

Some Personal Observations on the Debate on the Link Between Financial Reporting Quality and the Cost of Equity Capital

Terry Shevlin
Paul Merage School of Business
University of California-Irvine
Irvine, CA 92697-3125
tshevlin@uci.edu

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Abstract

Within the last decade there has been much written about the possible link between the quality of a firm's external financial reporting and its cost of equity capital. In this paper I provide my personal observations about the literature. I make the following points. First, I find the Francis, Lafond, Olsson and Schipper (2005) paper interesting and innovative. This paper documents a positive association between portfolio returns formed on the basis of accrual quality and firms' realized returns after controlling for the Fama-French three factors. Francis et al. conclude that accrual quality is a priced risk factor. Second, while this conclusion might be too strong based on their results, I think the Core, Guay and Verdi (2008) critique of the Francis et al. claim is also too strong and does not lead me to reject accrual quality as a priced risk factor. Third, the evidence between financial reporting quality and implied cost of capital estimates is robust. However several papers question the construct validity of these measures which are based on analyst earnings forecasts. I discuss these papers and conclude that the implied cost of capital does have empirical validity. Finally, various papers model the relation between financial reporting quality and cost of capital and, while interesting, mostly restrict themselves to a single factor asset pricing model. However, restricting the model to a single factor model by assumption rules out the possibility of information quality being a separately priced risk factor and further restricts the role information quality to informing about a firm's covariances (or estimation error in the CAPM beta) because it is assumed that information quality is diversifiable. I think whether something is diversifiable is an empirical question that cannot be resolved by assumption within a theoretical model.

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Some Personal Observations on the Debate on Whether Information Risk is a Price-Risk Factor

1. Introduction

In the past decade there has been much written about the association between financial reporting quality and the cost of equity capital. In this paper I provide a selective review of the empirical and theoretical papers in the area and offer my opinions on the evidence and arguments presented.

I start by discussing in some detail the Francis, Lafond, Olsson and Schipper (FLOS 2005) paper that concludes that accrual quality is a priced risk factor.¹ This paper regresses firm's realized returns on the Fama-French three factors plus an additional factor formed by going long in poor accrual quality firms and short in high accrual quality firms. Francis et al. document a significant positive association between the accrual quality factor returns and firm-specific returns. This paper led to a number of papers critiquing the theory, tests and FLOS's conclusions. The question is how does one interpret the positive association: is it simply a regression association or is accrual quality, or more generally financial reporting quality, a separately priced risk factor that determines a firm's cost of equity capital. Core, Guay and Verdi (2008) in an influential paper appears to convincingly show, via a number of tests, that the FLOS results cannot be interpreted as showing accrual quality is a separately priced risk. I argue that the Core et al. results and criticisms should be read with an open mind rather than be taken at face value. The Core et al. tests have also been subject to additional analyses, for example, Ogneva (2012), calling into question their results and inferences.

Core et al. (2008) also discuss the implied cost of equity tests as used in Francis, Lafond, Olsson and Schipper (FLOS 2004). Core et al. replicate the FLOS (2004) results but then go on to cite studies, for example, Easton and Monahan (2005) criticizing the implied cost of capital proxies and argue that more weight should be placed on the realized returns tests. I discuss these criticisms and discuss other papers, in particular, Botosan and Plumlee (2005) and Botosan,

¹ My focus is initially on the FLOS accrual quality measure which is used as a proxy for the broader concept of earnings quality which falls under the broad concept of financial reporting quality. For my purposes I use the terms somewhat interchangeably, noting there are alternative proxies for financial reporting quality and earnings quality. Dechow, Ge and Schrand (2010) provide a discussion of the concept of earnings quality and a review of common proxies including accrual quality. Dechow et al. also discuss the determinants of earnings quality and the consequences of variation in earnings quality including a brief discussion of the association of earnings quality with equity cost of capital.

Plumlee and Wen (2011), which I believe show these implied cost of equity measures can provide reliable results and inferences.

FLOS (2004, 2005) refer to several theoretical models, including a model by Easley and O'Hara (2004) to predict that a firm's financial reporting quality should be associated with its cost of equity capital. The Easley and O'Hara (2004) model and its predictions were quickly criticized on the basis that within their model financial reporting quality could be diversified away and thus could not influence a firm's cost of capital. On a positive note, the early empirical work has motivated a number of accounting theorists to address this important issue. However, much of the theory work is conducted within a single factor asset pricing model. The Core et al. (2008) asset pricing tests show that the market model beta from the single factor asset pricing model is robustly significantly *negatively* associated with future returns – the opposite of predictions but consistent with prior literature (for example, Fama and French 1993). Thus it is not clear to me how useful or valid it is to restrict the theoretical models to a single factor pricing model. Certainly such restrictions rule out the possibility of any additional priced risk factors such as financial reporting quality. Additionally these models assume diversification forces are at work and thus it is argued that financial reporting quality is diversifiable. In such models, financial reporting can inform only about covariances (for example, Lambert, Leuz and Verrecchia 2007).

Aboody, Hughes and Liu (2005) among their conclusions state “The results of Hughes, Liu and Liu (2005, published in 2007) suggest that the cross-sectional effect of asymmetric information on cost of capital may be fully diversified away in a pure exchange economy with a large number of assets. It seems intuitive that, in large economies, information must directly affect asset payoffs through production and investment decisions in order for asymmetric information to enter as a separate factor in the determination of cost of capital. An explicit model to incorporate such ideas is not available in the literature and warrants further research.” (p.671)

Hughes, Liu and Liu et al. (2007) state “Finally, an asymmetric information factor does not arise endogenously in our model. However, our model is silent on whether there exists a systematic information factor. Therefore, our model is not inconsistent with studies that assume the existence of an information factor (e.g., Aboody et al. 2005; Francis et al. 2004b (the published Francis et al. 2005 paper); Easley et al. 2002). We believe both theoretical and

empirical research on this issue is warranted.” (p. 708) I concur with these calls for additional theoretical work.

The paper proceeds as follows. Section 2 provides a discussion of the Francis et al. 2004 and 2005 papers. Section 3 discusses the Core et al. (2008) critique of the Francis et al. papers together with other studies of accrual quality as a priced risk factor. Section 4 discusses the implied cost of capital literature. Section 5 discusses the theory linking financial reporting quality and cost of capital and section 6 presents the conclusion.

2. Francis, Lafond, Olsson and Schipper (2004 and 2005) empirical evidence

The two papers by Francis, Lafond, Olsson and Schipper (FLOS 2004, 2005) stand out to me and appear to have sparked much of the subsequent literature. FLOS (2004) regress an implied cost of equity capital on a number of earnings attributes: the Dechow and Dichev (2002) accrual quality measure, earnings persistence, earnings predictability, earnings smoothness, earnings value relevance, earnings timeliness, and earnings conservatism. All earnings attributes are significantly associated with the implied cost of equity – firms with the least favorable values for each earnings attribute generally exhibiting higher implied cost of equity – with the largest association being for the accruals quality measure.²

FLOS (2005) focusses solely on the Dechow and Dichev (2002) accruals quality measure and it is this paper in particular that seems to have generated debate. In this paper (and also in their 2004 paper) FLOS rely on papers by Easley, Hvidjaer and O’Hara (2002) titled “Is information risk a determinant of asset returns?” and Easley and O’Hara (2004) titled “Information and the cost of capital.” Easley and O’Hara (2004) develop a multi-asset rational expectations model in which there is both public and private information with both components

² A pure conjecture on my part as to why researchers turned to cost of equity as a dependent variable of interest was that Holthausen and Watts (2001) in their critique of value relevance research as irrelevant called into question what we learn from price level regressions. (I should note Holthausen and Watts defined value relevance more broadly than simply those research designs using price level regressions but many people equate value relevance studies with price level regressions.) I also refer interested readers to the discussion response by Barth, Beaver and Landsman (2001). As senior editor at *The Accounting Review* shortly after the publication of Holthausen and Watts, I had more than one referee summarily reject (incorrectly in my opinion) any manuscripts that used price level (or market value) as the dependent variable citing the Holthausen and Watts critique. Price level regressions seemed to fall out of favor and I conjecture researchers searched for new dependent variables. At the same time the implied cost of equity capital emerged in the literature and this became the new dependent variable. Even if my conjecture is wrong we have seen a proliferation of empirical papers examining the implied cost of equity capital as a function of various firm characteristics. I list these papers below.

influencing expected returns and thus the cost of equity capital. In this model, firms about which there is more private information, that is asymmetrically informed investors, leads the less informed investors to require a higher expected return (as in price protection) to induce them to buy and hold the stock. “Uninformed investors thus face a form of systematic (i.e. undiversifiable) information risk, and will require higher returns (charge a higher cost of capital) as compensation.” (FLOS 2005, p.300). FLOS go on to state “Required returns are affected by both the amount of private information (with more private information increasing required returns) and by the precision of public and private information (with greater precision of either reducing required returns).” (p.300) Accounting information is a major source of publically available information and thus greater quantities and more precise accounting information is predicted to reduce the cost of equity capital. While quantity of information is somewhat difficult to measure, the precision of accounting information is arguably more amenable to measurement.³ Specifically FLOS (2005) propose the then recently developed accrual quality metric that measures how well accounting accruals map into cash flows as a proxy for the precision of financial accounting, specifically earnings.

FLOS present a number of tests. In their first set of tests, they form sample firms into 5 quintiles based on AQ and examine the cost of debt, industry EP ratios and Beta, the latter two as proxies for cost of equity or firm risk. They find that firms with poorer AQ quality (quintiles 4 and 5 as AQ is an inverse measure of accrual quality or precision in the accounting accruals) have lower industry EP ratios and higher betas. In their second set of tests, FLOS add an AQ factor to a single factor ($R_m - R_f$) and a multifactor ($R_m - R_f$, SMB and HML) returns model. It is this second set of tests that has attracted the most debate which I discuss below. In this second set of tests, FLOS calculate monthly returns to an AQ factor where the strategy is to go long in firms in quintile 5 and short in firms in quintile 1 (where firms in quintile 5 have low precision and are expected to earn higher returns). The single factor and multifactor model with AQ factor returns added are then estimated by firm with the coefficient estimates averaged across the N firms. I have reproduced the results from Table 5 of FLOS (2005) in my Table 1. In the single factor model in Panel B, the mean estimated coefficient on the AQ factor is 0.46 with a t statistic

³ Easley et al. (2002) use PIN scores, a market microstructure measure of informed trading, as a proxy for the quantity of privately available information. Higher PIN scores represent more private information. They find a positive association between expected returns and PIN scores consistent with their model’s prediction.

of 100.51.⁴ In the multifactor model, the mean estimated coefficient on the AQ factor is 0.29 with a statistic of 53.02. Based on these results, FLOS summarize as “The results in Table 3 suggest that accruals quality plays a statistically and economically meaningful role in determining the cost of equity capital.” (p.315) Because accruals quality is a proxy for information risk, the significant coefficient on the AQ factor is interpreted as accruals quality being a priced risk factor.⁵

If poor quality accruals increases a firm’s cost of equity capital, a natural question arises: why do firms not then improve their accrual quality so as to lower their cost of capital? There are two responses. First, the choice of accrual quality, to the extent it is a firm choice, presumably is subject to cost/benefit analysis and firms with lower accrual quality might have concluded the benefits of lower accrual quality outweigh the cost of capital effects. Second, AQ is likely determined by firm characteristics as much as if not more than by discretionary firm choice. FLOS partition the AQ measure into an innate and discretionary component by regressing AQ on Firm Size, $\sigma(\text{CFO})$, $\sigma(\text{Sales})$, operating cycle and a binary variable for negative earnings. These variables are identified in Dechow and Dichev (2002) as five innate firm factors affecting accrual quality. This regression is estimated annually and the innate component of AQ for year t is the fitted value from the regression while the discretionary

⁴ Gow, Ormazabal and Taylor (2010) in illustrating the extent of biased tests in panel data sets if standard errors are not adjusted for any cross-sectional or time-series dependence in the data examine the FLOS (2005) return tests. FLOS estimated firm-specific regressions of returns on an AQ factor and the Fama-French factors and reported t statistics in excess of 50 suggesting a dependence problem. In calculating the standard errors, FLOS basically assumed cross-sectional independence and simply calculated the standard deviation of the cross-sectional distribution of firm-specific regression coefficients. Gow et al. estimate pooled regressions which allow clustering of the standard errors by month to address the cross-sectional correlation in the data. Gow et al. show that the standard error on the AQ factor is overstated and the t statistics is dramatically reduced, from 72.32 in the pooled data set and 50.41 in the firm-specific regression to 9.27 in the pooled data set (their Table 3). However, it is important to note that the coefficient is still highly significant. Gow et al. next reexamine the implied cost of equity tests of FLOS (2004). In these tests FLOS estimate annual cross-sectional regressions and then use the Fama-MacBeth procedure to estimate the t statistics which method assumes times-series independence in the data – an assumption likely violated with these data. However, Gow et al. only examine results on earnings volatility and predictability from FLOS and not AQ. However they do show that when two-way clustering is used (which addresses both cross-sectional and time-series dependence) the estimated coefficients on both these variables disappears (their Table 5, Panels B and C). The reader is left to conjecture whether the significance of AQ in these regressions would also disappear. As an important aside, I recommend strongly that the interested reader study Petersen (2009) who carefully lays out the statistics to show the biases in OLS standard errors if any dependence in the data are ignored. An important and, in my opinion an overlooked, point in Petersen is that there needs to be dependence in both the residuals AND explanatory variable(s) for the dependence to be an issue. Dependence in one or the other does NOT cause problems.

⁵ Ecker, Francis, Kim, Olsson and Schipper (2006) propose the firm-specific coefficient estimate on the AQ factor, which they label as the e -loading, as a measure of earnings quality. They show that the e -loading correlates with other proxies for earnings quality.

component is the residual. FLOS then calculate Innate AQ factor returns and Discretionary AQ factor returns using a similar portfolio approach as used to calculate the overall AQ factor. Results are reported in their Table 4, panel B and reproduced in my Table 2. The mean estimated coefficient on the innate AQ factor is 0.23 with a t statistic of 52.20 and on the discretionary AQ factor is 0.10 with a t statistic of 8.94. The estimated coefficient on the discretionary component is significantly smaller than that on the innate component and FLOS conclude “We find significantly smaller pricing effects of discretionary accruals, relative to innate accruals; we attribute this difference in pricing effects to the presence of noise and opportunistic reporting choices.” (p.321)

Kravet and Shevlin (2010) use the FLOS approach to examine how AQ is priced subsequent to an earnings restatement. Similar to FLOS, they decompose the AQ measure into an innate and discretionary component and estimate factor returns to both components, similar to FLOS. Kravet and Shevlin argue and find evidence consistent with a greater pricing effect – a larger regression coefficient – on the factor returns formed on the basis of the discretionary component of the AQ measure. That is, in a setting where we might expect the discretionary component of AQ to play a larger role, it indeed does. They also show that the increase in factor weights results in an increase in the estimated cost of capital which is cross-sectionally associated with the magnitude of the short-window market reaction to the announcement of a restatement.

Gray, Koh and Tong (2010) employ a similar returns test (but using a pooled time-series regression on AQ factor returns while including the Fama-French 3 factors) using Australian data and find similar results to FLOS: a significant positive coefficient on the AQ factor returns (their Table 4). When they decompose the AQ factor into an innate and discretionary components and form factor returns (similar to FLOS), only the innate component of AQ exhibits a significant positive coefficient which they argue is consistent with the Australian institutional environment of continuous disclosure reducing the incentives for managerial opportunism in discretionary reporting choices (although this latter point is not directly tested).

A point to note about the two sets of tests in FLOS (2005) is that they are fundamentally different tests of how the precision of accounting reports might affect the cost of equity capital. The first set of tests examining beta assumes that beta is an important measure of risk or determinant of expected returns/cost of equity capital (which seems reasonable in a single factor

CAPM world) and that beta varies in the cross-section as a function of precision (or AQ). The second set of tests assumes that precision (or AQ) is a separate factor from beta in determining expected returns. Different theories are required to explain how precision of publically available information impacts beta versus being a separate risk factor and such theory or reconciliation is not offered in FLOS. Later theoretical work discussed below models the relation between beta and information risk; little theoretical work to date has attempted to directly model information risk as a separate priced risk factor.

3. The Core, Guay and Verdi (2008) critique of AQ as a priced risk factor (war!)

Core, Guay and Verdi (CGV 2008) question the interpretation of the significant coefficient on the AQ factor in the return tests as a priced risk factor. CGV point out that the FLOS regression approach does not formally establish that the AQ factor is indeed a priced risk factor. They argue that to infer the latter requires appropriate asset-pricing tests which involves a two stage process similar to the Fama and MacBeth (1973) approach. In the first stage, factor weights are estimated in a time-series regression of firm returns or a portfolio of returns on the contemporaneous factor returns ($R_{mt} - R_{ft}$, SMB, HML and AQ factors returns) hypothesized to be priced risk factors. In the second stage, future returns are cross-sectionally regressed on these factor weights and if the factors are priced, the factor should exhibit a positive and significant coefficient in the second stage. The estimated second stage regression coefficient is an estimate then of the risk premium associated with that risk factor.

Results are reported in their Table 4 with parts reproduced in my Table 3. In panel A, 25 size and book-to-market portfolios are formed as the portfolio unit of analysis. The results indicate that the beta on the AQ factor weight from the first stage is significantly negative when added to the 3 factor model and is negative but not significant when added to the single factor model. Similar results on the AQ factor weight are observed in other panels. However, strikingly from my point of view, is that the estimated coefficient on the $R_m - R_f$ factor weight, the market beta, is also negative and significant in both the multifactor and single factor regressions. That is, the risk premium to the traditional CAPM beta is negative (when predicted to be positive). Does this concern CGV? No. They explain it away as “Insignificant and/or negative coefficients, however, are typical in tests that use realized returns such as Petkova (2006), and Fama and French (1992). Recall that the use of size and book-to-market as pricing factors arose

in part because of the Fama and French (1992) demonstration of the lack of evidence that the market beta is priced.” (p.9).

Observing the significant negative coefficient on market beta raises the following questions for me. 1) Are these two-stage tests valid? If so, does this mean that the single factor CAPM is invalid and if so, why are theorists examining the role of information risk restricting themselves to a single factor model (e.g., Lambert, Leuz and Verrecchia 2007), and 2) if the two stage tests are not valid, we cannot conclude anything about whether or not AQ is a priced risk factor. I must admit that it is disconcerting that CGV interpret the negative and/or insignificant coefficient on AQ factor weight in the second stage as rejecting AQ as a priced risk factor but that the negative coefficient on market beta is consistent with prior literature and is to be expected.

CGV conduct some additional tests all of which they state offer little evidence in support of the inference that AQ is a priced risk factor. Risk factors should exhibit significant risk premiums – that is, the factor returns themselves should be significantly positive. CGV report in their Table 1 that the mean monthly return for the AQ factor is 0.23 percent or less than 3% per year and is not significantly different from 0 (with a t statistic of 0.59). The mean monthly return on the market factor $R_m - R_f$ is 0.49% or close to 6% per year, and on HML is 0.45% per month, both significant at greater than the 5% level. However SMB exhibits an insignificant monthly return of 0.13 (with a t statistic of 0.73). I have two points here. First, there are long periods of time when the realized $R_m - R_f$ return is negative (during the 1970s and early 1980s). Such negative realized returns do not invalidate the $R_m - R_f$ factor. Second, should the insignificant mean return on SMB also be interpreted as rejecting the SMB factor as a valid factor if such logic is used to reject the AQ factor?

Another test conducted by CGV is a regression of future returns on the firm characteristics themselves (Size, AQ, etc.) to address the question do firm characteristics predict future realized excess returns? CGV report their results in Table 5. Again they find an insignificant coefficient on AQ when it is included on its own, when included with market beta and with the 3 Fama-French characteristics (market beta, Size and book-to-market). Interestingly though, the estimated coefficient on market beta is negative although not significantly different than zero. I do note that Size and book-to-market exhibit the correct signs with significance.

In yet another test, CGV employ a portfolio strategy used by Aboody et al. (2005) to test whether the AQ factor weight or beta as a characteristic predicts future returns. In this test, a firm-specific weight/beta on the AQ factor is estimated from a regression of firm returns on the 3 FF factors and the AQ factor. The firm-specific AQ betas are then used to form hedge portfolio monthly returns by going long in low AQ beta firms and short in high AQ beta firms. This hedge return is then regressed on the 3 Fama-French factor returns in a time series regression. If the intercept is significantly greater than 0, then the excess returns to the AQ beta cannot be explained by the 3 FF factors: either AQ is priced as a risk factor or the market is inefficiently pricing AQ. Results are tabled in their Table 6. CGV report results for their full sample period 1971-2003 and two sub-periods: 1971-1984 and 1985-2003 (the period used in Aboody et al.). They find that during the first sub-period, the hedge returns (the intercept) are significantly negative (when predicted positive), during the second period the returns are significantly positive, consistent with Aboody et al. and for the overall period the returns are insignificant. CGV conclude that one should rely on longer time period results as they are more reliable. Overall, CGV conclude that their return-based tests do not support AQ as a priced risk factor.

In addition, CGV go on to discuss the FLOS (2004) results that AQ is positively associated with an implied cost of capital based on Value Line (VL) earnings forecasts. CGV show in their Table 8 that i) the positive association between the implied cost of capital and AQ appears to be very robust, ii) the VL implied cost of equity is significantly positively associated with 4 year ahead returns – the time period is chosen to match the VL 4 year target price forecast used to estimate the implied cost of capital, and iii) when the FF firm characteristics (beta, size and book-to-market, buy and hold returns – to reflect momentum), and AQ are regressed on 4 year ahead returns, the estimated coefficient on AQ is significantly negative when predicted to be positive. This latter result is consistent with the other return prediction tests in CGV. However, it should be noted that the estimated coefficients on beta, size and book-to-market are all insignificantly different from zero. Thus given the conflicting results as interpreted by CGV between their return-based tests and implied cost of equity tests, CGV ask how should we weigh the evidence. They acknowledge that returns-based tests using realized returns are “a noisy and potentially biased proxy for expected returns because they are confounded by changes in expectations about cash flows and discount rates.” (p.18) However they also go on to argue that implied cost of equity capital measures are also noisy and that “it is difficult to assign a high

weight to the implied cost of capital evidence.” (p.18) CGV reference the studies by Easton and Monahan (2005) and Guay, Kothari and Shu (2006 working paper, since published in 2011 and discussed below) while ignoring the study by Botosan and Plumlee (2005). I return to a discussion of the validity of the implied cost of capital estimates below. I, however, assign a higher weight than CGV to results that use the implied cost of equity approach to assessing whether hypothesized variables are associated with cost of capital.⁶

CGV also question the theoretical basis for the prediction that information risk is a priced risk factor. If information risk (or any factor) is diversifiable then it should not be priced or affect expected returns. I also return to this point below.

3.1 Ogneva (2012): The Core, Guay and Verdi two stage results revisited

CGV recognize that that realized returns are confounded by cash flow and expected return news during the realized return period. Ogneva (2012) revisits the CGV two-stage asset pricing tests and after adjusting realized returns for cash flow news finds that future realized returns are positively associated with the AQ factor weight in the second stage regressions. Ogneva argues and finds that AQ is negatively associated with future cash flow shocks – a necessary condition for cash flow shocks to “explain” the lack of an association between AQ and future realized returns. To adjust realized returns for cash flow shocks Ogneva uses the earnings response coefficient literature: $R_{it} = a + b UE_{it} + e_{it}$ where b is the earnings response coefficient, ERC, and $b UE_{it}$ is an estimate of the cash flow news in realized returns and the noncash flow (or returns reflecting expected returns) is $a + e_{it}$ (or $R_{it} - b UE_{it}$).⁷ This returns-earnings model is estimated both cross-sectionally pooling across all firms (linear model) or within quintiles formed on the basis of UE, a nonlinear cross-sectional model, and firm-specific time-series

⁶ Having said that, specific to whether AQ is associated with implied cost of equity capital, Dechow and Dichev (2002) acknowledge and discuss the existence of measurement error in the cash flow from operations variables used as explanatory variables in the estimation of the AQ measure. Li, Shevlin and Shores (2013) propose a method to address or mitigate this measurement error by calculating adjusted cash flow variables. As part of the analysis of their adjusted AQ measure, they revisit the FLOS (2005) results of a significant positive association between the implied cost of capital and the AQ measure. Using their adjusted AQ measure, Li et al. document a smaller but still marginally significant positive association with the implied cost of capital. However, unlike FLOS when additional variables are included in the regression model to reflect the fundamental (or innate) determinants of AQ, the significance on the adjusted AQ measure disappears.

⁷ A third component of realized returns is discount news. Ogneva discusses why discount (or expected return news) is not likely driving her results – see her Section V. Basically she shows low quality AQ firms appear to become more risky over time, consistent with the discount news shocks being negatively correlated with AQ which biases against finding a positive accrual quality premium.

estimation. Before reporting results using the adjusted realized returns, Ogneva replicates the returns tests of CGV: i) firm-level cross-sectional regressions of returns on AQ, market beta, Size and BM, ii) the monthly returns on the AQ factor, iii) time-series regression of monthly AQ factor returns on Fama-French Factor returns to test whether the intercept is positive and iv) the second stage regression of returns on the AQ factor weights – the betas from the first stage – and the FF factor weights. Her results replicate CGV (including the significant negative coefficient on the market beta!).

Ogneva then repeats the regression of firm returns using the adjusted returns on firm characteristics – AQ, beta, Size and BM – and finds the results on AQ are sensitive to the ERC model used. She argues that the firm-specific estimate provides the most reliable estimate of cash flow news and thus of adjusted returns. Using this model she finds a significant coefficient on AQ (her RDD variable in Panel B of Table 3). The estimated coefficient on market beta is now positive as expected but not significant ($p=.48$). She also redoes the second stage asset pricing tests regressing her adjusted returns on the AQ, beta, size and BM factor weights – with results reported in her Table 4. Again focusing on the firm-specific ERC model to estimate adjusted returns, the estimated coefficient (across a variety of portfolio approaches) on the AQ factor weight/beta is significantly positive as predicted if AQ is a priced risk factor. However, the estimated coefficient on the market beta continues to be insignificant (and sometimes of the wrong sign). Based on the estimated coefficients on the AQ characteristic and on the AQ factor loading, Ogneva estimates the premium on the AQ factor to be approximately 3-5% per annum. Overall she concludes the two-stage asset pricing tests provide evidence that is generally consistent with the AQ factor being priced in stock returns after controlling for the three Fama-French factors.

Kim and Qi (2010) also use the Fama and Macbeth (1973) and CGV two-stage cross-sectional regression approach to examine whether AQ is a priced risk factor. After controlling for low-priced stocks by allowing a separate beta/weight on low price stocks in their second stage regressions (plus including the beta/factor weights on the cross-sectional regressions of returns on the Fama-French 3 factors, a momentum factor, and a liquidity factor) they find a significant positive coefficient on the AQ factor weight. They conduct these analyses at both the individual firm and portfolio levels. Additionally, they show that the AQ pricing effect varies

with macroeconomic conditions.⁸ Poorer AQ firms are more susceptible to macroeconomic condition changes with the regression weights increasing monotonically across poor to good AQ portfolios on the macroeconomic variables. Thus these results are consistent with AQ being a priced risk factor, in contrast to the CGV results and inferences.

Gray et al. (2010) in their study using Australian data also employ the two-stage approach and contrary to the CGV results using U.S. data, find that the AQ factor weight from the first-stage regressions (and innate AQ factor weight but not the discretionary AQ factor weight) exhibit significant positive coefficients. Further, even in Australian data, beta exhibits a significant negative coefficient in the second stage.

3.2 Other evidence on the AQ as a separate priced risk factor

Aboody, Hughes and Liu (2005) also examine the relation between financial reporting quality and cost of capital while examining the role of inside trades. They examine four proxies for financial reporting quality (FRQ) including AQ. In their first set of analyses they include the hedge portfolio returns to the financial reporting quality proxies – factor returns – as an additional factor in the 3 factor Fama-French model. Similar to FLOS, they estimate this model by firm using time-series return data. The results, not surprisingly are similar to FLOS (although Aboody et al. do not report significance levels). Aboody et al. argue that if privately informed trading is the force at work in pricing of information risk then insiders should earn abnormal returns which differ across portfolios of financial reporting quality. That is, high financial reporting quality will mitigate the information asymmetry problem reducing the returns to insiders relative to low financial reporting quality firms. In their first test, within each FRQ quintile they classify firms into two groups: those in which monthly inside trades are net buys and those which are net sells. They then estimate the Fama-French model for each portfolio using the 227 months of data in their sample period. There are 10 portfolios in total: 5 FRQ portfolios times 2 net buy/sell portfolios per FRQ portfolio. They also estimate the Fama-French model for a hedge portfolio – the difference between the net buys for the lowest and highest FRQ quintiles and similarly for the net sells. The return to each portfolio is estimated by the intercept. To save space Aboody et al. report results only for the lowest and highest FRQ quintiles – in

⁸ I note that in Kim and Qi (2010) the market beta exhibits an insignificant negative coefficient in many of the regressions when betas are estimated in the first stage using 5 year rolling windows prior to the second-stage cross-sectional regressions, a result similar to CGV.

their Table 2. They find that three of their financial reporting quality proxies exhibit significant hedge portfolio returns, but AQ does not.

In their second set of tests, Aboody et al. estimate the risk premium associated with the FRQ measures, if any. They add the FRQ factor returns to the 3 factor Fama-French model to derive an estimate of the factor weight for each firm using rolling 36 month windows – the loading is used as an estimate of the firm's exposure to the systematic component of asymmetric information risk. They then form quintiles based on the firm-specific factor weights and estimate the Fama-French 3 factor model. The intercept is an estimate of the abnormal returns earned by each group. They also form hedge portfolio returns between the highest and lowest quintile of FRQ factor weight. The hedge return for the AQ factor weights is marginally significant but not significant for the 3 other FRQ proxies. However the returns to the high FRQ factor weight portfolio are all significant leading Aboody et al. to conclude that there is likely noise in the low FRQ portfolios reducing the significance.

In their third set of tests Aboody et al. examine whether the trading profits of insiders are positively correlated with the FRQ factor weights: higher factor weights imply higher sensitivity to the financial reporting quality factor and thus lower quality financial reporting which insiders can exploit. They repeat the analysis in their first set of tests but now with portfolios formed on FRQ factor weights and estimating the Fama-French 3 factor model but with the FRQ factor returns included as a fourth factor. The intercept is thus an estimate of abnormal returns after controlling for the 4 factors and estimates insiders trading profits. The hedge returns to net buys for the high factor weights less the low factor weight quintile are significant for all 4 FRQ proxies including AQ – although the latter is marginal with a t statistic of 1.56. None of the net sells exhibit significant returns – as Aboody et al. note this could be due to the selling of stock acquired from stock options for liquidity reasons. Purchases offer stronger evidence of information motivated trades. Overall, Aboody et al. conclude that their results are consistent with the systematic component of earnings quality, including AQ, being priced and that privately informed traders, namely insiders, earn greater returns when trading, specifically buying, stocks with higher exposure to an earnings quality risk factor. These results overall are consistent with FLOS (2005) results and inferences.⁹

⁹ There is some debate in the finance literature on whether the two stage asset pricing test is conclusive as to some factor being priced. The second stage regression result using the factor weight could be significant because the

Mashruwala and Mashruwala (2011) examine the effect of seasonality, specifically January, on the pricing effect of the AQ measure. They report a number of findings. First, in tests of AQ predicting future returns, they find high AQ stocks outperform low AQ stocks only in January (a positive hedge return). This relation is inverted in the rest of the calendar year such that for the full year, there is no AQ premium. Second, approximately 50% of the January AQ premium occurs in the first 5 trading days of January and that these price effects appear due to tax loss selling around the turn of the year. They conclude “these findings are difficult to reconcile with a risk interpretation of accruals quality.” (p.1349) Mashruwala and Mashruwala (2011) acknowledge that other hypothesized risk factors such as beta, size, book-to-market and idiosyncratic volatility also exhibit much of their return premiums in January, which in my opinion also calls into question these factors as additional priced risk factors.

4. Research using implied cost of equity capital

In their critique of FLOS, Core, Guay and Verdi (2008) refer to the paper by Easton and Monahan (2005) to argue more weight should be put on returns-based tests than implied cost of capital tests. However before turning to Easton and Monahan critique of implied cost of capital estimates, I note that there was at the time CGV was published a number of published studies using the implied cost of capital to examine whether disclosure quality and/or financial reporting quality was associated with the cost of capital. Examples include Botosan (1997), Botosan and Plumlee (2002), and Hail (2002) who all show that higher quality disclosure and/or higher

underlying firm characteristic predicts returns, for example firm size or accruals, rather than the factor being a priced risk factor. Daniel and Titman (1997) propose the characteristics versus covariances method. The method was used by Daniel and Titman to examine whether the book-to-market effect comes from HML as proposed by Fama and French (1993). Daniel and Titman agree with Fama and French that loadings on HML predict returns, but find that the loadings no longer predict returns after controlling for the book-to-market characteristic. The motivation for the test is that as Daniel and Titman show, generally factor loadings on a factor that is based on some firm characteristic (such as book-to-market) are highly correlated with the original characteristic. So a test that shows that loadings predict returns is really just replicating what was already known about an anomaly in the first place, the fact that the characteristic predicts returns. For this reason it is crucial to control for the characteristic to evaluate whether it is really the loadings that are the source of return predictability. Hirshleifer, Hou and Teoh (2012) use the characteristic versus covariance method to test whether the accrual anomaly comes from the accruals characteristic or from loading on a priced risk factor. They find that loadings on the accrual factor predict returns, but not after controlling for the accrual characteristic. Note that accruals quality can be operationalized in ways that are different from the level of accruals, so the Hirshleifer et al. paper does not answer the question of whether the accruals *quality* effect reflects a priced risk factor.

quality reporting are negatively associated with implied cost of capital estimates.¹⁰ Hribar and Jenkins (2004) show restatement firms suffer an increase in their implied cost of capital in the period after a restatement. Botosan, Plumlee and Xie (2004) examine the effect of the precision of both public and private information on the implied cost of capital. Using measures of precision from Barron, Kim, Lim and Stevens (1998), Botosan et al. document a negative (positive) association between the precision of public (private) information.

Subsequent to CGV and Easton and Monahan, the implied cost of capital methodology has continued to be employed to examine the association between cost of capital and financial reporting.¹¹ A partial list is as follows. Hail and Leuz (2006) report that firms from countries with more extensive disclosure requirements, stricter enforcement mechanisms and stronger securities regulation have significantly lower implied cost of equity capital. Daske, Hail, Leuz and Verdi (2008) examine whether the mandatory adoption of IFRS, among other questions, lowered a firms cost of capital (yes but with caveats). Daske, Hail, Leuz and Verdi (2013) show that “serious” as opposed to “label” voluntary adopters of IFRS exhibit lower implied cost of equity. Barth, Konchitchki and Landsman (2013) use a number of approaches, including the implied cost of equity, to show that firms with more transparent earnings (the R square from a regression of returns on earnings) are associated with lower cost of capital. Ashbaugh-Skaiffe, Collins, Kinney and Lafond (2009) show that firms reporting internal control deficiencies suffered an increase in their implied cost of equity although Ogneva, Subramanyan and Raghunandan (2007) report no association between implied cost of capital and internal control weaknesses in their study. Callahan, Smith and Spencer (2012) show that FIN 46 which requires consolidation of variable interest entities, is associated with an increased implied cost of capital after consolidation. They argue that FIN 46 led to an *increase* in cost of capital from improved accounting because the accounting now makes more transparent the underlying risk.

Dhaliwal, Krull and Moser (2005) examine the association between the implied cost of equity capital and the tax-penalized portion of dividend yield to examine whether investors capitalize the investor-level dividend tax into equity returns. Dhaliwal, Krull and Li (2007) show

¹⁰ Healy and Palepu (2001) provide a review of the empirical literature on information asymmetry and disclosure including a brief discussion of its economic consequences including its link to cost of capital (as in Botosan 1997).

¹¹ Mashruwala and Mashruwala (2011) in their Appendix A summarize a selection of papers that test and conclude that AQ proxies for information risk, those that use AQ as a proxy for information risk in different settings (e.g., underwrite gross spreads during a seasoned equity offering) and other papers that rely on the assumption that AQ proxies for information risk.

that the implied cost of capital declined after the 2003 Tax Act reduction in both dividend and capital gains taxes consistent with investor-level taxation being reflected in stock returns/prices. Hwang, Lee, Lim and Park (2013) use Korean data that allows more accurate identification of the trade side in the probability of informed (PIN) measure. Higher PIN indicates a higher probability of informed trade and greater asymmetric information. Hwang et al. find that PIN is positively associated with the implied cost of equity capital. Chava and Purnanandam (2010) show that default risk is positively associated with the implied cost of equity capital.

I expect we will continue to see growth in implied cost of capital as a dependent variable – in fact Hutchens and Rego (2013) and Goh, Lee, Lim and Shevlin (2013) both examine whether corporate level aggressive (less aggressive) tax avoidance increases (decreases) the cost of equity capital (using the implied cost of capital methodology). In evaluating a proposed new measure of disclosure quality, Chen, Miao and Shevlin (2013) document a negative association between their measure and implied cost of equity. To be clear, I am not arguing that because the implied cost of capital methodology continues to be used that therefore it must be valid.

4.1 Research examining the validity of the implied cost of equity capital methodology

As part of the natural progression of any research field, some methodology (or theory) is introduced and if it gains popularity it is not long before the methodology is subject to critique (for example, the Jones discretionary accrual model, the discontinuity in earnings distributions as evidence of earnings management). Such is the case with the implied cost of equity capital which has been subjected to examination by Gebhardt, Lee and Swaminathan (2001), Botosan and Plumlee (2005), Easton and Monahan (2005), Botosan, Plumlee and Wen (2011), and Guay, Kothari and Shu (2011).

The two papers published in 2005 arrive at diametrically opposed conclusions about the validity of implied cost of capital estimates. Botosan and Plumlee (BP, 2005) examine the association between various implied cost of capital approaches and other common proxies or variables which are expected to vary with cost of capital, namely unlevered market beta, leverage (debt to market value of equity), an information risk variable (the Value Line price high less Value Line price low, scaled by the midpoint the high and low price), Size (the natural log of the market value of equity), the book-to-market ratio, and forecast long-term earnings growth. BP examine 6 different but related measures of implied cost of equity and find in multiple

regressions that two measures are consistently and predictably related to the other common risk proxies. The two measures are the dividend premium (target price method, defined on p.25) and the PEG ratio method approaches (defined on p.31-32).

Easton and Monahan (EM 2005) question the results in BP and argue that a better approach to evaluating the implied cost of capital (ICC) measures/approach is to examine their association with future returns.¹² If the ICC measures are valid measures they should be significantly positively associated with future realized returns. However EM note that realized returns are a noisy ex post measure of expected returns because of other news arriving in the market. That is, realized returns can be written as (Voulteenaho 2002)

$$r_{it+1} \approx er_{it+1} + cn_{it+1} - rn_{it+1}$$

where r is realized return in period $t+1$, er is the expected return, cn is cash flow news and rn is return news (news or information leading to a revision in expected return). In a regression of realized returns on the three measures, and in the absence of measurement error in the 3 right hand side variables, the predicted coefficients are 1, 1 and -1, respectively. Additionally, a regression on just the expected return proxy would be biased IF the er proxy is correlated with cash flow and return news revealed in $t+1$. EM make the argument that indeed it is likely that the 3 variables are correlated – even in the absence of measurement error. Note that this is similar to the argument made by Ogneva (2012) in her re-examination of the Core, Guay and Verdi (2008) second stage regressions. However, as argued by EM, complicating the analysis is that all 3 of the right hand side variables are likely measured with error and the measurement error is likely correlated across the 3 variables making inferences difficult. EM thus conduct a complex measurement error analysis (obviously the interested reader can read EM). After extensive analysis, with their key results in Table 5, they conclude “none of the expected return proxies we evaluate has a statistically positive association with realized return even though we control for information surprises attributable to changes in expectation about future cash flows and future discount rates. Further, none of the proxies has less measurement error than the simplest proxy, r_{pe} , which is based on a restrictive set of assumptions about future growth and

¹² Easton and Monahan (2010) continue to argue that correlating the implied cost of capital estimates with other proxies for risk is illogical, because if these other risk proxies were valid we would not need the implied cost of capital estimates.

profitability. Taken together these results suggest the proxies we evaluate are unreliable.”
(p.520)

EM note that the er proxies rely heavily on analyst forecasts and if analyst forecasts are biased or noisy then the er proxies will reflect these problems. In additional analysis, reported in their Table 9, they find that the estimate r_{ct} (the Claus and Thomas (2001) proxy, defined in Table 1 p. 509 of EM) is reliable in samples when the consensus long-term growth forecast is low and several proxies perform well when ex post forecast errors are low (ex post analysts’ forecast accuracy is high) but of course this outcome is not known in period t when the expected return estimate is made. This latter set of results in my opinion appears to have been overlooked by critics of the implied cost of capital estimates who have focused on the EM conclusion I have highlighted in quotes. Of course, many others as listed above have continued to use implied cost of capital estimates relying on BP’s results while ignoring EMs results.

EM have to derive estimates of the cash flow and expected return news. I assigned both these papers in my PhD capital markets seminar at the University of Washington. A few years after its publication the students and I noticed that the proxy for cash flow news relies heavily on analyst forecasts, the same forecasts used to derive the er proxies and that the expected return news is proxied by the change in the implied cost of capital proxy being evaluated. While both these proxies concerned us we did not pursue it to determine what the consequences might be of such overlap. However, Botosan, Plumlee and Wen (BPW 2011) did pursue the issue. They show in section 7 of their paper, that defining rn_{it+1} as $= \rho/(1-\rho) \times (er_{it+2} - er_{it+1})$ (equation 11 of EM) where ρ is a capitalization factor and er_{it+2} and er_{it+1} are the implied costs of capital estimates estimated in period t+2 and t+1, respectively, removes the ability of the expected return proxy itself to explain realized returns.

Specifically, the realized return model is $r_{it+1} \approx er_{it+1} + cn_{it+1} - rn_{it+1}$. Empirically, $r_{it+1} \approx f(\Delta P)$ and $cn_{it+1} \approx f(\Delta CF)$. In EM’s empirical specification $rn_{it+1} = \Delta ICC \approx f(\Delta P, \Delta CF)$. Consequently, the model EM estimate can be shown by the following set of relationships:

$$r_{it+1} \approx er_{it+1} + cn_{it+1} - rn_{it+1}$$

$$f(\Delta P) \approx er_{it+1} + f(\Delta CF) - f(\Delta P, \Delta CF).$$

EM’s proxy for expected return news ($\Delta ICC = er_{it+2} - er_{it+1}$) is by construction a function of ΔCF and ΔP , which are also included in the model as dependent and explanatory variables,

respectively. Stated another way, rearranging the realized return equation to solve for er_{it+1} yields¹³

$$er_{it+1} \approx f(\Delta CF) - f(\Delta CF) + f(\Delta P) - f(\Delta P).$$

The right hand side implies a sum that is close to zero. Expected return is not likely to explain realized returns under this empirical specification. BPW argue “The resulting provoked circularity in the empirical model plays *no role* for $E_{t-1}(r_t)$ to contribute to the explanation of $r_{REAL,t}$, and as a result, any ICC estimate included in the model to proxy for $E_{t-1}(r_t)$ will be statistically insignificant, regardless of the validity, or lack thereof, of the ICC estimate employed.” (p.1117)

BPW show using return news proxied by $rn_{it+1} = \rho/(1 - \rho) X (er_{it+2} - er_{it+1})$ in a regression of realized returns on the er , cn and rn proxies that the estimated coefficients on the er proxies are generally insignificant (as in EM). When BPW use a proxy for rn that does not rely on the er proxies themselves, the estimated coefficients on the er proxies, particularly, r_{DIV} or r_{PEG} are significantly positive as predicted. Based on their results, BPW “recommend that researchers requiring a valid proxy for $E_{t-1}(r_t)$ employ either r_{DIV} or r_{PEG} . We caution against the use of realized returns or the other implied cost of capital estimates we examine to proxy for $E_{t-1}(r_t)$.” (p. 1086). As an aside I hope few researchers willingly want an invalid proxy! It should be noted that FLOS (2004) employ an estimate of the implied cost of capital that basically is equivalent to r_{DIV} - see FLOS (2004, p. 975) and examine the sensitivity of their results using r_{PEG} .

Guay, Kothari and Shu (2011) also use realized returns to examine the predictive ability of implied cost of capital estimates. Guay et al. also observe that the implied cost of equity approaches all rely on analyst forecasts of earnings (either short term or longer term) as a proxy for market expectations of earnings. Prior literature (Lys and Sohn 1990; Ali, Klein and Rosenfeld 1992) has shown that analysts are slow to update their forecasts relative to information in security prices/returns. For example, if there is a run-up (down) in stock price in the period before the cost of capital is estimated, then analyst forecasts will be biased downwards (upwards) relative to market expectations, and the resulting implied cost of capital estimate (the discount rate equating current stock price to future forecast earnings) will be biased downwards (upwards). Intuitively, if the forecast of earnings is too low, the discount rate required to equate

¹³ BPW spilt $f(\Delta P, \Delta CF)$ into $-f(\Delta P)$ and $+f(\Delta CF)$ arguing that expected returns are increasing in cash flows (holding price constant) and decreasing in price (holding cash flows constant).

the present value of the forecast earnings to current stock price will also be too low. This bias can lead to observing no association between the implied cost of capital estimate and future annual realized stock returns. In fact, Guay et al. report such “no association” results in their Table 3.

Empirically, Guay et al. first show that analyst forecasts are slow to incorporate information in stock returns (analyst forecast errors are negatively associated with prior period stock returns, Tables 4 and 5). They next show that the implied cost of capital estimates are also predictably related to the prior period stock returns. In an interesting analysis, they also show that for firms without recent stock price run-ups or run-downs, the implied costs of capital estimates are significantly positively associated with realized future stock returns.

Guay et al. propose two approaches to correct or mitigate the analyst forecast bias. The first main approach tries to correct the forecast for the expected bias using a regression approach of analyst forecast errors in $t+1$ (and $t+s$, $s=2-5$) on lagged stock returns and lagged stock returns interacted with firm characteristics (see Guay et al. pp. 141-143). Using the predicted value of the forecast error from this regression, they recover the corrected or adjusted EP forecast for $t+1$ (and $t+s$) which is then used to estimate the implied cost of capital measures. The second approach uses a somewhat older stock price relative to a more recent analyst forecast so that they both reflect similar information sets about expected earnings. Under both approaches, several of the revised implied cost of capital estimates exhibit the predicted positive association with future realized returns. A notable exception is the PEG approach which exhibits a negative but insignificant association with future returns when the regression is estimated at the individual firm level. Thus the state of the literature suggests that the r_{DIV} measure appears the best measure.

Mohanram and Gode (2013) also use a multiple regression approach to correct for analyst forecast errors when in estimating implied cost of capital. Their approach is to regress the analyst forecast error in $t+1$ (and $t+2$) on variables previously known to be associated with analysts' forecast errors; namely, recent stock returns, recent revisions in forecasts, accruals, sales growth, analyst long term growth estimates, growth in PP&E, and growth in other long term assets. They examine 4 common measures (including r_{PEG} but not r_{DIV}) plus the average of the 4 measures. They then replicate the Easton and Monahan (2005) return and measurement error tests. They find that their 4 measures and the average all exhibit the predicted positive

association with future returns, although several exhibit estimated coefficients significantly greater than the predicted value of +1. They conclude that overall the adjusted implied cost of capital measures are valid measures of expected returns.

Finally, McInnis (2010) also notes that analyst forecast bias can cause problems for the implied cost of equity approach. FLOS (2004) examine a number of financial reporting quality or attributes in addition to AQ. They report a positive association between smoothed earnings and the implied cost of capital. McInnis (2010) re-examines this relation using a returns approach. He finds using the CGV two-stage approach that a factor weight based on first stage regressions of returns on a hedge portfolio (non-smoothers less smoothers) is insignificant in the second stage (as is the estimated coefficient on beta). He then re-examines the relation using implied cost of capital and is able to reproduce the FLOS result. However, on further analysis he shows that this association is likely driven by optimism in analysts' long-term forecasts. This optimism leads to high target prices and thus high implied cost of capital for firms with high earnings volatility. He then suggests that the difference in results for AQ observed in CGV using realized returns versus implied cost of equity (in FLOS 2004) could also be driven by the same optimism in earnings forecasts and target prices. He shows that earnings forecast errors are negatively correlated with accrual quality (firms with poor accrual quality have higher forecast errors) and thus higher implied cost of equity estimates). He does not formally test this assertion. But McInnis' results do suggest that one has to think carefully about any biases in analyst forecasts and thus implied cost of capital being correlated with the test variable of interest.

5. Some discussion of the theory linking financial reporting quality and cost of capital (or information risk and firm risk)

The early literature linking financial reporting quality and cost of capital was based on estimation risk: securities with relatively less information (a quantity argument) available about them were argued to be more risky because of the greater uncertainty surrounding the parameters, specifically beta, of their return distributions. Representative papers using this approach are Klein and Bawa (1977), Barry and Brown (1985), Coles, Lowenstein and Suay (1995) and Clarkson, Guedes and Thompson (1996). These papers are well discussed in Artiach and Clarkson (2011). However as noted by Artiach and Clarkson there is an ongoing debate as

to whether estimation risk is or should be nondiversifiable and hence associated with the cost of capital.

Another approach linking information quality and firm risk is based on a transaction cost argument. More information (again a quantity argument) improves market liquidity and reduces bid-ask spreads (Amihud and Mendelson 1986) and/or increases the demand for a firm's securities (Diamond and Verrecchia 1991), both of which reduce the cost of equity capital. The transaction cost argument is based on the existence of asymmetric information and increased disclosures and information reduce the information asymmetry between informed and uninformed investors. Verrecchia (2001) provides an overview of the disclosure literature and suggests researchers focus more on the role of disclosure reducing the information component of the cost of equity capital as this link provides a rationale for efficient disclosure choice. Underlying this focus is an assumption of asymmetrically informed investors or imperfect competition (with perfect competition investors are price protected by competition of the parties on the other side of the transaction).¹⁴ Verrecchia goes further and calls for more empirical work that examines links between disclosure and its economic consequences. Such work could inform theorists.

FLOS (2005) refer to two different models to develop their prediction that financial reporting quality will be negatively associated with a firm's cost of capital. The first model they reference is a multi-asset rational expectations model developed by Easley and O'Hara (2004). The second model referred to by FLOS is by Leuz and Verrecchia (2004). In this model, financial reports inform investors about the firm's capital investments and low-quality financial reporting reduces the coordination between investors and managers about capital investment prospects and payoffs. This reduced coordination creates information risk leading investors to require a higher rate of return.

The Easley and O'Hara model however has attracted the most attention. In this model, there is both public and private information, with only some investors having the private information. These informed investors can adjust their portfolios as new private information becomes available whereas those with access to only the public information, the uninformed

¹⁴ In his discussion of the Verrecchia review paper, Dye (2001) offers alternative suggestions for future theory research on disclosure and thinks the information asymmetry component of the cost of capital has rather limited significance for future research. In his discussion of Healy and Palepu (2001) review paper, Core (2001) also calls for more research on whether disclosure quality affects the cost of capital, apart from its effect on stock liquidity – the information asymmetry component of the bid-ask spread.

investors, will not be able to optimally adjust their portfolios. Thus the uninformed investors face a form of systematic, undiversifiable, risk and will thus require higher returns to compensate them for this risk. In this model, required returns are affected by both the quantity of private information with more private information increasing the required returns of the uninformed and by the precision of both the public and private information, with higher precision reducing expected returns. Thus the predicted link between the quality of firms financial reporting and cost of capital: high quality financial reporting can decrease asymmetric information and increase the precision of publicly available information thus reducing the cost of equity capital.

As a financial accounting academic one has to like the prediction (if not the model). That is, an important role (but I am quick to add not the only role) for publically available financial reports is to reduce the risk faced by investors. I also like the intuition underlying this model by two non-accounting academics. While intuition is not always correct, at the same time how often do we hear from referees and workshop participants – these results appear too large, too small, or do not accord with one’s intuition and “do not pass the common sense” or “smell test.” Further there is at least some theory underlying why financial reporting might be a separately priced risk factor, unlike the two empirically derived Fama and French SMB and HML factors. And while SMB and HML are empirical factors with little theory behind them most researchers today examining market anomalies must control for the SMB and HML factors (even though they lack theoretical basis for inclusion) before they have a chance of reaching a revise and resubmit decision, let alone publication.

The Easley and O’Hara model quickly came under attack with the main criticism being that within the model, the risk facing the uninformed investors can be diversified away and thus should have no effect on the cost of capital (at least in that model). Hughes, Liu and Liu (2007) expand the Easley and O’Hara model to large economies, as opposed to the finite economy studied by Easley and O’Hara, where they argue that full diversification of firm-specific idiosyncratic information risk is likely and thus information risk is not priced at the individual firm level. However, in their model, greater information asymmetry about systematic factors does lead to higher factor risk premiums but does not affect the cost of capital in the cross-section.

Lambert, Leuz and Verrecchia (LLV 2007) also arrive at similar conclusions that the EO information risk pricing prediction is diversifiable. However, LLV show that in a single factor

risk model, financial reporting quality can still impact the firm's cost of capital or required return either through a direct effect or an indirect effect. The direct effect arises because information quality affects investors' assessments of the parameters of the distribution of expected cash flows – the variances and covariances with other firms' cash flows. The indirect effect arises when information quality influences firms' real production and investment decisions and/or affects managers' opportunistic actions; for example, reduced agency problems increase expected cash flows. These changed cash flows again affect investors' assessments of variances and covariances with other firms' cash flows. They argue that in large economies the variance effect is diversifiable but the covariance effect does not disappear in large economies thus leading to information quality being associated with the cost of capital.^{15,16}

With respect to the above debate I agree with Artiach and Clarkson (2011) who make the point: “critical to the challenges that both Hughes et al. (2007) and Lambert et al. (2007) mount to Easley and O'Hara's (2004) ‘pricing effect’ is an extension to a large economy setting. However, therein Hughes et al. state that they ‘*study the effects of private signals on risk premiums when the economy is large in the sense that the assets and the number of investors go to infinity*’.” (Artiach and Clarkson p.17). Thus diversification relies on an asymptotic argument, that the number of assets and investors goes to infinity, and in the end it is an empirical question as to whether information risk affects the cost of equity capital.

Hughes, Liu and Liu (2009) examine the theoretical relation between implied cost of capital estimates and the unobservable expected rate of return when the expected rate of return is stochastic (that is, can vary through time). Not surprisingly, because implied cost of capital

¹⁵ Reidl and Serafiem (2011) use the LLV model to examine whether greater information risk in financial instrument fair values (increasing information risk as move from level 1, 2 and 3) increases the cost of capital as measured by equity beta. Further this relation is mitigated (or magnified) in the cross-section as the firm's information environment improves (worsens). Information environment is proxied by analyst following, market capitalization, analyst forecast errors and forecast dispersion. Strobl (2013) expands the LLV model to examine the incentives for earnings management across the business cycle and shows that earnings management can influence a firm's cost of capital despite the forces of diversification.

¹⁶ Kothari, Li and Short (2009) refer to all three theories (estimation risk, information asymmetry, and the Lambert, Leuz and Verrecchia covariance model) to motivate their analysis of the effects of disclosures on firms cost of capital where cost of capital is estimated using the 3 factor Fama-French model. I further note Kothari et al. (2009) state “The consensus among financial economists is that a rich disclosure environment and low information asymmetry have many desirable consequences. These include the efficient allocation of resources in an economy, capital market development, liquidity in the market, *decreased cost of capital*, lower return volatility, and high analyst forecast accuracy.” (p.1640)

estimates assume the same discount rate to solve the present value calculation between current stock price and future earnings forecasts and target prices, the implied cost of capital measure estimates expected returns with error. But more importantly Hughes et al. argue that the error on average is a function of volatilities and correlations between expected returns and cash flows, growth in cash flows and leverage. They argue that their results provide alternative explanations for prior results examining implied cost of capital and market risk premiums, predictability of future returns, and information quality. Basically the measurement error in the implied cost of capital could lead to false inferences because of correlated omitted variables – normally researchers assume the measurement error in the dependent variable is uncorrelated with any explanatory variables and is thus restricted to the residual, reducing power but not inducing any bias in the estimated coefficients. However, Hughes et al. suggest that the error could be correlated with our test variables.

Lambert (2009) in his discussion of Hughes et al. argues that “While sets of parameter values can be constructed to be consistent with each individual empirical result, it is not clear that a single set of parameter values can explain all of them.” (p.266) Lambert further argues “that set of parameter values that leads to empirically observed biases in implied cost of capital will lead to the wrong correlations between implied cost of capital and growth, leverage and firm specific volatility, and vice versa. (p.267) Nevertheless, based on Hughes et al. one does need to think carefully about possible omitted variables that might be correlated with the measurement error in implied cost of capital.

5.1 Current state of the art

Lambert, Leuz and Verrecchia (LLV 2012) use a noisy rational expectations (RE) model to study the role of asymmetric information but in contrast to most RE model papers allow for market imperfection – where informed investors trade can affect prices whereas in perfectly competitive markets investors trades do not affect price (the demand curve is flat). They show that information asymmetry can be a separate risk factor for firms trading in imperfect markets. Additionally and importantly they show that it is important to distinguish between information asymmetry (differentially informed investors) and information precision. Even in perfectly competitive markets the cost of capital is directly influenced by the average precision of investors’ information. That is, even if investors are differentially informed, if the average precision of their information is higher, the cost of capital is lower. Thus firms with higher

average precision, regardless of the level of competition and information asymmetry, are predicted to have lower cost of capital.

Although not entirely clear to me in reading the LLV (2012) paper, it appears as though the direct effect of information quality (improved quality increases precision) lowering the cost of capital could be considered an additional risk factor rather than working through beta (as in the Lambert et al. 2007 model). Finally, average precision can increase if the informed investors become more informed and/or uninformed investors become more informed because of an increased availability of public information but average precision can decline if the level of asymmetric information is reduced by restricting information available to the informed investors. For example if Regulation FD reduced the flow of information to informed investors without increasing the flow to all investors, then it is likely that the average precision of information fell increasing the cost of capital even though it reduced information asymmetry which only affects cost of capital for firms in less competitive markets.

Armstrong, Core, Taylor and Verrecchia (2011) rely on the LLV model to develop tests of whether information asymmetry among investors has no separate effect on the cost of capital when markets are more competitive as compared to when markets are less than perfectly competitive, information asymmetry can have a separate effect on firm's cost of capital. Armstrong et al. form 5 portfolios sorted on the level of competition (proxied by the number of shareholders in the company) and (with either independent or dependent sorts) 5 portfolios sorted on the level of information asymmetry (using five different proxies but including the DD AQ measure). They regress monthly future returns of a hedge portfolio (the difference between the highest and lowest information asymmetry portfolio) for each of the 5 portfolios of competition levels on the Fama and French three factors. The hedge portfolio is estimated as the intercept in the model. They find a significant 0.42% per month or approximately 5% hedge return to the AQ hedge portfolio in the low competition group and an insignificant intercept (hedge portfolio return) in the remaining 4 competition portfolios. They thus conclude their results show "that information asymmetry has a positive relation with a firms' cost of capital in excess of standard risk factors when markets are imperfect and no relation when markets approximate perfect competition." (p. 1).¹⁷

¹⁷ Akin, Ng and Verdi (2012) also test whether asymmetric information is priced as a function of market competition. However they rely on trading models from Kyle (1985) to develop their predictions and define

Bhattacharya, Ecker, Olsson and Schipper (BEOS 2012) also test the implications of the LLV model. BEOS use the term information risk to denote both information precision (a direct link) and information asymmetry (an indirect link) effects. They use the DD AQ measure to proxy for information risk. They use both implied cost of equity and realized returns to proxy for cost of capital. They use both the adverse selection component of the bid-ask spread and PIN as proxies for information symmetry. As noted by LLV prior literature using AQ has appealed to both information asymmetry (indirect link) and precision of publicly available information (direct link) to justify a link between AQ (or more broadly financial reporting and/or disclosure quality) and the cost of capital. Thus one needs to think carefully about the role of AQ – what is the underlying construct the researcher is trying to capture with this measure. While AQ can help reduce the information asymmetry problem (poor AQ exacerbates any information asymmetry) as used in Armstrong et al (2011), I agree with BEOS that the more likely *direct* role for AQ is to increase the average precision of information about the firm. BEOS use path analysis to decompose the association between cost of capital and AQ into a direct path and an indirect path mediated by information asymmetry. They find that the direct path with AQ proxying for information precision is empirically more important. Further, consistent with LLV, they find that the relative importance of the indirect path, AQ reducing the information asymmetry problem, varies predictably with market competition: the indirect path increases in importance as markets become less competitive.¹⁸

Christensen, de la Rose and Feltham (CRF 2010) allow private information gathering in an Easley and O’Hara (2004) model, that is, they endogenize private information acquisition. Recall that Easley and O’Hara show that the cost of capital is increasing in asymmetric information (the proportion of information available only to the informed investors) and

competition somewhat differently than Armstrong et al. (2011). Akin et al. define market competition as the competition among informed investors as opposed to the number of investors. They use the asymmetric component of the bid-ask spread, PIN, and AQ as proxies for information asymmetry and find that the pricing of these proxies generally decreases as competition increases, consistent with the Armstrong et al. results. Balakrishnan, Vashishtha and Verrecchia (2012) exploit cross-country equity liberalization (allowing foreign investors to buy domestic equity) as a proxy for increased competition to test the association between information asymmetry and cost of capital. They find that the pricing of information asymmetry (future returns as a function of bid-ask spread and analyst coverage as proxies for information asymmetry) declines with an increase in the number of traders who can invest in the economy.

¹⁸ BEOS also decompose AQ into its innate and discretionary components. The direct effect continues to dominate the indirect effect for both components, and more so for the discretionary AQ component. BEOS also examine an indirect path for AQ on cost of capital via beta based on the Lambert, et al. (2007) model where information quality can influence the forward looking beta in a single factor CAPM. As I note in the text, this modeling approach precludes a separate direct effect of information quality on cost of capital.

decreasing in the number of informed investors. While not the main focus of Christensen et al., allowing for endogenous private information search, Christensen et al. show that the cost of capital is decreasing in the proportion of information that is privately available. The logic is as follows: with endogenous information acquisition, as information shifts from being public to private, more investors chose to acquire the private information leading prices to improve as a signal of private information. In equilibrium the uninformed investors suffer no loss of information (as more information becomes private, more is revealed in prices). However the average level of informedness (similar to LLV's average level of precision) has increased, lowering the cost of capital.

Clinch and Lombardi (2011) further examine the Easley and O'Hara and Christensen et al. results. They study two settings where the Easley and O'Hara result might continue to hold with endogenous private information search. First, they show that the Christensen et al. result depends on the cost of private information acquisition not increasing as more private information is acquired. Clinch and Lombardi allow the cost of private information search to increase in the precision of the private information. This reduces the number of investors choosing to become informed and thus there is no longer an offset of prices fully revealing the informed investors private information and uninformed investors suffer an information loss increasing the cost of capital (the Easley and O'Hara result). Second, they model private information spillovers (investors only have the option to acquire private information about all firms) with fixed information acquisition costs. In such a setting more investors want to become informed causing prices of all firms to become more informative, and similar to Christensen et al. in equilibrium these forces offset with no information loss to uninformed investors. However this balancing is across firms in the aggregate, not for each individual firm. For an individual firm, the effect on cost of capital is ambiguous and it is possible for a decline in the precision of the information of the uninformed investors (due to a shift from public to private information for that firm) to outweigh the increase fraction of informed investors in that firm, resulting in lower average precision of information and thus a higher cost of capital.

I note that many (the Lambert, Leuz and Verrecchia 2012 paper is a notable exception) of the theory papers start with a single factor asset pricing model bringing forth two comments from me. First, given the results in Core, Guay and Verdi (2008) (and the prior literature) that beta is significantly *negatively* associated with future returns when it should exhibit a positive

association, how valid is the single factor approach to developing models about the role of information quality (unless somehow the market betas used in the two-stage asset pricing tests are measured with error that is systematically associated with information quality which leads to the negative association between beta and future returns. That is, in such a single factor world we strongly believe that the theory is correct and that if there is a role for information quality it must be in correcting the measurement error in beta). Otherwise why start with the single factor model?¹⁹ Second, by definition, if one starts with or restricts the world to a single factor model, there is as far as I can see no way for a second factor to emerge. That is, by assumption, AQ cannot be an additional priced risk factor if one restricts their model choice to a single factor.

As financial accountants do we want to rely on the single factor CAPM?: in such a world the only role for accounting is to help assess the covariances of a firms' returns with those of the market (as summarized by beta). The CAPM assumes homogeneous expectations and thus by definition there is no role for accounting to reduce the information asymmetry between insiders and outside investors, and between informed and uninformed (or less informed) outside investors.

6. Conclusion

Beyer, Cohen, Lys and Walther (2010) provide a comprehensive review of the recent literature on the financial reporting environment. As part of their review they discuss the literature on the association between disclosure or financial reporting quality and cost of capital. I think many academic accountants likely share these authors' views. They highlight the analytical critiques of the Easley and O'Hara (2004) model by Hughes, Liu and Liu (2007) and Lambert, Leuz and Verrecchia (2007) that asymmetric information or information quality as a non-diversifiable risk factor is in fact diversifiable and thus should not affect the cost of capital. Beyer et al. then go on to discuss the Francis et al. (2004 and 2005) papers. They argue that the results in these papers can be explained by research design choices and they state that "the results are sensitive to research design choices. Similarly, conducting well specified asset-pricing tests, Core et al. (2008) find no evidence that accruals quality is a priced risk factor." (p.309) Beyer et al. also reference the Easton and Monahan (2005) critique leaving the distinct impression that

¹⁹ For a spirited defense of the CAPM see Brown and Walter (2012). One of their points is based on Roll's critique that one cannot really test the CAPM because the efficient market portfolio is empirically unobservable. Does such a critique also apply to tests of other factors?

implied cost of equity estimates are unreliable. Thus readers of Beyer et al. are left with a very pessimistic view of the empirical literature and the FLOS findings. However, Beyer et al. do positively reference Bhattacharya, Ecker, Olsson and Schipper (2012, then 2008 working paper) as a first step in trying to tease out the role of information quality/risk on cost of capital via direct and indirect path.

In this paper I have tried to make the case that the theory criticism that financial reporting quality or information risk is diversifiable is premature. Has empirical work run ahead of theory in this area? Possibly, but theory can be informed by empirical work and empirical work (i.e. empirical observations that do not accord with existing theories) can often lead to new theory. Recall Verrecchia's (2001) early call for more empirical (and theoretical work). The FLOS results, among others, have led to a number of accounting theorists developing models to study the association between information quality and expected returns/cost of equity capital. Accrual quality as a priced risk factor is a controversial result with battle lines clearly drawn with most I think on the side that accrual quality (or more generally financial reporting quality) is NOT a priced risk factor based on the Core, Guay and Verdi (2008) battery of tests. However, as I argue, I think Core, Guay and Verdi should be read with an open mind and with some skepticism because it appears to have been crafted with a blind belief that accrual quality could not possibly be priced because it is diversifiable. Too strong beliefs can hinder ones views: the strong belief in the efficient markets hypothesis took some time to overcome, and some still adhere to the hypothesis, despite both the post earnings announcement drift and accrual anomaly literatures. Having said that, I could not in good conscience advise a doctoral candidate or young faculty member to rely on accrual quality as a priced risk factor in their work – I think they would be met with too much opposition to ever get the manuscript published. I do believe however that the role of financial reporting quality in equity markets is a fascinating and important research question and that any dogmatic biases should be left at the door and results, tests and inferences be viewed with an open and critical mind.

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Table 1

Reproduced from Francis, Lafond, Olsson and Schipper (2005), *Journal of Accounting And Economics*, p. 314.

Table 3

Asset pricing tests of the association between future stock returns and accruals quality, 1971–2002

	Pred.Sign	Base model: CAPM				Base model: 3-factor			
		Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
<i>Panel A: Firm-specific cost-of-capital regressions (n = 8,881 firms with AQ values and returns data)^a</i>									
$R_M - R_F$	+	1.04	174.57	0.83	146.19	0.95	164.71	0.90	154.48
<i>SMB</i>	+	—	—	—	—	0.90	106.35	0.64	69.59
<i>HML</i>	+	—	—	—	—	0.21	23.53	0.30	34.42
<i>AQfactor</i>	+	—	—	0.47	83.48	—	—	0.28	44.72
Adj. R^2	+	0.135		0.178		0.189		0.208	
Inc R^2				0.043				0.019	
<i>Panel B: Firm-specific cost-of-capital regressions (n = 20,878 firms with returns data)^b</i>									
$R_M - R_F$	+	0.99	178.24	0.77	147.33	0.91	162.08	0.86	150.77
<i>SMB</i>	+	—	—	—	—	0.83	108.00	0.58	63.40
<i>HML</i>	+	—	—	—	—	0.21	24.22	0.32	36.24
<i>AQfactor</i>	+	—	—	0.46	100.51	—	—	0.29	53.02
Adj. R^2		0.120		0.161		0.173		0.195	
Inc R^2				0.041				0.021	

Sample description and variable definitions: The sample used in Panel A consists of 8,881 firms with data on *AQ* and with at least 18 monthly stock returns between April 1971 and March 2002. The sample used in Panel B consists of 20,878 firms with at least 18 monthly stock returns between April 1971 and March 2002. Variable definitions: $R_M - R_F$ = excess return on the market portfolio; *SMB* = return to size factor-mimicking portfolio; *HML* = return to book-to-market factor-mimicking portfolio; *AQfactor* = the return to the accruals quality factor-mimicking portfolio for *AQ*.

^aPanel A reports the average coefficient estimates across the $J = 8,881$ firm-specific estimations of the one-factor and 3-factor asset pricing models. For each of these base models, we also report coefficient estimates for regressions which include *AQfactor*.

^bPanel B reports similar information as Panel A, except these results are based on the $J = 20,878$ firms with at least 18 monthly returns.

Table 2
 Reproduced from Francis, Lafond, Olsson and Schipper (2005), *Journal of Accounting And Economics*, p. 318.
 Panel D extracted

Table 4 (continued)

Panel D: Mean results of firm-specific cost-of-capital regressions, 3-factor model (n = 20,878 firms)^d

		Total		Method 1		Method 2	
		Coef.est.	t-stat.	Coef.est.	t-stat.	Coef.est.	t-stat.
	Pred. Sign						
$R_M - R_F$	+	0.86	150.77	0.88	148.84	0.89	107.18
<i>SMB</i>	+	0.58	63.40	0.59	63.62	0.58	53.24
<i>HML</i>	+	0.32	36.24	0.32	34.65	0.27	24.15
<i>AQfactor</i>	Total	0.29	53.02	—	—	—	—
Method 1	Innate	—	—	0.23	52.20	—	—
	Disc	—	—	0.10	8.94	—	—
Method 2	Disc	—	—	—	—	0.09	3.98

Sample definition and variable definitions: Under Method 1, *InnateAQ* is the predicted value obtained from the annual parameter estimates and firm *f*'s reported values of the innate factors; *DiscAQ* is the residual. Under Method 2, *DiscAQ* is the coefficient on (total) *AQ*, including the innate factors as control variables. See Table 1 for other definitions.

^dPanel D reports similar information as Panel B, except that the focus is on the cost of equity, as captured by factor loadings on *AQfactor* in regressions of realized returns on the market risk premium, *SMB*, *HML* and *AQfactor*. The sample used in Panel D consists of 20,878 firms with at least 18 monthly stock returns between April 1971 and March 2002.

Table 3
 Reproduced from Core, Guay and Verdi (2008), *Journal of Accounting And Economics*, p. 10.
 Panel A extracted.

Table 4
 Cross-sectional regressions of excess returns on factor betas

Panel A—25 size and book-to-market portfolios
 Replication of Petkova (2006) over the period July 1963 to December 2001:

	Intercept	$b_{R_M-R_F}$	b_{SMB}	b_{HML}	Adj. R^2
Petkova's estimate	1.15	-0.65	0.16	0.44	0.71
FM t -stat	3.30	-1.60	1.04	3.09	
Our estimate	1.21	-0.70	0.17	0.44	0.72
FM t -stat	3.53	-1.74	1.07	3.08	

Our estimates over the period April 1971 and March 2002:

	Intercept	$b_{R_M-R_F}$	b_{SMB}	b_{HML}	$b_{AQ\ factor}$	Adj. R^2
Estimate	1.17	-0.65	0.08	0.47		0.66
FM t -stat	3.17	-1.47	0.46	2.80		
Estimate	1.54	-1.05	0.13	0.44	-0.78	0.73
FM t -stat	4.48	-2.51	0.77	2.65	-1.72	
Estimate	0.81	-0.26		0.46	0.10	0.59
FM t -stat	2.17	-0.58		2.74	0.22	
Estimate	1.95	-1.29			-0.13	0.47
FM t -stat	4.71	-2.88			-0.29	

Panel A (B) presents the estimated coefficients of a cross-sectional regression of average excess portfolio returns (i.e., portfolio return minus risk-free rate) from April 1971 to March 2002 on full-period factor betas for the 25 size and book-to-market portfolios (100 AQ portfolios). Panel C repeats the analyses for 64 size-BM-AQ portfolios. Panel D presents coefficient estimates from cross-sectional regressions of firm-specific excess returns on full-period factor betas using the Fama-MacBeth procedure. Full period betas are estimated on a multivariate time-series regression of portfolio returns on the respective factors during the period of April 1971 and March 2002 (of July 1963 to December 2001 for the replication of Petkova (2006)). $b_{R_M-R_F}$ is the portfolio beta related to the R_M-R_F factor. b_{SMB} is the portfolio beta related to the SMB factor. b_{HML} is the portfolio beta related to the HML factor. $b_{AQ\ factor}$ is the portfolio beta related to the $AQ\ factor$. Standard errors are computed using the Fama and MacBeth (1973) procedure.

Regression model: $\bar{R}_{q,t} - \bar{R}_{F,t} = \lambda_0 + \lambda_1 b_{q,R_M-R_F} + \lambda_2 b_{q,SMB} + \lambda_3 b_{q,HML} + \lambda_4 b_{q,AQ\ factor} + u_t$.