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Direct and mediated associations among earnings quality, information asymmetry and the cost of equity

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Direct and Mediated Associations Among Earnings Quality, Information Asymmetry and the Cost of Equity

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Using path analysis, we investigate the direct and indirect links between three measures of earnings quality and the cost of equity. Our investigation is motivated by analytical models that specify both a direct link and an indirect link that is mediated by information asymmetry, but do not suggest which link would be more important empirically. We measure information asymmetry as both the adverse selection component of the bid-ask spread and PIN (the probability of informed trading). For a large sample of Value Line firms during 1993-2005, we find statistically reliable evidence of both a direct path from earnings quality to the cost of equity, and an indirect path that is mediated by information asymmetry, with the weight of the evidence favoring the direct path as the more important.

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I. INTRODUCTION

Applying path analysis to a sample of Value Line firms during 1993-2005, we posit and test for evidence of a direct link (path) between the cost of equity capital and information risk as proxied by earnings quality, and an indirect link, in which information asymmetry is a mediator variable that is influenced by earnings quality and that in turn influences the cost of equity. Our investigation is motivated by the theoretical debate about whether earnings quality affects the cost of capital through its effect on information asymmetry and by the policy implications of the answer to that question.

We build on three streams of research that consider the relation between accounting-based information variables and market outcomes, including information asymmetry and the cost of equity, and the relation between those market outcomes. The first stream investigates links between earnings quality and information asymmetry. For example, Bhattacharya et al. (2009) document that poor earnings quality results in higher adverse selection risk and lower financial market liquidity. The second stream of research contains analytical models that specify how either the amount of information risk (that is, the quality or precision of information) or the distribution of information (that is, information asymmetry) relates to the cost of equity. Lambert et al. (2008) specify a direct link between information risk and the cost of equity and, in some circumstances, suggest an indirect link that operates through information asymmetry.[1] We aim to provide evidence on the existence and relative importance of both the direct link and the indirect link. In addition, based on Lambert et al. (2007), we posit and test for an indirect link between earnings quality and the cost of equity that is mediated by beta.

[1] Easley and O'Hara (2004) also predict a link from information asymmetry to the cost of equity. However, Lambert et al. (2008) show that in Easley and O'Hara's pure competition setting, changing information asymmetry can affect the cost of equity only if that change also affects investors' average level of information precision.

The third stream of research which forms the foundation for our analysis provides evidence on associations between measures of earnings quality and the cost of equity and, separately, between measures of information asymmetry and the cost of equity. With regard to the latter, Amihud and Mendelson (1986) show that bid-ask spreads are related to expected returns, and Easley et al. (2002) provide evidence that the probability of informed trading (*PIN*) is related to expected returns. With regard to the former, several recent studies document a relation between the cost of equity and information risk as captured by earnings quality (we provide an overview in section II). However, this research does not investigate *how* this association operates and, in fact, often appears to attribute the association to an indirect path mediated by information asymmetry. Our aim is to shed light on the extent to which this attribution is confirmed by empirical analyses.

Our measures of the cost of equity, earnings quality and information asymmetry follow prior research. We use a Value-Line-forecast-based measure of the cost of equity, based on previous research (e.g., Botosan and Plumlee 2005, Botosan et al. 2009) demonstrating the construct validity of this measure. In sensitivity tests, we also use a realized-returns-based measure and two measures based on earnings forecasts. We measure earnings quality as accruals quality (as defined by Dechow and Dichev 2002), as absolute abnormal accruals from a modified Jones (1991) model and as a composite measure that combines accruals quality, absolute abnormal accruals and earnings variability. We measure information asymmetry as the adverse selection component of the bid-ask spread, following Huang and Stoll (1996), and as *PIN*, following Easley et al. (2002).

We first verify that our sample exhibits cost of equity associations similar to the associations found in previous research. We next use path analysis to decompose the associations into a direct path from earnings quality to the cost of equity and an indirect path mediated by information asymmetry; we perform separate tests in which beta is an additional mediating variable. For all three measures of earnings quality, we find statistically reliable evidence of both a direct path and an indirect path, mediated by information asymmetry, between earnings quality and the cost of equity, as well as evidence of an indirect path mediated by beta. The direct path is empirically more important than the indirect path(s), and the relative importance of the direct versus the indirect path varies predictably with the market environment. Specifically, consistent with arguments in Lambert et al. (2008), when market friction is high, information asymmetry is relatively more important as a mediating variable. Results are broadly consistent for our two measures of information asymmetry, except that the *PIN* association is sensitive to size effects.

We interpret our results as supporting the predictions of analytical models which posit both a direct path and a mediated path from information risk, which we proxy by earnings quality, to the cost of equity. We also conclude that the attribution of the association between measures of earnings quality and the cost of equity to the information-asymmetry-mediated (indirect) path, made by Francis et al. (2005) and several other studies, is incomplete. Our results thus provide evidence about the *nature* of the relation between information risk and the cost of equity. While the *existence* of such a relation is predicted by analytical models, those models do not speak to the magnitudes of associations or to the possibility that both direct and indirect relations can exist, as an empirical matter, in a broad sample of firms.

Our finding that, in broad samples, the direct link between information risk and the cost of equity dominates the link mediated by information asymmetry suggests that when there is a trade-off between the two, increasing the quality of information has a bigger payoff, in the sense of favorable cost of equity effects, than does ensuring equal investor access to information (that is, reducing information asymmetry). In the context of management's reporting and disclosure decisions, our results suggest that efforts to simplify reporting and otherwise make the information more broadly understandable should be evaluated also by the effects of those efforts on information precision. In a regulatory context, requirements intended to affect the distribution of information (that is, information asymmetry) without altering the overall average precision of information include Regulation Fair Disclosure (Reg FD)[2] and prohibitions on insider trading. As discussed in Lambert et al. (2008) critics of Reg FD argued that it could reduce the amount and quality of information available to investors (that is, reduce information precision) and critics of insider trading prohibitions (e.g., Manne 1966, 2005) argue that these prohibitions impede the ability of better-informed insiders to enhance price discovery by their informed trading. Our results suggest that these and similar regulatory requirements would be expected to have a favorable *overall* cost of equity effect only if they do not reduce *average* information precision, for example, by discouraging actions that put more precise information into the marketplace.[3]

The rest of the paper proceeds as follows. Section II summarizes the research relating information variables to the cost of equity that forms the basis for our analysis and explains how these relations can be described and measured by path analysis. Section III describes our measures of earnings quality, information asymmetry and the cost of equity. Section IV reports the empirical results and section V concludes.

II. INFORMATION RISK AND THE COST OF EQUITY

Our investigation of the direct and indirect paths between earnings quality, our proxy for information risk, and the cost of equity is guided by analytical models that we interpret as supporting the possibility of both links. We use 'information risk' to denote both information precision effects and information asymmetry effects, and distinguish between models in which properties of firm-specific information are rationally priced along two related dimensions. The first is whether information risk derives from the *amount* of information uncertainty (or

[2] The Securities and Exchange Commission (SEC) adopted Regulation Fair Disclosure on August 15, 2000. The stated intent is to address selective disclosure of information. The Regulation requires that an SEC registrant that discloses material nonpublic information to certain individuals (e.g., analysts, large investors) must also make the information public.

[3] We recognize that policymakers may choose to accept reduced average information precision to achieve a social goal of equitable information distribution; the considerations involved in analyzing this tradeoff lie outside the scope of our paper.

imprecision, which we interpret as a measure of quality) or from the *distribution* of information; that is, from information asymmetry. The second dimension is whether the effects of information uncertainty are direct or mediated. Focusing on the *amount* of information imprecision, earnings quality as an indicator of information imprecision directly affects the cost of equity capital. Focusing on the *distribution* of information, the effect of earnings quality is indirect, mediated by information asymmetry. The basic structure can be represented by a path diagram, where the relations are represented by path arrows:

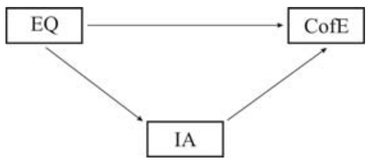

Figure 1: Basic path diagram showing posited direct and indirect (mediated by information asymmetry) paths between earnings quality (our proxy for information risk) and the cost of equity.

II.1 <u>Path analysis of the links between earnings quality and cost of equity.</u>

We use path analysis to decompose the correlation between the source (causal) variable earnings quality and the outcome variable cost of equity into direct and indirect (mediated) paths. This decomposition provides evidence on the existence and relative importance of the direct and indirect paths between earnings quality and the cost of equity.[4] Path analysis belongs to a class of causal (or structural equation) models that are used to provide persuasive explanations of correlation structures, by decomposing a correlation between two variables (in our case, earnings quality and the cost of equity) into a simple or direct path and a compound or indirect path that

[4] For additional description, see, for example, Asher (1983). Path analysis has been more used in auditing and managerial accounting research than in capital markets research. For example, Ramsay and Payne (2007) use path analysis to investigate how two distinct audit documentation approaches (summary memos versus detailed audit workpapers) affect audit outcomes such as error identification and fraud detection, via mediating variables such as time spent on the documentation task and intensity of examinations of audit evidence. Bouwens and Abernethy (2000) examine the relation between the design of management accounting systems (the outcome variable) and both customization (meaning that the customer affects the attributes of the item being purchased) and interdepartmental dependence, and find that customization operates on the outcome variable via departmental dependence, not directly. Also in managerial accounting, Parker and Kyj (2006) show that the outcome variable job performance is due to a complicated set of direct and mediated paths involving budget participation, organizational commitment, information sharing and ambiguity.

includes a mediating variable (in our case, information asymmetry).[5] The primary path analysis we consider is recursive (all the paths flow in only one direction) and consists of manifest (observable) variables; when some variables are unobservable (latent) the models are sometimes called LISREL-type models.

Path analysis can be compared to regression analysis along three dimensions that are pertinent to our research question. First, like a standard regression where one specifies a dependent variable as a function of explanatory variables, path analysis requires the researcher to postulate source or causal variables, mediating variables (influenced by source variables and influencing outcome variables) and outcome or consequent variables.[6] This *ex ante* specification can be derived from theory or from substantive, knowledge-based reasoning about the linkages among variables or from both. Our specification of the direct and mediated paths between earnings quality and the cost of equity is guided by the analytical models discussed in section II.2 and by previous empirical research, discussed in section II.3. Second, while regression analysis is informative about overall effects, path analysis provides evidence about the existence and relative importance of the possible alternative paths of influence that, taken together, create those overall effects. Third, path analysis allows for multiple source variables, each with its own set of direct and indirect paths, and for detection and analysis of correlations among source variables. If two source variables are statistically related, but only one influences a mediating or outcome variable, in a path analysis this relation will appear as a simple correlation between the two variables that is not part of the path between each source variable and the mediating or outcome variables. Although causal variables may covary, there is no path between causal variables (the researcher does not posit a directional

[5] This description of path analysis focuses on Figure 1, with information asymmetry as the mediating variable between earnings quality and the cost of equity. As discussed later, we also investigate several alternative and more complex specifications.

[6] Unlike standard regressions, path analysis can also be used to investigate alternative theory-based links in the same analysis. We provide such an analysis in section IV.3.2, where we investigate a potential feed-back link between earnings quality and information asymmetry.

link between them). In a regression, this potential covariation effect is not as readily detectable and separable from the actual paths of influence, and in fact may not be detectable at all. For example, in specifications that include, as source variables, beta, size and book-to-market (BM) (Fama and French 1993), we allow for a direct path between each factor and the cost of equity (these variables act like control variables in a regression).

The key outputs of a path analysis are *path coefficients* linking two variables in the path. A direct path has one path coefficient.[7] A mediated path contains a coefficient linking the source variable to the mediating variable and a coefficient linking the mediating variable to the outcome variable. The path coefficient for a mediated path is the product of the individual path coefficients for each segment of that path. In our setting, the total mediated path coefficient between earnings quality and the cost of equity is the product of the path coefficient between earnings quality and information asymmetry and the path coefficient between information asymmetry and the cost of equity. We measure the importance of a direct or indirect path, which we term *percentage*, as the ratio of the path coefficient for that path to the total correlation between the source variable and the outcome variable. For example, the ratio of the mediated path coefficient to the correlation between earnings quality and the cost of equity is the proportion of the total correlation between earnings quality and the cost of equity that is attributable to the mediated or indirect path, which captures the relative importance of that path.

II.2 <u>Analytical models that link information risk directly to the cost of equity and indirectly, through information asymmetry or beta.</u>

Lambert et al. (2008) show that in a perfect competition setting, the average precision of investors' assessments of firms' future cash flows directly affects the cost of equity. The extent to

[7] In a simple model such as the one described in Figure 1, the path coefficient for the direct path from *EQ* to *CofE* represents the link between *EQ* and *CofE* when *EQ* has been orthogonalized with respect to *IA*; that is, any shared variation between *EQ* and *IA* has been removed and only the unique *EQ-CofE* association remains.

which any single investor's information precision differs from the market average precision (the extent of information asymmetry among investors) does not matter as long as the average precision is controlled for. In their model, when some investors acquire more information (have more precise information), this additional information gets partially communicated through price, thereby decreasing the uncertainty of other investors. Alternatively, providing more information to more investors (one way to describe how to reduce information uncertainty) affects the cost of equity only because the additional information increases the average level of information precision. Based on this model, we posit a direct path from earnings quality (our proxy for information risk) to the cost of equity capital.

Our reading of the literature (e.g., Hughes et al. 2007, Lambert et al. 2008) suggests that some kind of capital market imperfection or friction is required to support a link between information asymmetry and the cost of equity. As Lambert et al. point out, researchers have characterized imperfectly competitive capital markets in several ways; they choose Diamond and Verrecchia's (1991) characterization in which the market contains a small number of large risk neutral traders who are at least potentially informed and a large number of less informed risk averse traders. We interpret Lambert et al. (2008) as implying the possibility of an indirect link from earnings quality to the cost of equity that is mediated by information asymmetry, provided the capital market is not perfectly competitive (which they characterize by reference to the composition of the investor base and investor characteristics). To the extent this characterization captures important aspects of the information and trading environment for a given sample of firms, that environment would be viewed as imperfectly competitive and thus offering the empirical possibility of an indirect path between information risk and the cost of equity.[8]

[8] Previous empirical research analyzing the capital market effects of information quality (e.g., Francis et al. 2005) has been motivated by O'Hara's (2003) and Easley and O'Hara's (2004) model of the consequences of information asymmetry in a capital

If information asymmetry is a mediating variable that affects the cost of equity, it is necessary to identify a source or causal variable that affects information asymmetry. Both Lambert et al. and Easley and O'Hara point to accounting information as one such variable. We focus on accounting quality, more specifically, earnings quality, as the source variable that is mediated by information asymmetry, both because it has a natural interpretation as a measure of information risk and because of its direct link to cash flows, the presumed object of investor interest. Because earnings quality is determined by the reporting entity's business model, operating environment and implementation of authoritative accounting guidance, it is not itself a characteristic of the capital market (as is, for example, analyst following).[9]

Lambert et al. (2007) develop a model, based on the Capital Asset Pricing Model (CAPM), in which information quality affects the cost of equity via an influence on systematic risk, specified as the (unobservable) forward-looking beta.[10] As both they and their discussant (Indjejikian 2007) point out, in their CAPM-based model only one factor is priced, so their model cannot suggest a direct link between earnings quality (our proxy for information quality) and the cost of equity. We present a path analysis which allows for both the effect predicted by Lambert et al. (2007) (earnings quality affects the cost of equity indirectly, via beta) and a direct effect which is not

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market characterized by rational expectations and differentially informed investors. O'Hara (2003) and Easley and O'Hara (2004) identify the *composition* of information, between public information and private information, as a determinant of the cost of equity. In their model, uninformed investors face an undiversifiable risk that arises from asymmetric information; an increase in the amount of private information, that is, an increase in information asymmetry, increases the required rate of return. Lambert et al. (2008) dispute that it is information asymmetry *per se* that causes the cost of capital effect in pure competition settings, such as in Easley and O'Hara (2004). Rather, reducing information asymmetry can affect the cost of equity when the reduction in asymmetry is accompanied by an increase in the average level of information precision.

[9] As a practical matter, information asymmetry is determined by factors that affect how (relatively) informed are the uninformed investors. Lambert et al. (2008) note that factors that reduce information asymmetry may also increase the average precision of information. Some of these factors are in turn associated with other capital market characteristics. Easley and O'Hara (2004) suggest, for example, that greater analyst scrutiny of a given firm will increase the dispersion of information about that firm across investors and thereby reduce information asymmetry. Previous research shows that analyst coverage is similarly determined by other capital market characteristics such as investor interest; for example, O'Brien and Bhushan (1990) find that analysts follow firms that institutions hold and institutions hold firms that analysts follow. Therefore, while analyst following would be expected to affect both average information precision and information asymmetry, analyst following appears to be a variable that is not itself a direct measure of information imprecision.

[10] This effect is similar to the estimation risk (or parameter uncertainty) link between information and systematic risk developed by, for example, Barry and Brown (1985) and Klein and Bawa (1976).

predicted by their model but which might exist in a multi-factor asset pricing scenario. Our measure of systematic risk is the CAPM beta estimated from historical data.[11]

In summary, we believe the analytical literature suggests that the existence and relative importance of direct and indirect (mediated by information asymmetry or systematic risk) paths from earnings quality to the cost of equity are empirical matters. Recognizing that actual capital market outcomes reflect conditions that may not be completely captured by any single analytical specification, our analyses test for the existence and relative importance of both direct and indirect links between information quality and the cost of equity. With regard to the direct link, we propose that poor earnings quality represents imprecise information about firms' future cash flows and thereby increases the cost of equity capital. With regard to the indirect links, prior research shows that poor earnings quality is associated with higher information asymmetry (e.g., Bhattacharya et al. 2009) and with higher systematic risk (e.g., Francis et al. 2005, Barth et al. 2006). We therefore propose indirect paths from earnings quality through information asymmetry and systematic risk.

II.3 Evidence on the links between information risk, information asymmetry and the cost of equity.

Our analysis is predicated on the existence of *empirical* relations between the cost of equity and measures of both information quality and information asymmetry. In this section, we describe empirical research that documents a link between accounting-based proxies for information risk (specifically, measures of earnings quality) and the cost of equity and a link between measures of information asymmetry and the cost of equity.

Earnings quality and the cost of equity. As described in section III, we measure earnings quality as accruals quality, absolute abnormal accruals and a composite factor based on the first two quality measures plus earnings variability. These accounting-based measures of information

[11] Because this measure is a noisy proxy for the forward-looking beta, the construct specified by Lambert et al., we acknowledge that the use of this noisy proxy could affect our results.

risk focus on the association between accruals (which link the outcomes of operating the firm's business model to reporting outcomes via management's implementation of authoritative accounting guidance) and accounting fundamentals (cash flows or property, plant and equipment and revenues). These measures capture effects of the firm's operating environment, not its trading environment, so they are likely to influence, as opposed to being influenced by, the market's information structure. In particular, accruals quality captures the uncertainty in current accruals about cash flows, and is therefore directly connected to the valuation construct in the analytical models that guide our research.

Previous research has investigated the relation between various accounting-based and market-based measures of earnings quality and various measures of the cost of equity, including valuation-model-based measures and realized-returns-based measures. Examples include Bhattacharya et al. (2003), Barone (2003), Francis et al. (2004, 2005), Aboody, et al. (2005), Barth et al. (2006), Berger et al. (2006), Chen et al. (2008), Core et al. (2008), Gray et al. (2008), Kravet and Shevlin (2009), Ogneva (2009), and Kim and Qi (2010). For a detailed discussion of this and related research, see Francis et al. (2008).[12]

Earnings quality and information asymmetry. Using the adverse selection component of the bid-ask spread as the proxy for information asymmetry, Bhattacharya et al. (2009) find that earnings quality affects the level of information asymmetry during non-earnings-announcement periods as well as the change in information asymmetry around earnings announcement windows. These effects persist after controlling for known determinants of bid-ask spreads. Welker (1995) and Brown and Hillegeist (2007) document associations between disclosure policy as proxied by

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[12] Briefly, these studies find an economically and statistically significant cost of equity effect associated with earnings quality. An exception is Core et al., who fail to find a significant risk premium associated with accruals quality using a two-stage test. As pointed out in Kravet and Shevlin (2009), the two-stage test also fails to find significant risk premia associated with models of fundamental risk such as the CAPM and the Fama and French three-factor model.

AIMR scores and two measures of information asymmetry: bid-ask spreads (Welker) and *PIN* scores (Brown and Hillegeist).

Information asymmetry and the cost of equity. We measure information asymmetry as the adverse selection component of bid-ask spreads (the price impact (*Impact*)), and *PIN* (probability-of-informed-trading) scores. Our estimate of price impact follows Huang and Stoll (1996), and is described in section III. Price impact has been used in the market microstructure literature (e.g., Bessembinder and Kaufman 1997, Stoll 2000, Wahal, Conrad and Johnson 2003) and also by market regulators.[13] It has to our knowledge not been tested explicitly as a determinant of expected returns. Variants of bid-ask spread variables have, however, been found to have explanatory power for expected returns; for example, Amihud and Mendelson (1986) find that raw bid-ask spreads are positively related to expected returns. While bid-ask spreads are related to firm size, Amihud and Mendelson document that size does not drive out the expected return effect associated with bid-ask spreads (if anything, size loses importance in the presence of the bid-ask spread). Using two measures of the variable and fixed costs of transacting, one of which includes the adverse selection component, Brennan and Subrahmanyam (1996) find a significant return premium, controlling for the Fama-French 3-factor model, associated with the variable and fixed trading cost components.

The theoretical development, estimation and properties of *PIN* as a measure of information asymmetry are described in several places, including Easley, Hvidkjær and O'Hara (2002), who also document an association between *PIN* and measures of expected returns. *PIN* has been used to measure information asymmetry in the financial economics literature and in the accounting literature (e.g., Brown et al. 2004, Botosan and Plumlee 2008, LaFond and Watts 2008), and we thus consider it as an alternative to *Impact*. However, size-*PIN* interactions documented and

[13] From September 2001, the SEC has required each U.S. stock "market center" to compile and disseminate, on a monthly basis, various standardized measures of execution quality to provide traders with information on the execution quality of their trades (SEC Rule 605, formerly 11Ac1-5). These measures include the effective spread and the price impact of trade metrics (Boehmer, 2005).

discussed by, for example, Easley et al. (2002, p. 2208), Easley et al. (2005), Botosan and Plumlee (2008) and Mohanram and Rajgopal (2009) suggest that *PIN* effects can be more sensitive to how firm size is included in the research design than are *Impact* effects.

Finally, Botosan and Plumlee's (2008) analysis of information asymmetry and the cost of equity is complementary to our results. They are interested in both the public versus private composition of information and the dissemination of private information across investors as measures of information asymmetry. They conclude that information composition, information dissemination and the precision of private and public information are all associated with the cost of equity. They investigate in detail *how* different information asymmetry attributes are priced, so their study is in the same spirit as ours. However, their analysis is not concerned with the path through which information risk is linked to the cost of equity.

II.4 Innate versus discretionary portions of earnings quality.

The models of information risk that form the basis for our analysis do not distinguish between the innate and the discretionary (or reporting choice) portion of earnings quality. However, both research on earnings management and knowledge of how the financial reporting process works suggest a difference between the imprecision of accruals for cash flows that arises from fundamentals innate to a firm's business model and its operating environment, and the imprecision that arises from management's period-by-period implementation of accounting guidance (that is, from reporting decisions). For consistency with previous research we refer to the former as innate earnings quality and the latter as discretionary earnings quality, recognizing that management can, over time, alter both business models and operating environments (e.g., by acquisition and divestiture) and that reporting choices are not purely discretionary (i.e., free choice), but rather subject to authoritative guidance.

The empirical associations between innate and discretionary earnings quality and the cost of equity differ. For example, Francis et al. (2005) report that the discretionary portion of accruals quality has a smaller cost of equity effect than does innate accruals quality, a finding confirmed by other studies. These results are predictable in light of the findings and related discussion in Guay et al. (1996) and Healy's (1996) related discussion. In the context of our analysis, their point is that a broad sample of financial reporting outcomes covering a long period will include reporting decisions that increase informativeness or reporting quality, decisions intended to manipulate the reporting outcome (and thereby reduce reporting quality), and decisions that introduce noise. Since a broad sample reflects an unknown mixture of the three types of reporting outcomes, which are in turn captured by discretionary earnings quality measures, the cost of equity effects of discretionary earnings quality should be smaller in a broad sample than the effects of innate earnings quality, because the latter reflects the imprecision introduced by innate factors, and not a mixture of potentially offsetting effects.

Based on this previous research, we include tests that separate innate from discretionary earnings quality. Either component, or both, could have a direct effect and/or a mediated effect on the cost of equity and the form of those effects could differ for the two components. For example, while we expect that information asymmetry is influenced by management's reporting decisions, it is possible that management may make reporting decisions to reduce information asymmetry. Thus, there may be a path from discretionary earnings quality to information asymmetry as well as a feedback path in the reverse direction. We address specification issues in section IV.3.2.

III. EMPIRICAL MEASURES AND SAMPLE DESCRIPTION

III.1 Measures of earnings quality, information asymmetry and cost of equity

Earnings quality. Because the analytical models we rely on tend to focus on the precision of information and to view cash flows as fundamental, we believe our research question calls for accounting-based earnings quality measures that capture the precision of earnings with respect to accounting fundamentals that are meant to capture the value generating process of the firm, especially cash flows. [14] Prior research by Francis et al. (2004) finds that accounting-based earnings attributes (in particular accruals quality, earnings persistence, and smoothness) have larger cost of equity effects than market-based attributes (value relevance, timeliness and conservatism); accruals quality is empirically the strongest of the accounting-based attributes they consider. Francis et al. (2004) also report that earnings variability has about the same cost of equity effect as accruals quality, and Aboody et al. (2005) as well as Francis et al. (2005) report that absolute abnormal accruals from a Jones (1991) model have non-trivial capital market effects.[15] Based on these results, and following the reasoning that the most appropriate measures of earnings quality for our purposes should focus on accounting fundamentals, we use accruals quality (*AQ*), absolute abnormal accruals (|*AA*|) and a composite measure that contains *AQ*, |*AA*| and earnings variability as our proxies for earnings quality.

We define accruals quality as the time-series standard deviation of residuals in regressions of working capital accruals on past, present and future cash flows from operations, plus the change in revenues and property, plant and equipment (Dechow and Dichev 2002, McNichols 2002). We measure the absolute value of abnormal accruals, |*AA*|, following a modified Jones (1991) approach. The estimation details can be found in Francis et al. (2005). Our composite earnings quality measure is the common factor score obtained from a factor analysis of *AQ*, $|AA|$ and

[14] The accounting literature has used three types of operationalizations of earnings quality: the accounting-fundamentals based measures we use; external assessments such as analyst rankings of financial report quality (e.g., Lang and Lundholm 1993, Botosan and Plumlee 2002); and market-based measures in which the quality of financial reporting is judged by its ability to capture the information that is already in returns or prices. For example, value relevance and timeliness metrics associate quality with the contemporaneous association between stock returns and earnings, while conservatism associates quality with differential associations of positive (good news) versus negative (bad news) stock returns with earnings (e.g., Basu 1997). For discussions of earnings quality, see, for example, Schipper and Vincent (2003), Dechow and Schrand (2004), and Francis et al. (2008).

[15] We are not aware of direct comparisons of the cost of capital effects of analyst based measures of earnings quality (such as AIMR scores) with the effects of other earnings quality proxies. However, Botosan and Plumlee (2002) report that the associations between AIMR scores and their measures of the cost of capital are weak and inconsistent.

earnings variability, measured as the standard deviation of earnings before extraordinary items, scaled by total assets, over the same seven year period used in the *AQ* calculation. For all three variables, larger values indicate poorer earnings quality. Using equation (1), provided in the Appendix, we decompose the earnings quality metrics into *innate* and *discretionary* components.

Information asymmetry. Our first information asymmetry measure, *Impact*, is based on the adverse selection component of the bid-ask spread, following Huang and Stoll (1996), and is expressed in terms of *percentage price impact*, given in equation (3) in the Appendix. Our second information asymmetry measure, *PIN*, is the unconditional probability that a randomly selected trade originates from an informed trader, and is given in equation (4) in the Appendix. Brown et al. (2004) provide a conceptual discussion and description of the empirical estimation of *PIN*.

Cost of equity. Our main cost of equity proxy (*CofE*) follows Brav et al.'s (2005) use of Value Line (VL) forecasts of price, dividend and growth, given in equation (5) in the Appendix. This *CofE* measure has been used by Brav et al. (2005) and Francis et al. (2004), and is qualitatively the same as the VL-based measure used by Botosan and Plumlee (2002, 2008). Research shows that the VL *CofE* measure has good construct validity (e.g., Botosan and Plumlee 2005, Botosan et al. 2009). While we believe the literature indicates the VL *CofE* measure is preferred, we recognize that there is no consensus on the best measure of the cost of equity. Consequently, we report (section IV.4.2) results of sensitivity tests with expected returns proxies based on realized returns and two earnings-based (rather than target price-based) implied cost of capital estimates.

III.2 Sample and data description

Our main sample covers 1993-2005. The alignment of information asymmetry and cost of equity variables is based on the fiscal years used to measure the earnings quality measures. For *PIN* scores and the Value Line *CofE*, which are available by calendar quarters, we average the four quarters' estimates that follow each firm's fiscal year end. For example, the *PIN* score and the *CofE* for a firm with a fiscal year end in May 2001 are the averages of the estimates for the four calendar quarters between July 2001 and June 2002. Following Bhattacharya et al. (2009), we estimate *Impact* by estimating equation (3, in the Appendix) over the 10 trading days ending two weeks before the first quarterly earnings announcement of the following fiscal year. Our intent is to ensure that financial information (and thus earnings quality) should be known to market participants before we measure information asymmetry and cost of equity.

Because we are constrained by Value Line coverage (for the cost of equity estimate) and by the existence of sufficient data to calculate earnings quality measures, our sample contains large firms (Value Line tends to cover big firms) and stable firms (they have existed for at least seven years).[16] As shown in Table 1, panel A, our Value Line sample contains between 920 and 1,040 firms per year (averaging 973) and a total of 12,648 firm-years. The sample accounts for between 33% (in 1999) and 53% (in 1994) of the total CRSP market capitalization, with an over-time average of 43%. These proportions are similar to results reported in Brav et al. (2005) and Francis et al. (2004), who also use Value Line-based samples. The number of firms in the sample, combined with the percent of total market capitalization accounted for, shows the bias towards larger firms.[17] The next two columns of panel A show the median return on assets (ROA) in our sample (5.06%) exceeds the median ROA of all Compustat firms (2.64%); the time series behavior of our sample firms' ROA is also more stable than the time series in the Compustat population. Our sample firms are in general more successful and more stable than the Compustat population, although there is substantial cross-sectional variation in profitability within our sample (the standard deviation of ROA is .0856; not reported in the table).

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[16] We also exclude firm-years with negative equity book values (2.1% of all firm-years) in order to be able to use meaningful book-to-market ratios in (some of) the cost of capital tests. When we repeat tests (that do not require book-to-market ratios) including these firm-years, there is no difference in results.

[17] In section IV.4, we report results based on a sample that does not require Value Line coverage and exhibits less size bias.

Panel B details the distribution of the earnings quality variables, the information asymmetry variables, the VL-based cost of equity estimates and beta. Both the mean (.0394) and median (.0310) reported for accruals quality (*AQ*) are larger than the estimates reported by Dechow and Dichev (2002) for their sample of manufacturing firms (.028 and .020, respectively) and similar to the estimates reported by Francis et al. (2005) for a broad sample of firms 1970-2001 (.044 and .031, respectively). The standard deviation of *AQ*, .0311, is roughly the same magnitude as the mean/median indicating substantial cross-sectional variation. The distributional properties for the other two earnings quality metrics are similar, in that the standard deviation is as big as the mean/median. Correlation tests (not tabulated) indicate that *AQ* is correlated .24 and .84 with $|AA|$ and *Composite*, respectively; and $|AA|$ is correlated about .50 with *Composite*.[18] Thus, we expect that *AQ* and *Composite* will behave relatively more similarly to each other in our empirical tests than either will to $|AA|$.

The information asymmetry measure based on the bid-ask spread, the percentage price impact (*Impact*), has a mean (median) of .292 (.174). Bhattacharya et al. (2009) report a mean (median) of .445 (.265). The lower *Impact* in our sample is consistent with the bias towards larger firms, which have lower information asymmetry (see, e.g., Stoll 2000). Similarly, in our sample *PIN* exhibits a lower mean (.153) and median (.143) than reported by Easley et al. (2002) (mean=.191, median=.185) and Brown et al. (2004) (mean=.182, median=.172). The cross-sectional variation in *PIN* (.061) is comparable to that reported in prior research (Easley et al. report a standard deviation of .057; Brown et al. report .077).

[18] The *Composite* variable, the common factor of *AQ*, |*AA*| and earnings variability, is correlated .75 with earnings variability (not tabulated). *Composite* is centered around a negative number. This is because we performed the factor analysis, by year, on the full samples of the three underlying earnings quality attributes, without requiring the existence of *CofE* and the information asymmetry measures. When we require the other variables, the decrease in the sample size shifts the distribution. We have reestimated *Composite* on only our sample firm-years, and the resulting *Composite* measure is correlated .99 with the tabulated *Composite* measure. Our tests yield virtually identical results using either variable.

Firm-specific betas are estimated over rolling five-year estimation periods. The distribution of betas indicates a fairly wide sample dispersion (standard deviation of .647) around a mean of .957. Our sample's mean (median) value of 15.4% (14.1%) for the cost of equity is similar to results in Brav et al. (2005), who report 15.1% (14.4%) for the portion of their sample period (1993-2001) that overlaps with ours.

To further calibrate our sample with prior research, we regress the cost of equity on earnings quality and information asymmetry variables, transformed into decile ranks, so that we can interpret the coefficients as the incremental cost of equity effect of moving from one decile to the next (control variables such as beta, size and BM retain their raw values). The results (not tabulated) show that when we regress *CofE* on decile-ranked *AQ*, the coefficient is .0062, indicating a 62 basis point (bp) change per *AQ* decile; the difference between the top and bottom *AQ* deciles is 5.6 percentage points (nine steps of .62% each). The effect is, predictably, diminished controlling for the CAPM and the 3-factor model, 51 and 41 bp per *AQ* decile, respectively. Francis et al. (2004) use a longer period (1975-2001) and report an effect of 41 bp per *AQ* decile, controlling for the 3-factor model. Relative to *AQ*, the 3-factor controlled |*AA*| effect is smaller and the *Composite* effect is larger, 22bp and 59bp per decile, respectively; all effects are significant at the .001 level; statistical inference here and in the tests that follow is based on standard errors clustered by firm and year, as derived by Cameron et al. (2006) and Thompson (2009) and applied by Petersen (2009) and Gow et al. (2010). We conclude that the cost of equity effects of all three earnings quality metrics in our sample are similar in magnitude to effects demonstrated in prior research. We next investigate *how* these cost of equity effects work.

IV. RESULTS OF PATH ANALYSES

Section IV.1 presents results of a path analysis of the cost of equity effects of total earnings quality. Section IV.2 contains results from alternative asset pricing model specifications, the

CAPM and the 3-factor model. Section IV.3 reports results for innate and discretionary components of earnings quality and section IV.4 reports results of additional analyses.

IV.1 Direct and mediated cost of equity effects of total earnings quality.

Our research question concerns the existence and relative importance of direct and indirect paths between earnings quality and the cost of equity. Table 2 presents the results of a path analysis with one source variable (earnings quality, measured as accruals quality (*AQ)*, absolute abnormal accruals (|*AA*|) and the composite factor (*Composite*). Panels A and B present results for information asymmetry measured as the adverse selection portion of the bid-ask spread (*Impact*) and *PIN*, respectively. We denote correlations with *r* and path coefficients with *p*.

Panel A shows results for information asymmetry measured by *Impact*, beginning with *r*, the Pearson correlation between the cost of equity and earnings quality. This correlation is about .23 for *AQ*, about .15 for |*AA*|, and about .30 for *Composite* (significant at the .001 level or better). The direct and mediated paths decompose this correlation into the portion attributable to the direct link between earnings quality and the cost of equity and the indirect link, mediated by information asymmetry. *p*[*EQ*, *CofE*] is the direct path coefficient; the ratio of this path coefficient to the total correlation (labeled *percentage* in the table) is the portion of the correlation between earnings quality and the cost of equity that is attributable to the direct path. Similarly, *p*[*EQ*, *Impact*] and *p*[*Impact*, *CofE*] are the path coefficients between earnings quality and information asymmetry and between information asymmetry and the cost of equity, respectively. The mediated path is the product of *p*[*EQ*, *Impact*] and *p*[*Impact*, *CofE*]. The ratio of the mediated path to the total correlation, labeled *percentage*, captures the portion of the correlation between earnings quality and the cost of equity that is attributable to the mediated effect.

As shown in Table 2, panel A, the correlation between *AQ* and *CofE* is about 81% attributable to a direct path between *AQ* and *CofE* and about 19% attributable to the mediated path; analogous results for |*AA*| and *Composite* are about 73% and 83%, respectively. Both direct and mediated paths are highly significant. Results are thus similar across our three measures of earnings quality, in that all direct and mediated paths are reliably non-zero and the direct link is substantially more important than the indirect (mediated via *Impact*) link. Results in Panel B of Table 2, using *PIN* as the measure of information asymmetry, suggest that the total correlation is about 10% attributable to the mediated path for *AQ*, and about 12% and 8% for |*AA*| and *Composite,* respectively. Inspection of the individual path coefficients reveals that the reduced importance of the mediated path in this specification is due to less important links between earnings quality and *PIN* and between *PIN* and *CofE,* relative to results for *Impact*. Taken together, the results in Table 2 suggest that the mediated (by information asymmetry) link between earnings quality and the cost of equity is reliably nonzero, smaller than the direct link, and more important for the *Impact* measure of information asymmetry than for the *PIN* measure.[19]

IV.2 CAPM and 3-factor model specifications.

The results reported in Table 2 do not control for other factors known to affect the cost of equity, such as beta (according to the CAPM, Sharpe 1964, Lintner 1965), or the book-to-market ratio (BM) and size (Fama and French 1993). To the extent these other factors are correlated with earnings quality or information asymmetry, part of their cost of equity effect will be ascribed to the variable(s) with which they are correlated (for example, size is correlated with earnings quality and information asymmetry; e.g., Dechow and Dichev 2002, Amihud and Mendelson 1986).

Table 3 repeats the analyses reported in Table 2, taking a CAPM perspective and including beta as a source variable that is posited to have a direct path to the cost of equity, and therefore to act like a control variable in a regression. Based on previous research we do not expect allowing

[19] To test the over-time stability of reported results, we also estimate the paths separately each sample year. The direct path always dominates the mediated path. For example, the direct path from *AQ* to *CofE* accounts for more than 75% of the total *AQ-CofE* correlation in all years but one (1998, when the direct path accounts for 63%).

for a direct path from beta to the cost of equity will substantially weaken the direct path from earnings quality to the cost of equity. However, results in, for example, Francis et al. (2005) also suggest that earnings quality and beta are related, so this path analysis may be empirically oversimplified. In addition, Lambert et al.'s (2007) CAPM-based model predicts a *mediated* (by beta) path between earnings quality and the cost of equity.[20] Therefore, in panels C and D, we report the results of a path analysis that posits a path between earnings quality and the cost of equity that is mediated by both information asymmetry and beta.

Results in Table 3, panels A and B, are generally consistent with expectations, in that the direct and mediated paths between all three measures of earnings quality and the cost of equity remain statistically reliably nonzero (at the .001 level), with the direct link consistently more important than the mediated (by information asymmetry) link. In these specifications, the portion of the correlation between earnings quality and the cost of equity that is attributable to the direct path decreases to about 61%, 57% and 64%, for *AQ*, |*AA*|, and *Composite*, respectively, when *Impact* is the measure of information asymmetry, and 70%, 71%, and 74%, respectively, when *PIN* is the information asymmetry metric. Panels C and D of Table 3 show results when earnings quality is posited to have a direct path and two indirect paths, via beta and information asymmetry; the latter is not affected by this change (that is, results for the mediated paths including *Impact* and *PIN* are the same as in panels A and B). Allowing for a path between earnings quality and beta means the model is just identified and, therefore, explains 100% of the total correlation between earnings quality and cost of equity. Consistent with Lambert et al. (2007), the path coefficient between all three earnings quality measures and beta is non-trivial, ranging from .11 in the case of

[20] In a specification that omits a path the percentages of correlation explained by all the estimated paths may not add to 100%. That is, the omission of one or more paths means that some of the total correlation that is decomposed by the path analysis would be attributable to a path (or paths) that is not estimated. In addition, the direct path between a source variable and an outcome variable can appear to explain more than 100% of the raw correlation between them when the source variable's correlation with another variable is omitted (in this case the omitted correlation is between earnings quality and beta).

|*AA*| to .38 in the case of *Composite*; all coefficients are highly significant. The total mediated path from earnings quality to beta to the cost of equity explains about 16%-19% of the correlation between earnings quality and the cost of equity, regardless of the measure of information asymmetry (*Impact* in panel C and *PIN* in panel D). Treating beta as a causal variable or as a mediated variable does not affect our basic finding, however, that the direct path from earnings quality to the cost of equity dominates the indirect path through information asymmetry.[21]

Table 4 introduces beta, size and book-to-market as additional source or causal variables, allowing each to take a direct path to *CofE*. Results in panel A, using *Impact* as the measure of information asymmetry, indicate statistically significant direct paths between earnings quality, beta, size, book-to-market, and *CofE*. The direct path between earnings quality and *CofE* explains about 60%, 53% and 67% of the correlation, when earnings quality is measured by *AQ*, |*AA*|, and *Composite*, respectively. The indirect path that includes *Impact* as a mediating variable explains about 12%, 17% and 11% of the correlation between earnings quality and the cost of equity for *AQ*, |*AA*|, and *Composite*, respectively; all results are reliably non-zero at the .01 level. Panel B of Table 4 reports results for *PIN* as the measure of information asymmetry. The direct path between earnings quality and *CofE* explains about 64%, 60% and 72% of the correlation between *AQ*, |*AA*|, and *Composite*, respectively, while the mediated path that includes *PIN* explains virtually none of the correlation between earnings quality and *CofE*. The path coefficient between earnings quality and *PIN* is reliably nonzero for all three earnings quality measures, but the path coefficient between *PIN* and *CofE* is not (t-statistics are below 1 in magnitude). We believe this result is likely due to the previously-discussed *PIN*-size sensitivity; when we rerun this estimation using only beta and book-to-market, results are similar to those obtained using only beta.

[21] Taking an alternative view about causation between earnings quality and beta, i.e., high beta is a primitive measure of business risk to which earnings quality responds, does not alter the main result. The direct path always dominates the mediated path between earnings quality and the cost of equity. Specifically, the path coefficients between earnings quality, information asymmetry and cost of equity are the same regardless whether one posits causality from earnings quality to beta or the other way around.

Taken together, we believe the results in Tables 2-4 indicate statistically reliable direct and indirect (mediated by information asymmetry) paths between earnings quality and the cost of equity. In both unconditional tests and tests that condition on beta alone and, separately, beta along with size and book-to-market, more of the total correlation between earnings quality and the cost of equity is attributable to the direct path (the direct path is between twice and nine times as important as the indirect path). We find stronger and more consistent mediated effects when we measure information asymmetry as the adverse selection component of the bid-ask spread (*Impact*) than when we use *PIN* (the *PIN*-to-cost of equity link is insignificant in the presence of a control for size). However, the weak *PIN* results in the presence of size cannot be taken as evidence of a null effect for information asymmetry in the presence of size control, because *Impact* has a reliably non-zero effect, regardless of size control variables. Results in Table 3 are also consistent with the existence of an indirect path, mediated by beta, from earnings quality to the cost of equity, as suggested by Lambert et al. (2007) in a CAPM setting.

IV.3.1 Direct and mediated effects of innate and discretionary earnings quality.

We separate earnings quality into orthogonalized innate and discretionary components following procedures outlined in Francis et al. (2005) and in the Appendix, and examine whether the relative importance of the indirect path between earnings quality and the cost of equity differs for the portion of earnings quality that arises from features of the firm's business model and operating environment (the innate portion) versus the portion unrelated to such innate factors and therefore more immediately under management control (the discretionary portion). Table 5 contains the results of the basic path analysis for the innate (Panel A) and discretionary (Panel B) components of earnings quality. From Panel A, the Pearson correlation *r* between innate earnings quality and the cost of equity is about .31 to .32, of which about 79-82% is attributable to the direct path between innate earnings quality and the cost of equity with the remainder attributable to the indirect path, mediated by *Impact*.[22] All paths are highly significant. These results are broadly consistent with those in Table 2 for total earnings quality, although the path coefficients between innate earnings quality and *Impact* (about .25-.30) tend to exceed the coefficients between total earnings quality and *Impact* (about .14-.21, in Panel A of Table 2).

Results for discretionary earnings quality are, as expected, more modest. Panel B of Table 5 shows that the correlation between discretionary earnings quality and the cost of equity is about .06 for *AQ*, about .04 for |*AA*|, and about .09 for *Composite,* less than one-third the correlation for innate earnings quality. All correlations are statistically significant at conventional levels. More than 90% of this correlation can be attributed to the direct path from discretionary earnings quality to the cost of equity when earnings quality is measured as either *AQ* or *Composite*, and around 79% when earnings quality is measured as |*AA*|. The statistical significance of the mediated path is also weak, with t-statistics ranging from 1.13 to 1.92, depending on the earnings quality measure.[23] In untabulated tests, we repeat the path analyses for innate and discretionary earnings quality reported in Table 5 including beta as a source variable and, separately, including beta, book-to-market and size. The conclusions are similar to those suggested by the results in Table 5.

We interpret the results in Table 5 as indicating that management's reporting decisions, proxied by discretionary earnings quality, have a weaker overall relation with information asymmetry than does innate earnings quality. We conjecture that this result is due to the effects described by Guay et al. (1996); in a broad sample like ours, management's reporting decisions, which determine discretionary earnings quality, are a mixture of performance-revealing information (which would increase reporting quality), manipulations and noise (both of which are

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[22] In these and later tests, only results for information asymmetry measured as *Impact* are tabulated; results based on *PIN* are consistent except for the previously-discussed size-related effects.

[23] The mediated path is relatively most important when discretionary earnings quality is measured as |*AA*|. We speculate that this result might be attributable to the nature of |*AA*|. This measure was originally developed to capture management's reporting decisions over and above those determined by accounting fundamentals and was therefore intended to be primarily discretionary.

expected to reduce reporting quality), with the result that discretionary earnings quality is not as pure a measure of information risk as is innate earnings quality, which is determined by business models and operating environments. These results reinforce a point made by Guay et al., and others, that it is difficult to draw inferences about the intent behind management's reporting decisions in broad samples.

IV.3.2 Alternative specifications for innate and discretionary earnings quality.

If earnings quality and information asymmetry are mutually determined by another variable, we may ascribe causality to what in reality could be spurious correlation. For example, prior literature documents that firm size is correlated with both earnings quality and information asymmetry. Because discretionary earnings quality is already orthogonalized with respect to known determinants of earnings quality, this potential problem would arise primarily in the innate earnings quality analysis. Another potential specification issue concerns causality between earnings quality and information asymmetry. The theory on which we base this study predicts that causality to flow from earnings quality to information asymmetry, and our research design reflects this prediction: earnings quality measurement precedes the measurement of information asymmetry. However, if management makes accounting decisions at least partly with a view towards the *expected* effect on information asymmetry in capital markets, there could be *both* a path from earnings quality to information asymmetry *and* a path from information asymmetry to earnings quality. Because the dual path involves managerial intent, this should primarily be an issue for discretionary earnings quality, as long as our separation of earnings quality into innate and discretionary portions is (at least relatively) exact.

To investigate these possible issues of causation, we specify a non-recursive model that includes a vector of potential determinants as well as a feedback loop between innate/discretionary earnings quality and information asymmetry, consisting of two separable paths:

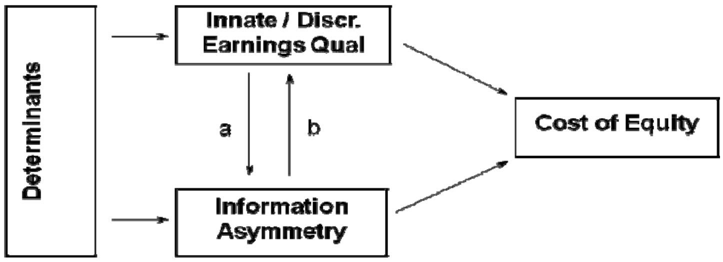

Figure 2: Non-recursive model with feedback loop (paths a and b)

By including variables correlated with both earnings quality and information asymmetry in the determinants vector, we can analyze the path structure in the presence of correlated variables (similar to using control variables in a regression). The specification also allows us to investigate the importance of the path from innate/discretionary earnings quality to information asymmetry *relative* to the reverse path. Therefore, we can formally test to what extent the data support our assumption about the causal flow between the two variables.[24]

To choose potential joint determinants of earnings quality and information asymmetry we proceed in two steps. First, prior literature (e.g., Dechow and Dichev 2002, Francis et al. 2005) shows that earnings quality is correlated with firm size, cash flow volatility, sales volatility, operating cycle, loss propensity, intangibles intensity, and capital intensity; research also shows (e.g., Amihud and Mendelson 1986, Stoll 2000, Easley et al. 2005) that information asymmetry among investors is correlated with firm size, the level of stock price, trading volume, and profitability. Both size and loss propensity/profitability (we interpret loss propensity and profitability as conceptually related) are correlated with both earnings quality and information asymmetry, and as such are potential joint determinants. Second, we analyze all other determinants of *either* earnings quality or information asymmetry; if the correlation between any of those variables and *both* earnings quality and information asymmetry exceeds 10%, we include that

[24] Path analysis models that include a feedback loop are called non-recursive. We refer to sources such as Timm (2002) for a more thorough discussion. Briefly, the estimation of feedback loops requires the inclusion in the estimation of instruments for at least one of the variables between which a feedback loop is hypothesized.

variable in the set of potential joint determinants. Both cash flow volatility and sales volatility meet this criterion, so we focus on four potential joint determinants: firm size ($Assets_{jt}$), profitability (ROA_{jt}), cash flow volatility ($\sigma(CFO)_{jt}$), and $\sigma(Sales)_{jt}$.

The results of the non-recursive path analysis (not tabulated) reveal that the path coefficient (path a) from *InnateAQ*, (*Innate|AA|*), [*InnateComposite*] to *Impact* is .1442, (.1614), [.1746], whereas the feedback path (path b) from *Impact* to *InnateAQ*, (*Innate|AA|*), [*InnateComposite*] is .0351, (.0321), [.0363]. All of these path coefficients are significant at the .05 level or better. We conclude that there appears to be a limited (in magnitude) feedback path from information asymmetry to earnings quality; the path from innate earnings quality to *Impact* dominates the reverse path by a factor of between four and five in magnitude.[25]

Non-recursive path models require the calculation of a "loop-enhanced" effect to arrive at the total effect of one variable on another. The total mediated (by *Impact*) path from innate earnings quality to cost of equity, therefore, includes the loop enhancement, which builds on an assumption of an infinite loop that describes the equilibrium relation between variables. The enhancement factor is a function of 1/(1–a×b), where a and b are the initial path coefficient and the feedback path coefficient, respectively. Because the feedback path (b) is small, the loop enhancement factor is very small, and does not affect our overall conclusions.

More important for the innate earnings quality analysis is how the path between innate earnings quality and information asymmetry is affected by the inclusion of variables that are correlated with both. As reported above, the direct path coefficients range from .1442 to .1746. The corresponding coefficients without correlated variables, reported in Panel A of Table 5, range from .2545 to .3054. While the path coefficients decline by as much as half, inferences about the

[25] If we include all determinants of earnings quality and information asymmetry (without requiring that prior literature has identified them as determinants of both, or that they have at least 10% correlation with both variables), results are similar. The path from *InnateEQ* to *Impact* dominates the reverse path by a factor of six or higher, depending on the earnings quality metric.

importance of the mediated and direct paths are qualitatively unchanged: the total mediated (by *Impact*) path still accounts for a modest portion of the total effect of innate earnings quality on the cost of equity, between 11.25% and 12.77% (compared to 18.43% to 21.13% without controls).

The reduction in the (absolute) magnitude of the path coefficients is to be expected, because the four joint determinant variables are a subset of the innate business model variables that define innate earnings quality in the first place. Therefore, these variables will subsume part of the innate earnings quality effect. To the extent the joint determinant variables are comprehensive, our design can also rule out spurious correlation between innate earnings quality and information asymmetry. We cannot assess how much of the reduction in magnitude of the mediated path is due to removing part of innate earnings quality and how much is due to reduced spurious correlation. Regardless, however, our main conclusions regarding the cost of capital links remain unaffected. The effect of innate EQ on the cost of equity capital is dominated by the direct path (roughly 80-90% of the total effect) and the indirect path (mediated by *Impact*) is substantially smaller (roughly 10-20%).

The mediated path for discretionary earnings quality is small, as reported in Panel B of Table 5. Applying the non-recursive design, including controls, similar to the innate earnings quality analysis above, does not change this result. Specifically, the feedback path (path b) is very small and never significant at conventional levels. Because the original unidirectional path is statistically weak to begin with, however (with t-statistics between 1.15 and 1.99, from Panel B of Table 5), we hesitate to draw conclusions beyond noting that none of the inferences from Panel B of Table 5 changes when we apply the non-recursive design. In particular, we find no statistically reliable reverse path (path b) from information asymmetry to discretionary earnings quality.

IV.3.3 Summary of results concerning innate and discretionary earnings quality

In summary, splitting earnings quality into an innate portion (tied to the firm's business model and operating environment) and a discretionary portion (under more immediate management control) does not alter the message from the main tests in our study: the dominant path in the earnings quality-cost of equity relation is the direct path. The indirect path, mediated by information asymmetry, is substantially less important, and particularly so in the case of discretionary earnings quality. Allowing for feedback loops between innate/discretionary earnings quality and control variables to test for omitted joint determinants of earnings quality and information asymmetry also does not affect the main conclusions: the indirect path is relatively small in magnitude, but non-trivial in the case of innate earnings quality. Our feedback tests are largely (but not fully) consistent with the theoretically-based assumption that both innate and discretionary earnings quality causally precede information asymmetry among investors.

VI.4.1 Effects of market competitiveness.

Based on Lambert et al.'s (2008) suggestion that the indirect path can occur in imperfectly competitive markets, we expect that the indirect path would be relatively more important when market competitiveness is low than when it is high. To test this expectation we re-estimate the path analysis after segmenting the sample by high versus low market competitiveness. We measure competitiveness as the *levels* of information asymmetry, analyst forecast dispersion, and stock price, guided by Stoll's (2000) discussion and analysis of indicators of capital market frictions,[26] and by the view that analyst consensus reflects capital market consensus, i.e., low information asymmetry among investors (e.g., Lang and Lundholm 1993, Barron et al. 1998, Levi and Zhang 2008). We measure analyst forecast dispersion based on all I/B/E/S analyst forecasts in the last fiscal quarter of the prior fiscal year (scaled by average stock price). We sort firms into annual portfolios of high and low market competitiveness based on above or below the median values of

[26] Stoll (2000) identifies the levels of information asymmetry variables as measures of the "friction" that he considers. (We place the word "friction" in quotes because, as Stoll notes in section IB, in models that propose information-based difficulties in trading assets, the market mechanism itself is frictionless; the issue is protection against losses from trading with better informed traders.) He also identifies stock price as an instrument for friction (intuitively, a stock trading at $2 carries higher information asymmetry/liquidity risk than a stock trading at, say, $20).

the three measures. High market competitiveness firms are characterized by low information asymmetry, low forecast dispersion, and high stock price in a given year.

Table 6 contains the results of our analysis. The *Mediated Path* measures the importance of the average indirect (mediated) path, i.e., the product of the path coefficient from earnings quality to information asymmetry and the path coefficient from information asymmetry to cost of equity (similar to the *total mediated path* reported in the main tests). For all three measures of earnings quality, the indirect path is more (less) important in the low (high) competitiveness subsample. For example, when *AQ* is the earnings quality measure, the mediated path is .0013 (t=.52) for low information asymmetry firms vs. .0322 (t=3.38) for high information asymmetry firms, the mediated path is .0109 (t=2.12) for low forecast dispersion firms vs. .0382 (t=2.84) for high forecast dispersion firms, and the mediated path is .0068 (t=2.26) for firms with a high stock price vs. .0342 (t=3.47) for firms with a low stock price. In other words, the mediated path is between 3.5 and 25 times bigger when market competitiveness is low compared to when it is high. Results are similar for the other measures of earnings quality. Tests of the difference between high and low competitiveness paths when we use *Level of Information Asymmetry* and *Level of Price* to measure market competitiveness yield t-statistics between 2.49 and 3.29. However, when we use *Level of Forecast Dispersion* to measure competitiveness, t-statistics are between 1.49 and 1.90.

We apply two caveats to these results. First, we acknowledge that there is no single generally-accepted empirical measure of capital market competitiveness. Second, splitting our sample based on high versus low *Impact*, or for that matter on the other discriminating variables, will naturally decrease the cross-sectional variation in information asymmetry. To the extent the discriminating variables are correlated with our measures of earnings quality and expected returns, the cross-sectional variation in both earnings quality and the cost of equity will also decrease. However, the sample split into high and low competitiveness portfolios does not predetermine the *relative* importance of the indirect paths within the portfolios. We therefore cautiously conclude that the importance of the mediated (by information asymmetry) path from earnings quality to the cost of equity is higher when markets are less competitive, and interpret this result as broadly consistent with arguments in Lambert et al. (2008). Information asymmetry has little importance for the relation between earnings quality and cost of equity when markets are highly competitive, and plays a more important (but still not dominating) role when market competitiveness is lower.

VI.4.2 Realized returns-based measure of the cost of equity

The results reported in Tables 2-6 are based on the Value Line cost of equity proxy, a measure that has been shown to have high construct validity relative to alternative implied cost of capital measures (e.g., Botosan and Plumlee 2005, Botosan et al. 2009).[27] To assess the sensitivity of our main results to the use of a cost of equity proxy based on realized returns, we calculate expected returns from a four-factor model, consisting of the Fama and French (1993) 3-factor model plus an accruals quality mimicking factor, as described in the Appendix. The correlations between the returns based measure of the cost of equity and *AQ*, |*AA*|, and *Composite* are .1839, .1196 and .2267, respectively (not tabulated), somewhat lower than the correlations reported in Table 2 for the Value Line measure of cost of equity (.2264, .1479, and .2986). The results of our basic path analysis show that the indirect path (mediated by *Impact*) accounts for 8.44%, 12.80%, and 6.11% of the overall cost of equity effect of *AQ*, |*AA*|, and *Composite*, respectively, when we use the realized returns measure of cost of equity (all results are significant at the .01 level or better). We conclude that using a realized returns based measure of the cost of equity does not

[27] Botosan and Plumlee (2005) find that a *PEG*-based implied cost of capital measure also has relatively high construct validity. Easton and Monahan (2005), however, investigate a number of earnings forecast based cost of capital metrics including *PEG* , and conclude that no metric based on earnings forecasts is predictably related to future returns. Gode and Mohanram (2008) argue that the weak results in Easton and Monahan can be ascribed to poor quality earnings forecasts, and develop a correction for predictable forecast biases. As a sensitivity test, we estimate a *PEG*-based implied cost of capital measure and an Ohlson and Juettner-Nauroth (2005) based measure after applying the earnings forecast adjustment routine described in Gode and Mohanram. The conclusions are unaffected in that the indirect path is always statistically significant and always dominated by the direct path.

qualitatively alter our main conclusion: the direct earnings quality path to the cost of equity capital dominates the mediated (by *Impact*) path, although the mediated path is non-trivial.

V. CONCLUSIONS

For a broad sample of Value Line firms covering 1993-2005, we examine the path that links earnings quality, as a proxy for information risk, to the cost of equity. We interpret models developed by Lambert et al. (2007, 2008) as predicting a direct path from earnings quality to the cost of equity, an indirect path mediated by information asymmetry under conditions of imperfect capital market competition, and an indirect path mediated by beta in a CAPM setting. Using path analysis, we test for the existence and relative importance of these paths, using three measures of earnings quality and two measures of information asymmetry. Our results provide statistically reliable evidence of both a direct path and an indirect path, with the direct path having greater (often, much greater) importance than the indirect path. While the indirect path increases in importance in settings with lower market competitiveness, the direct path always dominates. In addition, the innate component of earnings quality that is associated with the firm's business model and operating environment has a stronger association with the cost of equity than does the remaining component, which we associate with management's financial reporting decisions.

When we measure information asymmetry based on the adverse selection component of the bid-ask spread, our results are robust to the inclusion of beta, size and the book-to-market ratio as additional source variables in the path analysis. When we measure information asymmetry using *PIN*, the probability of informed trading, the inclusion of size, but not beta and the book-to-market ratio, reduces the importance of the mediated path. In general, the mediated (by information asymmetry) path is relatively more important when we measure information asymmetry with reference to the adverse selection component of the bid-ask spread, although the direct path between earnings quality and the cost of equity is more important in all specifications. In addition, we find evidence of an indirect path from earnings quality to the cost of equity, mediated by beta, as predicted by Lambert et al. (2007) in a CAPM setting.

Our results shed light on the means by which information risk, which we proxy as earnings quality, affects the cost of equity. We interpret our results as documenting a direct link, that is, a direct effect of earnings quality on the cost of equity, and two indirect links: one in which earnings quality operates through market microstructure variables that are intended to capture information asymmetry and one in which earnings quality operates through beta. While all three links are supported by theory, we view the relative importance of the various links between earnings quality and the cost of equity as an empirical question. Our results show that while both the direct and the indirect links are reliably nonzero, the direct link is (much) more important.

Previous research on the association between earnings quality and the cost of equity has tended (implicitly or explicitly) to attribute that association primarily, or even entirely, to an indirect path that is mediated by information asymmetry (for example, Aboody et al. (2005), Barth et al. (2006), Barone (2003), Berger et al. (2006), Bhattacharya et al. (2003), and Francis et al. (2004, 2005)). We interpret our results as suggesting that this attribution is incomplete. There are at least two other paths in addition to the one that operates through information asymmetry, and the direct path between earnings quality and the cost of equity is empirically the most substantial.

In addition to providing evidence on the nature of the association between information risk, as measured by earnings quality, and the cost of equity, our results also have implications for efforts to improve the allocation of capital by altering information structures. Our results suggest that if there is a tradeoff between altering information structures to improve the quality or precision of information, for example, by improving authoritative accounting guidance or the effectiveness of financial reporting implementations, and altering those structures to increase the equality of access to information, the former (precision) effect dominates the latter (asymmetry) effect.

APPENDIX

This appendix provides the equations and data used to estimate innate and discretionary components of earnings quality, the two information asymmetry variables *Impact* and *PIN*, the Value-Line-based measure of the cost of equity and the returns-based measure of the cost of equity.

Innate and discretionary earnings quality. We separate the two components of earnings quality by regressing, by year (t), each earnings quality metric on innate factors identified in Dechow and Dichev (2002) and Francis et al. (2004):

$$EQ_{jt} = \lambda_{0t} + \lambda_{1t} Assets_{jt} + \lambda_2 \sigma(CFO)_{jt} + \lambda_3 \sigma(Sales)_{jt} + \lambda_4 OperCycle_{jt} + \lambda_5 NegEarn_{jt} + \lambda_6 IntIntensity_{jt} + \lambda_7 CapIntensity_{jt} + \mu_{jt} \quad (1)$$

where EQ_{jt} is the respective earnings quality metric for firm *j* in year *t* (*AQ*, |*AA*|, or *Composite*), $Assets_{jt}$ is the log of firm j's total assets, $\sigma(CFO)_{jt}$ is the standard deviation of firm j's cash flow from operations scaled by total assets, $\sigma(Sales)_{jt}$ is the standard deviation of firm j's sales scaled by total assets, $OperCycle_{jt}$ is the log of firm j's operating cycle, $NegEarn_{jt}$ is the proportion of years (over the estimation period) where firm j reported negative net income before extraordinary items, $IntIntensity_{jt}$ is firm j's average research and development expense plus advertising expense divided by sales, and $CapIntensity_{jt}$ is firm j's average net PPE as a percentage of total assets.[28] The predicted value from regression (1) is the proxy for innate earnings quality, and the residual is the proxy for discretionary earnings quality.

Information asymmetry measures. We measure information asymmetry two ways: based on the bid-ask spread and based on the probability of informed trading (*PIN*). The bid-ask spread is represented by the highest limit price to buy and the lowest limit price to sell at any point in time. However, transactions can occur inside the posted bid and ask quotes (e.g., Lee 1993, Peterson and

[28] The firm-specific standard deviations, means and proportions used as variables in equation (3) are measured over the same seven year period over which accruals quality is measured.

Fialkowski 1994), while an order whose size exceeds the quoted quantity at the best prices could be completed at a price outside the bid-ask spread. Consequently, the simple bid-ask spread does not necessarily capture trading costs for transactions occurring either inside or outside the posted quotes. A measure of trading costs (e.g., Huang and Stoll 1996; Bessembinder and Kaufman 1997) that reflects trades inside or outside the quotes is the percentage effective spread defined as:

$$\textit{Percentage effective spread} = 2 \times D_{it} \times (Price_{it} - Mid_{it}) / Mid_{it} \times 100 \qquad (2)$$

where $Price_{it}$ is the transaction price for security i at time t, Mid_{it} is the mid-point of the quoted ask and bid prices prior to time t, and D_{it} is a binary variable that equals "1" for market buy orders and "-1" for market sell orders. We use the algorithm suggested in Lee and Ready (1991) to determine whether the *active* side of a trade is a buy or a sell.

Prior literature has identified three major components of trading costs: order processing cost, inventory holding cost and adverse selection cost, which represents the risk of trading with investors with superior private information. Glosten and Milgrom (1985) argue that the adverse selection component should be an increasing function of the fraction of traders who are better informed and the quality of their superior information. Huang and Stoll (1996) propose a measure of the adverse selection component of spreads, based on how privately informed trades are revealed to liquidity providers by order flow imbalances. Following Huang and Stoll (1996), we estimate the information asymmetry reflected in price adjustments (*Impact*) using the percentage price impact measure:

$$\textit{Percentage price impact} = 2 \times D_{it} \times (V_{i,t+30} - Mid_{it}) / Mid_{it} \times 100 \qquad (3)$$

where $V_{i,t+30,}$ is a measure of the "intrinsic" economic value of the asset after the trade, proxied by the mid-point of the first quote reported at least 30 minutes after the transaction.[29]

[29] Huang and Stoll (1996) report that results are similar across horizons from 5 minutes to 30 minutes.

PIN is computed as $PIN = \dfrac{\alpha\mu}{\alpha\mu + \varepsilon_b + \varepsilon_s}$ (4)

where α is the probability of an information event, μ is the rate of informed trade arrival, ε_b is the arrival rate of uninformed buy orders, and ε_s is the arrival rate of uninformed sell orders. Our *PIN* scores are taken from Stephen Brown's web site (http://userwww.service.emory.edu/~sbrow22/), where he has graciously made them publicly available.

Cost of equity measures. Our main cost of equity proxy (*CofE*) is derived from Value Line (VL) analysts' four-year-ahead price targets (*TP*), dividend forecasts (*DIV*), and dividend growth rates (*g*). Because they are based on forecasts, not realizations, our *CofE* measures reflect implied cost of equity estimates. Assuming that interim dividends are reinvested at the firm cost of equity, Brav et al. (2005) arrive at the following expression for the ex ante expected return:

$$(1 + CofE)^4 = \frac{TP}{P} + \frac{DIV\left[\dfrac{(1 + CofE)^4 - (1 + g)^4}{CofE - g}\right]}{P} \quad (5)$$

where P = stock price nine days prior to the date of the VL report. For each firm in our sample, the value of *CofE* that satisfies the equality is our estimate of the firm's implied cost of equity.

We also use a returns-based measure of the cost of equity, based on the Fama-French (1993) 3-factor model augmented by an accruals quality factor:

$$R_{it} - R_{ft} = a_i + b_i RMRF_t + s_i SMB_t + h_i HML_t + e_i AQfactor_t + v_{it} \quad (6)$$

where R_{it} is firm *i*'s return in month *t*, R_{ft} is the risk-free rate, $RMRF_t$ is the value-weighted market return less the risk-free rate, SMB_t, HML_t and $AQfactor_t$ are the returns on a size-mimicking portfolio, a book-to-market mimicking portfolio, and an accruals quality mimicking portfolio, respectively. R_{ft}, $RMRF_t$, SMB_t, and HML_t are from Kenneth French, as described in Fama and French (1993). $AQfactor_t$ is from Francis et al. (2005). We estimate the factor loadings over rolling five-year regressions of monthly returns, and we estimate the expected value of *RMRF*, *SMB*, *HML* and *AQfactor* as the annualized average return over the same five-year interval. So, for example, the expected return of firm *i* for 2002 is the b, s, h, and e coefficients estimated for the firm in equation (6) over 1997-2001, each multiplied by its associated average annual factor premium over the same estimation period, 1997-2001. The procedure is similar to the cost of equity calculations using varying asset pricing models in Fama and French (1997), Barth et al. (2006), and Berger et al. (2006).[30,31]

[30] The period over which factor premia are averaged varies, from as little as one year (in Barth et al.) to the full sample period (in Berger et al.).

[31] Unlike the Value Line *CofE* measure, which is independent of researcher-specified asset pricing factors, including *AQfactor* in the asset pricing model may to some extent hardwire a connection between earnings quality and the cost of equity. However, there is nothing that pre-specifies which path(s) the connection takes, and the latter is our main research question. Excluding an earnings quality factor from the asset pricing model is less desirable, because the measure of expected return would then be pre-specified not to include earnings quality effects, save for indirect effects of earnings quality on other asset pricing factors.

Table 1
Sample Characteristics and Descriptive Information on Variables

Panel A: Sample characteristics compared to overall market

Fiscal Year	No. of firms	% Mkt Cap	Sample ROA	Market ROA
1993	920	52.21%	4.46%	3.09%
1994	951	52.92%	5.17%	3.79%
1995	944	50.10%	5.53%	3.57%
1996	965	48.23%	5.86%	3.57%
1997	984	47.78%	5.63%	3.21%
1998	971	39.92%	5.02%	2.55%
1999	935	33.45%	5.22%	2.60%
2000	955	38.40%	5.04%	1.91%
2001	997	42.48%	3.86%	-0.38%
2002	1,026	40.91%	4.08%	0.97%
2003	1,040	37.89%	4.52%	2.19%
2004	995	36.98%	5.60%	3.46%
2005	965	37.21%	5.84%	3.75%
Average	973	42.96%	5.06%	2.64%
Total	12,648			

Panel B: Descriptive information on test variables[a]

	Mean	Std. Dev.	10%	25%	Median	75%	90%
AQ	0.0394	0.0311	0.0122	0.0194	0.0310	0.0498	0.0748
|AA|	0.0407	0.0456	0.0049	0.0126	0.0281	0.0536	0.0900
Composite	-0.3645	0.4372	-0.7595	-0.6515	-0.4783	-0.2076	0.1561
Impact	0.2916	0.3944	0.0447	0.0851	0.1744	0.3418	0.6294
PIN	0.1531	0.0605	0.0850	0.1090	0.1428	0.1878	0.2366
Beta	0.9573	0.6465	0.2503	0.5141	0.8597	1.2580	1.7937
CofE	0.1538	0.0803	0.0656	0.0991	0.1414	0.1946	0.2541

Our sample contains all Value Line firms with sufficient data to measure the test variables. We report data for our sample compared to the CRSP population for % Mkt Cap, which measures the ratio of market value of equity for our sample to the market value of the CRSP population. Market ROA is the median ROA of all Compustat firms. Test variables are defined as follows: *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; |*AA*| is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, |*AA*| and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown et al. (2004); beta is the CAPM beta and *CofE* is the implied cost of equity capital imputed from Value Line analysts' forecasts of price, dividends and growth rates. Descriptive information is based on 12,648 firm-year observations pooled over 1993-2005.

Table 2
Direct and Mediated Cost of Equity Effects of Earnings Quality

Panel A: Information asymmetry measured as Impact

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1827	10.37	0.1077	5.59	0.2472	11.70
percentage	*80.69%*		*72.77%*		*82.79%*	
Mediated Path						
p[EQ, Impact]	0.1627	5.80	0.1424	5.59	0.2082	6.52
p[Impact, CofE]	0.2686	6.38	0.2830	6.85	0.2468	6.26
Total mediated path	0.0437	4.29	0.0403	4.33	0.0514	4.52
percentage	*19.31%*		*27.23%*		*17.21%*	

Panel B: Information asymmetry measured as PIN

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.2043	10.65	0.1298	6.02	0.2758	12.37
percentage	*90.25%*		*87.72%*		*92.34%*	
Mediated Path						
p[EQ, PIN]	0.1203	6.78	0.0926	5.06	0.1336	6.55
p[PIN, CofE]	0.1835	7.10	0.1960	7.52	0.1712	6.64
Total mediated path	0.0221	4.90	0.0182	4.20	0.0229	4.66
percentage	*9.75%*		*12.28%*		*7.66%*	

The table reports path analyses of the links between earnings quality and *CofE*, a direct link and a link mediated by information asymmetry. *p* indicates path coefficients and *r* indicates (Pearson) correlation coefficients. *CofE* is the imputed cost of equity from Value Line analysts' forecasts of price, dividends and growth rates *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; |*AA*| is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, |*AA*| and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown et al. (2004). Statistical inference is based on standard errors clustered by firm and year.

Table 3
Direct and Mediated Cost of Equity Effects of Earnings Quality - CAPM regime

Panel A: Beta as source variable and information asymmetry measured as Impact

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1389	6.91	0.0837	4.78	0.1908	7.79
percentage	*61.36%*		*56.54%*		*63.89%*	
Mediated Path						
p[EQ, Impact]	0.1627	5.80	0.1424	5.59	0.2082	6.52
p[Impact, CofE]	0.2772	6.44	0.2881	6.85	0.2597	6.31
Total mediated path	0.0451	4.31	0.0410	4.33	0.0541	4.54
percentage	*19.93%*		*27.72%*		*18.11%*	
Direct Path						
p[Beta, CofE]	0.1819	8.34	0.2048	9.57	0.1417	6.58

Panel B: Beta as source variable and information asymmetry measured as PIN

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1595	7.75	0.1047	5.25	0.2219	8.88
percentage	*70.48%*		*70.75%*		*74.31%*	
Mediated Path						
p[EQ, PIN]	0.1203	6.78	0.0926	5.06	0.1336	6.55
p[PIN, CofE]	0.1981	7.47	0.2089	7.60	0.1853	7.12
Total mediated path	0.0238	5.02	0.0194	4.21	0.0247	4.82
percentage	*10.53%*		*13.08%*		*8.29%*	
Direct Path						
p[Beta, CofE]	0.1846	8.35	0.2104	9.11	0.1370	6.43

Table 3, Continued

Panel C: Beta as mediated variable and information asymmetry measured as Impact

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1389	6.91	0.0837	4.78	0.1908	7.79
percentage	*61.36%*		*56.54%*		*63.89%*	
Mediated Path (Impact)						
p[EQ, Impact]	0.1627	5.80	0.1424	5.59	0.2082	6.52
p[Impact, CofE]	0.2772	6.44	0.2881	6.85	0.2597	6.31
Total mediated path	0.0451	4.31	0.0410	4.33	0.0541	4.54
percentage	*19.93%*		*27.72%*		*18.11%*	
Mediated Path (Beta)						
p[EQ, Beta]	0.2329	7.61	0.1137	7.49	0.3794	6.78
p[Beta, CofE]	0.1819	8.34	0.2048	9.57	0.1417	6.58
Total mediated path	0.0424	5.62	0.0233	5.90	0.0538	4.72
percentage	*18.71%*		*15.74%*		*18.00%*	

Panel D: Beta as mediated variable and information asymmetry measured as PIN

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1595	7.75	0.1047	5.25	0.2219	8.88
percentage	*70.48%*		*70.75%*		*74.31%*	
Mediated Path (PIN)						
p[EQ, PIN]	0.1203	6.78	0.0926	5.06	0.1336	6.55
p[PIN, CofE]	0.1981	7.47	0.2089	7.60	0.1853	7.12
Total mediated path	0.0238	5.02	0.0194	4.21	0.0247	4.82
percentage	*10.53%*		*13.08%*		*8.29%*	
Mediated Path (Beta)						
p[EQ, Beta]	0.2329	7.61	0.1137	7.49	0.3794	6.78
p[Beta, CofE]	0.1846	8.35	0.2104	9.11	0.1370	6.43
Total mediated path	0.0430	5.62	0.0239	5.79	0.0520	4.67
percentage	*19.00%*		*16.17%*		*17.40%*	

The table reports path analyses of the direct and indirect (through information asymmetry) links between earnings quality and *CofE*. *p* indicates path coefficients and *r* indicates (Pearson) correlation coefficients. *Beta* is an additional causal variable (panels A and B), or an additional mediating variable (Panels C and D). *CofE* is the imputed cost of equity from Value Line analysts' forecasts of price, dividends and growth rates. *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; *|AA|* is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, *|AA|* and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown, Hillegeist and Lo (2004); beta is the CAPM beta. Statistical inference is based on standard errors clustered by firm and year.

Table 4
Direct and Mediated Cost of Equity Effects of Earnings Quality - 3-factor regime

Panel A: Information asymmetry measured as Impact

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1346	7.71	0.0781	4.82	0.2000	9.25
percentage	*59.47%*		*52.81%*		*66.96%*	
Mediated Path						
p[EQ, Impact]	0.1627	5.80	0.1424	5.59	0.2082	6.52
p[Impact, CofE]	0.1686	4.40	0.1732	4.66	0.1565	4.20
Total mediated path	0.0274	3.51	0.0247	3.58	0.0326	3.53
percentage	*12.12%*		*16.67%*		*10.91%*	
Direct Path						
p[Beta, CofE]	0.1947	9.33	0.2160	9.93	0.1525	7.75
Direct Path						
p[Size, CofE]	-0.1280	-4.27	-0.1461	-4.53	-0.1007	-3.56
Direct Path						
p[BM, CofE]	0.1613	5.62	0.1488	5.09	0.1863	6.54

Panel B: Information asymmetry measured as PIN

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[EQ, CofE]	0.2264	11.72	0.1479	6.41	0.2986	13.39
Direct Path						
p[EQ, CofE]	0.1454	8.54	0.0884	5.03	0.2163	10.52
percentage	*64.24%*		*59.74%*		*72.44%*	
Mediated Path						
p[EQ, PIN]	0.1203	6.78	0.0926	5.06	0.1336	6.55
p[PIN, CofE]	-0.0363	-0.94	-0.0372	-0.95	-0.0293	-0.79
Total mediated path	-0.0044	-0.93	-0.0034	-0.93	-0.0039	-0.78
percentage	*-1.93%*		*-2.33%*		*-1.31%*	
Direct Path						
p[Beta, CofE]	0.1882	9.10	0.2107	9.76	0.1430	7.17
Direct Path						
p[Size, CofE]	-0.2412	-5.83	-0.2632	-6.06	-0.1995	-5.24
Direct Path						
p[BM, CofE]	0.1621	5.46	0.1490	4.91	0.1892	6.47

The table reports path analyses of the direct and indirect (through information asymmetry) links between earnings quality and *CofE*. *p* indicates path coefficients and *r* indicates (Pearson) correlation coefficients. Beta, Size and BM are additional causal variables. *CofE* is the imputed cost of equity from Value Line analysts' forecasts of price, dividends and growth rates. *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; |*AA*| is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, |*AA*| and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown et al. (2004); beta is the CAPM beta, and Size and BM are the natural logarithms of market capitalization and the book-to-market ratio, respectively. Statistical inference is based on standard errors clustered by firm and year.

Table 5
Direct and Mediated Cost of Equity Effects of Innate and Discretionary Earnings Quality

Panel A: Innate earnings quality

	Earnings Quality Measure					
	AQ		|AA|		Composite	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
r[InnateEQ, CofE]	0.3120	15.05	0.3185	7.82	0.3220	13.19
Direct Path						
p[InnateEQ, CofE]	0.2528	13.61	0.2512	6.90	0.2627	12.33
percentage	*81.03%*		*78.87%*		*81.57%*	
Mediated Path						
p[InnateEQ, Impact]	0.2545	8.29	0.3054	9.02	0.2603	8.07
p[Impact, CofE]	0.2326	5.86	0.2203	7.01	0.2280	5.97
Total mediated path	0.0592	4.79	0.0673	5.53	0.0593	4.58
percentage	*18.97%*		*21.13%*		*18.43%*	

Panel B: Discretionary earnings quality

r[DiscrEQ, CofE]	0.0619	3.75	0.0401	3.19	0.0894	4.78
Direct Path						
p[DiscrEQ, CofE]	0.0563	4.01	0.0315	2.94	0.0842	5.09
percentage	*90.98%*		*78.58%*		*94.18%*	
Mediated Path						
p[DiscrEQ, Impact]	0.0240	1.27	0.0390	1.99	0.0228	1.15
p[Impact, CofE]	0.2326	5.86	0.2203	7.01	0.2280	5.97
Total mediated path	0.0056	1.24	0.0086	1.92	0.0052	1.13
percentage	*9.02%*		*21.42%*		*5.82%*	

The table reports path analyses of the direct and indirect links between earnings quality, separated into innate and discretionary portions, and *CofE*, the imputed cost of equity from Value Line analysts' forecasts of price, dividends and growth rates. *p* indicates path coefficients and *r* indicates (Pearson) correlation coefficients. Innate earnings quality is the fitted value from a regression of total earnings quality on innate factors identified by Dechow and Dichev (2002) and Francis et al. (2005). Discretionary earnings quality is the residual from the same regression. *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; |*AA*| is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, |*AA*| and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown et al. (2004). Statistical inference is based on standard errors clustered by firm and year.

Table 6

Mediated Cost of Equity Effects of Earnings Quality for Competitiveness Portfolios

	Earnings Quality Measure					
Competitiveness	AQ		|AA|		Composite	
	Mediated Path	t-statistic	Mediated Path	t-statistic	Mediated Path	t-statistic
Level of Information Asymmetry (Impact)						
Low	0.0013	0.52	0.0050	1.25	0.0037	1.23
High	0.0322	3.38	0.0368	4.16	0.0386	3.62
Difference	0.0309	3.14	0.0318	3.29	0.0349	3.15
Level of Forecast Dispersion						
Low	0.0109	2.12	0.0123	1.84	0.0150	2.44
High	0.0382	2.84	0.0271	3.74	0.0416	3.20
Difference	0.0274	1.90	0.0148	1.49	0.0266	1.85
Level of Price						
High	0.0068	2.26	0.0088	2.21	0.0102	2.56
Low	0.0342	3.47	0.0358	4.27	0.0390	3.60
Difference	0.0274	2.66	0.0270	2.91	0.0288	2.49

The table reports *Mediated Path*, the association between earnings quality and *CofE* that is attributable to the indirect path, mediated by information asymmetry, *Impact*. We separate the sample into two groups based on market competitiveness, proxied by the level of information asymmetry, forecast dispersion (measured during the prior fiscal quarter), and stock price. *CofE* is the imputed cost of equity from Value Line analysts' forecasts of price, dividends and growth rates. *AQ* is the Dechow-Dichev (2002) measure of accruals quality, capturing the time-series standard deviation of the portion of working capital accruals that does not map into previous-year, current-year, and one-year-ahead cash flows; |*AA*| is absolute abnormal accruals from a modified Jones (1991) model; *Composite* is the factor score from a factor analysis of *AQ*, |*AA*| and earnings variability, defined as the firm-specific standard deviation of earnings before extraordinary items. *Impact* is the adverse selection component of the bid-ask spread as in Huang and Stoll (1996); *PIN* is the probability of informed trading variable from Brown et al. (2004). Statistical inference is based on standard errors clustered by firm and year.

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