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Liquidity and the implied cost of equity capital*

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Abstract

We investigate the impact of liquidity level and risks on the implied cost of equity capital for 14,808 stocks from 52 countries. We find that the implied cost of capital increases in the illiquidity level and in the co-variance between firm-level illiquidity and market illiquidity, but decreases both in the covariance between firm-level returns and market illiquidity and in the co-variance between firm-level illiquidity and market returns. Specifically, an increase from the 25th to the 75th percentile of the aggregate liquidity risk factor increases the cost of capital by 109 basis points. The evidence we report is robust to wide range of tests. We also observe that liquidity level and risks impact the implied cost of capital during crisis and no-crisis periods, but this relation is more pronounced during crisis periods for the most illiquid stocks.

JEL classification: G11; G12; G14; G15; F36
Keywords: Cost of equity; Liquidity risk; Dynamic conditional correlation; Financial crisis.

1. INTRODUCTION

This paper investigates stock liquidity as a determinant of the cost of equity for firms from 52 countries. Liquidity is a complex notion that influences the firm's cost of equity capital through at least two channels, level and risk (Amihud, 1986; Acharya and Pederson, 2005). Investors care about the *level* of liquidity because it enables them to trade large quantities at a low cost in a relatively short amount of time. Amihud and Mendelson (1986) were the first to link liquidity level and the firm's cost of equity by showing that expected returns increase in illiquidity costs. More recent studies however focus on the risk dimension of liquidity and demonstrate that stock liquidity constitutes a source of *risk* if it dissipates at inopportune times (e.g., Pástor and Stambaugh, 2003; and Sadka, 2006).[1] These studies show that independent of the level of liquidity, liquidity risk is significantly associated with stock expected returns. Although the evidence regarding the relationship between liquidity and stock returns is compelling, no study has investigated the important question of whether liquidity level and risks affect the *ex-ante* measures of the cost of equity capital. In this paper, we contribute to the literature by examining the relation between the ex-ante cost of equity capital, implied by share prices and analyst forecasts, and the time-varying stock's liquidity level and risks in a cross-country setting. We further evaluate the extent to which this relationship is affected by market downturns.

We rely on Amihud's (2002) liquidity measure, $Illiq$, as a proxy for the illiquidity level and supplement it with three time-varying liquidity risks that stem from co-variations between firm-level illiquidity and returns and market-level illiquidity and returns (e.g., Pástor and Stambaugh,

[1] For example, illiquidity costs may become excessively high during market downturns when investors need to exit a position or rebalance their portfolios (Acharya and Pedersen, 2005).

2003; Acharya and Pedersen, 2005; Sadka, 2006). In a unified theoretical model, Acharya and Pederson (2005) develop a theoretical Liquidity Adjusted Capital Asset Pricing Model (LCAPM) and identify three time-varying liquidity co-variance risks that determine expected returns. The authors show that expected returns (i) increase in the co-variances between firm-level illiquidity and market illiquidity, (ii) decrease in the co-variance risk between firm-level returns and market illiquidity, and (iii) also decrease in the co-variance risk between firm-level illiquidity and market returns. In other words, investors require higher expected returns for stocks that become illiquid when the market is illiquid, accept lower expected returns for stocks with high returns when the market is illiquid, and also accept lower expected returns for liquid stocks during market downturns. Empirically, even though liquidity is known to vary over time (e.g., Acharya and Pedersen, 2005; Hagströmer et al., 2013), most studies that investigate the pricing of liquidity assume constant liquidity risks and use *unconditional* liquidity variables. In contrast, our study follows the theoretical predictions of the LCAPM and estimates the time-varying conditional liquidity risks by deploying the Dynamic Conditional Correlation and the Generalized Autoregressive Conditional Heteroskedasticity DCC-GARCH(1,1), model. Regression analysis is then conducted to test the significance of the relation between the estimated time-varying liquidity risks and the ex-ante cost of equity.

We follow Hail and Leuz (2006) and estimate the ex-ante cost of equity capital, R_{ICC}, which serves as an appropriate measure of expected returns by investors on an ex-ante basis (Claus and Thomas, 2001; Gebhardt et al., 2001; Easton, 2004; Ohlson and Juetttner-Nauroth, 2005). Compared to realized returns, R_{ICC} is forward-looking with higher ability to capture time-varying expected returns (e.g., Pástor et al., 2008). Other studies also confirm the conclusion of advancing R_{ICC} as a proxy for expected returns (e.g., Botosan and Plumlee, 2005; Chava and

Purnanandam, 2010; Botosan et al., 2011; Li et al., 2013). We assess the relationship between R_{ICC} and liquidity level and risks for a comprehensive set of common stocks around the globe with available analyst forecast data. The cross-country setting is justified by the considerable variations in the implied cost of equity capital (Hail and Leuz, 2006) and in illiquidity level and risks across firms from different countries (Lee, 2011; Karolyi et al., 2012). The use of an international sample is therefore desirable because it allows our investigation to capture the wide spectrum in firm-level cost of equity and liquidity dynamics. The final sample set comprises 14,808 stocks over the period 1985 to 2012.

We follow the literature and control for firm- and country-level variables known to determine the cost of equity (e.g., Hail and Leuz, 2009). Our vector of control variables includes: size, beta, book-to-market ratio, and financial leverage at the firm level, and GDP-per-capita, financial market development, and inflation at the country level. The regression analysis reveals that the implied cost of capital is positively linked to the level of illiquidity, controlling for firm- and country-level factors and country, industry, and year fixed effects. Consistent with our expectations, we find that R_{ICC} increases in the co-variances between firm-level illiquidity and market illiquidity, decreases in the covariance between firm-level returns and market illiquidity, and also decreases in the covariance between firm-level illiquidity and market returns. The impact of illiquidity on the cost of equity capital is economically significant. We find that an increase from the 25th to the 75th percentile of the liquidity risk factor increases the cost of capital by 109 basis points. The reported evidence that firms with higher liquidity level and lower liquidity risks enjoy cheaper cost of equity capital on an ex-ante basis is novel and survives a battery of robustness tests including, alternative measures of the implied cost of equity, different liquidity estimates, endogeneity concerns, noise in the analyst forecasts, sample composition, and the introduction of additional control variables.

Our thorough investigation leads us to test the relation between the implied cost of capital and other aspects of liquidity risks that may not be captured by the liquidity co-movement risks described above. In an important paper, Chordia et al. (2001) advance that total volatility in the level of liquidity is a liquidity risk for which investors require compensation. However, the authors report a *negative* relation between liquidity volatility and expected returns relation, which has the opposite expected sign. Further, Pereira and Zhang (2010) argue that investors may have a preference for stocks with higher volatility in liquidity because it provides them with the flexibility to time their trades when liquidity costs are low. Accordingly, a positive relation between liquidity volatility and expected returns should be expected. In this paper, we contribute to this question and test the relation between R_{ICC} and liquidity volatility. Consistent with Petkova et al. (2011), we find that liquidity volatility is positively related to R_{ICC}, even after controlling for $Illiq$ and the three liquidity co-variation risks.

We then investigate the dynamics of the relation between the implied cost of equity and the level of illiquidity and liquidity risks during market downturns. Ang et al. (2014) show that while liquidity may not be a concern for investors during normal times, it can arise as a major challenge during crises times. In an early study, Chordia et al. (2001) depict the change in the behavior of liquidity around market returns and report that liquidity dries up in down markets and recovers in up markets. Pástor and Stambaugh (2003) report asymmetric correlations between stock liquidity and market returns and show strong correlation with negative market returns and near-zero correlation with positive returns. The recent financial crisis came as a further attestation of the importance of liquidity dynamics during financial turmoil and ignited subsequent research on this topic (e.g., Brunnermeier and Pedersen, 2009; Acharya et al., 2013). By focusing on the supply of liquidity, Brunnermeier and Pedersen (2009) argue that when markets are down, financial intermediaries face funding constraints and accordingly lower liquidity provision. Their model predicts stronger liquidity risk, i.e., higher liquidity sensitivity to market returns during market downturns. This prediction was later supported by many subsequent empirical studies (e.g., Hameed et al., 2010; Lang and Muffet, 2011; Rösch and Kaserer, 2013). Motivated by this literature, we test whether liquidity risks have a bigger impact on the cost of equity during crisis times than non-crisis times. We expect illiquid stocks to experience a higher impact of liquidity risk on the cost of capital during crisis periods since they are more affected by the decrease of liquidity provision (Jensen and Moorman, 2010). The empirical evidence supports our conjecture. We find that when market returns are subjected to negative shocks, the implied cost of equity increases in the covariance risk between stock illiquidity and market returns during crisis and non-crisis periods, but its crisis impact is higher for the less liquid stocks.

Our study contributes to the existing evidence on the determinants of the implied cost of equity in international markets. Cross-country studies on the implied cost of capital propose various explanatory variables such as voluntary disclosure (Francis et al., 2005), effective regulations (Hail and Leuz, 2006), cross-listings in U.S. financial markets (Hail and Leuz, 2009), and corporate governance (e.g., Chen et al., 2011). However, none of these studies explores the ability of liquidity level and risks to determine the implied cost of equity. Our paper is related to Lang et al. (2012) who show that firm-level transparency affects firm valuation and the implied cost of equity capital through market liquidity. This study is different because we focus on liquidity risks that are at the core of our study. Moreover, our paper is not concerned with the effect of the level of firm transparency on market liquidity and firm value, but rather on how different aspects of liquidity (i.e., level and risks) affect the cost of equity. In another liquidity-cost of equity paper, Ortiz-Molina and Phillips (2014) provide evidence that real asset liquidity affects firms' cost of capital. The authors focus on real asset liquidity and not stock liquidity. To our knowledge, this is the first study to provide evidence that the stock illiquidity level and the time-varying liquidity risks determine the implied cost of equity capital. We add to the existing literature by showing that firms whose stocks trade at low liquidity levels or high liquidity risks, measured either as co-movements or volatility, experience higher cost of equity. Finally, our results show that the cost of equity-liquidity risk relation is stronger during market downturns, only for illiquid firms.

Our paper is related to the empirical literature that links liquidity to expected returns. These studies typically use "realized" returns as a proxy for expected returns since they are not observable.[2] Evidently, realized returns are poor measures of expected returns (e.g., Elton, 1999; Easton and Monahan, 2005; Lundblad, 2007), and are shown to be notoriously noisy (Pástor et al., 2008). By using realized returns, these studies in effect investigate a *historical* return-liquidity relation; instead we are interested in a *current* relation. Accordingly, in an additional contribution we depart away from these studies and do not use an ex-post proxy for expected returns (i.e., historical returns) but rather focus on the ex-ante cost of capital, measured by the implied cost of capital.

Collectively, our results deepen our understanding of the relation between the cost of equity capital and liquidity. The link between the firm trading environment and the cost of equity is of utmost importance because it has implications on the value of the firm (Lang et al., 2012) and on

[2] These studies include Brennan and Subrahmanyam (1996), Amihud (2002), Datar et al. (1998), Brennan et al. (1998), Asparouhova et al. (2010), Brennan et al. (2012), and Bali et al. (2014).

other numerous corporate financial decisions including capital structure (Lipson and Mortal, 2009), equity issuance (Stulz et al., 2014), and dividend policy (Banerjee et al., 2007).[3] Our results indicate that a firm can enjoy a lower cost of capital if it can improve the level and decrease the co-movement and variability of the liquidity of its stocks. To achieve the lower cost of equity and hence higher firm value, firms should consider policies designed to increase liquidity such as stock split (Lin et al., 2009) or information timeliness and quality (Lang and Maffet, 2011).

The rest of the paper is organized as follows. Section 2 discusses the expected relationship between liquidity level and risks and the implied cost of equity capital. Section 3 describes the data and variables. Section 4 presents the main empirical evidence and robustness checks. Section 5 analyzes the impact of liquidity on the implied cost of capital during market downturns. Section 6 concludes.

2. LIQUIDITY AND THE IMPLIED COST OF EQUITY CAPITAL

In this study, we rely on the theoretical and empirical literature (e.g., Acharya and Pederson, 2005; Lou and Sadka, 2011; Karolyi et al., 2012) to test whether stock liquidity level and risks determine the ex-ante cost of equity capital. Acharya and Pederson (2005) show that liquidity affects expected returns through its roles as a stock characteristic (liquidity level) and as a systematic risk factor (liquidity co-variances). The authors identify three liquidity covariance risks determined by the co-movements between the firm-level illiquidity and returns ($Illiq^i$ and r^i) and market-level illiquidity and returns ($Illiq^M$ and r^M), respectively, where the

[3] For a review please see Holden et al. (2014).

superscript i refers to the individual stock and M to the market. The three liquidity risks are as follows:

i. $COV(Illiq^i, Illiq^M)$: This liquidity risk, known as commonality in liquidity, results from the co-movements between the firm-level illiquidity and the market illiquidity. When market experience a liquidity shock, investors who wish to rebalance their portfolios run the liquidity risk that the individual stocks that they hold may become simultaneously illiquid with the market, making any exit strategy prohibitively expensive in terms of transaction costs. The expected sign on the commonality risk is positive since investors require compensation to carry this risk.

ii. $COV(r^i, Illiq^M)$: The second liquidity risk is concerned with the co-movements between firm-level returns and market illiquidity, i.e., return sensitivity to market illiquidity. When faced with a liquidity shock at the market level, investors prefer stocks with high returns. The expected sign on this risk is negative since stocks with such a characteristic can serve as a potential hedge against market liquidity shocks.

iii. $COV(Illiq^i, r^M)$: The third liquidity risk relates to the co-movements between firm-level illiquidity and market returns, i.e., illiquidity sensitivity to market returns. When markets are down, liquid stocks become attractive as they allow investors to execute their investment strategies at low transaction costs. The expected sign on this risk is negative since these stocks serve as a potential hedge against wealth shocks resulting from market downturns.

As discussed earlier, Acharya and Pederson (2005) show that expected returns: increase in the risk of commonality in liquidity, decrease in the stock return sensitivity to market illiquidity, and also decrease in the stock illiquidity sensitivity to market returns. With the exception of Lee (2011) who extends the findings of Acharya and Pederson to international markets, most studies that investigate liquidity level and risks either focus on a single liquidity risk, or limit the scope of investigation to the United States financial markets, or both. For example, Lou and Sadka (2011) study the second liquidity risk that gauges the return sensitivity to market illiquidity in the United States. The authors stress the importance of distinguishing between liquidity level and liquidity risk as each captures different an attribute of the stock liquidity. Importantly, Lou and Sadka show that liquidity risk provides a better explanation of stock returns than the level of liquidity during the recent global financial crisis. Also within the borders of the United States, Hagströmer, et al. (2013) estimate the conditional versions of all three liquidity risks for U.S. stocks and report evidence that liquidity risks constitute systematic risk factors. Internationally, Karolyi et al. (2012) pay particular attention to the commonality in liquidity and survey the different explanatory determinants that may lead to co-movements between firm and market liquidity levels. Karolyi et al. (2012) group the different explanations either as supply-side (e.g. funding constraints of financial intermediaries) or as demand-side (correlated trading by institutional investors). While instead, Amihud et al. (2015) exclusively focus on liquidity level (not risks) and estimate the illiquidity premium in stock markets from 45 countries. The authors report a positive illiquidity premium that survives controlling for a host of risk factors and other firm characteristics. All these studies rely on realized returns as a proxy for expected returns. Our study builds on the existing liquidity literature by providing a comprehensive cross-country investigation of the relation between the different aspects of stock liquidity and the ex-ante cost of capital.

To empirically test the impact of illiquidity level on the cost of capital, we rely on Amihud's (2002) illiquidity measure. The intuition behind this proxy is that it measures liquidity as the ability to accommodate heavy trading with the least impact on price. Our conjecture is that firms with higher illiquidity are expected to have higher cost of equity because investors require extra compensation for holding such stocks. Our first hypothesis can be stated as follows:

H1. The implied cost of equity capital increases in stock illiquidity level.

We then test the effect of the three liquidity risks on the cost of equity, while controlling for the level of illiquidity. By assuming the same price per unit of liquidity risk, we can aggregate the three liquidity risks into the net liquidity covariance $COV_{\mathrm{net}}^{\mathrm{i}}$, which is defined as the summation of the three liquidity co-variances. This leads us to our second main hypothesis:

H2. The implied cost of equity capital increases in the net of conditional liquidity covariance risk, $COV_{\mathrm{net}}^{\mathrm{i}}$.

Linked to the second hypothesis is a set of sub-hypotheses that relate to the individual components of the net liquidity covariance risk. Specifically, we investigate whether the cost of equity is higher for firms whose illiquidity increases when the market illiquidity increases.

H2a. The implied cost of equity capital increases in the conditional covariance between the firm-level illiquidity and market illiquidity, $COV\left(Illiq^{i}, Illiq^{M}\right)$.

Firms that are able to sustain resilient returns when market liquidity is low should experience lower cost of capital. We expect that the cost of capital is lower for firms with high returns when the market liquidity is low.

H2b. The implied cost of equity capital decreases in the conditional covariance between the firm-level returns and market illiquidity, $COV(r^i, Illiq^M)$.

Finally, firms whose stock liquidity resists shocks in market returns are expected to enjoy cheaper cost of equity capital. We expect that the cost of capital is lower for firms with high liquidity when market returns are down.

H2c. The implied cost of equity capital decreases in the conditional covariance between the firm-level illiquidity and market returns, $COV(Illiq^i, r^M)$.

3. DATA AND VARIABLES

3.1. SAMPLE SELECTION AND SCREENS

We investigate the relation between the implied cost of capital and liquidity by extracting available equities for exchanges around the world from DataStream for the period of January 1985 to October 2012. To achieve the biggest breadth of stocks, we do not limit our sample to countries' major exchanges. For instance, we include Shanghai and Shenzen exchanges for China, Osaka and Tokyo stock exchanges for Japan, etc. For U.S. stocks, we only include stocks that trade on NYSE. We follow Karolyi et al. (2012) and only keep common stocks. We eliminate depositary receipts (DRs), real estate investment trusts (REITs), preferred stocks, and investment funds, iShares, mutual funds, municipal funds, 144A, and stocks with special features. In some instances, we apply filters that are specific to certain countries to eliminate preferred stocks, income trusts, and non-common stocks. The details of all stock-related filters are reported in Appendix A.

Subsequently, we apply the following screens. We exclude non-trading days when more than 90% of the stocks listed on a given exchange have zero returns. We exclude stock-month if the number of zero-return days in a certain month exceeds 80%. We set daily returns to missing if the value of the total return index for either the previous or the current day is below 0.01. To fix errors in Datastream data reporting, we follow Ince and Porter (2006) and set daily returns to missing if any daily return equals or exceeds 100%, and is reversed the following day. In other words, the daily returns for both days d and *d-1* are set to missing if $ret_d^i \times ret_{d-1}^i - 1 \leq 0.5$, where ret_d^i is the gross return for stock i on a day d, and at least one of the two returns is 200% or greater. We further impose a price restriction, stocks with prices at the end of year that fall within the bottom or top 2.5% percentile range of the cross section for a given country are removed from the sample the year after.

To calculate the Amihud's (2002) liquidity measure, we collect the daily total return index *(RI*), the daily trading volume (*VO*), the daily price in local currency (*P*), and the market capitalization in U.S. dollars (*MV*). We require each stock to have a valid market capitalization in U.S. dollars at the end of each year. For the computation of R_{ICC}, we use I/B/E/S to collect the positive one-, two-, and three- year-ahead mean forecasted earnings per share ($FEPS_{t+j}$) and the long-term growth rate forecast (*LTG*). We replace missing or negative $FEPS_{t+j}$ by the historical earnings per share, which are estimated using the beginning year book value per share and the three-year median return on equity in the same year, country, and industry (Frankel and Lee, 1998; Hail and Leuz, 2009). Only firms with sufficient I/B/E/S forecasts are considered in this study. We discard a firm-year observation if none of the implied cost of equity estimates converges (Easton, 2004; Claus and Thomas, 2001; and Gebhardt et al., 2001), or is undefined (Ohlson and Juettner-Nauroth, 2005).[4] Appendix B details the description of the four models.

3.2. IMPLIED COST OF EQUITY

We follow prior studies (e.g., Hail and Leuz, 2006; Dhaliwal et al., 2006) and compute R_{ICC} as the arithmetic average of cost of equity estimates derived from four separate models. Two of these four models are residual income valuation models (Gebhardt et al., 2001; Claus and Thomas, 2001) whereas the other two are abnormal growth models (Easton, 2004; Ohlson and Juettner-Nauroth, 2005). In all four models, the implied cost of equity capital is defined as the discount rate that equates the stock price to the present value of its expected future cash flows. So far, the academic literature in accounting and finance does not recommend the use of a specific model to estimate the implied cost of equity. Thus, similar to Hail and Leuz (2006) and Dhaliwal et al. (2006), we estimate four measures of the firm's cost of equity, and then take the corresponding average of the available measures. Using the average of the four estimates avoids any spurious results that may stem from the use of a particular model (Dhaliwal et al., 2006). The individual cost of equity measures estimated using the Claus and Thomas (2001), Gebhardt et al. (2001), Easton, 2004, and Ohlson and Juettner-Nauroth (2005) models and their average are denoted as R_{CT}, R_{GLS}, R_{ES}, R_{OJ}, and R_{ICC}, respectively. It is noted that R_{OJ} is estimated in a closed form solution whereas the remaining three measures (R_{CT}, R_{GLS}, and R_{ES}) involve numerical techniques where the solution is bounded between 0% and 100%.

[4] In an unreported robustness test, we impose the restriction of having a valid cost of equity estimate for each model before taking the average to calculate R_{ICC}. The results remain unchanged.

3.3. EXPLANATORY VARIABLES

3.3.1. LIQUIDITY LEVEL AND CO-MOVEMENTS

We rely on Amihud (2002) as a proxy for Kyle's (1985) price impact measure of stock illiquidity (λ). Goyenko et al. (2009) examine the ability of various liquidity proxies to capture high frequency transaction costs and conclude that Amihud measure outperforms others in measuring price impact. Hasbrouck (2009) reports that among the daily proxies, the Amihud measure is most correlated with price impact measures based on tick-to-tick data. Moreover, the Amihud's measure has the advantage of not requiring microstructure data. This is especially useful for an international sample analysis where the availability of finer tick-to-tick data is either entirely unavailable or limited to more recent years. Fong et al. (2016) compare daily liquidity proxies that were constructed from intraday data for firms from 42 international markets and find that among the different daily cost-per-volume proxies, Amihud is the best. The Amihud measure is also used in several international studies. For example, Karolyi et al. (2012) employ the Amihud proxy to estimate the commonality in liquidity in 40 countries. More recently, Amihud et al. (2015) use the Amihud measure to examine the illiquidity premium in global financial markets.

We follow the literature and add a constant to the Amihud measure and then take the natural logarithm:

$$Amh_d^i = \log(1 + \frac{|r_d^i|}{P_d^i VO_d^i}) \qquad (1)$$

Where $|r_d^i|$ is the absolute value of return in local currency, P_d^i is the price in local currency, which we convert to dollars using daily exchange rates, and VO_d^i the trading volume of stock *i* on day *d*. We construct the daily time-series liquidity measure for every stock within each country. To eliminate outliers, we simultaneously discard stock-day observations with a daily return, or stock price, or *Amh* measure in the top or the bottom 1% of the cross-sectional distribution within a country.

We run first-order auto-regressive filtering regressions to take the innovations in daily illiquidity while controlling for day-of-the-week effects in liquidity (Hameed et al., 2010; Karolyi et al., 2012). We estimate the following regression for every stock *i* based on daily observations on day *d* within a month *m*:

$$Amh_{m,d}^{i} = \alpha_{m}^{i} Amh_{m,d-1}^{i} + \sum_{\tau=1}^{5} \beta_{m,\tau}^{i} D_{\tau} + Illiq_{m,d}^{i} \qquad (2)$$

Where $D_{\tau}(\tau = 1, \dots, 5)$ denotes day-of-the-week dummies. We interpret the error term, $Illiq_{m,d}^{i}$ as the innovations in illiquidity level.

We take the equally-weighted average of firm-level returns, $r_{m,d}^{i}$, and firm-level illiquidity, $Illiq_{m,d}^{i}$, for all stocks in a market, *M*, to arrive at the daily market return, $r_{m,d}^{M}$, and the daily market illiquidity, $Illiq_{m,d}^{M}$, respectively.[5] The market portfolio includes all individual stocks within a country; however, in our calculations, we require that the market average to contain no less than 10 valid observations in a single day. The resulting daily time-series of the firm-level returns and illiquidity, and the market returns and illiquidity are then used to estimate the conditional liquidity co-variances at the firm level. In our computations, we utilize the dynamic conditional correlation and the generalized autoregressive conditional heteroskedasticity, DCC-GARCH(1,1), model. The estimated liquidity co-movements are between: the firm-level

[5] We rely on equally-weighted average because it is more representative of the market than the value-weighted average that is biased towards large stocks (Acharya and Pederson, 2005).

illiquidity and the market liquidity, $COV(Illiq^i, Illiq^M)$; the firm-level returns and the market illiquidity, $COV(r^i, Illiq^M)$; and the firm-level illiquidity and the market returns, $COV(Illiq^i, r^M)$. Moreover, as per Acharya and Pederson (2005) and Lee (2011), the aggregate co-variance risk, COV^i_{net}, is defined as the summation of the three liquidity co-variances:

$$COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M) \quad (3)$$

3.3.2. Control variables

Following the literature on the cost of equity (e.g., Hail and Leuz, 2006), we introduce the firm-level and country-level control variables known to determine the cost of equity. The firm-level variables are: firm size (*SIZE*), estimated as the natural logarithm of the firm's total assets in U.S. dollar; Beta (*BETA*), estimated as the co-variance between the firm returns and the market returns relative to the variance of the market returns; leverage (*LEVERAGE*), computed as total debt to the market value of equity; and finally Book-to-Market Ratio (*BTM*), computed as book value of equity divided by the market value of equity. The expected sign is negative for *SIZE* (Fama and French, 1992), and positive for *BETA* (Sharpe, 1964; Lintner, 1965), *LEVERAGE* (Fama and French, 1992), and *BTM* (Fama and French, 1992).

At the country-level, we control for: logarithm of GDP-per-capita (*LNGDP*); inflation (*INFL*), measured as the annualized median of a country-specific one-year-ahead realized monthly inflation rate; and financial development (*FD*): calculated as the sum of market capitalization and private credit relative to GDP. The expected sign is negative for *LNGDP* and *FD* (Wurgler, 2000), and positive for *INFL* (Hail and Leuz, 2006).

Additionally, to control for any bias due to unobservable omitted variables, we include country, industry, and year fixed effects. Industry classifications are based on Campbell's (1996) 12 industry groups. We note that the control variables and the fixed effects are included in all regressions in this study. The variables and their sources are defined in Appendix C.

3.4. DESCRIPTIVE STATISTICS

Table 1 presents the descriptive statistics for the implied cost of equity estimates based on a 108,322 firm-year observations between 1985 and 2012 for firms from 52 countries with available I/B/E/S forecast data. The reported means for the alternative cost of equity measures in Panel A of Table 1 indicate that R_{ES} and R_{OJ} (13.79%, and 13.23%) are higher than R_{CT} and R_{GLS} (10.66% and 7.51%). Consistent with prior findings (e.g., Dhaliwal et al., 2006; Gode and Mohanram, 2003), the Gebhardt et al. (2001) model produces the lowest cost of equity capital. Panel B reports the Pearson Correlations among the implied cost of equity estimates. In line with Dhaliwal et al. (2006), we find that the correlations with R_{ICC} are higher for R_{ES} and R_{OJ} (0.775 and 0.643) than for R_{CT} and R_{GLS} (0.288 and 0.503). All reported correlations are statistically significant at 1%. Panel C reports the distribution of R_{ICC} by country. The statistics reveal that R_{ICC} ranges widely across countries, from 5.54% in China to 20.53% in India. In terms of country composition, the United States has the highest firm-year observations (24,602), and Japan second highest (17,801).[6]

[Insert Table 1 about here]

Panel A of Table 2 reports the descriptive statistics for the liquidity and the main control variables. Panel B shows that the liquidity variables are strongly correlated with each other.

[6] We handle concerns relating to sample composition in section 4.2.5.

Focusing on the correlations with the dependent variable, R_{ICC}, we find that $Illiq$, $COV(Illiq^i, Illiq^M)$, COV_{net}^i, and $IlliqVar$ are positively correlated with R_{ICC} whereas $COV(r^i, Illiq^M)$ and $COV(Illiq^i, r^M)$ are negatively correlated. Likewise, Panel C reports the corresponding correlations for the control variables. We report that the firm-level determinants, *BETA*, *BTM*, *LEVERAGE* are positively correlated with R_{ICC} whereas *SIZE* is negatively correlated. Finally, we find that *LNGDP* and *INFL* are negatively correlated with R_{ICC} and that *FD* is not correlated with R_{ICC}.

[Insert Table 2 about here]

4. Empirical Results

We begin with a multivariate analysis where we regress the cost of equity (R_{ICC}) on the level of illiquidity and liquidity co-movements, a host of control variables, and country, industry, and year fixed effects. Section 4.1 reports evidence that the liquidity level and risks are significant determinants of the implied cost of capital. Section 4.2 subjects our results to a battery of robustness tests.

4.1. Main Evidence

To test the relation between liquidity level and co-movements and the cost of capital, we estimate several specifications of the following model using pooled cross-sectional time-series regressions with robust standard errors:

$$R_{ICC_t}^i = \alpha_0 + \beta_1 Illiq_t^i + \beta_2 COV(Illiq_t^i, Illiq_t^M) + \beta_3 COV(r_t^i, Illiq_t^M) + \beta_4 COV(Illiq_t^i, r_t^M) + \beta_5 Controls + FE + \varepsilon_t^i \quad (4)$$

The set of control variables ($Controls$) consists of the cost of equity determinants at the firm-level (*SIZE*, *BETA*, *LEVERAGE*, and *BTM*) and the country-level (*LNGDP*, *INFL*, and *FD*). *FE* comprises of fixed effects dummy variables at the country, industry, and year levels. The liquidity effects on the cost of equity that result from estimating equation (4) are reported in Table 3. We start by estimating five different models of equation (4) that do not control for the country-level variables, columns (1)-(5). Then, we re-estimate the five models after introducing the country-level control variables, columns (6)-(10).

Column (1) of Table (3) tests the relation between $Illiq$ and R_{ICC}. As anticipated, we find a positive and significant relation at the 1% level, in support of the prediction in H1 that the cost of equity increases in the level of stock illiquidity. In columns (2)–(5), we turn our focus to the liquidity co-movements, our second set of variables of interest. To avoid any potential multi-collinearity issues, we introduce each of the conditional liquidity co-variance measures $COV\left(Illiq^i, Illiq^M\right)$, $COV\left(r^i, Illiq^M\right)$, and $COV(Illiq^i, r^M)$, and their sum COV_{net}^i in a separate regression. We test the significance of the relation between liquidity risks and the cost of capital in columns (2)-(5), while controlling for $Illiq$, firm control variables, and fixed effects dummy variables. We find that the relation between each of the conditional liquidity co-movement measures and the cost of equity is significant with the correct sign. Specifically, column (2) shows that the estimated coefficient of $COV\left(Illiq^i, Illiq^M\right)$ is positive, 5.216, and significant at the 5% confidence level. Column (3) shows that the estimated coefficient of $COV\left(r^i, Illiq^M\right)$ is negative, -1.663, and significant at 1% confidence level. Our last liquidity co-variance risk, $COV(Illiq^i, r^M)$, is also significant with the correct sign, -5.017 and significant at the 5%

confidence level in column (4). Finally, COV_{net}^{i} is positive, 2.079, and significant at the 1% confidence level. $Illiq$ remains significant in columns (2)-(5). The reported signs and significance of the estimated coefficients on the three liquidity risks in columns (2)-(4) and on their aggregate in column (5) are consistent with the predictions in H2a-H2c and H2, respectively. The effect of liquidity on the cost of capital is economically significant. We estimate the impact of a move in a specific liquidity co-variance from the 25th (P25) to the 75th (P75) percentile on the cost of equity as the difference in the co-variance (P75 – P25) multiplied by the corresponding estimated liquidity co-variance coefficient. The percentiles and the estimated coefficients are reported in Tables 2 and 3 respectively. For example, holding all else constant, a move from P25 to P75 in $COV(Illiq^{i}, Illiq^{M})$ leads to (0.088 – 0.000) × 5.216 or 4.6 basis points increase in the cost of equity. A similar analysis shows that comparable moves in $COV(r^{i}, Illiq^{M})$ and $COV(Illiq^{i}, r^{M})$ lead to 56 and 18 basis points, respectively. Focusing instead on COV_{net}^{i}, since it integrates all the liquidity risks, the impact is 109 basis points.

The estimated coefficients in columns (6)-(10) that control for country variables continue to support H1, H2, and H2a-H2c. The reported evidence shows that the cost of equity increases in $Illiq$ (column 6), increases in the firm-level illiquidity co-movement with the market illiquidity (column 7), decreases in the firm-level return co-movement with the market illiquidity (column 8), and also decreases in firm-level illiquidity co-movement with the market returns (column 9). Column (10) shows that the summation of three liquidity co-variances is also significantly related to R_{ICC}.[7] Moreover, all the four firm-level determinants are found significant with the correct signs. Particularly, we document a positive and significant association between the implied cost of capital and each of *BETA*, *LEVERAGE*, and *BTM*, together with a significant negative relation

[7] Unreported results show that our findings hold when clustering at the firm level and also when running fixed effects and random effects panel estimations.

with *SIZE*. Therefore, the cost of equity is higher for firms that are riskier, smaller, and with higher financial leverage and *BTM* ratios. On the other hand, we report less significance for the country-level determinants. The evidence shows that while inflation is significantly associated with the implied cost of equity, neither are the levels of economic and financial developments (*LNGDP* and *FD*).

[Insert Table 3 about here]

4.2. Robustness Checks

We test the sensitivity of our primary relations between the implied cost of capital and liquidity level and co-movements by conducting the following robustness checks: alternative measures of the cost of capital (section 4.2.1); alternative measures of the liquidity risk (section 4.2.2); endogeneity considerations (section 4.2.3); noise in analyst forecasts (section 4.2.4); and finally institutional variables and sample composition (section 4.2.5). In all the robustness tests, we refrain from reporting five regression outputs that correspond to columns (5)-(10) of Table 3, instead we only report the estimation of the most comprehensive specification presented in column (10), which we refer to the baseline regression model.[8] The reported results confirm our basic findings.

4.2.1. Alternative measures of the cost of capital

This section investigates whether the reported results in Table 3 are robust to alternative model specifications. We address the concern that R_{ICC} is calculated as the arithmetic average of the four implied cost of equity measures ($R_{OJ}, R_{CT}, R_{ES}, R_{GLS}$) in two ways. First, Table 4 column

[8] We thank the referee for this suggestion. Moreover, in unreported evidence, all tests conducted in this paper support H2a-H2c and are available upon request.

(1) re-estimates the baseline regression model as described in Table 3 column (10) after replacing the average of the four individual model estimates with the principal component. Second, in columns (2)-(5) we replicate the baseline regression model for the individual measures of the cost of equity, i.e., we replace R_{ICC} with each of R_{OJ}, R_{CT}, R_{ES}, and R_{GLS}. The reported results in columns (1)-(5) show that $Illiq$ and COV_{net} remain significantly related to the implied cost of equity, irrespective of how we measure the cost of equity, supporting the predictions in H1 and H2, respectively.

It is important to note that the estimations of R_{OJ} and R_{CT} assume a long-term growth rate that is calculated using the yearly one-year-ahead realized inflation rate. This makes R_{OJ} and R_{CT} particularly sensitive to the choice of the long-term growth rate assumption. In comparison, the estimations of R_{ES}, and R_{GLS} do not require an assumption about the growth rate beyond the forecast horizon. This concern does not bias the inferences of our findings since the reported results for R_{OJ} and R_{CT} (columns 2 and 3) are similar to those for R_{ES}, and R_{GLS} (columns 4 and 5). Moreover, estimating the baseline regression model for the principal component for R_{ES} and R_{GLS} does not change our conclusion, column (6). Together, the reported evidence in support of H1 and H2 is robust to using alternative measures of the implied cost of capital model.

Finally, although the choice of the dependent variable, R_{ICC}, is common in the cost of capital literature (e.g., Hail and Leuz, 2006), the practice in international asset pricing studies is to use the risk premium. Accordingly, we replicate our baseline regression after replacing R_{ICC} with the risk premium (R_{RP}), defined as R_{ICC} less the 10-year U.S. Treasury bond yield. The results reported in Table 4 column (7) corroborate our earlier evidence that the illiquidity level and aggregate liquidity risk are components of the risk premium.

[Insert Table 4 about here]

4.2.2. ALTERNATIVE MEASURES OF THE LIQUIDITY

We assess the robustness of our findings to the choice of Amihud (2002) as the liquidity proxy by testing the relation between the cost of equity and other liquidity measures. Goyenko et al. (2009) report overwhelming evidence that low-frequency liquidity proxies can accurately measure actual transaction costs based on intraday data. Running 'horseraces' among numerous low-frequency liquidity estimates, the authors conclude that while Amihud (2002) does well measuring the price impact component of liquidity, other liquidity proxies are more closely associated with liquidity spreads. More recently, Fong et al. (2016) test the best liquidity proxies for global research. Similar in spirit to Goyenko et al. (2009), the authors compare low-frequency liquidity proxies to their accurate global intraday liquidity benchmarks. Fong et al. (2016) classify low-frequency liquidity proxies into two major categories: "percent-cost" liquidity proxies which measure transaction costs for small trades and "percent-per-dollar-volume" liquidity proxies which measure marginal transaction costs per U.S. dollar of volume. Among the different percent-per-dollar-volume liquidity proxies, Fong et al. (2016) find that the Amihud is the best estimate at the daily level and ties among the best at the monthly level. As for the percent-cost liquidity proxies, the authors report that the Closing Percent Quoted Spread advanced by Chung and Zhang (2014) dominates other estimates.

Following Chung and Zhang (2014), we calculate the daily Closing Percent Quoted bid-ask spread (*CPQS*) for every stock as the difference between the daily Ask price and the daily Bid price divided by the mean of the Ask and Bid prices. Using *CPQS*, we re-estimate the respective liquidity covariance risks and run the baseline regression model. Table 5 column (1) shows that the cost of equity increases in $CPQS$ and in the associated COV_{net}. These results certify that the predictions in H1 and H2 are valid for the spread estimate ($CPQS$) and therefore robust to the alternative measures of liquidity.

Next, we examine whether our results are affected by the way we measure liquidity risk. In addition to using LCAPM liquidity covariance risk, we estimate liquidity risk as liquidity volatility, $IlliqVar$, which measures liquidity total risk and is defined as the monthly variance of the daily Amihud liquidity measure.[9] In our calculations of $IlliqVar$, we require no less than 10 valid daily $Illiq$ observations within a month. We average all our liquidity measures within the same year for a given firm to end up with firm-year liquidity measures. We assess the relation between $IlliqVar$ and the implied cost of equity capital after we replace COV_{net} with $IlliqVar$ as the liquidity risk variable in the baseline regression model. The reported results in column (2) reveal significance on the estimated coefficient on $IlliqVar$. This finding further asserts that our prediction in H2 is robust to the way liquidity risk is being measured. In column (3) we test the significance of $lliqVar$ while controlling for $Illiq$ and the aggregate liquidity risk. We notice that introducing $IlliqVar$ in the regressions does not diminish the significance on $Illiq$ and COV_{net}. In other words, discriminating against the different liquidity risks by adding $IlliqVar$ does not subsume the cost of equity impact of liquidity level and liquidity systematic risk. Moreover, the significance of $IlliqVar$ (liquidity total risk) in the presence of the liquidity covariance risk (systematic risk) suggests that liquidity idiosyncratic risk has an influence on the cost of equity

[9] The empirical evidence that investigates expected return and liquidity volatility relationship yields conflicting results. Empirically, Chordia et al. (2001) capture liquidity by using stock trading activity measured as dollar trading volume or turnover. Calculating liquidity volatility based on monthly trading activity observations, Chordia et al. (2001) document a negative relation between liquidity volatility and returns. The authors argue that this rather puzzling result could be due to possible correlation between liquidity volatility and some omitted variable. More recently, Petkova et al. (2011) address this puzzle and examine the impact of volatility of liquidity on expected returns. The authors document evidence that stocks with higher liquidity volatility command higher premium. It is important to note that Petkova et al. (2011) differ from Chordia et al. (2001) in two ways: first, by using Amihud as a liquidity proxy, and second, by calculating liquidity volatility as the variation in the daily liquidity proxy.

and that liquidity covariance risk does not capture all the risks that liquidity exerts on the cost of equity.

[Insert Table 5 about here]

4.2.3. ENDOGENEITY

In this section, we address endogeneity concerns that could be caused by potential omitted variables and reverse causality. First, we mitigate the concern that both the cost of equity and stock liquidity variables are jointly and endogenously determined (contemporaneous relation) due potential missing explanatory variables by estimating two-stage least square, 2SLS, regression models (e.g., Jayaraman and Milbourn, 2012). In the first step, we instrument $Illiq$ and COV_{net} by their averages that are computed at the country-year level, while excluding the focal firm. To guarantee that the focal firm is not biasing our instruments and that our instruments are completely exogenous to the firm under examination, we calculate the instruments for every firm by taking the country-year liquidity level and risk averages across all remaining firms.[10] We run key diagnostic tests on the appropriateness of the employed instruments that are used in the first step of the 2SLS. Following Sanderson and Windmeijer (2016), we assess the relevance and strength of the instruments by conducing under-identification and weak-identification tests. The under-identification test examines whether the instruments are relevant, whereas the weak identification test examines whether the instruments are weak. We rely on the Anderson canon LM statistic for the under-identification test. The estimated statistics reveal that this test rejects the null hypothesis of under-identification. Having rejected the under-identification of the instruments, we test whether our model is weakly identified (i.e., the instruments are weak). The

[10] We thank an anonymous referee to raising this point. Our results remain unchanged when the focal firm is not excluded in the computation of the instrumental variable.

null hypothesis of weakly identified equations for the liquidity level and risk instruments is easily rejected based on the Cragg-Donald statistic. Building on the finding that the instruments for the illiquidity level and liquidity risk variables are relevant and strong, we re-estimate our baseline regression model using the 2SLS and report the results of the second stage in Table 6 column (1). The reported results show that our basic findings still hold. Specifically, we continue to find positive and significant estimated coefficients on $Illiq$ and COV_{net}, supporting the predictions in H1 and H2 that liquidity level and risk are significant determinants of the implied cost of equity.

We next address the issue of reverse causality as another potential source of endogeneity that can exacerbate the challenge of interpreting our results. The research question in this paper is built on the assumption that the direction of causality goes from stock liquidity to the cost of equity capital. In other words, a change in stock liquidity causes a change in the firm's cost of capital. However, if reserve causality underpins the true relation between the cost of equity and stock liquidity, then the direction of the causality is in the reverse order; that is, a change in the cost of equity causes a change in stock liquidity, and not the other way around. To ensure that our results do not suffer from the issue of reverse causality, we regress the cost of capital on *lagged* stock liquidity level and *lagged* liquidity risk, and the remaining control variables that were used in the previous regressions. The introduction of lagged liquidity regressors is necessary for making sure that the reported results are not influenced by the potential simultaneity issues between the cost of capital and liquidity level and risk. Table 6, column (2) shows that the basic conclusion is not affected. The estimated coefficients on the lagged liquidity level and risks are statistically significant and have the expected positive signs. The finding that the documented evidence on the relation between liquidity and the cost of capital is robust to endogeneity concerns adds to the credibility of our previous results. Columns (3) and (4) show the estimations of the regression models described in columns (1) and (2) after substituting the measure of the illiquidity level $Illiq$ with $CPQS$ and the measure of the aggregate liquidity covariance risk COV_{net} with $COV_{net(CPQS)}$. The results support our earlier findings that are shown in columns (1) and (2) and indicate that endogeneity issues do not seem to bias the interpretation of our documented evidence on the influence of liquidity level and risk on the implied cost of equity.

Finally, to ascertain that the evidence is free of any endogeneity considerations, we re-run our baseline regression by replacing each variable by its average at the (1) firm level and (2) country-year level. By construction, the averages of these variables are less likely to be endogenously determined with contemporaneous cost of equity capital. Similar to prior conclusions, in unreported results, we find evidence that the average cost of equity increases in the illiquidity level and in the net covariance liquidity risk.

[Insert Table 6 about here]

4.2.4. NOISE IN ANALYST FORECASTS

Many researchers raise concerns that analyst forecasts are poor predictors of future earnings and often times excessively optimistic, which causes the implied cost of capital to be biased upwards (e.g., Kothari, 2001). We test the robustness of our results for the noise in analyst forecasts in five ways. First, we control for the firm's long-term growth measure, (*LTG*), to address over optimism in long-term forecasts, by using I/B/E/S five-year consensus earnings growth rate as a control variable in estimating equation (4). Second, we introduce forecast bias (*FBIAS*) as an extra explanatory variable to control for the analyst forecast optimism bias, defined as difference between the one-year-ahead forecasted and realized earnings. Third, we use dispersion (*DISPERSION*) as another control for the inaccuracy in the analyst forecasts. This variable measures the degree of disagreement in the analyst forecasts and thus the uncertainty about forecasted earnings per share. Measured as the ratio of the standard deviation of estimated first year earnings per share by the average forecasted first year earnings per share, *DISPERSION* is shown to have a positive impact on the cost of equity (Gode and Mohanram, 2003). Fourth, we use analyst coverage (*ANALYSTCOV*) as another control variable, measured as the number of analysts who are covering the firm by providing earnings forecasts. Analyst coverage captures the availability of information and likely its precision (Bowen et al., 2008). *ANALYSTCOV* is expected to be negatively associated with the cost of capital (Gebhardt et al., 2001). Fifth, we recalculate the implied cost of capital after excluding *FBIAS* observations that are higher than the 90th percentile of the distribution, as an alternative to including the *FBIAS* variable to control for the optimism bias in analyst forecasts (El Ghoul et al., 2011), and then re-estimate our baseline regression model. In sum, we re-estimate four regression models by individually including each of the four control variables (*LTG*, *FBIAS*, *DISPERSION*, and *ANALYSTCOV*) in the regression models and then report the results in Table 7, Panel A, columns (1)-(4). Column (5) reports the results for the *FBIAS*-adjusted cost of capital estimates. The results in columns (1)-(4) show that the analyst forecast control variables (*FBIAS*, *DISPERSION*, and *ANALYSTCOV*) are significantly associated with the cost of capital, while *LTG* is not. In other words, the implied cost of capital increases in *FBIAS* and *DISPERSION*, decreases in *ANALYSTCOV*, and is independent of *LTG*. Most importantly, the inclusion of these control variables does not change our main conclusion. Column (5) confirms our prior findings; liquidity level and risk remain significantly associated with the *FBIAS*-adjusted implied cost of capital.

Last, we tackle the concern that analysts are often slow in their updates in the presence of new information (e.g., Ali et al., 1992) in two ways. First, following Hail and Leuz (2006) and El

Ghoul et al. (2016), we run weighted-least squares regressions where the weight is the inverse of analysts' dispersion. The motivation behind using this regression estimation methodology is that it assigns less weight to inaccurate forecasts. In column (6), we find that liquidity level and risk retain their sign and significance, eliminating concerns that the predictions in H1 and H2 are biased by inaccurate analyst forecasts. Second, we follow Hail and Leuz (2006) and re-estimate R_{ICC} using January prices rather than June prices to allow analysts sufficient time to update their forecasts. The unreported results of the regression analysis, using the newly estimated implied cost of capital ($R_{ICC_{Jan}}$), support previous evidence. In summary, the relation between the implied cost of capital and liquidity level and risk is clearly not influenced by the inaccuracy in the analyst forecasts.

[Insert Table 7 about here]

4.2.5. Sample composition and additional control variables

A potential concern regarding the empirical evidence is that the set of country control variables in all prior regressions (GDP-per-capita, financial market development, and inflation) may miss other important country variables. We address this issue by conducting extra robustness tests that include additional explanatory variables in our regression models. Drawing from prior cross-country literature on the determinants of the cost of equity capital (e.g., Hail and Leuz, 2006) and liquidity (e.g., Eleswarapu and Venkataraman, 2006; and Karolyi et al., 2012), we control for formal institutional determinants, such as the strength of investor protection, legal institutions, and the information environment.

To gauge the strength of a country's investor protection environment, we use the investor protection index (*INVP*), which is derived from the Doing Business report and measures the degree of legal protection a country provides to minority shareholders. We use the efficiency of the judicial system of La Porta et al. (1998) to control for the enforcement quality. The efficiency of the judicial system (*JUDICIAL*) is an index ranging from zero to ten representing the average of investors' assessments of conditions of the judicial system in each country between 1980-1983 (lower scores represent lower efficiency levels). Finally, we rely on the disclosure intensity index (*DISCL*) of Bushman et al. (2004) to measure a country's information environment. The Center for International Financial Analysis and Research (CIFAR) creates the disclosure intensity index, which measures the degree of financial disclosure based on accounting and non-accounting items reported in the annual reports of sample companies. A higher score in either of these institutional determinants (*INVP*, *JUDICIAL*, and *DISCL*) represents a better institutional environment.

Table 7 Panel B reports the results for the regression estimations of the baseline regression after augmenting the set of country controls by institutional variables that measure investor protection in column (1), the efficiency of judicial system in column (2), and the information environment in column (3). The reported evidence indicates that our main conclusion is not changed. We continue to find that liquidity level and risk maintain their sign and significance even in the presence of extra institutional determinants of the cost of capital.[11]

In the following robustness tests we evaluate the sensitivity of our basic findings to industry and country composition. First, we investigate whether the documented relation that R_{ICC} increases in $Illiq$ and in COV_{net} is driven by the presence of financial firms in our sample. The concern is that financial firms, known to have higher leverage ratios than other non-financial firms, may influence the reported evidence. Although, all our regressions control for industry

[11] We also follow Gray et al. (2013) and control for two cultural dimensions, individualism and uncertainty avoidance and unreported results show that our main results still hold.

fixed effects, we further alleviate this concern by re-estimating our baseline regression model after excluding financial firms (SIC codes 6000-6999). Column (4) shows that the exclusion of financial firms does not affect our results. Second, we test whether our results are affected by the unduly representation of firms from the United States and Japan. We re-estimate the baseline regression model for firms outside the United States in column (5) and outside Japan in column (6). The reported results show that the estimated coefficients on the liquidity level and risk remain positive and statistically significant, confirming that the association between the implied cost of capital and liquidity variables is prevalent for firms from countries outside the United States and Japan. Third, within the cross-country setting of our sample we explore conditions where liquidity is expected to have most impact on the cost of equity. Liquidity is normally a bigger concern in less developed markets with limited supply of funds and for smaller firms that may be financially constrained without viable financing sources. To test whether the reported relation between liquidity and the implied cost of equity capital is conditional on the stock market financial development, we re-run our baseline regression for two subsamples. The first subsample consists of countries with less financially developed markets, defined as markets in the bottom quartile of the market capitalization to GDP ratio, and the second subsample corresponds to countries with more financially developed markets, defined as markets in the highest quartile of the market capitalization to GDP ratio. Columns (7) and (8) show that the estimated coefficient on COV_{net} is statistically higher for countries with the less financially developed markets than for countries with the financially developed markets, respectively. In our last test, we assess whether the documented relation between the cost of equity and liquidity variables is stronger for the smaller firms. We estimate the regression model for small firms, defined as firms in the bottom quartile of the size distribution of the sample firms, and then separately for large firms, defined as firms in the highest quartile of the size distribution of the sample firms. Columns (8) and (9) reveal that the estimated coefficient on COV_{net} is statistically higher for small firms than for large firms, respectively. In summary, consistent with our conjecture, we find that the impact of liquidity risk on the cost of equity is higher in less developed markets and for smaller firms.

Finally, we test the impact of controlling for cross-listed firms on the relation between the cost of equity and liquidity levels and risk. Hail and Leuz (2009) document that cross-listing in the U.S. financial markets reduces the firm's implied cost of equity. We re-estimate the regression model with an extra dummy variable (*CROSSLIST*), defined to take the value of one for firms that cross-list in the U.S., and zero otherwise. We find that adding *CROSSLIST* as an extra control variable in our regression has no impact on the evidence reported earlier, column (11). Finally, our last sensitivity test relates to the use of *BETA*. Earlier research (e.g., Gebhardt et al., 2001; Lee et al., 2009) casts doubt on the relation between the implied cost of capital and market beta. Moreover, Hail and Leuz (2006) show that the return-volatility better explains the cost of capital than market beta. Hence, we replace *BETA* with return volatility (*RETVOL*), defined as the 1-year volatility of daily returns, and re-estimate the model. The reported results in column (12), once again, reinforce our prior findings.

In conclusion, we report evidence that liquidity level and co-movements determine the implied cost of equity. This evidence is resilient to alternative measures of the cost of equity and liquidity risks, endogeneity concerns, noise in analyst forecast, sample composition, and extra control variables.

5. IMPLIED COST OF CAPITAL AND MARKET DOWNTURNS

We build on prior literature that studies the dynamics of liquidity risks during crisis periods (Hameed et al., 2010; Brunnermeier and Pedersen, 2009; Rösch and Kaserer, 2013) by testing for a higher impact of liquidity risk on the cost of equity during market downturns. We define market downturn period, or crisis period, as a period when the market return drops below its 3-year historical moving average by more than one standard deviation. For each of the three liquidity co-variances and net co-variance, we estimate a regression model during the no-crisis period (4 models) and then during the crisis period (4 models) and report the results in Table 8. Columns (1)-(8) show that the liquidity co-variance risks are significantly related to the implied cost of equity in both crisis and no-crisis period, except for $COV\left(r^i, Illiq^M\right)$, which we found to be statistically insignificant during crisis periods, column (4). We note that although $COV\left(Illiq^i, Illiq^M\right)$ and $COV(Illiq^i, r^M)$ are significantly related to the implied cost of equity in both periods, the difference in coefficients between crisis and no-crisis periods is not statistically significant.

In our investigation we distinguish among stocks by their liquidity level and test whether the documented relation between liquidity risk and the cost of equity is higher for the less liquid stocks during crisis periods. The reported results in columns (9)-(12) show that the results of $COV\left(Illiq^i, Illiq^M\right)$ and $COV\left(r^i, Illiq^M\right)$ for illiquid stocks are not different from the results for the entire sample stocks. That is, there is no statistical difference in the influence of either covariance risk on the implied cost of equity between the crisis period and the no-crisis period. However, we find that the effect of the risk of stock illiquidity sensitivity to market returns, $COV(Illiq^i, r^M)$, on the implied cost of equity is significantly stronger during crisis times than the no-crisis period. The no-crisis coefficient is -3.691 with a *t*-stat of -1.658 (column 13), while the crisis coefficient is -10.092 with a *t*-stat of -3.663 (column 14). The difference is statistically significant at the 5% level (one-tailed test). These results suggest that when facing a wealth shock, investors pay attention to the co-variance between stock illiquidity and market returns, mostly for the less liquid stocks.

[Insert Table 8 about here]

6. CONCLUSION

Liquidity impacts the implied cost of equity capital because shareholders require an extra premium for holding illiquid or high liquidity-risk stocks. Traditionally, the focus was on liquidity level; however, more recent literature shifted attention to liquidity risk, defined by liquidity co-movements across securities, and shows that liquidity is a priced risk factor that systematically affects asset prices. This study contributes to this literature by providing evidence on the relationship between the different liquidity aspects (i.e., level, co-movements, and variability) and the implied cost of capital for 14,808 unique stocks from 52 countries. We document significant association between the implied cost of capital and liquidity level and co-movements. The evidence we report is robust to alternative measures of the implied cost of capital, different estimates of liquidity, endogeneity considerations, noise in the analyst forecasts, sample composition, and additional control variables.

Moreover, the significance of liquidity volatility while controlling for the co-variance liquidity risk factors suggest that liquidity idiosyncratic risk affects the implied cost of capital. Together, our results imply that liquidity impacts the cost of equity through multiple, yet independent, channels. In addition, the documented evidence has implications on firms' control over its cost of capital. Our results suggest that a firm would be able to lower its cost of capital if it can enhance the liquidity level of its traded stock or reduce any of its liquidity co-movements and volatility. Finally, our financial crisis analysis suggests that when markets face a wealth shock, the cost of equity only for the illiquid stocks increases in the co-variance risk between stock liquidity and market return. We believe that our findings are important and offer a thorough assessment of the complex relation between liquidity and the cost of equity capital.

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Table 1
Descriptive statistics of the implied cost of equity

This table reports descriptive statistics for the cost of equity. Panels A and B report the descriptive statistics and the correlation matrix of the cost of equity obtained from four models $\mathbf{R_{ES}}$, $\mathbf{R_{OJ}}$, $\mathbf{R_{CT}}$, and $\mathbf{R_{GLS}}$ which represent the implied cost of equity estimates of the Easton (2004), Ohlson and Juettner-Nauroth (2005), Claus and Thomas (2001), and Gebhardt et al. (2001) models, respectively. Panel C reports the descriptive statistics by country for the $\mathbf{R_{ICC}}$, which is the average cost of equity obtained from the four models $\mathbf{R_{ES}}$, $\mathbf{R_{OJ}}$, $\mathbf{R_{CT}}$, and $\mathbf{R_{GLS}}$. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix B describes $\mathbf{R_{ES}}$, $\mathbf{R_{OJ}}$, $\mathbf{R_{CT}}$, and $\mathbf{R_{GLS}}$ models. Appendix C provides definitions and data sources for all variables.

Panel A: Alternative measures of the implied cost of capital

	N	Mean	P25	P50	P75	St. dev
R_{ES}	100,260	13.79%	9.48%	12.03%	15.92%	7.34%
R_{OJ}	91,961	13.23%	9.73%	12.10%	15.53%	5.38%
R_{CT}	75,933	10.66%	8.09%	10.03%	12.81%	4.60%
R_{GLS}	90,561	7.51%	4.58%	6.95%	9.62%	4.16%

Panel B: Correlations between the alternative measures of the implied cost of capital

	R_{ES}	R_{OJ}	R_{CT}	R_{GLS}	R_{ICC}
R_{ES}	1.000				
R_{OJ}	0.905***	1.000			
R_{CT}	0.243***	0.324***	1.000		
R_{GLS}	0.362***	0.451***	0.585***	1.000	
R_{ICC}	0.775***	0.643***	0.288***	0.503***	1.000

Panel C: Descriptive statistics of the implied cost of capital by country

Country	N	Mean	P25	P50	P75	St. dev
Argentina	235	11.20%	5.42%	7.11%	12.62%	10.07%
Australia	2,472	11.31%	4.94%	8.17%	14.27%	9.70%
Austria	437	6.43%	3.91%	5.08%	7.30%	4.42%
Belgium	819	7.04%	4.34%	5.52%	7.77%	4.98%
Brazil	404	9.10%	4.90%	7.01%	11.47%	6.48%
Canada	4,452	9.70%	4.58%	6.53%	12.43%	8.14%
Chile	466	8.95%	4.17%	5.40%	8.40%	12.25%
China	3,721	5.54%	3.42%	4.43%	6.21%	3.66%
Croatia	30	10.51%	4.33%	5.31%	12.95%	10.13%
Czech Republic	35	13.30%	4.98%	6.88%	16.99%	12.74%
Denmark	1,216	8.87%	4.43%	5.81%	9.25%	8.62%
Egypt	220	10.26%	6.36%	8.32%	12.49%	5.95%
Finland	1,084	7.84%	4.70%	5.97%	8.16%	6.07%
France	4,851	7.22%	4.09%	5.18%	7.29%	6.66%
Germany	1,084	7.29%	4.19%	5.27%	7.26%	6.56%
Greece	559	6.69%	3.83%	5.15%	7.54%	5.06%
Hong Kong	2,831	9.02%	5.16%	6.79%	10.11%	7.09%
Hungary	206	9.67%	5.59%	7.46%	11.03%	7.52%
India	53	20.53%	12.78%	18.08%	24.27%	11.97%
Indonesia	1,041	11.26%	5.44%	7.63%	12.70%	10.74%
Ireland	176	8.06%	4.64%	5.78%	6.80%	8.97%
Israel	251	8.70%	4.68%	6.38%	9.74%	8.06%
Italy	2,280	7.78%	3.83%	5.25%	8.30%	7.60%
Japan	17,801	6.37%	3.11%	4.33%	6.57%	6.96%
Kuwait	44	8.59%	3.88%	5.44%	10.76%	7.22%
Malaysia	3,046	6.67%	4.11%	5.36%	7.37%	4.94%
Mexico	660	8.20%	4.65%	6.19%	9.52%	6.72%
Morocco	139	7.68%	4.00%	5.68%	9.03%	5.48%
Netherlands	1,906	7.45%	4.87%	5.90%	7.43%	6.21%
New Zealand	654	6.72%	4.17%	5.37%	7.36%	4.97%
Norway	1,405	12.79%	5.64%	8.91%	15.90%	11.14%
Oman	41	8.02%	5.16%	6.90%	8.25%	4.34%
Pakistan	268	13.32%	6.92%	9.67%	15.00%	12.24%
Philippines	548	9.61%	4.78%	6.36%	10.59%	9.36%
Poland	222	11.96%	5.88%	9.14%	15.37%	10.61%
Portugal	407	7.44%	4.17%	5.28%	8.34%	5.58%
Qatar	49	7.74%	5.57%	6.92%	8.63%	3.60%
Russian Federation	100	18.32%	10.91%	15.80%	23.04%	11.23%
Saudi Arabia	178	9.09%	5.13%	6.63%	12.07%	5.96%
Singapore	1,829	7.20%	4.01%	5.60%	8.13%	5.64%
South Africa	1,503	8.77%	5.71%	7.08%	9.23%	6.53%
South Korea	816	12.39%	6.25%	8.71%	16.60%	9.04%
Spain	1,813	7.16%	4.04%	5.30%	7.25%	6.96%
Sri Lanka	146	10.36%	6.21%	8.59%	12.11%	6.54%
Sweden	2,536	9.76%	4.71%	6.38%	11.08%	9.05%
Switzerland	2,297	6.45%	3.94%	4.95%	6.42%	5.62%
Taiwan	2,415	7.14%	4.22%	5.54%	7.65%	5.75%
Thailand	2,019	9.16%	5.13%	6.97%	10.31%	7.49%
Turkey	646	10.19%	5.54%	7.44%	11.93%	7.80%
United Arab Emirates	48	8.10%	4.58%	7.37%	9.70%	5.94%
United Kingdom	11,261	9.08%	4.11%	5.75%	9.93%	9.75%
United States	24,602	6.29%	4.16%	5.08%	6.62%	4.46%
Total	108,322	7.64%	4.08%	5.40%	8.10%	7.22%

Table 2
Descriptive statistics and correlation matrix of the explanatory variables

This table reports descriptive statistics and Pearson's correlation coefficients for the main variables used in the regressions. Panel A reports descriptive statistics for the main explanatory variables. Panel B reports Pearson's correlation coefficients for the liquidity variables and the cost of equity. Panel C reports Pearson's correlation coefficients for the main control variables and the cost of equity. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables.

Panel A: Descriptive Statistics of the main explanatory variables

	N	Mean	P25	P50	P75	St. dev
Illiquidity variables						
Illiq	108,322	1.226	0.000	0.011	0.377	4.609
$\boldsymbol{COV(Illiq^i, Illiq^M)}$	108,322	1.356	0.000	0.000	0.088	5.849
$\boldsymbol{COV(r^i, Illiq^M)}$	108,322	-4.353	-3.373	-0.181	-0.010	12.382
$\boldsymbol{COV(Illiq^i, r^M)}$	108,322	-1.167	-0.356	-0.013	0.000	3.716
$\boldsymbol{COV^i_{net}}$	108,322	6.876	0.018	0.407	5.269	17.193
Control variables						
BETA	108,322	0.9843	0.6029	0.9375	1.2916	0.5768
BTM	108,322	0.9990	0.2959	0.5379	0.8529	8.1826
LEVERAGE	108,322	0.3140	0.0500	0.2529	0.5144	0.2826
SIZE	108,322	13.7899	12.4482	13.6403	14.9696	1.9175
LNGDP	105,839	10.0960	10.2351	10.4257	10.5238	0.8894
FD	102,370	103.2799	62.8009	89.6644	130.3927	68.7111
INFL	99,509	2.5092	1.2220	2.1762	3.3145	3.4605

Panel B: Pearson's correlations between illiquidity variables and the implied cost of capital

	Illiq	$\boldsymbol{COV(Illiq^i, Illiq^M)}$	$\boldsymbol{COV(r^i, Illiq^M)}$	$\boldsymbol{COV(Illiq^i, r^M)}$	$\boldsymbol{COV^i_{net}}$	$\boldsymbol{R_{ICC}}$
Illiq	1.000					
$\boldsymbol{COV(Illiq^i, Illiq^M)}$	0.638***	1.000				
$\boldsymbol{COV(r^i, Illiq^M)}$	-0.194***	-0.319***	1.000			
$\boldsymbol{COV(Illiq^i, r^M)}$	-0.675***	-0.587***	0.245***	1.000		
$\boldsymbol{COV^i_{net}}$	0.502***	0.697***	-0.882***	-0.592***	1.000	
$\boldsymbol{R_{ICC}}$	0.104***	0.105***	-0.082***	-0.107***	0.118***	1.000

Panel C: Correlations between the main control variables and the implied cost of capital

	$\boldsymbol{R_{ICC}}$	BETA	BTM	LEVERAGE	SIZE	LNGDP	FD	INFL
$\boldsymbol{R_{ICC}}$	1.000							
BETA	0.106***	1.000						
BTM	0.099***	0.005	1.000					
LEVERAGE	0.091***	0.038***	0.118***	1.000				
SIZE	-0.190***	0.134***	0.017***	0.343***	1.000			
LNGDP	-0.035***	0.062***	-0.083***	-0.056***	0.129***	1.000		
FD	-0.005	-0.021***	-0.011***	-0.182***	-0.034***	0.116***	1.000	
INFL	0.085***	-0.020***	0.055***	0.070***	-0.039***	-0.356***	-0.122***	1.000

Table 3
Illiquidity risks and the implied cost of capital

This table reports pooled OLS regression results of the following implied cost of equity capital model:

$$R^i_{ICC_t} = \alpha_0 + \beta_1 Illiq^i_t + \beta_2 COV\left(Illiq^i_t, Illiq^M_t\right) + \beta_3 COV\left(r^i_t, Illiq^M_t\right) + \beta_4 COV\left(Illiq^i_t, r^M_t\right) + \beta_5 Controls_{i,t} + FE + \varepsilon^i_t$$

The dependent variable R_{ICC} is the average of the four implied cost of equity capital models described in Appendix B. Liquidity variables are: $Illiq^i$: defined as the innovation in stock illiquidity using Amihud (2002) model, $COV(Illiq^i, Illiq^M)$: co-movement between firm-level illiquidity and market illiquidity, $COV(r^i, Illiq^M)$: co-movement between firm-level returns and market illiquidity, $COV(Illiq^i, r^M)$: co-movement between firm-level illiquidity and market returns, and $COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$. The set of control variables ($Controls$) is comprised of the cost of equity determinants at the firm-level and the country-level. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The firm-level variables are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

Variables	(1) R_{ICC}	(2) R_{ICC}	(3) R_{ICC}	(4) R_{ICC}	(5) R_{ICC}	(6) R_{ICC}	(7) R_{ICC}	(8) R_{ICC}	(9) R_{ICC}	(10) R_{ICC}
Liquidity variables										
Illiq	7.733***	4.130*	7.700***	5.353*	5.269**	6.745***	3.215*	6.695***	3.995*	4.261**
	(3.126)	(1.733)	(3.144)	(1.869)	(2.446)	(3.476)	(1.830)	(3.503)	(1.971)	(2.590)
$COV(Illiq^i, Illiq^M)$		5.216**					5.026*			
		(2.022)					(1.968)			
$COV(r^i, Illiq^M)$			-1.663***					-1.573**		
			(-2.684)					(-2.070)		
$COV(Illiq^i, r^M)$				-5.017**					-5.536**	
				(-2.132)					(-2.530)	
COV^i_{net}					2.079***					2.018**
					(3.009)					(2.424)
Control variables										
BETA	0.018***	0.018***	0.018***	0.018***	0.017***	0.018***	0.018***	0.017***	0.018***	0.017***
	(8.468)	(8.567)	(8.687)	(8.506)	(8.699)	(9.057)	(9.163)	(9.267)	(9.090)	(9.301)
BTM	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(3.539)	(3.537)	(3.542)	(3.538)	(3.542)	(4.172)	(4.170)	(4.173)	(4.171)	(4.173)
LEVERAGE	0.058***	0.058***	0.058***	0.058***	0.058***	0.057***	0.057***	0.057***	0.057***	0.057***
	(13.498)	(13.163)	(13.406)	(13.296)	(13.175)	(13.012)	(12.689)	(12.931)	(12.789)	(12.703)
SIZE	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(-5.487)	(-5.353)	(-5.467)	(-5.372)	(-5.367)	(-5.566)	(-5.427)	(-5.542)	(-5.436)	(-5.432)
LNGDP						-0.013	-0.013	-0.013	-0.013	-0.012
						(-0.599)	(-0.573)	(-0.591)	(-0.574)	(-0.568)
FD						-0.000	-0.000	-0.000	-0.000	-0.000*
						(-1.491)	(-1.560)	(-1.626)	(-1.607)	(-1.729)
INFL						0.001***	0.001***	0.001***	0.001***	0.001***
						(9.692)	(9.452)	(9.604)	(9.686)	(9.472)
Constant	0.183***	0.182***	0.183***	0.181***	0.181***	0.276	0.270	0.273	0.268	0.267
	(10.018)	(9.779)	(9.882)	(9.682)	(9.629)	(1.509)	(1.472)	(1.505)	(1.467)	(1.474)
Observations	108,322	108,322	108,322	108,322	108,322	96,078	96,078	96,078	96,078	96,078
Adjusted R-squared	0.167	0.168	0.168	0.168	0.168	0.167	0.168	0.168	0.167	0.168
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 4
Alternative measures of the implied cost of capital

This table reports pooled OLS regression results of the following implied cost of equity capital model:

$$R_t^i = \alpha_0 + \beta_1 Illiq_t^i + \beta_2 COV_{net,t}^i + \beta_3 Controls_{i,t} + FE + \varepsilon_t^i$$

In models (2)-(5) the dependent variable R_t^i refers to one of the four implied cost of equity capital models $\mathbf{R_{ES}}$ $\mathbf{R_{OJ}}$, $\mathbf{R_{CT}}$, and $\mathbf{R_{GLS}}$ described in Appendix B, $\mathbf{R_{PC}}$ is the principal component of the four individual cost of equity estimates, $\mathbf{R_{PC(ES,GLS)}}$ is the principal component of the $\mathbf{R_{ES}}$, and $\mathbf{R_{GLS}}$, $\mathbf{R_{RP}}$, is the risk premium defined as the average of the four cost of equity models, $\mathbf{R_{ICC}}$, less the 10-year U.S. Treasury bond yield. Liquidity variables are: $Illiq^i$: defined as the innovation in stock illiquidity using Amihud (2002) model, and $COV_{net}^i = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$, whereby $COV(Illiq^i, Illiq^M)$: co-movement between firm-level illiquidity and market illiquidity, $COV(r^i, Illiq^M)$: co-movement between firm-level returns and market illiquidity, $COV(Illiq^i, r^M)$: co-movement between firm-level illiquidity and market returns. The set of control variables ($Controls$) is comprised of the cost of equity determinants at the firm-level and the country-level. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The firm-level variables are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

Variables	(1) R_{PC}	(2) R_{OJ}	(3) R_{CT}	(4) R_{ES}	(5) R_{GLS}	(6) $R_{PC(ES,GLS)}$	(7) R_{RP}
Liquidity variables							
Illiq	130.241**	4.712***	4.601***	5.064**	2.600**	68.512**	4.239**
	(2.248)	(3.183)	(3.119)	(2.091)	(2.404)	(2.081)	(2.567)
COV_{net}^i	55.342**	1.598***	1.381***	2.228***	0.732*	42.538**	1.989**
	(2.290)	(2.816)	(4.187)	(2.954)	(1.748)	(2.260)	(2.420)
Control variables							
BETA	0.224***	0.011***	0.003***	0.020***	0.001	0.146***	0.017***
	(7.802)	(11.354)	(2.955)	(13.188)	(0.709)	(7.748)	(9.608)
BTM	0.522***	0.000	0.005*	-0.000	0.004***	0.059***	0.001***
	(3.093)	(0.586)	(1.974)	(-0.924)	(10.543)	(9.168)	(4.170)
LEVERAGE	0.910***	0.057***	0.025***	0.086***	0.034***	1.003***	0.057***
	(3.261)	(19.968)	(6.125)	(17.330)	(9.171)	(5.664)	(12.851)
SIZE	-0.203***	-0.007***	-0.005***	-0.010***	-0.004***	-0.141***	-0.010***
	(-6.883)	(-9.771)	(-5.412)	(-7.556)	(-5.059)	(-8.696)	(-5.480)
LNGDP	-0.080	-0.053*	-0.040	-0.051**	-0.029	-0.014	-0.012
	(-0.872)	(-1.722)	(-1.207)	(-2.069)	(-0.995)	(-0.182)	(-0.550)
FD	0.002***	-0.000**	-0.000	-0.000***	-0.000	0.002***	-0.000*
	(2.778)	(-2.651)	(-0.766)	(-2.822)	(-0.078)	(3.279)	(-1.768)
INFL	0.101***	0.001***	0.002***	0.002***	0.001***	0.069***	0.001***
	(6.233)	(4.329)	(2.953)	(7.345)	(3.352)	(5.597)	(9.695)
Constant	2.027	0.627**	0.477*	0.630***	0.356	1.076	0.185
	(0.893)	(2.477)	(1.703)	(3.142)	(1.488)	(0.000)	(0.988)
Observations	53,534	81,353	63,174	88,918	77,095	71,822	94,988
Adjusted R-squared	0.211	0.227	0.129	0.185	0.294	0.209	0.219
Fixed effects	YES	YES	YES	YES	YES	YES	YES

Table 5
The implied cost of capital and alternative measures of liquidity

In model (1) we estimate the baseline regression model with *CPQS*, the Closing Percentage Closing Spread as defined in Chung and Zhang (2014) being the liquidity proxy. $COV^{i}_{net(CPQS)}$ is defined similarly as COV^{i}_{net} with the exception of using *CPQS* instead of *Illiq*. In model (2), we estimate the baseline regression model after we replace COV_{net} with $IlliqVar$ as the liquidity risk variable. In model (3), we estimate the baseline regression model after introducing $IlliqVar$ as an extra liquidity risk variable. *IlliqVar*: the variance of the daily Amihud liquidity measure. The set of control variables ($Controls$) is comprised of the cost of equity determinants at the firm-level and the country-level. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The firm-level variables are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

Variables	(1) R_{ICC}	(2) R_{ICC}	(3) R_{ICC}
Liquidity variables			
CPQS	9.354*		
	(1.904)		
$COV^{i}_{net(CPQS)}$	0.186***		
	(4.922)		
Illiq		5.545**	4.129**
		(2.472)	(2.495)
COV^{i}_{net}			1.939**
			(2.352)
IlliqVar		47.797***	43.668***
		(2.795)	(2.836)
Control variables			
BETA	0.018***	0.016***	0.017***
	(13.137)	(8.346)	(9.312)
BTM	0.001***	0.001***	0.001***
	(3.285)	(5.220)	(4.173)
LEVERAGE	0.044***	0.046***	0.057***
	(5.999)	(6.982)	(12.577)
SIZE	-0.011***	-0.011***	-0.010***
	(-6.917)	(-6.467)	(-5.388)
LNGDP	0.007**	0.003	-0.013
	(2.708)	(1.056)	(-0.578)
FD	0.000	0.000	-0.000*
	(1.079)	(0.575)	(-1.701)
INFL	0.002***	0.002***	0.001***
	(3.731)	(4.395)	(9.469)
Constant	0.114	0.133***	0.268
	(1.273)	(4.948)	(1.482)
Observations	47,249	96,078	96,078
Adjusted R-squared	0.147	0.131	0.169
Fixed effects	YES	YES	YES

Table 6
Endogeneity tests

Column (1) reports the results of the second stage from the two-stage least square (2SLS) regressions for the baseline model. The illiquidity level (Illiq) and the liquidity aggregate covariance risk ($\mathrm{COV}^{\mathrm{i}}_{\mathrm{net}}$) are instrumented by their averages at the country-year level, while excluding the focal firm. Column (2) report the estimation of the baseline model after replacing each of Illiq and COV_{net} by their respective lagged variables. Columns (3) and (4) repeat the same analysis as in columns (1) and (2), respectively, while substituting in both columns (3) and (4) the illiquidity level (Illiq) with (CPQS) and the liquidity aggregate covariance risk (COV_{net}) with $COV_{net(CPQS)}$. In all columns, the dependent variable R_{ICC} is the average of the four implied cost of equity capital models described in Appendix B. Liquidity variables are: $Illiq^i$: defined as the innovation in stock illiquidity using Amihud (2002) model; $COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$, whereby $COV(Illiq^i, Illiq^M)$: co-movement between firm-level illiquidity and market illiquidity, $COV(r^i, Illiq^M)$: co-movement between firm-level returns and market illiquidity, $COV(Illiq^i, r^M)$: co-movement between firm-level illiquidity and market returns; *CPQS* is the Closing Percentage Closing Spread liquidity proxy as defined in Chung and Zhang (2014); and $COV^i_{net(CPQS)}$ is defined similarly as COV^i_{net} with the exception of using *CPQS* instead of *Illiq*. The set of control variables ($Controls$) is comprised of the cost of equity determinants at the firm-level and the country-level. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The firm-level variables are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

	(1)	(2)	(3)	(4)
Variables	R_{ICC}	R_{ICC}	R_{ICC}	R_{ICC}
Liquidity variables				
Illiq	3.995***	4.377***		
	(2.717)	(3.629)		
$\boldsymbol{COV^i_{net}}$	2.411***	1.721**		
	(2.775)	(2.479)		
CPQS			3.552**	7.523*
			(1.962)	(1.914)
$\boldsymbol{COV^i_{net(CPQS)}}$			8.973**	0.124***
			(1.978)	(3.612)
Control variables				
BETA	0.017***	0.017***	0.017***	0.018***
	(9.157)	(9.682)	(8.719)	(9.762)
BTM	0.001***	0.001***	0.001***	0.001**
	(4.179)	(4.042)	(3.044)	(2.581)
LEVERAGE	0.057***	0.056***	0.042***	0.057***
	(12.649)	(13.226)	(5.091)	(9.699)
SIZE	-0.010***	-0.008***	-0.011***	-0.010***
	(-5.429)	(-5.271)	(-5.645)	(-6.105)
LNGDP	-0.013	-0.013	0.006*	-0.017
	(-0.584)	(-0.777)	(1.794)	(-0.593)
FD	-0.001	-0.001**	0.001	-0.001
	(-1.400)	(-2.314)	(1.624)	(-0.100)
INFL	0.001***	0.001***	0.002***	0.001***
	(9.832)	(7.329)	(3.335)	(3.289)
Constant	0.273	0.282	0.128***	0.312
	(1.476)	(0.016)	(3.959)	(1.356)
Observations	96,078	96,078	47,249	47,249
Adjusted R-squared	0.168	0.159	0.138	0.165
Fixed effects	YES	YES	YES	YES

Table 7
Robustness Checks

This table reports regression results of the following implied cost of equity capital model:

$$R^i_{ICC_t} = \alpha_0 + \beta_1 Illiq^i_t + \beta_2 COV^i_{net,t} + \beta_3 Controls_{i,t} + FE + \varepsilon^i_t$$

In Panel A columns (1)-(4), the dependent variable R_{ICC} is the average of the four implied cost of equity capital models described in Appendix B. In column (5), the dependent variable $R_{ICC(FBIAS>90\%)}$ is computed for observations that exclude overly optimistic analyst forecast (*FBIAS* in the top 10% of the distribution). In column (6), we report the WLS estimates for the baseline regression model. The extra control variables in Panel A are: *LTG*: the firm's long-term growth measure, *FBIAS*: defined as difference between the one-year-ahead forecasted and realized earnings, *DISPERSION*: measured as the ratio of the standard deviation of estimated first year earnings per share by the average forecasted first year earnings per share, *ANALYSTCOV*: measured as the number of analysts who are covering the firm by providing earnings forecasts.

The extra control variables in Panel B are: in column (1), *INVP*: the investor protection index, derived from the Doing Business report, in column (2) *JUDICIAL*: the efficiency of the judicial system index of La Porta et al. (1998), ranges from zero to ten representing the average of investors' assessments of conditions of the judicial system in each country between 1980-1983 (lower scores represent lower efficiency levels), in column (3) *DISCL*: the disclosure intensity index of Bushman et al. (2004), in column (11) *CROSSLIST*: defined to take the value of one for firms that cross-list in the U.S. and zero otherwise, and in column (12) *RETVOL*: defined as the 1-year volatility of daily returns. Column (4) reports pooled OLS regression results for the baseline regression model after excluding financial firms (SIC codes 6000-6999), column (5) excludes firms from the United States, and column (6) firms from Japan. Columns (7) and (8) report the baseline regression estimations for countries with the less developed financial markets and then for countries with developed financial markets. Finally, the results of the estimating the model for small firms are reported in column (9) and for large firms in column (10). In both Panels, liquidity variables are: $Illiq^i$: defined as the innovation in stock illiquidity using Amihud (2002) model, and $COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$, whereby $COV(Illiq^i, Illiq^M)$: co-movement between firm-level illiquidity and market illiquidity, $COV(r^i, Illiq^M)$: co-movement between firm-level returns and market illiquidity, $COV(Illiq^i, r^M)$: co-movement between firm-level illiquidity and market returns. The firm-level variables that are common to both Panels A and B are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables that are common to both Panels A and B are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

Panel A: Bias in forecasted earnings per share and other analyst variables

Variables	(1) R_{ICC}	(2) R_{ICC}	(3) R_{ICC}	(4) R_{ICC}	(5) $R_{ICC(FBIAS>90\%)}$	(6) R_{ICC}
Liquidity variables						
Illiq	2.439*	4.453***	4.926***	4.019**	3.271***	3.891***
	(1.977)	(3.292)	(3.845)	(2.557)	(4.789)	(6.498)
COV_{net}^{i}	1.294**	1.519**	1.706**	1.986**	1.499***	1.802***
	(2.494)	(2.014)	(2.310)	(2.280)	(9.245)	(12.408)
Control variables						
BETA	0.011***	0.014***	0.014***	0.018***	0.011***	0.016***
	(11.288)	(8.439)	(9.042)	(8.968)	(20.090)	(42.603)
BTM	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(4.139)	(4.834)	(3.823)	(4.237)	(8.057)	(23.200)
LEVERAGE	0.043***	0.042***	0.042***	0.053***	0.033***	0.040***
	(21.864)	(13.273)	(13.904)	(12.428)	(33.927)	(47.739)
SIZE	-0.004***	-0.008***	-0.007***	-0.008***	-0.007***	-0.008***
	(-7.163)	(-5.587)	(-6.234)	(-4.467)	(-48.930)	(-58.890)
LNGDP	-0.026**	-0.005	-0.010	-0.019	0.002***	-0.004***
	(-2.284)	(-0.265)	(-0.660)	(-1.037)	(6.766)	(-13.726)
FD	-0.000***	-0.000*	-0.000**	-0.000*	0.000***	0.000***
	(-2.767)	(-1.689)	(-2.163)	(-2.003)	(7.017)	(3.985)
INFL	0.001***	0.001***	0.001**	0.001***	0.001***	0.001***
	(6.583)	(10.858)	(2.642)	(9.444)	(11.675)	(13.885)
LTG	-0.000					
	(-0.407)					
FBIAS		0.119***				
		(2.816)				
DISPERSION			0.264***			
			(4.188)			
ANALYSTCOV				-0.001***		
				(-3.208)		
Constant	0.316***	0.187	0.283*	0.301*	0.114***	0.181***
	(3.356)	(1.158)	(1.910)	(1.993)	(35.879)	(59.328)
Observations	82,033	92,179	82,645	96,066	84,808	80,544
Adjusted R-squared	0.164	0.183	0.237	0.171	0.097	0.120
Fixed effects	YES	YES	YES	YES	YES	YES

Table 7
Robustness Checks
Panel B: Other control variables

Variables	(1) R_{ICC}	(2) R_{ICC}	(3) R_{ICC}	(4) R_{ICC}	(5) R_{ICC}	(6) R_{ICC}	(7) R_{ICC}	(8) R_{ICC}	(9) R_{ICC}	(10) R_{ICC}	(11) R_{ICC}	(12) R_{ICC}
Liquidity variables												
Illiq	2.526***	2.353***	2.672***	3.978**	4.858***	3.689**	1.349	4.812***	0.661	4.390	4.803***	3.998**
	(3.377)	(3.147)	(3.578)	(2.659)	(2.846)	(2.417)	(0.961)	(5.078)	(0.598)	(1.406)	(3.009)	(2.398)
COV_{net}^{i}	1.749***	1.659***	1.541***	1.893**	1.590**	1.895**	3.695***	2.498***	1.920***	0.957***	1.536*	1.963**
	(9.256)	(8.848)	(8.093)	(2.110)	(2.110)	(2.361)	(6.311)	(10.780)	(6.471)	(3.240)	(1.952)	(2.332)
Control variables												
CROSSLIST											-0.010***	
											(-3.790)	
RETVOL												0.261***
												(8.021)
BETA	0.017***	0.016***	0.017***	0.018***	0.019***	0.018***	0.023***	0.014***	0.019***	0.016***		0.018***
	(27.147)	(26.867)	(27.230)	(9.220)	(12.299)	(8.502)	(10.097)	(27.120)	(21.771)	(25.467)		(9.827)
BTM	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.000***	0.001***	0.000***	0.001***	0.001***	0.001***
	(7.659)	(7.615)	(7.464)	(4.103)	(4.085)	(4.190)	(7.288)	(18.352)	(2.981)	(25.425)	(4.831)	(4.455)
LEVERAGE	0.043***	0.042***	0.042***	0.062***	0.059***	0.055***	0.067***	0.030***	0.041***	0.030***	0.047***	0.056***
	(39.735)	(39.517)	(39.167)	(12.437)	(12.184)	(11.916)	(17.127)	(23.261)	(16.728)	(24.484)	(11.131)	(12.258)
SIZE	-0.011***	-0.011***	-0.010***	-0.011***	-0.011***	-0.010***	-0.011***	-0.011***	-0.032***	-0.002***	-0.007***	-0.009***
	(-59.719)	(-59.866)	(-59.612)	(-5.154)	(-7.189)	(-4.869)	(-16.297)	(-61.948)	(-43.047)	(-7.582)	(-5.002)	(-4.945)
LNGDP	0.001***	0.004***	0.001***	-0.010	-0.012	-0.037**	-0.003***	0.007***	0.007***	-0.002***	-0.005	-0.013
	(2.780)	(7.766)	(3.220)	(-0.389)	(-0.537)	(-2.539)	(-3.781)	(14.062)	(10.544)	(-3.530)	(-0.330)	(-0.596)
FD	0.000***	0.000***	0.000***	-0.000	-0.000	-0.000	-0.000***	0.000***	0.000***	-0.000	-0.000**	-0.000*
	(7.555)	(9.605)	(10.949)	(-1.638)	(-1.621)	(-1.509)	(-3.140)	(8.843)	(6.687)	(-0.599)	(-2.586)	(-1.778)
INFL	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.002***	0.001***	0.001***	0.001***	0.001***
	(11.360)	(10.861)	(11.622)	(8.263)	(10.455)	(10.880)	(4.442)	(8.862)	(9.874)	(11.241)	(3.846)	(9.039)
INVP	-0.001											
	(-1.024)											
JUDICIAL		-0.002***										
		(-8.434)										
DISL			-0.017***									
			(-13.482)									
Constant	0.164***	0.152***	0.174***	0.261	0.271	0.472***	0.238***	0.117***	0.372***	0.085***	0.169	0.330
	(38.304)	(34.477)	(40.677)	(1.287)	(1.458)	(3.972)	(20.298)	(19.967)	(34.095)	(11.887)	(1.295)	(0.001)
Observations	92,169	92,169	92,169	83,108	75,263	79,069	6,225	45,324	24,260	23,814	84,889	96,078
Adjusted R-squared	0.114	0.114	0.115	0.184	0.167	0.180	0.113	0.118	0.104	0.094	0.196	0.170
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firms	ALL	ALL	ALL	Excluding Financial firms	Excluding firms from the U.S.	Excluding firms from Japan	Countries with less financially developed markets.	Countries with financially developed markets	Small Firm	Large Firm	ALL	ALL

Table 8
Market downturn, liquidity risks, and the cost of capital

This table reports pooled OLS regression results of the following implied cost of equity capital model:

$$R^i_{ICC_t} = \alpha_0 + \beta_1 Illiq^i_t + \beta_2 COV\left(Illiq^i_t, Illiq^M_t\right) + \beta_3 COV\left(r^i_t, Illiq^M_t\right) + \beta_4 COV\left(Illiq^i_t, r^M_t\right) + \beta_5 Controls_{i,t} + FE + \varepsilon^i_t$$

We split our sample into crisis versus no-crisis periods. We define market downturn, crisis period, as a period when the market return drops below its 3-year historical average by more than one standard deviation. We report the regressions results separately in models 1-8. In models 9-16, we re-run the same regressions as before but we only keep illiquid stocks, stocks whose illiquidity is higher than the median illiquidity. The dependent variable R_{ICC} is the average of the four implied cost of equity capital models described in Appendix B. Liquidity variables are: $Illiq^i$: defined as the innovation in stock illiquidity using Amihud (2002) model, $COV(Illiq^i, Illiq^M)$: co-movement between firm-level illiquidity and market illiquidity, $COV(r^i, Illiq^M)$: co-movement between firm-level returns and market illiquidity, $COV(Illiq^i, r^M)$: co-movement between firm-level illiquidity and market returns, and $COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$. The set of control variables ($Controls$) is comprised of the cost of equity determinants at the firm-level and the country-level. *FE* is the set of fixed effects dummy variables at the country, industry, and year levels. The firm-level variables are: *SIZE*: estimated as the natural logarithm of the firm's total assets, *BETA*: estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns, *LEVERAGE*: computed as total debt to the market value of equity, and *BTM*: computed as book value of equity divided by the market value of equity. The country-level variables are: *LNGDP*: Logarithm of GDP-per-capita, *INFL*: measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate, and *FD*: calculated as the sum of market capitalization and private credit relative to GDP. The total sample consists of 108,322 firm–year observations from 52 countries between 1985 and 2012. Appendix C provides definitions and data sources for all variables. Beneath each coefficient is the robust *t*-statistic clustered at the country level.

Variables	(1) R_{ICC}	(2) R_{ICC}	(3) R_{ICC}	(4) R_{ICC}	(5) R_{ICC}	(6) R_{ICC}	(7) R_{ICC}	(8) R_{ICC}	(9) R_{ICC}	(10) R_{ICC}	(11) R_{ICC}	(12) R_{ICC}	(13) R_{ICC}	(14) R_{ICC}	(15) R_{ICC}	(16) R_{ICC}
Liquidity variables																
Illiq	3.977**	-0.254	7.224***	4.868**	4.406**	2.508	4.682***	3.158	2.565	-5.409	5.496***	-1.163	3.717*	-3.133	3.288*	-3.363
	(2.316)	(-0.069)	(3.701)	(2.219)	(2.161)	(0.971)	(2.786)	(1.282)	(1.568)	(-1.560)	(3.020)	(-0.645)	(1.878)	(-1.577)	(1.780)	(-1.616)
$COV(Illiq^i, Illiq^M)$	4.901*	5.790*							5.412**	6.407**						
	(1.807)	(1.910)							(2.405)	(2.028)						
$COV(r^i, Illiq^M)$			-1.770**	-0.198							-1.728*	-0.533				
			(-2.201)	(-0.216)							(-1.981)	(-0.472)				
$COV(Illiq^i, r^M)$					-5.263**	-9.760**							-3.691*	-10.092***		
					(-2.364)	(-2.491)							(-1.658)	(-3.663)		
COV^i_{net}							2.094**	1.390*							2.271**	2.389**
							(2.369)	(1.692)							(2.472)	(2.687)
Control variables																
BETA	0.016***	0.025***	0.016***	0.025***	0.017***	0.025***	0.016***	0.025***	0.021***	0.039***	0.020***	0.039***	0.021***	0.039***	0.020***	0.039***
	(7.677)	(9.391)	(7.660)	(9.589)	(7.640)	(9.386)	(7.696)	(9.503)	(9.658)	(8.954)	(9.625)	(8.959)	(9.660)	(8.947)	(9.681)	(8.917)
BTM	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001	0.001***	0.001	0.001***	0.001	0.001***	0.001
	(3.905)	(6.178)	(3.908)	(6.227)	(3.906)	(6.263)	(3.907)	(6.282)	(6.546)	(1.534)	(6.555)	(1.523)	(6.550)	(1.512)	(6.560)	(1.508)
LEVERAGE	0.055***	0.060***	0.055***	0.060***	0.055***	0.060***	0.055***	0.060***	0.063***	0.074***	0.064***	0.075***	0.063***	0.074***	0.063***	0.074***
	(12.245)	(7.087)	(12.374)	(7.249)	(12.306)	(7.033)	(12.168)	(7.157)	(10.527)	(6.835)	(10.691)	(6.979)	(10.640)	(6.747)	(10.510)	(6.812)
SIZE	-0.010***	-0.012***	-0.010***	-0.012***	-0.009***	-0.012***	-0.009***	-0.012***	-0.012***	-0.017***	-0.012***	-0.017***	-0.012***	-0.016***	-0.012***	-0.017***
	(-5.124)	(-7.184)	(-5.205)	(-7.632)	(-5.120)	(-7.163)	(-5.103)	(-7.491)	(-4.433)	(-5.271)	(-4.503)	(-5.452)	(-4.464)	(-5.206)	(-4.396)	(-5.339)
LNGDP	-0.024	0.038	-0.024	0.036	-0.024	0.037	-0.023	0.030	-0.003	0.079*	-0.003	0.079*	-0.002	0.078	-0.002	0.070
	(-1.170)	(0.825)	(-1.191)	(0.798)	(-1.184)	(0.780)	(-1.157)	(0.666)	(-0.098)	(1.730)	(-0.100)	(1.693)	(-0.083)	(1.621)	(-0.085)	(1.546)
FD	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-1.175)	(-1.138)	(-1.205)	(-1.063)	(-1.200)	(-1.141)	(-1.322)	(-1.091)	(-1.140)	(-1.044)	(-1.143)	(-0.982)	(-1.143)	(-1.112)	(-1.241)	(-1.091)
INFL	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001	0.001***	-0.001
	(9.722)	(-0.860)	(8.997)	(-0.802)	(9.519)	(-0.817)	(8.811)	(-0.871)	(4.206)	(-0.579)	(4.169)	(-0.519)	(4.303)	(-0.558)	(3.937)	(-0.621)
Constant	0.413**	0.032	0.414**	0.044	0.413**	0.038	0.406*	0.078	0.253	-0.585	0.253	-0.583	0.248	-0.587	0.248	-0.505
	(2.008)	(0.109)	(2.046)	(0.153)	(2.026)	(0.125)	(2.003)	(0.265)	(0.883)	(-1.263)	(0.892)	(-1.231)	(0.867)	(-1.209)	(0.873)	(-1.101)
Observations	83,119	12,959	83,119	12,959	83,119	12,959	83,119	12,959	37,759	5,671	37,759	5,671	37,759	5,671	37,759	5,671
Adjusted R-squared	0.169	0.183	0.169	0.182	0.168	0.183	0.169	0.182	0.167	0.181	0.167	0.180	0.166	0.181	0.167	0.181
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Period	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis	No-Crisis	Crisis
Firms	All	All	All	All	All	All	All	All	Illiquid	Illiquid	Illiquid	Illiquid	Illiquid	Illiquid	Illiquid	Illiquid

Appendix A: Sample selection filters

We follow Karolyi et al. (2012). We describe the screening procedures used to select our sample stocks. We extract all available equities in Datastream, including active, dead, and suspended, to eliminate the survivorship bias. To eliminate depositary receipts (DRs), real estate investment trusts (REITs), preferred stocks, investment funds, iShares, mutual funds, municipal funds, 144A, or other stocks with special features, we:

Exclude the stocks whose names include "REIT", "REAL EST", "GDR", "PF", "PREF", or "PRF" as these terms may represent REITs, GDRs, or preferred stocks. We also exclude stocks whose names include "ADS", "RESPT", "UNIT", "TST", "TRUST", "INCOME FD", "INCOME FUND", "UTS", "RST", "CAP.SHS", "INV", "HDG", "SBVTG", "VTG.SAS", "GW.FD", "RTN.INC", "VCT", "ORTF", "HI.YIELD", "PARTNER", "HIGH INCOME", "INC.&GROWTH", "INC.&GW", "%", "DOW JONES", "ISHARE", "FD.UNT", "MERGER", "MUT FUND", "PRTF", "MUN.FD", "144A", "INSD. FD", "INSD.FD", "INSD", "MSDW", "MRLY", "MGST", "MERR.LYNCH", "LEHMAN BROS", "MUN.BD", and "CAP.TAX". Exclude stocks whose sector is "Real Estate Investment Trusts".

Further, we apply the following additional country-specific stock filers:

- In Belgium, we discard stocks whose names include "AFV" and "VVPR".
- In Brazil, we exclude preferred stocks whose names contain "PN".
- In Canada, we exclude income trusts by removing stocks with names including "INC.FD.".
- In Mexico, we discard convertible shares of the types "ACP" and "BCP".
- In France, we exclude preferred shares whose names include "ADP" and "CIP".
- In Germany, we exclude preferred shares with names including "GSH".
- In Italy, we discard non-voting shares with names including "RSP".
- In the U.S., we exclude ADRs by examining the names of stocks and non-common stocks by checking the CUSIP. We only include U.S. common shares whose 7^{th} and 8^{th} digits of the CUSIP are 1 and 0, respectively.

Appendix B: Implied cost of equity models

We first define the following variables that are common to the four models:

Variable	Description
P_t	Stock price in June of year t.
B_t	Book value per share at the beginning of year t.
$FEPS_{t+j}$	Mean forecasted earnings per share from I/B/E/S or implied EPS forecasts for year t + j recorded in June of year t.
LTG	Long-term growth forecast in June of year t.
$POUT$	The forecasted payout ratio. To estimate the dividend per share for year t + j, we use the firm's dividend payout ratio at time t if available and 50% if not, as in Claus and Thomas (2001).
R_{OJ} , R_{CT} , R_{GLS} , R_{ES}	The implied cost of equity derived from each of the four different models.

Model 1: R_{OJ}: Ohlson and Juettner-Nauroth (2005)

$$P_t = \frac{(FEPS_{t+1}/R_{OJ}).(gst + R_{OJ} \cdot DPS_{t+1}/FEPS_{t+1} - glt)}{(R_{OJ} - g_{lt})}$$

$$g_{st} = \frac{FEPS_{t+2} - FEPS_{t+1}}{FEPS_{t+1}}$$

This model is derived from the abnormal earnings valuation model developed by Ohlson and Juettner-Nauroth (2005). It uses one-year-ahead and two-years-ahead earnings per share, the future dividend per share, and a proxy of the long-term growth rate. The future dividend, DPS_{t+j}, is estimated as $FEPS_{t+j}$ multiplied by $POUT$. The asymptotic long-term growth rate, LTG, is calculated using the annualized yearly median of country specific one-year-ahead realized monthly inflation rates. LTG constitutes a lower bound for the cost of equity estimates.

Model 2: R_{CT}: Claus and Thomas (2001)

$$P_t = B_t + \sum_{j=1}^{5} \frac{FEPS_{t+j} - R_{CT}B_{t+j-1}}{(1+R_{CT})^j} + \frac{[FEPS_{t+5} - R_{CT}B_{t+4}]\,(1+glt)}{(R_{CT} - glt)(1+R_{CT})^5}$$

In this model, the price is a function of the future forecasted earnings per share, the book value per share and the asymptotic long-term growth rate. Claus and Thomas (2001) implement the model using the I/B/E/S forecasted earnings per share for the next five years. If the forecasts for earnings per share, $FEPS_{t+j}$, are not available in I/B/E/S for the years t + 3, t + 4, and t + 5, $FEPS_{t+j}$ = $FEPS_{t+j-1}$ (1 + LTG). The long-term abnormal earnings growth rate, LTG, is calculated using the annualized yearly median of a country specific one-year-ahead realized monthly inflation rates. Future book values are estimated by assuming the clean surplus relation, that is, B_{t+j} = B_{t+j-1} + $FEPS_{t+j}$ - DPS_{t+j}. The future dividend, DPS_{t+j}, is estimated by multiplying $FEPS_{t+j}$ by POUT. LTG constitutes a lower bound for the cost of equity estimates.

Model 3: R_{GLS}: Gebhardt, Lee, and Swaminathan (2001)

$$P_t = B_t + \sum_{j=1}^{T} \frac{(FROE_{t+j} - R_{GLS})B_{t+j-1}}{(1+R_{GLS})^j} + \frac{(FROE_{t+T+1} - R_{GLS})B_{t+T}}{(1+R_{GLS})^T R_{GLS}}$$

For the years t +1 to t +3, $FROE_{t+j}$ is equal to $FEPS_{t+j}/B_{t+j-1}$. After the forecast period of three years, $FROE_{t+j}$ is derived by linear interpolation to the industry-median ROE. Average ROEs are computed in a given year and country for each of the 12 industry classifications of Campbell (1996). Negative industry median ROEs are replaced by country-year medians. The abnormal earnings at year t + 12 are then assumed to remain constant afterwards. Future book values are estimated by assuming clean surplus. The future dividend, DPS_{t+j}, is estimated as $FEPS_{t+j}$ multiplied by $POUT$. We assume that T = 12.

Model 4: R_{ES}: Easton (2004)

$$P_t = \frac{FEPS_{t+2} - FEPS_{t+1} + R_{ES}DPS_{t+1}}{R_{ES}^2}$$

To implement the model, Easton (2004) uses the one-year-ahead and two-years-ahead forecasted earnings per share reported in I/B/E/S. The future dividend, DPS_{t+j}, is estimated as $FEPS_{t+j}$ multiplied by $POUT$. This model requires a positive change in forecasted earnings per share to yield a numerical solution.

Appendix C: Variables, definitions, and sources

Variable	Definition	Source
Panel A. Implied Cost of Equity		
$\boldsymbol{R_{CT}}$	Implied cost of equity estimated using the Claus and Thomas (2001) model.	Authors' calculation based on I/B/E/S and DataStream.
$\boldsymbol{R_{GLS}}$	Implied cost of equity estimated using the Gebhardt, Lee, and Swaminathan (2001) model.	As above
$\boldsymbol{R_{OJ}}$	Implied cost of equity estimated using the Ohlson and Juttner-Nauroth (2005) model.	As above
$\boldsymbol{R_{ES}}$	Implied cost of equity estimated using the Easton (2004) model.	As above
$\boldsymbol{R_{ICC}}$	Equally weighted average of $\boldsymbol{R_{ES}}$, $\boldsymbol{R_{OJ}}$, $\boldsymbol{R_{CT}}$, and $\boldsymbol{R_{GLS}}$	As above
$\boldsymbol{R_{RP}}$	Risk premium defined as the $\boldsymbol{R_{ICC}}$ less the 10-year Treasury bond yield.	As above
Panel B. Liquidity control variables		
$\boldsymbol{Illiq^i}$	The innovation in stock illiquidity using Amihud (2002) model.	Authors' calculation based on DataStream.
$\boldsymbol{COV}(\boldsymbol{Illiq^i}, \boldsymbol{Illiq^M})$	Co-movements between the firm-level illiquidity and the market liquidity, multiplied by 10^3, where $\boldsymbol{Illiq^M}$ is the innovation in market illiquidity using Amihud (2002) model.	As above
$COV(\boldsymbol{r^i}, \boldsymbol{Illiq^M})$	Co-movements between firm-level returns and the market illiquidity, multiplied by 10^3, where $\boldsymbol{r^i}$ is daily stock return in local currency.	As above
$\boldsymbol{COV}(\boldsymbol{Illiq^i}, \boldsymbol{r^M})$	Co-movements between firm-level illiquidity and the market returns, multiplied by 10^3, where $\boldsymbol{r^M}$ is market return in local currency.	As above
$\boldsymbol{COV^i_{net}}$	$COV^i_{net} = COV(Illiq^i, Illiq^M) - COV(r^i, Illiq^M) - COV(Illiq^i, r^M)$	As above
CPQS	Estimated as the difference between the individual stock Ask price and the Bid price divided by the mean of the Ask and Bid prices.	As above
$\boldsymbol{COV^i_{net(CPQS)}}$	Same definition as in $\boldsymbol{COV^i_{net}}$ with the exception of using CPQS instead of Illiq as the firm-level illiquidity measure.	As above
IlliqVar	Estimated as variance of the daily Amihud illiquidity measure	As above
Panel C. Main control variables		
BETA	Estimated as the co-variance between the firm returns and the market return relative to the variance of the market returns.	Authors' calculation based on DataStream.
BTM	Computed as book value of equity divided by the market value of equity.	As above
LEVERAGE	Computed as total debt to the market value of equity.	As above
SIZE	Estimated as the natural logarithm of the firm's total assets.	As above
LNGDP	Logarithm of GDP-per-capita.	International Financial Statistics and World Development Indicators
FD	Calculated as the sum of market capitalization and private credit relative to GDP.	As above
INFL	Measured as the annualized yearly median of a country-specific one-year-ahead realized monthly inflation rate.	As above
Panel D. Robustness check variables		
FBIAS	Defined as difference between the one-year-ahead forecasted and realized earnings.	Authors' calculation based on I/B/E/S
LTG	five-year consensus earing growth rate.	As above
DISPERSION	Measured as the ratio of the standard deviation of estimated first year earnings per share by the average forecasted first year earnings per share.	As above
ANALYSTCOV	Measured as the number of analysts who are covering the firm by providing earnings forecasts.	As above
CROSSLIST	Takes the value of one for firms that cross-list in the U.S., and zero otherwise.	JPMorgan and Bank of New York
RETVOL	Defined as the 1-year volatility of daily returns.	Authors' calculation based on DataStream
JUDICIAL	The efficiency of the judicial system index, ranges from zero to ten representing the average of investors' assessments of conditions of the judicial system in each country between 1980-1983 (lower scores represent lower efficiency levels).	La Porta et al. (1998)
INVP	The investor protection index measures the extent to which a country provides legal protection to minority shareholders. It varies between 0 and 10, with greater values indicating better protection of investors.	Doing Business Reports
DISCL	The disclosure intensity index, created by the Center for International Financial Analysis and Research (CIFAR) as a measure of disclosure intensity in a given country. It is an index that varies between 0 and 90, with greater values indicating an environment of greater transparency.	Bushman et al. (2004)

- We investigate the impact of liquidity level and risks on the implied cost of equity capital
- We find that liquidity risks affect the implied cost of capital
- Liquidity level and risks impact more the implied cost of capital during crisis periods for the most illiquid stocks
- Liquidity volatility affects the implied cost of capital