny firms and their managers tended to manage earnings downward through AEM (see Cahan 1992; Jones 1991); the findings of a number of studies (e.g. Pourciau 1993) suggest that incoming CEOs have incentives manage earnings downward through income-decreasing DA to increase reported earnings in the following year and thus enhance the incoming CEOs' reputation; the finding of Healy (1985) suggests that firms with cap on bonus awards are more likely to report accruals that defer income when the cap is reached than firms that have comparable performance but have no bonus cap (also see Holthausen et al. 1995). Therefore, we use the unsigned discretionary accruals as our dependent variable.

Our H2 predicts a negative relationship between stock liquidity and discretionary accruals when discretionary accruals are income-increasing (i.e. DA > 0), and a positive relationship between stock liquidity and discretionary accruals when discretionary accruals are income-decreasing (i.e. DA < 0). To accurately represent the relationships consistent with the prediction of H2, we include an indicator variable (DDA) that reflects the sign of discretionary accruals (i.e. DDA = 1 if DA > 0 and DDA = 0 if DA < 0), and interaction terms between this indicator variable and all other explanatory variables including our measure of stock liquidity in our regression equation used in the main test of H2. In addition, the way in which we set up the regression model avoids imposition of the mechanical constraint that relationships between explanatory variables and discretionary accruals are constant regardless of the nature of discretionary accruals (i.e., income-increasing vs. income-decreasing). The regression model used in our main test is as follows:

$$DA = \beta_0 + \beta_1 \times BIG + \beta_2 \times \Delta GDP + \beta_3 \times LMV + \beta_4 \times TIME + \beta_5 \times SCA + \beta_6 \times SOX + \beta_7 \times RM + \beta_8 \times BONUS + \beta_9 \times BONUS \times SCA + \beta_{10} \times BONUS \times SOX + \beta_{11} \times UN\_OPT + \beta_{12} \times UN\_OPT \times SCA + \beta_{13} \times UN\_OPT \times SOX + \beta_{14} \times GRNT\_OPT + \beta_{15} \times GRNT\_OPT \times SCA + \beta_{16} \times GRNT\_OPT \times SOX + \beta_{17} \times EX\_OPT + \beta_{18} \times EX\_OPT \times SCA + \beta_{19} \times EX\_OPT \times SOX + \beta_{20} \times OWNER + \beta_{21} \times OWNER \times SCA + \beta_{22} \times OWNER \times SOX + \boldsymbol{\beta_{23}} \times LIQ + \gamma_0 \times DDA + \gamma_1 \times DDA \times BIG + \gamma_2 \times DDA \times \Delta GDP + \gamma_3 \times DDA \times LMV + \gamma_4 \times DDA \times TIME + \gamma_5 \times DDA \times SCA + \gamma_6 \times DDA \times SOX + \gamma_7 \times DDA \times RM + \gamma_8 \times DDA \times BONUS + \gamma_9 \times DDA \times BONUS \times SCA + \gamma_{10} \times DDA \times BONUS \times SOX + \gamma_{11} \times DDA \times UN\_OPT + \gamma_{12} \times DDA \times UN\_OPT \times SCA + \gamma_{13} \times DDA \times UN\_OPT \times SOX + \gamma_{14} \times DDA \times GRNT\_OPT + \gamma_{15} \times DDA \times GRNT\_OPT \times SCA + \gamma_{16} \times DDA \times GRNT\_OPT \times SOX + \gamma_{17} \times DDA \times EX\_OPT + \gamma_{18} \times DDA \times EX\_OPT \times SCA + \gamma_{19} \times DDA \times EX\_OPT \times SOX + \gamma_{20} \times DDA \times OWNER + \gamma_{21} \times DDA \times OWNER \times SCA + \gamma_{22} \times DDA \times OWNER \times SOX + \boldsymbol{\gamma_{23}} \times DDA \times LIQ + \varepsilon \quad (4)$$

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise.
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation

received by the CEO and CFO of the firm in fiscal year t.

EX_OPT = the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.

UN_OPT = the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.

GRNT_OPT = the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.

OWNER = the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

H2 predicts that $\boldsymbol{\beta_{23} > 0 \; and \; \beta_{23} + \gamma_{23} < 0}$.

3.5 Estimation Technique

We apply OLS regression to estimate equation (2), (3) and (4). All datasets used in our analyses are panel data. Panel data generally exhibit cross-sectional (e.g. within-year) and serial (e.g., within-firm) correlations for variables of interest (Gow et al. 2010; Petersen 2009; Thompson 2011). Presence of cross-sectional and serial correlations generally leads to violation of the common assumption of independence in regression errors and thus results in misspecified test statistics. Gow et al. (2010) show that failure to correct for cross-sectional and time-series dependence produces misspecified test statistics in common accounting research settings. To ensure that our inferences are not confounded by misspecified test statistics induced by cross-sectional and serial correlations, we follow the suggestion given in Gow et al. (2010), Petersen (2009) and Thompson (2011) to apply two-way cluster-robust standard errors to compute test statistics[2]. Specifically, we use standard errors clustered by firm *and* year to compute our test statistics. Gow et al., (2010) show that the two-way cluster-robust standard errors are robust to both serial and cross-sectional correlations (also see Cameron et al. 2008).

[2] We thank Dr. Petersen for generously making his STATA code for calculating two-way cluster-robust standard errors available online.

4. DATA, SAMPLE, AND DESCRIPTIVE STATISTICS

To set up and estimate regression equation (1) – (4), we obtain financial, accounting, and auditor-related data from COMPUSTAT, stock-related data from CRSP, CEO and CFO compensation data from EXECCOMP, and GDP data from Bureau of Economic Analysis. In our robustness and causality tests, we obtain analysts-related data from I/B/E/S, institutional ownership data from Thomson CDA/Spectrum Institutional 13f Holdings, director-related and governance provisions data from RISKMETRICS, and marginal tax rate from Prof. John Graham[3].

Consistent with prior studies (e.g. Zang Forthcoming), we exclude financial (SIC 6000-6999) and utilities (SIC 4900-4999) firms from our sample. To maximize statistical power and generalizability of our findings, we only require that a firm-year observation has no missing values for variables used in the test to be included in one test. Therefore, different tests will have different sample composition. In addition, in our analysis we exclude observations for which the values of ratio-type variables such as operating cycles and return on assets are in the top or bottom 0.5%. Panel A of Table 1 reports the year-by-year distribution of observations used in our main test of H2.

For the sake of saving space, we only report summary statistics and correlations for variables used in the main test of H2 because of the centrality of H2 in our study[4]. Panel B of Table 1 reports the summary statistics for variables in our main test of H2. Overall, variables used in our study to test H2 are comparable to those used in prior studies regarding statistical distributions (e.g. Cohen et al. 2008).

[3] We thank Dr. Gramham for generously making his marginal tax rate data available to us.
[4] Summary statistics and correlations for variables used in other tests will be provided at request.

Panel C of Table 1 reports the Pearson and Spearman correlations between variables used in our main test of H2. We are cautious about drawing inferences from correlations between discretionary accruals and other variables because of the inherent correlations between variables that represent either motives for earnings management or determinants of discretionary accruals. However, we want to provide a brief discussion of the correlation between stock liquidity measure and discretionary accrual. Consistent with the prediction of H2, the correlation between discretionary accruals and stock liquidity is positive when discretionary accruals are income-decreasing (i.e., DA < 0), and negative when discretionary accruals are income-increasing (i.e., DA > 0).

Table 1
Descriptive Statistics

Panel A: Sample Distribution

Year	N	%
1992	609	3.04%
1993	853	4.25%
1994	936	4.66%
1995	987	4.92%
1996	1049	5.23%
1997	1122	5.59%
1998	1141	5.69%
1999	1104	5.50%
2000	1060	5.28%
2001	1077	5.37%
2002	1107	5.52%
2003	1142	5.69%
2004	1132	5.64%
2005	1085	5.41%
2006	1128	5.62%
2007	1165	5.81%
2008	1138	5.67%
2009	1128	5.62%
2010	1102	5.49%
Total	20065	100.00%

Table 1
Descriptive Statistics - Continued

Panel B: Summary Statistics

	DA > 0						DA < 0						
	N	Mean	Std. Dev.	Q1	Median	Q3	N	Mean	Std. Dev.	Q1	Median	Q3	Diff
DA	9335	0.058	0.068	0.017	0.038	0.074	10730	-0.068	0.097	-0.083	-0.042	-0.019	0.126**
LIQ	9335	4.781	0.506	4.422	4.795	5.149	10730	4.724	0.528	4.354	4.737	5.109	0.056**
BIG	9335	0.957	0.203	1.000	1.000	1.000	10730	0.956	0.205	1.000	1.000	1.000	0.001
ΔGDP	9335	2.782	1.797	1.900	3.000	4.100	10730	2.433	2.053	1.900	2.900	3.700	0.349**
LMV	9335	7.162	1.597	6.040	6.950	8.110	10730	7.132	1.617	6.011	6.970	8.124	0.030
TIME	9335	9.052	5.127	5.000	9.000	13.000	10730	9.836	5.400	5.000	10.000	15.000	-0.784**
SCA	9335	0.122	0.327	0.000	0.000	0.000	10730	0.093	0.291	0.000	0.000	0.000	0.028**
SOX	9335	0.459	0.498	0.000	0.000	1.000	10730	0.544	0.498	0.000	1.000	1.000	-0.085**
RM	9335	0.050	0.441	-0.119	0.061	0.268	10730	-0.037	0.454	-0.218	0.000	0.192	0.087**
BONUS	9335	0.157	0.159	0.000	0.128	0.250	10730	0.142	0.154	0.000	0.100	0.234	0.016**
EX_OPT	9335	0.005	0.009	0.001	0.003	0.007	10730	0.006	0.009	0.001	0.003	0.007	0.000*
UN_OPT	9335	0.002	0.004	0.000	0.001	0.002	10730	0.002	0.004	0.000	0.001	0.002	0.000
GRNT_OPT	9335	0.002	0.004	0.000	0.001	0.002	10730	0.002	0.004	0.000	0.001	0.002	0.000**
OWNER	9335	0.020	0.050	0.001	0.003	0.013	10730	0.017	0.045	0.001	0.003	0.011	0.003**

Panel C: Pairwise Pearson (Spearman) Correlations in Upper (Lower) Triangle

DA > 0	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
DA (1)		**-0.20**	**-0.04**	**0.08**	**-0.11**	**-0.05**	**0.09**	**-0.10**	-0.01	**0.02**	**0.06**	**0.08**	**0.09**	**0.10**
LIQ (2)	**-0.19**		**0.11**	**0.18**	**0.40**	**-0.09**	**-0.17**	0.00	**0.08**	**0.15**	**-0.12**	**-0.09**	**-0.15**	**-0.08**
BIG (3)	-0.02	**0.11**		**0.08**	**0.15**	**-0.10**	**0.04**	**-0.09**	0.01	0.01	-0.06	**0.00**	**-0.02**	**-0.08**
ΔGDP (4)	**0.08**	**0.11**	**0.07**		**-0.08**	**-0.56**	0.00	**-0.52**	0.00	**0.25**	**0.04**	**0.08**	**0.08**	**0.08**
LMV (5)	**-0.12**	**0.41**	**0.16**	**-0.09**		**0.21**	-0.01	**0.18**	0.00	-0.01	**-0.25**	**-0.16**	**-0.20**	**-0.17**
TIME (6)	**-0.05**	**-0.10**	**-0.10**	**-0.52**	**0.22**		**-0.04**	**0.86**	**0.06**	**-0.29**	**0.01**	-0.07	**-0.10**	**-0.12**
SCA (7)	**0.08**	**-0.17**	**0.04**	**-0.04**	-0.01	**-0.03**		**-0.34**	**0.02**	0.01	**0.03**	**0.06**	**0.06**	0.00
SOX (8)	**-0.10**	0.00	**-0.09**	**-0.58**	**0.19**	**0.86**	**-0.34**		**0.05**	**-0.20**	**0.02**	**-0.07**	**-0.11**	**-0.12**
RM (9)	**0.05**	**0.06**	-0.01	0.01	0.00	**0.07**	**0.03**	**0.05**		-0.01	**-0.03**	**-0.04**	**-0.05**	**-0.04**
BONUS (10)	0.01	**0.17**	0.02	**0.26**	0.01	**-0.35**	**0.03**	**-0.25**	**-0.03**		**0.03**	**0.07**	**-0.13**	**0.05**
EX_OPT (11)	**0.03**	**-0.12**	**-0.03**	**0.00**	**-0.27**	0.10	**0.05**	**0.09**	0.02	**-0.02**		**0.21**	**0.29**	**0.03**
UN_OPT (12)	**0.05**	**-0.09**	**0.02**	**0.05**	**-0.14**	**0.00**	**0.11**	**-0.02**	0.01	**0.04**	**0.42**		0.155	**0.03**
GRNT_OPT (13)	**0.04**	**-0.11**	**0.02**	0.08	**-0.17**	**-0.06**	**0.12**	**-0.10**	-0.01	-0.12	**0.36**	0.314		**0.06**
OWNER (14)	**0.10**	**-0.15**	**-0.09**	**0.05**	**-0.31**	**-0.02**	-0.01	**-0.04**	0.01	**-0.02**	**0.16**	**0.05**	0.02	

Table 1
Descriptive Statistics – Continued

DA < 0														
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
DA (1)		**0.26**	0.02	**0.02**	**0.13**	**0.02**	**-0.06**	**0.05**	**0.17**	**0.08**	**-0.04**	**-0.04**	**-0.09**	-0.01
LIQ (2)	**0.27**		**0.10**	**0.26**	**0.46**	**-0.14**	**-0.17**	**-0.05**	**0.06**	**0.20**	**-0.11**	**-0.09**	**-0.15**	**-0.08**
BIG (3)	**0.02**	**0.10**		**0.07**	**0.15**	**-0.10**	**0.03**	**-0.09**	0.02	-0.01	-0.09	**0.01**	0.01	**-0.08**
ΔGDP (4)	**0.04**	**0.21**	**0.06**		**-0.02**	**-0.57**	-0.01	**-0.49**	**-0.05**	**0.28**	**-0.01**	0.05	**0.07**	**0.06**
LMV (5)	**0.17**	**0.48**	**0.15**	**-0.03**		**0.14**	-0.02	**0.13**	0.02	**0.02**	**-0.25**	**-0.15**	**-0.21**	**-0.12**
TIME (6)	0.01	**-0.13**	**-0.10**	**-0.55**	**0.15**		**-0.08**	**0.87**	**0.08**	**-0.35**	**0.05**	**-0.05**	**-0.10**	**-0.11**
SCA (7)	**-0.03**	**-0.17**	**0.03**	**-0.07**	-0.02	**-0.10**		**-0.35**	0.00	**0.03**	**0.02**	**0.04**	**0.06**	-0.01
SOX (8)	**0.03**	**-0.05**	**-0.09**	**-0.56**	**0.14**	**0.86**	**-0.35**		**0.08**	**-0.25**	**0.07**	**-0.03**	**-0.11**	**-0.10**
RM (9)	**0.11**	**0.05**	0.02	**-0.05**	0.01	**0.08**	0.00	**0.08**		**-0.03**	**-0.04**	**-0.05**	**-0.08**	**-0.05**
BONUS (10)	**0.08**	**0.22**	0.01	**0.31**	**0.04**	**-0.42**	**0.05**	**-0.30**	**-0.04**		**-0.01**	0.06	**-0.14**	**0.04**
EX_OPT (11)	**-0.07**	**-0.15**	**-0.04**	-0.07	**-0.26**	**0.14**	**0.03**	**0.16**	**-0.02**	**-0.07**		**0.22**	**0.27**	0.00
UN_OPT (12)	**-0.06**	**-0.12**	**0.02**	**0.00**	**-0.13**	**0.04**	**0.07**	**0.04**	**-0.04**	**0.03**	**0.39**		**0.09**	0.00
GRNT_OPT (13)	**-0.10**	**-0.12**	**0.06**	**0.05**	**-0.16**	**-0.05**	**0.10**	**-0.06**	**-0.03**	**-0.13**	**0.33**	**0.26**		-0.01
OWNER (14)	**-0.04**	**-0.15**	**-0.09**	**-0.02**	**-0.28**	**0.03**	**-0.02**	0.02	0.00	**-0.04**	**0.17**	**0.07**	-0.02	

Correlations Significantly Different from Zero at p-Values Less Than 0.05 Are in Boldface Type

Panel A of Table 1 reports the year-by-year distribution of observations used to test H2.
Panel B of Table 1 reports the summary statistics for the variables used to test H2.
Panel C of Table 1 reports the pairwise Pearson/Spearman correlations between variables used to test H2.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.

Table 1
Descriptive Statistics – Continued

EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

5. RESULTS

5.1 H1: Stock Liquidity and Future Earnings Response Coefficient

Following Aiken and West's (1991) suggestion, we center our stock liquidity measure on its sample mean before we generate the interaction term between stock liquidity and changes in future earnings. Centering our stock liquidity measure on its sample mean makes regression coefficients on changes in future earnings empirically meaningful because in our sample stock liquidity measure is always positive (see Aiken and West 1991). Furthermore, centering our stock liquidity measure on its sample mean can mitigate potential collinearity problems associated with inclusion of interaction terms in the regression equation (see Aiken and West 1991).

Table 2 reports the OLS estimates of equation (2) and (3). Consistent with the prediction of H1, the regression coefficients on the interaction terms between stock liquidity and changes in future earnings are positive, suggesting that as stock liquidity increases contemporaneous variations in stock prices will be more driven by changes in future earnings.

Following Aiken and West's (1991) suggestion we draw Figure 1 to illustrate how the regression coefficient on changes in future earnings (fiscal year t+1) varies with the magnitude of stock liquidity. From equation (2) we can get [5]

$$\frac{\partial RET_{i,t}}{\partial \Delta E_{i,t+1}} = \beta(\Delta E_{t+1}) = \alpha_1 + \gamma_1 * LIQ_{i,t} \quad (5)$$

Therefore,

$$\beta(\widehat{\Delta E_{t+1}}) = \widehat{\alpha_1} + \widehat{\gamma_1} * LIQ_{i,t} \quad (6)$$

And

[5] Derivation is the same when referring to equation (3).

Table 2

Stock Liquidity and Future Earnings Response Coefficient (Gelb and Zarowin 2002)

Dependent Variable - RET_t			
Variables	Expected Sign	Model 1	Model 2
Intercept	?	0.182**	0.181**
E/P_{t-1}	+	0.733**	0.705**
AG_t	+	0.213**	0.210**
LMV_t	-	-0.018**	-0.019*
RET_{t+1}	-	-0.140**	-0.139**
RET_{t+2}	-	-0.044**	-0.044**
RET_{t+3}	-	-0.064**	-0.063**
ΔE_t	+	1.101**	1.101**
ΔE_{t+1}	+	1.285**	1.389**
ΔE_{t+2}	+	0.260**	0.300**
ΔE_{t+3}	+	0.107*	0.127**
LIQ_t	?		-0.001
LIQ_t x ΔE_t	+		-0.009
LIQ_t x ΔE_{t+1}	+		0.229**
LIQ_t x ΔE_{t+2}	+		0.102*
LIQ_t x ΔE_{t+3}	+		0.051
N		91644	91644
R^2		0.143	0.145

Note: t-statistics are computed by using two-way cluster-robust standard errors

**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Table 2 reports the results of regression of contemporaneous annualized stock returns on the interaction term(s) between stock liquidity and changes in earnings and other control variables.

Variable Definitions:

RET_{t+j} = annualized stock return that starts from the fourth month after the end of fiscal year t+j-1, j=0, 1, 2, 3.

ΔE_{t+j} = change in income before extraordinary items from fiscal year t+j-1 to fiscal year t+j scaled by the market value of equity at the beginning of fiscal year t+j, j=0, 1, 2, 3.

E/P_t = the ratio of income before extraordinary items of fiscal year t to the market value of equity at the beginning of fiscal year t.

Table 2
Stock Liquidity and Future Earnings Response Coefficient (Gelb and Zarowin 2002) – Continued

AG_t	=	growth rate of total assets from fiscal year t-1 to fiscal year t.
LMV_t	=	the natural log of the market value of equity at the end of fiscal year t.
LIQ_t	=	the natural log of the inverse of the high-low estimate of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 1 provides the details.

$$Std.Dev\left(\beta(\widehat{\Delta E_{t+1}})\right) = \sqrt{Var(\widehat{\alpha_1}) + Var(\widehat{\gamma}_1) * LIQ_{i,t}^2 + 2 * LIQ_{i,t} * Covariance(\widehat{\alpha_1}, \widehat{\gamma}_1)} \quad (7)$$

We obtain $\widehat{\alpha_1}$, $\widehat{\gamma}_1$, $Var(\widehat{\alpha_1})$, $Var(\widehat{\gamma}_1)$ and $Covariance(\widehat{\alpha_1}, \widehat{\gamma}_1)$ from OLS estimates of equation (2). In our sample, the magnitude of stock liquidity ranges from 0.82 to 7.74. To draw Figure 1, we use the range of 0.50 to 8.0 to ensure that the value range of stock liquidity better represents the population. Figure 1 clearly shows that as stock liquidity increases the relationship between contemporaneous variations in stock prices and changes in future earnings strengthens. As evident in Figure 1, when stock liquidity is below certain value (about 2.0 in our sample) $\beta(\Delta E_{t+1})$ is not statistically different from zero. In other words, when stock liquidity is very low (i.e., less than 2.0 in our sample) contemporaneous variations in stock prices convey no information about changes in future earnings (fiscal year t+1)[6].

5.2 H2: Stock Liquidity and Discretionary Accruals

To gain first-hand insight into the relationship between stock liquidity and discretionary accruals, we draw Figure 2 for a direct illustration of the relationship between stock liquidity and discretionary accruals. To draw Figure 2, we sort all observations with no missing values for both stock liquidity and discretionary accruals measures into five equal groups according to the

[6] For changes in earnings for fiscal year t+2 and t+3, we come to qualitatively the same conclusion after following the same procedure to draw figures.

magnitude of stock liquidity (larger group number means higher stock liquidity), and independently sort the same set of observations into two groups according to the sign of discretionary accruals. In total, 75003 firm-year observations are used to draw Figure 2 and 36568 firm-year observations have positive discretionary accruals.

Figure 2 exhibits several interesting patterns regarding the relationship between stock liquidity and discretionary accruals. First, consistent with the prediction of H2, Figure 2 reveals a positive relationship between stock liquidity and discretionary accruals when discretionary accruals are negative, and a negative relationship when discretionary accruals are positive, suggesting that as stock liquidity increases and consequently stock prices become more efficient firms will engage in less AEM.

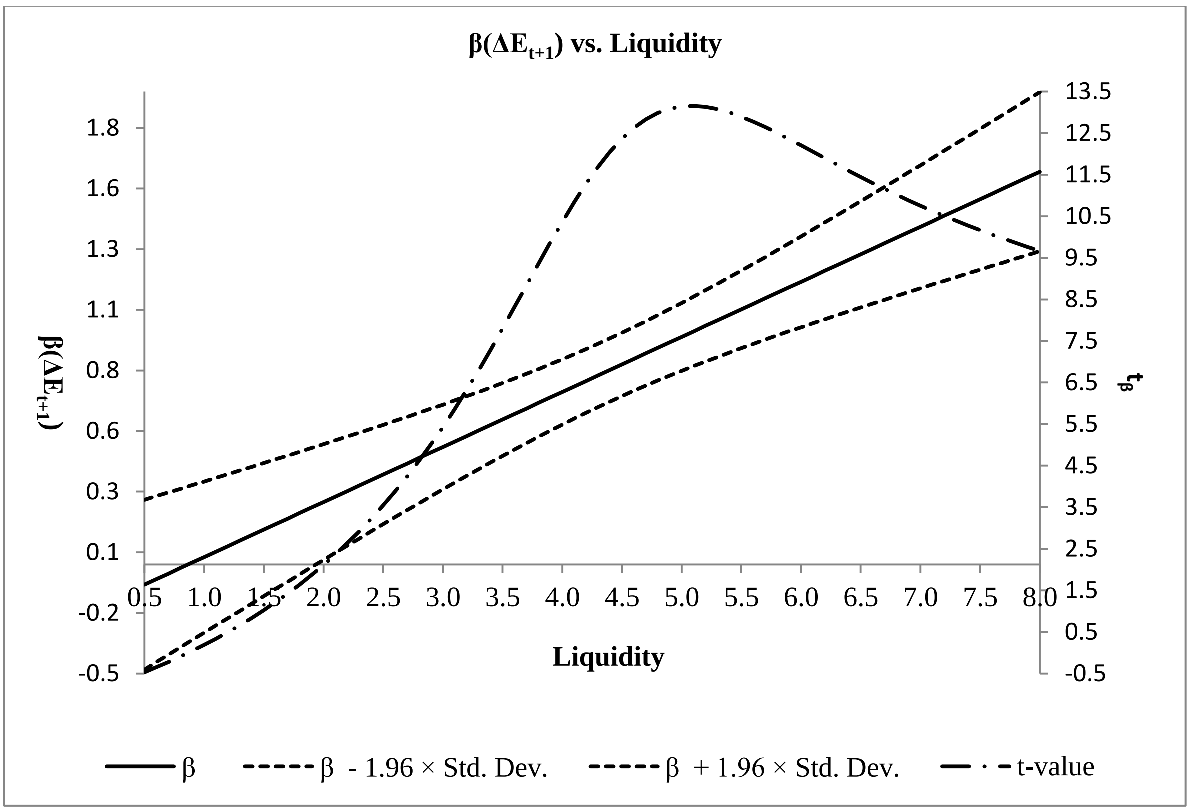

Figure 1

Stock Liquidity and Future Earnings Response Coefficient (Gelb and Zarowin 2002)

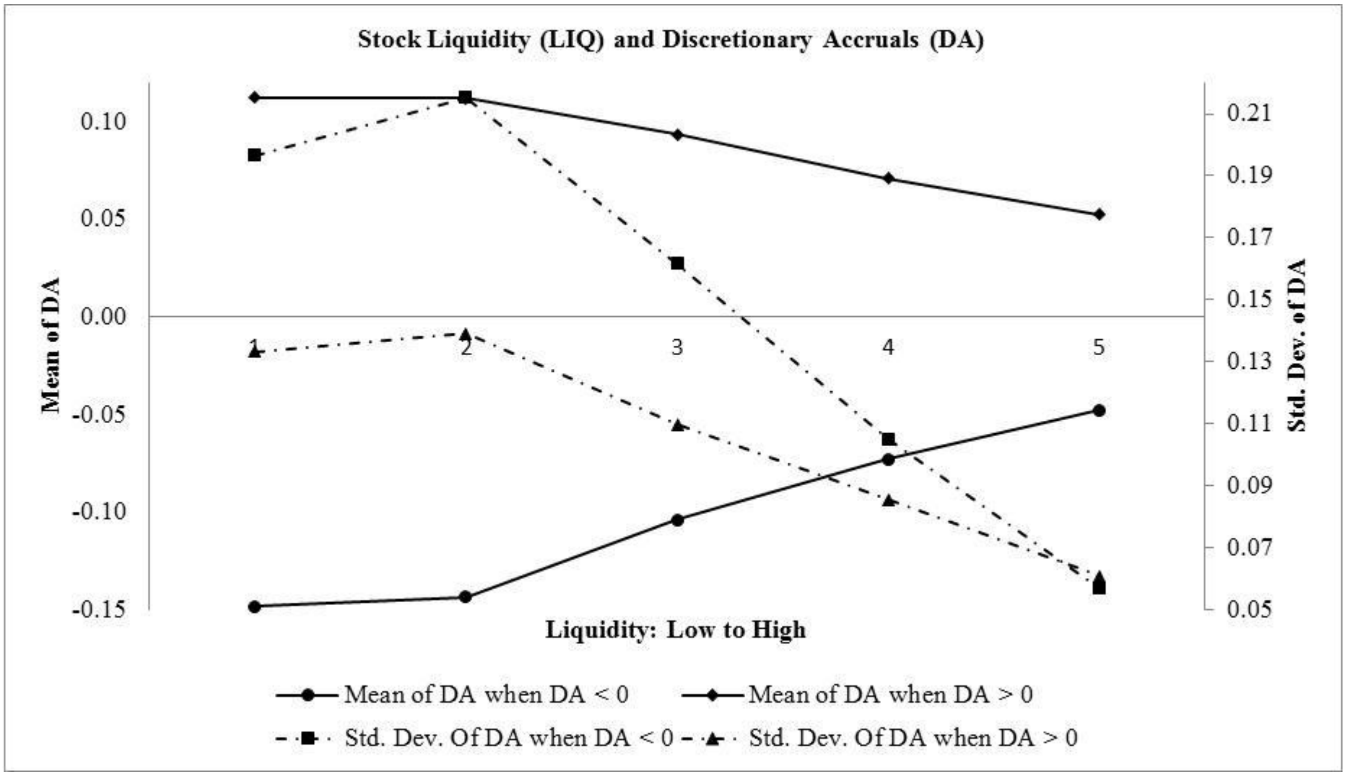

Figure 2

Stock Liquidity and Discretionary Accruals: Cross-sectional Evidence

Figure 2 depicts the cross-sectional relationship between stock liquidity and the magnitude and standard deviation of discretionary accruals. To draw Figure 2, we separate observations into two groups according to the sign of their discretionary accruals, and sort all observations into five equal groups according to the magnitude of stock liquidity.

Second, the strength of the relationship between stock liquidity and discretionary accruals is stronger when discretionary accruals are negative than when discretionary accruals are positive. We argue that the differential strengths regarding the effect of stock liquidity on AEM may stem from the fact that it is more costly and risky for investors to engage in short arbitrage than in long arbitrage. Holding everything else equal, positive discretionary accruals are likely to cause overvaluation while negative discretionary accruals are likely to generate undervaluation. In the presence of overvaluation, arbitrage requires short sale of shares while in the presence of undervaluation, arbitrage requires taking a long position. In practice, it is more costly and risky to engage in short arbitrage than in long arbitrage (Hirshleifer et al. 2011). Therefore, the effect of stock liquidity on price efficiency is less significant in the presence of resulting from income-increasing AEM than in the presence of undervaluation brought about by income-decreasing AEM. Furthermore, Figure 2 shows that the standard deviation of discretionary accruals declines as stock liquidity increases, suggesting that as stock liquidity increases and consequently prices become more efficient firms not only engage in less AEM but also engage in less extreme AEM.

Table 3 reports the OLS estimates of regression equation (4). Consistent with the prediction of our H2, the coefficient on stock liquidity is positive when discretionary accruals are negative, and negative when discretionary accruals are positive. Regardless of the sign of discretionary accruals, the regression coefficients on stock liquidity are statistically significant. Moreover, consistent with the pattern revealed in Figure 2, the absolute value of regression coefficient on stock liquidity when DA < 0 is greater than that on stock liquidity when DA > 0. Moreover, not only there is difference regarding the strength of the relationship between stock liquidity and AEM between DA < 0 and DA >0, but also the difference is statistically significant (i.e. $p < 0.01$). Furthermore, the impact of stock liquidity on AEM is also economically significant. When stock liquidity increases from half standard deviation below the sample mean to half standard deviation above the sample mean, discretionary accruals will be reduced by 0.013 (22.37% of the sample mean) when DA > 0; discretionary accruals will be increased by 0.022 (33.58% of the sample mean) when DA < 0.

Our findings about other determinants of AEM are generally consistent with those of prior studies (e.g. Cohen et al. 2008). Here, in our interpretation of regression coefficients on other determinants of AEM we focus on coefficients that are statistically significant. After controlling for other determinants, the period after SOX was characterized by lower AEM, and the decrease in AEM mainly resulted from reduction in income-increasing AEM. As turned out in our sample, income-increasing AEM increases over time while there is no clear trend for income-decreasing AEM. We find no significant impact of Big 8 auditing firms on AEM while the sign of the regression coefficient on Big 8 is consistent with theoretical expectation (i.e. negative when DA > 0 and positive when DA < 0). The finding about firm size (LMV) is similar to that for Big 8. Consistent with Cohen et al. (2008) we find no significant direct evidence that AEM is greater during accounting scandal period (SCA = 1). We document a significant, positive relationship between REM and AEM when DA < 0 suggesting a substitution effect between AEM and REM when DA < 0. We find no significant relationship between REM and AEM when DA > 0. Different from Cohen et al. (2008) we document a significant positive relationship between change in real gross domestic product (ΔGDP) and AEM when DA > 0, suggesting that DA is higher when overall macroeconomic situation is better.

We document a significant positive relationship between the average bonus awarded to CEO and CFO (BONUS) as percentage of total compensation and AEM when DA > 0 during pre-SCA and post-SOX periods, and no statistically significant during accounting scandal period (i.e. SCA = 1). We find no statistically significant relationship between BONUS and AEM when DA < 0 during pre-SCA period, and statistically significant positive relationship between BONUS and AEM during SCA and post-SOX periods.

Table 3

Main Test: Stock Liquidity and Discretionary Accruals

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.066**	DDA	0.137**	Intercept	0.070**	-0.066**
BIG	0.001	DDA x BIG	-0.008	BIG	-0.006	0.001
ΔGDP	-0.001	DDA x ΔGDP	0.005**	ΔGDP	0.003**	-0.001
LMV	0.001	DDA x LMV	-0.001	LMV	-0.000	0.001
Time	0.000	DDA x Time	0.001	Time	0.002**	0.000
SCA	-0.007	DDA x SCA	0.013	SCA	0.005	-0.007
SOX	0.003	DDA x SOX	-0.022†	SOX	-0.018**	0.003
RM	0.032**	DDA x RM	-0.030**	RM	0.002	0.032**
BONUS	0.023	DDA x BONUS	-0.010	BONUS	0.013*	0.023
BONUS x SCA	0.089	DDA x BONUS x SCA	-0.108	BONUS x SCA	-0.020	0.089
BONUS x SOX	0.004	DDA x BONUS x SOX	0.009	BONUS x SOX	0.013	0.004
UN_OPT	-0.588	DDA x UN_OPT	1.647*	UN_OPT	1.059**	-0.588
UN_OPT x SCA	-1.267	DDA x UN_OPT x SCA	2.250	UN_OPT x SCA	0.983	-1.267
UN_OPT x SOX	0.736	DDA x UN_OPT x SOX	-2.171**	UN_OPT x SOX	-1.435**	0.736
GRNT_OPT	-0.673	DDA x GRNT_OPT	1.603	GRNT_OPT	0.930	-0.673
GRNT_OPT x SCA	1.076	DDA x GRNT_OPT x SCA	-2.326*	GRNT_OPT x SCA	-1.251†	1.076
GRNT_OPT x SOX	-0.155	DDA x GRNT_OPT x SOX	0.512	GRNT_OPT x SOX	0.356	-0.155
EX_OPT	-0.192	DDA x EX_OPT	0.346	EX_OPT	0.154	-0.192
EX_OPT x SCA	0.307	DDA x EX_OPT x SCA	-0.719	EX_OPT x SCA	-0.413	0.307
EX_OPT x SOX	0.432	DDA x EX_OPT x SOX	-0.485	EX_OPT x SOX	-0.053	0.432
OWNER	0.018	DDA x OWNER	0.100†	OWNER	0.118**	0.018
OWNER x SCA	0.144*	DDA x OWNER x SCA	-0.176*	OWNER x SCA	-0.032	0.144*
OWNER x SOX	0.071	DDA x OWNER x SOX	-0.148*	OWNER x SOX	-0.077†	0.071
LIQ	0.044**	DDA x LIQ	-0.069**	LIQ	-0.025**	0.044**
		N	20065			
		R^2	0.412			

Table 3

Main Test: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Table 3 reports the OLS regression results of the main test of H2.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise.
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

We documented no significant relationship between the average options granted to CEO and CFO (GRNT_OPT) as percentage of total outstanding shares and AEM when DA > 0 during pre-SCA and SCA periods even though the drop in the strength of the relationship between GRNT_OPT and AEM when DA > 0 is negative and marginally significant. During post-SOX period, the relationship between GRNT_OPT and AEM is positive and marginally statistically significant when DA > 0. We find a statistically significant negative relationship between GRNT_OPT and AEM when DA < 0 during post-SOX period, and no statistically significant relationship during pre-SCA and SCA periods.

We document no significant relationship between the average exercisable stock options held by CEO and CFO (EX_OPT) as percentage of total outstanding shares and AEM regardless of the sign of DA and observation periods. Our finding about the relationship between EX_OPT and AEM is consistent with Cheng and Warfield's (2005) argument that equity incentives leading to earnings management arise from future trading in the company's stock, and exercisable options involve no future trading in the company's stock.

We document a significant positive relationship between the average of CEO's and CFO's stock ownership (OWNER) as percentage of total outstanding shares and AEM during pre-SCA and SCA periods, and no significant relationship between OWNER and AEM after the passage of SOX when DA > 0. We find no significant relationship between OWNER and AEM during pre-SCA period, and significant positive relationship between OWNER and AEM during SCA and post-SOX periods when DA < 0. In summary, our findings about the relationship between components of CEOs' and CFOs' compensation and AEM are consistent with prior studies (e.g. Cheng and Warfield 2005; Cohen et al. 2008; Healy 1985), and are theoretically sensible.

5.3 Robustness Tests

5.3.1 Robustness Test: Stock Liquidity and Future Earnings Response Coefficients

To ensure that our finding about H1 is robust to the empirical model used, we do robustness test of H1 by using the model proposed in Lundholm and Myers (2002). The model proposed in Lundholm and Myers (2002) is also adapted from Collins et al. (1994), and has been widely used in prior studies (e.g., Choi et al. 2011; Orpurt and Zang 2009; Tucker and Zarowin 2006). Consistent with prior studies, we control for firm size, sign of earnings, asset growth, institutional ownership, analysts following, and earnings volatility. Prior studies show that these firm-related characteristics affect price informativeness about future earnings. We refer readers to prior studies (e.g., Choi et al. 2011; Tucker and Zarowin 2006) for justifications of controlling-for these firm-related characteristics.

However, firm size, institutional ownership, and analyst following are arguably associated with or related to stock liquidity. For instance, stock liquidity encourages the formation of large blockholdings and thus increases institutional ownership (Edmans et al. 2011), and analysts following is related to institutional holdings (Brennan and Subrahmanyam 1995). While we acknowledge that firm size matters with respect to price informativenss about future earnigns we argue that we should care more about why firm size matters. Therefore, because of the centrality of stock liquidity as a microstructure mechanism contributing to price efficiency in our study we orthogonalize institutional ownership, and analyst following over stock liquidity before including them in the empirical model. The empirical model for robustness test of H1 is as follows:

$RET_t = \beta_0 + \beta_1 * E_{t-1} + \beta_2 * E_t + \beta_3 * E_{t3} + \beta_4 * RET_{t3} + \alpha_1 * R\_LMV_t + \alpha_2 *$

$R\_LMV_t * E_{t3} + \alpha_3 * AG_t + \alpha_4 * AG_t * E_{t3} + \alpha_5 * STD\_E_t + \alpha_6 * STD\_E_t * E_{t3} +$

$$\alpha_7 * LOSS_t + \alpha_8 * LOSS_t * E_{t3} + \alpha_9 * R\_LCOV_t + \alpha_{10} * R\_LCOV_t * E_{t3} + \alpha_{11} * IO_t + \alpha_{12} * IO_t * E_{t3} + \gamma_0 * LIQ_t + \gamma_1 * LIQ_t * E_{t-1} + \gamma_2 * LIQ_t * E_t + \gamma_3 * LIQ_t * E_{t3} + \gamma_4 * LIQ_t * RET_{t3} + \varepsilon_t \quad (8)$$

Where, for fiscal year *t* and firm *i*,

RET_t = annualized stock return that starts from the fourth month after the end of fiscal year t-1.

E_{t+j} = the income available to common shareholders before extraordinary items for fiscal year t+j, j=-1, 0 deflated by the market value of equity at the beginning of fiscal year t.

E_{t3} = the sum of income available to common shareholders before extraordinary items for fiscal years t+1 through t+3 deflated by the market value of equity at the beginning of fiscal year t.

RET_{t3} = the cumulative stock return over the three-year period that starts in the fourth month after fiscal year t.

LIQ_t = the natural log of the inverse of the high-low estimate of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 1 provides the details.

AG_t = growth rate of total assets from fiscal year t-1 to fiscal year t.

R_LMV_t = the estimated residual from the following regression: $LMV_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where LMV_t is the natural log of the market value of equity at the beginning of fiscal year t.

STD_E_t = the standard deviation of the income available to common shareholders before extraordinary items for fiscal years t through t+3.

D_LOSS_t = an indicator variable that equals one if $E_{t3} < 0$ and equals zero if otherwise.

R_LCOV_t = the estimated residual from the following regression: $LCOV_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where $LCOV_t$ is the natural log of (one plus the number of analysts following the firm in the three months prior to earnings announcement for fiscal year t).

R_IO_t = the estimated residual from the following regression: $IO_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where IO_t is the proportion of shares held by institutional investors at the end of the calendar quarter closest to the end of fiscal year t.

H1 predicts that $\gamma_4 > 0$. Table 4 reports the results of OLS estimate of equation (8). Consistent with the prediction of H1, we find that $\widehat{\gamma_4} > 0$. That is, our empirical finding about the validity of H1 is robust to the choice of a different empirical model. In addition, we draw Figure 3 by following the procedure used to draw Figure 1. Figure 3 reveals an empirical pattern that is qualitatively similar to that revealed in Figure 1. That is, when stock liquidity is rather low contemporaneous variations in stock prices convey no information about changes in future earnings (fiscal year t+1 to t+3); as stock liquidity increases future earnings response coefficient increases.

Table 4

Robustness Test: Stock Liquidity and Future Earnings Response Coefficient (Lundholm and Myers 2002)

Dependent Variable - RET_t			
Variables	Expected Sign	Model 1	Model 2
Intercept	?	0.072*	0.079*
E_{t-1}	-	-0.925**	-0.974**
E_t	+	0.689**	0.560**
E_{t3}	+	0.560**	0.583**
RET_{t3}	-	-0.083**	-0.081**
R_LMV_t	-	-0.042**	-0.041**
$R\_LMV_t \times E_{t3}$	+	0.002	0.002
AG_t	+	0.186**	0.179**
$AG_t \times E_{t3}$	-	0.013	0.011
STD_E_t	?	0.616**	0.675**
$STD\_E_t \times E_{t3}$	-	-0.395**	-0.408**
D_LOSS_t	-	-0.112**	-0.099**
$D\_LOSS_t \times E_{t3}$	-	-0.671**	-0.663**
R_LCOV_t	?	0.038**	0.037**
$R\_LOV_t \times E_{t3}$	+	0.040*	0.039*
R_IO_t	?	0.014	0.005
$R\_IO_t \times E_{t3}$	+	0.263**	0.269**
LIQ_t	?		0.027*
$LIQ_t \times E_{t-1}$	?		-0.057
$LIQ_t \times E_t$	?		-0.215**
$LIQ_t \times E_{t3}$	+		0.036**
N		93020	93020
R^2		0.184	0.186

Table 4

Robustness Test: Stock Liquidity and Future Earnings Response Coefficient (Lundholm and Myers 2002) - Continued

Note: t-statistics are calculated by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Table 4 reports the results of the robustness test of the relationship between stock liquidity and future earnings response coefficient by using the method proposed in Lundholm and Myers (2002).

Variable Definitions:

RET_t	=	annualized stock return that starts from the fourth month after the end of fiscal year t-1.
E_{t+j}	=	the income available to common shareholders before extraordinary items for fiscal year t+j, j=-1, 0 deflated by the market value of equity at the beginning of fiscal year t.
E_{t3}	=	the sum of income available to common shareholders before extraordinary items for fiscal years t+1 through t+3 deflated by the market value of equity at the beginning of fiscal year t.
RET_{t3}	=	the cumulative stock return over the three-year period that starts in the fourth month after fiscal year t.
LIQ_t	=	the natural log of the inverse of the high-low estimate of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 1 provides the details.
AG_t	=	growth rate of total assets from fiscal year t-1 to fiscal year t.
R_LMV_t	=	the estimated residual from the following regression: $LMV_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where LMV_t is the natural log of the market value of equity at the beginning of fiscal year t.
STD_E_t	=	the standard deviation of the income available to common shareholders before extraordinary items for fiscal years t through t+3.
D_LOSS_t	=	an indicator variable that equals one if $E_{t3} < 0$ and equals zero if otherwise.
R_LCOV_t	=	the estimated residual from the following regression: $LCOV_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where $LCOV_t$ is the natural log of (one plus the number of analysts following the firm in the three months prior to earnings announcement for fiscal year t).
R_IO_t	=	the estimated residual from the following regression: $IO_t = ß_0 + ß_1 * LIQ_t + \varepsilon_t$ where IO_t is the proportion of shares held by institutional investors at the end of the calendar quarter closest to the end of fiscal year t.

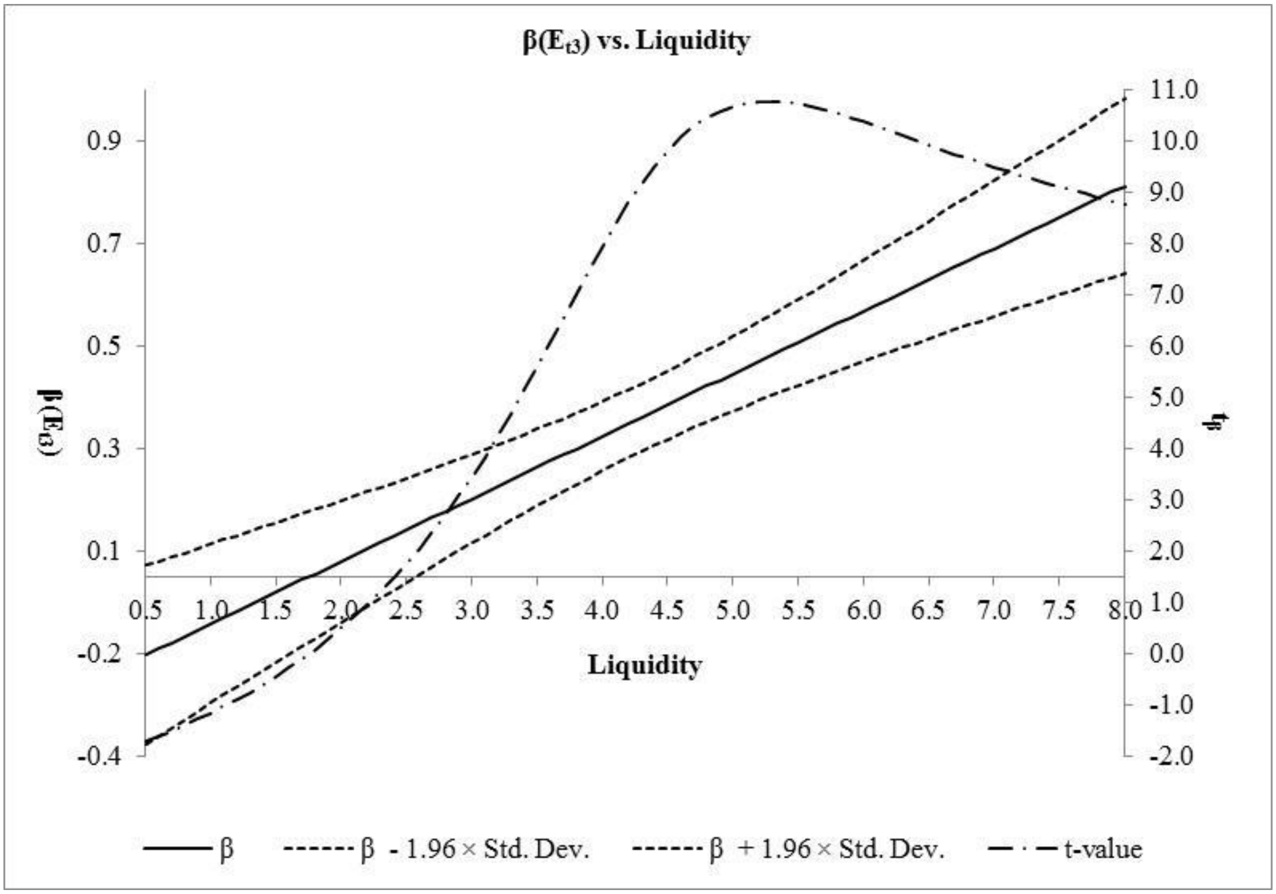

Figure 3
Robustness Analysis: Stock Liquidity and Future Earnings Response Coefficient (Lundholm and Myers 2002)

Figure 3 depicts how future earnings response coefficient varies with the level of stock liquidity.

5.3.2 Robustness Tests: Stock Liquidity and Accruals-Based Earnings Management

We run a battery of robust tests of H2. First, to ensure that our finding about H2 is not driven by the way in which we set up our regression model, we follow Cohen et al. (2008) to do the following two robustness tests: use the absolute value of discretionary accruals as the dependent variable and run the regression separately for observations with positive and negative discretionary accruals. As evident in the results reported in the Panel A and Panel B of Table 5, estimates of regression coefficients and respective test statistics remain unchanged regardless of the way in which we set up the regression model for testing H2 and run the regression analysis.

We argue that the results reported in the Panel A and Panel B of Table 5 are not surprising because the flexibility inherent in the original regression setup already implies the results of these two robustness tests.

We adopt alternative regression models of normal accruals to estimate discretionary accruals and examine whether our finding about H2 is robust to the way in which discretionary accruals are calculated. We use Dechow et al.'s (2003) (hereafter, DRT) model to estimate the normal level of total accruals (i.e. nondiscretionary accruals). DRT arguably improves the modified Jones model in several aspects. First, DRT explicitly models and thus captures the expected change in credit sales for a given change in sales rather than presumes that all credit sales are discretionary. Second, DRT includes lagged total accruals to control for the predicted proportion of total accruals. Third, DRT includes next-year's sales growth to capture the increase in inventory that is related to growth prospects. We also use the original Jones model proposed in Jones (1991) to estimate the normal level of total accruals. As shown in results reported in Panel C and Panel D of Table 5, our finding regarding H2 remains unchanged.

Instead of using two-digit SIC codes to classify the industry membership of firm-year observations we adopt the latest Fama-French industry classification scheme (49 industries in total) to estimate the modified Jones model. As shown in results reported in the Panel E of Table 5, our finding about the empirical validity of H2 remains essentially unchanged

To further ensure that our finding about H2 is not sensitive to our choice of stock liquidity measure, we adopt the stock liquidity measure proposed in Amihud (2002) and the stock liquidity measure proposed in Hasbrouck (2009) to rerun our main test of H2. Appendix 2 provides brief technical background of each stock liquidity measure. As shown in the results reported in Panel F and Panel G of Table 5, our finding regarding H2 remains unchanged regardless of the stock liquidity measures used.

In summary, our finding about H2 is robust to the way in which we set up the regression model for testing H2, to the application of alternative total accruals models to estimate discretionary accruals, to the application of different industry classification schemes, and to the use of different stock liquidity measures.

5.4 Causality Analysis: Stock Liquidity and Discretionary Accruals

As evident in our review of the literature about the relationship between stock liquidity and price efficiency and in our development of H2, the relationship between stock liquidity and AEM is theoretically sound. However, the findings of prior studies suggest that there is possible reversal causality between stock liquidity and AEM. For instance, Lang et al. (Forthcoming) find that greater stock liquidity is associated with less earnings management. Moreover, endogeneity problems are ubiquitous in empirical studies. In our research setting, it is possible that third variables drive the empirical relationship between stock liquidity and discretionary accruals documented by us. For example, Chung et al. (2010) find that greater stock liquidity is associated with better corporate governance. Chung et al. (2010) attributed their finding to the possibility that effective governance enhances financial and operational transparency, and thus decreases information asymmetries between insiders and outside investors as well as among outside investors. The findings of prior studies (e.g. Ghosh et al. 2010; Klein 2002) suggest that better corporate governance can mitigate accruals-based earnings management. Therefore, it is arguable that variation in underlying corporate governance may drive the empirical relationship between stock liquidity and discretionary accruals documented in our study.

Table 5
Robustness Tests: Stock Liquidity and Discretionary Accruals

Panel A: Use of Absolute Value of DA (ADA) as Dependent Variable

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	0.066**	DDA	0.004	Intercept	0.070**	0.066**
BIG	-0.001	DDA x BIG	-0.005	BIG	-0.006	-0.001
ΔGDP	0.001	DDA x ΔGDP	0.002*	ΔGDP	0.003**	0.001
LMV	-0.001	DDA x LMV	0.001	LMV	-0.000	-0.001
Time	-0.000	DDA x Time	0.002**	Time	0.002**	-0.000
SCA	0.007	DDA x SCA	-0.002	SCA	0.005	0.007
SOX	-0.003	DDA x SOX	-0.015†	SOX	-0.018**	-0.003
RM	-0.032**	DDA x RM	0.034**	RM	0.002	-0.032**
BONUS	-0.023	DDA x BONUS	0.036*	BONUS	0.013*	-0.023
BONUS x SCA	-0.089	DDA x BONUS x SCA	0.069†	BONUS x SCA	-0.020	-0.089
BONUS x SOX	-0.004	DDA x BONUS x SOX	0.017	BONUS x SOX	0.013	-0.004
UN_OPT	0.588	DDA x UN_OPT	0.470	UN_OPT	1.059**	0.588
UN_OPT x SCA	1.267	DDA x UN_OPT x SCA	-0.285	UN_OPT x SCA	0.983	1.267
UN_OPT x SOX	-0.736	DDA x UN_OPT x SOX	-0.699	UN_OPT x SOX	-1.435**	-0.736
GRNT_OPT	0.673	DDA x GRNT_OPT	0.257	GRNT_OPT	0.930	0.673
GRNT_OPT x SCA	-1.076	DDA x GRNT_OPT x SCA	-0.175	GRNT_OPT x SCA	-1.251†	-1.076
GRNT_OPT x SOX	0.155	DDA x GRNT_OPT x SOX	0.201	GRNT_OPT x SOX	0.356	0.155
EX_OPT	0.192	DDA x EX_OPT	-0.037	EX_OPT	0.154	0.192
EX_OPT x SCA	-0.307	DDA x EX_OPT x SCA	0.145	EX_OPT x SCA	-0.162	-0.307
EX_OPT x SOX	-0.432	DDA x EX_OPT x SOX	0.128	EX_OPT x SOX	-0.304	-0.432
OWNER	-0.018	DDA x OWNER	0.136**	OWNER	0.118**	-0.018
OWNER x SCA	-0.144*	DDA x OWNER x SCA	0.112*	OWNER x SCA	-0.032	-0.144*
OWNER x SOX	-0.071	DDA x OWNER x SOX	-0.006	OWNER x SOX	-0.077†	-0.071
LIQ	-0.044**	DDA x LIQ	0.019**	LIQ	-0.025**	-0.044**
		N	20065			
		R^2	0.095			

Table 5
Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test
Panel A of Table 5 reports the OLS regression results of the robustness test of H2 that uses the absolute value of discretionary accruals as the dependent variable.

Variable Definitions:

ADA	=	absolute value of DA. DA is the measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel B: Run the Regression Analysis Separately for Positive and Negative DA Observations

Variables	DA > 0	DA < 0
Intercept	0.070**	-0.066**
BIG	-0.006	0.001
ΔGDP	0.003**	-0.001
LMV	-0.000	0.001
Time	0.002**	0.000
SCA	0.005	-0.007
SOX	-0.018**	0.003
RM	0.002	0.032**
BONUS	0.013*	0.023
BONUS x SCA	-0.020	0.089
BONUS x SOX	0.013	0.004
UN_OPT	1.059**	-0.588
UN_OPT x SCA	0.983	-1.267
UN_OPT x SOX	-1.435**	0.736
GRNT_OPT	0.930	-0.673
GRNT_OPT x SCA	-1.251†	1.076
GRNT_OPT x SOX	0.356	-0.155
EX_OPT	0.154	-0.192
EX_OPT x SCA	-0.178	0.307
EX_OPT x SOX	-0.287	0.432
OWNER	0.118**	0.018
OWNER x SCA	-0.032	0.144*
OWNER x SOX	-0.077†	0.071
LIQ	-0.025**	0.044**
N	9335	10730
R^2	0.073	0.100

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel B of Table 5 reports the OLS regression results of the robustness test of H2 that sorts observations into two groups according to the sign of discretionary accruals estimates and runs the regression separately for both groups.

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5
Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel C: Adopt the Modified Jones Model Proposed in Dechow, Richardson, and Tuna (2003) to Estimate Discretionary Accruals

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.070**	DDA	0.133**	Intercept	0.063**	-0.070**
BIG	0.004	DDA x BIG	-0.009	BIG	-0.005	0.004
ΔGDP	-0.002**	DDA x ΔGDP	0.004**	ΔGDP	0.002**	-0.002**
LMV	0.002†	DDA x LMV	-0.003†	LMV	-0.001	0.002†
Time	-0.001	DDA x Time	0.002†	Time	0.001*	-0.001
SCA	0.000	DDA x SCA	0.000	SCA	-0.001	0.000
SOX	0.012	DDA x SOX	-0.027*	SOX	-0.015**	0.012
RM	0.027**	DDA x RM	-0.028**	RM	0.000	0.027**
BONUS	0.019	DDA x BONUS	-0.008	BONUS	0.012*	0.019
BONUS x SCA	0.062†	DDA x BONUS x SCA	-0.076†	BONUS x SCA	-0.014†	0.062†
BONUS x SOX	0.003	DDA x BONUS x SOX	-0.005	BONUS x SOX	-0.002	0.003
UN_OPT	-0.365	DDA x UN_OPT	1.478*	UN_OPT	1.113**	-0.365
UN_OPT x SCA	-0.637	DDA x UN_OPT x SCA	0.187	UN_OPT x SCA	-0.449	-0.637
UN_OPT x SOX	0.573	DDA x UN_OPT x SOX	-1.333†	UN_OPT x SOX	-0.760	0.573
GRNT_OPT	-0.933†	DDA x GRNT_OPT	1.649†	GRNT_OPT	0.715	-0.933†
GRNT_OPT x SCA	0.947	DDA x GRNT_OPT x SCA	-0.819	GRNT_OPT x SCA	0.128	0.947
GRNT_OPT x SOX	0.193	DDA x GRNT_OPT x SOX	-0.018	GRNT_OPT x SOX	0.175	0.193
EX_OPT	-0.281	DDA x EX_OPT	0.479†	EX_OPT	0.197	-0.281
EX_OPT x SCA	0.469	DDA x EX_OPT x SCA	-0.712	EX_OPT x SCA	-0.243	0.469
EX_OPT x SOX	0.491	DDA x EX_OPT x SOX	-0.773*	EX_OPT x SOX	-0.282	0.491
OWNER	-0.001	DDA x OWNER	0.084*	OWNER	0.083**	-0.001
OWNER x SCA	0.115*	DDA x OWNER x SCA	-0.079	OWNER x SCA	0.037	0.115*
OWNER x SOX	0.095**	DDA x OWNER x SOX	-0.134*	OWNER x SOX	-0.039	0.095**
LIQ	0.036**	DDA x LIQ	-0.059**	LIQ	-0.023**	0.036**
		N	18218			
		R^2	0.420			

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel C of Table 5 reports the OLS regression results of the robustness test of H2 that adopts the modified Jones model proposed in Dechow et al. (2003) to estimate discretionary accruals.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (2003). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel D: Adopt the Jones Model Proposed in Jones (1991) to Estimate Discretionary Accruals

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.065**	DDA	0.145**	Intercept	0.080**	-0.065**
BIG	0.003	DDA x BIG	-0.011	BIG	-0.008	0.003
ΔGDP	-0.003*	DDA x ΔGDP	0.006*	ΔGDP	0.003**	-0.003*
LMV	-0.000	DDA x LMV	0.001	LMV	0.001	-0.000
Time	0.000	DDA x Time	0.002	Time	0.002**	0.000
SCA	-0.020	DDA x SCA	0.038	SCA	0.018†	-0.020
SOX	0.000	DDA x SOX	-0.019	SOX	-0.019**	0.000
RM	0.041**	DDA x RM	-0.032**	RM	0.009†	0.041**
BONUS	0.012	DDA x BONUS	0.004	BONUS	0.016*	0.012
BONUS x SCA	0.163	DDA x BONUS x SCA	-0.182	BONUS x SCA	-0.019	0.163
BONUS x SOX	0.018	DDA x BONUS x SOX	-0.016	BONUS x SOX	0.001	0.018
UN_OPT	-0.363	DDA x UN_OPT	1.273†	UN_OPT	0.911**	-0.363
UN_OPT x SCA	-0.588	DDA x UN_OPT x SCA	2.569	UN_OPT x SCA	1.981†	-0.588
UN_OPT x SOX	0.571	DDA x UN_OPT x SOX	-1.538†	UN_OPT x SOX	-0.967*	0.571
GRNT_OPT	-1.096**	DDA x GRNT_OPT	2.025*	GRNT_OPT	0.928	-1.096**
GRNT_OPT x SCA	1.456	DDA x GRNT_OPT x SCA	-2.659	GRNT_OPT x SCA	-1.203	1.456
GRNT_OPT x SOX	0.881†	DDA x GRNT_OPT x SOX	-0.502	GRNT_OPT x SOX	0.379	0.881†
EX_OPT	-0.156	DDA x EX_OPT	0.487	EX_OPT	0.331	-0.156
EX_OPT x SCA	-0.055	DDA x EX_OPT x SCA	-0.559	EX_OPT x SCA	-0.614	-0.055
EX_OPT x SOX	0.447	DDA x EX_OPT x SOX	-0.361	EX_OPT x SOX	0.086	0.447
OWNER	-0.033	DDA x OWNER	0.133	OWNER	0.100**	-0.033
OWNER x SCA	0.189*	DDA x OWNER x SCA	-0.183*	OWNER x SCA	0.005	0.189*
OWNER x SOX	0.112	DDA x OWNER x SOX	-0.169	OWNER x SOX	-0.057	0.112
LIQ	0.044**	DDA x LIQ	-0.068**	LIQ	-0.024**	0.044**
		N	20065			
		R^2	0.365			

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors

**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel D of Table 5 reports the OLS regression results of the robustness test of H2 that adopts the Jones model proposed in Jones (1991) to estimate discretionary accruals.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the Jones model proposed in Jones (1991). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel E: Adopt the Industry Classification Scheme Proposed in Fama and French (1997) to Estimate Discretionary Accruals

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.063**	DDA	0.140**	Intercept	0.077**	-0.063**
BIG	0.000	DDA x BIG	-0.010	BIG	-0.009*	0.000
ΔGDP	-0.001	DDA x ΔGDP	0.005**	ΔGDP	0.003**	-0.001
LMV	0.000	DDA x LMV	0.001	LMV	0.001	0.000
Time	0.000	DDA x Time	0.001	Time	0.002**	0.000
SCA	-0.010†	DDA x SCA	0.011	SCA	0.001	-0.010†
SOX	0.000	DDA x SOX	-0.022*	SOX	-0.021**	0.000
RM	0.030**	DDA x RM	-0.028**	RM	0.002	0.030**
BONUS	0.018	DDA x BONUS	-0.010	BONUS	0.008	0.018
BONUS x SCA	0.097†	DDA x BONUS x SCA	-0.115	BONUS x SCA	-0.018	0.097†
BONUS x SOX	0.008	DDA x BONUS x SOX	0.008	BONUS x SOX	0.016	0.008
UN_OPT	-0.377	DDA x UN_OPT	1.386*	UN_OPT	1.009**	-0.377
UN_OPT x SCA	-1.185	DDA x UN_OPT x SCA	2.134	UN_OPT x SCA	0.948*	-1.185
UN_OPT x SOX	0.493	DDA x UN_OPT x SOX	-1.639*	UN_OPT x SOX	-1.146**	0.493
GRNT_OPT	-1.017*	DDA x GRNT_OPT	1.886*	GRNT_OPT	0.868	-1.017*
GRNT_OPT x SCA	1.436*	DDA x GRNT_OPT x SCA	-2.836**	GRNT_OPT x SCA	-1.400*	1.436*
GRNT_OPT x SOX	0.211	DDA x GRNT_OPT x SOX	0.126	GRNT_OPT x SOX	0.337	0.211
EX_OPT	-0.059	DDA x EX_OPT	0.241	EX_OPT	0.182	-0.059
EX_OPT x SCA	0.155	DDA x EX_OPT x SCA	-0.407	EX_OPT x SCA	-0.252	0.155
EX_OPT x SOX	0.208	DDA x EX_OPT x SOX	-0.404	EX_OPT x SOX	-0.196	0.208
OWNER	0.010	DDA x OWNER	0.096	OWNER	0.106**	0.010
OWNER x SCA	0.140**	DDA x OWNER x SCA	-0.172*	OWNER x SCA	-0.032	0.140**
OWNER x SOX	0.072	DDA x OWNER x SOX	-0.119	OWNER x SOX	-0.047	0.072
LIQ	0.044**	DDA x LIQ	-0.072**	LIQ	-0.028**	0.044**
		N	20065			
		R^2	0.416			

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel E of Table 5 reports the OLS regression results of the robustness test of H2 that applies the industry classification scheme proposed in Fama and French (1997) to estimate discretionary accruals.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5
Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel F: Adopt the Liquidity Measure Proposed in Amihud (2002)

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.071**	DDA	0.145**	Intercept	0.074**	-0.071**
BIG	0.003	DDA x BIG	-0.012†	BIG	-0.009†	0.003
ΔGDP	0.001**	DDA x ΔGDP	0.001	ΔGDP	0.002**	0.001**
LMV	0.013**	DDA x LMV	-0.019**	LMV	-0.006**	0.013**
Time	0.000	DDA x Time	0.002**	Time	0.002**	0.000
SCA	-0.019**	DDA x SCA	0.029**	SCA	0.010**	-0.019**
SOX	0.010*	DDA x SOX	-0.034**	SOX	-0.024**	0.010*
RM	0.036**	DDA x RM	-0.036**	RM	-0.000	0.036**
BONUS	0.044**	DDA x BONUS	-0.038**	BONUS	0.006	0.044**
BONUS x SCA	0.090*	DDA x BONUS x SCA	-0.110**	BONUS x SCA	-0.020	0.090*
BONUS x SOX	-0.013	DDA x BONUS x SOX	0.032†	BONUS x SOX	0.019†	-0.013
UN_OPT	-0.805†	DDA x UN_OPT	1.973**	UN_OPT	1.168**	-0.805†
UN_OPT x SCA	-1.245	DDA x UN_OPT x SCA	2.073	UN_OPT x SCA	0.828	-1.245
UN_OPT x SOX	0.819	DDA x UN_OPT x SOX	-2.330**	UN_OPT x SOX	-1.511**	0.819
GRNT_OPT	-1.013†	DDA x GRNT_OPT	2.147**	GRNT_OPT	1.134**	-1.013†
GRNT_OPT x SCA	1.481	DDA x GRNT_OPT x SCA	-2.802†	GRNT_OPT x SCA	-1.321	1.481
GRNT_OPT x SOX	-0.176	DDA x GRNT_OPT x SOX	0.562	GRNT_OPT x SOX	0.387	-0.176
EX_OPT	-0.163	DDA x EX_OPT	0.369	EX_OPT	0.206	-0.163
EX_OPT x SCA	0.405	DDA x EX_OPT x SCA	-0.922†	EX_OPT x SCA	-0.517	0.405
EX_OPT x SOX	0.533	DDA x EX_OPT x SOX	-0.711*	EX_OPT x SOX	-0.178	0.533
OWNER	-0.024	DDA x OWNER	0.163**	OWNER	0.139**	-0.024
OWNER x SCA	0.168**	DDA x OWNER x SCA	-0.239**	OWNER x SCA	-0.070	0.168**
OWNER x SOX	0.096*	DDA x OWNER x SOX	-0.194**	OWNER x SOX	-0.098**	0.096*
LIQ	0.005**	DDA x LIQ	-0.007**	LIQ	-0.002†	0.005**
		N	20064			
		R^2	0.390			

Table 5
Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel F of Table 5 reports the OLS regression results of the robustness test of H2 that adopts the liquidity measure proposed in Amihud (2002).

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the illiquidity measure proposed in Amihud (2002) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Panel G: Adopt the Liquidity Measure Proposed in Hasbrouck (2009)

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.065**	DDA	0.134**	Intercept	0.069**	-0.065**
BIG	0.002	DDA x BIG	-0.007	BIG	-0.005	0.002
ΔGDP	0.000	DDA x ΔGDP	0.003†	ΔGDP	0.003**	0.000
LMV	0.003†	DDA x LMV	-0.003†	LMV	-0.001	0.003†
Time	-0.000	DDA x Time	0.003**	Time	0.002**	-0.000
SCA	-0.013†	DDA x SCA	0.019	SCA	0.006	-0.013†
SOX	0.000	DDA x SOX	-0.019†	SOX	-0.019**	0.000
RM	0.033**	DDA x RM	-0.031**	RM	0.002	0.033**
BONUS	0.037*	DDA x BONUS	-0.029	BONUS	0.007	0.037*
BONUS x SCA	0.091	DDA x BONUS x SCA	-0.109	BONUS x SCA	-0.018	0.091
BONUS x SOX	-0.002	DDA x BONUS x SOX	0.018	BONUS x SOX	0.017†	-0.002
UN_OPT	-0.719	DDA x UN_OPT	1.859*	UN_OPT	1.140**	-0.719
UN_OPT x SCA	-1.260	DDA x UN_OPT x SCA	2.119	UN_OPT x SCA	0.859	-1.260
UN_OPT x SOX	0.824	DDA x UN_OPT x SOX	-2.228**	UN_OPT x SOX	-1.404**	0.824
GRNT_OPT	-0.957	DDA x GRNT_OPT	2.031†	GRNT_OPT	1.074†	-0.957
GRNT_OPT x SCA	1.439†	DDA x GRNT_OPT x SCA	-2.621*	GRNT_OPT x SCA	-1.182†	1.439†
GRNT_OPT x SOX	0.080	DDA x GRNT_OPT x SOX	0.021	GRNT_OPT x SOX	0.100	0.080
EX_OPT	-0.179	DDA x EX_OPT	0.370	EX_OPT	0.191	-0.179
EX_OPT x SCA	0.315	DDA x EX_OPT x SCA	-0.801	EX_OPT x SCA	-0.487	0.315
EX_OPT x SOX	0.451	DDA x EX_OPT x SOX	-0.554	EX_OPT x SOX	-0.103	0.451
OWNER	-0.009	DDA x OWNER	0.144*	OWNER	0.134**	-0.009
OWNER x SCA	0.158**	DDA x OWNER x SCA	-0.213**	OWNER x SCA	-0.055*	0.158**
OWNER x SOX	0.088†	DDA x OWNER x SOX	-0.178*	OWNER x SOX	-0.090*	0.088†
LIQ	0.025**	DDA x LIQ	-0.041**	LIQ	-0.016**	0.025**
		N	19969			
		R^2	0.401			

Table 5

Robustness Tests: Stock Liquidity and Discretionary Accruals - Continued

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Panel G of Table 5 reports the OLS regression results of the robustness test of H2 that adopts the liquidity measure proposed in Hasbrouck (2009).

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise
LIQ	=	the natural log of the inverse of the effective trading cost measure proposed in Hasbrouck (2009) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

To mitigate concerns with the possibility that our empirical finding about H2 is confounded by endogeneity problems, we incorporate firm / year / industry fixed effects and a long list of additional variables including governance-related variables identified from existing literature into equation (4)[7]. In general, endogeneity problems are driven by omitted correlated variables (Larcker and Rusticus 2010). Firm fixed effects control for unobservable time-invariant sources of firm heterogeneity. That is, the fixed-effects method solves the joint determination problem wherein an unobservable time-invariant variable simultaneously determines both stock liquidity and discretionary accruals. Industry fixed effects control for industry varying effects on stock liquidity and discretionary accruals. We identify a long list of additional control variables by referring to prior studies (i.e. Badertscher 2011; Bebchuk et al. 2009; Bhagat and Bolton 2008; Chung et al. 2010; Cohen et al. 2008; Zang Forthcoming). [8]Prior studies suggest that these variables are either arguably related to or simply associated with AEM and/or stock liquidity. We provide the details including definitions, theoretical and empirical justification, and references in Appendix 3.

The finding of Chung et al. (2010) suggests that corporate governance setup may be important omitted correlated "variables" because good corporate governance setup arguably constrains managers from engaging accruals-based earnings management and at the same time contributes to stock liquidity. Therefore, in our causality analysis, we need to control for variations in corporate governance. Because of the multi-dimension and context-contingency

[7] Though not perfect, our approach to dealing with endogeneity problem is pragmatically recommended (see Larcker and Rusticus 2010). Use of instrumental variable(s) is the other econometrically sound approach to dealing with endogeneity problems. However, it is difficult to find an instrument variable that satisfies required econometrical conditions. Moreover, simulation results suggest that estimates based on instrument variables that only slightly violate required econometrical conditions may be "more biased and more likely to provide the wrong statistical inference" than those estimates that make no correction for endogeneity (see Larcker and Rusticus 2010).

[8] Badertscher (2011) finds that use of accruals to manage earnings is affected by the degree of overvaluation. Badertscher (2011) measures the degree of overvaluation by the difference between market value and "fundamental" value derived from residual income model. In our study, we measure the degree of overvaluation by the cumulative stock returns of past three years. It is arguably sensible to presume that firms with high cumulative stock returns in the past are more likely to be overvalued.

nature of different corporate governance mechanisms (see Larcker et al. 2007), we refer to prior studies (i.e., Bechuk et al. 2009; Bhagat and Bolton 2008; Chung et al. 2010) to identify the most "relevant" corporate governance mechanisms. Specifically, we include governance measures related to CEO-Chair duality, director stock ownership, board size, board independence, audit committee independence, and entrenchment index developed in Bebchuk et al. (2009) in our causality test.

To mitigate concerns with potential reverse causality, we measure stock liquidity as the natural logarithm of the inverse of high-low estimates of bid-ask spreads calculated over a period of 252 trading days that ends in the *last* month of fiscal year t. The findings of Zang (2012) suggest that major decisions on AEM are generally made after fiscal year end. Therefore, there is generally a time lag between our measure of stock liquidity and firms' decisions on AEM. We argue that in the presence of such a time lag, evidence supporting H2 cannot be simply attributed to reverse causality. In addition, we include the absolute value of discretionary accruals of fiscal year t-1 in the extended version of equation (4). If there were a reverse causality between stock liquidity and AEM, inclusion of the absolute value of discretionary accruals of fiscal year t-1 will further ensure that evidence supporting H2 cannot be simply attributed to reverse causality.

Table 6 reports the OLS estimates of the extended version of equation (4). The finding generally supports H2. That is, there exists a negative relationship between stock liquidity and discretionary accruals when discretionary accruals are income-increasing and a positive relationship when discretionary accruals are income-decreasing. Surprisingly, the regression coefficient on LIQ is not statistically significant when DA < 0 even though the sign of the coefficient is consistent with the prediction of H2. We conjecture that the finding about the relationship between liquidity and DA when DA < 0 may be driven by certain features unique to the limited sample used in the test as a result of requirement of availability of a long list of control variables.

In summary, H2 empirically holds after controlling for firm industry fixed effects and a comprehensive list of covariates and taking into account potential reverse causality. Therefore, we argue that endogeneity issues and reverse causality may not drive our finding about H2.

5.5 Additional Analysis: Trends of Stock Liquidity and Discretionary Accruals

Prior studies show that stock liquidity varies over time (e.g. Chordia et al. 2008). Given the strong cross-sectional evidence about the relationship between stock liquidity and AEM, we argue that it is interesting to examine whether AEM co-varies with overall stock liquidity over time. We draw Figure 4 to examine whether the time-series pattern of co-variation between stock liquidity and AEM is in line with H2. To draw Figure 4, we separate observations with negative discretionary accruals from those with positive discretionary accrual. H2 indicates that stock liquidity and discretionary accruals positively co-vary when $DA < 0$ and negatively co-vary when $DA > 0$.

Figure 4 reveals several interesting patterns. First, consistent with Cohen et al. (2008) Figure 4 reveals that there is an overall trend of increase in AEM during the period of 1989-2000 and that there is an overall trend of decrease in AEM during the period of 2002-2005. Second, Figure 4 shows that starting from 1997 stock liquidity and discretionary accruals co-vary closely as implied by H2, especially when $DA < 0$.

Table 6
Causality Test: Stock Liquidity and Discretionary Accruals

Variables	Coeff.	Variables	Coeff.	Variables	DA > 0	DA < 0
Intercept	0.000	DDA	0.071**	Intercept	0.072**	0.000
BIG	-0.042**	DDA x BIG	0.009	BIG	-0.033**	-0.042**
ΔGDP	0.000	DDA x ΔGDP	0.001	ΔGDP	0.001*	0.000
LMV	-0.001	DDA x LMV	0.001	LMV	0.001	-0.001
Time	-0.001	DDA x Time	0.000	Time	-0.000	-0.001
SCA	0.008†	DDA x SCA	0.011†	SCA	0.019**	0.008†
SOX	0.015**	DDA x SOX	-0.008	SOX	0.008	0.015**
BONUS	-0.034	DDA x BONUS	0.018	BONUS	-0.017	-0.034
BONUS x SCA	0.001	DDA x BONUS x SCA	-0.010	BONUS x SCA	-0.009	0.001
BONUS x SOX	0.020	DDA x BONUS x SOX	-0.003	BONUS x SOX	0.017	0.020
UN_OPT	-1.521	DDA x UN_OPT	2.799	UN_OPT	1.278*	-1.521
UN_OPT x SCA	1.949	DDA x UN_OPT x SCA	-0.229	UN_OPT x SCA	1.721	1.949
UN_OPT x SOX	1.585	DDA x UN_OPT x SOX	-4.191*	UN_OPT x SOX	-2.606**	1.585
GRNT_OPT	-0.938	DDA x GRNT_OPT	1.865	GRNT_OPT	0.927	-0.938
GRNT_OPT x SCA	-0.205	DDA x GRNT_OPT x SCA	-3.123	GRNT_OPT x SCA	-3.328*	-0.205
GRNT_OPT x SOX	0.033	DDA x GRNT_OPT x SOX	-1.031	GRNT_OPT x SOX	-0.999	0.033
EX_OPT	0.462	DDA x EX_OPT	-0.773	EX_OPT	-0.312	0.462
EX_OPT x SCA	-0.744	DDA x EX_OPT x SCA	0.742	EX_OPT x SCA	-0.002	-0.744
EX_OPT x SOX	-0.166	DDA x EX_OPT x SOX	0.270	EX_OPT x SOX	0.104	-0.166
OWNER	-0.082	DDA x OWNER	0.135	OWNER	0.053	-0.082
OWNER x SCA	0.053	DDA x OWNER x SCA	-0.034	OWNER x SCA	0.019	0.053
OWNER x SOX	0.103	DDA x OWNER x SOX	-0.171†	OWNER x SOX	-0.068	0.103
AT	0.000**	DDA x AT	-0.000	AT	0.000**	0.000**
AT2	-0.000	DDA x AT2	-0.000	AT2	-0.000*	-0.000
D_NOA	0.002	DDA x D_NOA	-0.001	D_NOA	0.002	0.002
OC	-0.000†	DDA x OC	-0.000	OC	-0.000*	-0.000†
PRM	0.221**	DDA x PRM	0.015	PRM	0.236**	0.221**
RRM	-0.075**	DDA x RRM	0.004	RRM	-0.071**	-0.075**

Table 6

Causality Test: Stock Liquidity and Discretionary Accruals – Continued

MS	0.015†	DDA x MS	-0.005	MS	0.010	0.015†
ZS	-0.001*	DDA x ZS	0.001	ZS	-0.000	-0.001*
MTB	-0.009	DDA x MTB	-0.034	MTB	-0.043*	-0.009
IO	-0.042**	DDA x IO	0.015	IO	-0.027*	-0.042**
ROA	0.568**	DDA x ROA	-0.229**	ROA	0.339**	0.568**
MB	-0.011**	DDA x MB	0.003	MB	-0.008**	-0.011**
CC	0.003	DDA x CC	-0.004	CC	-0.000	0.003
DO	-0.328	DDA x DO	0.211	DO	-0.117	-0.328
DS	0.001	DDA x DS	-0.002*	DS	-0.001	0.001
DI	0.007	DDA x DI	-0.014	DI	-0.006	0.007
AI	-0.015	DDA x AI	0.020†	AI	0.005	-0.015
EI	0.001	DDA x EI	-0.000	EI	0.000	0.001
HI	0.047	DDA x HI	-0.024	HI	0.023	0.047
LCOV	-0.009**	DDA x LCOV	0.007*	LCOV	-0.002	-0.009**
LIT	0.007	DDA x LIT	-0.002	LIT	0.005	0.007
SEO	0.006	DDA x SEO	-0.010†	SEO	-0.005	0.006
MBE	-0.018**	DDA x MBE	0.010†	MBE	-0.009**	-0.018**
D_RET1	-0.003	DDA x D_RET1	0.003	D_RET1	0.000	-0.003
D_RET2	-0.002	DDA x D_RET2	0.006	D_RET2	0.003	-0.002
D_RET3	-0.006	DDA x D_RET3	0.005	D_RET3	-0.000	-0.006
D_RET4	-0.015**	DDA x D_RET4	0.016*	D_RET4	0.001	-0.015**
LEV	0.052**	DDA x LEV	-0.033*	LEV	0.019	0.052**
IC	0.001	DDA x IC	-0.017	IC	-0.016	0.001
LCSHO	0.001	DDA x LCSHO	-0.005	LCSHO	-0.004	0.001
ADA_P1	0.025	DDA x ADA_P1	0.061†	ADA_P1	0.087**	0.025
LIQ	0.002	DDA x LIQ	-0.017**	LIQ	-0.015**	0.002
		Industry Fixed Effects	YES	Industry Fixed Effects	YES	
		Firm Fixed Effects	YES	Firm Fixed Effects	YES	
		N	5702			
		R^2	0.789			

Table 6

Causality Test: Stock Liquidity and Discretionary Accruals – Continued

Note: t-statistics are computed by using cluster-robust standard errors

**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Table ? reports the OLS regression results of the causality test of H2 that includes firm and industry fixed effects, the absolute value of discretionary accruals of prior fiscal year, and a comprehensive list of control variables identified from the literature.

Variable Definitions:

DA	=	measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.
DDA	=	an indicator variable that equals one if DA > 0, and zero if otherwise.
LIQ	=	the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
UN_OPT	=	the average number of un-exercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
OWNER	=	the average stock ownership of CEO and CFO where stock ownership is the ratio of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t to total outstanding shares of the firm.
AT	=	the number of years that the auditor has audited the firm.
AT2	=	the square of AT.
D_NOA	=	an indicator variable that equals one if the net operating assets (i.e., shareholders' equity less cash and marketable securities plus total debt) at the beginning of fiscal year t divided by lagged sales is greater than the median of the corresponding industry-year, and zero if otherwise.
OC	=	days receivable plus days inventory minus days payable at the beginning of fiscal year t.

Table 6

Causality Test: Stock Liquidity and Discretionary Accruals – Continued

PRM = the predicted component of real activities-based earnings management. Appendix 3 provides the details.

RRM = the unexpected component of real activities-based earnings management. Appendix 3 provides the details.

MS = the ratio of the firm's sales to the total sales of its industry at the beginning of fiscal year t, where industry is defined on the basis of 3-digit SIC codes.

ZS = z-score at the beginning of fiscal year t, where z-score is $0.3\frac{Net\ Income}{Assets} + 1.0\frac{Sales}{Assets} + 1.4\frac{Retained\ Earnings}{Assets} + 1.2\frac{Working\ Capital}{Asset} + 0.6\frac{Stock\ Price \times Shares\ Outstanding}{Total\ Liabilities}$.

MTB = the marginal tax rate, defined and provided by Professor John Graham.

IO = the percentage of institutional ownership in the calendar quarter that is closest to the end of fiscal year t.

ROA = the return on assets, computed using net income for the rolling four quarters that ends in the third quarter of fiscal year t.

MB = The ratio of market value of equity to the book value of equity.

CC = an indicator variable that equals one if CEO is the chairman of the board of directors, and zero if otherwise.

DO = the average stock ownership of board of directors.

DS = the number of directors serving in the board of directors.

DI = the percentage of independent directors in the board of directors.

AI = the percentage of independent directors in the audit committee of the board of directors.

EI = the entrenchment index developed in Bebchuk, Cohen, and Ferrell (2009) that is based on six provisions. Appendix 2 provides the details.

HI = Herfindahl index, the sum of squares of the ratio of each firm's sales to total sales in the same industry defined by three-digit SIC codes in year t-1.

LCOV = the natural log of one plus the number of analysts following the firm in the three months prior to the earnings announcement.

LIT = an indicator variable that equals one if the firm is in a high litigation risk industry including biotechnology, computers, electronics, and retail. Appendix 3 provides the details.

SEO = an indicator variable that equals one if the firm ever sells stocks in the next three fiscal years and equals zero if otherwise.

MBE = the percentage of times of meeting/beating analysts' forecast consensus in the past eight quarters.

D_RET_j = a dummy variable that indicates the membership of a firm-year observation in five equal groups generated according to the magnitude of cumulative stock returns over past three years where the group with lowest cumulative stock returns serves as the benchmark, j=1,2,3,4.

Table 6
Causality Test: Stock Liquidity and Discretionary Accruals – Continued

LEV	=	the ratio of total debt to total assets.
IC	=	the inverse of interest coverage ratio computed as the interest expense in fiscal year t divided by operating income before depreciation in fiscal year t-1.
LCSHO	=	the natural log of total outstanding shares.
ADA_P1	=	the absolute value of discretionary accruals of fiscal year t-1.

However, during the period of 1989-1996 the pattern of co-variation between stock liquidity and discretionary accruals is not consistent with the prediction of H2. We notice that during the period of 1989-1996 the overall stock liquidity is low. During the period of 1989-1996 the tick size is $1/8 while tick size in late periods of my study is either $1/8 or $1/100. Tick size is found to be negatively related to stock market liquidity (Chordia et al. 2008). We conjecture that the relationship between stock liquidity and discretionary accruals may be empirically nonlinear rather than linear as presumed in our H2. Therefore, the nonlinear relationship between stock liquidity and discretionary accruals may account for the finding that the co-variation between liquidity and discretionary accruals is not consistent with the prediction of H2 during the period of 1989-1996 when stock liquidity is low.

To examine whether the relationship between stock liquidity and discretionary accruals is empirically nonlinear, we first sort all firm-year observations into five equal groups according to the magnitude of stock liquidity and then generate four dummy variables to indicate the membership of each firm-year observation. Table 7 reports the OLS estimates of the modified version of equation (4) that uses the four dummy variables as measure of liquidity rather than the original liquidity measure. The results reported in Table 7 confirm our conjecture about the nonlinearity of the relationship between stock liquidity and discretionary accruals. We argue that the nonlinearity of the relationship between stock liquidity and discretionary accruals may account for why the pattern of co-variation between stock liquidity and discretionary accruals is not consistent with the prediction of H2 during the period of 1989-2001 when stock liquidity is low.

Cohen et al. (2008) attribute the decline in AEM during the period of 2002-2005 to the passage of SOX and other concurrent events such as high visibility of enforcement actions against offending corporate officers. However, we find it difficult to apply Cohen et al.'s (2008) argument to account for the close co-variation between stock liquidity and discretionary accruals. In other words, Cohen et al.'s (2008) argument may be used to justify the overall decline in AEM after 2002 but could not explain the overtime variation in AEM before and after 2002. Our finding about H2 provides an additional if not alternative explanation for overtime variation in AEM: that is, the overtime variation in stock liquidity and ensuing price efficiency may drive the overtime variation in AEM. Our finding about H2 suggests that during the period of 2002-2005 improvement in stock liquidity and ensuing price efficiency may drive the overall decline in AEM[9].

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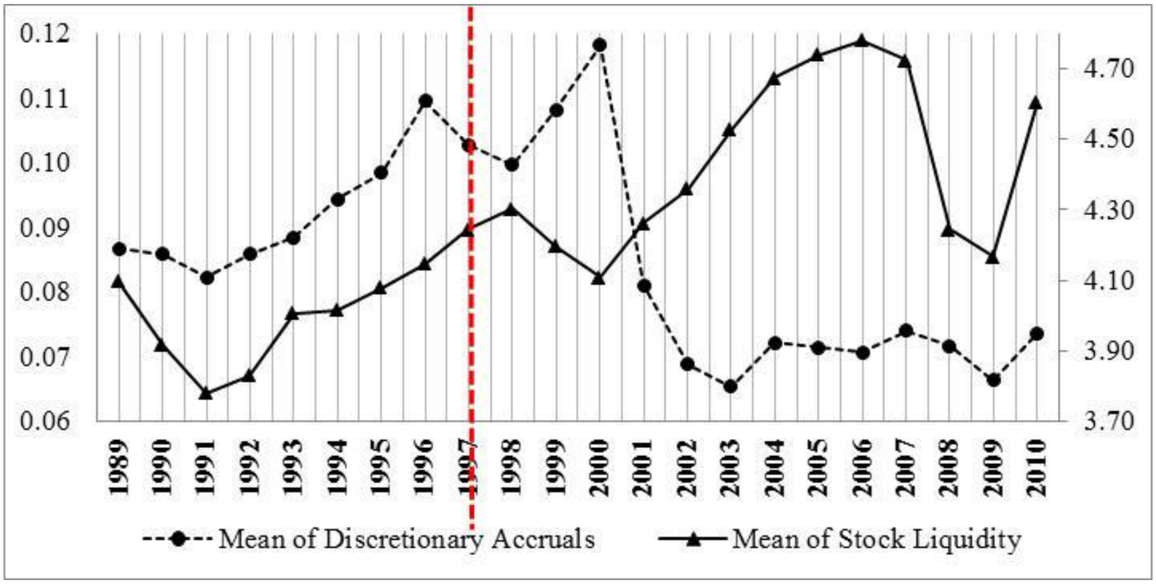
[9] In 1997 the tick size of stock markets is reduced from $1/8 to $1/16; in 2001 the tick size of stock markets is reduced from $1/16 to $1/100. All these reductions in tick size are found to contribute to improvement in overall stock market liquidity (Chordia et al. 2008).

Panel A: DA > 0



Panel B: DA < 0

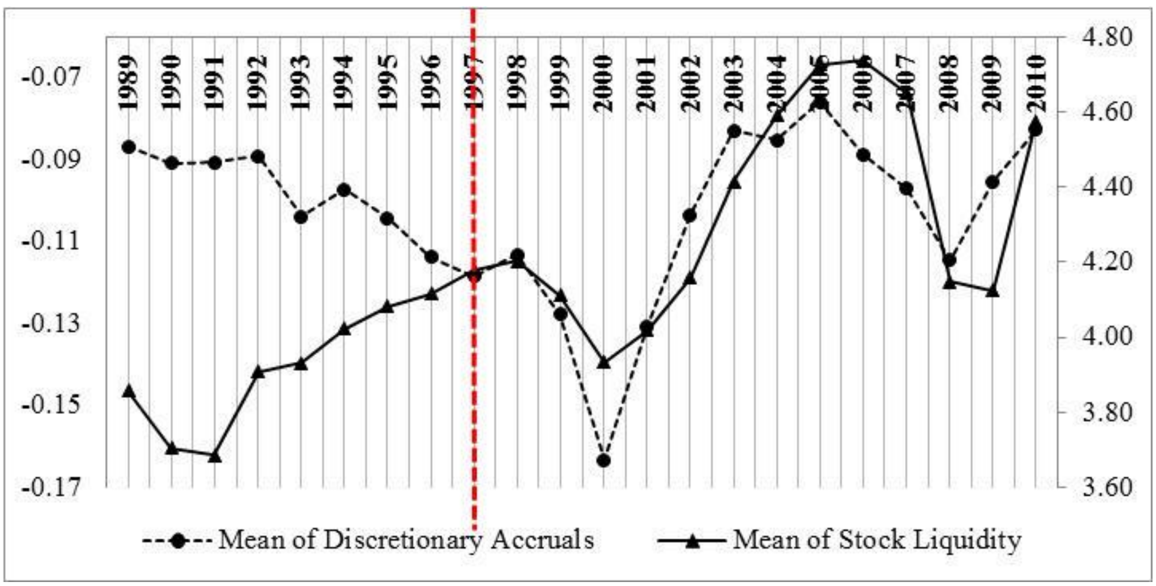


Figure 4

Stock Liquidity and Discretionary Accruals: Time-Series Evidence

Figure 4 depicts the over-time co-variation between stock liquidity and discretionary accruals. To draw Figure 4, each year we sort all observations into two groups according to the sign of their discretionary accruals and compute the means of stock liquidity and discretionary accruals separately.

Table 7
Additional Test: the Nonlinearity of the Relationship between Stock Liquidity and Discretionary Accruals

Variables	Coeff.	Variables	Coeff.		DA > 0	DA < 0
Intercept	-0.105**	DDA	0.194**	Intercept	0.089**	-0.105**
BIG	0.001	DDA x BIG	-0.008	BIG	-0.006	0.001
ΔGDP	-0.001†	DDA x ΔGDP	0.005**	ΔGDP	0.004**	-0.001†
LMV	0.001	DDA x LMV	-0.001	LMV	-0.000	0.001
Time	0.000	DDA x Time	0.001	Time	0.002**	0.000
SCA	-0.009	DDA x SCA	0.015	SCA	0.006	-0.009
SOX	0.003	DDA x SOX	-0.021†	SOX	-0.018**	0.003
RM	0.032**	DDA x RM	-0.030**	RM	0.002	0.032**
BONUS	0.029*	DDA x BONUS	-0.018	BONUS	0.011*	0.029*
BONUS x SCA	0.083	DDA x BONUS x SCA	-0.102	BONUS x SCA	-0.019	0.083
BONUS x SOX	-0.002	DDA x BONUS x SOX	0.017	BONUS x SOX	0.015	-0.002
UN_OPT	-0.610	DDA x UN_OPT	1.660*	UN_OPT	1.049**	-0.610
UN_OPT x SCA	-1.091	DDA x UN_OPT x SCA	2.151	UN_OPT x SCA	1.060	-1.091
UN_OPT x SOX	0.719	DDA x UN_OPT x SOX	-2.165**	UN_OPT x SOX	-1.446**	0.719
GRNT_OPT	-0.739	DDA x GRNT_OPT	1.672	GRNT_OPT	0.933	-0.739
GRNT_OPT x SCA	1.223	DDA x GRNT_OPT x SCA	-2.457*	GRNT_OPT x SCA	-1.234†	1.223
GRNT_OPT x SOX	-0.097	DDA x GRNT_OPT x SOX	0.456	GRNT_OPT x SOX	0.359	-0.097
EX_OPT	-0.198	DDA x EX_OPT	0.367	EX_OPT	0.169	-0.198
EX_OPT x SCA	0.323	DDA x EX_OPT x SCA	-0.749	EX_OPT x SCA	-0.426†	0.323
EX_OPT x SOX	0.439	DDA x EX_OPT x SOX	-0.523	EX_OPT x SOX	-0.084	0.439
OWNER	0.010	DDA x OWNER	0.107†	OWNER	0.118**	0.010
OWNER x SCA	0.162**	DDA x OWNER x SCA	-0.198**	OWNER x SCA	-0.035	0.162**
OWNER x SOX	0.078	DDA x OWNER x SOX	-0.160*	OWNER x SOX	-0.082*	0.078
D1_LIQ	0.032**	DDA x D1_LIQ	-0.042**	D1_LIQ	-0.010	0.032**
D2_LIQ	0.046**	DDA x D2_LIQ	-0.067**	D2_LIQ	-0.021**	0.046**
D3_LIQ	0.055**	DDA x D3_LIQ	-0.082**	D3_LIQ	-0.027**	0.055**
D4_LIQ	0.061**	DDA x D4_LIQ	-0.097**	D4_LIQ	-0.036**	0.061**
		N	20065			
		R^2	0.410			

Note: t-statistics are computed by using two-way cluster-robust standard errors
**, *, † Significant at 1%, 5% and 10% level, respectively, using a 2-tailed test

Table 7 reports the OLS regression results of the additional test that examines the nonlinearity of the relationship between stock liquidity and discretionary accruals.

Variable Definitions:

DA = measure of discretionary accruals estimated by using the modified Jones model proposed in Dechow et al. (1995). Appendix 1 provides the details.

DDA = an indicator variable that equals one if DA > 0, and zero if otherwise.

Dx_LIQ	=	a dummy variable that indicates the membership of a firm-year observation in five equal group generated according to the magnitude of stock liquidity (LIQ) with the group with lowest stock liquidity serving as the benchmark group, where LIQ is the natural log of the inverse of the high-low estimates of bid-ask spread proposed in Corwin and Schultz (2012) computed over a period of 252 trading days that ends in the last month of fiscal year t. Appendix 2 provides the details. x = 1, 2, 3, 4.
BIG	=	an indicator variable that equals one if the firm's auditor is one of the Big 8, and zero if otherwise.
ΔGDP	=	the percentage change in the real gross domestic product from year t-1 to year t.
LMV	=	the natural log of the market value of equity at the end of fiscal year t.
TIME	=	a trend variable that equals the difference between the year of observation and 1992.
SCA	=	an indicator variable that equals one if the year of observation is 2000 or 2001.
SOX	=	an indicator variable that equals one if the year of observation is greater than or equal to 2002, and zero if otherwise.
RM	=	measure of real activities-based earnings management. Appendix 1 provides the details.
BONUS	=	the average bonus compensation as a proportion of total compensation received by the CEO and CFO of the firm in fiscal year t.
EX_OPT	=	the average number of exercisable options that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
UN_OPT	=	the average number of unexercisable options (excluding options grants in fiscal year t) that CEO and CFO held at the end of fiscal year t scaled by total outstanding shares of the firm.
GRNT_ OPT	=	the average number of options granted to CEO and CFO in fiscal year t scaled by total outstanding shares.
OWNER	=	the average of the sum of restricted stock grants in fiscal year t and the aggregate number of shares held by CEO and CFO at the end of fiscal year t scaled by total outstanding shares of the firm.

6. CONCLUSION

Our study examines the effect of stock liquidity on the ability of stock prices to convey information about future earnings and accruals-based earnings management. In line with micro-level evidence that stock liquidity improves price efficiency, we find that as stock liquidity increases the ability of stock prices to reflect future earnings increases as measured by future earnings response coefficients. Moreover, we find that stock prices convey information about future earnings only when stock liquidity is above certain threshold. Our finding about the effect of stock liquidity on stock price informativeness regarding future earnings is robust to adoption of different model specifications and use of different stock liquidity measures. Our finding about the relationship between stock liquidity and price informativeness as measured by future earnings response coefficients provides macro-level evidence about the effect of stock liquidity on price efficiency.

We argue that stock liquidity and ensuing stock price efficiency dampen certain motives for firms and their managers to manage earnings will be dampened. Specifically, we argue that as stock liquidity increases and thus stock prices become more informative about firms' economic fundamentals, managers will find it more difficult and thus less beneficial to manipulate investors' perceptions of firms' economic fundamentals through AEM. Moreover, both theories and empirical evidence suggest that as stock liquidity increases and consequently stock prices become more efficient (i) the sensitivity of managers' pay to stock prices increase (Holmstrom and Tirole 1993; Jayaraman and Milbourn Forthcoming) and (ii) firms and their directors assign greater weight to stock price performance in their decisions about annual compensation for CEOs and top-paid executives (Banker and Datar 1989; David et al. 2011). Therefore, we argue that given two additional regularities: managerial attention and cognition are strategically scarce and stock prices become more responsive to managers' value creation efforts in a less biases manner as stock liquidity increases we can see that managers should rationally engage in less earnings management and allocate more efforts to value creation as stock liquidity increases and stock prices become more efficient. Furthermore, we argue that stock liquidity and ensuing price efficiency also reduce the demand for communication of managers' private information through earnings management. In conclusion, we hypothesize that as stock liquidity increases firms engage in less AEM.

Our finding confirms our hypothesized dampening effect of stock liquidity on AEM. Our finding about the dampening effect of stock liquidity and ensuing price efficiency on AEM is robust to chosen regression models of normal accruals, the industry classification schemes adopted to estimate normal accruals, and the use of different liquidity measures. Further analyses suggest that endogeneity issues and potential reverse causality may not drive our finding about H2.

Stock liquidity varies over time. Our cross-section finding about the effect of stock liquidity on AEM suggests that over time variations in AEM may be driven by variations in stock liquidity and thus variations in overall stock price efficiency. Our additional analysis shows that when stock liquidity is not very low, AEM and stock liquidity closely co-vary over time as implied in our H2. Our finding about the co-variation of stock liquidity and AEM provides a *market efficiency-based* explanation of the decline in AEM during the period of 2002-2005 first documented in Cohen et al. (2008), and thus has important implication.

In this study, we focus on the impact of stock liquidity on AEM. Actually, our argument about the effect of stock liquidity on AEM also applies to real-activities manipulation (see Edmans 2009). Real-activities manipulation generally involves sub-optimal real business decisions, and therefore may have long-lasting negative economic effects. We welcome research that examines the impact of stock liquidity on real-activities manipulation.

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APPENDIX 1: MEASURES OF ACCRUALS-BASED AND REAL ACTIVITIES-BASED EARNINGS MANAGEMENT

We identify three regression models from the accounting literature (i.e., Jones 1991 (J); Dechow et al. 1995 (DSS); Dechow et al. 2003 (DRT)) to estimate the normal levels of accruals. We estimate each regression model cross-sectionally within each industry-year over the period of 1989 – 2010. The residuals from each regression model are our measure of accruals-based earnings management. In our main test of H2, we use residuals obtained from the modified Jones model proposed in Dechow et al. (1995). However, our findings about H2 still hold when we use residuals obtained from the original Jones model proposed in Jones (1991) or from the modified Jones model proposed in Dechow et al. (2003). We mainly define industry membership on the basis of two-digit SIC codes while our findings about H2 still hold when we adopt the industry classification scheme proposed in Fama and French (1997).

DSS (1995): $\frac{TAC_{j,t}}{A_{j,t-1}} = \frac{\alpha_0}{A_{j,t-1}} + \beta_1 \frac{\Delta S_{j,t} - \Delta REC_{j,t}}{A_{j,t-1}} + \beta_2 \frac{PPENT_{j,t}}{A_{j,t-1}} + \varepsilon_{j,t}$ (a)

DRT (2003): $\frac{TAC_{j,t}}{A_{j,t-1}} = \frac{\alpha_0}{A_{j,t-1}} + \beta_1 \frac{(1+k)\Delta S_{j,t} - \Delta REC_{j,t}}{A_{j,t-1}} + \beta_2 \frac{PPE_{j,t}}{A_{j,t-1}} + \beta_3 \frac{TAC_{j,t-1}}{A_{j,t-2}} + \beta_4 \frac{\Delta S_{j,t+1}}{S_{j,t}} + \varepsilon_{j,t}$ (b)

J (1991): $\frac{TAC_{j,t}}{A_{j,t-1}} = \alpha_0 + \beta_1 \frac{1}{A_{j,t-1}} + \beta_2 \frac{\Delta S_{j,t}}{A_{j,t-1}} + \beta_3 \frac{PPEGT_{j,t}}{A_{j,t-1}} + \varepsilon_{j,t}$ (c)

Variable definitions:

- $TAC_{j,t}$ = total accruals calculated by using the cash-flow approach (i.e., ibc – (oancf – xidoc), see Hribar and Collins (2002)) for fiscal year t.
- $\Delta S_{j,t}$ = change in net sales (i.e., sale) from fiscal year t-1 to fiscal year t.
- $A_{j,t-1}$ = total assets (i.e., at) at the beginning of fiscal year t.
- $\Delta REC_{j,t}$ = change in accounts receivable (i.e., rect) from fiscal year t-1 to fiscal year t.
- $PPENT_{j,t}$ = property, plan, and equipment (i.e., ppent) at the end of fiscal year t.
- $PPEGT_{j,t}$ = property, plan, and equipment (i.e., ppegt) at the end of fiscal year t.
- k = slope coefficient from a regression of ΔREC on ΔS (i.e., $\Delta REC_{i,t} = a + k\Delta S_{i,t} + \varepsilon_{i,t}$) estimated within each year-industry.
- $TAC_{j,t-1}$ = total accruals calculated by using the cash-flow approach (i.e., ibc – (oancf – xidoc), see Hribar and Collins (2002)) for fiscal year t-1.
- $A_{j,t-2}$ = total assets (i.e., at) at the beginning of fiscal year t-1.
- $\Delta S_{j,t+1}$ = change in net sales (i.e., sale) from fiscal year t to fiscal year t+1.

$S_{j,t}$ = net sales (i.e., sale) in fiscal year t.

We estimate each regression model for any industry-year with at least fifteen observations. We report coefficients as the mean value of coefficients across industry-years. We calculate t-statistics by using the standard error of the mean value of coefficients across industry-years. We report the adjusted R^2 (number of observations) as the mean value of adjusted R^2 (number of observations) across industry-years. Our results are comparable to those of prior studies (e.g., Zang 2007, 2012).

Panel A: Estimation of Normal Level of Total Accruals

Coefficients	DSS		DRT		J	
	SIC2	FF	SIC2	FF	SIC2	FF
α_0	-0.526**	-0.372**	-0.347**	-0.266**	-0.039**	-0.037**
β_1	0.027**	0.039**	0.015**	0.025**	-0.430**	-0.360**
β_2	-0.152**	-0.170**	-0.122**	-0.130**	0.031**	0.042**
β_3			0.223**	0.237**	-0.046**	-0.057**
β_4			0.029**	0.017**		
Adj. R^2 (%)	37.95	34.52	45.79	42.68	28.90	28.48
# of obs.	122.54	152.29	105.84	128.43	123.38	152.74
# of industry-years	1084	881	945	789	1083	884

Panel B: Summary Statistics for Accruals-Based Earnings Management

Variables	Mean	Std. Dev.	Q1	Median	Q3
DA - DSS - SIC2	-0.0204	0.2358	-0.0695	-0.0033	0.0574
DA - DSS - FF	-0.0203	0.2359	-0.0704	-0.0034	0.0585
DA - DRT - SIC2	-0.0124	0.1737	-0.0579	-0.0008	0.0510
DA - DRT - FF	-0.0121	0.1740	-0.0596	-0.0011	0.0520
DA - J - SIC2	0.0001	0.2977	-0.0488	0.0165	0.0808
DA - J - FF	0.0001	0.2965	-0.0500	0.0169	0.0814

Panel C: Pearson (Upper Triangle) and Spearman (Lower Triangle) Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
DA - DSS - SIC2 (1)		0.97	0.90	0.88	0.91	0.88
DA - DSS - FF (2)	0.93		0.88	0.90	0.88	0.91
DA - DRT - SIC2 (3)	0.86	0.83		0.96	0.79	0.77
DA - DRT - FF (4)	0.83	0.87	0.92		0.77	0.79
DA - J - SIC2 (5)	0.86	0.81	0.78	0.75		0.96
DA - J - FF (6)	0.81	0.87	0.74	0.78	0.89	

Following Zang (2012) we examine two types of real activities-based earnings management: overproducing inventory to reduce the cost of goods sold and increase earnings, and cutting discretionary expenditures (i.e., R&D, advertising, and selling, general and administrative (SG&A) expenditures). In line with prior studies (e.g., Badertscher 2011; Cohen et al. 2008; Zang Forthcoming), we follow the regression models proposed in Roychowdhury (2006) to estimate the abnormal level of production costs associated with overproduction of inventory, and the abnormal level of discretionary expenditures.

$$\frac{PROD_{j,t}}{A_{j,t-1}} = \alpha_0 + \beta_1 \frac{1}{A_{j,t-1}} + \beta_2 \frac{S_{j,t}}{A_{j,t-1}} + \beta_3 \frac{\Delta S_{j,t}}{A_{j,t-1}} + \beta_4 \frac{\Delta S_{j,t-1}}{A_{j,t-1}} + \varepsilon_{j,t} \text{ (d)}$$

$$\frac{DISX_{j,t}}{A_{j,t-1}} = \alpha_0 + \beta_1 \frac{1}{A_{j,t-1}} + \beta_2 \frac{S_{j,t-1}}{A_{j,t-1}} + \varepsilon_{j,t} \text{ (e)}$$

Variable definitions:

$PROD_{j,t}$	=	the sum of the cost of goods sold (i.e., cogs) in fiscal year t and the change in inventory (i.e., invt) from fiscal year t-1 to fiscal year t.
$DISX_{j,t}$	=	the sum of R&D (i.e., xrd), advertising (i.e., xad), and SG&A (i.e., xsga) expenditures.
$A_{j,t-1}$	=	total assets (i.e., at) at the beginning of fiscal year t.
$S_{j,t}$	=	net sales (i.e., sale) in fiscal year t.
$S_{j,t-1}$	=	net sales (i.e., sale) in fiscal year t-1.
$\Delta S_{j,t}$	=	change in net sales (i.e., sale) from fiscal year t-1 to fiscal year t.
$\Delta S_{j,t-1}$	=	change in net sales (i.e., sale) from fiscal year t-2 to fiscal year t-1.

We estimate regression model (d) and (e) for any industry-year with at least fifteen observations. We report coefficients as the mean value of coefficients across industry-years. We calculate t-statistics by using the standard error of the mean value of coefficients across industry-years. We report the adjusted R^2 (number of observations) as the mean value of adjusted R^2 (number of observations) across industry-years. The residual from regression model (d) is the estimated amount of inventory overproduction (denoted as RM_PROD). That is, higher residuals indicate larger amount of inventory overproduction and greater earnings management through reducing the cost of goods sold. The residual from regression model (e) is the estimated abnormal level of discretionary expenditures. We multiply the residuals from regression model (e) by negative one (denoted as RM_DISX) so that higher residuals suggest greater reduction of discretionary expenditures by firms to increase reported earnings. Consistent with prior studies (e.g., Zang Forthcoming) we aggregate the two measures of real activities-based earnings management into one proxy (i.e., RM = RM_PROD + RM_DISX). Our results are comparable to those of prior studies (e.g., Zang Forthcoming).

Panel A: Estimation of Normal Level of Discretionary Expenditures and Production Costs

Coefficients	DISX		PROD	
	SIC2	FF	SIC2	FF
α_0	0.147**	0.187**	-0.088**	-0.072**
β_1	1.451**	1.021**	0.009	0.276**
β_2	0.148**	0.135**	0.776**	0.741**
β_3			-0.014	0.011
β_4			-0.029**	-0.032**
Adj. R^2 (%)	43.26	41.39	84.80	81.49
# of obs.	118.23	141.71	114.66	143.91
# of industry-years	1041	880	1063	856

Panel B: Summary Statistics for Real Activities-Based Earnings Management

Variables	Mean	Std. Dev.	Q1	Median	Q3
RM - SIC2	-0.0190	0.5617	-0.1999	0.0369	0.2582
PROD - SIC2	-0.0401	0.3026	-0.1535	-0.0228	0.0888
DISX - SIC2	0.0211	0.3732	-0.0743	0.0525	0.1983
RM - FF	-0.0209	0.5500	-0.1975	0.0372	0.2427
PROD - FF	-0.0405	0.3006	-0.1521	-0.0242	0.0873
DISX - FF	0.0197	0.3655	-0.0737	0.0538	0.1859

Panel C: Pearson (Upper Triangle) and Spearman (Lower Triangle) Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
RM - SIC2 (1)		0.79	0.87	0.92	0.71	0.81
PROD - SIC2 (2)	0.80		0.37	0.72	0.90	0.34
DISX - SIC2 (3)	0.87	0.47		0.81	0.34	0.94
RM - FF (4)	0.89	0.71	0.77		0.78	0.86
PROD - FF (5)	0.71	0.89	0.43	0.80		0.36
DISX - FF (6)	0.76	0.41	0.88	0.86	0.46	

APPENDIX 2: STOCK LIQUIDITY MEASURES

In our study, we adopt three liquidity measures: the high-low measure of effective spread (LIQ_HL) proposed in Corwin and Schultz (2012), the Gibbs estimate of effective spread (LIQ_G) proposed in Hasbrouck (2009), and the price impact estimate (LIQ_A) proposed in Amihud (2002). All these three liquidity measures are computed from daily stock data provided by CRSP, and exhibit desirable statistical properties with respect to liquidity measures computed from intra-day transaction-level data (see Corwin and Schultz 2012; Goyenko et al. 2009; Hasbrouck 2009). In our main test of H2, we adopt LIQ_HL while our findings regarding H2 still hold when using LIQ_G and LIQ_A as our stock liquidity measures.

Corwin and Schultz (2012) developed their high-low measure on the basis of simple uncontroversial ideas. That is, daily high prices are always buyer-initiated while daily low prices are always seller-initiated. Therefore, the ratio of high-to-low prices reflect both the fundamental volatility of the stock and the stock's bid-ask spread. Moreover, the component of the high-to-low price ratio attributed to fundamental volatility increase proportionately with the trading interval while the component attributed to bid-ask spreads stay relatively constant over a short period. In other words, the price range over a two-day period reflects two days' volatility and one bid-ask spread while the sum of the price ranges over two consecutive single days reflect two days' volatility and twice the spread. Based on these simple insights, Corwin and Schultz (2012) first derived a function of the high-low price ratios on two consecutive single days and a function of the high-low ratio from a single two-day period and then applied these two functions to solve both the spread (S) and the variance (σ^2).

Analytically Corwin and Schultz (2012) showed

$$\sigma_{HL}^2\left(k_2^2(2-2\sqrt{2})+k_1\right)+\sigma_{HL}k_2\left(2\sqrt{2}-2\right)\sqrt{\sigma_{HL}^2(k_2^2-k_1)+{}^{\beta}/_{2}}+\frac{\beta}{2}-\gamma=0\ (a)$$

$$\alpha=-k_2\sigma_{HL}+\sqrt{\sigma_{HL}^2(k_2^2-k_1)+{}^{\beta}/_{2}}\ (b)$$

$$S=\frac{2(e^{\alpha}-1)}{1+e^{\alpha}}\ (c)$$

where

$$k_1=4\ln(2), k_2=\sqrt{\frac{8}{\pi}}, \beta=E\left\{\sum_{j=0}^{1}\left[\ln(\frac{H_{t+j}^O}{L_{t+j}^O})\right]^2\right\}, \gamma=\left[\ln(\frac{H_{t,t+1}^O}{L_{t,t+1}^O})\right]^2$$

$H_t^O\,(L_t^O)$ *are the observed high (low)price for day t.*

Empirically, we estimate β and γ from stock return data and then numerically solve equation (a) to get σ_{HL}. After we get σ_{HL} we can refer to equation (b) to get α. Once we get α, we can refer to equation (c) to get empirical bid-ask spread S. Furthermore, Corwin and Schultz (2012) showed that under reasonable empirical conditions, we can get a closed-form solution for α. In our study, we adopt the closed-form solution for α to compute the high-low measure of effective spread. Readers can refer to Corwin and Schultz (2012) for the derivation and estimation details. The closed-form solution for α is as follows:

$$\alpha=\frac{\sqrt{2\beta}-\sqrt{\beta}}{3-2\sqrt{2}}-\sqrt{\frac{\gamma}{3-2\sqrt{2}}}(d)$$

Hasbrouck (2009) proposed his Gibbs sampler estimate of effective trading cost that is based on daily closing prices. The Gibbs sampler estimate is built on Roll's (1984) model of security prices in a market with transaction costs. Roll (1984) modeled the price dynamics as

$m_t = m_{t-1} + u_t$

$p_t = m_t + cq_t$

where m_t is the log quote midpoint prevailing prior to the t^{th} trade (i.e., efficient price), p_t is the log trade price, and the q_t are direction indicators that equal +1 for a buy or -1 for a sale with equal probability. u_t reflects public information uncorrelated with q_t. We can view c as the effective cost because Roll's model applies to transaction prices.

Roll's model implies

$\Delta p_t = c\Delta q_t + u_t$ (e) and $c = \sqrt{-Cov(\Delta p_t, \Delta p_{t-1})}$ where $Cov(\Delta p_t, \Delta p_{t-1})$ is the first-order auto-covariance of price changes.

Hasbrouck's Gibbs sampler estimate takes equation (e) as a linear regression and applies the Gibbs sampler developed in the context of Bayesian statistics to simulate the coefficients of the linear regression, the error covariance matrix, and the trade direction indicators. Interested readers can refer to Hasbrouck (2009, 1448-1455) for the details. Empirically, Hasbrouck (2009) extended Roll's price dynamics model by including daily market return in equation (e). Hasbrouck (2009) argued that inclusion of daily market return in equation (e) can sharpen the allocation of transaction price changes between "true" (efficient price) returns and transient trading costs.

In our robustness test of H2, we also adopt the price impact measure proposed in Amihud (2002). Prior studies (e.g., Goyenko et al. 2009; Hasbrouck 2009) find that Amihud's (2002) measure exhibits desirable statistical attributes in relation to transaction-level measure of price impacts. Amihud's (2002) measure is defined as the average ratio of the daily absolute return to the dollar trading volume on that day, $|R_{iyd}|/VOLD_{iyd}$. R_{iyd} is the return on stock *i* on day *d* of year *y* and $VOLD_{iyd}$ is the respective daily dollar volume. Amihud (2002) argued that his measure captures Kyle's concept of illiquidity – the response of price to order flow (see Kyle 1985). The following formula captures the way in which we compute Amihud's price impact measure:

$$10^6 \times \frac{1}{D_{iy}} \times \sum_{t=1}^{D_{iy}} \frac{|R_{iyd}|}{VOLD_{iyd}} \quad (f)$$

where D_{iy} is the number of days for which data are available for stock *i* in year *y*.

These three "liquidity" measures essentially capture stock *illiquidity*. Consistent with prior studies (e.g. Fang et al. 2009; Edmans et al. 2012) we use the natural log of the inverse of these three "illiquidity" measures as our measure of liquidity. Panel A of the following table reports the descriptive statistics for the illiquidity and the liquidity measures based on the high-low, Gibbs sampler and Amihud approaches. To generate the following table, for the period of 1970-2010, we compute the illiquidity measures over a period of 252 trading days that ends in the December of each year. After obtaining these illiquidity measures, we use the natural log of the inverse of these illiquidity measures as our measure of liquidity. Panel B of the following table reports the Pearson and Spearman correlations between these illiquidity and liquidity measures.

Panel A: Descriptive Statistics

Variables	Mean	Std. Dev.	Q1	Median	Q3
HL	0.018	0.022	0.006	0.011	0.021
Gibbs	0.011	0.015	0.003	0.006	0.013
Amihud	8.278	68.895	0.018	0.190	2.005
LIQ_HL	4.426	0.852	3.858	4.512	5.068
LIQ_G	5.017	1.001	4.314	5.108	5.761
LIQ_A	1.736	3.228	-0.696	1.663	4.033

Panel B: Pearson (Upper Triangle) and Spearman (Lower Triangle) Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)
HL (1)		0.93	0.53	-0.81	-0.74	-0.59
Gibbs (2)	0.89		0.53	-0.78	-0.81	-0.66
Amihud (3)	0.68	0.79		-0.27	-0.25	-0.24
LIQ_HL (4)	-1.00	-0.89	-0.68		0.91	0.69
LIQ_G (5)	-0.89	-1.00	-0.79	0.89		0.79
LIQ_A (6)	-0.68	-0.79	-1.00	0.68	0.79	

APPENDIX 3: ADDITIONAL CONTROL VARIABLES INCLUDED IN THE CAUSALITY TEST

Variables		Definitions	Justification	References
AT	=	the number of years that the auditor has audited the firm.	The risk of not detecting errors as a result of unfamiliarity decreases with tenure.	Zang (2012) Stice (1991) Myers et al. (2003)
AT2	=	the square of AT.	Potential nonlinear relationship between auditor tenure and audit quality	
D_NOA	=	an indicator variable that equals one if the net operating assets (i.e., shareholders' equity less cash and marketable securities plus total debt) at the beginning of fiscal year t divided by lagged sales is greater than the median of the corresponding industry-year, and zero if otherwise.	Managers' capability of managing earnings upward through accruals is constrained by accruals-based earnings management made in prior periods. Net operating assets proxy for the extent of accruals-based earnings management in prior periods.	Zang (2012) Barton and Smiko (2002)
OC	=	days receivable plus days inventory minus days payable at the beginning of fiscal year t.	Firms with longer operating cycles have larger accruals accounts and wait a longer period for accruals to reverse. Therefore, firms with longer operating cycles have greater flexibility for accruals-based earnings management.	Zang (2012)
PRM	=	the predicted component of real activities-based earnings management.	Managers use real activities-based and accruals-based earnings management as substitutes.	Zang (2012)
RRM	=	the unexpected component of real activities-based earnings management.		
MS	=	the ratio of the firm's sales to the total sales of its industry at the beginning of fiscal year t, where industry is defined on the basis of 3-digit SIC codes.	Accruals-based earnings management increases with costs associated with real activities-based earnings management. • Firms with larger market shares and their managers may consider real activities-based earnings management be relatively less	Zang (2012) Graham et al. (2005) Bushee (1998) Roychowdhury (2006)
ZS	=	z-score at the beginning of fiscal year t, where z-score is $0.3\frac{Net\ Income}{Assets} + 1.0\frac{Sales}{Assets} +$		

	$1.4\frac{Retained\ Earnings}{Assets} + 1.2\frac{Working\ Capital}{Asset} + 0.6\frac{Stock\ Price \times Shares\ Outstanding}{Total\ Liabilities}$.	costly. • Firms with poor financial health and their managers may perceive real activities-based earnings management more costly given concerns with survival and potential long-term negative impact of real activities-based earnings management. • The greater marginal tax rates, the relatively higher the net present value of tax costs associated with real activities-based earnings management. • The higher the proportion of institutional owners the greater the scrutiny by institutional investors and therefore the more difficult real activities-based earnings management.	
MTB	= the marginal tax rate, defined and provided by Professor John Graham.		
IO	= the percentage of institutional ownership in the calendar quarter that is closest to the end of fiscal year t.		
ROA	= the return on assets, computed using net income for the rolling four quarters that ends in the third quarter of fiscal year t.	Earnings management is related to firm performance. Return on assets (ROA) measures firm performance.	Badertscher (2011) Zang (2012)
MB	= The ratio of market value of equity to the book value of equity.	Need to control for firms' growth rate. The ratio of market value of equity to book value of equity proxies for firms' growth prospects.	Zang (2012)
CC	= an indicator variable that equals one if CEO is the chairman of the board of directors, and zero if otherwise.	Effective governance constrains earnings management and improves financial reporting transparency. As a result, firms with better corporate governance have greater stock liquidity because information asymmetries across investors are lower as a	Bebchuk et al. (2009) Bhagat and Bolton (2008) Chung et al. (2010)
DO	= the average stock ownership of board of directors.		
DS	= the number of directors serving in the board of directors.		

DI	= the percentage of independent directors in the board of directors.	result of better corporate governance. Effectiveness of corporate governance is shaped by • Board structure: directors' ownership, board size, CEO-chair duality, director independence, independence of audit committee • Governance provisions: entrenchment index	Leuz et al. (2003)
AI	= the percentage of independent directors in the audit committee of the board of directors.		
EI	= the entrenchment index developed in Bebchuk, Cohen, and Ferrell (2009) that is based on six provisions. Appendix 2 provides the details.		
HI	= Herfindahl index, the sum of squares of the ratio of each firm's sales to total sales in the same industry defined by three-digit SIC codes in year t-1.	The greater industry competition the more costly real activities-based earnings management.	Badertscher (2011) Zang (2012)
LCOV	= the natural log of one plus the number of analysts following the firm in the three months prior to the earnings announcement.	The greater the number of analysts following a firm the greater the monitoring by analysts and therefore more constraints on accruals-based earnings management.	Badertscher (2011) Zang (2012)
LIT	= an indicator variable that equals one if the firm is in a high litigation risk industry including biotechnology, computers, electronics, and retail. Appendix 3 provides the details.	Firms competing in high litigation risk industries tend to engage less in accruals-based earnings management.	Badertscher (2011) Francis et al. (1994)
SEO	= an indicator variable that equals one if the firm ever sells stocks in the next three fiscal years and equals zero if otherwise.	Firms tend to manage earnings when planning to have SEOs in the near future.	Teoh et al. (1998)
MBE	= the percentage of times of meeting/beating analysts' forecast consensus in the past eight quarters.	Firms with consistent MBE performance in the past have a stronger incentive to manage earnings.	Bartov et al. (2002) Kasznik and McNichols (2002)
D_RET_j	= a dummy variable that indicates the membership of a firm-year observation in five equal groups generated according to the magnitude of cumulative stock returns over past three years	Firms with overvalued stocks tend to manage earnings. Past cumulative stock performance reasonably captures the extent to which	Jensen (2005) Badertscher (2011)

		where the group with lowest cumulative stock returns serves as the benchmark, j=1,2,3,4.	firms' stocks are overvalued.	
LEV	=	the ratio of total debt to total assets.	Firms manage earnings to avoid debt covenant violations.	Healy and Wahlen (1999)
IC	=	the inverse of interest coverage ratio computed as the interest expense in fiscal year t divided by operating income before depreciation in fiscal year t-1.		
LCSHO	=	the natural log of total outstanding shares.	It will be more difficult for firms to manage earnings to achieve desired earnings per share when the number of shares outstanding is greater.	Zang (2012)
ADA_P1	=	the absolute value of discretionary accruals of fiscal year t-1.	Less earnings management leads to greater transparency and therefore greater liquidity.	Chung et al. (2010) Lang and Maffett (2011)

VITA

Jing Fang grew up in a village located in the northern part of China. He received his Bachelor of Engineering from East China University of Science and Technology in 1998. Then he worked in Mauritius, a beautiful island country located in Indian Ocean, for about five years before he came back to Shanghai for his MBA study. In 2004, he received his MBA from China-Europe International Business, the best business school in China. He came to USA for PhD study in MIS at the University of Oklahoma in 2006. He received his MS in MIS in 2008 and then started PhD study in SCM at the Arizona State University. He came to LSU in 2009 for PhD study in accounting. He managed to obtain his PhD in accounting from LSU in three years.

He is going to teach both undergraduate and graduate accounting courses as an assistant professor at the University of South Dakota in fall, 2012. He once held junior and middle-level managerial positions at ESQUEL Group, Apple Inc., and FSI Specialists, Inc., and took internships with Dell Inc., and BestBuy Co., Inc.

He is doing research in corporate governance, capital market efficiency, and accounting choices. His choice of research areas stems from his strong belief that knowledge and appreciation of institutional and organizational contexts are necessary to have a complete view of accounting phenomena because accounting phenomena do not occur within a vacuum. He is going to present two of his working papers in the prestigious annual conference of the American Accounting Association, and once presented one of his working papers in 2009 annual conference of the Academy of Management.