Information Asymmetry and the Cost of Equity Capital

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Abstract

This study examines the effect of information asymmetry on the cost of equity capital of firms listed on the Australian Stock Exchange. We calculate the ex ante cost of equity capital for constituent companies of the S&P/ASX 200 Index. The bid-ask spread of the companies are decomposed to find the adverse selection component, which is used to measure the information asymmetry of the company. We control for factors generally known to influence the required return on equity, such as industry, beta, size and book-to-market, and analyst coverage and forecast EPS dispersion (to proxy for the information environment). This study documents a significant and robust negative relationship between information asymmetry and ex ante investor's required rate of return. We also find that earnings forecast dispersion increases ex ante cost of capital, while analyst coverage tends to decrease the return required by investors. This is consistent with the expectation that cost of capital increases with higher levels of information uncertainty and asymmetry.

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1. Introduction

Past literature suggests that information plays an important role in affecting firms' cost of equity capital (COEC) (e.g., Botosan, 1997; Leuz and Verrecchia, 2000; Botosan and Plumlee, 2002; Hail, 2002; and Francis et al., 2004, 2005). Firms with more forthcoming information disclosure policies are shown to be associated with lower COEC. For example, Botosan (1997) estimates that, in a sample of manufacturing firms with low analyst following, firms with the most transparent disclosure experience a 9.7% reduction in its COEC relative to the least forthcoming firms. Building upon this informational-COEC relational framework, we propound three unique motivations for this study. First, prior literature (Easley and O'Hara, 2004; Grossman and Stiglitz 1980; Leland, 1992; and Wang, 1993) focuses on the theoretical relation between information asymmetry and a firm's COEC and lack coherence in conclusions drawn. We provide further evidence by empirically testing whether the information structure of firms (private versus public) affects investors required rate of return. Second, unlike prior research that uses realized stock returns as an estimate for required cost of capital, this study uses models that estimate the ex ante cost of capital based on market data and analyst forecasts. This provides a forward-looking measure of investors' expected returns. Third, while prior studies examine the relations between information and the cost of capital by examining firm disclosure practices and required rate of return, this study focus's on the effect of information asymmetry. We employ a refined proxy by using the adverse selection component of the bid-ask spread (Brockman and Chung, 1999). By employing high frequency trade data from the Australian Stock Exchange, we are better able to measure information asymmetry.

Prior studies that investigate whether investors demand a return premium for investing in stocks that exhibit substantial information asymmetry are mainly theoretical. Easley and O'Hara (2004) document that differences in the composition of information (public vs private) affect the cost of capital. They argue that information asymmetry increases firms' cost of capital, because less informed traders recognize they are at an information disadvantage and will hold assets where their disadvantage is less. This drives down the price of securities with high degrees of information asymmetry, thereby increasing the cost of capital. The conclusion is that private information thus induces a new form of systematic risk, and in equilibrium investors require compensation for it. Furthermore, they suggest that firms can influence their cost of capital by affecting the precision and quantity of information through the firm's selection of accounting standards, disclosure policies, attracting an active analyst following and choosing where to list their securities for trading.

However, prior research is not unanimous on the impact of information asymmetry on the COEC. For example, Leland (1992) and Wang (1993) suggest that increasing the percentage of informed investors in the economy lowers the cost of capital, because this information is communicated (partially) through price when investors condition their expectations over price in determining their trade (e.g., Grossman and Stiglitz, 1980; Leland, 1992). Wang (1993) documents in a two-asset multiperiod model that asymmetric information has two effects on asset prices. First, uninformed investors require a risk premium to compensate them for the adverse selection problem that arises from trading with informed traders. Second, informed trading also makes prices more informative, thereby reducing the risk for the uninformed and lowering the risk premium. Leland (1992) finds that allowing insider trading will, on average, increase stock prices despite the fact that the presence of insiders increases information asymmetry in the economy. Although he does not couch his analysis in terms of cost of capital, higher stock prices on average are tantamount to a decrease in firms' cost of capital. Lambert, Leuz, and Verrecchia (2008) examine the relation between information differences across investors and the cost of capital. They show that increasing information asymmetry actually decreases the firm's cost of capital, provided the change in information structure increases average precision. Information differences across investors affect a firm's cost of capital through investors' average information precision, and not information asymmetry *per se*. Diamond and Verrecchia (1991) develop a model in an imperfect competition market in which investors are differentially informed. They show that revealing public information to reduce information asymmetry among investors can increase liquidity and reduce a firm's cost of capital.

This study investigates the role of information in determining companies cost of equity capital, with a specific focus on the effect of asymmetry between public and private information. The question we seek to answer here is: whether and how does the composition of information influence investors required rate of return on a stock? Unlike prior research that uses realized stock returns as an estimate for required cost of capital, this study uses models that estimate the ex ante rate of return required by investors based on market data and analyst forecasts. Techniques to obtain unbiased estimates of expected returns from realized stock returns require long time-series to wash out the effects of shocks to firms' growth opportunities (e.g., Elton, 1999; Stulz, 1999). The prevalent asset pricing model for estimating the cost of capital in the financial economics literature employs the Fama-French three-factor model (see Fama and French, 1993). However, Fama and French (1997) demonstrate the difficulties encountered in accurately estimating the cost of capital and show that the three-factor cost-of-capital estimates are imprecise at the firm level as well as the industry level. Furthermore, the issues of whether and how information differences across investors affects the cost of capital cannot be addressed in conventional models of asset pricing, such as the Fama and French model, because these models generally assume investors have homogeneous beliefs (Lambert, Leuz and Verrecchia, 2009). This study uses four different models developed in the literature to compute the implied cost of capital from 2001 to 2008 for constituent companies in the S&P/ASX 200 Index. This method of estimation provides a representation of the rate of return expected by investors on an ex ante basis. (See Claus and Thomas, 2001; Gordon and Gordon, 1997; Ohlson and Juettner-Nauroth, 2000; and Easton 2004).

The bid-ask spread of the companies are decomposed to find the adverse selection component, which is used to measure the information asymmetry of the company. We control for factors generally known to influence the required return on equity, such as industry, beta, size and book-to-market. Furthermore, investment banks routinely solicit underwriting business by arguing that their financial analysts will lower a company's cost of capital by attracting a greater institutional following to the stock.[1] To proxy for the information environment of a firm we also control for analyst coverage and forecast EPS dispersion. We find evidence supporting Easley and O'hara's (2004) empirical prediction; by showing that information asymmetry is related to higher cost of equity capital. This study documents a significant and robust negative relationship between information asymmetry and ex ante investor's required

[1] Parkash, M. and W. K. Salatka (1999) finds significant relations between dispersion of analyst's forecasts and firm-specific characteristics that proxy for business risk, financial risk and information availability.

rate of return. We also find evidence that the dispersion of analysts' forecasts increases ex ante cost of capital, while analyst coverage tends to have a negative relation to expected return. This is consistent with the expectation that cost of capital increases with information uncertainty and asymmetry

The remaining parts of this paper are organized as follows. The data requirements are described in Section 2. This is followed by a discussion of the methodology in Section 3. Section 4 presents the results. This is followed by the conclusion in section 5.

2. Data

Several datasets are employed to construct and identify variables for the regression model used in this study. Each of the data sources are summarized in Table 1. The measures of the equity cost of capital are constructed using monthly observations of individual companies between 2001 and 2008.

< INSERT TABLE 1 >

To compute the cost of capital estimates, we obtain company financial and share price data from Datastream and analyst forecasts information from *I/B/E/S*. Each observation is required to have one-year-ahead and two-year ahead non-negative earnings forecasts; either a long-term growth forecast or a three-year-ahead earnings forecast, and a contemporaneous share price in order to be included in the cost of capital computation. For each firm-month observation, we compute the ex ante cost of capital implied in contemporaneous stock price and analyst forecast data. The basic premise of the models is to substitute price and analyst forecasts into the valuation equation and to back out the cost of capital as the internal rate of return that equates current stock price and the expected future sequence of residual incomes or abnormal earnings. We use the one-year-ahead realized rates of inflation as a proxy for expected terminal growth (Hail and Leuz, 2006). Firms with only one analyst following their stock are removed.

With the assumptions of the four models (See Claus and Thomas 2001; Gordon and Gordon, 1997; Ohlson and Juettner-Nauroth, 2000; and Easton 2004), implied rate of return cannot be calculated given negative earnings. Furthermore, investors required rate of return can never be negative. Therefore, we use only positive earnings forecasts and growth rates. Although applying this filter eliminates less than 4 percent of observations, it could potentially bias the results. Any firm with consistent losses and no expected profit is likely to become bankrupt and cease to exist. A firm with negative earnings and positive stock price is expected to generate a profit in the future. Investor's required rate of return for firms with short-term negative earnings may be higher than a consistently profitable firm, because of the additional risk. Therefore the exclusion of such firms would create a downward bias on estimates, which is a limitation of our method.

To estimate the adverse selection component of the bid-ask spread, trade-by-trade data with prevailing bid-ask quotes over the period 1 January, 2001 to 31 December, 2008 are used. The adverse selection and order processing components of the bid-ask spread are calculated for each trade and averaged for every firm-month.

3. Methods

3.1 Cost of Equity Capital Estimation

We calculate the firms' implied cost of capital on the IBES consensus date of every month. While there is little consensus among academics as to how to construct the equity cost of capital for a country or market, extant literature does point to several methodologies that provide a proxy for the true cost of capital.

The four models utilized are employed in the recent literature, specifically Hail and Leuz (2006), and Bhattacharya and Daouk (2002). The individual models differ with respect to the use of analyst forecast data, the assumptions regarding short-term and long-term growth, the explicit forecasting horizon, and terminal value. Together, they help generate findings that are robust to the different possible cost of capital estimation techniques. The models developed by Claus and Thomas (2001) is a special case of the residual income valuation model described by Ohlson (1995), while the models developed by Gordon and Gordon (1997), Ohlson and Juettner-Nauroth (2005) and Easton (2004) are based on the abnormal earnings growth valuation model and discounted dividends models. We follow the procedures in Gode and Mohanram (2003) in computing the OJN estimate, and use Botosan and Plumlee's (2005) implementation in computing the PEG Ratio. The aim of all four models is to substitute price and analyst forecasts into a valuation equation and then to recursively determine the cost of capital as the internal rate of return that equates current stock price and the expected future sequence of residual incomes or abnormal earnings. The four implied cost of capital approaches share the same underlying valuation model, i.e., the discounted cash flow model.

The following four models are constructed using the variables listed below:

P_t	Market price of a firm's stock at date t
bv_t	Book value per share at the beginning of time t
$bv_{t+\varphi}$	Expected future book value per share at date t + φ
$\hat{x}_{t+\varphi}$	Expected future earnings per share for period t + φ using the mean of analyst forecasts
$\hat{d}_{t+\varphi}$	Expected future net dividends per share for period t + φ using the mean of analyst forecasts
g_{st}	Expected short term growth rate
g_{lt}	Expected long term growth rate
r	Implied cost of capital estimates calculated as the internal rate of return solving the above valuation equations

Model by Claus and Thomas (2001)

The first proxy for the cost of capital is constructed by Claus and Thomas (2001), and is a variation of the residual income valuation model. It is employed in Hail and Leuz (2006) and also in Francis, Khurana and Pereira (2005). It uses actual book values per share and forecasted earnings per share up to five years ahead to derive the expected future residual income series. Residual income is defined as forecasted earnings per share less a cost of capital charge for beginning-of-year book value of equity per share. The model assumes a clean surplus relationship in accounting, i.e., future book values are imputed from current book values, forecasted earnings and dividends. Dividend payout ratio is assumed to be a constant fraction of forecasted earnings. As a proxy for *g*, the one-year-ahead realized inflation rate is used. The value of *g* used in this model sets the lower bound of the cost of equity estimates. Given the complexity of this measure of the cost of capital and the availability of data, it is necessary to solve them iteratively.

$$P_t = bv_t + \sum_{\psi=1}^{T} \frac{(\hat{x}_{t+\psi} - r.bv_{t+\psi-1})}{(1+r)^{\psi}} + \frac{(\hat{x}_{t+T} - r.bv_{t+T})(1+g)}{(r-g)(1+r)^{T}} \tag{1}$$

Model by Gordon and Gordon (1997)

The second proxy for the cost of capital is constructed by Gordon and Gordon (1997) and is a variation of the dividend discount model. It is employed in Guay, Kothari and Shu (2005). This is a special case of the residual income valuation model. It uses forecasted dividend and earnings per share to derive the expected rate of return. The Finite Horizon Gordon model assumes the return on equity reverts back to *r* after the forecast horizon ends.

$$p_t = \sum_{i=1}^{T} \frac{E[d_t]}{(1+r)^t} + \frac{E[EPS_{T+1}]}{r(1+r)^T} \quad (2)$$

Model by Ohlson and Juettner-Nauroth (2000)

The third proxy for the cost of capital is developed by Ohlson and Juettner-Nauroth (2005) and is a special case of the abnormal earnings growth valuation model. This model is utilized by Hail and Leuz (2006) and by Botosan, Plumlee and Xie (2006) in their analysis of the importance of private information. It uses one-year ahead forecasted earnings and dividends per share as well as forecasts of short-term and long-term abnormal earnings growth. Dividend payout ratio is assumed to be a constant fraction of forecasted earnings. Following Gode and Mohanram (2003), the short-term growth rate g_{st} is estimated as the average between the forecasted percentage change in earnings from year *t*+1 to *t*+2 and the five-year growth forecast provided by financial analysts on *I/B/E/S*. This model requires a positive change in forecasted earnings to yield a numerical solution. The long-term earnings growth rate g_{lt} incorporates the assumption that growth in abnormal earnings per share beyond year *t*+1 equals the one-year-ahead realized inflation rate. We will use the annualized country-specific median of one year ahead realized monthly inflation rates.

$$P_t \qquad \frac{\left(\frac{\hat{x}_{t+1}}{r}\right)\left(\frac{g_{st} + r.\hat{d}_{t+1}}{\hat{x}_{t+1} - g_{lt}}\right)}{r \quad g_{lt}} \quad (3)$$

Modified PEG ratio model by Easton (2004)

The fourth proxy for the cost of capital is constructed by Easton (2004) and is a variation of the abnormal growth valuation model developed by Ohlson and Juettener-Nauroth (2004). It uses one-year ahead and two-year ahead earnings per share forecasts as well as expected dividends per share in period t+1 to derive a measure of abnormal earnings growth. Dividend payout ratio is assumed to be a constant fraction of forecasted earnings. The model embeds the assumption that growth in abnormal earnings persists in perpetuity after the initial period. Due to the nature of the model it requires positive changes in forecasted earnings (including re-invested dividends) to yield a solution.

$$P_t = \frac{(\hat{x}_{t+2} + r.\hat{d}_{t+1} - \hat{x}_{t+1})}{r^2} \qquad (4)$$

For the valuation models that have no closed form solution, we use an iterative procedure to determine the internal rate of return. This numerical approximation identifies the annual firm-specific discount rate that equates to the market price in the respective equity valuation model. All estimates are mean analyst consensus forecasts.

3.2 Estimation of Adverse Selection

Financial theory suggests that bid-ask spreads can be partitioned into three components: order processing costs, inventory holding costs and adverse selection costs. The fixed cost of doing business is defined as order processing cost (Tinic, 1972). Order flow imbalances generate inventory holding costs for the market maker (Stoll, 1989). The cost from asymmetric information and informed trading to the market maker form the adverse selection component of the bid-ask spread. Glosten and Harris (1988) conduct one of the first studies that decomposes the bid-ask spread into transitory and permanent components. Lin, Sanger and Booth (1995) propose a simple method of decomposing the bid-ask spread into order-processing and adverse selection in their study to explore the relation between dealer costs and trade size. Brockman and Chung (1999) use this method to extend bid-ask decomposition literature into the order driven market.

We estimate the following regression model according to Lin, Sanger and Booth (1995)

$$\Delta Q_{t+1} = \lambda Z_t + e_{t+1} \tag{6}$$

$$\Delta P_{t+1} = -\gamma Z_t + u_{t+1} \tag{7}$$

where $\Delta Q_{t+1} = Q_{t+1} + Q_t$, Q_t is the log quote midpoint at time *t*. $\Delta P_{t+1} = P_{t+1} + P_t$; $Z_t = P_t - Q_t$, P_t is the transaction price at time *t*, and $Q_t = (A_t + B_t)/2$. The disturbance terms e_{t+1} and u_{t+1} are assumed to be uncorrelated. λ is the adverse information component of the effective spread. γ is the order processing component of the bid-ask spread.

3.3 Regression Analysis

In this section, we examine how information asymmetry influence cost of equity capital of companies? Based on arguments of Easley and O'Hara (2004) – less informed traders recognize they are at an information disadvantage and will hold assets where their disadvantage is less. This drives down the price of securities with high degrees of information asymmetry, thereby increasing the cost of capital.

The null hypothesis that information asymmetry (proxied by adverse selection cost) does not affect the cost of equity capital is tested by regressing the average estimate of cost of equity capital (COC_AVG) against logged number of analysts covering a stock (LogNumber), logged mean-adjusted standard deviation of EPS forecast (LogEPSVAR) and adverse selection component of the bid-ask spread (logadv), along with control variables derived from the Fama-French three-factor model (Fama and French, 1993), logged book-to-market ratio (LogBMR), logged market capitalization (LogMV) and beta. Further, industry sector (financial, health, industrial, information technology and telecommunications, material, metals, oil and gas, and utilities) is added to investigate whether particular sectors are related to the implied cost of capital.

To formally test for the effect of information asymmetry (proxied by adverse selection) we regress the variables on cost of equity capital using ordinary least squares regression with Newey and West t-statistics and Hansen's (1982) Generalized Methods of Moments (GMM) procedure. GMM estimates the coefficients through the use of orthogonality conditions and provides results that are robust to the presence of autocorrelation and heteroskedasticity. We control for autocorrelation and heteroskedasticity using the Parzen Kernel (Gallant, 1987). Andrews (1991) shows that the Bartlett Kernel used by Newey and West (1987) exhibits greater bias and is 100 percent less efficient asymptotically than the Parzen Kernel. The lag truncation period is calculated using the formula n^(1/5) (Andrews, 1991). As a robustness check we rerun the regression with White's heteroscedasticity consistent t-statistics.

$$COEC\_AVG_{it} = c_1 + c_2 LogNumber_{it} + c_3 LogEPSVar_{it} + c_4 LogBMR_{it} + c_5 LogMV_{it} + c_6 \beta_{it} + c_7 LogAdv_{it} + \sum_{j=8}^{k} c_j GICS_{it} \quad (5)$$

We calculate the standard deviation of analyst EPS forecasts for the next forecast period end. Beta is estimated using monthly returns for the 5 years prior. The values of beta are winsorized to be between -0.5 and 2.5. We use the number of analysts covering a particular stock on the consensus date of every month in the *I/B/E/S* database. Forecast EPS dispersion is measured by the standard deviation of analyst EPS forecasts on the consensus date of every month in the *I/B/E/S* database.

4. Results

Table 2 provides descriptive statistics on the ex-ante implied cost of capital (COC) using four different models employed in prior studies. These models are the finite Gordon model (COC_FHG) the Claus and Thomas model (COC_CT), the Ohlson and Juettner-Nauroth model (COC_OJ) and the modified price earnings growth ratio model by Easton (2004) (COC_PEG). The average COC (COC_AVG) across the 4 models for the years 2001-2008 is 8.93% for an average sample size of 980 firm months. The average cost of equity capital ranges from 8.31% in 2007 to 9.41% in 2008. Results from all four measures show the same trend in the required rate of returns demanded by investors throughout this period. After the bear market at the start of the millennium, cost of equity capital trended downwards in the bull market leading up to the global financial crisis of 2008. Amid the financial crisis, investors became more risk averse and demanded a higher rate of return to compensate for the risks they are taking. The four measures of cost of equity generate different results for each year. In particular, the Ohlson and Juettner-Nauroth model generates lower estimates (approximately 7% p.a.) compared to the other measures (which generate COC estimates of between 9% and 10% p.a.). This is due to differences in the underlying assumptions of the models. Albeit this distinction in the absolute values, the COC estimates of the four models show a high degree of consistency in changes through time.

< INSERT TABLE 2 >

The correlation between the COC based on the four models are presented in Table 3. All models show a positive correlation with each other. For example, CT has a 38.67%, 73.49% and 85.61% correlation with the PEG, OJN and FHG models respectively. This is reassuring because the four models, despite differing in their techniques, generate results that are qualitatively similar.

< INSERT TABLE 3 >

Table 4 presents descriptive statistics of the cost of equity capital variables for the sample period from 1/1/2001 to 31/12/2008. There are total of 7838 observations. The average (median) firm in the full sample has a COC of 9.0% (8.1%), with the interquartile distribution of COC ranging from 7.2% to 9.7%. The correlation matrix of the explanatory variables are shown in Table 5. These variables are the log of adverse selection cost (logadv), the firm beta

(beta), the log of analyst coverage (LogNumber), the log of analyst dispersion (LogEPSVAR), the log of book to market ratio (LogBMR) and the log of the market value of the firm (LogMV). All signs of the correlation coefficients between regressors are consistent with expectation. For instance, the high correlation between LogNumber and LogMV (48.85%) is attributed to greater market capitalized firms attracting higher analyst following (coverage). Additionally, the negative correlation between LogBMR and LogMV (-31.35%) results from the market value of a firm, by definition, being embedded within the denominator of the BMR. Further, LogMV is negatively correlated with beta given that higher market capitalized firms are more stable and less sensitive to systematic risk.

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Table 6 presents a comparison between the adverse selection cost and order processing cost components of the bid ask spread for all Australian Securities Exchange (ASX) trades from 2001 through 2008. The mean percent of the bid-ask spread attributable to adverse selection is 21.02%, comparable to the value reported for the SEHK order-driven market (31.15%) and the NYSE quote driven market (35%)[2]. This relatively smaller adverse selection component against the quote-driven market suggests the necessity for compensation under a voluntary system of market making that relies exclusively on public limit orders. This difference is also due to the fact the stocks in our sample are constituents stocks of the S&P/ASX 200 Index. Larger stocks tend to have higher liquidity and lower information asymmetry. Adverse selection cost ranges from 16.43% to 25.46% while order processing cost ranges from

[2] Brockman and Chung (1999) report an adverse selection component of 31.15% for their study based upon the Hong Kong Stock Exchange (SEHK) order-driven market. Evidence from quote-driven market is shown by Glosten and Harris (1988) and Lin et al. (1995), each reporting an adverse selection component of approximately 35%.

50.26% to 62.21%. The overall consistency of the higher order processing cost (relative to adverse selection cost) indicates that the fixed cost of doing business (Tinic, 1972) is significantly higher than the cost due to asymmetric information (Stoll, 1989). This may suggest that the order-driven market design is conducive to a lower information asymmetry between market participants but at the same time allowing a greater number of small retail traders to enter the market, thereby increasing the number of small trade parcels, which in turn increases the total fixed cost of trading for the market as a whole.

< INSERT TABLE 6 >

To examine the effect of information asymmetry (proxied by adverse selection) we regress the variables upon cost of equity capital using ordinary least squares regression with Newey and West t-statistics and Hansen's (1982) Generalized Methods of Moments (GMM) procedure. GMM provides results that are robust to the presence of autocorrelation and heteroskedasticity. Table 7 depicts the results of the regression using four different measures of cost of equity and their average estimate. The results are robust across different estimates of cost of equity capital. For the FHG, PEG and AVG measures the information asymmetry proxied by adverse selection component of the bid-ask spread have a positive relation with cost of capital, significant at the 1% level. This relation is significant at the 5% level for the cost of capital estimates using CT and OJ methods. The signs of the Fama-French control variables are as expected. Analyst coverage reduces the cost of capital for all cases expect the FHG measure for which the result is insignificantly negative. Forecast EPS dispersion increases the cost of capital for all cases expect the OJ measure for which the result is significantly positive. More emphasis should be given to the average of the cost of capital measures when interpreting the results. Research shows that averaging ex-ante estimates are generally more robust and empirically more accurate (see Clemen, 1989).

< INSERT TABLE 7 >

Table 8 examines the robustness of the relation between information asymmetry and the cost of equity capital using various models, which controls for different variables. The generalized method of moments regressions is performed on only the average cost of equity capital, but using different specifications. Model I only controls for the Fama-French three factors, while Model II also accounts for industry sectors. Model III controls for the Fama-French three factors, analyst coverage and forecast earnings dispersion while ignoring industry sectors. The Full Model combines all the factors to examine the impact of information asymmetry on ex-ante required returns. The results are significant and robust. All the models suggest that an increase in adverse selection component of the bid-ask spread will increase cost of equity capital on firms, significant at the 1% level. The signs of the Fama-French control variables are as expected. Analyst coverage reduces the cost of capital, while forecast EPS dispersion increases the cost of capital with varying degrees of significance.

< INSERT TABLE 8 >

The results of this OLS regression are shown in Table 9 and Table 10. White's estimators are used in this OLS to overcome variables encountering heteroskedasticity, as a robust check against the GMM regression approach. Results are qualitatively consistent with those shown in Tables 7 and 8. Information asymmetry (logadv) is positively significant at the 1% level for all the models used.

< INSERT TABLES 9 >

< INSERT TABLES 10 >

These results provide direct evidence of a significant relation between the implied cost of capital, and information availability, uncertainty and asymmetry that remain even after controlling for Fama-French three factors LogBMR, LogMV and beta. The negative coefficient on analyst coverage supports investment banks' arguments that analyst following reduces firms' cost of capital. Greater disclosure enhances stock market liquidity and through reduced transaction costs or increased demand for a firm's securities, the cost of equity capital is reduced. The positive relation between the implied cost of capital and analysts' earnings forecast dispersion is in line with Stuerke (1998), who finds a positive association between dispersion in earnings forecasts, the magnitude of price reactions around subsequent earnings releases, and information uncertainty. Further, the positive relation between the implied cost of capital and information asymmetry (measured by the adverse selection cost) supports our hypothesis. This is explained by Easley and O'Hara (2004) where less-informed traders understand they are disadvantaged and will hold assets where their disadvantage is less, thus driving down share prices of stocks with high levels of information asymmetry, thereby increasing the cost of capital.

5. Conclusion

This study empirically examines the effect of information on firms' cost of equity capital. We use analysts' short- and long-term earnings forecasts as proxies for the market's expectation of future earnings, and solve for the implied discount rate that equates the present value of the expected future payoffs to the current stock price. The effect of information asymmetry (proxied by adverse selection) on cost of equity capital is examined, after controlling for size, beta, book-to-market, and industry. This study documents a robust and significant positive relation between adverse selection component of the bid-ask spread and the cost of equity capital, while analyst following decreases the firm's required rate of return. This is consistent with the hypotheses that cost of capital decreases with higher levels of information and increases with information uncertainty and asymmetry.

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Table 1 – Summary of Data Sources

Data	Source	Period	Purpose
Price	Data Stream	Jan 2001 to Dec 2008	Implied Expected Return
Forecast EPS	IBES	Jan 2001 to Dec 2008	Implied Expected Return
Dividend	Data Stream	Jan 2001 to Dec 2008	Implied Expected Return
Book to Market	Data Stream	Jan 2001 to Dec 2008	Book Value
Inflation	Data Stream	Jan 2001 to Dec 2008	Long-term Growth
Intraday Trades	SIRCA	Jan 2001 to Dec 2008	Adverse Selection
Analyst Coverage & Dispersion	IBES	Jan 2001 to Dec 2008	Dispersion

Table 2 – Descriptive Statistics of cost of equity capital for S&P/ASX 200 Index constituent stocks from 1/1/2001 to 31/12/2008

Year	N	COC_AVG	COC_CT	COC_PEG	COC_OJ	COC_FHG
2001	974	9.37%	9.67%	9.99%	7.66%	10.18%
2002	1199	9.20%	9.54%	9.83%	7.63%	9.79%
2003	1109	9.23%	9.72%	9.50%	7.80%	9.92%
2004	957	8.69%	9.25%	9.24%	7.22%	9.07%
2005	960	8.56%	9.22%	9.07%	7.17%	8.80%
2006	982	8.67%	9.26%	9.59%	7.09%	8.72%
2007	877	8.31%	8.96%	9.44%	6.60%	8.23%
2008	780	9.41%	10.16%	10.11%	7.61%	9.78%
Average	980	8.93%	9.47%	9.60%	7.35%	9.31%

This table shows the average yearly implied cost of capital measured as of I/B/E/S consensus date of every month from January 2001 to December 2008. Refer to Section 3 – Methods for notations and procedures to calculate the four cost of capital measures.

Table 3 – Correlation between different methods of implied cost of capital calculation

Correlation	CT	PEG	OJ	FHG	AVG
CT	100.00%	38.67%	73.49%	85.61%	84.87%
PEG		100.00%	32.67%	46.98%	71.71%
OJ			100.00%	88.93%	84.37%
FHG				100.00%	93.92%
AVG					100.00%

This table presents average cross correlations between the five costs of capital measures. We calculate correlations from January 2001 to December 2008, and present the time-series means of these monthly correlations.

Table 4 – Descriptive Statistics of cost of capital and regression variables for S&P/ASX 200 Index constituent stocks from 1/1/2001 to 31/12/2008

Variables	N	Mean	STD	Q3	Median	Q1
COC_AVG	7838	0.090	0.033	0.072	0.081	0.097
COC_CT	7838	0.095	0.028	0.102	0.090	0.081
COC_FHG	7838	0.094	0.047	0.099	0.083	0.072
COC_OJ	7838	0.074	0.031	0.083	0.069	0.058
COC_PEG	7838	0.097	0.050	0.110	0.087	0.068
LogNumber	7838	2.024	0.444	2.303	2.079	1.792
LogEPSVAR	7838	-2.856	0.938	-2.325	-2.887	-3.450
LogBMR	7838	-0.704	0.701	-0.219	-0.646	-1.031
LogMV	7838	7.482	1.373	8.441	7.326	6.483
Beta	7838	0.933	0.616	1.317	0.949	0.535
LogAdv	7838	-1.715	0.611	-1.304	-1.630	-2.028

This table provides descriptive statistics on the cost of equity capital measures and the regression variables. Refer to Section 3 – Methods for notations and procedures to calculate the four cost of capital measures. Log number of analyst coverage (LogNumber); log mean-adjusted analyst earnings forecast dispersion (LogEPSVAR); log book-to-market ratio (LogBMR); log market capitalization (LogMV); *Beta* is estimated from a market model regression for each firm of monthly returns over the past five years (I require a minimum of 18 monthly returns available for each firm to estimate *Beta*); log adverse selection components of the bid-ask spread (LogAdv).

Table 5 – Correlation between regression variables

Correlation	logadv	beta	LogNumber	LogEPSVAR	LogBMR	LogMV
logadv	100.00%	-13.45%	23.20%	1.81%	-25.15%	20.33%
beta		100.00%	-28.12%	9.88%	7.66%	-25.62%
LogNumber			100.00%	-0.21%	-15.63%	48.85%
LogEPSVAR				100.00%	5.36%	-21.00%
LogBMR					100.00%	-31.35%
LogMV						100.00%

This table presents average cross correlations between the regression variables. We calculate correlations from January 2001 to December 2008, and present the time-series means of these monthly correlations

Table 6 – Descriptive Statistics of adverse selection and order processing components of the bid-ask spread for S&P/ASX 200 Index constituent stocks from 1/1/2001 to 31/12/2008

Year	Adverse_Selection	Order_processing
2001	25.46%	50.26%
2002	21.60%	51.29%
2003	20.28%	51.43%
2004	22.19%	53.98%
2005	23.69%	54.71%
2006	16.43%	54.09%
2007	17.95%	56.71%
2008	20.58%	62.21%
Average	21.02%	54.33%

This table shows the average annual components of the bid-ask spread. The bid-ask spread is decomposed into adverse selection and order processing using the Lin, Sanger and Booth (1995) method.

Table 7 – Generalized Method of Moments Regressions with different cost of equity capital measures

Parameter	CT	FHG	OJ	PEG	AVG
Intercept	10.978	13.3833	8.8688	19.9204	13.2876
	20.31***	16.23***	15.52***	23.9***	22.93***
LogBMR	0.3719	2.0199	1.4392	0.4746	1.0764
	3.46***	10.98***	12.28***	3.62***	9.21***
LogMV	-0.135	-0.088	-0.026	-0.376	-0.156
	-2.29**	-0.78	-0.37	-4.66***	-2.19**
beta	0.6262	1.254	0.9359	0.2424	0.7646
	4.47***	4.55***	5.41***	1.33	4.4***
LogNumber	0.0181	-0.162	-0.388	-0.819	-0.338
	0.11	-0.71	-2.37**	-2.89***	-2.03**
LogEPSVAR	0.0261	0.2944	-0.209	1.8053	0.4792
	0.42	3***	-2.8***	15.61***	6.81***
logadv	0.1721	0.5089	0.1953	0.4626	0.3347
	2.01**	3.5***	2.01**	3.96***	3.51***
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R-Square	0.1141	0.1661	0.1896	0.355	0.2111
Number of Obs.	7838	7838	7838	7838	7838

The regressand is the average cost of equity capital calculated from the four implied rate of return measures. Log number of analyst coverage (LogNumber); log mean-adjusted analyst earnings forecast dispersion (LogEPSVAR); log book to market ratio (LogBMR); log market capitalization (LogMV); five year rolling market beta (beta); log adverse selection components of the bid-ask spread (LogAdv) and Dummy variables for GICS sectors. T-statistics are presented in italics below coefficient estimates. *, **, and *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels.

Table 8 – Generalized Method of Moments Regressions on the average cost of equity capital

Parameter	Model-I	Model-II	Model-III	Full
Intercept	0.124225	0.117593	0.138118	13.2876
	21.35***	25.15***	19.63***	22.93***
LogBMR	0.008118	0.011095	0.008128	1.0764
	8.35***	9.25***	8.51***	9.21***
LogMV	-0.0039	-0.00252	-0.00272	-0.156
	-5.41***	-3.56***	-4.07***	-2.19**
beta	0.009693	0.008575	0.00854	0.7646
	5.91***	4.97***	5.03***	4.4***
logadv	0.004915	0.003063	0.004291	0.3347
	5.02***	3.2***	4.55***	3.51***
LogNumber			-0.00133	-0.338
			-0.76	-2.03**
LogEPSVAR			0.006971	0.4792
			10.19***	6.81***
Industry Dummies	NO	Yes	NO	Yes
Adj. R-Square	0.1183	0.197	0.1549	0.2111
Number of Obs.	7838	7838	7838	7838

The regressand is the average cost of equity capital calculated from the four implied rate of return measures. Log number of analyst coverage (LogNumber); log mean-adjusted analyst earnings forecast dispersion (LogEPSVAR); log book to market ratio (LogBMR); log market capitalization (LogMV); five year rolling market beta (beta); log adverse selection components of the bid-ask spread (LogAdv) and Dummy variables for GICS sectors. T-statistics are presented in italics below coefficient estimates. *, **, and *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels.

Table 9 – OLS Regressions with different cost of equity capital measures (White's Hetero-Adjusted T-stats)

Parameter	CT	FHG	OJ	PEG	AVG
Intercept	10.978	13.3833	8.8688	19.9204	13.2876
	39.35***	29.04***	29.52***	46.9***	43.06***
LogBMR	0.3719	2.0199	1.4392	0.4746	1.0764
	7.51***	24.7***	26.99***	6.3***	19.66***
LogMV	-0.135	-0.088	-0.026	-0.376	-0.156
	-4.72***	-1.85*	-0.84	-8.65***	-4.94***
beta	0.6262	1.254	0.9359	0.2424	0.7646
	11.81***	14.32***	16.4***	3***	13.04***
LogNumber	0.0181	-0.162	-0.388	-0.819	-0.338
	0.21	-1.16	-4.28***	-6.39***	-3.62***
LogEPSVAR	0.0261	0.2944	-0.209	1.8053	0.4792
	0.71	4.86***	-5.29***	32.33***	11.81***
logadv	0.1721	0.5089	0.1953	0.4626	0.3347
	3.21***	5.75***	3.39***	5.67***	5.65***
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Adj. R-Square	0.1141	0.1661	0.1896	0.355	0.2111
Number of Obs.	7838	7838	7838	7838	7838

The regressand is the average cost of equity capital calculated from the four implied rate of return measures. Log number of analyst coverage (LogNumber); log mean-adjusted analyst earnings forecast dispersion (LogEPSVAR); log book to market ratio (LogBMR); log market capitalization (LogMV); five year rolling market beta (beta); log adverse selection components of the bid-ask spread (LogAdv) and Dummy variables for GICS sectors. T-statistics are presented in italics below coefficient estimates. *, **, and *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels.

Table 10 – OLS Regressions on the average cost of equity capital (White's Hetero-Adjusted T-stats)

Parameter	Model-I	Model-II	Model-III	Full
Intercept	0.124225	0.117593	0.138118	13.2876
	48.17***	44.44***	47.6***	22.93***
LogBMR	0.008118	0.011095	-0.00133	1.0764
	15.24***	20.22***	-1.42	9.21***
LogMV	-0.0039	-0.00252	0.006971	-0.156
	-14.01***	-8.95***	18.37***	-2.19**
beta	0.009693	0.008575	0.008128	0.7646
	16.47***	14.86***	15.54***	4.4***
logadv	0.004915	0.003063	-0.00272	0.3347
	8.27***	5.18***	-8.75***	3.51***
LogNumber			0.00854	-0.338
			14.39***	-2.03**
LogEPSVAR			0.004291	0.4792
			7.27***	6.81***
Industry Dummies	NO	Yes	NO	Yes
Adj. R-Square	0.1183	0.197	0.1549	0.2111
Number of Obs.	7838	7838	7838	7838

The regressand is the average cost of equity capital calculated from the four implied rate of return measures. Log number of analyst coverage (LogNumber); log mean-adjusted analyst earnings forecast dispersion (LogEPSVAR); log book to market ratio (LogBMR); log market capitalization (LogMV); five year rolling market beta (beta); log adverse selection components of the bid-ask spread (LogAdv) and Dummy variables for GICS sectors. T-statistics are presented in italics below coefficient estimates. *, **, and *** indicate two-tailed statistical significance at 10, 5, and 1 percent levels.