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Keywords

disclosure, information asymmetry, cost of capital, managerial incentives, corporate governance

Disciplines

Accounting | Business Administration, Management, and Operations

**A review of the empirical disclosure literature:
Discussion[☆]**

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Abstract

Healy and Palepu, J. Account. Econ. (2001), this issue, provide a broad review of the empirical disclosure literature. This discussion focuses on the empirical voluntary disclosure literature, and assumes firms' disclosure policies are endogenously determined by the same forces that shape firms' governance structures and management incentives. This provides not only a more focused view of the literature, but also alternative explanations for some of the results discussed in *Review* and specific suggestions for future research.

JEL classification: D82, G12, G32, J33, M41

Keywords: Disclosure; Information asymmetry; Cost of capital; Managerial incentives; Corporate governance

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1. Introduction

Healy and Palepu (2001, hereafter, “*Review*”) provide a broad overview of the empirical disclosure literature and ask big-picture questions about: accounting information; the firms that produce it and use it to evaluate their employees; the persons who use this information in allocating capital to firms; and the persons who produce, verify, regulate and interpret this information. These questions are important, and much research remains to be done before we can confidently answer them.

In this discussion, I focus on *Review*'s analysis of the empirical voluntary disclosure literature for two reasons. First, other literature covered by *Review* is also covered by other conference surveys and discussions. More important, the voluntary disclosure literature appears to offer the greatest opportunity for large increases in our understanding of the role of accounting information in firm valuation and corporate finance.

Because of its broad perspective, *Review* does not specify an economic theory of voluntary disclosure, does not analyze the empirical literature in detail, and offers few specific suggestions for future research. This discussion attempts to complement *Review* by using a specific framework based on the economic theory of the firm. Briefly, this framework assumes that the relation between disclosure, managers, individual and institutional investors, and analysts is endogenously determined by the same forces that shape firms' governance structures and management incentives. This framework provides the basis for: (1) a more focused view of the literature; (2) alternative explanations for some of the results discussed in *Review*; and (3) specific suggestions for future research.

I present this framework in Section 2.1, and in Section 2.2 use it to analyze one of *Review*'s hypothesized determinants of voluntary disclosure and to suggest an alternative interpretation of the evidence. Section 2.3 discusses literature on the association between institutional investors and disclosure, which is not examined in *Review*. I conclude Section 2 by briefly reviewing research on the economic consequences of voluntary disclosure with a focus on identifying needs for future research. Section 3 suggests that research efforts be concentrated on: (1) better understanding the link between information asymmetry and the cost of capital; (2) creating better measures of the information asymmetry component of the cost of capital; (3) and creating better measures of disclosure quality. Section 4 provides a summary and conclusion.

2. Discussion

2.1. Disclosure quality, disclosure credibility, and corporate finance theory

Corporate finance theory predicts that shareholders endogenously optimize disclosure policy, corporate governance, and management incentives in order to maximize firm value. This choice involves trading off the reduction in the information asymmetry component of the cost of capital that results from increased disclosure quality against the costs of reduced incentives (e.g., Evans and Sridhar, 1996), litigation costs (Skinner, 1994), and proprietary costs (Verrecchia, 1983). As a simple example of how this trade-off works in cross-section, assume that growth opportunities and the quality of mandated disclosure are exogenous, and consider whether firms provide voluntary disclosure to reduce information asymmetry.¹ For a firm without growth opportunities, mandated disclosure might be of sufficiently high quality to produce low

¹ I follow previous research and define any disclosure above the mandated minimum as “voluntary” disclosure. For simplicity, I assume that the mandated minimum level of disclosure quality is exogenous. *Review* discusses how this minimum may evolve endogenously.

information asymmetry. Because this firm has no need for external finance and has low litigation, incentive, and proprietary costs, it has little need for voluntary disclosure. For firms with high growth opportunities, mandated disclosure is low quality and information asymmetry is high. For these firms, some reduction in information asymmetry through voluntary disclosure is optimal, and the optimum is determined as a function of the quality of mandated disclosure and a trade-off of lower capital and litigation costs against higher proprietary and incentive costs. After this optimal choice, high-growth firms use more voluntary disclosure, but they likely still have greater information asymmetry than low-growth firms.

Perfectly credible (or, equivalently, completely unbiased) disclosure is not optimal because it is too costly:

. . . Not all managerial accounting manipulation will be eliminated. It may be too costly . . . to eliminate all such manipulation . . . In labor and capital markets characterized by rational expectations, managers will not, on average, gain from such manipulation (Watts and Zimmerman, 1986, p. 205).

The statement that it is too costly to eliminate all manipulation means that managers can add some bias to disclosure at a low personal cost. If it is known that all managers wish to bias disclosure in the same direction and if disclosure is costly, the theory discussed in *Review* suggests that a “lemons” equilibrium can occur in which no firm discloses. However, if shareholders are uncertain about the direction of managers' incentives to bias disclosure, a pooling equilibrium occurs in which there is disclosure, and some disclosure contains bias (e.g., Dye, 1988; Fischer and Verrecchia, 2000).² Accordingly, theory predicts that even though

² Lang and Lundholm's (2000) study provides an example: Because shareholders do not know which firms intend to make stock offerings, and because not all firms that make offerings bias their disclosure, some firms can temporarily increase their stock prices through increased, "hyped" disclosure. However, once the

disclosure contains some bias, in equilibrium it is still credible. Therefore, all empirical studies of disclosure credibility will find disclosure to be credible; interesting studies explore cross-sectional variation in the bias in disclosure (e.g., Lang and Lundholm, 2000).

While the optimal disclosure policy allows some managerial manipulation of disclosure, it is the governance structure that constrains the manager to follow the optimal policy (e.g., Shleifer and Vishny, 1997; Zingales, 1998). Accordingly, cross-sectional differences in firms' disclosure policies result from cross-sectional differences in: (1) the optimal disclosure policy; and (2) the ability of firms' governance to enforce the optimal policy.³ In summary, theory predicts an endogenous relation between information asymmetry, disclosure quality, managerial incentives, and corporate governance.

In contrast, *Review* uses a broad framework based on the intuition provided by Akerlof's (1970) illustration of adverse selection costs. This framework provides macro-economic intuition for why lack of disclosure is costly for firms, for the existence of financial and information intermediaries, and for why there may be a demand for disclosure regulation. While this framework confirms our intuition that we live in a world of partial disclosure, it is not specific enough to give satisfying explanations for cross-sectional differences in firms' disclosure policies. All of the managerial motives for voluntary disclosure described in *Review* assume that disclosure policy, corporate governance, and management incentives are exogenous at the time

offering is announced, the stock price falls dramatically for the firms with increased disclosure, but very little for firms without unusual disclosure increases.

³ That there is variation in disclosure policies around the optimum means that well-designed cross-sectional tests can avoid the problem of spurious correlation between disclosure quality and information asymmetry illustrated above and in sections 2.2 and 2.4 below. For example, if industry membership is the primary endogenous determinant of an optimal disclosure policy, within-industry variation in disclosure policy can be considered exogenous in a test of the predicted negative effect of disclosure quality on the cost of capital (e.g., Botosan, 1997).

a manager makes a disclosure choice. Each of the following three sub-sections examines different contexts in which this simplifying assumption causes interpretation problems. Section 2.2 uses the more specific theory described above to reinterpret *Review's* hypothesized association between stock compensation and disclosure. Section 2.3 discusses the interrelation between analysts, institutional investors, and information asymmetry, and Section 2.4 provides a brief alternative view of the evidence on the economic consequences of voluntary disclosure.

2.2. *The endogenous relation between disclosure policy and management incentives*

Because it does not explicitly recognize endogenous relations, *Review* does not always give a thorough and critical evaluation of the research it discusses. I choose to discuss in detail the following example, because I think that the reader could be misled by the short discussion in *Review* of the evidence for the “stock compensation hypothesis”:

Consistent with this hypothesis, Noe (1999) provides evidence that the incidence of management forecasts is positively associated with trading by insiders in the firm's stock. Aboody and Kasznik (2000) find that firms delay disclosure of good news and accelerate the release of bad news prior to stock option award periods, consistent with managers making disclosure decisions to increase stock-based compensation. Miller and Piotroski (2000) find that managers of firms in turnaround situations are more likely to provide earnings forecasts if they have higher stock option compensation at risk (section 3.3.2).

At a superficial level, Noe's (1999) evidence supports the unsurprising result that managers follow the law and either disclose or abstain from trading. An alternative, more interesting, interpretation of the evidence in both Noe (1999) and Aboody and Kasznik (2000) is that managers selectively time trading and disclosures at the expense of other stockholders. This interpretation contradicts *Review's* hypothesis that managers use disclosure to reduce

contracting costs, although it is consistent with the theory discussed above that it is too costly to eliminate all managerial manipulation. In addition, both Noe (p. 325) and Aboody and Kasznik (p. 98) are careful to point out that their evidence is consistent with managers acting in shareholders' interests. For example, because the incentives to increase stock-price volatility created by an in-the-money option are lower than those created by an at-the-money option (Lambert, Larcker, and Verrecchia, 1991), firms may wish to issue in-the-money options but prefer to avoid the accounting cost of such options. To accomplish this objective, they allow managers to time disclosures.

Miller and Piotroski (2000) find that sample firms with more shares *reserved* for options (as a percentage of shares outstanding) make more forecasts.⁴ Because their tests do not recognize that options use, disclosure quality, and information asymmetry are simultaneously determined, Miller and Piotroski provide no support for the hypothesis that option compensation motivates managers to provide more voluntary disclosure. Firms with greater information asymmetry use more stock and option incentives (Demsetz and Lehn, 1985; Smith and Watts, 1992; Core and Guay, 1999; Bryan, Hwang, and Lilien, 2000), and greater information asymmetry is associated with more voluntary disclosure (Lang and Lundholm, 1993). Therefore, as suggested above, we would expect an association between managers' equity incentives and voluntary disclosure, as they are both associated with information asymmetry, but this does not mean that options use causes disclosure.

⁴ The percentage of shares *reserved* for options outstanding and future grants is an extremely weak proxy for managers' "stock option compensation at risk." Managers care about their dollar wealth, not their percentage ownership. It is well known that managers of larger firms have fewer options as a fraction of shares outstanding, but the dollar value of these options holdings is much higher than those of small firms

2.3. *The relation between voluntary disclosure, institutional investors, and financial analysts*

Given the focus of *Review* on the role of intermediaries, it is odd that there is no analysis of empirical research on the relation between disclosure and institutional investors.⁵ Healy, Hutton, and Palepu (1999) find that increases in disclosure are associated with increases in institutional ownership. Bushee and Noe (2001) confirm this association, but find that increases in “transient” institutional investors (institutions that trade aggressively) are associated with increases in stock price volatility. Assuming that increases in stock price volatility are costly, this finding is consistent with the intuition that partial disclosure is optimal, and that too much disclosure can be as costly as too little disclosure.

Tasker (1998) finds that firms with greater analyst following and greater institutional ownership are less likely to have conference calls, and Bushee, Matsumoto, and Miller (2001) find that firms with greater analyst following and greater institutional ownership are less likely to have conference calls that provide open access to all investors. This evidence is consistent with the intuition that informed investors prefer less disclosure, but is also consistent with the notion that analysts and institutions produce information, and reduce information asymmetry and the need for conference calls.

Review discusses the endogenous relation between disclosure quality, information asymmetry, and financial analysts explored in Lang and Lundholm (1996). Brennan and Subramanyam’s (1995) simultaneous-equations model provides evidence of this endogenous

(Baker and Hall, 1998). Further, options owned by the executives who are likely to make disclosure decisions constitute a small fraction of shares reserved for options (Core and Guay, 2001).

relation. One equation shows that the number of analysts reduces information asymmetry (proxied by the information asymmetry component “IAC” of the bid-asked spread). A second equation shows that the causality also runs in the opposite direction, that is, reductions in information asymmetry increase the number of analysts. Brennan and Subrahmanyam’s (1995) predictions are based on a theory relating information asymmetry to informed trading, and they test the theory using analysts as a proxy for informed traders. The same theory predicts a simultaneous relation between information asymmetry and institutional investors, who are also informed.⁶

The interpretation of any evidence involving buy-side institutions or sell-side analysts is clouded because of the known, but not well understood, endogenous relation between these two intermediaries (e.g., O’Brien and Bhushan, 1990). The imbalance between the small amount of research on *buy-side* analysts and the vast amount of research on *sell-side* analysts suggests much opportunity for useful future research. While it is unclear how one would address such a broad question as “how effective are financial analysts as information intermediaries?” (*Review*, Table 1), there is no satisfying answer to this question that does not involve a theory of how the buy-side is related to the sell-side. For example, knowing how institutional investors interpret analysts’ forecasts is likely to help us understand whether analyst optimism is a statistical artifact or whether it is an economically important phenomenon.⁷ Clearly we want to understand how

⁵ *Review* does mention the theoretical prediction of Diamond and Verrecchia (1991) and Kim and Verrecchia (1994) that disclosure attracts institutional investors: “In addition, these studies argue that expanded disclosure and stock liquidity will be associated with increased institutional ownership” (section 3.4.2).

⁶ Brennan and Subrahmanyam ignore this theory, as they use institutional investors as a determinant for the number of analysts, but not as a determinant of the IAC of the bid-asked spread.

⁷ While *Review* notes intertemporal differences in levels of analyst optimism, it does not discuss research that questions whether optimism tells us anything about analysts’ abilities or incentives. For example, Abarbanell and Lehavy (2000) suggest that apparent differences in optimism are artifacts of data problems,

well the number of sell-side analysts and the number of institutional investors proxies for the degree of information asymmetry and the cost of capital, but can we know this without a better understanding of the joint relation between sell-side analysts and institutional investors?

One way of shedding light on these questions is to examine the extent to which buy-side analysts agree with (or disagree with) the sell-side's recommendations and earnings forecasts. For example, Krische and Lee (2000) provide indirect evidence that quantitative, "anomalies-based" trading firms use an information set that is mostly orthogonal to the recommendations of sell-side analysts. An extension of Ali, Durstch, Lev, and Trombley (2000) could provide more direct evidence on whether return variation associated with changes in institutional holdings is correlated with analysts' recommendations. Another way of addressing this question would be to compare the performance of industry-sector mutual funds to the weighted post-commission performance of the recommendations of the sell-side analysts who cover these industries (by extending the method of Barber, Lehavy, McNichols, and Trueman, 2001). Evidence that the returns to these sector funds are correlated (uncorrelated) with the returns to the sell-side analysts' recommendations would be consistent with the hypothesis that buy-side analysts agree with (disagree with) the sell-side's recommendations. Understanding these correlations would in turn shed additional light on the interrelation between buy-side institutions, sell-side analysts, disclosure quality, and information asymmetry.

2.4. Empirical evidence on the consequences of voluntary disclosure

and Gu and Wu (2000) suggest that optimism can be an outcome of a rational and unbiased forecasting process.

As *Review* alludes to in section 3.3.2, disclosure quality is an *ex ante* commitment or policy to provide voluntary disclosure over time, and this endogenously determined policy affects the level of information asymmetry. When a manager receives information at a point in time, the manager may *ex post* choose to withhold or provide this information in order to correct mis-valuation (e.g., Healy and Palepu, 1995). If the manager chooses to disclose this information, this disclosure will change the stock price. However, firms with higher disclosure quality withhold less information. Therefore, there are two effects: (1) disclosure quality, which is the firm's ongoing *ex ante* commitment to provide disclosure; and (2) "discretionary" disclosure, which is an *ex post* realization of this *ex ante* commitment.

2.4.1. *Discretionary disclosure*

Because discretionary disclosure is a particular realization of a firm's disclosure policy, cross-sectional studies of discretionary disclosure are essentially equivalent to cross-sectional studies of disclosure quality. Accordingly, if the research design is not careful to control for the endogenous determinants of disclosure policy, there is the potential for spurious inference about the discretionary disclosure under study.

As an example, consider the Kasznik and Lev (1995) finding that firms that warn investors of bad earnings news experience significantly more negative returns per unit of unexpected earnings than firms that do not warn. This finding suggests that firms are penalized for disclosing bad news early. Shu (2000) argues that this apparently puzzling difference in returns occurs because of a failure to model firms' disclosure policies. Suppose that firms with high disclosure quality have policies to "disclose bad earnings news early." *Ceteris paribus*, firms with high disclosure quality have high earnings quality, which means that their earnings

surprises contain more information about future cash flows. Therefore, the market reaction to the disclosure of earnings information will be higher for firms with higher disclosure quality. If firms that warn have higher disclosure quality, the market reaction per unit of unexpected earnings is greater, and the Kasznik and Lev finding is not puzzling, but what one would expect.

As a second example, consider Francis, Philbrick and Schipper (FPS, 1994), whom *Review* cites as mixed evidence on the litigation cost hypothesis. Firms in the FPS litigation sample were more likely to pre-announce bad news than firms in the no litigation sample. This greater incidence of litigation is interpreted by *Review* as evidence that pre-disclosure is ineffective. However, FPS are careful to point out that their litigation sample is about ten times larger than the no litigation sample, and subsequent research shows that firm size is a significant determinant of litigation risk. Therefore, an alternative interpretation is that the FPS evidence is completely consistent with firms' optimally using disclosure to minimize litigation costs. Larger firms expect to be sued more frequently, and their choice to pre-disclose more frequently lowers the conditional costs of these suits (Skinner, 1997).

2.4.2. *Disclosure quality*

Because a firm's optimal disclosure policy will trade-off its need for a low cost of capital against other costs, *ceteris paribus* one expects to find a negative relation between disclosure and the cost of capital. As discussed in *Review*, researchers examine how disclosure affects two separate components of the cost of capital: (1) liquidity costs such as the IAC of the bid-asked spread, which increase trading costs and reduce the net proceeds of a stock offering, and (2) the equity discount rate. In addition to the endogeneity problems discussed in *Review* and discussed above (e.g., the simultaneous relation between financial analysts and information

quality), two additional factors complicate this research. First, there are measurement problems both with the proxies for disclosure quality (discussed by *Review*) and with the proxies for the cost of capital. These measurement problems both weaken the tests and also exacerbate the potential for endogeneity problems to cause spurious inference. Second, tests of a link between disclosure quality and the cost of capital are *joint* tests of a theory linking disclosure quality to information asymmetry *and* a theory linking information asymmetry to a cost of capital.

For example, the tests in Botosan and Plumlee (2000) are joint tests of the hypothesis that disclosure quality affects information asymmetry and the hypothesis that information asymmetry affects the equity discount rate (proxied by the cost of capital implied by inverting various dividend discount models). Assuming that information asymmetry affects discount rates, such a test can fail to find an association because of unsystematic error in the proxies for disclosure quality and the cost of capital. On the other hand, systematic error, such as biases in the analysts' disclosure ratings and in the analysts' forecasts on which the cost of capital are based, can show evidence of a non-existent relation.

3. Future research

It seems important to create better measures for the information asymmetry component of the cost of capital and for disclosure quality, and these are discussed below in sections 3.2 and 3.3. First, however, we must establish whether information asymmetry only affects stock liquidity or if it also affects equity discount rates. This assessment will point to where disclosure quality can have an economically important effect on the cost of capital, where research efforts should be focused, and how to interpret prior research.

3.1. How does information asymmetry affect the cost of capital?

There seems to be consensus both in the theoretical and empirical market micro-structure literature that greater information asymmetry reduces stock liquidity (e.g., Brennan and Subrahmanyam, 1995; Verrecchia, 2001). However, conference participants noted that changes in the structure of U.S. stock markets have resulted in bid-asked spreads that are economically negligible as a fraction of most firms' stock prices. Therefore, if the IAC of the bid-asked spread is the only means by which the cost of information asymmetry manifests itself, one would conclude, as do Leuz and Verrecchia (2001), that the U.S. disclosure environment is already so rich that it would be difficult to find strong disclosure-related effects in broad cross-sections of U.S. firms.⁸ In this case, the effect of disclosure is likely to be a subtle, second-order, effect for most U.S. firms, and this effect would only be detected in samples where there are large changes in disclosure policy such as in Healy et al. (1999), Lang and Lundholm (2000), and Leuz and Verrecchia (2001).

On the other hand, if information asymmetry affects expected returns, disclosure choices can have a first-order economic effect by reducing information asymmetry and lowering firms' equity discount rates, and this effect would be detected in broad samples. In this case, strong disclosure-related effects could be found in U.S. return data, and it would be worthwhile to use more sophisticated measures for the cost of capital and to validate carefully prior results on U.S. data before proceeding abroad where institutions and market-making are known to be quite different.

⁸ In this case, an additional interpretation suggested by *Review* is that there is too much disclosure regulation in the U.S., and that market participants would be willing to accept larger IAC (and larger spreads) in exchange for firms spending less cash on information production.

Recent finance literature shows that three proxies for information asymmetry appear to explain cross-sectional returns in excess of the three Fama-French (1992) factors. Brennan and Subrahmanyam (1996) find that firms with a lower IAC of the bid-asked spread have lower expected returns. In addition, lower information asymmetry is associated with higher volume, and recent empirical evidence suggests that higher-volume stocks have lower expected returns (Brennan, Chordia, and Subrahmanyam, 1998; Chordia, and Subrahmanyam, and Anshuman, 2001).⁹ Finally, Easley, Hvidkjaer, and O'Hara (EHO, 2000) proxy for information asymmetry using the Easley, Kiefer, O'Hara, and Paperman (1996) probability of informed trade (PIN) metric. EHO find that firms with higher PINs have higher excess returns, and interpret this result as evidence that information risk increases expected returns.

Each of these three proxies for information asymmetry has been shown to be related to disclosure policy. For example, Leuz and Verrecchia (2001) show that a commitment to increased disclosure lowers bid-asked spreads and increases volume, and note that Easley, Kiefer, O'Hara, and Paperman (1996) show a negative correlation between the PIN metric and volume. Finally, in research-in-progress, Brown, Finn, and Hillegeist (2000) examine the association between the PIN metric and disclosure quality as measured by the AIMR scores for a cross-section of 200 firms in 1995. Preliminary results indicate that there is a significant negative correlation between the two variables.

⁹ Findings in Brennan, Chordia, and Subrahmanyam suggest that the negative relation between firm size and expected returns (Fama and French, 1992) can be interpreted as size proxying for liquidity effects. When a more direct proxy for liquidity, dollar volume, is included in a regression of excess returns, it is significantly negative, and size becomes insignificant.

Even if strong links from various proxies for information asymmetry to expected returns could be established, there remains the challenge of establishing strong links from disclosure quality to the information asymmetry proxies. If this can be accomplished, research could then seek to establish a direct link from disclosure quality to expected returns. This work would have the potential “added benefit of explaining why it is that some accounting data appear to be informative for asset pricing” (EHO, section 6). However, to answer these questions requires better understanding of the various proxies for information asymmetry and for disclosure quality.

3.2. Measuring the information asymmetry component of the cost of capital

There is little research guidance as to which of the noisy proxies for the information asymmetry component of the cost of capital are likely to be more accurate. Researchers indirectly address measurement problems with the cost of capital by repeating their tests on different proxies for the cost of capital (e.g., Healy et al., 1999; Leuz and Verrecchia, 2001). However, because these tests are not independent, it is difficult to assess significance.

Moreover, when one has several noisy proxies, one can construct a more powerful test by using a weighted combination of the proxies in a single regression, where the weights are derived in order to diversify away the measurement error (see Ittner and Larcker, 2001). For example, consider the hypothesis that information asymmetry affects expected returns. One would expect that the three measures discussed above (the IAC of the bid-asked spread, volume, and the PIN metric) are noisy proxies for information asymmetry, and that power could be gained by aggregating the proxies into a single measure.

A large sample study could assess the measurement properties of various proxies for the cost of capital. Correlation analysis and factor analysis would shed light on the relative

amounts of error in the proxies, and would suggest combinations of proxies that could be weighted together to create more powerful tests. Because they require the analysis of intra-day trading data, it is very expensive to compute some proxies such as the PIN metric and the IAC of the bid-asked spread. Another useful contribution would be to create a “good enough” measure for the information asymmetry component of the cost of capital. Such a measure would consist of easily-computed proxies and would be highly correlated with the most precise, but more expensive, measure.

3.3. *Measures of disclosure quality*

Improved measures of disclosure quality also need to be developed. The AIMR discontinued its disclosure rankings in 1997 (after ranking fiscal year 1995). There may be some small problems of judgment error in the metrics constructed by Botosan (1997), Lang and Lundholm (2000), and Miller (1999), but the real problem with these measures is that they are so labor-intensive that they are feasible only for small samples.

Here, I conjecture that researchers can substantially lower the cost of computing these metrics by importing techniques in natural language processing from fields like computer science, linguistics, and artificial intelligence. An example of a widespread natural language processing technology is the grammar-checking device provided with many word-processing programs. This device provides information on the frequency of use of the passive tense. Little (1998, pp. 96-98) identifies the passive tense as one of a number of linguistic devices for hiding meaning that are examined in the law and linguistics literature.

These programs also provide other readability statistics, and one would expect to see a correlation between these readability statistics and the AIMR ratings, which are analysts' ratings

of written disclosure. It seems worthwhile to investigate whether more sophisticated natural language processing technology could be used to replicate ratings by the AIMR and ratings by researchers. If this can be accomplished, it would significantly reduce the cost of creating disclosure quality indices from firm reports and press releases. Assuming good voice-recognition technology, it would be possible to machine-code conference call disclosure as well.

Natural language processing programs could be also used to create proxies for the “tone” of disclosure (Lang and Lundholm, 2000) and proxies for the precision and bias of the information that is conveyed. Healy and Palepu (1993, 1995, and 2001) emphasize the important idea that managers communicate with investors. Managers use natural language for this communication, and we can advance work in accounting by using research from other fields to find ways to machine-code the precision of this language and any bias contained in it.

4. Conclusion

This paper discusses *Review* and uses corporate finance theory to expand on and to provide an alternative analysis of the voluntary disclosure literature. The endogeneity problems and the measurement error problems that make this literature difficult are also what make this literature an especially promising area for future research. As discussed above and in Bushman and Smith (2001), the voluntary disclosure literature is interlinked with the literature on corporate governance and the literature on management incentives. Each of these literatures has endogeneity problems, and there is uncertainty and active debate on how to measure governance quality (e.g., Bushman, Chen, Engel, and Smith, 2000) and how to measure incentives (e.g., Core and Guay, 1999).

A major contribution can be made to the voluntary disclosure literature by establishing how information asymmetry affects the cost of capital, and in particular determining whether information asymmetry affects expected returns. A second contribution can be made by creating more precise measures of the information asymmetry component of the cost of capital. A final contribution can be made by using computer technology to lower the cost of computing disclosure quality indices. These measures would add power to most disclosure-related research designs, as well as help address more general issues of fundamental interest to accounting researchers. Specifically, researchers could employ these measures to shed light on many of the broader questions proposed in *Review*.

Potentially the most interesting question for future research is to examine the firm's simultaneous choice of disclosure quality, management incentives, and corporate governance structure. Bushman et al. (2000) make an important start in this area by documenting that lower accounting quality (measured by a returns-earnings correlation) is associated with more costly corporate governance mechanisms. Future research can build on these results by examining whether firms with low accounting quality improve their disclosure quality through voluntary disclosures. In this case, one would expect an association between the level of voluntary disclosure and the firm's level of managerial equity incentives. This association would simply reflect firms' optimal choices, and would not provide evidence of a stock compensation hypothesis.

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