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Stock liquidity and managerial short-termism

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ABSTRACT

We examine whether stock liquidity exacerbates or mitigates managerial short-termism. Utilizing earnings management as a proxy for managerial short-termism, we establish three major findings. First, firms with liquid stocks engage in less accrual-based and real earnings management. Second, the effect of stock liquidity on earnings management is amplified for firms with high levels of managerial pay-for-performance sensitivity. Third, the positive association between the intensity of earnings management and firm cost of capital is evident only for firms with low stock liquidity. Our findings are consistent with the threat of blockholder exit as the main governance channel through which stock liquidity discourages opportunistic earnings management and mitigates managerial short-termism.

"Take care of this quarter's numbers, and the future will take care of itself! This oft-repeated adage captures the essence of the short-termism that the corporate and investment communities practice"

Alfred Rappoport, *Saving capitalism from short-termism: How to build long-term value and take back our financial future* (2011, p. 1)

1. Introduction

Managerial short-termism, or the "desire to achieve a high stock price by inflating current earnings at the expense of long-term growth" (Stein, 1989), is a major issue of interest to academics, practitioners, and legislators. Jacobs (1991), Porter (1992) document that U.S. managers have been heavily criticized for their obsession with short-term performance and their myopic investment behavior. Indeed, Graham et al. (2005) report that 78% of executives would sacrifice long-term value to meet near-term earnings targets. In a similar vein, the Chartered Financial Analyst (CFA) Institute and the Business Roundtable Institute for Corporate Ethics emphasize that the excessive focus that corporate executives place on short-term earnings destroys long-term value for shareholders (Krehmeyer et al., 2006). In a more recent study, Dichev et al. (2013) report that, in any given period, 20% of firms manage earnings in an attempt to influence stock price and avoid adverse compensation and career concerns. These studies clearly highlight the importance of understanding the determinants of managerial short-termism, which is viewed as a first-order problem by academics and practitioners (Edmans, 2009).

Utilizing an earnings management setting, this paper examines how stock liquidity affects managerial short-termism. Prior research shows that managers resort to earnings management using their discretion in financial reporting and investment decisions to pursue short-run objectives, and that the long-term costs of such activities for shareholders are substantial (Bushee, 1998; Teoh and Wong, 2002; Aboody et al., 2005; Bhojraj and Libby, 2005;

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Graham et al., 2005; Roychowdhury, 2006; Francis et al., 2008; Karpoff et al., 2008; Cohen and Zarowin, 2010; de Jong et al., 2014). Building on these papers, we view earnings management as a natural setting to examine managerial short-termism, as it captures the essence of managerial myopic behavior, in the spirit of Stein (1989), Graham et al. (2005).

Our research is timely, in light of intense debate over the impact of stock liquidity on managerial short-termism. One view is that higher stock liquidity increases capital market pressure on managers to focus on near-term results, thus enhancing managerial short-termism. This view is succinctly described by Bhide (1993, p. 31): "...stock liquidity discourages internal monitoring by reducing the costs of 'exit' of unhappy stockholders." This view is echoed in a number of studies (Coffee, 1991; Porter, 1992; Fang et al., 2014).

Another view is that higher stock liquidity facilitates blockholder control over firm management, either by enhancing blockholder voice (Maug, 1998) or by amplifying blockholder threat of exit (Edmans, 2009; Edmans and Manso, 2011). This view suggests that higher stock liquidity encourages managers to undertake actions that boost long-term firm value, thus resulting in less managerial short-termism. Given the competing predictions and mixed empirical evidence, further investigation is warranted to determine whether stock liquidity encourages or impedes managerial short-termism.

To investigate the impact of stock liquidity on managerial short-termism as reflected in earnings management practices, we examine three distinct research questions. First, we investigate whether the intensity of earnings management is affected by the liquidity of firm stock. Using a large sample of U.S. firms for the period 1993–2010, we find that firms with liquid stocks engage in less accrual-based earnings management, as evidenced by lower discretionary accruals and higher accrual quality. We also find that firms with liquid stocks engage in less real earnings management, such as overproduction and opportunistic reduction of discretionary expenses. These results are robust to alternative measures of earnings management and stock liquidity, and hold after controlling for a range of factors identified in prior research as determinants of earnings management.

While establishing a negative association between stock liquidity and intensity of earnings management, our baseline results are subject to endogeneity concerns. In particular, Bhattacharya et al. (2013) show that poor earnings quality leads to lower liquidity. Further, Chung et al. (2010) show that firms with better governance have higher liquidity. Therefore, our baseline results could be an artifact of either reverse causality or an omitted correlated variable (e.g., some unobservable attribute of corporate governance). To address these important concerns, we utilize the 1997 minimum tick size change and the 2001 decimalization events as exogenous shocks to stock liquidity. The results confirm the causal effect of stock liquidity on the intensity of earnings management.

The results from this first investigation reveal that higher stock liquidity results in less earnings management. This finding leads us to the second of our three research questions: what is the governance channel that drives the negative impact of stock liquidity on earnings management observed in our sample? We consider two major channels: (i) governance by voice (or intervention), and (ii) governance by exit.[1] We find that the effect of stock liquidity on earnings management is stronger for firms with higher levels of managerial pay-for-performance sensitivity. This finding provides support for the threat-of-exit channel, as the threat of exit is amplified when manager wealth is closely tied to stock price. Since we find no effect from the level of shareholder rights on the stock liquidity-earnings management relation, we conclude that governance by intervention is not the channel through which stock liquidity affects earnings management.

The results for our first two research questions highlight the role of stock liquidity as an important determinant of intensity of earnings management, yet generate little evidence on how the information content of earnings management varies across firms with high versus low levels of stock liquidity. While the overall weight of the empirical evidence is consistent with earnings management being driven by managerial opportunistic motives, several studies suggest that managers may also manage earnings to convey information about future prospects of the firm to investors (Gul et al., 2003; Gunny, 2010). Thus, if stock liquidity enhances monitoring, it should affect not only the intensity but also the information content of earnings management.

To distinguish between opportunistic and information production motives of earnings management, we observe that opportunistic earnings management makes firm financial disclosure more opaque, giving rise to information risk, in contrast to earnings management driven by information production motives. In turn, information risk results in higher firm cost of capital (Aboody et al., 2005; Francis et al., 2008; Kim and Qi, 2010; Ng, 2011; Kim and Sohn, 2013). This leads us to the third of our three research questions: how does the association between the intensity of earnings management and firm cost of capital vary across firms with high versus low levels of stock liquidity? We posit that if stock liquidity discourages opportunistic motives for earnings management, then the association between the earnings management proxies and firm cost of capital should be weaker for firms with higher levels of stock liquidity. Consistent with our prediction, we document a positive and significant association between earnings management proxies and firm cost of capital for low-liquidity firms, but not for high-liquidity firms. These results further support our conclusion that higher stock liquidity reduces the extent of earnings manipulation, thus mitigating managerial short-termism.

Our paper makes several contributions to the literature. First, we contribute to the rapidly growing stream of research examining the effects of stock liquidity on managerial short-termism (Bharath et al., 2013; Edmans et al., 2013; Fang et al., 2014). These studies provide mixed evidence as to whether stock liquidity exacerbates or mitigates managerial short-termism. We document that higher stock liquidity results in less earnings management, suggesting that stock liquidity discourages managerial short-termism.

Our second contribution is to the literature that examines the determinants of earnings management. Our paper documents that higher stock liquidity results in less earnings management, thus establishing an important link between market conditions for a firm's stock and earnings management practices. Our results should be of interest to legislators, as prior research shows that liquidity can be altered through market regulations (Fang et al., 2009; Bharath et al., 2013). Specifically, our findings suggest that regulations aimed at improving market liquidity are also expected to have a beneficial effect on both the quality of financial reporting and real investment decisions, by discouraging accrual-based and real earnings management practices.

Our third contribution is to the research on the consequences of earnings management. Prior studies document a positive association between the intensity of earnings management and firm cost of capital, consistent with the notion of earnings management making the firm information environment more opaque (Aboody et al., 2005; Francis et al., 2008; Kim and Qi, 2010; Kim and Sohn, 2013). Our findings suggest that such an effect is concentrated in the subsample of low-liquidity firms, thus highlighting the role of stock liquidity as an important moderator of the relation

[1] For a comprehensive review of the two channels, please refer to Edmans (2014).

between the opacity of the firm information environment and firm cost of capital.

Our study is also related to recent research that examines the linkages between stock liquidity and the quality of corporate disclosure.[2] Prior studies in this stream of research emphasize the role of stock liquidity as the channel through which information quality affects firm valuation, thus positing information quality as a determinant of stock liquidity (Lang and Maffett, 2011; Ng, 2011; Bhattacharya et al., 2013). Little is known, however, about whether stock liquidity itself impacts the quality of corporate disclosure. We attempt to fill the void by examining the effect of stock liquidity on corporate earnings management practices.

There are two contemporaneous, but independently executed, studies related to this paper. Dou et al. (2015) test governance by exit channel in the context of financial reporting quality. Similar to our study, these authors show that as exit threat increases, firms demonstrate higher financial reporting quality. Our study differs from Dou et al. (2015) in the following ways. First, these authors focus solely on the threat-of-exit channel, whereas prior research shows that monitoring may occur through both intervention and exit channels (e.g., Edmans et al., 2013). In contrast, we explore both intervention and exit channels as potential mechanisms for the documented effect of stock liquidity on earnings management. The second key difference is that we study the role of stock liquidity in the relation between earnings management and firm cost of capital. In so doing, we address an important concern raised by Dechow et al. (2010), who argue that focusing on only one aspect (i.e., either determinants or consequences of earnings management), gives an incomplete picture.

Fang et al. (2015) show that the prospect of short-selling curbs earnings management and improves price efficiency, identifying short-sale constraints as a significant determinant of earnings management. Our study differs from Fang et al. (2015) in the following ways. First, Fang et al. (2015) focus on trading (in their case, the prospect of short-selling) as a mechanism that mitigates earnings management. In contrast, we explore both intervention and exit as potential channels through which liquidity reduces earnings management. Second, their focus is solely accruals-based earnings management, while we study the impact of stock liquidity on both accruals-based and real earnings management activities. This is an important distinction, as Zang (2012) shows that managers may substitute both types of earnings management. Third, Fang et al. (2015) focus solely on the intensity of earnings management, while we examine the impact of stock liquidity on both the intensity of earnings management and its implications for firm cost of capital.

The remainder of this paper proceeds as follows. In Section 2, we discuss related literature and develop our hypotheses. Section 3 describes the data and variables. In Section 4, we examine the impact of stock liquidity on earnings management. Robustness tests are presented and discussed in Section 5. In Section 6, we explore potential channels through which stock liquidity impacts earnings management. In Section 7, we examine the effect of stock liquidity on the earnings management–firm cost of capital relation. Section 8 sets forth our conclusions.

2. Related literature and hypothesis development

2.1. Earnings management: a brief overview

This section briefly reviews the basic types of earnings management identified in prior research and summarizes the implications of earnings management for long-run firm value. Healy and Wahlen (1999) state that "earnings management occurs when managers use judgement in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company, or to influence contractual outcomes that depend on reported accounting numbers." As a result, managers have substantial latitude in financial reporting and investment decisions.

Prior research identifies two basic mechanisms through which firms manage their earnings: (i) accrual-based earnings management, and (ii) real earnings management. Zang (2012) succinctly defines accrual-based earnings management as a change in the accounting methods or estimates used when presenting a given transaction in the financial statements. For instance, managers may choose to change the depreciation method for fixed assets, bad debt provision, or inventory cost methods to inflate reported earnings, without changing the economic nature of the transaction. Prior research shows that managers extensively engage in accrual-based earnings management around major business decisions, such as initial public offerings (Teoh et al., 1998a), seasoned equity offerings (SEOs) (Rangan, 1998; Teoh et al., 1998b), and share repurchases (Gong et al., 2008). Even though accrual-based earnings management does not change the structure or timing of a transaction, it makes firm financial disclosure opaque, giving rise to information risk. Consistent with this, prior studies document that accrual-based earnings management has an economically and statistically significant effect on firm cost of capital (Aboody et al., 2005; Francis et al., 2008; Chung et al., 2010; Kim and Qi, 2010; Bhattacharya et al., 2013), thus resulting in erosion of firm value in the long run.

In contrast to accrual-based earnings management, which does not alter execution of the transaction, real earnings management is achieved by altering the real economic activities of the firm. Roychowdhury (2006, p. 337) defines real earnings management as "departures from normal operational practices, motivated by managers' desire to mislead at least some stakeholders into believing certain financial reporting goals have been met in the normal course of operations." Research shows that managers who aim to inflate reported earnings systematically engage in acceleration of sales, overproduction, and opportunistic reduction of R&D expenditures (Bushee, 1998; Roychowdhury, 2006; Bhojraj et al., 2009; Cohen and Zarowin, 2010). Since real earnings management is achieved by altering firm operations, the implications of real earnings management for the long-run value of the firm are more severe compared to accrual-based earnings management, which cannot persist. Similar to accrual-based earnings management, real earnings management leads to lower quality of firm financial disclosure, which in turn results in higher cost of capital for the firm (Kim and Sohn, 2013). Further, real earnings management is detrimental to firm long-term profitability and competitiveness (Kothari et al., 2012), and thus has negative long-term implications for the firm's future cash flows. Consistent with this, Cohen and Zarowin (2010) find that, while firms engage in both accrual-based and real earnings management activities prior to SEOs, the decline in post-SEO performance due to real activities management is more severe than that due to accrual-based earnings management.

2.2. Stock liquidity as a determinant of earnings management

Bushee (1998) describes two types of institutional investor: short-term-oriented ("transient") institutions and long-term-oriented ("dedicated") institutions. The former group acts more like "traders" rather than "owners," creating capital market pressure on managers and forcing them to make myopic decisions, whereas the latter group encourages managers to target long-term corporate value. The hidden costs of stock liquidity are pointed out

[2] See Sadka (2011) for an excellent review of the literature.

in earlier studies: stock liquidity discourages internal monitoring by reducing the cost of exit of unhappy stockholders (Bhide, 1993) or by attracting short-horizon institutional investors (Coffee, 1991; Porter, 1992). The excessive focus of transient institutional investors on short-term performance creates incentives for managing earnings. Consistent with this view, prior studies show that higher presence of transient institutional investors encourages earnings management practices (Bushee, 1998; Matsumoto, 2002; Liu and Peng, 2006; Burns et al., 2010). Matsumoto (2002) shows that firms with higher transient institutional ownership are more likely to manage earnings to avoid negative earnings surprises. Liu and Peng (2006) find that firms with higher transient institutional ownership have lower accrual quality. Burns et al. (2010) document that transient institutional ownership is positively associated with both the likelihood and severity of earnings restatements, concluding that firms attempt to mask bad performance by aggressively managing their earnings to prevent transient investors from leaving the firm.

An opposing view holds that higher stock liquidity enhances the ability of blockholders to exert control over firm management, thus discouraging earnings management. This view touches upon the critical role played by blockholders in improving corporate governance. Prior research identifies two mechanisms for such an effect: (i) the threat of intervention (or voice) (Kahn and Winton, 1998; Maug, 1998; Norli et al., 2010); and (ii) the threat of exit (Edmans, 2009; Edmans and Manso, 2011; Bharath et al., 2013; Edmans et al., 2013). Maug (1998) demonstrates that a liquid market makes it less costly to buy large stakes and easier to buy additional shares. Hence, by facilitating formation of large stakes, higher stock liquidity encourages intervention (or voice) and makes corporate governance more effective; hence, the higher the liquidity, the more monitoring there is. Maug's prediction is supported by Kahn and Winton (1998), Faure-Grimaud and Gromb (2004): stock liquidity encourages value-maximizing intervention by blockholders as public trading results in the formation of a stock price that is informative on blockholder activity.

Edmans (2009), Edmans and Manso (2011) show that the mere act of trading by blockholders can facilitate monitoring and improve corporate governance. In their models, blockholders are viewed as informed traders who exert control over management by means of "exit" (i.e., the threat of selling their stakes based on private information). Under the threat-of-exit perspective, possession of superior information about the firm's fundamentals allows blockholders to exert governance by influencing stock prices. For instance, in the Edmans (2009) model, a liquid market amplifies the threat of exit by encouraging blockholders to acquire private information and to trade on it in larger volumes, causing prices to reflect fundamental values. By selling firm shares, blockholders exert downward pressure on share price, thus penalizing management through its stakes in firm equity for actions considered not to be in the best interests of the firm. Consequently, managers tend to avoid actions that result in blockholders leaving the firm.

Empirical work on which of the two mechanisms, intervention or exit, drives the effect of stock liquidity on corporate governance is still evolving. For instance, Norli et al. (2010) illustrate that poor firm performance increases the probability of shareholder activism, and this relation intensifies with stock liquidity. Bharath et al. (2013) attribute to the threat-of-exit channel their finding of firms with higher levels of managerial pay-for-performance sensitivity experiencing greater declines (increases) in firm performance following negative (positive) shocks to market liquidity. Taking advantage of the fact that hedge funds have the choice of "intervention" (active monitoring) and "exit" (passive monitoring), Edmans et al. (2013) document that over half of hedge funds engage in both types of monitoring. Dou et al. (2015) find that blockholders "influence" (rather than "select") firms' accounting practices, consistent with the monitoring role of blockholders suggested by Edmans (2009), Edmans and Manso (2011).

As the above discussion suggests, prior research presents competing views regarding the impact of stock liquidity on earnings management. One view is that higher stock liquidity reduces institutional monitoring by attracting short-horizon institutional investors (Coffee, 1991; Bhide, 1993; Fang et al., 2014). From this viewpoint, higher stock liquidity should result in more earnings management. The other view is that higher stock liquidity increases institutional monitoring by enhancing blockholder control over firm management (Maug, 1998; Edmans, 2009; Edmans and Manso, 2011; Bharath et al., 2013; Edmans et al., 2013). From this viewpoint, higher stock liquidity should result in less earnings management. Since our research question focuses on clarifying the effect of stock liquidity on earnings management, we hypothesize that the intensity of earnings management is affected by stock liquidity.

3. Data, variables, and estimation methods

3.1. Data

We obtain our data from multiple sources. Firm financial information is obtained from Compustat and stock returns from CRSP. Our main measure of stock liquidity is the relative effective spread, calculated using intra-day data from the Trade and Quote database. This measure originated in Vanderbilt University's Financial Markets Research Centre (FMRC).[3] Our initial sample consists of all firms in the Compustat fundamental annual files over the sample period, 1993–2010.[4]

We impose the following filtering criteria on our initial sample. First, we drop observations lacking enough information to construct the accrual-based and real earnings management measures, along with those missing stock liquidity data from TAQ or stock return data from CRSP. Second, we require each observation to have a non-missing value for our variables in the baseline analysis. We winsorize the variables at the 1st and 99th percentiles to mitigate the effect of outliers.

3.2. Measuring accrual-based earnings management

We employ discretionary accruals as our primary measure of accrual-based earnings management.[5] Our main measure of discretionary accruals is estimated using the Jones (1991) model modified by Dechow et al. (1995). These authors document that this model provides the most power in detecting earnings management. The specification of the modified Jones model is:

[3] We are grateful to Hans Stoll and Christoph Schenzler at the Financial Markets Research Center (FMRC), Vanderbilt University for providing the data.

[4] Our sample period starts in 1993, since prior to that period the data from TAQ are not available.

[5] Discretionary accruals are employed as a proxy for earnings management in a variety of research areas: the initial public offerings (Teoh et al., 1998a), seasoned equity offerings (Rangan, 1998; Teoh et al., 1998b; Cohen and Zarowin, 2010), share repurchases (Gong et al., 2008), and compensation plans (Bergstresser and Philippon, 2006; Burns and Kedia, 2006). Our choice of discretionary accruals as a primary measure of accrual-based earnings management over other widely used measure of accrual quality (e.g., Dechow and Dichev, 2002; McNichols, 2002) is driven by several considerations. First, since stock liquidity varies not only across firms, but also across time, our research question calls for a measure which timely reflects changes in firm earnings management. While discretionary accruals can be estimated on an annual basis, estimation of accrual quality measures requires a time-span of several years. Second, utilizing discretionary accruals allows separate investigation of how stock liquidity affects upward versus downward earnings management. In contrast, the accrual quality measure is unsigned, which constitutes an important drawback of this proxy (Dechow et al., 2010).

$$\frac{TA_{i,t}}{AT_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{AT_{i,t-1}} + \beta_2 \left(\frac{\Delta REV_{i,t}}{AT_{i,t-1}} - \frac{\Delta AR_{i,t}}{AT_{i,t-1}} \right) + \beta_3 \frac{PPE_{i,t}}{AT_{i,t-1}} + \varepsilon_{i,t} \quad (1)$$

where i denotes firm, t denotes year, and ε is the error term; TA is total accruals of the firm, calculated as the difference between income before extraordinary items and operating cash flows; AT is the firm's book assets; ΔREV is the change in sales from year $t-1$ to t; ΔAR is the change in accounts receivable from year $t-1$ to t; and PPE denotes gross property, plant, and equipment. We perform the regression in each year for each two-digit SIC code industry and require each industry-year to have at least 15 observations. We then define discretionary accruals ($ACCR$) as the absolute value of the residuals from the industry-year regressions. A higher value of discretionary accruals indicates more accrual-based earnings management.

3.3. Measuring real earnings management

We construct three measures of real earnings management following Roychowdhury (2006), Cohen and Zarowin (2010). Specifically, we estimate abnormal production costs using the following regression:

$$\frac{PROD_{i,t}}{AT_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{AT_{i,t-1}} + \beta_2 \frac{SALE_{i,t}}{AT_{i,t-1}} + \beta_3 \frac{\Delta SALE_{i,t}}{AT_{i,t-1}} + \beta_3 \frac{\Delta SALE_{i,t-1}}{AT_{i,t-1}} + \varepsilon_{i,t} \quad (2)$$

where i denotes firm, t denotes year, $PROD$ is the sum of the cost of goods sold and the change in inventory from year $t-1$ to t; AT is the firm's book assets; $SALE$ is the firm's sales revenue; and ε is the error term.

We estimate abnormal discretionary expenses from the following model:

$$\frac{DISX_{i,t}}{AT_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{AT_{i,t-1}} + \beta_2 \frac{SALE_{i,t-1}}{AT_{i,t-1}} + \varepsilon_{i,t} \quad (3)$$

where $DISX$ is the sum of R&D, advertising, and selling, general & administrative expenses. Following Cohen and Zarowin (2010), we set R&D and advertising expenses to zero if they are missing. All other variables are defined as in Eq. (2).

Finally, we estimate abnormal operating cash flows using the following model:

$$\frac{CFO_{i,t}}{AT_{i,t-1}} = \beta_0 + \beta_1 \frac{1}{AT_{i,t-1}} + \beta_2 \frac{SALE_{i,t}}{AT_{i,t-1}} + \beta_3 \frac{\Delta SALE_{i,t}}{AT_{i,t-1}} + \varepsilon_{i,t} \quad (4)$$

where CFO is firm operating cash flows. All other variables are defined as in Eq. (2).

We perform the regression in each year for each two-digit SIC code industry and require each industry-year to have at least 15 observations. We define abnormal production costs ($ABPROD$), abnormal discretionary expenses ($ABDISX$), and abnormal operating cash flows ($ABCFO$) as the regression residuals from the three models, respectively. A higher value of abnormal production costs indicates more real earnings management, whereas lower values of abnormal discretionary expenses and abnormal operating cash flows indicate more real earnings management.

To capture the overall effects of real earnings management, we follow Cohen and Zarowin (2010) and combine the three individual measures to create two indices of real earnings management activity. To compute our first composite measure of real earnings management ($REM1$), we multiply abnormal discretionary expenses by negative 1 and add them to abnormal production costs. To compute our second composite measure of real earnings management ($REM2$), we multiply abnormal operating cash flows and discretionary expenses by negative 1 and aggregate the two items into one measure. For both indices, higher values indicate more real earnings management.

3.4. Measuring stock liquidity

Following prior studies (Fang et al., 2009, 2014), our primary measure of stock liquidity is relative effective spread, defined as the ratio of the difference between the trade price and the midpoint of the bid–ask quote over the trade price. The relative effective spread is regarded as one of the best measures of stock liquidity (Hasbrouck, 2009), and is often used as the benchmark measure to compare with liquidity measures constructed using low-frequency data. FMRC computes daily relative effective spread for the stock as the trade-weighted average of the relative effective spreads of all the day's trades. To obtain the annual relative effective spread, we take the arithmetic mean of the daily relative effective spread over the firm's fiscal year. Since the raw relative effective spread is highly skewed, we follow Fang et al. (2009) and use the natural logarithm of the measure in our analysis. Higher value of the relative effective spread indicates lower stock liquidity. For ease of interpretation, we define our stock liquidity measure (LIQ) as minus 1 times the natural logarithm of relative effective spread.

3.5. Control variables

The selection of control variables follows prior literature (Bergstresser and Philippon, 2006; Yu, 2008; Zang, 2012). Firm size ($SIZE$) is the natural log of the firm's book assets, and sales growth (SG) is the annual percentage increase in the firm's sales revenue. Sales growth volatility (SGV) is the standard deviation of sales growth over the past three years. Cash flow (CF) is the ratio of the firm's operating cash flow over its book assets, and cash flow volatility (CFV) is the standard deviation of cash flow over the past three years. Debt ratio ($DEBT$) is the ratio of the firm's total debt over its book assets. Loss dummy ($LOSS$) is a dummy variable equal to one if the firm's operating income is negative, zero otherwise. Altman's Z-score (AZ) is a bankruptcy probability measure of Altman (1968). Market-to-book (MB) is the ratio of the firm's market value of assets over its book assets. Stock returns (RET) is cumulative monthly stock returns over the fiscal year. Stock return volatility (SRV) is the standard deviation of monthly stock returns over the past two years. Since accrual-based earnings management and real earnings management might be used by firms to substitute or complement each other, we follow Franz et al. (2014) and control for real earnings management (accrual-based earnings management) in the regressions when the dependent variable is accrual-based earnings management (real earnings management).[6]

3.6. Descriptive statistics

Table 1 presents summary statistics of the variables. The sample means of the discretionary accruals and the two real earnings management indices are 0.122, 0.111, and 0.05, respectively. Mean stock liquidity is 5.556. A typical firm in our sample has firm size of 5.849 (USD 346.89 million), a debt ratio of 0.205, and a market-to-book ratio of 1.639.

Table 2 presents the correlation matrix of the variables. This table shows that discretionary accruals exhibit weak correlations with both real earnings management indices, suggesting that these constructs capture different aspects of earnings management activities. The two real earnings management indices are

[6] We control for $REM1$ in the discretionary accruals regression. The results from controlling for $REM2$ (untabulated) are qualitatively the same.

Table 1
Summary statistics.

	Mean	S.D.	10%	Median	90%
ACCR	0.122	0.138	0.030	0.078	0.163
REM1	0.111	0.474	−0.081	0.093	0.357
REM2	0.050	0.319	−0.081	0.041	0.209
LIQ	5.556	1.282	6.566	5.433	4.528
SIZE	5.849	1.907	4.490	5.755	7.065
SG	0.107	0.290	−0.030	0.076	0.216
SGV	0.244	0.165	0.126	0.198	0.316
CF	0.056	0.137	0.011	0.070	0.130
CFV	0.083	0.071	0.039	0.064	0.100
DEBT	0.205	0.202	0.020	0.160	0.324
LOSS	0.288	0.453	0.000	0.000	1.000
AZ	1.331	2.080	0.498	1.613	2.523
MB	1.639	1.505	0.774	1.167	1.930
RET	0.168	0.727	−0.271	0.040	0.397
SRV	0.135	0.076	0.078	0.122	0.180
Obs.	36,578				

This table presents the mean, standard deviation (S.D.), 10th percentile (10%), median, and 90th percentile (90%) of each variable in the analysis. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. Variable definitions are provided in Appendix.

significantly correlated with each other. Further, stock liquidity is negatively correlated with discretionary accruals and both real earnings management indices.[7]

4. Stock liquidity and earnings management: main results

4.1. Accrual-based earnings management

This section examines the relation between stock liquidity and accrual-based earnings management. The baseline regression specification is as follows:

$$ACCR_{i,t} = \beta_0 + \beta_1 LIQ_{i,t-1} + \beta_2 SIZE_{i,t-1} + \beta_3 SG_{i,t-1} + \beta_4 SGV_{i,t-1} + \beta_5 CF_{i,t-1} + \beta_6 CFV_{i,t-1} + \beta_7 DEBT_{i,t-1} + \beta_8 LOSS_{i,t-1} + \beta_9 AZ_{i,t-1} + \beta_{10} MB_{i,t-1} + \beta_{11} RET_{i,t-1} + \beta_{12} SRV_{i,t-1} + \beta_{13} REM1_{i,t-1} + IND + YR + \varepsilon_{i,t} \quad (5)$$

The dependent variable is *ACCR*, which is discretionary accruals, and the explanatory variable of interest is *LIQ*, which is the measure of stock liquidity. Control variables are outlined in Section 3. To mitigate potential endogeneity concerns, explanatory variables are lagged one year, following Fang et al. (2009). The model is estimated using pooled ordinary least squares (OLS), with year fixed effects (*YR*) and industry fixed effects (*IND*) based on two-digit SIC codes.

We present the regression results in Column (1) of Table 3. The results show that discretionary accruals are negatively and significantly associated with stock liquidity, suggesting that firms with higher levels of stock liquidity engage in less accrual-based earnings management. The results for the control variables are largely consistent with prior literature (e.g., Bergstresser and Philippon, 2006; Yu, 2008). Discretionary accruals are positively related to sales growth and market-to-book, suggesting that high-growth firms manage their earnings more. Discretionary accruals are also positively related to sales growth volatility and cash flow volatility, suggesting that firms with unstable business patterns manage their earnings more. Further, discretionary accruals are negatively related to firm size, while positively related to debt ratio.

In the main analysis, we follow prior research by employing the absolute value of discretionary accruals as our measure of accrual-based earnings management. One concern is that our results could be driven by negative discretionary accruals for firms that take large write-offs. To mitigate this concern, we follow Yu (2008) and split the sample into subsamples based on whether the signed discretionary accruals are positive or negative. We then run the regression on the two subsamples separately and present the results in Columns (2) and (3) of Table 3. The results show that the coefficient of stock liquidity is negative and significant for the subsample with positive signed discretionary accruals and is insignificant for the subsample with negative signed discretionary accruals. These results suggest that our results are not driven by firms with large write-offs.

4.2. Real earnings management

This section examines the relation between stock liquidity and real earnings management activities. The regression specification is as follows:

$$REM1_{i,t}/REM2_{i,t} = \beta_0 + \beta_1 LIQ_{i,t-1} + \beta_2 SIZE_{i,t-1} + \beta_3 SG_{i,t-1} + \beta_4 SGV_{i,t-1} + \beta_5 CF_{i,t-1} + \beta_6 CFV_{i,t-1} + \beta_7 DEBT_{i,t-1} + \beta_8 LOSS_{i,t-1} + \beta_9 AZ_{i,t-1} + \beta_{10} MB_{i,t-1} + \beta_{11} RET_{i,t-1} + \beta_{12} SRV_{i,t-1} + \beta_{13} ACCR_{i,t-1} + IND + YR + \varepsilon_{i,t} \quad (6)$$

The dependent variables are *REM1* and *REM2*, the two real earnings management indices described in Section 3, and the explanatory variable of interest is *LIQ*, which is the measure of stock liquidity. Control variables are the same as in Eq. (5). Similar to our analysis in Eq. (5), the model is estimated using pooled OLS, with year and industry fixed effects.

The regression results are presented in Columns (4) and (5) of Table 3. The results show that both *REM1* and *REM2* are negatively and significantly associated with stock liquidity. Overall, the results suggest that firms with higher levels of stock liquidity engage in less real earnings management. The results for the control variables are largely in line with the literature (e.g., Zang, 2012). Larger firms engage more in real earnings management. Further, firms with lower sales growth and lower cash flow volatility engage more in real earnings management as well, suggesting that firms with stable business patterns are better able to manipulate earnings through real operations. The results also show that real earnings management is positively associated with debt ratio, while negatively associated with cash flow.

Following Cohen and Zarowin (2010), we use the real earnings management indices, which aggregate different types of real earnings management activity, in the main analysis. To examine the effect of stock liquidity on each type of real earnings management activity, we regress each of the three components of *REM1* and *REM2* indices, namely, abnormal production costs, abnormal discretionary expenses, and abnormal operating cash flows, against stock liquidity and the control variables.

The regression results are presented in Columns (6)–(8) of Table 3. The results reported in Column (6) show that the coefficient of stock liquidity is negative and significant. Since higher values of abnormal production costs indicate more real earnings management, these results suggest that firms with higher levels of stock liquidity are less likely to manage their earnings through overproduction. The results reported in Column (7) show that the coefficient of stock liquidity is positive and significant. Since lower values of abnormal discretionary expenses indicate more real earnings management, this finding suggests that firms with higher levels of stock liquidity are also less likely to manage their earnings

[7] Untabulated results show that the highest variance inflation factor (VIF) among the explanatory variables is 2.83, which is well below the common threshold of 5 (O'Brien, 2007). Based on these results, we conclude that multicollinearity does not pose a concern in our analysis.

Table 2
Correlation matrix.

	ACCR	*REM1*	*REM2*	*LIQ*	*SIZE*	*SG*	*SGV*	*CF*	*CFV*	*DEBT*	*LOSS*	*AZ*	*MB*	*RET*	*SRV*
ACCR	1.000														
REM1	**0.066**	1.000													
REM2	**0.048**	**0.889**	1.000												
LIQ	−0.001	**−0.042**	**−0.027**	1.000											
SIZE	**−0.129**	**0.116**	**0.053**	**0.691**	1.000										
SG	**0.151**	**−0.108**	**−0.218**	**0.012**	**−0.036**	1.000									
SGV	**0.210**	−0.008	−0.001	**−0.098**	**−0.249**	**0.149**	1.000								
CF	**−0.137**	−0.006	**−0.205**	**0.268**	**0.273**	**−0.018**	**−0.291**	1.000							
CFV	**0.225**	**−0.109**	**−0.059**	**−0.183**	**−0.452**	**0.057**	**0.493**	**−0.362**	1.000						
DEBT	**0.011**	**0.085**	**0.119**	−0.007	**0.228**	**−0.014**	**−0.030**	**−0.046**	**−0.143**	1.000					
LOSS	**0.094**	**0.012**	**0.089**	**−0.215**	**−0.225**	**−0.117**	**0.276**	**−0.471**	**0.285**	**0.099**	1.000				
AZ	**−0.117**	**0.072**	**−0.024**	**0.104**	**0.147**	**0.017**	**−0.371**	**0.617**	**−0.343**	**−0.106**	**−0.484**	1.000			
MB	**0.144**	**−0.207**	**−0.228**	**0.133**	**−0.187**	**0.243**	**0.144**	**0.013**	**0.288**	**−0.174**	**−0.014**	**−0.083**	1.000		
RET	**0.041**	**−0.057**	**−0.100**	**0.033**	**−0.028**	**0.149**	**0.020**	**0.145**	**0.010**	**−0.052**	**−0.164**	**0.077**	**0.306**	1.000	
SRV	**0.079**	0.003	**0.013**	**−0.220**	**−0.179**	**0.067**	**0.097**	**−0.123**	**0.112**	**0.020**	**0.144**	**−0.100**	**0.056**	**−0.033**	1.000

This table presents the correlation matrix of the variables. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. Variable definitions are provided in Appendix. Bold font denotes statistical significance at the 5% level.

Table 3
Regressions of earnings management proxies on stock liquidity: main results.

Dependent variable:	Accrual-based earnings management			Real earnings management				
	Full sample *ACCR* (1)	Positive discretionary accruals subsample *ACCR* (2)	Negative discretionary accruals subsample *ACCR* (3)	Full sample *REM1* (4)	Full sample *REM2* (5)	Full sample *ABPROD* (6)	Full sample *ABDISX* (7)	Full sample *ABCFO* (8)
LIQ	−0.003	−0.005	0.001	−0.029	−0.019	−0.010	0.019	0.000
	(−2.613)***	(−3.437)***	(0.788)	(−4.674)***	(−5.082)***	(−3.384)***	(5.070)***	(0.102)
SIZE	−0.005	−0.006	−0.003	0.045	0.025	0.013	−0.031	0.007
	(−5.310)***	(−5.333)***	(−2.525)**	(10.409)***	(9.484)***	(6.531)***	(−11.560)***	(6.346)***
SG	0.018	0.021	0.013	0.005	−0.032	0.011	0.009	0.022
	(5.703)***	(5.336)***	(2.440)**	(0.441)	(−4.347)***	(2.246)**	(1.310)	(5.305)***
SGV	0.053	0.053	0.068	0.377	0.201	0.151	−0.219	0.018
	(7.409)***	(5.886)***	(6.556)***	(10.550)***	(9.144)***	(9.566)***	(−9.735)***	(1.927)*
CF	−0.012	−0.011	−0.011	−0.322	−0.409	−0.480	−0.141	0.536
	(−1.119)	(−0.788)	(−0.779)	(−6.981)***	(−13.482)***	(−22.724)***	(−4.876)***	(36.013)***
CFV	0.130	0.081	0.240	−0.712	−0.309	−0.109	0.575	−0.276
	(6.820)***	(3.377)***	(8.150)***	(−7.235)***	(−5.116)***	(−2.504)**	(9.186)***	(−9.865)***
DEBT	0.032	0.048	0.003	0.248	0.185	0.084	−0.162	−0.020
	(5.515)***	(6.260)***	(0.451)	(9.435)***	(11.210)***	(7.339)***	(−9.774)***	(−3.062)***
LOSS	−0.001	−0.009	0.017	−0.003	−0.003	0.006	0.013	−0.012
	(−0.630)	(−3.264)***	(5.652)***	(−0.376)	(−0.642)	(1.836)*	(2.425)**	(−4.690)***
AZ	0.000	0.002	−0.002	0.054	0.030	0.022	−0.029	−0.002
	(0.568)	(1.589)	(−2.192)**	(12.276)***	(10.945)***	(11.315)***	(−10.701)***	(−1.777)*
MB	0.006	0.007	0.006	−0.081	−0.053	−0.037	0.039	0.012
	(7.399)***	(6.560)***	(4.674)***	(−19.089)***	(−19.603)***	(−20.958)***	(13.458)***	(9.536)***
RET	0.007	0.012	−0.002	0.015	−0.002	0.011	−0.003	0.004
	(5.980)***	(7.781)***	(−0.973)	(3.700)***	(−0.734)	(5.838)***	(−1.024)	(2.284)**
SRV	0.024	0.027	0.027	0.020	−0.012	0.002	−0.003	0.016
	(2.238)**	(1.986)**	(1.727)*	(0.427)	(−0.401)	(0.092)	(−0.098)	(1.246)
REM1	0.022	0.028	0.005					
	(10.146)***	(10.103)***	(1.501)					
ACCR				0.183	0.102	0.054	−0.129	0.027
				(7.900)***	(6.543)***	(5.346)***	(−8.519)***	(3.318)***
Obs.	36,578	23,826	12,752	36,578	36,578	36,578	36,578	36,578
Adj. R^2	0.177	0.197	0.164	0.230	0.194	0.177	0.298	0.353

This table presents the results from regressing accruals and real earnings management on stock liquidity. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. The regressions are performed by ordinary least squares, with the *t*-statistics (in parentheses) computed using standard errors robust to both clustering at the firm level and heteroskedasticity. All the independent variables are lagged one year. Constant, industry fixed effects based on two-digit SIC codes and year fixed effects are included. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are provided in Appendix.

through cutting discretionary expenses. Finally, the coefficient of stock liquidity for abnormal operating cash flows is insignificant, as shown in Column (8). Insignificant results for abnormal operating cash flows, coupled with the significant results for abnormal product costs and abnormal discretionary expenses, is potentially attributed to the offsetting effects of the latter two items on abnormal operating cash flows.[8]

5. Robustness tests

5.1. Economic significance

To facilitate economic interpretation of our results, we rank each explanatory variable (except for the dummy variables) for each year, and then partition the resulting ranks into deciles labeled from 1 (lowest decile) to 10 (highest decile). Next, we regress discretionary accruals and each of the two real earnings management indices on the decile rankings of explanatory variables.

The results are presented in Panel A of Table 4. For the sake of brevity, we report only the coefficients of stock liquidity. The results further confirm the negative relation between earnings management and stock liquidity. The magnitude of the coefficient suggests that moving from the 1st to the 10th decile of stock liquidity reduces discretionary accruals by $0.003 \times (10 - 1) = 0.027$, or 2.7% of total assets. Similarly, moving from the 1st to the 10th decile of stock liquidity reduces real earnings management by $0.009 \times (10 - 1) = 0.081$ or 8.1% of total assets according to *REM1* and $0.006 \times (10 - 1) = 0.054$ or 5.4% of total assets according to *REM2*. Collectively, the results suggest that the impact of stock liquidity on earnings management is statistically significant and economically meaningful.

5.2. Alternative measures of earnings management and stock liquidity

This section examines the robustness of our findings across alternative measures of accrual-based earnings management and stock liquidity. We consider three alternative measures of discretionary accruals, estimated using the Jones (1991), Larcker and Richardson (2004), Kothari et al. (2005) models, and two accrual quality measures, estimated using the Dechow and Dichev (2002) model and the modified Dechow and Dichev (2002) model of McNichols (2002).

The results are presented in Panel B of Table 4. For brevity, for each test, we report only the coefficient of stock liquidity. The results show that stock liquidity is negatively and significantly associated with discretionary accruals and accruals quality measures in all the tests, suggesting that our findings are robust to alternative measures of accrual-based earnings management.

Next, we examine the robustness of our results across alternative measures of stock liquidity. Specifically, we employ the Amihud price impact measure (Amihud, 2002), the Gibbs sampler of implicit bid–ask spread (Hasbrouck, 2009), and the percentage of zero daily returns (Lesmond, 2005) as alternative measures of stock liquidity. Since, for all three measures, higher values indicate less liquidity, we multiply each of the measures by negative 1 for ease of interpretation.

The results are presented in Panel C of Table 4. Again, for each test, we report only the coefficient of stock liquidity. The results show that all three liquidity measures are negatively and significantly related to both discretionary accruals and real earnings management indices, suggesting that our findings are robust to alternative measures of stock liquidity.[9]

Table 4
Regressions of earnings management proxies on stock liquidity: robustness tests.

Dependent variable:	Coefficient of *LIQ*		
	ACCR	*REM1*	*REM2*
Panel A. Economic significance			
(1) Decile ranking of independent variables	−0.003 (−2.965)***	−0.009 (−3.127)***	−0.006 (−3.544)***
Panel B. Alternative accruals measures			
(1) Jones (1991)	−0.004 (−3.338)***	– –	– –
(2) Larcker and Richardson (2004)	−0.002 (−1.836)*	– –	– –
(3) Kothari et al. (2005)	−0.002 (−3.564)***	– –	– –
(4) Dechow and Dichev (2002)	−0.001 (−2.380)**	– –	– –
(5) McNichols (2002)	−0.001 (−2.866)***		
Panel C. Alternative liquidity measures			
(1) Amihud price impact	−0.001 (−1.982)**	−0.016 (−6.956)***	−0.012 (−8.189)***
(2) Implicit bid–ask spread	−0.002 (−2.685)***	−0.022 (−3.670)***	−0.010 (−2.780)***
(3) Percentage of zero daily returns	−0.001 (2.188)**	−0.004 (−1.863)*	−0.006 (−2.118)**
Panel D. Alternative specifications			
(1) Control for firm fixed effects	−0.002 (−2.219)**	−0.011 (−2.674)***	−0.010 (−3.159)***
(2) Control for board characteristics	−0.004 (−1.720)*	−0.012 (−1.887)*	−0.010 (−2.115)**
(3) Control for other additional variables	−0.007 (−3.205)***	−0.020 (−2.106)**	−0.012 (−2.051)**
Panel E. Subsample analysis			
(1) Manufacturing industry subsample	−0.004 (−2.048)**	−0.035 (−3.743)***	−0.024 (−4.283)***
(2) Pre-SOX subsample	−0.005 (−2.349)**	−0.036 (−3.424)***	−0.022 (−3.432)***
(3) Post-SOX subsample	−0.002 (−4.593)***	−0.027 (−4.052)***	−0.018 (−4.428)***

This table presents the results of robustness checks on the relation between earnings management and stock liquidity. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. The regressions are performed by ordinary least squares, with the *t*-statistics (in parentheses) computed using standard errors robust to both clustering at the firm level and heteroskedasticity. All independent variables are lagged one year. Constant, industry fixed effects based on two-digit SIC codes, and year fixed effects are included. For the regression with firm fixed effects, industry fixed effects are not included and *t*-statistics are computed using standard errors robust only to heteroskedasticity. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are provided in Appendix A.

5.3. Omitted variable problem

This section examines the robustness of our results to the omitted variable problem. We conduct three analyses to address this issue. In our first analysis, we include firm fixed effects in our baseline regressions to control for any time-invariant firm characteristics. In our second analysis, we include a number of board

[8] Specifically, price discounts and overproduction have a negative effect on abnormal operating cash-flows, while reduction of discretionary expenses has a positive effect (Roychowdhury, 2006).

[9] For robustness purposes, we repeat our analyses using raw (instead of log transformation of) relative effective spread and the dummy variable indicating whether the firm has above-median relative effective spread. We also exclude the period of the recent financial crisis (2008 and onward). The results (untabulated) remain qualitatively similar to those reported in this paper.

characteristics as additional control variables in our baseline regression. Prior research (e.g., Klein, 2002; Karamanou and Vafeas, 2005) documents the importance of the board and the audit committee in limiting earnings management. Thus, we include board characteristics in the regression to mitigate the concern that our findings are driven by the correlation between board monitoring and blockholder monitoring via either threat of intervention or threat of exit. Specifically, we include board size, board independence, audit committee size, audit committee independence, and CEO–Chair of the Board duality. Board size is defined as the natural logarithm of the number of directors on the board. Board independence is the proportion of independent directors on the board. Audit committee size is the natural logarithm of the number of directors on the audit committee of the board. Audit committee independence is the proportion of independent directors on the audit committee of the board. CEO duality is a dummy variable equal to 1 if the CEO and the chairman of the board are the same individual, zero otherwise. Data for board characteristics are obtained from RiskMetrics, which covers S&P 1500 firms since 1996.

Finally, we include several additional control variables other than board characteristics in our baseline regressions. First, we include the WW index of Whited and Wu (2006) to control for firm access to external financing. Second, we include residual analyst coverage in the regression, following Yu (2008), who documents that firms with higher analyst coverage manage earnings less.[10] Third, we control for dedicated institutional ownership and information asymmetry proxied by probability of informed trading (PIN). Dedicated institutional ownership is defined as the proportion of shares held by dedicated institutional investors, as classified by Bushee (1998, 2001). We obtain the institutional investor classification data from Brian Bushee's homepage, and the PIN data from Stephen Brown's homepage.[11,12] The regression results are presented in Panel D of Table 4. Similar to our previous analyses, for each test, we report only the coefficient of stock liquidity. The results show that the coefficient of stock liquidity remains negative and significant for both discretionary accruals and real earnings management indices. Thus, we conclude that our results are unlikely to be driven by the omitted variable problem.

5.4. Subsample analysis

This section sets forth subsample analysis to further validate our findings. Since overproduction as a real earnings management tool is available primarily to firms in the manufacturing industry, we examine whether our findings hold for the subsample of manufacturing firms. We define manufacturing firms as those with SIC codes between 2000 and 3999, which constitutes 47.49% of our sample firms. Further, prior studies (e.g., Cohen et al., 2008) document that the introduction of the Sarbanes–Oxley Act (SOX) in 2002 had a pronounced impact on firm earnings management activity. To mitigate the concern that our findings are not driven by time-series changes in earnings management, we conduct subsample analysis for the pre- and post-SOX periods, separately.

The results of the subsample regressions are presented in Panel E of Table 4. Again, we report only the coefficient of stock liquidity for the sake of brevity. The panel shows that the coefficient of stock liquidity is always negative and significant in the regression analysis on the manufacturing industry subsample, the pre-SOX subsample, and the post-SOX subsample. Therefore, our findings continue to hold in the subsample analyses.

5.5. Endogeneity

An important concern is that our results could be driven by the endogeneity of stock liquidity. To address this concern, we follow Fang et al. (2009), Bharath et al. (2013) by employing the 1997 minimum tick size reduction and the 2001 decimalization events as exogenous shocks to stock liquidity. During the period, May 7, 1997 to June 24, 1997, the major U.S. stock exchanges, including NYSE, AMEX, and NASDAQ, reduced the minimum tick size from \$1/8 to \$1/16. Further, NYSE and AMEX commenced trading all their listed stocks in decimals on January 29, 2001, and NASDAQ changed all its listed stocks to decimal pricing over the period March 12, 2001 to April 9, 2001. Tick size change and decimalization lowered investors' costs of trading and improved stock liquidity. Furthermore, since the two events were not affected by corporate earnings management, the change in tick size and adoption of the decimal pricing scheme provide a natural setting to test the causal effect of stock liquidity on earnings management.

Panel A of Table 5 confirms the impact of tick size change and decimalization on stock liquidity. The panel shows that the mean stock liquidity of the fiscal year before tick size change was 4.841. It increases to 5.087 in the fiscal year immediately after the tick size change. The increase in mean stock liquidity is 0.246, which is significantly different from zero. Similarly, a significant increase in stock liquidity is observed around decimalization.

Next, we perform a difference-in-difference analysis to examine the changes in discretionary accruals and the two real earnings management indices around the 1997 tick size change and 2001 decimalization, respectively. Following Fang et al. (2014), we first sort firms with data available on both the fiscal year before and the fiscal year after each event into two equal groups based on the changes in stock liquidity around the event. The top group includes firms with greater improvement in stock liquidity and the bottom group includes firms with lower improvement in stock liquidity.

Second, we calculate the propensity score of being included in the top group by conducting a probit regression with the independent variables being firm size, market-to-book ratio, leverage ratio, profitability, and industry fixed effects. Third, we match each firm in the top group (treatment firms) with a firm in the bottom group with the closest propensity score (control firms). If a control firm is matched with more than one treatment firm, we keep the pair for which the propensity score is closest. This results in 432 unique pairs for the 1997 tick size change and 401 unique pairs for the 2001 decimalization.

Fourth, we create two dummy variables. The post dummy (*Post*) is equal to one for the fiscal year after the event and zero for the fiscal year before the event. The treatment dummy (*Treat*) is equal to one for treatment firms and zero for control firms. We include the two dummies as well as their interaction term in the regression. The variable of interest is the interaction term, which captures changes in earnings management for the treatment firms around the events, as compared to the control firms. The regression specification is as follows.

$$\begin{aligned} ACCR_{i,t} = {} & \beta_0 + \beta_1 Treat + \beta_2 Post + \beta_3 Treat \times Post + \beta_4 SIZE_{i,t-1} \\ & + \beta_5 SG_{i,t-1} + \beta_6 SGV_{i,t-1} + \beta_7 CF_{i,t-1} + \beta_8 CFV_{i,t-1} \\ & + \beta_9 DEBT_{i,t-1} + \beta_{10} LOSS_{i,t-1} + \beta_{11} AZ_{i,t-1} + \beta_{12} MB_{i,t-1} \\ & + \beta_{13} RET_{i,t-1} + \beta_{14} SRV_{i,t-1} + \beta_{15} REM1_{i,t-1} \\ & + IND + \varepsilon_{i,t} \end{aligned} \tag{7a}$$

[10] Following Yu (2008), we compute residual analyst coverage by first regressing total analyst coverage against a number of firm characteristics, including firm size, return on assets, asset growth, cash-flow volatility, and external financing, and then take the regression residuals.

[11] http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html.

[12] http://www.rhsmith.umd.edu/faculty/sbrown/pinsdata.html.

Table 5
Regressions of earnings management proxies on stock liquidity: exogenous shocks to stock liquidity.

Mean *LIQ*	Before	After	Difference	*t*-Statistics
Panel A. Univariate analysis				
1997 tick size change	4.841	5.087	0.246	(7.983)***
2001 decimalization	5.218	5.685	0.467	(13.49)***

Dependent variable:	1997 Tick size change			2001 Decimalization		
	ACCR (1)	*REM1* (2)	*REM2* (3)	*ACCR* (4)	*REM1* (5)	*REM2* (6)
Panel B. Regression analysis						
Treat	−0.007	0.040	0.028	0.010	−0.003	−0.009
	(−1.104)	(1.207)	(1.239)	(0.891)	(−0.088)	(−0.405)
Post	0.014	0.035	0.024	−0.009	−0.071	−0.035
	(1.687)*	(1.807)*	(1.582)	(−0.807)	(−2.855)***	(−1.863)*
Treat × *Post*	−0.012	−0.049	−0.054	−0.025	−0.031	−0.037
	(−2.182)**	(−2.727)***	(−3.636)***	(−2.144)**	(−1.946)*	(−2.499)**
SIZE	−0.008	0.039	0.016	−0.008	0.051	0.028
	(−4.444)***	(3.661)***	(2.270)**	(−2.996)***	(5.234)***	(4.393)***
SG	0.017	0.069	0.003	0.030	0.022	−0.013
	(1.471)	(1.352)	(0.074)	(2.199)**	(0.500)	(−0.405)
SGV	0.017	0.281	0.073	0.049	0.561	0.289
	(0.670)	(2.337)**	(0.900)	(1.538)	(5.012)***	(4.045)***
CF	−0.025	−0.401	−0.493	0.028	−0.086	−0.251
	(−0.720)	(−2.691)***	(−4.882)***	(0.542)	(−0.538)	(−2.257)**
CFV	0.205	−0.542	−0.146	0.074	−0.608	−0.151
	(3.114)***	(−1.714)*	(−0.697)	(0.855)	(−2.052)**	(−0.733)
DEBT	0.018	0.407	0.281	0.039	0.233	0.191
	(1.137)	(5.235)***	(5.644)***	(1.701)*	(3.051)***	(4.188)***
LOSS	−0.001	0.033	0.010	0.000	−0.003	−0.001
	(−0.116)	(0.904)	(0.413)	(0.003)	(−0.084)	(−0.073)
AZ	−0.002	0.056	0.033	0.002	0.059	0.034
	(−0.624)	(3.184)***	(3.067)***	(0.450)	(3.711)***	(3.170)***
MB	0.002	−0.089	−0.063	0.006	−0.080	−0.052
	(0.704)	(−8.078)***	(−8.717)***	(1.985)**	(−7.292)***	(−6.664)***
RET	0.011	0.052	0.022	0.012	0.006	−0.002
	(1.967)**	(2.472)**	(1.444)	(2.013)**	(0.391)	(−0.165)
SRV	0.002	0.022	0.003	0.056	0.144	0.081
	(0.058)	(0.127)	(0.028)	(1.201)	(1.020)	(0.813)
REM1	−0.006			0.021		
	(−0.869)			(2.315)**		
ACCR		0.005	−0.067		0.125	0.053
		(0.030)	(−0.628)		(1.249)	(0.777)
Obs.	1572	1572	1572	1490	1490	1490
Adj. R^2	0.167	0.272	0.271	0.249	0.312	0.239

This table presents the results of changes in accruals and real earnings management around the 1997 tick size change and the 2001 decimalization. *Treat* is a dummy variable equal to 1 for treatment firms and zero for control firms. *Post* is a dummy variable equal to 1 for the fiscal year immediately after the events and zero for the fiscal year immediately before the events. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. The regressions in Panel B are performed by ordinary least squares, with the *t*-statistics (in parentheses) computed using standard errors robust to heteroskedasticity. All independent variables are lagged one year. Constant and firm fixed effects are included. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are provided in Appendix.

$$\begin{aligned} REM1_{i,t}/REM2_{i,t} = {} & \beta_0 + \beta_1 Treat + \beta_2 Post + \beta_3 Treat \times Post \\ & + \beta_4 SIZE_{i,t-1} + \beta_5 SG_{i,t-1} + \beta_6 SGV_{i,t-1} \\ & + \beta_7 CF_{i,t-1} + \beta_8 CFV_{i,t-1} + \beta_9 DEBT_{i,t-1} \\ & + \beta_{10} LOSS_{i,t-1} + \beta_{11} AZ_{i,t-1} + \beta_{12} MB_{i,t-1} \\ & + \beta_{13} RET_{i,t-1} + \beta_{14} SRV_{i,t-1} + \beta_{15} ACCR_{i,t-1} \\ & + IND + \varepsilon_{i,t} \end{aligned} \quad (7b)$$

The results are reported In Panel B of Table 5. Columns (1)–(3) present the results for the 1997 tick size change and Columns (4)–(6) present the results for the 2001 decimalization. The regression results show that the coefficient of the interaction term between the treatment dummy and the post dummy is negative and significant in all columns, suggesting that the treatment firms experience greater reduction in both accruals and real earnings management relative to the control firms. Since the treatment firms experience a greater reduction in stock liquidity due to the exogenous shock, the findings suggest a causal effect from stock liquidity to earnings management.

6. Governance channel of stock liquidity: threat of exit versus intervention

Our results suggest that higher stock liquidity results in less earnings management. As discussed above, such an effect can be

motivated based on either the threat of blockholder exit or blockholder intervention mechanisms. To examine which of the two mechanisms drives the liquidity effect observed in our sample, we conduct two analyses.

First, we examine the effect of managerial pay-for-performance sensitivity on the stock liquidity–earnings management relation. The disciplining effect of the threat of exit occurs through manager wealth invested in firm stock (Edmans, 2009; Bharath et al., 2013). Hence, under the threat-of-exit perspective, the effect of stock liquidity on earnings management should be amplified for firms whose manager wealth is highly sensitive to changes in stock price, that is, firms with high levels of managerial pay-for-performance sensitivity. In contrast, under the intervention perspective, the impact of stock liquidity depends on the balance of power between shareholders and managers, and not on the sensitivity of managers' wealth to changes in stock price. Thus, under the intervention perspective, we should observe no effect of managerial pay-for-performance sensitivity on the stock liquidity–earnings management relation.

We follow Core and Guay (2002) and compute managerial pay-for-performance sensitivity as the natural logarithm of the dollar value change in the top five management stock and option holdings with respect to a one-percent change in stock price.[13] To implement the test, we first divide the sample into deciles by managerial pay-for-performance sensitivity. Next, the observations in the top and the bottom three deciles of pay-for-performance sensitivity are used to form a subsample. We then define a dummy variable (*DPPS*) equal to one if the firm is in the top three deciles of pay-for-performance sensitivity and zero if the firm is in the bottom three deciles of pay-for-performance sensitivity. We estimate our baseline regressions (Eqs. (5) and (6)) with the interaction term of stock liquidity with *DPPS* using the subsample of the top three and bottom three pay-for-performance sensitivity deciles.

The results are presented in Columns (1)–(3) of Table 6. The coefficient of the interaction term of stock liquidity with *DPPS* is negative and significant for both discretionary accruals and real earnings management indices. Collectively, the results suggest that the effect of stock liquidity on earnings management is stronger for firms with higher levels of managerial pay-for-performance sensitivity. These findings are consistent with the threat-of-exit channel.[14]

Second, we examine the impact of shareholder rights on the relation between stock liquidity and earnings management. If higher stock liquidity enhances blockholders' voice and their incentives to intervene, the effect of stock liquidity on earnings management should be stronger for firms with higher shareholder rights, that is, firms where managers are less immune to shareholder intervention. In contrast, under the threat-of-exit perspective, we should observe no effect of shareholder rights on the stock liquidity–earnings management relation, since governance by exit occurs through blockholder trading, and thus does not depend on the extent of management immunity to shareholder intervention.

We employ the governance index (*G*-index) proposed by Gompers et al. (2003) as the measure of shareholder rights.[15] This index ranges from zero to 24 and is a count of the number of anti-takeover provisions in a firm's charter and in the legal code of the state in which the firm is incorporated. Higher values of *G*-index indicate lower shareholder rights. To implement the test, we first divide the sample into deciles by *G*-index and then define a dummy variable (*DRIGHTS*) equal to 1 if the firm is in the bottom three deciles of the *G*-index, and zero if the firm is in the top three deciles of the *G*-index. Next, we estimate our baseline regressions with the interaction term of stock liquidity with *DRIGHTS* for the subsample of firms in the top and bottom three deciles of the *G*-index.

The results are presented in Columns (4)–(6) of Table 6. The coefficient of the interaction term of stock liquidity with *DRIGHTS* is insignificant for both discretionary accruals and real earnings management indices. Overall, we document no evidence that the effect of stock liquidity on earnings management is stronger for firms with higher shareholder rights. Thus, our results are inconsistent with the blockholder intervention channel.[16]

7. Stock liquidity, earnings management, and firm cost of capital

The results documented in the preceding sections show that firms with higher stock liquidity have lower discretionary accruals and lower real earnings management indices, suggesting that stock liquidity is an important determinant of the *intensity* of earnings management. Yet, these findings provide little evidence as to whether and how stock liquidity impacts the *information content* of earnings management; that is, whether stock liquidity impacts the association between the extent of earnings management and a firm's subsequent performance. This section complements our findings by examining whether the information content of earnings management varies across firms with high versus low stock liquidity.

Prior research highlights two potential motives for the firm to manage earnings: (i) managerial opportunism, and (ii) information production. While the overall weight of the empirical evidence is consistent with earnings management being driven by managerial opportunism (e.g., Teoh et al., 1998a,b; Roychowdhury, 2006; Bhojraj et al., 2009; Cohen and Zarowin, 2010), several studies suggest that managers may also manage earnings to convey information about future firm prospects to investors (Gul et al., 2003; Gunny, 2010). Thus, if higher stock liquidity enhances monitoring of firm management by blockholders, then it is expected to have an impact not only on the intensity but also on the information content of earnings management.

To explore this issue, we examine how the effect of earnings management on firm cost of capital varies across firms with high versus low levels of stock liquidity. An extensive body of research documents that firm cost of capital is positively associated with the extent of earnings management (Aboody et al., 2005; Francis et al., 2008; Kim and Qi, 2010; Kim and Sohn, 2013), consistent with the notion that earnings management reduces earnings quality and makes the firm information environment more opaque. These findings also suggest that, on average, earnings management measures predominantly reflect managerial opportunism rather than information production motive. However, if stock liquidity enhances blockholder control over firm management, then the relative importance of these two motives should vary across high- versus low-liquidity firms. Specifically, if stock liquidity enhances

[13] This measure has been widely adopted in prior studies (e.g., Coles et al., 2006; Armstrong and Vashishtha, 2012). We construct the measure using data from ExecuComp, which cover the stock and option compensation information of the management of S&P 1500 component firms since 1992.

[14] We conduct several robustness tests using the following alternative measures of pay-for-performance sensitivity: (1) CEO pay-for-performance sensitivity measure of Core and Guay (2002); (2) CEO wealth-performance sensitivity measure of Edmans (2009); (3) CFO pay-for-performance sensitivity measure of Core and Guay (2002). The results (untabulated) are qualitatively similar to those reported in this paper.

[15] We obtain the *G*-index data from RiskMetrics. This database covers the anti-takeover provisions of S&P 1500 firms since 1996.

[16] We conduct two robustness tests, In the first test, we define the *G*-index dummy as a proxy for the level of shareholder rights using the threshold suggested by Gompers et al. (2003) (i.e., equal to 0 if *G*-index is less than or equal to 5, and 1 if *G*-index is greater or equal to 14). In the second test, we use the entrenchment index (*E*-index) proposed by Bebchuk et al. (2009) as a proxy for the level of shareholder rights. The results (untabulated) are qualitatively similar to those reported in this paper.

Table 6
Regressions of earnings management proxies on stock liquidity: the role of managerial pay-for-performance sensitivity and shareholder rights.

Dependent variable:	Pay-for-performance sensitivity			Shareholder rights		
	ACCR (1)	*REM1* (2)	*REM2* (3)	*ACCR* (4)	*REM1* (5)	*REM2* (6)
LIQ	−0.004 (−1.214)	0.031 (1.205)	0.018 (0.711)	−0.001 (−2.183)**	−0.003 (−1.204)	−0.007 (−1.743)*
LIQ × *DPPS*	−0.005 (−2.123)**	−0.047 (−3.107)***	−0.021 (−2.328)**			
DPPS	−0.009 (−0.471)	0.251 (2.461)**	0.074 (1.182)			
LIQ × *DRIGHTS*				0.002 (0.599)	−0.012 (−0.804)	−0.008 (−0.922)
DRIGHTS				−0.011 (−0.616)	0.042 (0.411)	0.032 (0.524)
SIZE	−0.008 (−4.529)***	0.048 (5.612)***	0.030 (5.613)***	−0.004 (−2.116)**	0.049 (5.439)***	0.026 (4.858)***
SG	0.029 (3.461)***	0.032 (1.362)	−0.023 (−1.395)	0.017 (2.105)**	0.041 (1.507)	−0.018 (−1.047)
SGV	0.035 (2.149)**	0.317 (3.919)***	0.116 (2.369)**	0.010 (0.535)	0.333 (3.338)***	0.152 (2.582)***
CF	−0.009 (−0.396)	−0.522 (−5.210)***	−0.490 (−7.328)***	−0.018 (−0.645)	−0.281 (−2.274)**	−0.341 (−4.420)***
CFV	0.107 (2.545)**	−0.459 (−2.225)**	−0.181 (−1.433)	0.252 (4.516)***	−0.430 (−1.440)	−0.197 (−1.109)
DEBT	0.012 (1.023)	0.263 (5.433)***	0.199 (6.240)***	0.030 (2.200)**	0.258 (4.231)***	0.209 (5.305)***
LOSS	0.010 (2.282)**	−0.039 (−2.527)**	−0.029 (−2.664)***	0.001 (0.176)	−0.008 (−0.485)	−0.015 (−1.333)
AZ	0.001 (0.461)	0.050 (5.503)***	0.028 (5.065)***	−0.001 (−0.360)	0.056 (5.285)***	0.034 (5.116)***
MB	0.004 (2.650)***	−0.084 (−13.279)***	−0.058 (−13.119)***	0.006 (3.403)***	−0.102 (−11.232)***	−0.072 (−12.403)***
RET	0.010 (3.282)***	0.028 (3.186)***	0.002 (0.352)	0.004 (1.325)	0.029 (2.968)***	0.003 (0.461)
SRV	0.019 (0.938)	0.186 (1.745)*	0.068 (0.997)	0.008 (0.377)	0.110 (1.193)	0.051 (0.873)
REM1	0.031 (6.781)***			0.031 (6.656)***		
ACCR		0.282 (5.871)***	0.164 (4.787)***		0.218 (3.815)***	0.117 (3.071)***
Obs.	7317	7317	7317	6794	6794	6794
Adj. R^2	0.178	0.267	0.260	0.173	0.299	0.273

This table presents the regression results of the interaction term between stock liquidity and measures of managerial incentives and shareholder rights. Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database and stock returns data from CRSP. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. The regressions are performed by ordinary least squares, with the *t*-statistics (in parentheses) computed using standard errors robust to both clustering at the firm level and heteroskedasticity. All independent variables are lagged one year. Constant, industry fixed effects based on two-digit SIC codes, and year fixed effects are included. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are provided in Appendix A.

monitoring, then, relative to low-liquidity firms, earnings management in the high-liquidity firms is less likely to reflect managerial opportunism and more likely to be driven by information production motives. Therefore, the positive association between earnings management proxies and firm cost of capital (which reflects information risk) should be weaker for high-liquidity firms than for low-liquidity firms.

To test this prediction, we examine the association between the intensity of earnings management and firm cost of capital, using the following regression:

$$\begin{aligned} ICC_{i,t} = {} & \beta_0 + \beta_1 Orth\_ACRR_{i,t-1}/Orth\_REM1_{i,t-1}/Orth\_REM2_{i,t-1} \\ & + \beta_2 MCAP_{i,t-1} + \beta_3 DEBT_{i,t-1} + \beta_4 MB_{i,t-1} + \beta_5 BETA_{i,t-1} \\ & + \beta_6 IDV_{i,t-1} + \beta_7 CFV_{i,t-1} + \beta_8 AF_{i,t-1} + IND + YR + \varepsilon_{i,t} \quad (8) \end{aligned}$$

The dependent variable is the firm's implied cost of capital (*ICC*). In terms of research design, we estimate the cost of equity that is implied by market prices and analyst earnings forecasts using four different models introduced by Gebhardt et al. (2001), Claus and Thomas (2001), Easton (2004), Ohlson and Juettner-Nauroth (2005). Specifically, for each firm–year observation and for each of these four models, we estimate the implied expected return on equity that equates current share price of firm i in year t to the discounted stream of projected future cash flows estimated using analyst earnings forecasts. Since there is little consensus on which model performs best, we follow Chen et al. (2011) in using the median of the estimates from the four models as our measure of cost of equity.

The explanatory variables of interest are the earnings management proxies orthogonalized with respect to stock liquidity

Table 7
Regressions of implied cost of capital on earnings management proxies.

Dependent Variable:	Discretionary accruals			Real earnings management index 1			Real earnings management index 2		
	Full sample *ICC* (1)	Low-liquidity subsample *ICC* (2)	High-liquidity subsample *ICC* (3)	Full sample *ICC* (4)	Low-liquidity subsample *ICC* (5)	High-liquidity subsample *ICC* (6)	Full sample *ICC* (7)	Low-liquidity subsample *ICC* (8)	High-liquidity subsample *ICC* (9)
Orth_ACCR	0.878 (2.288)**	2.450 (2.089)**	−0.596 (−1.079)						
Orth_REM1				0.484 (3.471)***	0.885 (2.787)***	0.151 (0.739)			
Orth_REM2							0.641 (3.197)***	1.356 (3.031)***	0.373 (1.229)
MCAP	−0.283 (−6.146)***	−0.784 (−6.146)***	−0.009 (−0.132)	−0.293 (−6.441)**	−0.789 (−6.198)***	−0.015 (−0.215)	−0.289 (−6.351)***	−0.781 (−6.156)***	−0.017 (−0.239)
DEBT	3.875 (11.359)***	5.430 (6.429)***	2.216 (4.085)***	3.828 (11.233)***	5.433 (6.424)***	2.174 (4.009)***	3.814 (11.216)***	5.374 (6.351)***	2.148 (3.935)***
MB	−0.128 (−2.860)***	−0.038 (−0.346)	−0.153 (−2.381)***	−0.083 (−1.961)**	0.058 (0.505)	−0.141 (−2.242)**	−0.083 (−1.958)**	0.054 (0.466)	−0.131 (−2.177)**
BETA	−0.049 (−0.520)	0.352 (1.397)	0.312 (1.467)	−0.042 (−0.454)	0.393 (1.559)	0.308 (1.442)	−0.036 (−0.386)	0.417 (1.649)*	0.311 (1.456)
IDV	38.667 (7.222)***	23.501 (2.070)**	11.900 (0.763)	39.554 (7.415)***	24.831 (2.246)**	12.332 (0.796)	39.197 (7.342)***	23.999 (2.156)**	12.653 (0.823)
CFV	7.932 (5.035)***	12.469 (4.042)***	5.209 (1.244)	8.461 (5.315)***	13.821 (4.528)***	5.156 (1.224)	8.356 (5.267)***	13.625 (4.446)***	5.226 (1.234)
AF	−0.351 (−4.304)***	−0.482 (−2.448)**	−0.218 (−1.429)	−0.359 (−4.389)***	−0.483 (−2.442)**	−0.207 (−1.362)	−0.358 (−4.387)***	−0.494 (−2.496)***	−0.202 (−1.326)
Obs.	19,109	3815	3827	19,109	3815	3827	19,109	3815	3827
Adj. R^2	0.167	0.141	0.258	0.168	0.142	0.258	0.167	0.142	0.258

This table presents the results of regressing implied firm cost of capital on the accrual-based and real earnings management proxies. *Orth_ACCR*, *Orth_REM1*, and *Orth_REM2* are orthogonalized earnings management measures as the raw value of the measure minus stock liquidity times the coefficient for stock liquidity from Eq. (5). Our initial sample consists of all firms in the Compustat database over the period 1993–2010. We merge the sample with the stock liquidity measures generated from the Trade and Quote (TAQ) database, stock returns data from CRSP, and analyst forecast data obtained from IBES. We require each firm–year observation to have non-missing values for the variables in the baseline analysis and we winsorize all variables at both the 1st and 99th percentiles. The regressions are performed by ordinary least squares, with the *t*-statistics (in parentheses) computed using standard errors robust to clustering at the firm level and heteroskedasticity. All independent variables are lagged one year. Constant, industry fixed effects based on two-digit SIC codes, and year fixed effects are included. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Variable definitions are provided in Appendix.

(*Orth_ACCR*, *Orth_REM*1, and *Orth_REM2*). We estimate each of the orthogonalized earnings management proxies as the raw value of the proxy minus stock liquidity times the coefficient for stock liquidity from Eq. (5).[17] We use orthogonalized instead of raw earnings management proxies to avoid spurious effects of stock liquidity on the earnings management-cost of capital relation driven by the impact of stock liquidity on the intensity of earnings management documented in this study.

Selection of control variables follows the literature (e.g., Gebhardt et al., 2001; Chen et al., 2011). Specifically, we include market capitalization (*MCAP*), defined as the natural log of firm market capitalization. We also include debt ratio (*DEBT*), market-to-book (*MB*), and cash flow volatility (*CFV*), which have the same definition as those in Eq. (5). Further, we include firm beta (*BETA*), and idiosyncratic volatility (*IDV*), estimated as the standard deviation of the regression residuals from the value-weighted market model. Finally, we include analyst following (*AF*), defined as the average number of analysts following the firm during a given year. The models are estimated using pooled OLS, with year fixed effects and industry fixed effects included in all regressions.

For each earnings management proxy, we estimate Eq. (8) three times: (1) using the whole sample; (2) using the subsample of low-liquidity firms; and (3) using the subsample of high-liquidity firms. We classify low (high) liquidity firms as those in the top (bottom) quintile of the relative effective spread. Our prediction is that the coefficients for the earnings management proxies will be positive for the whole sample and for the subsample of low-liquidity firms. Further, we predict that the coefficients for the earnings management proxies will be larger for the subsample of low-liquidity firms than for the subsample of high-liquidity firms.

The results are reported in Table 7. First, consider the results for the accrual-based earnings management regressions. For the whole sample, we find that firm cost of capital is positively associated with *Orth_ACCR*. This finding is consistent with results reported in the literature (Aboody et al., 2005; Francis et al., 2008; Kim and Qi, 2010). Also, we document a positive and significant association between firm cost of capital and *Orth_ACCR* for the subsample of low-liquidity firms. In contrast, we find no such evidence for the subsample of high-liquidity firms. The difference between the coefficients of *Orth_ACCR* across the two subsamples is positive and significant.

Next, we present the results for the real earnings management regressions. For the whole sample, we find that firm cost of capital is positively associated with both *Orth_REM1* and *Orth_REM2*, in line with the results reported by Kim and Sohn (2013). Also, the coefficients of both *Orth_REM1* and *Orth_REM2* indices are positive and significant for the subsample of low-liquidity firms. In contrast, for the subsample of high-liquidity firms, the coefficients of both *Orth_REM1* and *Orth_REM2* are insignificant. The difference

[17] For instance, $Orth\_ACCR_{i,t}$ is calculated as $ACCR_{i,t} - (-0.004) \times LIQ_{i,t-1}$ where −0.004 is the coefficient for stock liquidity in the discretionary accruals equation, as reported in Column (1) of Table 3. As a robustness test, we repeat the analysis using raw measures of discretionary accruals and real earnings management indices. The results (untabulated) remain qualitatively identical to those reported in this paper.

between the coefficients across the two subsamples is positive and significant for *Orth_REM1*, and positive and marginally significant for *Orth_REM2*.

Collectively, the results suggest that while the intensity of earnings management positively associates with firm cost of capital, the effect is concentrated within the subsample of low-liquidity firms. These findings are consistent with our prediction that stock liquidity impacts the information content of earnings management and, more importantly, that the information risk of earnings management for investors is lower for firms with high stock liquidity. These findings provide further support for our conclusion that stock liquidity discourages opportunistic earnings management, thus mitigating managerial short-termism.

8. Conclusion

This paper examines the effect of stock liquidity on managerial short-termism. Utilizing earnings management as a proxy for managerial short-termism, we address three important research questions. First, we examine the effect of stock liquidity on the intensity of earnings management. Second, we identify the potential channel through which stock liquidity affects earnings management. Third, we examine the consequences of earnings management for firm cost of capital, and how the effect of earnings management on firm cost of capital varies across firms with high versus low levels of stock liquidity.

We establish three new results. First, we find that firms with liquid stocks engage in less accrual-based and real earnings management. Second, we find that the effect of stock liquidity on earnings management is amplified for firms with high levels of managerial pay-for-performance sensitivity. Third, we find that higher stock liquidity attenuates the positive association between the intensity of earnings management and firm cost of capital. Collectively, our findings suggest that higher stock liquidity reduces managerial short-termism by enhancing governance by exit, in which the disciplining effect of liquidity comes through managers' wealth invested in firm stock.

Our findings should be of interest to both finance and accounting researchers. In particular, our results indicate that stock liquidity is a significant determinant of earnings management. Further, our findings suggest that stock liquidity is an important moderator of the earnings management–firm cost of capital relation. As such, our paper contributes to the extensive body of literature examining the causes and consequences of earnings management. Our paper also contributes to the corporate finance literature by emphasizing the beneficial role of stock liquidity in reducing managerial short-termism.

Appendix A

Variables and definitions

Variable	Definition
ABCFO	Abnormal operating cash flows, estimated following Roychowdhury (2006)
ABDISX	Abnormal discretionary expenses, estimated following Roychowdhury (2006)
ABPROD	Abnormal production costs, estimated following Roychowdhury (2006)
ACCR	Discretionary accruals, defined as the absolute value of abnormal accruals estimated from the modified Jones model of Dechow et al. (1995)
AF	Number of analysts following, defined as the average number of analysts following the firm during the year
AZ	Altman's *Z*-score, defined as (3.3 * operating income (IOADP) + sales (SALE) + 1.4 * retained earnings (RE) + 1.2 * (current assets (ACT) − current liability (LCT)))/total assets (AT)
BETA	Stock beta, defined as the beta estimates from the value-weighted market model
CF	Cash flows, defined as cash flow from operations (OANCF)/total assets (AT)
CFV	Standard deviation of cash flows over the past three years
DEBT	Debt ratio, defined as (long-term debt (DLTT) + debt in current liabilities (DLC))/total assets (AT)
DPPS	Dummy variable equal to 1 (zero) if the firm is in the top (bottom) three deciles of pay-performance-sensitivity. Pay-for-performance sensitivity is estimated following Core and Guay (2002)
DRIGHTS	Dummy variable equal to 1 (zero) if the firm is in the top (bottom) three deciles of the governance index proposed by Gompers et al. (2003)
IDV	Idiosyncratic volatility, defined as the standard deviation of the regression residuals from the value-weighted market model
INDLIQ	Industry average stock liquidity, defined as the average stock liquidity over the firm's two-digit SIC industry (excluding the firm)
LIQ	Stock liquidity, defined as (−1) * the natural logarithm of the ratio of the difference between the trade price and the midpoint of the bid–ask quote divided by the trade price
LOSS	Dummy variable equal to 1 if operating income (IB) is negative, zero otherwise
MCAP	Market capitalization, defined as the natural logarithm of stock price (PRCC_F) times shares outstanding (CSHPRI).
MB	Market-to-book ratio, defined as (stock price (PRCC_F) * Shares outstanding (CSHPRI) + long-term debt (DLTT) + debt in current liabilities (DLC))/total assets (AT)
REM1	Real earnings management index 1, defined as ABPROD plus (−1) * ABDISX
REM2	Real earnings management index 2, defined as (−1) * ABCFO plus (−1) * ABDISX
RET	Stock returns, defined as cumulative stock returns over the fiscal year
SG	Annual growth rate of sales (SALE), where sales is deflated to 2005 dollars
SGV	Standard deviation of sales growth (SG) over the preceding three years
SIZE	Firm size, defined as the natural logarithm of total assets (AT), where total assets are deflated to 2005 dollars
SRV	Stock return volatility, defined as the standard deviation of monthly stock returns over the preceding two years

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