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Excess cash, trading continuity, and liquidity risk

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Abstract

This study investigates the impact of excess cash on the liquidity risk faced by investors and their required liquidity premium. It shows that excess cash improves trading continuity and reduces both liquidity risk and the cost of equity capital. These findings are consistent with the view that firms with excess cash attract more traders even when market liquidity dries up. The increase in investors' trading propensity reduces stock price exposure to shocks to market liquidity and the liquidity premium required by investors. We also examine the impact of excess cash on firm value. We show that while the direct effect of excess cash on firm value is negative, its indirect effect through liquidity is significantly positive, indicating that investors are less likely to sanction (or even reward) illiquid firms for holding excess cash. Further analysis suggests that the liquidity benefits of excess cash are greater for financially constrained firms and firms with high growth opportunities. Our results are robust over time, after addressing endogeneity concerns, and to alternative estimation methods and alternative measures of liquidity.

Keywords: Excess cash holdings; Asset liquidity; Stock liquidity; Liquidity risk; Cost of equity capital

JEL classifications: G11; G12; G14

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1. Introduction

Cash reserves held by US firms have increased considerably in the last few decades. According to Huang et al. (2013), non-financial firms increased their holdings of cash and other liquid assets to a record $2 trillion in 2011. Early studies, such as Jensen and Meckling (1976), Jensen (1986), and Myers and Majluf (1984), have debated the potential costs and benefits of corporate cash holdings. Related studies by Opler et al. (1999) and Harford et al. (2008) have investigated the effect of various financial variables on the level of corporate cash reserves and identified size, book-to-market ratio, and past cash flows as the key determinants of corporate cash holdings. More recently, a number of papers have focused on whether investors sanction firms for hoarding cash in excess of the level predicted by firm characteristics ("excess cash"). However, the results of these studies have been relatively mixed. For example, Simutin (2010) documents a positive association between excess cash and stock returns, implying that investors view excess cash as a proxy for risky growth opportunities. Nevertheless, Asem and Alam (2014) show that the relationship between excess cash and stock returns depends on investors' outlook for firm prospects and conclude that investors' support for cash hoards is not ubiquitous.

In this study, we assess investors' perceptions of excess cash from a different perspective. Specifically, we investigate whether excess cash affects stock trading continuity and the liquidity risk faced by investors. Excess cash may affect stock trading continuity and liquidity risk in two ways. On the one hand, it is commonly argued that managers hoard cash to cushion shortfalls in future cash flows (e.g., Bates et al., 2009; Palazzo, 2012) or to finance growth (Simutin, 2010). Consistent with this prediction, Faulkender and Wang (2006) and Denis and Sibilkov (2009) show that cash holdings are more valuable for financially constrained firms with valuable growth opportunities. Similarly, Pinkowitz and Williamson (2007) and Brown and Petersen (2011) find that the value of cash holdings is highest in R&D intensive firms, as cash reserves help these firms avoid the high adjustment costs associated with altering the path of

R&D projects. Since cash helps firms finance their profitable investment opportunities and survive economic downturns, excess cash may serve as a useful mechanism for firms, particularly financially constrained ones and/or those with valuable growth opportunities, to attract investors. If firms with excess cash attract more traders when market liquidity dries up, their stock prices should exhibit less exposure to shocks to market liquidity. The decrease in liquidity risk would, in turn, reduce the liquidity premium and the cost of equity capital. In what follows, we will refer to this hypothesis as the *investment opportunities hypothesis*.

On the other hand, the theory of free cash flow suggests that managers may hold excess cash to pursue their own objectives at shareholders' expense (Jensen, 1986). These agency conflicts are aggravated in the presence of greater information asymmetry, as the lack of transparency makes it difficult to monitor or discipline misbehaving managers (Ball et al., 2000, 2003; Ball, 2006). Johnson et al. (2000) argue that minority shareholders are exposed to greater expropriation by managers and controlling shareholders during economic downturns. Because of the heightened fear of expropriation, stocks of firms with excess cash reserves may be unattractive to investors and may therefore be less liquid. The decline in stock liquidity would make the stock price more vulnerable to shocks to market liquidity. As investors face higher liquidity risk, they would require a higher liquidity premium, which in turn would increase the cost of equity capital. We will refer to this hypothesis in what follows as the *management entrenchment hypothesis*.

We test the above hypotheses using a large sample of NYSE/AMEX/NASDAQ common stocks over the period 1991 – 2014. Our definition of liquidity risk is based on the premise that non-trading reflects illiquidity (Liu, 2006; Lin et al., 2009). Because investors are expected to trade only when the benefits of trading exceed trading costs (Lesmond et al., 1999), greater incidence of no trading indicates higher (unobservable) trading costs and lower liquidity (Lin et al., 2009). While the bid-ask spread has also been commonly used as a trading cost measure, the bid and ask quotes are often relevant to small trades, as large transactions are usually negotiated

(Lin et al., 2009). Furthermore, Liu (2006) argues that liquidity has multiple dimensions and is not well represented by bid-ask spread or any other traditional measure, such as illiquidity measure of Amihud (2002) and the turnover measure of Datar et al. (1998). Liu also shows that his trading discontinuity measure (*LM*12), which is defined as standardized turnover-adjusted number of zero daily trading volumes over the prior 12 months, is able to capture multiple dimensions of liquidity, including trading speed, trading quantity, and trading cost.

Our analysis provides strong evidence in support of the *investment opportunities hypothesis* and refutes the management entrenchment argument. Specifically, we find a significantly negative association between excess cash holdings and Liu's (2006) *LM*12, consistent with the view that excess cash attracts more traders and reduces incidents of no trading. We also find strong evidence that firms with high levels of excess cash exhibit lower liquidity risk. All else being equal, a one unit increase in excess cash is associated with an average reduction of 0.489 percentage points (or 5.366% relative to the sample mean) per annum in the cost of capital, indicating that the economic benefit of excess cash is nontrivial. We also evaluate the impact of excess cash on firm value. In addition to the direct effect, we show that excess cash affects firm value indirectly through its interaction with the firm's stock liquidity. Specifically, we find that while the direct effect of excess cash on firm value is negative, the value of the marginal dollar of excess cash held by illiquid firms is significantly higher than that held by more liquid firms. Further analysis suggests that the liquidity benefits of excess cash are greater for financially constrained firms and firms with high growth opportunities. Our results are robust over time, after addressing endogeneity concerns, and to alternative measures of the key variables and alternative estimation methods.

This study contributes to the literature in a number of ways. First, to the best of our knowledge, we are the first to investigate the relationship between excess cash and liquidity risk. Existing studies (e.g., Gopalan et al., 2012; Charoenwong et al., 2014) focus on the impact of asset liquidity, measured as the *level* of cash in the firm's balance sheet, on one or a few dimensions of stock liquidity, such as trading volume, bid-ask spread, and Amihud's illiquidity ratio. In this study, we emphasize *excess* cash for two reasons: (i) excess cash has the potential to capture information about firm prospects above and beyond that reflected in the usual proxies such as size and book-to-market ratio (Simutin, 2010); and (ii) it is more likely to be wasted by entrenched managers (Harford et al., 2008). Further, Liu (2006) argues that, due to the multifaceted nature of liquidity, conventional liquidity measures, such as trading volume and bid-ask spread, may not fully reflect liquidity. Thus, unlike prior studies, we use Liu's *LM*12 to capture multiple dimensions of liquidity. We also use liquidity betas estimated from Liu's liquidity-augmented CAPM (LCAPM) to examine the link between excess cash holdings and the sensitivity of stock returns to shocks to market liquidity.

Second, our study contributes to the literature on how cash holding can benefit firms facing financing frictions. Several studies argue and show that excess cash can benefit firms by minimizing the need to fund future investment opportunities with costly external financing (Kim et al., 1998; Almeida et al., 2004; Acharya et al., 2007). Our study identifies a new channel through which excess cash can reduce the cost of financing. Specifically, we argue, and find confirming empirical evidence, that excess cash increases trading activity and reduces the liquidity premium required by investors. This evidence is particularly strong among financially constrained firms and firms with valuable growth opportunities. The liquidity benefits of excess is also evident from our analysis of the joint effect of excess cash and stock liquidity on firm value. Unlike existing studies, which focus on the direct impact of excess cash on firm value (Faulkender and Wang, 2006; Pinkowitz et al., 2006; Pinkowitz and Williamson; 2006), we show that excess cash also affects firm value indirectly through its impact on stock liquidity.

Third, this study improves our understanding of the mechanisms that underlie the relation between excess cash holdings and expected stock returns. Simutin (2010) documents a positive association between excess cash and future returns. He also shows that high excess cash firms have higher market betas and investment expenditures. His findings indicate that high excess cash firms earn higher returns because they are riskier than their low excess cash counterparts. Asem and Alam (2014) examine the link between excess cash and stock returns in advancing and declining markets. They document an inverted U-shaped relationship when investors expect declines in future cash flows and a generally positive relationship when they expect increases in growth opportunities. We contribute to this strand of research by providing a rationale and evidence on how liquidity risk acts as a channel through which excess cash holdings can affect expected stock returns.

Finally, our study complements the literature exploring the determinants of liquidity risk. For example, Ng (2011) reports a negative association between information quality and liquidity risk. Cao and Petrasek (2014) find that institutional ownership lowers liquidity betas, consistent with Baker and Stein's (2004) argument that institutional ownership reduces stock returns exposure to fluctuations in market liquidity because institutional trades are less likely to be motivated by sentiment than individual trades. We extend this line of research by showing that excess cash holdings is another important determinant of systematic liquidity risk.

The remainder of this study is organized as follows. Section 2 reviews the related literature and develops our hypotheses. Section 3 explains how we measure our key variables and specifies the empirical models used for hypothesis testing. Section 4 describes our data and summary statistics. Section 5 discusses our main empirical findings. Section 6 reports the results of our robustness checks and Section 7 concludes.

2. Related literature and hypothesis development

In a perfect capital market environment, holdings of cash and liquid assets are irrelevant. This is because firms can raise external capital to operate and grow at zero cost. Furthermore, since there is no liquidity premium in such an environment, cash holdings have no opportunity cost and, therefore, do not affect shareholder wealth (Opler et al., 1999). However, in a world with imperfections, such as information asymmetry, agency conflicts, and financial distress, cash reverses can have a significant impact on firm performance and market value.

Myers and Majluf (1984) argue that information asymmetries between shareholders and managers can cause severe underpricing of firm securities and can make it expensive for firms to raise external funds. When information asymmetries are high, a cash flow shortfall may involve greater costs, as it can prevent firms from financing their operations and investing in profitable projects. These costs are expected to be larger for firms with high research and development (R&D) expenses (Opler and Titman, 1994) and greater investment opportunities (Smith and Watts, 1992; Jung et al., 1996; Pinkowitz and Williamson, 2007). Thus, when information asymmetries are important, firms can find it profitable to hoard high levels of excess cash in order to mitigate costs of financial distress. However, in the presence of agency conflicts, managers may hold excess cash to pursue their own objectives rather than maximize shareholders' wealth (Jensen and Meckling, 1976). Excess cash provides managers with more flexibility in making investment decisions and enables them to avoid market discipline. It also allows entrenched managers to increase private benefits of control or engage in empire building by undertaking projects that outside investors are not willing to finance (Jung et al., 1996). Hence, excess cash can destroy firm value and should optimally be kept low to mitigate the conflicts of interests between managers and shareholders (Stulz, 1990).

Most of the existing empirical studies evaluate the relative costs and benefits of cash holdings by examining the effects of cash reserves on firm performance and market value. Unfortunately, the results have been inconclusive. Some studies show that high levels of cash destroy shareholder value. For example, Harford (1999) finds that firms with large cash reverses are more likely to engage in value destroying acquisitions and capital investments. Similarly, Lee and Powell (2011) show that firms that persistently hold excess cash underperform in the long-run. Other studies, such as Mikkelson and Partch (2003), find that firms with high cash holdings have a higher median operating performance than their low cash holding counterparts.

Yet another group of studies documents that the value of excess cash varies with firm characteristics. For example, Faulkender and Wang (2006) and Denis and Sibilkow (2009) show that the marginal value of cash is higher for financially constrained firms with valuable investment opportunities, while Pinkowitz and Williamson (2007) find that the marginal value of cash is higher in R&D intensive industries.

In recent years, there has been a growing interest in the link between asset liquidity and stock liquidity. Gopalan et al. (2012) develop a model in which the relationship between asset liquidity and stock liquidity depends on the tendency of the firm to invest. Specifically, liquid assets, if not reinvested, would reduce the valuation uncertainty associated with assets-in-place and improve stock liquidity. However, reinvesting liquid assets would lead to greater uncertainty about future assets and lower stock liquidity. Consistent with their model, Gopalan et al. (2012) document a positive association between asset liquidity and stock liquidity and show that this relationship is stronger for firms that are less likely to reinvest their liquid assets. Charoenwong et al. (2014) also examine the relation between asset liquidity and stock liquidity across 47 countries. They find that, on average, firms with greater asset liquidity have higher stock liquidity. Consistent with the valuation uncertainty argument, they also show that the asset-stock liquidity relation is more positive in countries with poor accounting transparency.

The focus of prior studies has been on the impact of the level of cash holding on the conventional measures of stock liquidity, such as bid-ask spread, Amihud's (2002) illiquidity, and Datar et al.'s (1998) turnover measure. In this paper, we investigate the impact of cash in excess of that of the level required to fund normal operations and investments on both trading continuity and liquidity risk. Excess cash is different from the level of cash as it is shown to contain important information about firm prospects (Simutin, 2010) and is more likely to be wasted by entrenched managers (Harford et al., 2008). Our liquidity proxies are also different from the conventional measures of liquidity, which tend to focus on one dimension of liquidity and, since liquidity is multifaceted, none of them can capture liquidity risk fully. In this study, we use Liu's (2006) trading continuity measure (*LM*12), which is shown to simultaneously capture the trading speed, the trading quantity, and the trading cost dimensions of liquidity, as our main proxy for liquidity.

We argue that the impact of cash holdings on trading continuity will depend on the ability of firms with excess cash to attract uninformed investors to participate in stock trading. The *investment opportunities hypothesis* suggests that excess cash can reduce the cost of capital through two channels: (i) through the efficient utilization of a cheap from of funding (relative to equity), which would help firms avoid disruptions to their existing operations and provide greater certainty on the funding and implementation of their future investment plans (Opler et al., 1999; Bates et al., 2009); and (i) through the reduction of the liquidity premium due to increased trading participation. Our study emphasizes the latter. Specifically, we argue that if cash holdings lower the volatility in the value of assets-in-place (Gopalan et al., 2012), firms with excess cash would attract more investors, particularly uninformed investors. The increased participation of uninformed traders would reduce the market makers' inventory costs and adverse selection costs, allowing the latter to provide services at a lower cost. The reduction in trading costs would, in turn, increase investors' propensity to trade and improve trading continuity (Lin et al., 2009). As high excess cash improves trading continuity, stock prices of firms with excess cash should become more resilient and less sensitive to innovations in aggregate market liquidity. The reduced liquidity risk would lower the liquidity premium and the cost of equity capital.

In contrast, the *management entrenchment hypothesis* predicts a negative association between excess cash and trading continuity. Empirical studies on the determinants of cash holdings document a significantly positive association between cash holdings and information asymmetry (e.g., Dittmar et al., 2003; Ferreira and Vilela, 2004; Ozkan and Ozkan, 2004; Garcia-Teruel et al., 2009). Specifically, these studies show that firms with high levels of financially opacity tend to face excessive costs of external finance and are therefore expected to hoard more cash. The high level of information asymmetry can aggravate the agency costs of cash (Jensen, 1986) and make firms with excess cash reverses less attractive to uninformed traders. The reduced participation of uninformed traders would increase market makers' losses from trading with informed traders and the costs they charge for providing liquidity services. The increased trading costs would reduce investors' propensity to trade and increase the chance of firms with excess cash facing trading discontinuity. As the liquidity environment deteriorates, stock prices should become less resilient and more exposed to shocks to market liquidity. Consequently, investors face greater liquidity risk and require a higher liquidity premium which, in turn, increases the cost of equity capital.

The above arguments suggest that the impact of excess cash on trading continuity, liquidity risk, and the cost of equity is theoretically ambiguous. As a result of this ambiguity, we choose to address the issue empirically. Throughout our analysis, we focus on the following four questions. First, does excess cash improve or worsen trading continuity? Second, does excess cash increase or decrease liquidity risk? Third, does excess cash increase or reduce the cost of equity capital? Fourth, does excess cash affect firm value? Finally, does the effect of excess cash on trading continuity and liquidity risk depend on the firm's growth opportunities and its access to external financing?

3. Measurement of variables and model specification

3.1. Measurement of trading continuity and liquidity risk

Following Liu (2006), we measure stock liquidity as the standardized turnover-adjusted number of days with zero trading volume over the prior 12 months (*LM*12):

$$LM12 = \left[ZEROS + \frac{1/TURNOVER}{DEFLATOR}\right] * \frac{252}{TRAD} \qquad (1)$$

where *ZEROS* is the total number of zero daily trading volume over the prior 12 months, *TURNOVER* is the sum of daily turnover over the prior 12 months, *DEFLATOR* is set to 11,000 as in Liu (2006) in order to ensure that $0 < \frac{1/TURNOVER}{DEFLATOR} < 1$ for all stocks, and *TRAD* is the total number of trading days over the prior 12 months.

This measure is based on the intuition that incidents of no trading reflect higher latent costs of trading, with higher values of *LM*12 indicating low levels of trading continuity and high degrees of illiquidity (Lin et al., 2009). It also captures the multifaceted aspects of liquidity, placing particular emphasis on trading speed, which has been largely ignored in the previous studies (Liu, 2006).

After calculating *LM*12, we use Liu's (2006) two-factor model and estimate liquidity risk by running the following time-series regression for each firm and every year over our sample period: [1]

$$r_{it} - r_{ft} = \alpha_i + \beta_{im}(r_{mt} - r_{ft}) + \beta_{il}LIQ_{t,i} + \varepsilon_{it} \quad (2)$$

where r_{it}, r_{ft}, and r_{mt} are monthly returns on firm *i*, the US market, and the one-month Treasury bill[2]; $LIQ_{t,i}$ is the liquidity mimicking factor, defined as the return difference between a low-liquidity portfolio (containing high *LM*12 stocks) and a high liquidity portfolio (containing low *LM*12)[3]; and the factor loadings β_{im} and β_{il} represent the stock *i*'s market beta and liquidity risk, respectively.

[1] Pastor and Stambaugh (2003) measure liquidity risk as the sensitivity of stock returns to innovations in market-wide liquidity. However, their measure is designed to capture the illiquidity that relates to the price of impacts of trades rather than the liquidity risk stemming from trading discontinuity (Lin et al., 2009) and works better for portfolios than individual stocks (Pastor and Stambaugh, 2003).

[2] Data on r_{ft}, and r_{mt} is obtained from Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html

[3] We are very grateful to Weimin Liu for providing us with his liquidity factors. For more details on the construction of these factors refer to Liu (2006, pp. 550-551).

3.2. Measurement of excess cash

Following others (e.g., Opler et al., 1999; Harford et al., 2008; Asem and Alam, 2014), each year, we estimate excess cash for firm *i* as the residual of the following cross-sectional regression:

$$CASH_i = \alpha_0 + \alpha_1 CF_i + \alpha_2 LEVERAGE_i + \alpha_3 MTB_i + \alpha_4 SIZE_i + \alpha_5 NWC_i + \alpha_6 CAPEX_i + \alpha_7 DIV_i + \alpha_8 R\&D_i + \alpha_9 REG_i + \alpha_{10} INDSIG_i + \varepsilon_i \quad (3)$$

where *CASH* is the natural log of cash and short-term investments scaled by net assets; *CF* is earnings after interest, dividends, and taxes, but before depreciation scaled by net assets; *LEVERAGE* is the ratio of total debt to net assets; *MTB* is the market value of assets divided by total assets; *SIZE* is the natural log of net assets deflated in 1994 dollars; *NWC* is net working capital (net of cash), scaled by net assets; *CAPEX* is capital expenditures scaled by net assets; *DIV* is a dummy variable with a value of one if the firm pays dividends, and zero otherwise; *R&D* is the research and development expenditures scaled by sales; *REG* is a dummy which equals one if the firm is in a regulated industry, and zero otherwise;[4] *INDSIG* is industry cash flow risk, defined as the mean of the ratio of the standard deviations of cash flows to the total assets over 20 years for firms in the same industry (by 2-digit SIC code).

All variables are winsorized at the 1% and 99% percentiles to mitigate outlier effects. The exponential form of residual ε_i is used as a proxy for firm *i*'s excess cash (*ECASH*) in a given year. A positive (negative) residual indicates that the firm hoards more (less) cash than it needs for its normal operational activities and investments during that year.

[4] As per Barclay and Smith (1995), regulated industries are railroads (SIC code 4011), trucking (SIC code 4210 and 4213), airlines (SIC code 4512), and telecom (SIC code 4812 and 4813).

3.3. Model specification

To test the effects of excess cash on trading continuity and liquidity risk, we estimate the following regression:[5]

$$LIQUIDITY_{i,t} = \alpha + \beta_C ECASH_{i,t-1} + \gamma Z_{i,t-1} + YEAR + INDUSTRY + \varphi_{i,t} \quad (4)$$

where subscripts i and t represent firm and year, respectively; $LIQUIDITY$ represents firm liquidity and is measured in the following two different ways: (a) as the natural logarithm of Liu's (2006) $LM12$ ($lnLM12$) and (b) as the liquidity beta (β_{il}) in Equation (2) ($LIQBETA$); $ECASH$ is the cash in excess of normal operations and investments, estimated as the exponential form of the residual term in Equation (3); $Z_{i,t\text{-}1}$ is a vector of control variables, which are lagged one year to mitigate reverse causality concerns; $YEAR$ and $INDUSTRY$ are year and industry dummies, respectively; and φ is a residual error term.

Building on the related literature (e.g., Brockman et al., 2009; Lin et al., 2009; Ng, 2011), we include in our regressions several control variables that are known to affect stock liquidity. These variables are market-to-book ratio (*MTB*), firm size (*SIZE*), leverage (*LEVERAGE*), a dummy for dividend payers (*DIV*), capital expenditures (*CAPEX*), R&D expenses (*R&D*), stock price (*PRICE*), stock return (*RET*), the number of shareholders (*NSHAR*), block ownership (*BLOCK*), institutional ownership (*IO*), and a dummy for NASDAQ stocks (*NASDAQ*). Following Lin et al. (2009), we also add $lnLM12$ to the list of control variables when $LIQBETA$ is used as the dependent variable in Equation (4). Appendix A provides a detailed definition of all variables used in our regressions.

All continuous variables are winsorized at the 1% and 99% percentiles. We further include year and industry dummies to control for potential year and industry fixed effects. Finally, we use robust standard errors that are adjusted for double clustering by firm and year.

[5] We also use cash instead of excess cash as our main independent variable and our conclusion remains unchanged. Further details on these results are available upon request.

4. Data and summary statistics

Our initial sample consists of all NYSE/AMEX/NASDAQ common stocks of US industrial firms, excluding utilities (SIC 4900-4999) and financial firms (SIC 6000-6999), with available accounting data from Compustat at any time during the period of 1991 – 2014. Stock price data is collected from CRSP. Ownership data is obtained from Worldscope and Thomson Reuters Institutional (13F) Holdings. To ensure the firms are publicly traded, we only include firms that have securities with CRSP share codes of 10 or 11. We also exclude stocks with share prices of less than $5 or greater than $1000 and those traded for less than 200 days in the previous year.[6] To mitigate any potential bias from the small size effect, we also exclude firms with market capitalizations of less than 10 million dollars. Finally, to reduce the effect of outliers, we exclude firms with negative assets, negative sales, and those with annual assets or sales growth larger than 100%. The final sample includes 3,810 firms and 28,310 firm-years.

Insert Table 1 about here

Table 1 reports the firm characteristics for the full sample and the subsamples by exchange listing. It shows that NASDAQ firms are smaller, have a smaller shareholder base, and are traded less frequently than the NYSE/AMEX firms. It also shows that firms traded on NASDAQ have greater growth opportunities, hold more cash, and pay less dividends than those traded in NYSE/AMEX. These findings provide initial evidence consistent with the view that managers hoard cash to cushion shortfalls in future cash flows and/or to finance growth (Bates et al., 2009; Simutin, 2010; Palazzo, 2012).

Table 2 presents the unconditional correlations across firm-years between the various variables included in our analysis. The highest correlation is between *INVESTOR* and *SIZE*

[6] Amihud (2002) argues that excluding stocks that are traded less than 200 days in the previous year helps to mitigate the potential effect of thin trading problems on the results.

(0.56), which indicates that large firms attract more investors and therefore have a larger investor base. The correlation between *PRICE* and *SIZE* is also relatively high (0.53). The correlation between *DIVIDEND* and *NASDAQ* is -0.34, implying that firms listed on NASDAQ stock exchange are less likely to pay dividends. The correlation between *lnLM*12 and *LIQBETA* is positive and significant, implying that trading discontinuity increases liquidity risk. This result is consistent with Acharya and Pedersen (2005), who report a negative association between liquidity risk and liquidity level. The correlation between *ECASH* and *lnLM*12 is significantly negative (-0.06), while that between *ECASH* and *LIQBETA* is positive and significant (0.07), providing preliminary evidence in support of our *investment opportunities hypothesis*, which suggests that excess cash increases trading continuity and reduces liquidity risk.

We use variance inflation factor (VIF) analysis to diagnose multicollinearity. The mean VIF of the variables is 1.57, indicating that multicollinearity is not a serious problem in our study.

Insert Table 2 about here

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5. Empirical Findings

5.1. Core findings

Table 3 reports the results of estimating Equation (4). The first four columns present the results with *lnLM*12 as the dependent variable. Column (1) reports the results with excess cash as the only explanatory variable. It shows that the coefficient on *ECASH* is negative and highly significant, with a 1% increase in excess cash resulting in a 3.9% decrease in *lnLM*12. Column (2) shows that the significantly negative effect of excess cash on trading discontinuity remains after controlling for other determinants of stock liquidity. Columns (3) and (4) present the results for the two subsamples by exchange listing. While the coefficient on *ECASH* is significantly negative in both subsamples, its magnitude is more than double for the NASDAQ than the NYSE/AMEX firms. Specifically, we find that a 1% increase in excess cash increases liquidity (i.e. decreases *lnLM*12) by 1.9% for NYSE/AMEX firms and 5.8% for NASDAQ firms. These findings are consistent with the *investment opportunities hypothesis*, which predicts the liquidity benefits of excess cash to be stronger for smaller firms with greater growth opportunities (Opler et al., 1999; Bates et al., 2009).

Insert Table 3 about here

Columns (5) to (8) report the results of Equation (4) with $LIQBETA$ as the dependent variable. The coefficient on *ECASH* in column (5) is negative and significant, implying that excess cash reduces liquidity risk. In economic terms, a 1% increase in excess cash lowers liquidity risk by 5.6%. This finding is robust after controlling for other determinants of liquidity risk (column (6)). Columns (7) and (8) show that the coefficients on *ECASH* for the subsamples of NYSE/AMEX and NASDAQ firms are -0.041 (t-value = -4.188) and -0.074 (t-value = -4.519), respectively, implying that the liquidity benefits from holding excess cash are stronger for NASDAQ firms. This evidence is again consistent with the *investment opportunities hypothesis*, which posits that small firms with high growth opportunities are more likely to benefit from holding excess cash.

To derive a better understanding of the economic significance of our results, we quantify the effects of excess cash on the cost of capital through liquidity risk. Following Lin et al. (2009) and Ng (2011), we estimate the liquidity risk premium per unit of liquidity risk ($E(LIQ)$) as the long-term average of the liquidity mimicking factor (*LIQ*). Since we are using monthly data to estimate *LIQBETA*, we estimate the annualized reduction in the cost of equity capital associated with a 1% increase in excess cash by compounding $LIQBETA * E(LIQ)$ for 12 months. The value of $E(LIQ)$ during the period 1991 – 2014 is 0.69% per month, which is similar to Liu

(2006) and Lin et al. (2009).[7] Column (6) suggests that a one unit increase in excess cash is associated with an average reduction of 0.065 in liquidity risk, which translates into an average reduction of 0.54 (i.e., $(1+(0.065*0.69\%))^{12} - 1$) percentage points per annum in the liquidity premium required by investors. This is a nontrivial reduction, as it represents 5.816% of average cost of equity for the sample firms.[8] Columns (7) and (8) show that a one unit increase in excess cash is associated with an average reduction of 0.043 and 0.082 in the liquidity risk for the subsamples of NYSE/AMEX and NASDAQ firms, respectively. This indicates that, all else equal, a one unit increase in excess cash lowers the cost of capital for NYSE/AMEX and NASDAQ firms by 0.357 and 0.681 percentage points per annum, respectively.

Among the control variables in Table 3, firm size and book-to-market ratio are negatively associated with trading discontinuity and liquidity risk, a result consistent with Cao and Petrasek (2014). Stock price is positively related to trading discontinuity and liquidity beta, consistent with the view that low-priced stocks attract more informed traders (see, e.g., Schultz, 2000; Easley et al., 2001). Prior return is negatively related to trading discontinuity and liquidity risk, indicating that firms whose stocks have recently performed well attract more traders and hence exhibit a lower exposure to innovations in aggregate liquidity. Trading discontinuity and liquidity betas are also smaller for firms with higher capital expenditures and higher R&D expenditures. Furthermore, the effects of leverage, dividends, and investor base on trading discontinuity and liquidity beta are positive and significant at the 1% level. Moreover, we show that block shareholding is significantly negatively related to trading continuity, suggesting that block ownership is detrimental to the firm's trading activities (Brockman et al., 2009). Institutional ownership also has a significantly positive effect on both trading continuity and

[7] The estimated monthly mean values of LIQ documented in Liu (2006) and Lin et al. (2009) are 0.749% (1964-2003) and 0.76% (1975-2004), respectively.

[8] We estimate the average cost of equity capital ($E(r_i)$) using the following LCAPM model: $E(r_i) - r_f = \beta_{im}\left(E(r_m) - r_f\right) + \beta_{il}E(LIQ)$, where $E(r_m)$, $E(LIQ)$ and r_f are the long-term averages of the market return, liquidity mimicking factor and risk free rate, respectively. During the sample period, we have r_f = 0.22%, $\left(E(r_m) - r_f\right)$ = 0.65%, and $E(LIQ)$ = 0.69%. We estimate the cost of equity capital per annum by compounding $E(r_i)$ over 12 months. The average cost of capital for our sample firms is about 9.28%.

liquidity risk, consistent with Gompers and Metrick (2001) and Bennett et al. (2003). In the regressions with *LIQBETA* as the dependent variable, the coefficient on *lnLM*12 is positive and significant, implying that trading discontinuity increases stock price vulnerability to shocks to market liquidity (see, e.g., Liu, 2006; Lin et al., 2009). Nevertheless, none of these variables subsume the effect of excess cash on trading continuity and liquidity beta. Specifically, we show that excess cash alone accounts for 7.9% of the cross-sectional variation in *lnLM*12, whereas the adjusted R^2 is 26% after including the control variables. We also show that excess cash accounts for 3.1% of the variation in liquidity betas and the adjusted R^2 increases to 4.4% after controlling for other determinants of liquidity risk.

To gain further insight into the liquidity benefit of excess cash, we fit the following regression:[9]

$$Q_{i,t} = \kappa_0 + \kappa_1 ECASH_{i,t-1} + \kappa_2 LIQUIDITY_{i,t} + \kappa_3 ECASH_{i,t-1} * LIQUIDITY_{i,t} + \gamma X_{i,t-1} + YEAR + INDUSTRY + \upsilon_{i,t} \quad (5)$$

where $Q_{i,t}$ is a proxy for firm value and is defined as the ratio of market value of assets (book value of assets minus book value of equity plus market value of equity) to book value of assets (see, e.g., Lehn and Poulsen (1989), Servaes (1991), and Nohel and Tarhan (1998).[10] The $X_{i,t-1}$ is a vector of lagged control variables, which includes firm size (*SIZE*), daily turnover by volume (*TURNOVER*), long-term debt divided by total assets (*LTD*), a dummy for dividend payers (*DIV*), capital expenditures (*CAPEX*), return on assets (*ROA*). The choice of these variables is guided by the literature on determinants of firm value (see, e.g., Allayannis and Weston, 2001; Carter et al., 2006; Roll et al., 2009) and their detailed definitions are provided in the Appendix. The rest of variables in Equation (5) are as defined in Section 3.3.

[9] We are grateful to anonymous referee for making this suggestion.
[10] For robustness purposes, we also define Q as the ratio of market value of firm (market value of equity plus book value of debt) to book value of firm (total assets) (see, e.g., Chung and Pruitt, 1994; Pinkowitz et al., 2006). The results of these analysis are available upon request.

Table 4 reports the results for different specifications of Equation (5). The coefficient on $ECASH_{i,t-1}$ is negative and significant, indicating that shareholders value the marginal dollar of excess cash significantly lower than its face value. Similar results are reported by Pinkowitz and Williamson (2007) and Dittmr and Mahrt-Smith (2007), who examined the impact of the level of cash holdings on firm value.[11] The coefficient on *lnLM*12 is negative and significant, suggesting that trading discontinuity is detrimental to firm value. This finding is consistent with the evidence in Fang et al. (2009), which also shows that stock liquidity improves firm value. The interaction terms in Columns (1) and (2) are positive and significant, implying that the value of the marginal dollar of excess cash held by illiquid firms is significantly higher than that held by more liquid firms. This finding is again consistent with predictions of our *investment opportunities hypothesis*.

Most of the control variables in the regressions are significant. The significantly positive coefficient on firm size is consistent with Mueller's (1987) view that big firm size implies greater efficiency, as it might an outcome of a firm's exploration and exploitation activities. Share turnover is also positive and significant, indicating the presence of liquidity premium in stock returns (Amihud and Mendelson, 1986). The positive coefficient on capital expenditure indicates that firms that invest more may have greater growth opportunities and higher valuation (Roll et al., 2009). Leverage is significantly negative, presumably reflecting the distress costs associated with having debt in the capital structure. Finally, the significantly negative coefficient on the dividend dummy suggests that dividend paying firms are less constrained and therefore have more free cash flow, which can potentially be wasted by entrenched managers (Harford et al., 2008).

[11] Existing evidence shows that the impact of cash holdings on firm value varies systematically across firms with corporate characteristics. For example, Pinkowitz and Williamson (2007) show cash is value at a premium when it is by riskier companies with growth opportunities and at discount when held by mature firms with less volatile cash flow. In a similar vein, Dittmar and Mahrt-Smith (2007) find that cash holdings by well-governed firms tend to command premium values while cash holding by poorly governed firms tend to be penalized by market investors.

Insert Table 4 about here

In summary, our results provide strong support of the *investment opportunities hypothesis*, which suggests that excess cash improves trading continuity and reduces the sensitivity of stock prices to shocks to aggregate liquidity. We also show that while the direct effect of excess cash on firm value is negative, its indirect effect through liquidity is significantly positive, indicating that shareholders are less likely to sanction (or even reward) firms with high trading discontinuity and liquidity risk for holding excess cash. These findings remain robust after controlling for other well-known determinants of stock liquidity and firm value.

5.2. Additional analysis and robustness tests

In this section, we conduct numerous tests to check the robustness of our results after adjusting for endogeneity and to alternative estimation methods, alternative measures of the key variables, and alternative subsamples and time periods.

5.2.1. Endogeneity concerns

The documented negative effects of excess cash on trading continuity and liquidity risk might be endogenous for two reasons. First, omitted variables that are correlated with both liquidity and excess cash may bias our estimates towards our baseline results. Second, stock liquidity may also influence a firm's decision to hoard cash (Gopalan et al., 2012), implying that causality might operate in the reverse direction. Although the use of fixed effects and the extensive set of control variables may have already absorbed the effects of a wide array of omitted variables and the use of lagged independent variables may have alleviated concerns of reverse causality, the endogeneity issues relating to both omitted variables and reverse causality may not be fully resolved.

To further alleviate these endogeneity concerns, we use an instrument variable (IV) approach as an identification strategy to test the effects of excess cash on trading discontinuity and liquidity risk. We estimate two-stage least squares (2SLS) IV regressions with industry and year fixed effects and standard errors clustered at the firm level. In the first stage, we regress *ECASH* on a selected instrumental variable and a set of control variables. Admittedly, finding a variable based on economic theory that predicts excess cash but not trading continuity or liquidity risk is quite challenging. Nevertheless, we use the natural logarithm of the industry average excess cash (*IECASH*) as our instrument.[12] *IECASH* is likely to be related to firm-level excess cash as firms in the same industry may adopt a similar cash holding policy. Furthermore, although the liquidity characteristics of a given firm might influence the same firm's excess cash holdings, they are unlikely to be related to industry-level excess cash holdings. Managers may also have influence over their own firm's excess cash holdings, but they should have limited influence, if any, on other firms' excess cash holding policies. Thus, *IECASH* should be a valid instrument, as it is likely to be related to firm-level excess cash, but not to trading discontinuity or liquidity risk. The F-statistic from the Kleibergen-Paap test is significant, indicating that *IECASH* is not a weak instrument.

Table 4 presents the results of the 2SLS IV regressions. Columns (1) and (3) present the results of the first stage with *ECASH* as the dependent variable. The coefficients on *IECASH* is positive and significant, suggesting that firm level and industry level excess cash are positively related to one another. We use the predicted values of *ECASH* from the first-stage regression in the second stage equation. Columns (2) and (4) report the second stage results using *lnLM12* and *LIQBETA* as liquidity proxies, respectively. The results continue to show a negative relation

[12] The use of the industry average of the main explanatory variable as an instrument variable in 2SLS is common in the literature (see, e.g., John and Knyazeva, 2006; John and Kadyrzhanova, 2008; Jiraporn et al., 2011; Ghaly et al., 2015).

between *ECASH* and both *lnLM*12 and *LIQBETA*, which suggests a casual relation from excess cash to both trading discontinuity and liquidity risk. Overall, the results in Table 4 are consistent with the predictions of the *investment opportunities hypothesis*, which suggests that excess cash improves trading continuity and reduces stock price exposure to innovations in aggregate liquidity.

Insert Table 4 about here

5.2.2. Alternative estimation methods

In our earlier analysis, we use robust standard errors to account for heteroscedasticity and autocorrelations in the residuals of the pooled OLS regression. For robustness purposes, we also use the Fama and MacBeth (1973) regression method to account for the cross-correlations and the serial correlations in the residual terms. Specifically, each year we estimate cross-sectional regressions of firm liquidity on excess cash and other control variables. We then average the yearly cross-sectional slope coefficients to obtain the final estimates and use the time series of the coefficient estimates to compute standard errors.

Table 5 presents the Fama-MacBeth estimates with *lnLM12* (column (1)) and *LIQBETA* (column (2)) as the dependent variable, respectively. The t-statistics in parentheses are based on the Newey and West (1987) heteroscedasticity and autocorrelation consistent standard errors. The coefficient on *ECASH* is significantly negative in both columns, indicating that firms with high excess cash on average trade more frequently and have lower liquidity risk than those with low excess cash.

Insert Table 5 about here

5.2.3. Alternative measures of liquidity

To further examine the robustness of our results, we use the illiquidity ratio by Amihud (2002) and the bid-ask spread as alternative liquidity measures. The illiquidity ratio is defined as the average of the daily ratio between the absolute value of the stock's return and its dollar volume over the prior 12 months, where the final value is multiplied by (10^6). The bid-ask spread is defined as the average value of the daily difference between the ask price and bid price, divided by the ask price, over the past 12 months.

The results are reported in Table 6 (see Panel A for Amihud's (2002) illiquidity measure and Panel B for the Amihud and Mendelson's (1986) bid-ask spread). The coefficient on *ECASH* is negative and significant at the 1% level, except for the subsample of NYSE/AMEX firms when the bid-ask spread is used as the liquidity measure. Overall, our findings suggest that excess cash reduces illiquidity and trading costs and the reduction is larger for NASDAQ firms, consistent with the predictions of the *investment opportunities hypothesis*.

Insert Table 6 about here

5.2.4. The role of financial constraints and growth opportunities

Existing studies show that cash holdings are more valuable for financially constrained firms (see, e.g., Almeida et al., 2004; Faulkender and Wang, 2006; Chan et al., 2012) and for firms with growth opportunities (see, e.g., Pinkowitz and Williamson, 2007; Denis and Sibilkov, 2009; Brown and Petersen, 2011). In this section, we investigate whether the extra benefits of holding excess cash that accrue to these types of firms can be at least partly attributed to the reduction in their liquidity risk. Following existing studies (e.g., Almeida et al., 2004; Acharya et al., 2007; Farre-Mensa and Ljungqvist, 2016), we use firm size, dividends, credit rating, the KZ index of Kaplan and Zingales (1997), the WW index of Whited and Wu (2006), and the HP index of Hadlock and Pierce (2010) as proxies for financial constraints. More specifically, at the beginning of every year, we define financially constrained firms as those: (i) in the bottom three size deciles; (ii) that do not pay dividends; (iii) that do not have credit ratings; (iv) in the top three KZ index deciles; (v) in the top three WW index deciles; and (vi) in the top three HP index deciles. The definition of each financial constraint proxy is given in Appendix A. Following the literature (see, e.g., Smith and Watts, 1992; Gaver and Gaver, 1993; Bates el al., 2009), we also use book-to-market equity ratios, R&D expenses and capital expenditures as proxies for growth opportunities. At the beginning of each year, we use the mean value of each proxy for growth opportunities to recognize a firm as high (low) growth firm if its growth opportunities are above (below) the mean.

Insert Table 7 about here

To test whether the liquidity benefits of holding excess cash accrues more to financial constrained firms or to firms with growth opportunities, we modify our baseline equation as follows:

$$LIQUIDITY_{i,t} = \alpha_0 + \beta_0 ECASH_{i,t-1} + \alpha_1 DUM + \beta_1 ECASH_{i,t-1} * DUM + \gamma Z_{i,t-1} + YEAR + INDUSTRY + \varphi_{i,t} \quad (6)$$

where DUM is a dummy variable that is defined either as *FC*, which takes a value of one if the firm is financially constrained, and zero otherwise or *GO*, which equals to one for firms with high growth opportunities, and zero otherwise. The remaining variables are as defined in Section 3.3. Our variable of interest is the interaction term ($ECASH_{i,t-1} * DUM$). When DUM is set to equal *FC*, a significantly negative (positive) β_1 would suggest that the liquidity benefits of excess cash is significantly higher (lower) for financially constrained firms than unconstrained firms. Similarly, when DUM is set to equal GO, a significantly negative (positive) β_1 would imply that excess cash brings more (less) liquidity benefits to growth firms than value firms.

Table 7 presents the results of the various specification of Equation (6). Panel A reports the results for financially constrained and unconstrained firms. When *lnLM*12 is used as the dependent variable, the coefficient on $ECASH_{i,t-1} * FC$ is negative and significant across all of the constraints measures, except KZ index, suggesting that the improvement in trading continuity associated with holding excess cash is greater for financial constrained firms. The coefficient on $ECASH_{i,t-1} * FC$ is also negative and significant for four out of the six constraints measures when *LIQBETA* is used as the dependent variable. For the remaining two classifications, namely credit ratings and KZ index, the magnitude of the *ECASH* coefficient is almost the same for the constrained and unconstrained firms. Nevertheless, Hadlock and Pierce (2010) and Farre-Mensa and Ljungqvist (2016) show that the dividend payout is unlikely to measure financial constraints and credit ratings are more likely to capture firm size and age rather than financial constraints. Hadlock and Pierce (2010) suggest that the KZ index is not related to firm characteristics that are believed to be associated with financial constraints and it is therefore unlikely to be a measure of financial constraints. Given these criticisms, we base our conclusions on more recently developed proxies for financial constraints, namely the WW index and the HP index, which suggest that excess cash reduces trading discontinuity and liquidity risk and the effect is greater for constrained firms.

Panel B reports the results for the high and low growth firms. In the specification where *lnLM*12 is the dependent variable, the coefficient on $ECASH_{i,t-1} * GO$ is negative and highly significant when R&D and CAPEX are used as growth opportunity measures. When *LIQBETA* is the dependent variable, the coefficient $ECASH_{i,t-1} * GO$ is negative, but only significant when R&D is used as the growth opportunities measure. These findings suggest that excess cash reduces trading discontinuity and liquidity risk and the effect is generally stronger for firms with greater growth opportunities.

Overall, our results suggest that the reduction in trading discontinuity and liquidity risk associated with holding excess cash is greater for financially constrained firms and firms with high growth opportunities, consistent with our *investment opportunities hypothesis*.

5.2.5. The role of crisis

Duchin et al. (2010) show that firms rely more heavily on cash holdings to finance their investments during the 2008 financial crisis. They also show that cash-rich firms outperform cash-poor firms during the recent financial crisis. This evidence suggests that investors perceive firms with excess cash as good investments during economic downturns and that the liquidity benefits of excess cash may be unique to the crisis periods. To investigate this possibility, we split our sample into crisis and non-crisis periods and present the results in Table 8.

Panel A of Table 8 reports the results for the periods before 2008, between 2008 and 2009, and after 2009. The coefficient on *ECASH* is significantly negative across the three sub-periods, suggesting that the liquidity benefits of excess cash are not unique to the recent global financial crisis. To further investigate the role of the crisis, we use information on the US business cycle expansions and contractions available from the National Bureau of Economic Research (NBER) and identify the years 1991, 2001, 2007, 2008, and 2009 as crisis years. Panel B present the results for the crisis and non-crisis periods. We find that excess cash improves trading continuity in both crisis and non-crisis periods. We also find that excess cash reduces liquidity betas, but this effect is significant only in the non-crisis periods. These results refute the view that the liquidity benefits of excess cash are specific to economic downturns.

Insert Table 8 about here

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6. Conclusion

Existing empirical studies on cash holdings focus mainly on the effects of corporate cash reserves on firm value and firm performance (e.g., Mikkelson and Partch, 2003; Pinkowitz and Williamson, 2007; Brown and Peterson, 2011). In this paper, we assess the costs and the benefits of excess cash by investigating the link between excess cash and the liquidity risk faced by investors and their required liquidity premium. To this end, we propose and test two competing hypotheses. The *investment opportunities hypothesis* asserts that excess cash reduces the volatility in the value of assets-in-place and attracts more uninformed trading, which, in turn, reduces trading costs, increases trading continuity, and reduces liquidity risk. In contrast, the *management entrenchment hypothesis* suggests that managers hoard cash to pursue their own objectives at shareholder expense. The growing fear of expropriation renders firms with excess cash unattractive to uninformed traders. The reduced participation of these traders, in turn, increases the cost at which market makers provide liquidity services, reduces investors' propensity to trade and increases liquidity risk.

We examine a large sample of US stocks and find evidence consistent with the *investment opportunities* hypothesis. Specifically, we show that excess cash reduces incidents of no trading and reduces stock price vulnerability to shocks to market liquidity. As investors face reduced liquidity risk, they require a lower liquidity premium. In terms of economic significance, our analysis suggests that a one unit increase in excess cash is associated with a 0.06 decline in liquidity beta, which translates into an average reduction of 0.489 percentage points (or 5.366% relative the sample mean) per annum in the cost of equity capital. We also investigate the impact of excess cash holdings on firm value. We show that while the direct effect of excess cash on firm value is negative, its indirect effect through liquidity is positive. Specifically, we find that the value to the marginal dollar of excess cash held by illiquid firms is significantly higher than that held by more liquid firms. Further analysis suggests that liquidity benefits of excess cash are higher for financial constrained firms and firms with high growth opportunities. Our results are robust over time, after addressing potential endogeneity issues, and to alternative estimation methods and alternative measures of liquidity.

Overall, this study contributes to literature on the link between cash holdings and stock liquidity (e.g., Gopalan et al., 2012; Charoenwong et al., 2014) by showing that excess cash improves trading continuity and liquidity risk. It also adds to the stream of studies on the link between corporate liquidity management and the expected equity returns (e.g., Palazzo, 2009; Simutin, 2010; Asem and Alam, 2014) by identifying liquidity risk as a channel through which excess cash can affect the cost of equity capital. Furthermore, it contributes to the literature by identifying liquidity as a new channel through which excess cash can affect firm value. Finally, we advance the literature on liquidity risk (e.g., Liu, 2006; Ng., 2011; Cao and Petrasek, 2014) by showing that excess cash is an important determinant of the liquidity beta.

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Table 1
Sample characteristics by stock market exchanges and trading continuity.
This table reports the mean and the median (in parentheses) of the dependent and independent variables used in our regression models over the period 1991-2014. *lnLM12* is a natural logarithm of Liu's (2006) trading continuity measure (*LM*12) and *LIQBETA* is the liquidity beta from Liu's (2006) liquidity-augmented CAPM (LCAMP). *ECASH* is the excess cash estimated as the residual of Equation (3); *MTB* is market value of assets divided by total assets; *SIZE* is the natural log of net assets deflated in 1994 dollars; *LEVERAGE* is the ratio of total debt scaled by net assets; *DIV* is a dummy variable with a value of one if a firm pays dividend, and zero otherwise; *CAPEX* is capital expenditures scaled by net assets; *R&D* is research and development expenditure scaled by sales; *PRICE* is the stock price; *RET* is the stock return; *NSHAR* is the number of shareholders; *BLOCK* is the total block ownership; *IO* is the total shares outstanding held by 13F institutions; *NASDAQ* is a dummy variable equal to one for NSADAQ stocks, and zero otherwise. The values of *ECASH*, *MTB*, *SIZE*, *LEVERAGE*, *DIV*, *CAPEX*, *R&D*, *PRICE*, *RET*, *NSHAR*, *BLOCK*, *IO* and *NASDAQ* are lagged in one period. Detailed variable definitions and sources are provided in Appendix A.

	Full sample (N=28,310)	NYSE/AMEX (N=15,018)	NASDAQ (N=13,292)
lnLM12	0.321	0.224	0.432
	[0.000]	[0.000]	[0.000]
LIQBETA	-0.222	-0.156	-0.297
	[-0.140]	[-0.082]	[-0.231]
ECASH	0.039	-0.052	0.143
	[0.204]	[0.083]	[0.341]
MTB	2.020	1.828	2.237
	[1.589]	[1.519]	[1.706]
SIZE	5.959	6.817	4.991
	[5.938]	[6.816]	[4.951]
LEVERAGE	0.237	0.267	0.203
	[0.206]	[0.252]	[0.124]
DIV	0.451	0.612	0.269
	[0.000]	[1.000]	[0.000]
CAPEX	0.070	0.068	0.073
	[0.050]	[0.050]	[0.051]
R&D	0.094	0.024	0.173
	[0.002]	[0.000]	[0.014]
PRICE	26.197	31.615	20.076
	[20.600]	[26.510]	[15.000]
RET	0.190	0.176	0.205
	[0.097]	[0.112]	[0.075]
NSHAR	1.387	1.739	0.989
	[1.037]	[1.447]	[0.655]
BLOCK	22.921	20.631	25.508
	[17.360]	[14.610]	[20.770]
IO	51.343	54.701	47.548
	[57.295]	[62.934]	[49.122]
NASDAQ	0.470	0.000	1.000
	[0.000]	[0.000]	[1.000]

Table 2
Correlation matrix of the dependent and independent variables.
This table shows the unconditional, pair-wise correlations of the variables used in the regression models. *lnLM12* is the natural logarithm of Liu's (2006) trading continuity measure (*LM*12) and *LIQBETA* is the liquidity beta from Liu's (2006) liquidity-augmented CAPM (LCAMP). *ECASH* is the excess cash estimated as the residual of Equation (3); *MTB* is market value of assets divided by total assets; *SIZE* is the natural log of net assets deflated in 1994 dollars; *LEVERAGE* is the ratio of total debt scaled by net assets; *DIV* is a dummy variable with a value of one if a firm pays dividend, and zero otherwise; *CAPEX* is capital expenditures scaled by net assets; *R&D* is research and development expenditure scaled by sales; *PRICE* is the stock price; *RET* is the stock return; *NSHAR* is the number of shareholders; *BLOCK* is the total block ownership; *IO* is the total shares outstanding held by 13F institutions; *NASDAQ* is a dummy variable equal to one for NSADAQ stocks, and zero otherwise. The values of *ECASH*, *MTB*, *SIZE*, *LEVERAGE*, *DIV*, *CAPEX*, *R&D*, *PRICE*, *RET*, *NSHAR*, *BLOCK*, *IO*, and *NASDAQ* are lagged in one period. Detailed variable definitions and sources are provided in Appendix A. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

		a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.
a.	lnLM12	1														
b.	LIQBETA	0.07***	1													
c.	ECASH	-0.06***	-0.05***	1												
d.	MTB	-0.15***	-0.07***	0	1											
e.	SIZE	-0.35***	0.02**	-0.02***	-0.22***	1										
f.	LEVERAGE	-0.03***	0.04***	0	-0.10***	0.23***	1									
g.	DIV	-0.02***	0.05***	-0.01*	-0.08***	0.37***	-0.03***	1								
h.	CAPEX	-0.01	-0.04***	-0.02***	0.12***	-0.07***	0	-0.07***	1							
i.	R&D	-0.05***	-0.04***	0.01	0.25***	-0.27***	0.06***	-0.16***	0.09***	1						
j.	PRICE	-0.20***	0	0.03***	0.22***	0.53***	-0.04***	0.32***	0.01	-0.11***	1					
k.	RET	-0.04***	-0.06***	0	0.17***	-0.04***	-0.06***	-0.04***	0.10***	-0.02***	0.10***	1				
l.	NSHAR	-0.20***	0.03***	0.03***	0.01*	0.56***	0.05***	0.32***	-0.01	-0.07***	0.30***	-0.02***	1			
m.	BLOCK	0.31***	0.03***	-0.04***	-0.05***	-0.29***	0.03***	-0.10***	0.03***	-0.03***	-0.22***	-0.02*	-0.28***	1		
n.	IO	-0.27***	-0.03***	0.05***	0	0.32***	-0.01	0.07***	-0.07***	-0.07***	0.28***	0.01	0.05***	-0.33***	1	
o.	NASDAQ	0.12***	-0.03***	0.06***	0.16***	-0.49***	-0.14***	-0.34***	0.03***	0.18***	-0.28***	0.02***	-0.30***	0.12***	-0.11***	1

Table 3
Excess cash and trading continuity.
This table displays results for the OLS estimations of the baseline regression model (Equation (4)). The dependent variable is the liquidity measure and is measured in two different ways: (a) as the natural logarithm of Liu's (2006) $LM12$ ($lnLM12$) and (b) as the liquidity beta (β_{il}) in Equation (2) ($LIQBETA$). Definitions of all dependent and independent variables can be found in Table 1 and Appendix A. The estimations include year and two-digit SIC industry dummies. The t-statistics, which are adjusted for clustering by firm and year, are reported in parentheses. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: lnLM12				Dependent variable: LIQBETA			
	Full Sample	Full Sample	Subsample NYSE/AMEX	Subsample NASDAQ	Full Sample	Full Sample	Subsample NYSE/AMEX	Subsample NASDAQ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ECASH	-0.038***	-0.035***	-0.018*	-0.046***	-0.063***	-0.065***	-0.043***	-0.082***
	(-4.262)	(-4.269)	(-1.719)	(-3.983)	(-6.256)	(-6.177)	(-3.799)	(-5.552)
MTB		-0.158***	-0.140***	-0.157***		-0.090***	-0.038**	-0.103***
		(-10.652)	(-8.102)	(-9.725)		(-3.417)	(-1.970)	(-3.084)
SIZE		-0.220***	-0.237***	-0.199***		-0.061**	-0.037	-0.078***
		(-9.640)	(-8.637)	(-7.760)		(-2.351)	(-1.177)	(-3.106)
LEVERAGE		0.185***	0.211***	0.140**		0.224**	0.176	0.239*
		(3.715)	(2.732)	(2.473)		(2.489)	(1.618)	(1.916)
DIV		0.129***	0.062**	0.215***		0.121***	0.091**	0.118**
		(4.265)	(1.990)	(4.069)		(3.206)	(2.136)	(2.173)
CAPEX		-0.686***	-0.987***	-0.518***		-0.621**	-1.173**	-0.093
		(-4.500)	(-4.289)	(-2.670)		(-2.068)	(-2.258)	(-0.257)
R&D		-0.169***	-0.037	-0.159***		-0.159	-0.070	-0.154
		(-6.429)	(-0.394)	(-6.677)		(-1.489)	(-0.304)	(-1.605)
PRICE		0.006***	0.005***	0.006***		0.003**	0.003**	0.003
		(6.978)	(6.276)	(4.290)		(2.009)	(2.329)	(1.145)
RET		-0.042**	-0.043**	-0.047**		-0.133***	-0.116*	-0.125***
		(-2.474)	(-2.251)	(-2.573)		(-2.751)	(-1.787)	(-3.012)

NSHAR		0.027***	0.056***	-0.014		0.070***	0.061***	0.064**
		(3.066)	(4.279)	(-0.862)		(5.150)	(4.039)	(2.107)
BLOCK		0.762***	0.569***	0.937***		0.075	0.012	0.119
		(8.262)	(6.561)	(6.600)		(1.222)	(0.236)	(1.165)
IO		-0.183***	-0.161***	-0.196***		-0.130*	-0.143**	-0.121
		(-4.553)	(-3.507)	(-3.272)		(-1.892)	(-2.007)	(-1.124)
NASDAQ		0.053				-0.032		
		(1.318)				(-0.809)		
lnLM12						0.078***	0.075***	0.089***
						(3.603)	(2.884)	(3.734)
Constant	1.095***	2.151***	2.001***	2.382***	0.498***	0.654***	0.384	0.838***
	(3.741)	(7.409)	(11.082)	(4.020)	(3.127)	(2.974)	(1.305)	(4.230)
Observations	28,310	28,310	15,018	13,292	28,310	28,310	15,018	13,292
Adjusted R-squared	0.063	0.273	0.253	0.318	0.031	0.043	0.051	0.052
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4

The joint effect of trading liquidity and excess cash on firm valuation.

This table displays results for the OLS estimations of the valuation regression model (Equation (5)). The dependent variable Q is defined as the market capitalization of common stock plus book value of long-term debt divided by total assets. The main independent variables are excess cash, trading liquidity and the interaction of these two. Liquidity (*LIQUIDITY*) measure is either $lnLM12$ or $LIQBETA$, which captures the trading activities during the current year. Following Roll et al. (2009), we include *SIZE* (market capitalization), *TURNOVER* (the sum of daily turnover over the prior 12 months), *ROA* (net income divided by total assets), *CAPEX* (capital expenditures by net assets), *LTD* (long-term debt divided by total assets), and *DIV* (dividend dummy which equals one if the firm pays a dividend, otherwise zero) as control variables in the regression. The t-statistics, which are adjusted for clustering by firm and year, are reported in parentheses. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variable: Q	
LIQUIDITY measures:	lnLM12	LIQBETA
ECASH	-0.104***	-0.088***
	(-5.269)	(-5.513)
LIQUIDITY	-0.017	-0.026**
	(-0.633)	(-2.099)
ECASHxLIQUIDITY	0.039***	0.009**
	(3.725)	(2.234)
SIZE	0.170***	0.174***
	(5.825)	(6.919)
TURNOVER	0.310***	0.306***
	(4.847)	(4.953)
ROA	0.294	0.294
	(0.515)	(0.522)
CAPEX	4.484***	4.450***
	(9.322)	(9.359)
LTD	-1.354***	-1.347***
	(-6.898)	(-6.860)
DIV	-0.284***	-0.278***
	(-5.081)	(-5.178)
Constant	1.193***	1.161***
	(3.846)	(3.836)
Observations	22,236	22,236
Adjusted R-squared	0.198	0.198
Year FE	Yes	Yes
Industry FE	Yes	Yes

Table 5
The results of the two-stage least squares instrumental variable (2SLS IV) regressions.
In the first stage, we regress excess cash (*ECASH*) on a selected instrument variable and a set of control variables, including industry and year dummies. We use the natural logarithm of the industry average excess cash holding (*IECASH*) as our instrument. We use the predicted values of *ECASH* from the first-stage regression in the second stage regressions. Further details on variable definitions and sources can be found in Table 1 and Appendix A. The t-values (for the first stage) and z-values (for the second stage) are reported in the parentheses and are computed from the heteroscedasticity adjusted standard errors, clustered by firm. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variables			
	First stage ECASH	Second stage lnLM12	First stage ECASH	Second stage LIQBETA
IECASH	1.047***		1.043***	
	(0.025)		(0.025)	
ECASH (instrumented)		-0.043***		-0.091***
		(0.016)		(0.019)
MTB	-0.099***	-0.158***	-0.111***	-0.093***
	(0.012)	(0.008)	(0.012)	(0.013)
SIZE	-0.057***	-0.220***	-0.074***	-0.063***
	(0.015)	(0.012)	(0.015)	(0.013)
LEVERAGE	0.474***	0.188***	0.487***	0.234***
	(0.077)	(0.045)	(0.077)	(0.068)
DIV	0.144***	0.130***	0.154***	0.122***
	(0.037)	(0.026)	(0.037)	(0.027)
CAPEX	1.410***	-0.673***	1.353***	-0.582**
	(0.226)	(0.135)	(0.226)	(0.245)
R&D	-0.182***	-0.170***	-0.195***	-0.162***
	(0.031)	(0.016)	(0.031)	(0.045)
PRICE	0.006***	0.006***	0.006***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
RET	-0.013	-0.042***	-0.016	-0.133***
	(0.012)	(0.007)	(0.012)	(0.027)
NSHAR	0.066***	0.028***	0.068***	0.073***
	(0.015)	(0.009)	(0.015)	(0.013)
BLOCK	-0.033	0.761***	0.026	0.076
	(0.082)	(0.060)	(0.082)	(0.068)
IO	0.217***	-0.180***	0.202***	-0.123***
	(0.053)	(0.033)	(0.053)	(0.045)
NASDAQ	0.141***	0.054*	0.145***	-0.026
	(0.043)	(0.031)	(0.043)	(0.030)
lnLM12			-0.078***	0.076***
			(0.019)	(0.014)
Constant	-0.197		-0.029	
	(0.207)		(0.203)	
Observations	28,310	28,310	28,310	28,310

Adjusted R-squared	0.283	0.241	0.285	0.023
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
IV F-stat	1797.80***		1783.42***	
CD Wald F-stat	6874.43***		6838.26***	

Table 6
The results from the Fama-MacBeth (1973) method.
This table presents the Fama-MacBeth regression estimates of Equation (4). The dependent variable is either *lnLM*12 or *LIQBETA*. The regression models include control variables, which are defined in more details in Table 1 and Appendix A. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Dependent variables	
	lnLM12	LIQBETA
ECASH	-0.042***	-0.068***
	(-7.366)	(-5.294)
MTB	-0.170***	-0.078**
	(-9.337)	(-2.759)
SIZE	-0.250***	-0.055**
	(-9.842)	(-2.100)
LEVERAGE	0.257***	0.291***
	(6.278)	(3.104)
DIV	0.167***	0.133***
	(8.103)	(3.464)
CAPEX	-0.432***	-0.395
	(-6.312)	(-1.006)
R&D	-0.193***	-0.237**
	(-7.896)	(-2.432)
PRICE	0.007***	0.003**
	(7.876)	(2.212)
RET	-0.038*	-0.118**
	(-2.066)	(-2.417)
NSHAR	0.050***	0.087***
	(6.219)	(6.433)
BLOCK	0.810***	0.151
	(9.210)	(1.491)
IO	-0.205***	-0.122*
	(-7.536)	(-1.875)
NASDAQ	0.062**	-0.040
	(2.137)	(-0.959)
lnLM12		0.067**
		(2.470)
Constant	1.733***	0.045
	(12.546)	(0.215)
Observations	28,310	28,310
Average R-squared	0.261	0.083

Table 7

Alternative liquidity measures.

This table displays results from Equation (4) with Amihud's (2002) illiquidity and the bid-ask spread as alternative liquidity measures. Amihud's (2002) illiquidity is defined as the average of the daily ratio of the absolute value of a stock's return to its dollar volume over the past the past 12 months. The bid-ask spread is defined as the average value of the daily difference between ask price and bid price, divided by the ask price, over the past 12 months. All regressions include control variables, year and two-digit SIC industry dummies. The t-statistics adjusted for clustering by firm and year are reported in parentheses and detailed variable definitions and sources can be found in Table 1 and Appendix A. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Full Sample	Subsample NYSE/AMEX	Subsample NASDAQ
Panel A. Dependent variable: Amihud (2002) Illiquidity			
ECASH	-0.018***	-0.009***	-0.026***
	(-6.725)	(-3.264)	(-5.294)
Observations	28,310	15,018	13,292
Adjusted R-squared	0.121	0.109	0.135
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Panel B. Dependent variable: Bid-ask spread			
ECASH	-0.060***	0.001	-0.092***
	(-6.389)	(0.125)	(-6.622)
Observations	23,858	10,967	12,891
Adjusted R-squared	0.636	0.674	0.669
Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Table 8

The role of financial constraints and growth opportunities.

This table provides a summary of the estimation of Equation (6). We define financially constrained firms as those: (i) in the bottom three size deciles; (ii) that do not pay dividend; (iii) that do not have credit ratings; (iv) in the top three KZ index deciles; (v) in the top three WW index deciles; and (vi) in the top three HP index deciles. We use book-to-market equity ratios, R&D expenses, and capital expenditures as proxies for growth opportunities. At the beginning of each year, we calculate the mean value of each proxy of growth opportunities and set a dummy value to 1 (0) for firms with high (low) growth opportunities. All regressions include control variables, year and two-digit SIC industry dummies. The t-statistics adjusted for clustering by firm and year are reported in parentheses and detailed variable definitions and sources can be found in Table 1 and Appendix A. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Interacted with financial constraint dummy (FC)

	Dependent variable: lnLM12					
FC measures:	ECASH	*t*-stat	ECASHxFC	*t*-stat	N	Adj. R2
Firm size	0.025***	(2.674)	-0.129***	(-6.393)	18,779	0.323
Payout ratio	-0.010	(-0.831)	-0.054***	(-3.440)	18,492	0.287
Credit ratings	0.016*	(1.932)	-0.076***	(-5.663)	28,310	0.277
KZ index	-0.053***	(-3.022)	0.030	(1.478)	13,951	0.254
WW index	0.024**	(2.401)	-0.103***	(-5.373)	18,247	0.294
HP index	-0.004	(-0.423)	-0.082***	(-4.710)	13,697	0.281
	Dependent variable: LIQBETA					
FC measures:	ECASH	*t*-stat	ECASHxFC	*t*-stat	N	Adj. R2
Firm size	-0.036**	(-2.089)	-0.052***	(-3.079)	18,779	0.038
Payout ratio	-0.028**	(-2.132)	-0.065**	(-2.311)	18,492	0.042
Credit ratings	-0.061***	(-3.872)	-0.006	(-0.444)	28,310	0.043
KZ index	-0.091***	(-5.412)	0.026	(1.101)	13,951	0.043
WW index	-0.026**	(-2.025)	-0.064***	(-3.075)	18,247	0.036
HP index	-0.011	(-0.572)	-0.078***	(-2.961)	13,697	0.042

Panel B: Interacted with growth opportunities dummy (GO)

	Dependent variable: lnLM12					
GO measures:	ECASH	*t*-stat	ECASHxGO	*t*-stat	N	Adj. R2
MTB	-0.038***	(-3.869)	0.014	(1.188)	28,310	0.275
R&D	-0.024***	(-2.672)	-0.059***	(-3.232)	28,310	0.275
CAPEX	-0.029***	(-3.032)	-0.019*	(-1.737)	28,310	0.273
	Dependent variable: LIQBETA					
GO measures:	ECASH	*t*-stat	ECASHxGO	*t*-stat	N	Adj. R2
MTB	-0.062***	(-5.905)	-0.012	(-0.486)	28,310	0.043
R&D	-0.044***	(-4.760)	-0.118***	(-2.676)	28,310	0.044
CAPEX	-0.057***	(-4.832)	-0.023	(-1.251)	28,310	0.043

Table 9

Sub-period analysis.

This table presents the OLS regression estimates of Equation (4) for the period before and after 2008. To further investigate the role of crisis, Panel A report the results for three sub-periods: before 2008, 2008-2009, and after 2009 for the liquidity model with *lnLM12* and *LIQBETA*, respectively. In Panel B, we use the US business cycle expansions and contractions information available in the National Bureau of Economic Research (NBER) and identify the years 1991, 2001, 2007, 2008, and 2009 as episodes of crisis and estimate Equation (4) separately for crisis and non-crisis periods. All regressions include control variables, year and two-digit SIC industry dummies. The t-statistics adjusted for clustering by firm and year are reported in parentheses and detailed variable definitions and sources can be found in Table 1 and Appendix A. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A:	Dependent variable: lnLM12			Dependent variable: LIQBETA		
	Before 2008	2008-2009	After 2009	Before 2008	2008-2009	After2009
ECASH	-0.046***	-0.025***	-0.006	-0.069***	-0.078***	-0.044***
	(-5.063)	(-3.736)	(-0.941)	(-4.855)	(-3.582)	(-2.671)
Observations	20,260	2,814	5,236	20,260	2,814	5,236
Adjusted R-squared	0.299	0.155	0.159	0.051	0.075	0.040
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B:	Dependent variable: lnLM12		Dependent variable: LIQBETA	
	Off crisis (NBER)	During crisis (NBER)	Off crisis (NBER)	During crisis (NBER)
ECASH	-0.036***	-0.031***	-0.072***	-0.035
	(-4.007)	(-4.228)	(-6.829)	(-1.210)
Observations	23,122	5,188	23,122	5,188
Adjusted R-squared	0.279	0.246	0.049	0.041
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Appendix A
Variable definitions.
The data sources are CRSP and Compustat unless specified otherwise. Data item codes are in *Italics*.

lnLM12	A natural logarithm form of Liu (2006)'s stock liquidity measure, which is the standardized turnover-adjusted number of days with zero trading volumes over prior 12 months (LM12): $\mathrm{LM12} = [\mathrm{ZEROS} + (1/\mathrm{TURNOVER})/\mathrm{DEFLATOR}] * 252/\mathrm{TRAD}$, where ZEROS is the total number of zero daily trading volumes in prior 12 months, TURNOVER is the sum of daily turnover over the prior 12 month, DEFLATOR is set to 11,000 as in Liu (2006) in order to ensure that $0 < \frac{1/\mathrm{TURNOVER}}{\mathrm{DEFLATOR}} < 1$ for all stocks, and TRAD is the total number of trading days over the prior 12 months.
LIQBETA	The liquidity beta is estimated from Liu's (2006) two-factor monthly time-series regression of stock excess returns on market excess returns and a liquidity mimicking factor over the prior 12 months for firm i in a given year: $r_{it} - r_{ft} = \alpha_i + \beta_{im}(r_{mt} - r_{ft}) + \beta_{il}\mathrm{LIQ}_{t,i} + \varepsilon_{it}$, where r_{it}, r_{ft}, and r_{mt} are monthly returns of firm i, US market, and one-month Treasury bill. Market return and one-month Treasury bill data is obtained from Kenneth French Website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html). LIQ is the mimicking liquidity, kindly provided by Weimin Liu More details on the construction of this factor can refer to Liu (2006, pp 550-551).
ECASH	The residual of a cross-sectional regression of cash holdings on firm characteristics (Equation (3)). The dependent variable is the natural log of cash and short-term investments (*che*) scaled by net assets (*at-che*). The independent variables include the ratio of cash flows (*ebitda-xint-txt-dvc*) scaled by net assets; the ratio of total debt (*dltt+dlc*) scaled by net assets; the market value of assets divided by total assets (*at-ceq+(csho*prcc)/at*); the natural log of net assets (*at-che*) deflated in 1994 dollars; net working capital (*wcap-che*), scaled by net assets; capital expenditures (*capx*) scaled by net assets; a dummy variable with a value of one if a firm pays dividends (*dvc*) and zero, otherwise; research and development expenses (*xrd*) scaled by sales (*sales*); a dummy which equals to one if a firm is in a regulated industry (including railroads (SIC code 4011), trucking (SIC code 4210 and 4213), airlines (SIC code 4512), and telecom (SIC code 4812 and 4813)), and zero otherwise; industry cash flow risk, defined as the mean of the ratio of the standard deviations of cash flows dividend by the total assets over 20 years for firms in the same industry (2-digit SIC code).
MTB	The market value of assets divided by total assets (*at-ceq+(csho*prcc)/at*).
SIZE	The natural log of net assets (*at-che*) deflated in 1994 dollars.
DIV	A dummy variable with a value of one if a firm pays dividend (*dvc*) and zero, otherwise.
CAPEX	Capital expenditures scaled by net assets, (*capx*/(*at-che*)).

R&D	Research and development expenses (*xrd*) scaled by sales (*sale*).
PRICE	The close price on a stock in a fiscal year (*prcc_f*).
RET	The stock's holding period return from CRSP (*ret*).
NSHAR	The natural log of the number of common/ordinary shareholders (*cshr*).
BLOCK	The fraction of closely held shares held by blockholders, including officers, directors, trusts, pension/benefit plans. Data source: Worldscope.
IO	The fraction of total shares outstanding held by 13F institutions. Data source: Thomson Reuters Institutional Manages (13F) Holdings.
NASDAQ	A dummy variable equal to one for NSADAQ stocks (*exchg*=14), and 0 otherwise.
Financial constraints	Measures: (a) Firm size: Constrained (unconstrained) firms are in the bottom (top) three deciles sorted by firm size (SIZE). (b) Payout ratio: Constrained (unconstrained) firms are in the bottom (top) three deciles sorted by payout ratio. Payout ratio is measured as the total payouts (*dvc*+*prstkc*) scaled by operating income (*oibdp* - *txt* - *xint* - *dvc*). (c) Credit rating: Unrated firms by S&P Domestic Long Term Issuer Credit Rating (*splticrm*) are classified as constrained, otherwise as financially unconstrained. (d) KZ index (Lamont, Polk, and Saa-Requejo, 2001): KZ = -1.001909*[(*ib* +*dp*)/*ppent*]+0.2826389*[(*at* + (*prcc_f***csho*) - *ceq* - *txdb*)/*at*] +3.139193*[(*dltt* + *dlc*)/(*dltt* +*dlc* + *seq*)]-39.3678*[(*dvc* + *dvp*)/*ppent*]-1.314759*[*che*/*ppent*], where ppent is the beginning of year *t*. (e) WW index (Whited and Wu, 2006; Hennessy and Whited, 2007): WW equals 1 if the total of common dividends and preferred dividends (*dvc*+*dvp*) is greater than zero, and 0 otherwise. (f) HP index (Hadlock and Pierce, 2010): HP= -0.737*SIZE+0.043*SIZE^2-0.04*age, where age is measures as the number of years since the firm's inception. Using KZ index, WW index, and HP index, constrained (unconstrained) firms are those in the top (bottom) three deciles.
Growth opportunities	Measures: (a) MTB; (b) R&D; (c) CAPEX (capital expenditures scaled by net assets, (*capx*/(*at*-*che*)). The full sample is split by the mean value of growth opportunities measure. Those greater (less) than the mean value are growth (value) firms.

Highlights

- We investigate how excess cash affects trading continuity and liquidity risk.
- The increase in investors' trading propensity reduces stock price exposure to shocks to market liquidity and the required liquidity premium.
- The liquidity benefits of excess cash are greater for financially constrained firms and firms with high growth opportunities.
- Findings are robust to alternative estimation methods and measures of liquidity.