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Disclosure and the cost of capital: what do we know?

Christine A. Botosan*

Abstract—Whether firms receive cost of capital benefits from greater disclosure is an important and controversial question. This paper reviews the relevant academic research that can provide insights into this question. In conducting this review, my primary objectives are to highlight the implications of existing research for accounting practitioners, standard setters, and academicians, and to address not only the question what do we know, but also the question what do we not know, yet? The overriding conclusion of existing theoretical and empirical research is that greater disclosure reduces cost of capital. Even so, several avenues for future research exist.

1. Introduction

Whether firms receive cost of capital benefits from greater disclosure is an important and controversial question for managers, capital market participants, and standard setters. The Report of the American Institute of Certified Public Accountants' Special Committee on Financial Reporting (AICPA Report) (1994) identifies a lower cost of equity capital as an important benefit of greater disclosure, and Financial Accounting Standards Board (FASB) member, John ('Neel') Foster (2003) argues that this relation is intuitive. But, all constituents do not share this view. For example, the Financial Executives Institute argues that the enhanced disclosures recommended in the AICPA Report would increase share price volatility and risk, and lead to a higher cost of equity capital[1], and interim reporting has long been the subject of similar criticisms. In light of the ongoing debate academic research can provide insights into the relation between disclosure and cost of capital.

This paper reviews this academic research. I focus on the cost of *equity* capital since this cost component receives most of the attention in the literature. However, I devote one section of the paper to empirical research that explores the association between disclosure and the cost of *debt* capital. In conducting this review, my primary objectives are to highlight the implications of existing research for accounting practitioners, standard setters, and academicians and to address not only the question what do we know, but also the question what do we not know, yet?

A sizeable body of theoretical research examines the link between information and cost of equity capital. Although the bulk of this literature suggests that greater disclosure reduces the cost of equity capital, consensus has not been reached. The empirical literature has grown in recent years as researchers experiment with new methods for dealing with the thorny problems of estimating cost of equity capital and measuring disclosure. Most of this research concludes that greater disclosure reduces cost of equity capital. Even so, a relatively early stream of research indicates that certain types of disclosure might have the opposite effect.

The remainder of this paper is organised as follows. Section 2 addresses two questions: What is the cost of equity capital? How is it measured? Section 3 reviews the theoretical research, and Section 4 reviews the empirical research, that links disclosure to the cost of capital. Finally, Section 5 concludes the paper by summarising the findings of existing research and identifying open research questions.

2. What is the cost of equity capital? How is it measured?

2.1. What is the cost of equity capital?

The cost of equity capital (r) is the minimum rate of return equity investors require for providing capital to the firm. It is comprised of the risk free rate of interest (r_f) and a premium for the firm's *non-diversifiable risk* (r_{prem}) as shown in equation (1).

$$r = r_f + r_{prem} \quad (1)$$

Cost of equity capital can also be described as the risk-adjusted discount rate that investors apply to expected future cash flows (E_t(Div)) to arrive at current stock price (P_t). This notion is captured by

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[1] Wall Street Journal, 16 August 1994.

the traditional dividend discount formula given by equation (2).

$$P_t = \sum_{\tau=1}^{\infty} \frac{E_t(Div_{t+\tau})}{(1+r)^{\tau}} \tag{2}$$

Cost of equity capital is sometimes referred to as the 'expected' cost of equity capital because it is a forward-looking concept, which is not directly observable in the market place. For publicly traded companies stock price is observable, but the market's expectation of future cash flows and cost of equity capital are not. As a result, neither component is directly observable from realized prices or returns.

2.2. How is cost of equity capital measured?

In the absence of a directly observable measure, cost of equity capital must be estimated, but because it is difficult to estimate academics continue to actively debate the best method. One class of methods uses predetermined priced risk factors to yield explicit estimates of cost of equity capital. For example, the Capital Asset Pricing Model (CAPM) defines cost of equity capital as the risk free rate plus the market's expected risk premium ($E_t(r_m - r_f)$) (i.e. the price of risk) multiplied by the company's amount of risk as measured by market beta (β). That is,

$$r = r_f + \beta\left(E_t\left[r_m - r_f\right]\right) \tag{3}$$

Using estimated values of the risk free rate, the company's market beta and the risk premium, equation (3) can be used to estimate a value for r. Although this approach is popular in practice, its widespread use is not without controversy. First, one must estimate the market's expected risk premium because this forward looking metric is not directly observable. Users of the CAPM often employ the historical premium to proxy for the expected value, but this imposes inter-temporal stability assumptions that may not be descriptive. Moreover, the magnitude of the historical risk premium is in dispute, as it is sensitive to the period examined and the risk-free rate employed. Typical estimates of the historical risk premium range from 7% to 9%, but Claus and Thomas (2001) argue that the equity risk premium has averaged around 3%. Estimating a firm's market beta is similarly fraught with difficulty. Estimates of the company's historical market beta are sensitive to a number of factors including the estimator's choice of (1) market index, (2) return interval, and (3) estimation period.

Finally, even in the absence of any disagreement regarding the appropriate estimates for use in the model, the validity of the model itself is questionable. The overriding conclusion from numerous empirical tests of the CAPM is that it is not descriptive.[2] It is now fairly well-accepted that risk factors other than market beta are priced. The Fama and French (1995) three-factor model expands the set of risk factors to include the risks captured by firm size and market-to-book. Unfortunately, the three-factor model presents the same estimation problems described above. In addition, the model is absent a theory to explain the nature of the non-diversifiable risks captured by firm size and market-to-book, and many question whether even this model is complete.

Whether estimated using the CAPM or some other multifactor model, the resulting cost of equity capital estimates are not useful to empiricists investigating the link between disclosure and cost of equity capital. Because these models assume that the priced risk factors are known and limited to the factors in the model, the nature of the empirical relation between disclosure and cost of equity capital is preordained. If the model does not include disclosure related risk as a priced risk factor, the relevant question becomes whether disclosure is related to any of the factors that are in the model. For example, since the CAPM limits the risk factors to market beta, disclosure can impact cost of equity capital only if it impacts market beta. But, the hypothesis that more disclosure reduces market beta enjoys little theoretical support.

A second class of methods broaches the cost of equity capital estimation problem by computing the internal rate of return that equates the market's expectation of future cash flows to current stock price.[3] In other words, these models estimate the cost of equity capital implied by equation (2) given current stock price and a proxy for future cash flows. As shown in equation (2) however, price reflects an *infinite* series of expected future cash flows. To make the model tractable this series is truncated by inserting a terminal value that captures cash flows beyond the forecast horizon. Since the majority of the expected future cash flows reside in this terminal value, successful deduction of cost of equity capital depends largely on one's ability to discern the market's terminal value forecast. Alternative estimation methods deal with this issue differently and with varying degrees of success.

Botosan and Plumlee (2005) (BP) assess the empirical reliability of five of this literature's most popular approaches for estimating cost of equity capital. BP conclude that two of the five approaches produce cost of equity capital estimates that are

[2] For a summary of this evidence see Fama and French (2004).

[3] See for example, Botosan (1997), Gebhardt, Lee and Swaminathan (2001), Botosan and Plumlee (2002), Gordon and Gordon (1997), Gode and Mohanram (2003) and Easton (2004).

related to various measures of risk in a theoretically predictable and stable manner. One of the preferred approaches is based on equation (2) directly (Botosan and Plumlee, 2002), and the other is based on the price-earnings growth (PEG) ratio, which is derived from equation (2) given certain assumptions (Easton, 2004).

The estimates produced by this stream of literature have proven more useful to researchers investigating the link between disclosure and cost of equity capital than the estimates discussed previously. It is established in the literature that at least two of the models produce estimates that capture cross-sectional variation in risk in a predictable manner (Botosan and Plumlee, 2005); an important first step in establishing construct validity. Moreover, these estimates are not a function of a predetermined set of priced risk factors, which makes them particularly useful to researchers endeavouring to establish whether a particular type of risk is priced.

Despite these advantages most agree that this approach is not a panacea. Many models require analyst forecasts to proxy for the market's beliefs about future cash flows, which introduces measurement error if the market and analysts hold different beliefs.[4] If the error is systematically related to the variables of interest conclusions drawn from the results could be misleading. It also limits the analysis to firms with an analyst following. In addition, although existing research supports the validity of the estimates generated by certain methods construct validity cannot be proven unequivocally because 'true' cost of equity capital is not observable. Finally, it is questionable whether any particular firm's point estimate of cost of equity capital is correct. This is a significant drawback from a practitioner's perspective, but is much less of an issue from an academic's perspective where capturing the cross-firm ranking in cost of equity capital is generally sufficient.

2.3. Summary

Given the difficulties involved in estimating cost of equity capital it is not surprising that a multitude of proxies are found in empirical research and that research into alternative methods continues. Existing research demonstrates that certain estimates capture the cross-firm ranking of cost of equity capital reasonably well, but establishing the reliability of the magnitude of the estimates is a more formidable problem. It is an important issue however, since in practical settings correctly capturing the magnitude of a given firm's cost of equity capital is paramount. Even so, the progress academic research has achieved has permitted empirical disclosure research to advance.[5] I summarise the findings of these empirical studies in Section 4, but before doing so I review the theories that underlie them in the next section of the paper.

3. The theoretical link between disclosure and cost of equity capital

A sizeable body of theoretical research supports a link between information and the cost of equity capital. One stream of research suggests that information reduces cost of equity capital by reducing investors' estimation risk. Another stream of research suggests that information reduces cost of equity capital by reducing information asymmetry and/or transaction costs. In the following paragraphs I briefly summarise the main findings of this literature and highlight open research questions.

3.1. Estimation risk and cost of equity capital

The literature characterises 'estimation risk' as an additional element of risk that arises because investors are uncertain about the parameters of a security's return or payoff distribution. Because investors estimate the parameters based on available information, their confidence level depends on the attributes of their information set. This literature reaches two conclusions that are particularly relevant for disclosure research. First, estimation risk is *non-diversifiable* such that cost of equity capital is higher for low information (i.e. high estimation risk) securities.[6] Second, traditional analysis of optimal portfolio choice and equilibrium pricing ignores estimation risk by treating the estimated parameters as if they are true. As a result, estimation risk is not captured by market beta.

The basic idea conveyed in these studies is illustrated by the following simple example. Two firms, Firm A and Firm B, have the same expected payoff, but differ in terms of the amount of information available to investors. Investors are confident of their predictions regarding Firm A's future payoff because ample information is available about the firm. In contrast, little information is available about Firm B, and as a result investors are quite uncertain about their predictions for this firm. The CAPM treats the expected payoff for both firms as if 'true' and ignores investors' differential uncertainty with regards to their predictions. Consequently the CAPM provides no role for in-

[4] The use of analysts' forecasts to proxy for the market's expectations is standard in many branches of empirical accounting and finance research, however.

[5] Throughout this review I use the phrase 'disclosure research' to refer narrowly to the body of literature that investigates the link between disclosure and cost of equity capital as opposed to the much broader complete body of disclosure research.

[6] See Klein and Bawa (1976), Barry and Brown (1985), Coles and Loewenstein (1988), Handa and Linn (1993) and Coles et al. (1995).

vestors' uncertainty in determining their optimal portfolio choice or the equilibrium pricing of securities. In contrast, the literature cited above explicitly incorporates investors' uncertainty into the model and concludes that in equilibrium securities with greater estimation risk garner lower stock prices, all else equal.

The ongoing debate in this literature centres on whether estimation risk is diversifiable (i.e. not priced) or non-diversifiable (i.e. priced). Ultimately this debate spurred Clarkson et al. (1996) to conclude that 'the extent of the impact of estimation risk remains, fundamentally, an empirical question'. (p.79)

3.2. Transaction costs, information asymmetry and cost of equity capital

Another stream of research suggests that investors pay less for stocks with high transaction costs, which renders a higher cost of equity capital. Many of these studies link higher transaction costs to information asymmetry and/or market illiquidity. For example, Amihud and Mendelson (1986) argue that cost of equity capital is greater for securities with larger bid-ask spreads.[7] Amihud and Mendelson (1988) forge the link to disclosure by recommending that managers disclose their private information to reduce their bid-ask spread and cost of equity capital. This recommendation and the reasons for it are echoed in King et al. (1990) who argue that disclosure reduces investors' incentives to acquire costly private information. Further, Diamond and Verrecchia (1991) contend that because disclosure reduces the amount of information revealed by a trade, disclosure reduces the adverse price impact of large trades. This prompts investors to amass larger stock holdings than they otherwise would, which increases demand and stock price, and reduces the cost of equity capital.[8]

A recent paper by Easley and O'Hara (2004) (EO) extends the literature on the link between information asymmetry and cost of equity capital. Specifically, EO examine the impact of several attributes of information on cost of equity capital: the proportion of the information set that is private; the dispersion of private information across traders; and the combined precision of public and private information. Their model is characterised by uninformed investors who require compensation for expected losses from transacting with informed investors. Although uninformed investors cannot directly observe the private information held by informed investors, they can partially discern it from stock price. In addition, investors demand more of securities about which they are informed.

Because of the additional compensation required by uninformed investors, cost of equity capital is higher for firms with a larger proportion of private information. But if private information is more widely dispersed, a larger number of informed investors demand the stock. This reduces cost of equity capital because greater demand increases stock price. In addition, when private information is more widely dispersed it is impounded into stock price with greater precision. This reduces the additional compensation required by the uninformed investors, which further reduces cost of equity capital. Finally, uninformed investors require less additional compensation when the public information they observe directly, and the private information they discern from stock price, are more precise. Accordingly, greater precision also reduces cost of equity capital.

Many of the conclusions in this literature rest on the critical assumption that public disclosure mitigates information asymmetry by displacing private information. Often this assumption is implicit, although in some research (e.g. Easley and O'Hara (2004)) it is explicitly stated. Although it seems intuitive that greater public disclosure reduces information asymmetry, Verrecchia (2001) notes that neither theory nor extant empirical evidence unambiguously supports this assumption.[9] For example Lundholm (1988) shows that when the errors in the public and private signals are sufficiently correlated public and private information complement each other. Kim and Verrecchia (1994) conclude that public disclosure might be processed into private information by informed investors. Kim and Verreccchia (1991) suggest that informed investors increase the precision of their private information more than less informed investors in response to an increase in the precision of public information; and McNichols and Trueman (1994) extend this finding to short-horizon investors acquiring private information in anticipation of a public information release.

3.3. Summary and concluding observations

All else equal, investors prefer securities with low estimation risk, low transaction costs and/or less information asymmetry. Since demand is greater for securities with these characteristics, stock prices are higher and cost of equity capital is

[7] See also Demsetz (1968), Copeland and Galai (1983) and Glosten and Milgrom (1985).

[8] When reduced information asymmetry results in a rapid exit from market-making the opposite result obtains. However, the authors describe the conditions that give rise to this result as 'less typical.'

[9] For differing theoretical perspectives on this question, see Verrecchia (1982), Diamond (1985), Bushman (1991), Lundholm (1991), Alles and Lundholm (1993), Lundholm (1988), Kim and Verrecchia (1991 and 1994) and McNichols and Trueman (1994). See Callahan, Lee and Yohn (1997) or Botosan, Plumlee and Xie (2004) for more discussion of this point.

lower for such firms. If disclosure mitigates estimation risk, transaction costs and/or information asymmetry, a negative relation exists between disclosure and cost of equity capital.

Certain issues with implications for this hypothesis remain open, however. If estimation risk is not priced, greater disclosure does not reduce cost of equity capital through this avenue. Moreover, if in some circumstances, disclosure leads to greater information asymmetry, a positive association between disclosure and cost of equity capital could be observed. Thus, it is an empirical question whether the negative association purported to exist in theory between disclosure and cost of equity is observed in the market. The next section of the paper reviews the relevant empirical literature.

4. The empirical link between disclosure and the cost of equity capital

A growing body of empirical research investigates the association between disclosure and cost of equity capital using a variety of research methods. Most studies employ archival empirical data, but some are conducted in the laboratory. Most examine the association between disclosure and the cost of *equity* capital, but limited evidence concerning the cost of *debt* capital exists. Some studies side-step the problem of estimating cost of equity capital by investigating managers' reporting practices when raising capital. Other studies achieve the same result by examining variables expected to be related to cost of equity capital (i.e. indirect measures), while another branch of the literature attempts to link disclosure to the cost of equity capital estimates (i.e. direct measures) discussed in Section 2. In this section I review the findings of this varied body of research.

4.1. Indirect measures of cost of equity capital

4.1.1. Proxies for priced risk

Early research investigates the association between disclosure and cost of equity capital using measures of risk. Total security risk is comprised of diversifiable and non-diversifiable risk, but since theory suggests that only non-diversifiable risk is priced measures of this type of risk are the most relevant. Even so, some research employs measures of total risk, arguing that contrary to theory investors might also price diversifiable risk.

Researchers often use the standard deviation of returns to proxy for total risk, but separating total risk into diversifiable and non-diversifiable risk is difficult. Many studies assume that the CAPM is descriptive and use market beta to proxy for non-diversifiable risk. For example, Dhaliwal et al. (1979) (DSV) investigate the impact of the Securities and Exchange Commission's (SEC) decision to require segment disclosures on nondiversifiable risk (market beta) and total risk (the standard deviation of returns). Relative to a sample of unaffected firms, DSV show that total risk declined for firms initiating disclosure, but their results regarding non-diversifiable risk are mixed.

Prodhan and Harris (1989) (PH) examine a similar question around the adoption of *SFAS No. 14: Financial Reporting for Segments of a Business Enterprise*. Unlike DSV, PH find that nondiversifiable risk (market beta) declined for firms initiating geographic segment disclosure relative to firms not affected by the standard. This result supports the hypothesis that greater disclosure reduces cost of equity capital, if market beta is a reasonable proxy for the type of non-diversifiable risk that is mitigated by disclosure. This supposition is problematic, however. As discussed earlier, the overriding conclusion in the literature is that the CAPM is not descriptive,[10] and theory suggests that market beta does not capture estimation risk. A weak link between estimation risk and market beta might explain why this literature documents mixed results with respect to the association between disclosure and market beta.

The analysis of total risk as measured by the standard deviation of returns bypasses this problem. But even if disclosure reduces total risk, disclosure might not reduce cost of equity capital. The mitigated component of total risk might be diversifiable in nature, which is not price if investor behaviour accords with theory. Thus while the results of these early studies are provocative they are far from definitive.

4.1.2. Proxies for transaction costs and/or information asymmetry

More recent studies examine the relation between disclosure and cost of equity capital using proxies for transaction costs and/or information asymmetry. A number of alternative proxies are employed in these studies including: relative spreads (the bid-ask spread deflated by stock price), share turnover (trading volume scaled by shares outstanding), and standard deviation of returns.[11]

Greenstein and Sami (1994) (GS) re-examine the impact of the SEC's segment disclosure requirement on cost of equity capital using the relative spread. Compared to a sample of unaffected firms, GS find that relative spreads declined for firms initiating disclosure. Similarly, Welker (1995) finds that firms with higher Association for

[10] For a discussion of the CAPM controversy see Lakonishok (1993).

[11] As discussed above the standard deviation of returns is also used as a proxy for total risk.

Investment Management and Research (AIMR) disclosure scores enjoy lower relative spreads.[12] Healy et al. (1999) (HHP) examine 97 firms with a large and sustained increase in their AIMR disclosure scores and document a decline in relative spreads coincident with improved disclosure practices. HHP also document increases in stock price, analyst and institutional investor following, and increased use of public financing for these firms. These latter results provide additional evidence of improved market liquidity and/or reduced information asymmetry following an improvement in disclosure practices.

Leuz and Verrecchia (2000) (LV) and Mohd (2005) examine changes in information asymmetry around a change in accounting standards. Both studies employ relative spread and share turnover in their analyses to proxy for information asymmetry. LV investigate whether information asymmetry declines for German firms that voluntarily embrace a higher standard of disclosure by adopting International Accounting Standards (IAS) or US generally accepted accounting principles (US GAAP).[13] Mohd focuses on the adoption of *SFAS No. 86: Accounting for Software Development Costs*. Mohd investigates whether the flexibility to capitalise or expense software development costs afforded by the standard allows managers to communicate their superior information concerning future benefits. Over time and relative to a sample of firms not impacted by the change in accounting standards, both studies conclude that relative spreads decline and share turnover increases for adopting firms.[14]

The studies discussed in the preceding paragraphs provide evidence that greater disclosure is associated with lower transaction costs and reduced information asymmetry. If, as theory suggests, cost of equity capital is less for securities with lower transaction costs or less information asymmetry, these studies suggest that greater disclosure is associated with a lower cost of equity capital.

Several research design issues could have implications for the reliability of this conclusion, however. Using the bid-ask spread to proxy for information asymmetry can be problematic because the spread incorporates inventory holding and order processing costs, which are unrelated to information asymmetry. Empirical studies suggest that less than half of the total spread is comprised of information costs (George et al., 1991 and Stoll, 1989).

Despite this, most studies use the total spread because isolating the information cost component is computationally difficult and measurement error in the total spread biases against finding an association between disclosure and information asymmetry. Chiyachantana et al. (2004) (CJTW) is an exception. CJTW find that post-Regulation Fair Disclosure (FD) the information cost component of the spread measured just prior to firms' quarterly earnings announcements declined. This suggests that Regulation FD achieved its goal of leveling the informational playing field, at least prior to earnings announcements.[15]

Because relative spread is the absolute spread deflated by stock price, a change in the relative spread reflects changes in the absolute spread *or* stock price or both. Berk (1995) argues that riskier firms tend to have lower market values because their future cash flows are discounted at higher costs of equity capital. If stock price and risk are negatively related, disclosure improvements that reduce estimation risk, increase stock price and decrease the relative spread even if information asymmetry remains unaffected. Even more troubling is the concern that relative spread might still decline when both information asymmetry and estimation risk are held constant. This is because stock price is also a function of future cash flows, such that a decline in relative spread might simply reflect an increase in stock price due to an increase in the market's expectation of future cash flows.

For example, Lang and Lundholm (1993) find that AIMR disclosure scores are positively related to firm performance. If the voluntary improvements in disclosure examined in Healy et al. (1999) (HHP) are related to improved performance, upward revisions in the market's expectation of future cash flows could lead to a decline in relative spread even if estimation risk and information asymmetry are held constant.[16] HHP include contemporaneous earnings in their analyses to control for firm performance, but this control variable might not capture the extent of the market's revision of expected cash flows.

The last point in the preceding paragraph high-

[12] Up until 1996 the AIMR produced annual rankings of the quality of the corporate disclosure practices of select firms belonging to a diverse group of industries. In addition to providing rankings of overall disclosure quality, the AIMR produced three category scores: (1) annual report, (2) quarterly and other reports, and (3) investor relations activities. Welker limits his analysis to the overall disclosure score.

[13] In a subsequent study, Leuz (2003) partitions the sample between the IAS adopters and the US GAAP adopters. Leuz finds no differences in information asymmetry between the two groups and concludes that IAS and US GAAP are similar in quality.

[14] LV also examine the standard deviation of returns, but do not document any significant results with this metric.

[15] The SEC imposed Regulation Fair Disclosure effective 23 October 2000. It prohibits selective disclosure of material information to specific entities unless the issuer also simultaneously releases the information to the public. It is intended to level the informational playing field in terms of access to information.

[16] This discussion also applies to studies that examine the cross-sectional association between relative spread and disclosure level.

lights a final research design issue that could have implications for the reliability of the conclusions drawn from some of the voluntary disclosure studies discussed in this section: self-selection bias. Managers select disclosure practices in response to specific incentives. If the variables that explain managers' disclosure decisions also explain the proxies for information asymmetry/transaction costs employed in the analysis, a correlated omitted variable biases could confound the results. For example, 86% of Leuz and Verrecchia's (2000) sample of adopting firms listed on the London (LSE) or New York Stock Exchange (NYSE) as compared to only 19% of the German GAAP firms. Since listing on the LSE or NYSE is associated with lower relative spreads and increased share turnover, it is difficult to determine whether LV's results reflect improved disclosure or exchange listing.

LV address this problem by modelling the disclosure decision and controlling for the self-selection bias (see also Welker, 1995 and Mohd, 2005). But, if the disclosure decision model is incomplete this approach fails to resolve the problem. Other studies deal with the issue by examining changes in disclosure. Healy et al. (1999) state, 'By using each firm as its own control, our time-series approach mitigates these potential [omitted variables] problems.' (p. 489) However, in his discussion of the Leuz and Verrecchia (2000) study Joos (2000) counters this claim. He states: '...event tests mitigate the correlated omitted variable problem best when the event is exogenously imposed, no other changes occur in the event window, and the windows are short. ...[*Otherwise*] time-series tests do not completely control for the correlated omitted variable bias problem.' (p. 134)

4.2. Managers' reporting behaviours when raising capital

This literature links disclosure to cost of capital by examining whether managers are more forthcoming with voluntary information when they access the capital market. Using a self-constructed disclosure index related to the annual report, Choi (1973) finds that firms significantly improve their financial disclosure upon entry into the Eurobond market. Similarly, Healy et al. (1999) document increased use of public financing by firms with large and sustained increases in AIMR disclosure scores. Frankel et al. (1995) find that managers accessing the capital markets provide more frequent management earnings forecasts. Finally, Lang and Lundholm (2000) conclude that firms that increase their disclosure level in anticipation of a stock offering experience price increases prior to the offering. All of these studies document results which suggest that managers act as if greater disclosure reduces cost of capital.

4.3. Direct measures of cost of equity capital

The research discussed in this section of the paper uses the cost of equity capital estimates described in Section 2 to proxy for cost of equity capital. Since these estimates have been developed relatively recently (post-1995), this literature comprises a small but growing segment of disclosure research. Botosan (1997) examines the relation between self-constructed, annual report disclosure scores, and the cost of equity capital estimates implied by equation (2). She uses analysts' forecasts of future cash flows and terminal price at the forecast horizon to proxy for the market's expectation.[17] Botosan finds that greater disclosure is associated with a lower cost of equity capital, but her analysis is limited to one industry and year, and holds only for firms lightly followed by analysts. Subsequent research extends Botosan's initial finding to samples comprised of lightly followed Canadian firms (Richardson and Welker, 2001) (RW), Swiss firms (Hail, 2002), European and non-European banks (Poshakwale and Courtis, 2005), and heavily followed US firms across a broad spectrum of industries (Botosan and Plumlee, 2002). Altogether the results of these studies provide a growing body of evidence that supports a negative association between annual report disclosure level and cost of equity capital.

The results presented in two of the five studies (RW and Hail, 2002) must be discounted however, because the authors employ Gebhardt et al. (2001) (GLS) estimates to proxy for the cost of equity capital. It is now well-documented in the literature that these estimates are not related to risk in a reasonable manner, calling into question their validity as a proxy for cost of equity capital. For example, RW state that they exclude market beta, market value of equity, and book-to-market ratios (i.e. the Fama/French three factors) from their analyses because 'Gebhardt et al. document that they are statistically unrelated to our measure of the cost of equity capital'. (p. 609) Botosan and Plumlee (2005) find that the GLS estimates are positively or negatively related to market beta, depending on the other risk factors included in the model, and that in some specifications the estimates are positively related to firm size and negatively related to growth, contrary to expectations. This discussion highlights the critical importance of construct validity for one's ability to draw meaningful conclusions from empirical analysis.

The issue of self-selection bias discussed earlier

[17] Botosan actually employs the residual income valuation (RIV) model when estimating cost of equity capital, but provided the clean surplus relation holds the RIV model produces estimates identical to those produced by the approach outlined in the text. Analysis in Botosan and Plumlee (2005) confirms that the estimates produced by the two approaches are virtually identical.

also applies to this stream of literature and could confound the results of these studies. Hail (2002: 747) states, 'companies that opt for a high disclosure environment might differ from those that do not in terms of firm characteristics and hence may have lower costs of capital regardless.' Few studies address this concern by modelling the disclosure decision and controlling for the self-selection bias directly, due to the difficulty of adequately modelling the disclosure decision. It is also questionable whether the potential for correlated omitted variables is mitigated by examining the association between changes in disclosure and cost of equity capital since voluntary changes in disclosure are endogenous. However, if the change in disclosure is externally imposed, this approach might prove fruitful. Finally, it is important to note that self-selection bias is problematic only if the firm characteristics referred to by Hail are related to one or more priced risks not controlled for in the analysis. Thus the potential impact of self-selection bias is mitigated to the extent that these studies control for known risk factors and include market value of equity or book-to-price in the analysis to control for any remaining unmeasured risk (Berk, 1995).[18]

Another issue that could confound the results of these studies is the existence of other avenues of disclosure not included in the analysis. Botosan (1997) identifies this as a possible explanation for her inability to document a significant association between annual report disclosure level and cost of equity capital for heavily followed firms. Gietzmann and Ireland (2005) (GI) test Gietzmann and Trombetta's (2003) theory that accounting policy choice is a correlated omitted variable with implications for the conclusions drawn in existing disclosure research. But GI employ the Gebhardt et al. (2001) estimates in their analysis, which renders their results difficult to interpret.

If disclosure is positively correlated across different disclosure avenues and the excluded disclosure is negatively (or unrelated) to cost of equity capital, a lack of completeness in the disclosure measure is not a significant problem. The first condition appears to be met. Lang and Lundholm (1993) (LL) document significant correlations among AIMR disclosure rankings of annual reports, other publications and investor relations disclosures, suggesting that firms' disclosure behaviours are similar across alternative avenues. The second condition is more problematic, however. Although most of this research documents a negative association between disclosure level and cost of equity capital, Botosan and Plumlee (2002) document a *positive* association with the AIMR quarterly report score.[19] This finding suggests that certain types of omitted disclosures might produce a correlated omitted variable bias and that additional research is needed to further our understanding of the impact of different types of disclosure on cost of equity capital.

The Botosan and Plumlee (2002) finding of a positive association between cost of equity capital and quarterly report scores is contrary to theoretical predictions. Measurement error in the proxies or correlated omitted variables might explain this counter-intuitive result, but it is also possible that the relationships among disclosure, firms' information environments and cost of equity capital are more complicated than those captured by existing theories. Early research findings suggest that certain types of public disclosure (e.g. quarterly earnings announcements) generate private information (see Barron et al., 2005 and Botosan et al., 2004). If so, some public disclosures might result in increased information asymmetry and a higher cost of equity capital. Alternatively, Bushee and Noe (2000) find that transient institutional investors are particularly attracted to quarterly report disclosures. Because transient institutional investors trade aggressively on short-term earnings news, their trading activities can have a detrimental effect on stock return volatility. If the market equates greater volatility with greater priced risk, providing greater quarterly report disclosures could have an unexpected investor clientele effect that manifests in a higher cost of equity capital. Given the important role cost of equity capital plays in the allocation of resources among and within firms, additional research is needed to resolve this issue.

4.4. Disclosure and cost of equity capital in the laboratory

Bloomfield and Wilks (2000) examine the relation between disclosure quality and liquidity, and cost of equity capital in an experimental market setting. They find that stock prices are enhanced when investors receive a larger number of informative signals about the value of a security. Investors who face less payoff uncertainty are willing to buy at higher prices, all else equal, thereby yielding a lower cost of equity capital to the firm.

4.5. Disclosure and the cost of debt capital

Sengupta (1998) addresses the association between disclosure level and the cost of debt capital.

[18] Unfortunately controlling for market value of equity (or book-to-price) can be problematic since the positive correlation that exists between market value of equity and disclosure levels can induce multicollinearity that reduces the statistical power of the analysis.

[19] Richardson and Welker (2001) also document a positive association between social disclosure level and cost of equity capital, however this result may be related to their use of GLS estimates to proxy for cost of equity capital. Moreover, as RW point out, social disclosures might be motivated by reasons other than the desire to minimise cost of capital.

Sengupta documents a negative association between AIMR overall disclosure scores and two alternative measures of the cost of debt collected from *Moody's Bond Surveys*. Sengupta's results support the hypothesis that greater disclosure reduces the cost of debt.

5. Summary and conclusions

This paper reviews the literature that relates traditional concepts of 'disclosure' to cost of capital. Excluded from my review is a relatively new stream of academic research that broadens the concept of disclosure to include other attributes of information such as earnings quality (e.g. Francis, LaFond, Olsson and Schipper, 2004, Hribar and Jenkins, 2004 and Mikhail et al., 2004), and the precision, dissemination, and composition of the information set (Botosan and Plumlee, 2005). Similar to the research reviewed herein, these studies generally find that the information environment and managers' financial reporting choices impact cost of equity capital.

From my review of the literature, I draw the following observations and suggestions for future research. First, academic research has made significant progress in estimating cost of equity capital, and this has allowed empirical disclosure research to progress. Even so, additional research is needed to advance the state of the art for practitioners and academics. Second, extant theory strongly supports the hypothesis that greater disclosure reduces cost of equity capital. However, the assumption that public disclosure mitigates information asymmetry, which underpins some of this literature, is worthy of additional consideration in light of early stage empirical evidence that public and private information act as complements in some circumstances. Third, while no one academic study is perfect, the sum total of the evidence accumulated across many studies using alternative measures, samples and research designs lends considerable support to the hypothesis that greater disclosure reduces cost of equity capital. Still, additional research might explain certain anomalous results in the literature (e.g. the positive association between timely disclosure level and cost of equity capital).

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