Research Program on Forecasting

Information Environment and The Cost of Capital

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Abstract: In empirical tests guided by recent theory (e.g., Hughes, Liu and Liu 2007; and Lambert, Leuz and Verrecchia 2012), we examine the *joint* effects of information asymmetry and information precision on the cost of capital and how these effects vary based on the amount and quality of available information and the level of market competition. Consistent with theory, we find that average information precision is an important factor that may alter the relation between information asymmetry and the cost of capital, leading to erroneous inferences, if not considered. We also show that, while information asymmetry *increases* the cost of capital in most settings, it *decreases* the cost of capital when the amount of public information is low, while it has *no effect* when the total information is of high quality and when there is a high level of market competition. Our final results indicate that the precision of private information *decreases* the cost of capital when the amount of public information is low, while it *increases* it when the quality of total information is low. Besides examining various aspects of the environment jointly, our study is also unique in that we use better measures of information asymmetry and precision, which allows us to tease out the economic significance of each factor on cost of capital. We find that cost of equity capital varies greatly with our measures of information asymmetry and average information precision. For example, our regression estimates suggest that information asymmetry and average information precision are comparable in importance to equity beta and firm size in determining firms' cost of capital.

JEL Classification: M41, G14, G12, D82

Key Words: cost of capital, information quality, information asymmetry, ST uncertainty, BKLS

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Information Environment and The Cost of Capital

In empirical tests guided by recent theory (e.g., Hughes, Liu and Liu 2007; and Lambert, Leuz and Verrecchia 2012), we examine the *joint* effects of information asymmetry and information precision on the cost of capital and how these effects vary based on the amount and quality of available information and the level of market competition. Consistent with theory, we find that average information precision is an important factor that may alter the relation between information asymmetry and the cost of capital, leading to erroneous inferences, if not considered. We also show that, while information asymmetry *increases* the cost of capital in most settings, it *decreases* the cost of capital when the amount of public information is low, while it has *no effect* when the total information is of high quality and when there is a high level of market competition. Our final results indicate that the precision of private information *decreases* the cost of capital when the amount of public information is low, while it *increases* it when the quality of total information is low. Besides examining various aspects of the environment jointly, our study is also unique in that we use better measures of information asymmetry and precision, which allows us to tease out the economic significance of each factor on cost of capital. We find that cost of equity capital varies greatly with our measures of information asymmetry and average information precision. For example, our regression estimates suggest that information asymmetry and average information precision are comparable in importance to equity beta and firm size in determining firms' cost of capital.

1. INTRODUCTION

The effects of information asymmetry and information quality on firms' cost of equity capital are of great interest to managers and investors and have been much debated by academics in recent years. The primary question of dispute is whether information asymmetry affects the cost of capital directly or the relation between the two constructs depends on other, perhaps more important, features of the information environment. In this study, we extend prior findings by examining empirically the variation in the effect of information asymmetry on the cost of capital, based on certain features of the environment, suggested by different theories. In addition, we quantify the economic magnitude of our documented effects on the cost of capital, which is in itself a matter of debate (Zimmerman 2012). Our main finding is that the relation between information asymmetry and the cost of equity capital varies greatly, both in direction and in magnitude, based on information precision, the quantity and quality of available information and the market competition among investors.

Our empirical analysis is closely related to that of Botosan, Plumlee and Xie (2004) and Botosan and Plumlee (2007), who examine the relation between several features of the information environment and the cost of capital. We further their research by (1) examining additional aspects of the information environment in joint tests that are guided by recent theory, (2) using new, less noisy measures of the information environment that allow us to estimate the economic magnitude of the effect of the information environment on the cost of capital, and (3) exploring in more depth the relation between private information precision and the cost of capital, because theory predicts that private information precision does not always have the positive effect documented by Botosan et al. (2004) and Botosan and Plumlee (2007).

We base much of our analysis on the theoretical papers by Easley and O'Hara (2004), Hughes, Liu and Liu (2007) and Lambert, Leuz and Verrecchia (2012). Easley and O'Hara (2004) identify information asymmetry and the precision of public and private information, among other non-information variables, as the main determinants of the cost of capital. One of the authors' main and most cited result is that information asymmetry increases the cost of equity capital. Hughes et al. (2007) and Lambert et al. (2012), on the other hand, argue that the relation between information asymmetry and the cost of capital depends on the nature of the market, i.e. the size of the economy and the extent to which a single transaction affects price. Specifically, Hughes et al. (2007) argue that information asymmetry does not affect the cost of capital in large economies where full diversification occurs. Lambert et al. (2012) show that after controlling for the average precision of information, information asymmetry does not affect the cost of capital when there is perfect market competition. Moreover, the authors suggest that information asymmetry may actually *decrease* the cost of capital if information precision increases. Leland (1992) and Wang (1993) also provide evidence consistent with information asymmetry decreasing firm cost of capital. Therefore, this research suggests a significant variation in the effect of information asymmetry on the cost of capital, from a positive to a non-existent, and even a negative relation. Hence, we test these theories empirically by examining the link between information asymmetry and the cost of capital after controlling for the average precision and while holding the nature of the market fixed, proxied by the amount and quality of information and the level of market competition. In addition, we examine the effect of information precision on the cost of capital. Specifically, we predict a negative relation between the cost of capital and the average information precision and the precision of public information, but are unable to make a directional prediction about the relation between the cost of capital and the precision of private information. Our study sheds light on the debate over the effect of firm-specific information characteristics on the cost of capital and provides an improvement over prior research, which focuses on a subset of these constructs or refers to them collectively as information risk or information quality.

To test our predictions about the effect of firms' information environment characteristics on the cost of capital, we collect a sample with available quarterly earnings forecasts in the I/B/E/S Detail data for the period 1983-2010. Our final sample includes a total of 36,919 firm/quarter observations from 636 firms. However, most of our analyses are based on the 614 sample firms that are listed on both Compustat and CRSP.

The results show that average information precision lessens the effect of information asymmetry on the cost of equity capital, but does not eliminate it in our full sample. The economic effect of precision is many times larger than that of information asymmetry, but nevertheless, the information asymmetry effect continues to be statistically and economically significant, especially for firms with information of low quality and where the level of market competition is low. Further, we find that information asymmetry *decreases* the cost of capital when the amount of public information is low, while it does not affect it when the overall information is of high quality.

Next, we consider the effect of market competition, proxied by size and the number of shareholders. We find evidence that the relation between information asymmetry and the cost of capital is much stronger for firms with low competition and it goes away for firms with high competition, when this construct is proxied by size. Our results with the number of shareholders as a proxy are not as strong and suggest that there is an information asymmetry effect for both firms with high and low market competition, but this may be due to a poor proxy for market competition. In addition, we find that information precision also has an effect on the cost of capital – average precision and the precision of public information are negatively related to the cost of capital, i.e. they decrease the cost of capital, although the economic magnitude of their effect varies based on the other characteristics. Interestingly, the precision of private information does not affect the cost of capital in our full sample but we show that when the amount of public information is low, the precision of private information actually *decreases* the cost of capital, which is consistent with Easley and O'Hara's (2004) argument that more precise private information is better than no information. Finally, private information precision has a statistically and economically significant positive effect of the cost of capital for firms with low quality of information; i.e. when the quality of overall information is poor, more precise private information *increases* the cost of capital.

In addition to examining aspects of the information environment jointly, we also employ the empirical approach of Sheng and Thevenot (2012 hereafter ST), which modifies the information environment measures of Barron, Kim, Lim and Stevens (1998 hereafter BKLS). Our improved measures allow us to demonstrate not only the direction and statistical significance of different cost of capital determinants but also their economic significance. In supplementary (untabulated) analyses, we compare our results to those obtained using original BKLS measures and while, the results are generally consistent in terms of the direction of the relations, the statistical and economic significance are much lower when using the BKLS measures. This is because the new measures are, by design, subject to less measurement error. Moreover, our regression estimates suggest that information asymmetry and information precision are important factors in determining firms' cost of capital, and that the importance of these aspects of the information environment is not apparent using the BKLS measures.

This paper makes two significant contributions to the literature. First, it provides systematic evidence of the relation between investors' information environment and the cost of equity capital. Prior empirical evidence in the literature is mixed due to the difficulties associated with measuring the necessary information environment characteristics and the lack of thorough understanding of the determinants of the cost of equity capital. In addition, recent theoretical research by Hughes et al. (2007) and Lambert et al. (2012) challenges the source and intuition behind the positive relation between information asymmetry and the cost of capital examined by Easley and O'Hara (2004). As a result, Lambert et al. (2012) call on empiricists to find "more settings that result in distinct proxies for average precision and information asymmetry with contrasting predictions" (p. 20). In addition, Botosan et al. (2004) call for more research on the type of firms where the magnitude and direction of public and private information precision on the cost of capital may vary. To the best of our knowledge, this is the first paper that provides systematic evidence of the varied effects of information-based factors on the cost of capital.

Second, the paper uses improved measures of the characteristics of investors' information environment, which allow us to abstract the relative economic significance of information-based determinants of the cost of capital and other well-known factors, such as beta and size. Zimmerman (2012) argues that information-based factors are at best of secondary importance, while the literature has assumed that they have a primary effect on price and the cost of capital. Our paper provides evidence on this debate and allows the readers to make their own conclusions about the relative importance of each factor in several different settings. In addition, Lambert et al. (2012) imply that while, it may be difficult to distinguish average precision from information asymmetry empirically, unless we do so, we will not be able to attribute an observed effect solely to information asymmetry. This paper provides a step in the right direction in separating the two effects in different settings. Finally, Verdi's (2005) results suggest that the choice of an information risk proxy can affect the inference from tests of whether increased information risk increases the cost of capital. This paper provides an econometric technique that can be used to obtain estimates of these unobservable properties that are well aligned with the underlying theoretical constructs and alleviate some of the limitations of other previously used measures.

The rest of the paper is organized as follows. Section 2 provides the hypothesis development. Section 3 discusses the research design and gives details on the empirical proxies used in the paper. Section 4 provides the sample selection and descriptive statistics and Section 5 discusses the empirical results. Finally, Section 6 concludes.

2. PREDICTIONS

We explore the effect of certain information environment characteristics on the cost of capital, as suggested by several theories. Specifically, we focus on the distribution of information (information asymmetry, the amount of public information) and the quality of information (average precision and precision of public and private information) as important determinants of the cost of capital. In addition, we consider the effect of market competition on these relations. We examine the relations empirically as actual market outcomes are unlikely to be captured fully by a single analytical specification.

Our study on the association between the distribution of information and the cost of capital is motivated by the theoretical papers of Easley and O'Hara (2004), Hughes et al. (2007) and Lambert et al. (2012). Easley and O'Hara (2004) develop a model in which differences in the composition of information between public and private affect the cost of capital, with investors demanding a higher return to hold stocks with greater private (and less pubic) information. In addition, when the amount of public information is low, more precise private information, i.e. higher information asymmetry, is beneficial and should decrease firm cost of capital. However, Hughes et al. (2007) refute the price-protection intuition in Easley and O'Hara (2004) and suggest that the effect of information asymmetry on the cost of capital is driven by under-diversification by investors. Hughes et al.'s (2007) model further implies that the under-diversification effect disappears when the economy is large. In a similar vein, Lambert, et al. (2011) further point out that the relation between information asymmetry and the cost of capital depends on the quality of information and the role of market competition. With perfect competition, there is no separate systematic risk factor in price that stems from information asymmetry and thus, the cost of capital is not affected by information asymmetry per se but by the average information precision. With imperfect competition, however, information asymmetry affects the cost of capital even after controlling for investors' average precision. Moreover, information asymmetry may even decrease the cost of capital if average precision increases. This also suggests that information precision is an important variable correlated with both information asymmetry and the cost of capital and if excluded, may lead to a serious correlated omitted variable problem and consequently, erroneous inferences. Overall, the studies imply that the relation between information asymmetry and cost of capital depends on the information environment. Therefore, based on the arguments above, we predict the following. First, we expect to find that the cost of capital is increasing in the information asymmetry, holding average information precision fixed. Second, we predict that information asymmetry *decreases* the cost of capital when the amount of public information is low and when the quality of information is high, holding information precision fixed.

Prior research suggests that information asymmetry does not affect the cost of capital in large economies (Hughes et al. 2007) and in the presence of perfect competition (Lambert et al. 2012). However, to the extent that some market imperfection or friction exists, the effect of information asymmetry on the cost of capital will be observed. Therefore, the joint effect of information asymmetry and the nature of the market on the cost of capital is an empirical question. Consistent with these theories and based on different proxies for the degree of market competition, Armstrong, Core, Taylor and Verrecchia (2011) and Akins, Ng and Verdi (2011) find that the effect of information asymmetry on the cost of capital is stronger when the level of market competition is lower. However, we test the moderating effects of both average information precision and market competition on the relation between information asymmetry and the cost of capital. Therefore, we predict that information asymmetry does not have an effect on the cost of capital when the level of market competition is high, holding average precision fixed.

As aptly pointed out by Lambert et al. (2012) and discussed above, the effect of information quality, i.e. average information precision, on the cost of capital should be considered separately from the effect of information asymmetry. Their model implies that the cost of capital is always decreasing in the average information precision with both perfect and imperfect competition. Consistent with this idea, recent empirical research explores the interactive effects of information asymmetry and the quality of information on the cost of capital. Lambert, Leuz and Verrecchia (2006) show that information quality directly affects a firm's cost of capital because an improvement in information quality decreases non-diversifiable risk. Bloomfield and Fischer (2010) analyze how disagreement influences the cost of capital. They find that more precise information disclosure reduces the cost of capital by reducing uncertainty, regardless of disagreement. In addition, Ng (2011) shows that higher information quality decreases liquidity risk and thereby decreases the cost of capital. Using path analysis, Bhattacharya, Ecker, Olsson and Schipper (2011) find significant evidence of both a direct path from earnings quality to the cost of capital, consistent with an information quality effect, and an indirect path that is mediated by information asymmetry. This suggests that when there is a trade-off between the quality and distribution of information, increasing information quality has a bigger effect on the cost of capital than decreasing information asymmetry. Hence, both information asymmetry and overall precision have to be considered in tandem in order to isolate the effect of each on the cost of capital. We predict that the cost of capital is decreasing in the average information precision, holding information asymmetry fixed.

A standard assumption in the literature is that analysts' information set includes both public and private information (e.g. BKLS). Prior analytical and empirical research suggests that more precise public information decreases the cost of capital via a reduction in information asymmetry and estimation risk. Therefore, we predict that the cost of capital is decreasing in the precision of public information precision. However, existing studies provide conflicting results regarding the effect of private information precision on the cost of capital. One stream implies that more precise private information increases the cost of capital through greater information asymmetry (see, e.g., Botosan et al. 2004, Botosan and Plumlee 2007, Lambert, et al. 2011). However, another stream implies that more precise private information reduces the cost of capital through reduced estimation risk, although the effect exists when the level of public information is low, i.e. more private information is better than no information (see, e.g., Easley and O’Hara 2004). This suggests that the effect of private information precision on the cost of capital may depend on other factors, such as the amount of available information. Therefore, we expect that private information precision *decreases* the cost of capital when the amount of public information is low. We also examine the effect of the quality of total information but do not form a specific prediction due to the lack of guidance from prior research.

3. RESEARCH DESIGN AND EMPIRICAL PROXIES

3.1. Research Design

To test our hypotheses, we estimate the following regression models:

$$COC_{it}=\beta_0+\beta_1 Beta_{it}+\beta_2 LMktvalue_{it}+\beta_3 LBM_{it}+\beta_4 Growth_{it}+\beta_5 Asym_{it}+\beta_6 LAveprec+e_{it} \quad (1)$$

and

$$COC_{it}= \gamma_0 + \gamma_1 Beta_{it}+ \gamma_2 LMktvalue_{it}+ \gamma_3 LBM_{it}+ \gamma_4 Growth_{it} + \gamma_5 Lh_{it}+ \gamma_6 Ls_{it}+ u_{it}, \quad (2)$$

where COC_{it} is the cost of capital for firm *i* in quarter *t*; $Beta_{it}$ is the market model beta for firm *i* in quarter *t*; $LMktvalue_{it}$ is the natural logarithm of the market value of equity for firm *i* in quarter *t*; LBM_{it} is the natural logarithm of the book-to-market ratio for firm *i* in quarter *t*; $Growth_{it}$ is growth in earnings for firm *i* in quarter *t*; $Asym_{it}$ is the information asymmetry for firm *i* in quarter *t*; $LAveprec_{it}$ is the natural logarithm of average information precision for firm *i* in quarter *t*; Lh_{it} is the natural logarithm of public information precision for firm *i* in quarter *t* and Ls_{it} is the natural logarithm of private information precision for firm *i* in quarter *t*. We also include firm and year fixed effects in all model specifications.[1]

We follow prior cost of capital research and include controls for risk (*Beta*), size (*LMktvalue*, *LBM*) and growth in earnings (*Growth*) in our models. We expect that the coefficient estimates on *Beta*, *LBM* and *Growth* will be positive and the coefficient estimate on *LMktvalue* will be negative. Our primary interest is in the coefficient on $Asym_{it}$, which is

[1] Our results are robust to two-way clustering as suggested by Gow, Ormazabal and Taylor (2010), as well as to including firm fixed effects and clustering by year as suggested by Thompson (2011).

expected to vary based on the information environment, i.e. the amount and quality of information, and market competition, as discussed in the previous section. We expect the coefficient on $LAveprec_{it}$ to be negative. Additionally, the coefficient on Lh_{it} is predicted to be negative and the coefficient on Ls_{it} is expected vary based on the information environment.

To explore the possible effect of the information environment and market competition on the relation between information asymmetry and the cost of capital, we run the regressions above on sub-samples based on the lowest and highest quintiles of the following variables: consensus (as a proxy for the amount of public information), average information precision (as a proxy for the quality of total information), size and the number of shareholders (as proxies of market competition). The first quintiles represent firms with the lowest values and the top quintiles represent firms with the highest values of the given variables. The variable measurements are explained in more detail in the next section.

3.2. Empirical Proxies

3.2.1. Cost of Capital (COC)

To estimate the firm's cost of capital we use Easton's (2004) PEG ratio method as this is one of the most widespread and well-behaved estimates of the implied cost of capital (see, e.g., Botosan and Plumlee 2005; Botosan, Plumlee and Wen 2011). According to this method, cost of capital can be estimated using the following expression:

$$COC_{it} = \sqrt{(eps_{i(t+2)} - eps_{i(t+1)})/p_{it}}\,, \qquad (3)$$

where $eps_{i(t+1)}$ ($eps_{i(t+2)}$) is the firm's one-year ahead (two-year ahead) mean forecast of earnings and p_{it} is the current price from IBES summary files.[2] We estimate *COC* in the month of the current quarter-end. As an alternative, we use the measure of cost of capital obtained with the

[2] Our results are identical when we use median forecasts.

target price method employed by Botosan et al. (2004), which is based on Value Line forecasts. We obtain qualitatively identical results using this alternative measure and the results are omitted for brevity.[3]

3.2.2. Market Beta (Beta), Market Value of Equity (LMktvalue), Book-to-Market Ratio (LBM) and Growth (Growth)

We follow prior research on the cost of capital and include control variables for risk, size and growth in earnings in all of our empirical analyses. Market beta (*Beta*) is estimated using the market model with a minimum of 30 out of 60 monthly returns and the value-weighted market index return from CRSP as a measure of the market return. The estimation for *Beta* ends in the month before the current quarter-end.

Firms' market value of equity is calculated as the number of common shares times the stock price and the book-to-market ratio is equal to common equity divided by the market value of equity. Both variables are calculated at the end of the quarter prior to the quarter in which *COC* is estimated using quarterly Compustat data. If unavailable, we use annual Compustat and calculate the variables at the fiscal year-end immediately prior to the current quarter-end. We follow prior research and take the natural logarithms of the variables to mitigate the skewness in the distributions. Finally, growth in earnings is calculated as $(eps_2\text{-}eps_1)/|eps_1|$, where $eps_{i(t+1)}$ ($eps_{i(t+2)}$) are defined above.

[3] There is an ongoing debate about what measures of cost of capital are most appropriate – implied cost of capital estimates or realized returns. A concern with using implied cost of capital measures based on analyst forecasts is that the relation between the constructs may be driven or affected by analysts' forecast bias. However, we argue that the analyst bias is less likely to be an issue in this study and choose to use implied cost of capital measures for the following reasons. First, Botosan et al. (2011) conclude that only estimates based on the PEG ratio and the target price method are valid in a variety of settings. Second, our ST adjusted measures of information asymmetry and average precision are less likely to be affected by the bias, because they are partly based on debiased past forecast errors and on short-term quarterly forecasts, which are not biased. Third, our results hold across two implied cost of capital measures constructed from different sets of analysts and Value Line forecasts tend to be less optimistically biased than I/B/E/S forecasts.

3.2.3. Information asymmetry (Asym), Average Information Precision (LAveprec) and Precision of Public Information (Lh) and Private Information (Ls)

To obtain empirical proxies for information asymmetry, average information precision and the precision of public and private information we use the BKLS measures modified by ST (i.e., Sheng and Thevenot 2012). BKLS show that one can express consensus, uncertainty and the precision of public and private information as follows:

$$\rho_{it} = \frac{SE_{it} - \frac{D_{it}}{N}}{SE_{it} + (1 - \frac{1}{N})D_{it}}, \tag{4}$$

$$V_{it} = SE_{it} + (1 - \frac{1}{N})D_{it}, \tag{5}$$

$$h_{it} = \frac{SE_{it} - \frac{D_{it}}{N}}{[SE_{it} + (1 - \frac{1}{N})D_{it}]^2}, \tag{6}$$

and

$$s_{it} = \frac{D_{it}}{[SE_{it} + (1 - \frac{1}{N})D_{it}]^2}, \tag{7}$$

where ρ is consensus, *V* is overall uncertainty, *h* is precision of public information, *s* is precision of private information, *SE* is the expected squared error of the mean forecast, *D* is expected forecast dispersion and *N* is the number of analysts. BKLS suggests that one can use observed dispersion and mean squared error as proxies for D_{it} and SE_{it} to empirically estimate the constructs in equations (4)-(7). Since it is based on information available to analysts at the time the forecasts are made, observed forecast dispersion seems to be a good proxy for its expected counterpart, D_{it}. However, using actual earnings to estimate SE_{it} may pose a serious problem because forecast errors are known to analysts only after the announcement of actual earnings. To alleviate the issues associated with using an *ex post* estimate of SE_{it}, ST use a generalized autoregressive conditional heteroskedasticity (GARCH) model to estimate the squared error of the mean forecast using historical data only. Specifically, the method uses the time series of errors in the mean forecast to provide an estimate of their variance, σ_{it}^2. After estimating the GARCH model, one can obtain the conditional variance, $\hat{\sigma}_{it}^2$, which is then used as an estimate of SE_{it} in the expressions above. When this substitution is used, we then refer to the BKLS measure as having been either "ST adjusted", or simply "adjusted" and subscript the variable with an "a".[4]

We take *1-ρ* as our measure of information asymmetry. Since ρ is the ratio of public to total information, *1-ρ* measures the ratio of private to total information. This estimate of information asymmetry is used in prior research. The rational for this measure is stated by Barron, Stanford and Yu (2009) as follows:

> "We use lack of consensus (*1-ρ*) to proxy simultaneously for two forms of information asymmetry. First, this measure is specifically designed to gauge the degree to which individual analysts possess private information that is different from that of other analysts (i.e., information asymmetry among analysts). Second, we assume that the relative degree to which analysts possess private information also reflects the degree of information asymmetry between informed and uninformed investors. This assumption is consistent with analysts representing relatively informed investors who are likely to have more information than uninformed investors when a greater proportion of the analysts' information is private in nature (p. 333)."

We take *Aveprec* as our measure of average information precision, which is simply the inverse of ST uncertainty (i.e. *1/V*). Lambert et al. (2012) show that average information precision is equal to the average amount of uncertainty that investors assess and this uncertainty is measured by their average precision regarding the distribution of cash flows. Hence, the inverse of earnings forecast uncertainty provides a good proxy for the average information precision construct examined by Lambert et al. (2012).

[4] Matlab code for estimating σ_{it}^2 using GARCH is available from the authors upon request.

Our measures of public and private information precision are provided in equations (6) and (7) and are obtained using the ST approach as discussed above. Specifically, we replace SE_{it} by $\hat{\sigma}_{it}^2$. We estimate our information environment variables using forecasts in the 90 days before the current quarter's earnings announcement.[5]

It should be noted that while the ST adjusted measures provide an improvement over the original BKLS measures, they have certain limitations as well. First, the GARCH estimation requires a long time-series of data and hence, our sample includes primarily large and heavily followed firms. Therefore, our results may not be generalizable to smaller or short-lived firms. Second, as Williams (2004) points out, our measures of the information environment are based on analysts' forecasts and hence, do not necessarily reveal information characteristics of investors or the public at large. Third, our estimates are subject to the same assumptions as the BKLS measures, which are discussed in detail in Barron et al. (1998). Nevertheless, the BKLS measures based on analyst forecasts have been used extensively in a variety of settings and there is no reason to believe that they are inadequate, except for measuring the underlying theoretical constructs with noise, which is alleviated with the ST adjustment.

3.2.4. The amount of public information, the quality of total information and market competition

We base our proxy for the amount of public information on consensus (i.e., ρ in equation (4) above). As discussed previously, consensus measures the proportion of total information that is public. If consensus is equal to one, then all information is public and if it is equal to zero, then

[5] We replace negative values of consensus and precision of public information with missing values as they represent measurement errors. As a result, less than one percent of ST adjusted measures and about ten percent of unadjusted BKLS measures are eliminated.

all information is private. Therefore, the bottom quintile of consensus includes those firms with the lowest amount of public information relative to the total information and conversely, the top quintiles includes those firms with the highest amount of public information, relative to the total information, within our sample. We run our main models using these two subsamples and posit that the first sub-sample is the one with the least amount of public information, while the second sub-sample is the one with the highest amount of public information.

Similarly, we define a sub-sample with the lowest (highest) quality of total information, based on the bottom (top) quintile of average information precision (*Aveprec)*, as defined above. We run our main models using these two subsamples and posit that the first sub-sample is the one with the lowest quality of total information, while the second sub-sample is the one with the highest quality of information.

Finally, we take the bottom (top) quintiles for size (i.e., *Mktvalue*) and the number of shareholders to proxy for low (high) market competition. Large firms are more likely to be actively traded and heavily followed by analysts and therefore, their cost of capital is less likely to be affected by information asymmetry (Lambert et al. 2012). We also follow Armstrong et al. (2011) and use the number of shareholders to measure the extent of market competition. We use the number of shareholders of record from annual Compustat as of the fiscal year end immediately prior to the current quarter.

4. SAMPLE SELECTION AND DESCRIPTIVE STATISTICS

Our initial sample includes all US firms with quarterly forecasts in the I/B/E/S Detail tape for the period 1983 – 2010. For the purposes of obtaining the measures of interest in this paper, we use analyst forecasts made 90 days prior to the quarterly earnings announcement where the earnings announcement is made within 90 days of the quarter end. If an analyst issued multiple forecasts in this period, we retain only the forecast closest to the earnings announcement date. In addition, we retain firm/quarters with at least two forecasts in the 90 days before the earnings announcement. Since GARCH estimation requires long time-series of data, we require a minimum of 40 consecutive quarters of observations in the 1983 – 2010 time period. This yields a total of 36,919 firm/quarter observations from 636 unique firms of which 616 firms are listed on Compustat, 628 are listed on CRSP and 614 are listed on both Compustat and CRSP.

The descriptive statistics pertaining to the variables used in our empirical analyses are displayed in Table 1. The mean (median) value of our estimate of the cost of capital is 11.9 (10.0) percent. We lose some observations when we obtain an estimate of the cost of capital using the PEG ratio method because it requires that the two-year ahead mean forecast is higher than the one-year ahead mean forecast. Mean (median) market beta for our sample is 1.09 (1.05), which suggests that the average sample firm is riskier than the market. The mean (median) market value of equity of approximately $12,790 ($3,941) million indicates that our sample consists of primarily large firms. This is not surprising given our data requirements of a long time-series of available data. Mean (median) book-to-market ratio is 0.52 (0.46) implying that our sample firms trade at a large premium above book value. The mean (median) earnings growth rate is 50 (15) percent. We follow most of prior research and take the natural logarithm transformations of *Mktvalue* and *BM* in our subsequent analyses.

Asym may be interpreted as the ratio of analysts' private to total information and the mean (median) value of information asymmetry in our sample is approximately 19 (11) percent. Summary values of *Aveprec*, *h* and *s* in Table 1 show that these variables' distributions are highly skewed with large standard deviations. Therefore, we use natural logarithm transformations of these information environment variables in our later analyses.

Table 2 provides Spearman and Pearson correlation coefficients. Almost all correlation coefficients are highly statistically significant in the expected direction. Consistent with prior research, our cost of capital measure *COC* is positively related to *Beta*, *LBM* and *Growth* and negatively related to *LMktvalue*. *COC* is negatively related to all our precision variables. The negative relation between *COC* and Ls_a suggest that higher precision of private information is associated with lower cost of capital, consistent with Easley and O'Hara's (2004) theory but inconsistent with Botosan et al.'s (2004) and Botosan and Plumlee's (2007) empirical findings. However, *Lh* and *Ls* are positively related and hence, it is necessary to examine their effect on the cost of capital while controlling for each other in a multivariate setting. Interestingly, the Spearman correlation coefficient between *COC* and *Asym* is negative and highly statistically significant, while the Pearson correlation coefficient between the same variables is significant in the opposite direction. This highlights the need to examine the relation between these two variables in a multivariate analysis. Additionally, perhaps contrary to common belief, the correlation between *LAveprec* and *Asym* is positive and statistically significant implying that higher information precision is associated with higher information asymmetry.

5. EMPIRICAL RESULTS

Table 3 presents the regression results for the relation between the cost of capital and information asymmetry. All control variables are highly statistically significant in the right direction. Prior research suggests and finds a positive relation between information asymmetry and the cost of capital. Our results reported in Table 3 are consistent with this finding. However, Lambert et al. (2012) point out that this relation is modified by the average information precision. Specifically, the association between information asymmetry and the cost of capital should decrease or even disappear if average precision is controlled for. Our results suggest that information asymmetry has a separate effect on the cost of capital apart from average precision. The coefficient estimate of 0.029 (0.016) is highly statistically significant with a t-value of 15.380 (8.358) when average information precision is excluded (included). This result is consistent with a large literature that has documented a positive relation between information asymmetry and the cost of capital (see, e.g., Botosan and Plumlee 2007, Bhattacharya, Desai and Venkataraman 2008, Barth, Konchitchki and Landsman 2011, among others). However, the magnitude of the coefficient estimate and the significance level decrease by almost one half when average precision is included in the model, which is consistent with Lambert et al.'s (2012) theory. In addition, the coefficient estimate on average information precision is negative and highly statistically significant with a t-value of -29.078.

To examine the economic significance of our results we calculate the percentage change in the cost of capital for one standard deviation increase in each of the independent variables. Table 3 shows that the cost of capital increases by 3.70 (2.02) percent for one standard deviation increase in information asymmetry when average precision is excluded (included). This suggests that average information precision does indeed decrease the effect of information asymmetry on the cost of capital but the remaining effect continues to be economically significant. For example, the economic effect of information asymmetry is about the effect of beta on the cost of capital even when average precision is controlled for. Interestingly, average information precision has a comparable economic effect on the cost of capital to the effect of size; firm cost of capital decreases by 19.60 percent for one standard deviation increase in the logarithmic transformation of average information precision. In addition, this effect is much more substantial than the effect of information asymmetry, which is consistent with theory and Bhattacharya et al. (2011).

Next, we examine the effect of the amount and quality of information on the relation between information asymmetry and the cost of capital. Table 4 presents the results for firms with low and high amount of public relative to the total available information. While the results presented in the first columns where average information precision is excluded are comparable between firms with low (Panel A) and firms with high (Panel B) amount of public information in terms of direction and economic significance, the results when average precision is included are dramatically different. As expected, information asymmetry actually *decreases* the cost of capital when the amount of public information is low; the coefficient is -0.014 with a t-value of -2.825, suggesting that cost of capital decreases by 1.74 percent for each standard deviation increase in information asymmetry. [6] In the case of firms with high amount of public information, asymmetry continues to have a statistically and economically significant positive effect of the cost of capital. Table 5 provides evidence on the modifying effect of information quality, as Lambert et al. (2012) suggest that information asymmetry may decrease the cost of capital when average information increases. Indeed the coefficient on *Asym* is negative for firms with high information quality when information precision is included but it is not statistically significant. However, the positive relation between asymmetry and the cost of capital is especially pronounced for firms with low quality, suggesting the uninformed investors of such firms are at a particular disadvantage, relative to the informed.

[6] The calculated economic significance in sub-sample analyses is based on means and standard deviations of the variables in the given sub-sample.

The results so far suggest that firms with low amount of public information can benefit from higher information asymmetry because some of the private information is revealed through informed investors' actions making a poor information environment richer (Easley and O'Hara 2004). Also, average information precision poses a significant correlated omitted variable problem, if it is excluded from a model of cost of capital on information asymmetry. The inclusion of this variable in the model eliminates or even reverses the relation in certain circumstances.

Next, we examine the effect of market competition since Lambert et al. (2012) show that information asymmetry has an effect on the cost of capital only when there is imperfect market competition. Therefore, we repeat the analysis on sub-samples of low and high market competition. Table 6 shows the results for size, where small (large) firms are those with low (high) level of market competition. Indeed, the relation between asymmetry and the cost of capital is no longer significant for large firms and it is more positive for small firms than that of other samples. The last column in Panel A of Table 6 suggests that the cost of capital of small firms increases by 12.83 percent for each standard deviation increase in information asymmetry, while the effect is zero for large firms.

The results for the number of shareholders proxy for market competition are not as strong as Table 7 shows a statistically and economically significant effect of asymmetry on the cost of capital for both sets of firms, although the cost of capital percentage changes are slightly lower for the high number of shareholders sub-sample, relative to the low number of shareholders sub-sample. This is due perhaps to the limitations of this variable as a proxy for market competition (Armstrong et al. 2011).

We examine the effect of public and private information precision on the cost of capital in Tables 8, 9 and 10. Consistent with the theory of Easley and O'Hara (2004) and the empirical results of Botosan et al. (2004) and Botosan and Plumlee (2007) we find that higher public information precision is associated with lower cost of capital; the coefficient on *Lh* is -0.011 and highly statistically significant with a t-value of -30.730. The coefficient on *Ls* is not statistically significant. This may be due to the potential dual effect of private information precision on the cost of capital. On one hand, more precise private information may lead to greater information asymmetry and hence, is associated with higher cost of capital (see, e.g. Diamond and Verrecchia 1991). On the other hand, as Easley and O'Hara (2004) discuss, higher precision of private information may decrease the cost of capital, particularly when there is limited public information. Therefore the effect of private information precision on the cost of capital may depend on the amount and quality of information.

To examine this possibility, we perform the analysis on our sub-samples based on the amount and quality of information. Table 9 shows the precision of private information actually *decreases* the cost of capital in firms with low amount of private information, which is again consistent with Easley and O'Hara's (2004) argument that more precise private information is better than no information. The economic impact of private information precision is large as well; one standard deviation increase in private information precision is associated with a 17.17-percent decrease in the cost of capital. In addition, the effect of public information precision almost disappears in this sub-sample, which is intuitive; when there is no public information available, its precision does not matter. However, when there is high amount of public information, private information precision has no effect, while the effect of public information precision has a particularly strong negative effect on the cost of capital.

Table 10 shows the results for the low and high information quality sub-samples. Consistent with prior results in Botosan et al. (2004) and Botosan and Plumlee (2007), we find that both public and private information precision have a separable and opposite effect on the cost of capital for firms with low quality, while only public information matters for the cost of capital when firms have high quality of information. This may also imply that the sample in these prior studies includes primarily firms with lower quality of information and their results may not be generalizable to the wider population of firms.

Overall, we find that the relation between information asymmetry and the cost of capital depends on several important factors. First, average information precision should always be included in models of cost of capital and asymmetry, as failure to do so may lead to erroneous inferences due to a correlated omitted variable problem. Second, while the positive relation between asymmetry and the cost of capital holds in most situations, it is reversed when there is little public information available and at the very least, does not exist when the total information is of high quality and when there is a high level of market competition. In addition, we find that private information precision has opposing effects on the cost of capital for firms with low amount of public information vs. firms with low quality of information.

6. CONCLUSION

The primary purpose of this study is to test theories on the effect of important information environment characteristics on the cost of equity capital. Consistent with Lambert et al. (2012) we find that average information precision is an important factor that is related to both information asymmetry and the cost of capital, potentially yielding a serious correlated omitted variable problem if excluded from a model of the cost of capital on information asymmetry.

Indeed, the well cited result of Easley and O'Hara (2004) that information asymmetry increases cost of capital is reversed when information precision is considered and the amount of public information is low, while it disappears when the total information is of high quality or there is high market competition. We find a negative relation between the cost of capital and both the total information precision and the public information precision, which is consistent with theory and prior research. Interestingly, the positive effect of private information precision on the cost of capital documented by Botosan et al. (2004) exists only when the available information is of low quality and in fact, reverses when the amount of public information is low.

A secondary purpose of this paper is to introduce measures of the information environment characteristics that are less noisy than previously used proxies, which may allow researchers to test new hypotheses. For example, the new measures will be particularly useful if a certain relation depends on the forecast horizon and if the researcher is interested in longer horizons. In addition, future research may examine the reaction of different market participants to the firm information environment characteristics.

One of our more interesting findings concerns the economic significance of factors determining the cost of capital, a significance which, to our best knowledge, is not seen in prior research. This evidence is timely and important because of the debate on the importance of different information-based variables for the determination of firm value and cost of equity capital (Zimmerman 2012). We provide evidence on the economic significance of several information environment variables relative to other well-known determinants, such as size and beta and the reader may make their own conclusions about the relative importance of each factor. Our study should be useful in this respect.

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Table 1: Descriptive statistics

Variable	N	Mean	Std Dev	Q 1	Median	Q 3
COC	34,424	0.119	0.105	0.083	0.100	0.127
Beta	34,899	1.090	0.565	0.717	1.048	1.375
Mktvalue	35,041	12,789.910	30,551.390	1,637.890	3,940.950	10,588.410
BM	34,545	0.519	0.370	0.288	0.456	0.664
Growth	36,427	0.500	3.541	0.100	0.151	0.260
Asym	36,630	0.189	0.207	0.036	0.113	0.270
Aveprec	36,919	3,049.430	26,740.580	68.099	287.585	1,380.440
h	36,630	2,437.820	24,282.260	53.039	227.711	1,091.460
s	36,919	631.162	5,572.270	4.378	30.715	189.934
Shareholders	34,477	63.677	184.078	4.162	15.576	49.566

The table is based on available firm/quarter observation from 1983 – 2010.

COC is the implied cost of capital based on the PEG ratio method (Easton 2004). *Beta* is the market beta estimated using the market model with a minimum of 30 out of 60 monthly returns prior to the month in which *COC* is estimated using the value-weighted market index return. *Mktvalue* is the market value of equity as of the most recent quarter prior to the month, in which *COC* is calculated, stated in millions of dollars; if unavailable market value of equity at the previous fiscal year end is used. *BM* is common equity divided by market value of equity as of the most recent quarter prior to the month, in which *COC* is calculated; if unavailable book-to-market ratio at the previous fiscal year end is used. *Growth* is growth in earnings calculated as $(eps_2-eps_1)/|eps_1|$. *Asym* is the proportion of total information that is private calculated as $1-\frac{SE_{it}-\frac{D_{it}}{N}}{SE_{it}+\left(1-\frac{1}{N}\right)D_{it}}$ over the 90 days prior to the current quarter's earnings announcement, where *i* denotes the firm and *t* denotes the quarter, *SE* denotes the GARCH estimate of the expected squared error in the mean forecast, as suggested by Sheng and Thevenot (2012), *D* is the forecast dispersion and *N* is the number of analysts. *Aveprec* is the average precision calculated as $1/(SE_{it}+(1-\frac{1}{N})D_{it})$ over the 90 days prior to the current quarter's earnings announcement. *h* is the precision of public information, calculated as $\frac{SE_{it}-\frac{D_{it}}{N}}{[SE_{it}+(1-\frac{1}{N})D_{it}]^2}$ over the 90 days prior to the current quarter's earnings announcement. *s* is the precision of private information, calculated as $\frac{D_{it}}{[SE_{it}+(1-\frac{1}{N})D_{it}]^2}$ over the 90 days prior to the current quarter's earnings announcement. *Shareholders* is the number of common shareholders on record as of the previous fiscal year end, stated in millions.

Table 2: Spearman (below the diagonal) and Pearson (above the diagonal) correlation coefficients

	COC	Beta	LMktvalue	LBM	Growth	Asym	LAveprec	Lh	Ls
COC		0.175	-0.255	0.280	0.782	0.035	-0.284	-0.289	-0.125
Beta	0.321		-0.146	-0.064	0.335	-0.029	0.048	0.050	0.010
LMktvalue	-0.355	-0.167		-0.349	-0.204	0.122	0.107	0.089	0.105
LBM	0.305	-0.066	-0.344		-0.066	-0.048	-0.444	-0.432	-0.218
Growth	0.782	0.335	-0.204	-0.066		-0.033	-0.002	0.002	-0.025
Asym	-0.043	-0.043	0.146	-0.064	-0.033		0.073	-0.101	0.341
LAveprec	-0.280	0.059	0.106	-0.499	-0.002	0.139		0.982	0.544
Lh	-0.274	0.061	0.089	-0.482	0.002	0.017	0.983		0.492
Ls	-0.250	0.025	0.162	-0.426	-0.025	0.611	0.849	0.774	

LMktvalue is the natural logarithm of *Mktvalue*. *LBM is* the natural logarithm of *BM*. *LAveprec* is the natural logarithm of *Aveprec. Lh* is the natural logarithm of *h*. *Ls* is the natural logarithm *s*. All other variables are defined in Table 1.
All correlation coefficients are significant at the 1% level except the Pearson correlation coefficient between *Beta* and *Ls,* which is significant at the 10% level and the Pearson and Spearman correlation coefficients between *Growth* and *LAveprec* and Growth and *Lh*, which are statistically insignificant.

Table 3: Information asymmetry and the cost of capital

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.387	***		0.474	***	
	(42.185)			(49.742)		
Beta	0.005	***	1.74	0.006	***	2.06
	(5.018)			(5.814)		
LMktvalue	-0.027	***	-24.10	-0.028	***	-24.70
	(-35.276)			(-37.501)		
LBM	0.013	***	5.59	0.009	***	3.83
	(13.931)			(9.193)		
Growth	0.002	***	1.76	0.002	***	4.31
	(20.794)			(19.921)		
Asym	0.029	***	3.70	0.016	***	2.02
	(15.380)			(8.358)		
LAveprec				-0.014	***	-19.60
				(-29.078)		
N	31,044			31,044		
Adj. R-sq	0.40			0.42		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%; T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable, where the other variables are held at their means.

Table 4: Information asymmetry and the cost of capital: the amount of public information

Panel A: Firms with low amount of public information

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.427	***		0.533	***	
	(20.142)			(22.818)		
Beta	0.003		1.22	0.003		1.20
	(1.346)			(1.549)		
LMktvalue	-0.034	***	-36.36	-0.036	***	-37.96
	(-18.092)			(-19.291)		
LBM	0.01	***	5.26	0.006	***	3.11
	(4.614)			(2.887)		
Growth	0.002	***	1.52	0.002	***	4.83
	(8.327)			(7.542)		
Asym	0.013	***	1.63	-0.014	***	-1.74
	(2.978)			(-2.825)		
LAveprec				-0.013	***	-20.76
				(-10.353)		
N	6,030			6,030		
Adj. R-sq	0.62			0.62		

Panel B: Firms with high amount of public information

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.376	***		0.461	***	
	(13.493)			(16.669)		
Beta	-0.001		-0.31	-0.001		-0.30
	(-0.418)			(-0.448)		
LMktvalue	-0.024	***	-19.09	-0.025	***	-18.77
	(-15.041)			(-15.794)		
LBM	0.012	***	4.69	0.007	***	2.58
	(6.015)			(3.591)		
Growth	0.005	***	3.10	0.004	***	4.99
	(14.179)			(13.675)		
Asym	0.329	***	1.42	0.548	***	2.23
	(3.121)			(5.285)		
LAveprec				-0.015	***	-20.93
				(-16.841)		
N	6,189			6,189		
Adj. R-sq	0.43			0.45		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%; T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.

Table 5: Information asymmetry and the cost of capital: the quality of information

Panel A: Firms with low quality of information

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.945	***		1.041	***	
	(7.930)			(8.898)		
Beta	-0.002		-0.36	-0.001		-0.16
	(-0.457)			(-0.215)		
LMktvalue	-0.078	***	-34.35	-0.076	***	-30.01
	(-20.537)			(-20.389)		
LBM	0.022	***	4.50	0.017	***	3.12
	(5.061)			(4.022)		
Growth	0.001	***	0.66	0.001	***	1.79
	(5.256)			(4.593)		
Asym	0.085	***	6.10	0.072	***	4.63
	(9.340)			(7.990)		
LAveprec				-0.033	***	-12.82
				(-14.129)		
N	5,329			5,329		
Adj. R-sq	0.41			0.44		

Panel B: Firms with high quality of information

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.19	***		0.242	***	
	(28.475)			(26.954)		
Beta	-0.001		-0.53	-0.001		-0.53
	(-1.187)			(-1.448)		
LMktvalue	-0.01	**	-16.00	-0.01	**	-16.19
	(-14.318)			(-14.367)		
LBM	0.002	***	1.31	0.002	***	1.32
	(2.449)			(2.305)		
Growth	0.004	***	2.31	0.004	***	4.37
	(18.289)			(18.231)		
Asym	0.005	***	0.95	-0.000		0.00
	(3.302)			(-0.073)		
LAveprec				-0.006	***	-5.70
				(-8.518)		
N	6,727			6,727		
Adj. R-sq	0.47			0.48		

All regression models include firm and year fixed effects.
***Significant at 1%; **Significant at 5%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.

Table 6: Information asymmetry and the cost of capital: size

Panel A: Small firms

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.462	***		0.59	***	
	(18.135)			(21.890)		
Beta	0.008	**	7.05	0.009	**	9.73
	(1.999)			(2.489)		
LMktvalue	-0.064	***	-64.48	-0.065	***	-80.35
	(-17.021)			(-17.643)		
LBM	0.012	***	11.57	0.004		4.73
	(2.923)			(1.031)		
Growth	0.002	***	1.63	0.002	***	14.41
	(5.412)			(4.907)		
Asym	0.057	***	16.56	0.036	***	12.83
	(7.536)			(4.705)		
LAveprec				-0.025	***	-110.10
				(-13.008)		
N	5,902			5,902		
Adj. R-sq	0.41			0.42		

Panel B: Large firms

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.194	***		0.226	***	
	(9.426)			(11.053)		
Beta	0.002		1.24	0.004	***	3.34
	(1.553)			(2.800)		
LMktvalue	-0.01	***	-8.87	-0.01	***	-11.92
	(-7.492)			(-7.409)		
LBM	0.008	***	6.69	0.007	***	7.88
	(6.444)			(5.493)		
Growth	0.002	***	3.02	0.002	***	9.61
	(13.377)			(12.826)		
Asym	0.009	***	2.35	-0.000		0.00
	(4.194)			(-0.049)		
LAveprec				-0.009	***	-32.10
				(-13.447)		
N	6,341			6,341		
Adj. R-sq	0.43			0.45		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%; **Significant at 5%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.

Table 7: Information asymmetry and the cost of capital: number of shareholders

Panel A: Firms with low number of shareholders

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.259	***		0.36	***	
	(16.256)			(21.288)		
Beta	0.006	***	4.17	0.008	***	6.06
	(3.693)			(4.610)		
LMktvalue	-0.023	***	-30.14	-0.024	***	-34.27
	(-13.756)			(-14.436)		
LBM	0.009	***	6.89	0.006	***	5.01
	(3.895)			(2.730)		
Growth	0.002	***	2.46	0.002	***	7.68
	(11.035)			(10.904)		
Asym	0.033	***	7.35	0.013	***	3.16
	(8.719)			(3.282)		
LAveprec				-0.017	***	-42.76
				(-15.470)		
N	5,647			5,647		
Adj. R-sq	0.43			0.46		

Panel B: Firms with high number of shareholders

Variable	Estimate		Percent change	Estimate		Percent change
Intercept	0.407	***		0.452	***	
	(25.596)			(28.144)		
Beta	0.012	***	5.03	0.013	***	5.83
	(6.030)			(6.662)		
LMktvalue	-0.03	***	-30.36	-0.03	***	-32.51
	(-18.543)			(-18.330)		
LBM	0.01	***	5.47	0.007	***	4.10
	(5.961)			(4.273)		
Growth	0.002	***	1.63	0.002	***	6.00
	(15.994)			(16.256)		
Asym	0.022	***	3.67	0.013	***	2.32
	(7.774)			(4.611)		
LAveprec				-0.01	***	-19.71
				(-12.882)		
N	6,149			6,149		
Adj. R-sq	0.53			0.54		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%; **Significant at 5%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.

Table 8: Public and private information precision and the cost of capital

Variable	Estimate		Percent change
Intercept	0.46	***	
	(48.376)		
Beta	0.006	***	2.03
	(5.734)		
LMktvalue	-0.028	***	-24.30
	(-36.943)		
LBM	0.009	***	3.77
	(9.863)		
Growth	0.002	***	4.24
	(19.901)		
Lh	-0.011	***	-15.33
	(-30.730)		
Ls	0.000		0.00
	(1.413)		
N	30,657		
Adj. R-sq	0.41		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable, where the other variables are held at their means.

Table 9: Public and private information precision and the cost of capital: the amount of public information

Panel A: Firms with low amount of public information

Variable	Estimate		Percent change
Intercept	0.513	***	
	(22.893)		
Beta	0.003		1.19
	(1.538)		
LMktvalue	-0.036	***	-37.53
	(-19.229)		
LBM	0.006	***	3.08
	(2.938)		
Growth	0.002	***	4.77
	(7.573)		
Lh	-0.001	*	-1.72
	(-1.653)		
Ls	-0.011	***	-17.17
	(-7.173)		
N	6,030		
Adj. R-sq	0.62		

Panel B: Firms with high amount of public information

Variable	Estimate		Percent change
Intercept	0.458	***	
	(16.211)		
Beta	-0.002		-0.60
	(-0.748)		
LMktvalue	-0.024	***	-18.32
	(-14.272)		
LBM	0.009	***	3.38
	(4.115)		
Growth	0.004	***	5.07
	(13.132)		
Lh	-0.015	***	-21.27
	(-16.114)		
Ls	-0.000		0.00
	(-0.264)		
N	5,801		
Adj. R-sq	0.45		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.

Table 10: Public and private information precision and the cost of capital: the quality of information

Panel A: Firms with low quality of information

Variable	Estimate		Percent change
Intercept	0.993	***	
	(8.494)		
Beta	-0.001		-0.18
	(-0.227)		
LMktvalue	-0.075	***	-33.47
	(-20.276)		
LBM	0.017	***	3.52
	(4.089)		
Growth	0.001	***	2.02
	(4.635)		
Lh	-0.031	***	-14.10
	(-16.135)		
Ls	0.002	***	2.28
	(3.746)		
N	5,300		
Adj. R-sq	0.43		

Panel B: Firms with high quality of information

Variable	Estimate		Percent change
Intercept	0.219	***	
	(27.946)		
Beta	-0.001		-0.51
	(-1.593)		
LMktvalue	-0.01	***	-15.39
	(-14.944)		
LBM	0.001		0.63
	(1.500)		
Growth	0.004	***	4.15
	(18.075)		
Lh	-0.003	***	-2.91
	(-7.082)		
Ls	-0.000		0.00
	(-1.230)		
N	6,543		
Adj. R-sq	0.48		

The dependent variable is *COC*. All variables are defined in Table 1 and Table 2.
All regression models include firm and year fixed effects.
***Significant at 1%. T-values of two tailed tests are in parentheses.
The Percent change columns provide the percentage change in the cost of capital for one standard deviation increase in the respective variable for the given sub-sample, where the other variables are held at their means.