Earnings Quality Measures and Excess Returns

Pietro Perotti

and

Alfred Wagenhofer

University of Graz

This paper examines the relative ability of eight common earnings quality measures to explain future excess returns. We rank the measures based on the size of hedge returns earned from portfolios constructed by sorting over the respective measures. Using a large sample of U.S. non-financial firms over 1988-2007, our findings suggest that market-based measures (earnings response coefficient, value relevance) are associated with higher hedge returns than accounting-based measures, of which accruals quality and abnormal accruals perform significantly better than persistence, predictability, and smoothness. These results are not explained by cost of capital effects or well documented pricing anomalies. Our results also suggest that high abnormal accruals and high smoothness may indicate high rather than low earnings quality.

We thank Phil Brown, Robert Bushman, Thomas Dangl, Ralf Ewert, John Hand, Jack Hughes, Andrei Kovrijnykh, Wayne Landsman, Catherine Schrand, Josef Zechner, and participants at the Accounting Research Workshop in Fribourg, the Finance Seminar at the Vienna University of Economics and Business Administration, and a workshop at the University of North Carolina for helpful comments. Part of this work was accomplished when Perotti was visiting Bocconi University.

Center for Accounting Research
University of Graz
Universitaetsstrasse 15, A-8010 Graz, Austria
pietro.perotti@uni-graz.at, alfred.wagenhofer@uni-graz.at

December 2011

Earnings Quality Measures and Excess Returns

1. Introduction

There has been considerable interest in the quality of financial reporting. Many studies analyze earnings quality trends over time and their determinants; others measure the effects of specific changes in accounting standards, enforcement systems, or corporate governance requirements within or across countries; further studies use earnings quality to explain variations in economic outcomes, such as the cost of capital. Standard setters, including the FASB and the IASB, aim at improving the quality of financial reporting as noted in their Conceptual Framework (FASB 2010).

Since earnings quality is not directly observable, the empirical literature has developed several measures as proxies for earnings quality (see the surveys in, e.g., Schipper and Vincent 2003, Dechow and Schrand 2004, Francis, Olsson, and Schipper 2006, and Dechow, Ge, and Schrand 2010). Most measures are based on intuitive and plausible conceptions about desirable characteristics of a useful accounting system. Despite the voluminous literature, there is little theoretical guidance on what characteristics the earnings quality measures really capture. Acknowledging this difficulty, earnings quality measures are sometimes neutrally referred to as earnings attributes or earnings properties. There is also little guidance on the relationship between different measures, including the precision, sensitivity, and correlation among the measures. The selection of the measures is a critical research design issue and has a significant effect on the results of the research.

This paper studies the relationship among commonly used earnings quality measures by analyzing how much of future excess returns they are able to explain. We consider four sets of measures with two typical measures each: time-series measures (persistence, predictability), smoothness measures, accruals measures (abnormal accruals, accruals quality), and value relevance measures. Although the measures in the same sets are intended to capture similar constructs, we find, consistent with prior literature, that they correlate only weakly. Our proxy for ranking earnings quality measures is the size of one-year hedge returns from portfolios constructed by ranking firms according to the respective measures and going long in high-quality firms and short in low-quality firms. We argue that measures that are associated with higher hedge returns are more informative about future stock returns and, thus, "better" measures of earnings quality. Excess returns have also been used, for example, in the corporate governance literature to understand the economic effects of adopting good governance measures (e.g., Gompers, Ishii, and Metrick 2003, Bebchuk, Cohen, and Ferrell 2008). Earnings quality is often considered as a result of good governance, so this paper also adds to that strand of literature by considering an aspect of corporate governance and financial reporting.

Earlier work, such as Francis, LaFond, Olsson, and Schipper (2005) and Core, Guay, and Verdi (2008), has focused mainly on the implications of earnings quality on the cost of capital and discussed whether differences in expected returns are attributable to omitted risk factors, e.g., information risk. Excess ("abnormal") returns can result from several causes, one of which is a potential misspecification in the cost of capital. Examining hedge returns entails a more comprehensive test of the pricing effects of earnings quality because it includes additional potential reasons for excess returns, including market mispricing. A further advantage is that we use the same research design for all the earnings quality measures, which allows for their comparative evaluation; it also mitigates potential misspecification concerns in the hedge portfolio returns because the respective measures act as controls of each other.

We test a set of hypotheses on the relationship among different earnings quality measures for a large sample of U.S. firms over a twenty-year period from 1988 to 2007. The earnings quality measures are defined similar to those used in the accounting literature. We estimate the risk-adjusted cost of capital of each firm using the Fama-French three-factor asset pricing model augmented by momentum. Excess returns are calculated as the difference between actual returns and expected returns (cost of capital). Hedge returns are the one-year excess returns of equal weighted portfolios for the top and bottom quartiles of firms based on each of eight earnings quality measures.

Our main findings are as follows: Market-based measures are generally associated with higher hedge returns than the accounting-based measures. Within the accounting-based measures, accruals measures are the measures that yield the highest hedge returns. Time-series measures yield significant hedge returns when used in their raw form, but do not after controlling for innate factors. Smoothness measures do not earn significant hedge returns. Importantly, the hedging strategy is remarkably different across the measures. For the market-based measures, positive hedge returns obtain from going long in high-quality firms and short in low-quality firms, whereas for accruals measures, positive hedge returns are achieved by the reverse hedge strategy. These findings suggest that high abnormal accruals may indicate high rather than low earnings quality, which is in contrast to the dominant use of this proxy in the literature. We also perform several analyses to shed light on potential explanations for the occurrence of excess returns. In particular, we argue that cost of capital is unlikely to have a first-order effect in our results. The results are also not driven by well documented anomalies, such as price momentum, asset growth, book-to-market ratio, and accruals. However, we cannot rule out mispricing due to the inability of investors to fully understand earnings quality. These results are robust for a large set of sensitivity tests.

This paper adds to the extant earnings quality literature. For example, Francis, LaFond, Olsson, and Schipper (2004) study seven earnings quality measures and their association with ex ante cost of equity capital and other proxies, including realized returns. Their analysis focuses on the cost of capital estimates implied by Value Line target prices and dividend forecasts. They offer an intuitive discussion on how the earnings quality measures are related to information risk, but do not base them on theoretical results. Their findings suggest that, generally, accounting-based measures have more explanatory power than market-based measures and that accruals quality is the dominant measure. Their results on predictability and conservatism are mixed. These results differ significantly from ours.

Francis, LaFond, Olsson, and Schipper (2004) also report correlations between their seven earnings quality measures. They are generally significant, but economically not large, which suggests there is little overlap between them. Dechow, Ge, and Schrand (2010) report correlations and find significant negative correlations among several of the earnings quality measures, indicating that they may provide conflicting results when applied to the same research question. Our approach provides new insights into these relationships.

Aboody, Hughes, and Liu (2005) use two accrual measures, abnormal accruals and accruals quality, and construct hedge portfolios based on those measures. They examine whether they proxy for priced risks and, additionally, whether insiders can make a profit from trading shares based on the exposure to these measures. Their results are consistent with both hypotheses. Different from our paper, their focus is not on the comparison of different earnings quality measures.

There is little theoretical literature on earnings quality measures. Ewert and Wagenhofer (2011) model earnings quality in a rational expectations capital market equilibrium, and allow for private information by management and earnings management. They examine persistence, predictability, smoothness, discretionary accruals, and value relevance. By varying the incentives and operating and accounting characteristics, they compare these measures based on their ability to capture the change in the information content of reported earnings. They find that value relevance is a particularly good proxy, whereas earnings smoothness and discretionary accruals are unreliable according to their model. Marinovic (2010) examines earnings management and capital market reactions when there is uncertainty whether the manager can bias the earnings report. He finds that persistence is a useful measure, whereas predictability and smoothness do not reflect earnings quality because they behave non-monotonically in the information content of reported earnings. Christensen, Feltham, and Şabac (2005) and Christensen, Frimor, and Şabac

(2009) study earnings quality in an agency setting with renegotiation. They examine the relation between value relevance and persistence and earnings management in an optimal contract. One finding is that persistence and value relevance may be undesirable characteristics of accounting systems used for stewardship purposes. Drymiotes and Hemmer (2011) study the implications of conservatism on stewardship and valuation. They find that value relevance from a price-earnings regression is an unreliable measure of earnings quality.

This paper proceeds as follows: In the next section, we develop the hypotheses on the relative hedge returns of commonly used earnings quality measures. Section 3 explains our research design, particularly, how the measures and excess returns are calculated. Section 4 describes the sample. Section 5 contains the main empirical tests and sensitivity tests. Section 6 concludes.

2. Hypothesis development

2.1. Measures of earnings quality

Earnings quality research has been surveyed in many papers, including Schipper and Vincent (2003), Dechow and Schrand (2004), Francis, Olsson, and Schipper (2006), and Dechow, Ge, and Schrand (2010). Most of the research uses either one or a few of common measures, although there is other work that adapts these or defines specific measures to address specific questions or research settings. If several earnings quality measures are used, then they are often aggregated into a single score with a view that this enables the measure to capture multiple aspects of the individual measures. To do this in a meaningful way, it is important how to interpret each measure and to consider the relationships between measures.

In this paper, we take a broad view and examine eight commonly used earnings quality and their relationship based on their ability to generate excess returns. We consider both accounting-based and market-based measures. Accounting-based measures only use accounting earnings and components thereof, whereas market-based measures are based on accounting earnings and market returns. Within the group of accounting-based earnings quality measures we study measures that are based on the time series of earnings, on their volatility or smoothness, and on the unexpected part of accounting accruals. Our time-series measures are persistence and predictability. Persistence measures the extent that current earnings persist or recur in the future. It is commonly estimated as the slope coefficient from a regression of current earnings on lagged earnings or on components of lagged earnings, such as cash flows and accruals. High persistence is positively associated with high earnings quality, since it indicates a stable, sustainable and less volatile earnings generation process; this is particularly valued by investors. Predictability captures the notion that earnings are of higher quality the more useful they are to predict future earnings. Similar to persistence, predictability is viewed as a desirable attribute of earnings because it increases the precision of earnings forecasts.[1] A common measure is the R^2 of the regression of current earnings on lagged earnings. The time series of earnings is affected by the volatility of the operations, of the economic environment, and of the accounting system used by firms. Since we are interested in the accounting system, which measures earnings, we control for the other effects in the analysis. For that reason, we hypothesize that time-series earnings quality measures (after controlling for these factors) result in lower excess returns than other measures.

The second set of earnings quality measures contains smoothness of earnings. Smoothness is commonly measured based on the volatility of earnings or accruals relative to the volatility of operating cash flows. This measurement uses operating cash flows as the reference proxy for performance, which presupposes that cash flows are not subject to (real) earnings management. Earnings smoothness has been used differently in empirical studies. The prevailing view is that smoothness is negatively associated with earnings quality. The reason is that smoother earnings are considered to be a result of earnings management, which has a negative connotation. Earnings management is an attempt to mask a firm's "true" performance and reduces

[1] Marinovic (2010) finds that persistence is indicative of high information content in earnings and, thus high earnings quality, but predictability is non-monotonic in information content.

information carried in reported earnings, making them less useful. An alternative view is based on the observation that the objective of accounting is to determine earnings, which are operating cash flows plus accounting accruals, and that accruals are designed to smooth cash flows to filter out some of the volatility of cash flows. Similar to persistence and predictability, a smoother earnings stream is less volatile and allows better forecasting. So, some extent of smoothing should be good, otherwise users would just consider cash flows and ignore earnings. Moreover, since management uses its private information to decide on the amount of bias, smoothing incorporates private information about future cash flows into concurrent earnings ("forward" smoothing). Under this alternative view, smoothness should be positively associated with earnings quality.[2] In stating the hypothesis we follow the prevailing view, but we expect to find low excess returns for smoothness measures in our tests if both views are present.

The third set of earnings measures focuses on accruals. One common approach is to split accruals into "normal" and "abnormal" accruals, based on a forecast model for total accruals (e.g., following Jones 1991). Abnormal accruals are the difference between actual and expected accruals. Higher (absolute) abnormal accruals are commonly interpreted as lower earnings quality because the firm's accrual process is less predictable and abnormal accruals are likely to be discretionary, i.e., result from earnings management. However, there again is an alternative view, namely that abnormal accruals are the means within the accounting system to communicate private information. If actual accruals are equal to their forecast values, there is nothing new one can learn from observing accruals. Thus, abnormal accruals are an indicator of high earnings quality, although it is dampened by earnings management. The results in Ewert and Wagenhofer (2011) suggest that the information component outweighs the earnings management component because rational investors use their knowledge about management incentives to back out the expected earnings management from reported earnings. The amount of

---

[2] This view is consistent with the analytical results in Ewert and Wagenhofer (2011) and with empirical evidence in Tucker and Zarowin (2006).

abnormal accruals does not capture this potential market reaction, and therefore abnormal accruals should be a less useful proxy for earnings quality.

A second common accruals measure is accruals quality (Dechow and Dichev 2002). This measure maps working capital accruals to lagged, contemporaneous, and future cash flows from operations. According to most of the prior literature, the better this mapping explains the accruals the lower is the residual from a regression based on these cash flows and the higher is the earnings quality. The empirical literature suggests accruals quality is a better measure than other accounting-based measures,[3] and therefore it is used in many studies. However, accruals quality is subject to a similar concern as noted for abnormal accruals, as the residual not only captures earnings management but also potentially useful firm information.

The most common measure among market-based measures is value relevance. Value relevance is measured by the earnings response coefficient, which is the slope coefficient in a regression of the market returns on earnings, sometimes augmented by changes in earnings, or by the R^2 of such a regression. High value relevance is generally considered to indicate high earnings quality. Ewert and Wagenhofer (2011) find that value relevance is the best among the measures they study,[4] and therefore we predict that value relevance outperforms the other measures. Although there is concern about inferences one can draw from value relevance studies (see, e.g., Holthausen and Watts 2001), this concern comes more from a contracting role of accounting than the decision-usefulness view that underlies financial reporting standards (e.g., FASB 2010).

---

[3] See, e.g., Francis, LaFond, Olsson, and Schipper (2004, 2005). However, Wysocki (2009) finds that accruals quality has limited power to distinguish between normal and abnormal accruals.

[4] Other analytical models (e.g., Christensen, Frimor, and Şabac 2009, Drymiotes and Hemmer 2011) come to different conclusions because their accounting system serves a different purpose.

2.2. Excess returns

The above discussion provides a set of predictions about the direction and the degree which we expect that earnings quality measures are associated with "real" earnings quality and, thus, with each other. We test these predictions by measuring the amount of hedge returns earned by investing in portfolios constructed on the value of the respective earnings quality measure. Hedge returns are the difference between the excess returns of going long in a portfolio and short in a portfolio of equal size selected on the basis of a particular earnings quality measure. We posit that an earnings quality measure is more useful or "better" than another measure if it generates higher hedge returns. The reason is that higher earnings quality helps to explain a higher portion of future excess returns, thus it captures more information about firms.

Most previous literature has focused on the cost of capital implications of earnings quality and discusses whether differences in expected returns are due to omitted risk factors, e.g., information risk. Higher earnings quality reduces the uncertainty and, thus, the information risk; hence, the estimated cost of capital is expected to decrease in earnings quality. This design has the limitation that either there is no observable benchmark or one has to assume that the pricing error is zero (which is consistent with a fully efficient market).

Our design is more comprehensive because excess returns capture cost of capital effects and other sources of potential mispricing. To see this, define excess returns as actual returns (*RET*) less (real) risk-adjusted cost of capital (*COC*). The pricing error is

$$PRICINGERR = RET - COC$$

Actual returns *RET* are observable, but cost of capital is not. Usually, it is estimated by the expected returns determined from a model. The models typically do not capture all potential risk factors, so they measure cost of capital with a model error,

$$MODELERR = COC - E[RET]$$

Excess returns now include both potential errors,

$$EXRET \equiv RET - E[RET] = PRICINGERR + MODELERR \quad (1)$$

hence, they are a more comprehensive measure than the cost of capital to assess the performance of earnings quality measures.

There is little theoretical basis and mixed empirical evidence to draw conclusions about what are really the sources for excess returns. For example, Easley and O'Hara (2004), show that information asymmetry among investors affects the other systematic risk factors. Hughes, Liu, and Liu (2007) show in a more comprehensive factor model that information on idiosyncratic risk is not priced, only information on the systematic component is. In a consumption CAPM economy with symmetric information, Yee (2006) finds that poorer earnings quality increases the equity risk premium. Lambert, Leuz, and Verrecchia (2007) also show that idiosyncratic information affects the risk premium because it changes the covariance between a firm's cash flows and the cash flows of other firms in the economy. Christensen, de la Rosa, and Feltham (2010) argue that the cost of capital decreases after the release of information, but since there is no change in the ex ante cost of capital, lower cost of capital is offset by higher cost of capital before information arrives.

Francis, LaFond, Olsson, and Schipper (2005) test cost of capital implications of accruals quality and interpret their findings as suggesting accruals quality is a priced risk factor, capturing non-diversifiable information risk. However, they also find that the slope coefficients on the Fama-French risk factors change significantly if they include accruals quality. Core, Guay, and Verdi (2008) conduct a series of tests and find no support for the conclusion in Francis, LaFond, Olsson, and Schipper (2005) that accruals quality is a priced risk factor. They also show that the results vary substantially contingent on the sample period and on the frequency of portfolio rebalancing. Chen, Dhaliwal, and Trombley (2008) provide empirical support for the implications of Yee's (2006) model, which predicts that accruals quality is negatively associated with the cost of equity capital and the magnitude of the association increases with fundamental risk. Ng (2011) find that higher information quality is associated with lower liquidity risk and, therefore, with lower cost of capital.

Excess returns can also be a result of market mispricing. Due to a lack of a generally accepted asset pricing model, it is generally difficult to identify a specific reason for potential mispricing. Mispricing may be a result of market inefficiencies or behavioral biases of investors. Explanations include unsophisticated investors (Bartov, Radhakrishnan and Kriski 2000), limited attention (Hirschleifer, Lim, and Teoh 2010), cost to acquire information (Landsman, Miller, Peasnell, and Yeh 2011), transaction costs and limits to arbitrage (Ng, Rusticus, and Verdi 2008, Zhang, Cai, and Keasey 2010), time of the year (Mashruwala and Mashruwala 2011) and divergence of opinions (Garfinkel and Sokobin 2006). Penman and Zhu (2011) find that excess returns can be consistent with rational pricing if earnings and revisions in earnings growth expectations are considered appropriately. Excess returns may also occur under rational pricing if firms experience unexpected shocks in operating profitability.

Given the lack of consensus about different explanations for excess returns, we do not attempt to identify a specific explanation in this paper. What we presume for our analysis is that excess returns and, a fortiori, hedge returns are systematically related to earnings quality; so, they capture some information contained in earnings reports that varies with the quality of earnings quality and, thus, our earnings quality measures. One may argue that if excess returns arise from market mispricing, higher earnings quality reduces excess returns as investors should be able to understand high-quality earnings reports and price the information contained in them.[5] However, we take the excess returns as given and assess how different measures of earnings quality are associated with them.

---

[5] For example, Barth, Konchitchki, and Landsman (2010) define earnings transparency as the extent to which earnings captures changes in a firm's economic condition in a way that is understandable to investors, combining these two notions.

Nevertheless, we provide some tests that may shed light on the prevailing explanation for excess returns because some explanations predict opposing signs of hedge returns. In particular, finding positive hedge returns for going long in low-quality firms and short in high-quality firms is consistent with a risk premium for low-quality firms because excess returns are likely to arise from a modeling error in the cost of capital. On the other hand, positive hedge returns by going long in high-quality firms and short in low-quality firms is more consistent with a pricing error.

2.3. Hypotheses

We summarize the above discussion with formulating the following hypotheses (stated in alternative form).The first hypothesis predicts which earnings quality measures earn higher hedge returns and are the "better" measures.

H1: (*a*) *Hedge returns are higher for market-based measures than for the accounting-based measures studied.*

(*b*) *Hedge returns are higher for accruals measures than for other accounting-based measures.*

The next hypothesis predicts the sign of the hedge return, i.e., whether positive hedge returns arise from going long in low-quality or high-quality firm. This depends on which explanation is prevalent for the rise of excess returns.

H2: *Positive hedge returns obtain from going long in high-quality firms and short in low-quality firms.*

As we discuss earlier, time-series and value relevance measures are generally interpreted in a way that higher EQ measures indicate higher earnings quality. Smoothness and accruals measures are commonly interpreted as capturing earnings management that is viewed as inducing low earnings quality. However, there are valid arguments to predict the converse relationship. Formally, H2 is a joint hypothesis of the prevailing explanation and the interpretation of these two sets of measures. We can disentangle these opposing effects if we assume that the prevailing explanation for excess returns is the same for all eight measures. Then the signs indicate which interpretation of smoothness and accruals measures is consistent with the findings.

3. Research design

3.1. Calculation of earnings quality measures

We calculate the earnings quality (EQ) measures in line with the literature (for surveys see Schipper and Vincent 2003, Dechow and Schrand 2004, Francis, Olsson, and Schipper 2006, and Dechow, Ge, and Schrand 2010). The base earnings measure is net income before extraordinary items (*NIBE*). Total accruals (*ACC*) is calculated from $ACC = \Delta CA - \Delta CL - \Delta CASH + \Delta STDEBT - \mathrm{DEPR}$, where the variables are change in current assets, change in current liabilities, change in cash, change in short-term debt, and depreciation in the fiscal year ending at *t*, respectively. Cash flow from operations (*CFO*) is calculated from $CFO = NIBE - ACC$. Current accruals (*CACC*) is computed as $CACC = \Delta CA - \Delta CL - \Delta CASH + \Delta STDEBT$. All of the eight EQ measures are estimated for each firm and year over rolling ten-year windows t–9 to t. Table 1 summarizes the definitions of the earnings quality measures used.

[Table 1]

The two time-series measures are persistence and predictability. Persistence (EQ1) is equal to the slope coefficient β of the following regression:

$$NIBE_{i,t} = \alpha + \beta NIBE_{i,t-1} + \varepsilon_{i,t} \qquad (2)$$

where *NIBE* is scaled by total assets at the beginning of period *t*. Predictability (EQ2) is the R^2 of this regression.

Our first smoothness measure (EQ3) is the ratio of the standard deviation of earnings over the standard deviation of cash flow from operations,

$$\frac{\sigma(NIBE_{i,t})}{\sigma(CFO_{i,t})} \tag{3}$$

where *NIBE* and *CFO* are scaled by total assets at the beginning of period *t*. The second smoothness measure (EQ4) is based on the correlation of accruals and cash flow from operations,

$$\rho(ACC_{i,t}, CFO_{i,t}) \tag{4}$$

ACC and *CFO* are scaled by total assets at the beginning of period *t*. Since EQ4 is generally negative, the interpretation of both smoothness measures is that higher values imply higher earnings quality (if one follows the prevailing interpretation that little smoothing indicates high earnings quality).

The third set of earnings quality measures, abnormal accruals and accruals quality, focus on accruals and intends to capture earnings management. Abnormal accruals (EQ5) are estimated based on the following regression:[6]

$$ACC_{i,t} = \alpha + \beta_1(\Delta REV_{i,t} - \Delta AR_{i,t}) + \beta_2 PPE_{i,t} + \varepsilon_{i,t} \tag{5}$$

where ΔREV is the change in revenues, ΔAR the change in accounts receivable, and *PPE* is property, plant, and equipment. All variables are scaled by total assets at the beginning of period *t*. The abnormal accruals measure is the absolute residual, $\left|\varepsilon_{i,t}\right|$.[7]

Accruals quality (EQ6) is defined as the standard deviation of the residuals of the following regression of current accruals

---

[6] This specification follows the modification of Dechow, Sloan, and Sweeney (1995).

[7] Francis, LaFond, Olsson, and Schipper (2005), p. 299, suggest taking the absolute values for an earnings quality measure and signed accruals for studying earnings management.

$$CACC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t+1} + \varepsilon_{i,t} \tag{6}$$

All variables are scaled by total assets at the beginning of period *t*. Note that the prevailing interpretation of the two accruals measures is that higher values of EQ5 and EQ6 indicate *low* earnings quality. To conform to the literature that uses these accruals measures we keep this convention and do not multiply the values by negative one.

Finally, the two value relevance measures are estimated using the following regression:

$$RET_{i,t} = \alpha + \beta\, NIBE_{i,t} / P_{i,t} + \varepsilon_{i,t} \tag{7}$$

where *RET* denotes the 12-month return ending three months after the end of the fiscal year, and *P* is the market value of equity at the beginning of period *t*. Our first measure (EQ7) is the earnings response coefficient (*ERC*), which is the β in (7). The second measure (EQ8) is the R^2 of the regression.

The EQ measures include all sources for variations in reported earnings. The EQ measures may also be affected by the business model, operating risk, and the operating environment (Francis, Olsson, and Schipper (2006) call these innate sources) and by financial reporting quality, which is a result of accounting standards, their application, management incentives, auditing, corporate governance, enforcement, and other aspects of the regulatory environment. In particular, the two time-series measures are strongly affected by innate factors. Moreover, earnings quality measures may be affected by differences in the information environment across firms. For example, the precision of earnings announcements or analyst following have an effect on earnings quality measures.[8]

Since we are interested in effects of accounting on earnings quality, we use residual-form measures after controlling for variables that capture the innate factors and the information environment. We run two-stage regressions, in which the first regression captures the innate

---

[8] See, e.g., Burgstahler and Chuk (2010).

factors, and we use the residual, which captures the accounting-based factors in the earnings quality. Based on the literature, we use the following controls: *Size*: natural logarithm of total assets; *Operating cycle*: natural logarithm of the sum of days accounts receivable and days inventory;[9] *Intangible intensity*: reported R&D expense divided by sales (R&D expense is set equal to zero when missing); *Capital intensity*: net book value of property, plant and equipment divided by total assets; *Growth*: percentage change in sales; *Leverage*: total liabilities divided by equity book value.[10] Our main analyses focus on the residual-form measures. In some tables, we also report the raw-form measures, which are index by "Raw".

Our estimation of the EQ measures over rolling ten years takes care of industry differences because it uses each firm as its own control. It assumes that earnings quality is a sticky characteristic.[11] As our results indicate, there is still sufficient variability in the hedge portfolios because firms are assigned to the portfolios based on their relative rather than their absolute earnings quality measures.

3.2. Computation of hedge returns

To compute hedge returns, we use the three-factor asset pricing model by Fama and French (1993) plus the momentum factor (Carhart 1997) to estimate the expected risk-adjusted return of each firm in the hedge portfolios.[12] There may be other common risk factors, but there is no

---

[9] The days accounts receivable are calculated from 365 times accounts receivables turnover over sales; the days inventory from 365 times inventory over cost of goods sold.

[10] Gerakos and Kovrijnykh (2011) suggest that earnings volatility and economic shocks may affect the EQ measures. These are to some extent captured by our control variables. See also Ogneva (2008), who controls for future cash flow shocks.

[11] Barth, Konchitchki, and Landsman (2010) question this implied stability and develop an annual transparency measure based on annual regressions of industry and industry-neutral commonalities.

[12] The factor-mimicking portfolio returns for SMB, HML, and momentum are obtained from French's website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

consensus as to which ones are the most descriptive and whether adding additional factors improves the net benefit of forecasting and valuation.

We follow the procedure in Landsman, Miller, Peasnell, and Yeh (2011) to calculate the expected returns for each firm. For each firm and month we estimate the factor β's over a 36 month period prior to the respective month by

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i^{MKT}(R_{M,t} - R_{f,t}) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{UMD} UMD_t + \varepsilon_{i,t} \qquad (8)$$

where $R_{i,t}$ is the actual monthly return of firm i, $R_{f,t}$ is the monthly riskless rate of return, $R_{M,t}$ is the monthly market return, SMB_t is the monthly return on the size factor mimicking portfolio, HML_t the monthly return on the book-to-market factor mimicking portfolio, and UMD_t the monthly return of the momentum factor mimicking portfolio.

Taking these estimated factor β's for month t as expected β's for month t+1 we calculate the expected risk-adjusted return from the following equation:

$$E[R_{i,t+1}] = R_{f,t+1} + \beta_i^{MKT}(R_{M,t+1} - R_{f,t+1}) + \beta_i^{SMB} SMB_{t+1} + \beta_i^{HML} HML_{t+1} + \beta_i^{UMD} UMD_{t+1} \qquad (9)$$

where the factor returns in t+1 are obtained as each factor's average monthly return over the previous 36 months.

The excess return of each firm and month is the actual return minus the expected return,

$$EXRET_{i,t} = R_{i,t} - E[R_{i,t}] \qquad (10)$$

where $EXRET_{i,t}$ is the month t percentage excess return on the stock of firm i. Monthly excess returns are then aggregated using the following formula,

$$RET_i = \exp[\sum_{t=1}^{12} \ln(1 + E[R_{i,t}])] - 1$$

to obtain annual buy and hold returns.

We form equal-weighted portfolios of firms for each of the earnings quality measures we study. We do not consider value-weighted portfolios because the results are likely to be driven by a small number of the largest firms. Assuming that financial reports of a specific year are available within three months after fiscal year-end, we start accumulating excess returns beginning in the fourth month for a 12-month period. To avoid concerns regarding the potential influence of outliers that are likely to be accumulated at the extremes of the distributions, we use quartiles rather than deciles.[13] The top quartile contains the 25 percent of firms with the highest value of the earnings quality measure, the bottom quartile the 25 percent of firms with the lowest value of the earnings quality measure. Hedge returns are computed as the difference between the average excess returns of the firms in the top quartile minus the average of the excess returns of the firms in the bottom quartile. This procedure corresponds to a buy-and-hold strategy of half of the sample firms in each year.[14] Rebalancing occurs once a year to mitigate concerns of bias due to bid-ask spread bounces (see Core, Guay, and Verdi 2008).

4. Sample description

The sample consists of U.S. non-financial firms drawn from Compustat and CRSP. To analyze earnings quality measures over a 20-year period from 1988 to 2007, we require financial statements data from 1978 to 2008 because all the earnings quality measures are computed over a ten-year rolling estimation period, and some of them involve items over two or three consecutive periods. For each firm in a certain year, we require that data are available in the respective and nine prior years to avoid concerns that differences in the samples for measuring the earnings quality measures drive the results. All data are winsorized on the 1% level to control for outliers.

---

[13] A disadvantage is the potential reduction in hedge returns and a loss of significance of their differences. However, this biases our results against finding significant effects.

[14] An alternative approach would be relating excess returns to earnings quality measures using linear regressions. For example, Fama and French (2008) use both the sorting approach and the regression approach for a number of pricing anomalies and obtain analogous results; they also discuss the advantages and disadvantages of the two methods.

We require sufficient data to calculate all 16 earnings quality measures for each firm in a yearly sample. To avoid excluding too many firms, we do not require data availability for each firm over the full 30 year period. As a consequence, the composition of firms in the yearly samples varies. Survivorship bias is expected to play a minor role in the analysis because it only arises for the ten-year estimation periods. The number of firms in each year varies between 1,184 and 1,445, the average number is 1,334. The total sample includes 26,684 firm-year observations.

Table 2 reports descriptive statistics of the main variables used to calculate the earnings quality measures and the controls over the 20 years.

[Table 2]

Table 3 presents descriptive statistics for the 16 earnings quality measures. Some measures are not symmetrically distributed, and some of the top and bottom deciles include extreme values. To further mitigate the effect of potential outliers, we use quartiles to construct the hedge portfolios.

[Table 3]

Table 4 shows the Pearson correlations. With few exceptions, the correlations are significant, although most of them are economically small.[15] The correlations between the

---

[15] This result is consistent with earlier findings, for example, by Francis, LaFond, Olson, and Schipper (2004). Spearman correlations are similar to Pearson correlations. Furthermore, correlations in the stocks in the extreme EQ quartile portfolios are similar.

earnings quality measures are generally positive; there are few measures which are negatively associated with other measures, and the negative correlations are of much smaller size than the positive ones. However, there is no single measure that is consistently positively correlated with the rest of the measures. A large positive correlation would be consistent with the view that these measures capture a similar underlying construct. Therefore, it is surprising that the correlations are generally not economically high. High correlations arise only between pairs measures within the same set, particularly, +0.8201 for smoothness (EQ3 and EQ4), but only +0.3921 for accruals measures (EQ5 and EQ6) and less for the two other sets. The correlations among the raw-form measures are higher, which is expected due to the innate factors that are common for many measures. This holds particularly for the time-series measures ($EQ1^{Raw}$ and $EQ2^{Raw}$).

[Table 4]

Table 5 shows the change in the composition of the portfolios based on the eight EQ measures over time. It reports the frequency of the annual changes of all firms across the different quartiles of earnings quality measures. No change occurs with around 67 percent on average and has the highest frequency; a change from a low (high) EQ to a high (low) EQ portfolio occurs rarely. Portfolio selection based on abnormal accruals (EQ5) leads to the most changes in and out of the portfolios, based on accruals quality (EQ6) to the least changes.

[Table 5]

5. Results

5.1. Hedge returns for earnings quality measures

Table 6 provides the main results to test the hypotheses. For each of the eight EQ measures, it states the one-year mean excess returns of the firms in the quartile with the highest EQ measures and the mean excess returns of the firms within the quartile with the lowest measures. The hedge returns are the difference between these two mean excess returns. The last column reports unpaired samples t-statistics of the hedge returns. To see the effect of using raw or residual measures, we report both in the table, but focus the analysis on the residual form measures.

[Table 6]

Table 7 reports the differences of the absolute values of the hedge returns and a significance test for these differences, which are calculated from a two-sided *z*-test using the difference of the values divided by its standard error. The standard errors are obtained from a bootstrapping procedure with 1,000 replications.

[Table 7]

Hypothesis H1 predicts partial rankings of measures based on the absolute value of the hedge returns for each EQ measures. The absolute value of the hedge returns is achieved by a hedge strategy that goes long in the portfolio with higher excess returns and short in the portfolio with the lower excess returns. We consider the signs of the hedge returns when testing hypothesis H2.

Hypothesis H1 predicts that hedge returns are higher for the market-based measures (EQ7 and EQ8) than for the accounting-based measures (EQ1 to EQ6), and it predicts that hedge returns are higher for accruals measures (EQ 5 and EQ6) than for other accounting-based measures (EQ1 to EQ4). The results show that EQ7 yields the highest hedge returns with 3.2% annual return,[16] followed by EQ6 with 2.9% and EQ5 with 2.8%. An exception is that EQ8 yields a return of 2.4% that is somewhat smaller than the hedge returns of the accruals measures. Consistent with the prediction we find that the hedge returns for EQ1 to EQ4 are significantly smaller than those for EQ5 and EQ6, and they are even insignificantly different from zero.[17] Table 7 shows that the differences in the hedge returns between the set of EQ measures with significant returns (EQ5 to EQ8) and the other measures (EQ1 to EQ4) are generally significant, but that the differences within these groups are not. So, while the results largely support hypothesis H1, some of the differences in hedge returns are not significantly different from zero.

Comparing the hedge returns of the EQ measures with those from raw-form measures, we find that the time-series measures ($EQ1^{Raw}$ and $EQ2^{Raw}$) yield the highest absolute hedge returns, which we attribute to the innate common factors that we control with the measures in residual form. The ranking of the other measures is not significantly affected by controlling for innate factors. Smoothness measures never yield significant hedge returns.

We now turn to hypothesis H2, which predicts the signs of the hedge returns for the different EQ measures. Our convention for calculating hedge returns is a hedge strategy that goes

---

[16] We also test a measure suggested by Ewert and Wagenhofer (2011), which is equal to the square of the earnings response coefficient times the variance of earnings, $(ERC_{i,t})^2 \cdot Var(NIBE_{i,t})$. Untabulated results show that, consistent with the prediction in Ewert and Wagenhofer, this adjusted value relevance measure consistently ranks among the top of measures with the highest hedge returns.

[17] Wysocki (2009) suggests a modified accruals quality measure to avoid some limitations of the original EQ6 measure. We calculate his metric 1, which is defined as the difference between the R^2 of (6) and the R^2 of a regression of working capital accruals only on contemporaneous operating cash flow. Untabulated results show that neither the raw-form nor the residual-form measures produce significant hedge returns.

long in firms with a high value of the respective EQ measure and short in firms with a low value. With this analysis, we seek to gain insights into possible explanations for excess returns and into the interpretation of those EQ measures that are ambiguously related to earnings quality.

Consider the EQ measures in Table 6 whose relationship with earnings quality is theoretically unambiguous. These are the two time-series measures, persistence (EQ1) and predictability (EQ2), and the two value relevance measures (EQ7 and EQ8). Hedge returns for EQ7 and EQ8 are significantly positive, which is consistent with hypothesis H2 that positive hedge returns obtain from going long in high-quality firms and short in low-quality firms. The hedge returns for EQ1 and EQ2 are insignificantly different from zero. Interestingly, the hedge returns for the corresponding raw-form measures $EQ1^{Raw}$ and $EQ2^{Raw}$ are negative and significant, which we attribute to innate factors.

Next consider those EQ measures whose relationship with earnings quality is theoretically ambiguous. The two smoothness measures yield insignificant hedge returns, whereas the two accruals measures yield significant positive hedge returns. Note that the accruals measures are defined such that higher values imply higher abnormal or unexplained accruals, which are commonly interpreted as higher earnings management and lower earnings quality. Under the assumption that the prevailing explanation for excess returns is the same for all measures, we can use the results for EQ7 and EQ8 as benchmark and assume that higher earnings quality is associated with higher excess returns. Together, these assumptions suggest that higher abnormal or unexpected accruals are indicative of *higher* earnings quality. This result contrasts with the common interpretation of accruals measures, but is consistent with theoretical and some empirical literature that emphasizes the information in the abnormal accruals.

It is interesting to note that the pairs of EQ measures in the same sets show very similar results despite the fact that they are only weakly correlated (see again Table 4). Thus, a high correlation is not a necessary condition for measures to serve as proxies for the same underlying concept. Similarly, there is a strong distinction between the accounting-based and the market-based EQ measures. Since the market-based measures include both accounting and market information, they may include more information as investors react to accounting information anticipating and correcting for an expected bias. However, they may also include more information because market prices include information outside the financial statements. We control for the different information environments with the control variables that are used to derive the residual-form measures. Since the results are not strongly dependent on the raw-form or residual-form measures we conclude that differences in the information environment are not a major reason for our results.

5.2. Possible explanations for excess returns

The literature has not come to a consensus as to what can be explanations for excess returns. In this section, we consider two possibilities, misspecification of the estimation of cost of capital and common market mispricing sources.

Prior accounting literature suggests that higher earnings quality is associated with lower cost of capital. To explore whether cost of capital drives our results, we calculate the average expected cost of capital of the firms in the two portfolios for which the hedge returns are determined. The cost of equity capital estimate $E[RET]$ is defined in equation (9) based on the four-factor model for each portfolio. We aggregate the estimates by year to obtain an annual measure of the cost of equity capital.

Table 8 reports the differences in the expected cost of equity capital between the high-EQ and low-EQ portfolios for each EQ measure. The cost of equity capital is generally in the range of 11 to 13 percent, which is consistent with findings in the prior literature. The differences in the cost of capital between the high and low EQ portfolios are economically small, although significant for three EQ measures. However, the differences are much smaller than the hedge returns. The largest absolute value arises for the smoothness measure EQ4 with 0.64%, which is of the order of 1/5 of the highest hedge returns. The other significant differences exist for the second smoothness measure EQ3 and for value relevance EQ7. Overall, these results are not able explain the pattern observed in hedge returns across our EQ measures.

[Table 8]

Note that only the result for EQ7 is in line with the prediction that higher earnings quality lowers the cost of capital. EQ 3 and EQ4 show significantly positive differences, suggesting that *smoother* earnings decrease the expected cost of capital. This is in contrast to the prevailing interpretation of smoothness having a negative impact on earnings quality. This result is consistent with the finding based on the (reverse) sign of the hedge returns for accruals measures and suggests again that the prevailing view is not supported by the data.

We caution that the cost of capital estimates in Table 8 are those from the four factor model, so it would be difficult to interpret them as indicating an omitted information risk factor. If the cost of capital is higher for a high EQ measure, this could be because the firms in the top portfolio have higher exposure to the four factors or that there is an omitted risk factor. Furthermore, the portfolio approach we adopt only allows for a comparison of expected returns within our portfolios. It does not allow drawing inferences on the effect of the earnings quality measures on the cost of equity capital in the population because the portfolios might vary systematically by other determinants of cost of equity capital.[18] For these reasons, our results cannot be directly compared with other papers on the effect of earnings quality on the cost of capital.

---

[18] Other determinants identified in previous literature include, e.g., CAPM β (Barry and Brown 1985), analyst coverage (Diether, Malloy, and Scherbina 2002), industry concentration (Hou and Robinson 2006), and firm age (Pastor and Veronesi 2002).

Next, we address the question whether the hedge returns reflect pricing anomalies identified in prior research. We consider four well documented anomalies: price momentum (Jegadeesh and Titman 2003), asset growth (Fairfield, Whisenant and Yohn 2003), book-to-market ratio (Fama and French 1992) and accruals (Sloan 1996). Momentum is measured as the cumulative stock return from month *t*–12 to month *t*–2, where *t* is the month in which hedge returns begin to accumulate; asset growth is measured as the natural logarithm of the assets at fiscal year-end divided by assets at the previous fiscal year-end; the book-to-market ratio is measured as the natural logarithm of the ratio of equity book value divided by market capitalization; finally, accruals (*ACC*) are used to capture the accrual anomaly. We follow a double sorting approach as, for example, in Landsman, Miller, Peasnell, and Yeh (2011). For each year, we group firms in three portfolios based on the magnitude of each of these factors. Then we rank the firms in each of the portfolios on the respective earnings quality measure. We pool firms in the top and bottom quartiles over the three portfolios and over all years and calculate the hedge returns for these portfolios. Table 9 presents the results. Most of them are qualitatively similar to our main results in Table 6, which suggests that these anomalies are not driving our results. We also control for the potential interaction with size, measured by the natural logarithm of market capitalization, triple-sorting firms for each year first by size, then by one anomaly variable, and finally by the earnings quality measures. Untabulated results are analogous.

[Table 9]

In further untabulated tests, we double-sort firms based on trading volume of the stock, using share turnover (logarithm of the number of shares traded divided by the number of shares outstanding during the year) as proxy. In addition, double-sorting based on illiquidity, using the annual of daily absolute stock return per dollar trading volume (Amihud 2002) averaged over the fiscal year corresponding to the earnings quality measure yields similar results. We also perform the analysis after excluding penny stocks (stock price less than one dollar); the results are essentially unchanged.

We check whether an explanation for our results could be differences between profit and loss firms. For example, Balakrishnan, Bartov, and Faurel (2010) argue that investors may not fully understand the different persistence of loss earnings. We split the sample in firms with positive and negative earnings (*NIBE*) and find (in untabulated results) that the hedge returns for the profitable firms are similar to those for the full sample, but that the hedge returns are higher, although less significant (due to the lower subsample size), for the unprofitable firms. We also double-sort firms based on profitability (following, e.g., Fama and French 2008), using the ratio of equity income over equity book value as a measure of profitability and find qualitatively similar results.

Overall, these tests suggest that hedge returns are not likely to be driven by common pricing anomalies.

Our findings might be explained by investors not fully understanding the quality of earnings because high-quality firms appear to be underpriced whereas low-quality firms appear to be overpriced. To corroborate this explanation we extend the time horizon for earning hedge returns. For example, Landsman, Miller, Peasnell, and Yeh (2011) argue that mispricing is more a short-term effect and should diminish over time, whereas model errors are likely to be stable. We therefore calculate two-year and three-year hedge returns and find (untabulated) that hedge returns do not significantly diminish over time.[19] The only notable difference is that three-year hedge returns become highest for accruals quality (EQ6). These findings do not support the mispricing explanation of excess returns under the assumption that investors learn about the

[19] One explanation could be that, as noted later, the hedge returns for a 12-month earlier window are larger, so there would be a decrease for longer windows.

effect of earnings quality. However, one reason for a persistence of the hedge returns may be that they are not large (in the order of annual 3%), so that it would be too costly to actually trade on them.[20]

5.3. Further sensitivity tests

We run a number of sensitivity tests to assess the robustness of our results. First, we check if alternative specifications of the measures we use provide different results. We compute the returns in the market-based measures for 15-month windows rather than 12-month windows (beginning three months after the fiscal year-end). Furthermore, we repeat the analysis with 30 percent top and bottom portfolios instead of 25 percent. Since raw data on cash flows from operations are not available for the early periods, we calculate the *CFO* following the literature indirectly by adjusting net income for changes in certain balance sheet items. Alternatively, we use the reported cash flows from operations for the periods for which they are available. In all of these tests, we find no qualitatively different results. To address potential concerns that the results are driven by the period for which we collect data,[21] we run the tests with shorter periods of the last 15 years (1993 to 2007) and the last ten years (1998 to 2007) and find results that are qualitatively similar to those reported in Table 6 for the 20 years. We also check whether there are non-monotonic relationships between the earnings quality measures and hedge returns. To do so, we run the analyses for portfolios formed of the extreme 40 percent and middle 40 percent of firms. We do not find significant results.

The hedging strategy we employ is a one-year hold strategy beginning three months after fiscal year-end because we focus on an implementable strategy. However, contemporaneous returns may be better in capturing systematic risk. We modify the accumulation period from months t–8 to t+3, that is, when the financial statements are assumed to become available.

---

[20] Note, however, that our portfolios include quartiles of firms. Taking deciles instead increases the hedge returns.

[21] See, e.g., Core, Guay, and Verdi (2008) who find significant differences for different periods.

Untabulated results indicate that the hedge returns for the significant returns (for EQ5 to EQ8) are higher by the order of 1-2%, but the hedge returns remain insignificant for EQ1 to EQ4, so that the ranking of the EQ measures is basically unchanged.

To investigate the possibility that the significance of the results is affected by cross-correlated returns we examine mean excess returns aggregated by year following Mashruwala, Rajgopal, and Shevlin (2006) and treat them as a single observation for each year. This yields 20 observations for each earnings quality measure. Table 10, Panel A reports the results. Due to the low number of observations a Wilcoxon signed rank test is used instead of a t-test. Again, the results are similar to those in Table 6, with earnings response coefficients (EQ7 and EQ9) yield the highest hedge returns, albeit in different order. The main deviation from earlier results is that the residual-form persistence measure (EQ1) yields a significantly positive hedge return.

[Table 10]

We also study the association between excess returns and the sets of EQ measures. We consider five groups of measures: time-series measures (EQ1, EQ2); smoothness measures (EQ3, EQ4); accruals measures (EQ5, EQ6); accounting-based measures (EQ1 to EQ6); and market-based measures (EQ7, EQ8). For each year we rank firms in deciles corresponding to each measure, then we obtain the index as the average rank across the measures considered. An analogous approach to aggregating different earnings attributes is used, for example, by Bhattacharya, Daouk, and Welker (2003) to derive an earnings opacity measure. The results, which are reported in Table 10, Panel B show that trading on the accruals and value relevance measures yields positive and significant hedge returns. The market-based measures yield higher hedge returns than the accounting-based measures. The results are consistent with those obtained using the individual measures.

Finally, we examine how the EQ measures interact with one another in the determination of excess returns. This potentially helps to gain insights on the different signs of hedge returns obtained for accounting-based and market-based measures. To do so, we again take a double sorting approach. For each pair of measures *i* and *j* and for each year, we first group firms in four portfolios based on *i*, then we rank the firms in each of the quartile portfolios based on *j*, and we pool all observations together to compute hedge returns corresponding to *j*. The results in Table 10, Panel C are generally consistent with the signs and the significance levels of the hedge returns corresponding to accruals measures (EQ5 and EQ6) and market-based measures (EQ7 and EQ8) documented in the main analysis. The significance levels decline with an increase in the correlation between pairs of measures. Furthermore, when controlling for the accounting-based measures, the hedge returns corresponding to market-based measures maintain the signs and significance levels obtained without the double sorting; the same is true for accounting-based measures, when controlling for market-based measures. The results suggest that possible interactions among the EQ measures do not affect our main findings.

6. Summary

Earnings quality has been used extensively in empirical studies on the effects of accounting standards and other institutional changes. It is also at the heart of the objective of standard setters such as the FASB and the IASB. Despite its importance, there is little guidance on which measures are better proxies for "real" earnings quality. This paper contributes to a better understanding of the performance of earnings quality measures using their ability to explain excess returns as the ranking criterion. We study eight different measures: six accounting-based measures (persistence, predictability, two measures of smoothness, abnormal accruals, and accruals quality) and two market-based measures (earnings response coefficient and value relevance). Different from prior literature on the capital market consequences, such as cost of capital, of earnings quality, we examine the hedge returns that can be earned by trading portfolios selected on the measures. Hedge returns capture many effects of earnings quality, including the cost of capital. We argue that a measure is relatively more useful or "better" than another measure if a hedge portfolio yields a higher return.

We hypothesize that hedge returns are higher for market-based measures than for the accounting-based measures and higher for accruals measures than for other accounting-based measures. The second hypothesis is that positive hedge returns obtain from going long in high-quality firms and short in low-quality firms. We test the hypotheses for a large sample of U.S. firms over a twenty-year period from 1988 to 2007. Our findings are largely consistent with the hypotheses. We find that market-based measures are generally associated with higher hedge returns than accounting-based measures. Portfolios based on accruals measures yield significantly higher high hedge returns than those based on the other accounting-based measures. Persistence, predictability, and smoothness measures do not yield significant hedge returns.

For our market-based measures, we find that going long in high-quality firms and short in low-quality firms yields significant positive hedge returns. In contrast, positive hedge returns obtain for going long in firms with high accruals measures, which are commonly considered as low-quality firms. Under the assumption that the prevailing explanation for excess returns is the same for all measures, these results suggest that high abnormal or unexpected accruals are more consistent with high earnings quality than with earnings management that reduces the quality of earnings.

Although we emphasize the difficulty to identify reasons for the existence of excess returns, we perform additional tests to rule out some possible explanations. In particular, the cost of capital estimation does not seem to be a major reason for our results, nor are well documented accounting anomalies. A potential explanation that we cannot rule out is that investors do not fully understand and appreciate earnings quality. Finally, we perform sensitivity tests and find that these results are robust to changes in the specifications of the empirical study.

Our results open avenues for further research. Our hypotheses are relatively broad and we do not specifically design tests to exploit more precise predictions. Another avenue for further research is to study subsamples for which the variations are more pronounced or to single out certain changes in a factor that is predicted to change earnings quality and study the impact on the earnings quality measures. Another extension is to examine more explicitly potential explanations for the existence of excess returns. However, it is likely that several sources jointly determine excess returns. For example, event studies may shed more light on the information content of earnings announcements and also on potential unexpected returns explanations for excess returns. Other market variables, such as trading volume and bid-ask spreads, or the analysis of analysts' forecasts can provide further insights. Despite many possible extensions and refinements, this paper documents systematic and robust effects of earnings quality measures and contributes to better understanding and interpreting earnings quality measures and the relationships between them.

Literature

Aboody, D., J. Hughes, and J. Liu (2005): Earnings Quality, Insider Trading, and Cost of Capital, *Journal of Accounting Research* 43: 651-673.

Amihud, Y. (2002): Illiquidity and Stock Returns: Cross-Section and Time-Series Effects, *Journal of Financial Markets* 5: 31-56.

Balakrishnan, K., E. Bartov, and L. Faurel (2010): Post Loss/Profit Announcement Drift, *Journal of Accounting and Economics* 50: 20-41.

Barry, C., and S. Brown (1985): Differential Information and Security Market Equilibrium, *Journal of Financial and Quantitative Analysis* 20: 407-422.

Barth, M.E., Y. Konchitchki, and W.R. Landsman (2010): Cost of Capital and Earnings Transparency, Working paper, June.

Bartov, E., S. Radhakrishnan, and I. Krinksy (2000): Investor Sophistication and Patterns in Stock Returns after Earnings Announcements, *The Accounting Review* 75: 43-63.

Bhattacharya, U., H. Daouk, and M. Walker (2003): The World Price of Earnings Opacity, *The Accounting Review* 78: 641-678.

Bebchuk, L, A. Cohen, and A. Ferrell (2009): What Matters in Corporate Governance?, *Review of Financial Studies* 22: 783-827.

Burgstahler, D., and E. Chuk (2010): Earnings Precision and the Relations Between Earnings and Returns, Working Paper, October.

Carhart, M. (1997): On Persistence in Mutual Fund Performance, *Journal of Finance* 52: 57-82.

Chen, L., D. Dhaliwal, and A. Trombley (2008): The Effect of Fundamental Risk on the Market Pricing of Accruals Quality, *Journal of Accounting*, *Auditing and Finance* 23: 471-492.

Christensen, P.O., G.A. Feltham, and F. Şabac (2005): A Contracting Perspective on Earnings Quality', *Journal of Accounting and Economics* 39: 265-294.

Christensen, P.O., H. Frimor, and F. Şabac (2009): Earnings Quality and Earnings Management, Working paper, April.

Christensen, P.O., L.E. de la Rosa, and G.A. Feltham (2010): Information and the Cost of Capital: An Ex-Ante Perspective, *The Accounting Review* 85: 817-848.

Core, J.E., W.R. Guay, and R. Verdi (2008): Is Accruals Quality a Priced Risk Factor?, *Journal of Accounting and Economics* 46: 2-22.

Dechow, P.M., and I.D. Dichev (2002): The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors, *The Accounting Review* 77: 35-59.

Dechow, P.M., W. Ge, and K.M. Schrand (2010): Understanding Earnings Quality: A Review of the Proxies, Their Determinants and Their Consequences, *Journal of Accounting and Economics* 50: 344-401.

Dechow, P.M., and K.M. Schrand (2004): *Earnings Quality*, Charlotteville, VA.

Dechow, P., R. Sloan, and A. Sweeney (1995): Detecting Earnings Management, *The Accounting Review* 70: 193-225.

Diether, K., C. Malloy, and A. Scherbina (2002): Differences of Opinion and the Cross Section of Stock Returns, *Journal of Finance* 46: 1325-1359.

Drymiotes, G., and T. Hemmer (2011): On the Stewardship and Valuation Implications of Accrual Accounting Systems, Working paper, May.

Easley, D., and M. O'Hara (2004): Information and the cost of capital, *Journal of Finance* 59: 1553-1583.

Ecker, F., J. Francis, I. Kim, P.M. Olsson, and K. Schipper (2006): A Returns-Based Representation of Earnings Quality, *The Accounting Review* 81: 749-780.

Ewert, R., and A. Wagenhofer (2011): Earnings Quality Metrics and What They Measure, Working paper, August.

Fairfield, P. M., S. Whisenant, and T. Lombardi Yohn (2003): Accrued Earnings and Growth: Implications for Future Profitability and Market Mispricing, *The Accounting Review* 78: 353–371.

Fama, E., and K. French (1992): The Cross-Section of Expected Stock Returns, *Journal of Finance* 47: 427–465.

Fama, E., and K. French (1993): Common Risk Factors in the Returns on Bonds and Stocks, *Journal of Financial Economics* 33: 3-56.

Fama, E., and K. French (2008): Dissecting Anomalies, *Journal of Finance* 63: 1653-1678.

FASB (2010): Statement of Financial Accounting Concepts No. 8, Norwalk, CT, September.

Francis, J., R. LaFond, P.M. Olsson, and K. Schipper (2004): Costs of Equity and Earnings Attributes, *The Accounting Review* 79: 967-1010.

Francis, J., R. LaFond, P. Olsson, and K. Schipper (2005): The Market Pricing of Accruals Quality, *Journal of Accounting and Economics* 39: 295-327.

Francis, J., P. Olsson, and K. Schipper (2006): Earnings Quality, *Foundations and Trends in Accounting* 1: 259-340.

Garfinkel, J., and J. Sokobin (2006): Volume, Opinion Divergence, and Returns: A Study of Post-Earnings Announcement Drift, *Journal of Accounting Research* 44: 85-112.

Gerakos, J., and A. Kovrijnykh (2011): Reporting Bias and Economic Shocks, Working paper, February.

Gompers, P., J. Ishii, and A. Metrick (2003): Corporate Governance and Equity Prices, *Quarterly Journal of Economics* 118: 107-155.

Gow, I.D., G. Ormazabal, and D.J. Taylor (2010): Correcting for Cross-Sectional and Time-Series Dependence in Accounting Research, *The Accounting Review* 85, 483-512.

Gunny, K., J. Jacob, and B.N. Jorgensen (2009): Earnings Attributes of Alternate Annual Reporting Periods, Working paper, March.

Hirshleifer, D., S.S. Lim, and S.H. Teoh (2010): Limited Investor Attention and Stock Market Misreactions to Accounting Information, Working paper, November.

Holthausen, R.W., and R.L. Watts (2001): The Relevance of the Value-relevance Literature for Financial Accounting Standard Setting. *Journal of Accounting and Economics* 31: 3-75.

Hou, K., and D.T. Robinson (2006): Industry Concentration and Average Stocks Returns, *Journal of Finance* 61: 1927-1956.

Hughes, J.S., Jing Liu, and Jun Liu (2007): Information Asymmetry, Diversification, and Cost of Capital, *The Accounting Review* 82: 705-729.

Jegadeesh, N., and S. Titman (1993): Returns To Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *Journal of Finance* 48: 65-91.

Jones, J. (1991): Earnings Management during Import Relief Investigations, *Journal of Accounting Research* 29: 193-228.

Kraft, A., A.J. Leone, and C. Wasley (2006): An Analysis of the Theories and Explanations Offered for the Mispricing of Accruals and Accrual Components, *Journal of Accounting Research*44: 297-339.

Lambert, R.A., C. Leuz, and R.E. Verrecchia (2007): Accounting Information, Disclosure, and the Cost of Capital, *Journal of Accounting Research* 45: 385-420.

Landsman, W.R., B.L. Miller, K. Peasnell, and S. Yeh (2011): Do Investors Understand *Really* Dirty Surplus?, *The Accounting Review* 86: 237-258.

Marinovic, I. (2010): Internal Control System, Earnings Quality and Restatements, Working paper, September.

Mashruwala, C., and S. Mashruwala (2011): The Pricing of Accruals Quality: January versus the Rest of the Year, *The Accounting Review* 86: 1349-1381.

Mashruwala, C., S. Rajgopal, and T. Shevlin (2006): Why Is the Accrual Anomaly Not Arbitraged Away? The Role of Idiosyncratic Risk and Transaction Costs, *Journal of Accounting and Economics* 42: 3-33.

Ng, J. (2011): The Effect of Information Quality on Liquidity Risk, *Journal of Accounting and Economics* (forthcoming).

Ng, J., T. Rusticus, and R. Verdi (2008): Implications of Transaction Costs for the Post-Earnings Announcement Drift, *Journal of Accounting Research* 46: 661-696.

Ogneva, M. (2008): Accrual Quality and Expected Returns: The Importance of Controlling for Cash Flow Shocks, Working Paper, November.

Pastor, L., and P. Veronesi (2003): Stock Valuation and Learning About Profitability, *Journal of Finance* 58: 1749-1790.

Penman, S., and J. Zhu (2011): Accounting Anomalies, Risk and Return, Working Paper, May.

Richardson, S., I. Tuna, and P. Wysocki (2010): Accounting Anomalies and Fundamental Analysis: A Review of Recent Research Advances, *Journal of Accounting and Economics* 50: 410-454.

Schipper, K., and L. Vincent (2003): Earnings Quality, *Accounting Horizons* 17, Supplement: 97-110.

Sloan, R.G. (1996): Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings?, *The Accounting Review* 71: 289-315.

Tucker, J.W., and P.A. Zarowin (2006): Does Income Smoothing Improve Earnings Informativeness?, *The Accounting Review* 81: 251-270.

Wysocki, P.D. (2009): Assessing Earnings and Accruals Quality: U.S. and International Evidence, Working Paper, January.

Yee, K. (2006): Earnings Quality and the Equity Risk Premium: A Benchmark Model, *Contemporary Accounting Research* 23: 833-877.

Zhang, Q., C.X. Cai, and K. Keasey (2010): Information Risk and Transaction Costs: A Unified Test of Post Earnings Announcement Drift, Working paper, September.

Table 1: Definition of earnings quality measures

This table describes the earnings quality measures used. *NIBE*: net income before extraordinary items; *CFO*: cash flow from operations; *ACC*: total accruals; *CACC*: current accruals; *PPE*: property, plant and equipment; *ΔREV*: variation in revenues; *ΔAR*: variation in accounts receivable. All the aforementioned variables are scaled by total assets at the beginning of the period. *RET*: 12-month stock return ending three months after the end of the fiscal year; *P* is market price of equity.

The earnings quality measures are obtained from the residuals from the original variables on six innate factors, i.e. *Size*: natural logarithm of total assets; *Operating cycle*: natural logarithm of the sum of days accounts receivable and days inventory; *Intangible intensity*: reported R&D expense divided by sales; *Capital intensity*: net book value of property, plant and equipment divided by total assets; *Growth*: percentage change in sales; *Leverage*: total liabilities divided by equity book value.

The direction of effect is based on the prevailing interpretation of the association between the value of the measure and earnings quality. For example, larger EQ5 or EQ6 indicates lower earnings quality.

Measure	**Description**	**Definition**	**Direction of effect**
Time-series measures			
EQ1	Persistence	Slope coefficient β from $NIBE_{i,t} = \alpha + \beta NIBE_{i,t-1} + \varepsilon_{i,t}$	+
EQ2	Predictability	R^2 from $NIBE_{i,t} = \alpha + \beta NIBE_{i,t-1} + \varepsilon_{i,t}$	+
Smoothness measures			
EQ3	Smoothness	Standard deviation ratio $\sigma(NIBE)/\sigma(CFO)$	+
EQ4	Smoothness	Correlation $\rho(ACC, CFO)$	+
Accruals measures			
EQ5	Abnormal accruals	Absolute value of residual from $ACC_{i,t} = \alpha + \beta_1(\Delta REV_{i,t} - \Delta AR_{i,t}) + \beta_2 PPE_{i,t} + \varepsilon_{i,t}$	–
EQ6	Accruals quality	Standard deviation of residual $\varepsilon_{i,t}$ of $CACC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t+1} + \varepsilon_{i,t}$	–
Value relevance measures			
EQ7	Earnings response coefficient (ERC)	Slope coefficient β from $RET_{i,t} = \alpha + \beta\, NIBE_{i,t}/P_{i,t} + \varepsilon_{i,t}$	+
EQ8	Value relevance	R^2 from $RET_{i,t} = \alpha + \beta\, NIBE_{i,t}/P_{i,t} + \varepsilon_{i,t}$	+

Table 2: Descriptive statistics of main variables

This table reports the mean, the standard deviation, the 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th} percentile for the main variables used. The sample period spans from 1988 to 2007 and it corresponds to 26,684 firm-year observations for which all the earnings quality measures considered can be computed. *NIBE*: net income before extraordinary items; *CFO*: cash flow from operations; *ACC*: total accruals; *CACC*: current accruals; *PPE*: property, plant and equipment; *ΔREV*: variation in revenues; *ΔAR*: variation in accounts receivable. All the aforementioned variables are scaled by total assets at the beginning of the period. *Size*: natural logarithm of total assets; *Operating cycle*: natural logarithm of the sum of days accounts receivable and days inventory; *Intangible intensity*: reported R&D expense divided by sales (R&D expense is set equal to zero when missing); *Capital intensity*: net book value of property, plant and equipment divided by total assets; *Growth*: percentage change in sales; *Leverage*: total liabilities divided by equity book value.

	Mean	*Std. Dev.*	*10%*	*25%*	*50%*	*75%*	*90%*
NIBE	0.0381	0.1291	-0.0488	0.0123	0.0467	0.0848	0.1319
CFO	0.0753	0.1417	-0.0359	0.0354	0.0844	0.1338	0.1910
ACC	-0.0371	0.0917	-0.1207	-0.0758	-0.0403	-0.0044	0.0469
CACC	0.0115	0.0885	-0.0629	-0.0208	0.0059	0.0388	0.0888
PPE	0.3681	0.2589	0.0930	0.1756	0.3047	0.5077	0.7547
ΔREV	-0.0029	0.0858	-0.0676	-0.0231	0.0000	0.0209	0.0587
ΔAR	-0.0161	0.5404	-0.3133	-0.1105	0.0000	0.1040	0.2695
Size	6.0669	2.1092	3.2671	4.4947	6.0044	7.6273	8.9647
Oper. cycle	4.7812	0.6454	4.0463	4.4531	4.8315	5.1830	5.5005
Intang. int.	0.0360	0.1546	0.0000	0.0000	0.0003	0.0336	0.0929
Capital int.	0.3391	0.2228	0.0884	0.1657	0.2866	0.4682	0.6972
Growth	0.0913	0.2720	-0.1162	-0.0109	0.0623	0.1557	0.3038
Leverage	1.4053	2.6436	0.2638	0.5473	1.1194	1.9112	3.0285

Table 3: Descriptive statistics of earnings quality measures

The table reports the mean, the standard deviation, the 10th, 25th, 50th, 75th and 90th percentiles for the 16 earnings quality measures. Descriptions of the measures are given in Table 1.

	Mean	*Std. Dev.*	*10%*	*25%*	*50%*	*75%*	*90%*
$EQ1^{Raw}$	0.3602	0.3649	-0.1038	0.1265	0.3793	0.5990	0.7755
$EQ2^{Raw}$	0.2327	0.2249	0.0063	0.0411	0.1629	0.3720	0.5739
$EQ3^{Raw}$	0.7284	0.3762	0.2944	0.4475	0.6842	0.9500	1.1970
$EQ4^{Raw}$	-0.6664	0.3334	-0.9658	-0.9150	-0.7850	-0.5270	-0.1682
$EQ5^{Raw}$	0.0416	0.0510	0.0039	0.0105	0.0255	0.0537	0.0977
$EQ6^{Raw}$	0.0416	0.0336	0.0110	0.0191	0.0322	0.0532	0.0842
$EQ7^{Raw}$	2.4794	5.4473	-1.8971	-0.0014	1.5159	4.1480	8.3164
$EQ8^{Raw}$	0.1737	0.1863	0.0045	0.0271	0.1074	0.2629	0.4527
EQ1	0.0486	0.3490	-0.4025	-0.1924	0.0495	0.2915	0.4954
EQ2	0.1134	0.1356	0.0023	0.0138	0.0604	0.1660	0.3060
EQ3	0.6619	0.3518	0.2819	0.4129	0.6120	0.8479	1.0802
EQ4	-0.7301	0.2847	-0.9690	-0.9273	-0.8285	-0.6344	-0.3567
EQ5	0.0313	0.0364	0.0031	0.0084	0.0204	0.0412	0.0715
EQ6	0.0262	0.0199	0.0077	0.0127	0.0208	0.0335	0.0520
EQ7	2.5578	7.2123	-3.1493	-0.4178	1.5451	4.7577	9.6683
EQ8	0.1551	0.1733	0.0032	0.0213	0.0899	0.2344	0.4144

Table 4: Cross-correlations of earnings quality measures

The table reports Pearson correlation coefficients among the 16 earnings quality measures. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	$EQ1^{Raw}$	$EQ2^{Raw}$	$EQ3^{Raw}$	$EQ4^{Raw}$	$EQ5^{Raw}$	$EQ6^{Raw}$	$EQ7^{Raw}$
$EQ2^{Raw}$	0.7472***						
$EQ3^{Raw}$	0.0813***	0.0511***					
$EQ4^{Raw}$	0.0626***	0.0383***	0.8402***				
$EQ5^{Raw}$	-0.0301***	-0.0388***	0.0179***	-0.0177***			
$EQ6^{Raw}$	-0.0916***	-0.1121***	0.4344***	0.3380***	0.4295***		
$EQ7^{Raw}$	0.0401***	0.0733***	-0.1318***	-0.1332***	-0.0545***	-0.1205***	
$EQ8^{Raw}$	-0.0430***	-0.0292***	-0.0607***	-0.0620***	0.0271***	0.0145**	0.3787***

	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7
EQ2	0.2138***						
EQ3	0.0420***	0.0332***					
EQ4	0.0324***	0.0399***	0.8201***				
EQ5	-0.0525***	-0.0070	-0.0231***	-0.0339***			
EQ6	-0.0349***	-0.0289***	0.4514***	0.3859***	0.3921***		
EQ7	0.0268***	0.0090	-0.0944***	-0.0937***	-0.0426***	-0.1080***	
EQ8	-0.0241***	-0.0274***	-0.044***	-0.0354***	0.0190***	0.0071	0.3181***

Table 5: Frequency of annual changes across the different quartiles of earnings quality measures

The table presents the frequency of annual changes across the different quartiles (denoted by *Q*) of the earnings quality measures. The columns of the table refer to the quartile changes (for example, -3*Q* indicates the shift of a firm from the highest quartile to the lowest quartile of an earnings quality measure).

	-3Q	*-2Q*	*-1Q*	*no change*	*+1Q*	*+2Q*	*+3Q*
EQ1	0.3731%	1.7970%	13.4451%	67.9890%	14.1528%	2.0543%	0.2273%
EQ2	0.9135%	4.2287%	17.0777%	55.9506%	16.7646%	4.1729%	0.9435%
EQ3	0.0300%	0.5318%	10.5159%	78.7794%	9.4523%	0.6047%	0.0386%
EQ4	0.0343%	0.4289%	10.9234%	78.1233%	9.8941%	0.5189%	0.0214%
EQ5	3.3581%	10.4473%	19.5179%	33.4949%	19.7667%	10.2029%	3.2594%
EQ6	0.0043%	0.0686%	6.3259%	87.8544%	5.6997%	0.1029%	0.0000%
EQ7	0.7377%	1.9042%	10.7990%	73.9246%	10.2672%	1.8270%	0.5618%
EQ8	0.6304%	3.0879%	15.8125%	61.3244%	15.3579%	3.1222%	0.7119%

Table 6: One-year hedge returns

The table presents one-year mean excess returns (as described in section 3.2) by earnings quality portfolio. *High EQ* refers to the top quartile portfolio of an earnings quality measure, *low EQ* to the bottom quartile portfolio. The hedge return is computed by going long in the high-EQ portfolio and short in the low-EQ portfolio. The return accumulation period starts three months after the end of the fiscal year and lasts 12 months. A *t*-test for the null hypothesis that the hedge return is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	High EQ	*Low EQ*	*Hedge return*	*t-statistic*
$EQ1^{Raw}$	-0.7046	2.1576	-2.8622	-3.1121***
$EQ2^{Raw}$	-1.2062	1.6288	-2.8350	-3.2031***
$EQ3^{Raw}$	1.3936	0.3647	1.0289	1.0616
$EQ4^{Raw}$	0.8206	0.3317	0.4889	0.5135
$EQ5^{Raw}$	1.7594	-0.5545	2.3138	2.4966**
$EQ6^{Raw}$	1.3536	-0.4963	1.8499	1.9459*
$EQ7^{Raw}$	1.5865	-0.8897	2.4763	2.8970***
$EQ8^{Raw}$	1.6131	-0.5559	2.1690	2.4472**
EQ1	0.8507	-0.2641	1.1147	1.2403
EQ2	0.1848	0.6045	-0.4197	-0.4578
EQ3	1.3158	0.6213	0.6945	0.7418
EQ4	0.9595	0.4084	0.5511	0.5929
EQ5	1.8214	-0.9378	2.7592	2.9026***
EQ6	2.0648	-0.8560	2.9208	3.0584***
EQ7	2.3281	-0.8845	3.2125	3.6749***
EQ8	1.7877	-0.5774	2.3651	2.5429**

Table 7: Hedge returns differences across earnings quality measures

The table reports the difference in the absolute hedge returns of one-year hedge returns across the 16 earnings quality measures. Differences are calculated as absolute hedge return of the column EQ minus the absolute hedge return of the row EQ as reported in Table 6. Significance is computed by a *z*-test for the null hypothesis that the difference in hedge returns is zero, based on bootstrapped standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7
EQ2	0.6950						
EQ3	0.4202	-0.2748					
EQ4	0.5636	-0.1314	0.1434				
EQ5	-1.6445	-2.3395*	-2.0647	-2.2081**			
EQ6	-1.8061	-2.5011*	-2.2263**	-2.3697**	-0.1616		
EQ7	-2.0978*	-2.7928**	-2.518*	-2.6614*	-0.4533	-0.2917	
EQ8	-1.2504	-1.9454*	-1.6706	-1.8140*	0.3941	0.5557	0.8474

Table 8: Expected cost of equity capital by earnings quality portfolio

This table presents the average cost of equity capital (as described in section 3.2, we estimate the cost of equity capital with the four-factor model used in the computation of excess returns) by earnings quality portfolio. *High EQ* refers to the top quartile portfolio of an earnings quality measure, *low EQ* to the bottom quartile portfolio. The difference between the average cost of equity capital in the high-EQ and in the low-EQ portfolio is also presented. The return accumulation period starts three months after the end of the fiscal year and lasts 12 months. A *t*-test for the null hypothesis that the mean difference is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	High EQ	*Low EQ*	*Difference*	*t-statistic*
EQ1	12.3749	12.4887	-0.1138	-0.4040
EQ2	12.6480	12.6079	0.0401	0.1438
EQ3	12.9245	12.3468	0.5777	2.0079**
EQ4	12.9749	12.3360	0.6389	2.2285**
EQ5	12.5472	12.4339	0.1133	0.3942
EQ6	12.5998	12.1703	0.4294	1.4936
EQ7	12.0861	12.5729	-0.4869	-1.7553*
EQ8	12.6540	12.6407	0.0132	0.0470

Table 9: Controlling for pricing anomalies

This table presents one-year hedge returns (as described in section 3.2) by earnings quality portfolio. For each fiscal year, firms are first assigned to three portfolios based on the magnitude of momentum (return from month t–12 to month t–2), asset growth (natural logarithm of the ratio of total assets at the end of the period divided by total assets in the previous period), book to market ratio (denoted by *BTM* and defined as the natural logarithm of the ratio of equity book value divided by market capitalization) and accruals (the value of *ACC*). Within each anomaly portfolio firms are assigned to the earnings quality portfolios. *High EQ* refers to the top quartile portfolio of an earnings quality measure, *low EQ* to the bottom quartile portfolio. The hedge return is computed by going long in the high-EQ portfolio and short in the low-EQ portfolio. The return accumulation period starts three months after the end of the fiscal year and lasts 12 months. A t-test for the null hypothesis that the hedge return is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	Momentum	*Growth*	*BTM*	*Accruals*
EQ1	0.9254	1.3393	1.4063	0.9963
EQ2	-0.7511	-0.1632	-0.0277	-0.2234
EQ3	0.6925	0.2281	1.0109	0.7092
EQ4	0.5388	0.2604	0.5592	-0.2526
EQ5	2.5842***	2.1730**	2.6190***	1.7914*
EQ6	3.1060***	2.1254**	3.0474***	2.7377***
EQ7	3.2147***	3.2188***	3.6640***	3.3406***
EQ8	2.6290***	2.3202**	2.1626**	2.2915**

Table 10: Sensitivity tests

Panel A – Hedge returns aggregated by year

Panel A presents one-year mean excess returns (as described in section 3.2) by earnings quality portfolio. Each year is here treated as a single observation: the means and the tests are therefore computed over 20 observations. *High EQ* refers to the top quartile portfolio of an earnings quality measure, *low EQ* to the bottom quartile portfolio. The hedge return is computed by going long in the high-EQ portfolio and short in the low-EQ portfolio. The return accumulation period starts three months after the end of the fiscal year and lasts 12 months. A Wilcoxon signed rank test for the null hypothesis that the median hedge return is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	High EQ	*Low EQ*	*Hedge return*	*Wilcoxon-z*
EQ1	2.1061	-0.1402	2.2463	3.9199***
EQ2	1.3394	1.3176	0.0217	-1.6800
EQ3	1.8969	1.8469	0.0500	0.6347
EQ4	1.6699	1.4318	0.2381	1.1200
EQ5	2.1808	0.6786	1.5022	2.4266**
EQ6	2.9032	0.2976	2.6056	2.4640**
EQ7	3.6471	-0.3065	3.9536	3.9199***
EQ8	2.3763	1.1702	1.2061	2.9119***

Panel B – Hedge returns by sets of earnings quality measures

Panel B presents one-year mean excess returns (as described in section 3.2) by portfolios constructed on the four sets of earnings quality measures. For each year and summary measure, we first rank firms in ten deciles and we then obtain the index as the average rank across a set of measures. *High EQ* refers to the top quartile portfolio of an earnings quality index, *low EQ* to the bottom quartile portfolio. The first column indicates the measures used to compute each index. The hedge return is computed by going long in the high-EQ portfolio and short in the low-EQ portfolio. The return accumulation period starts three months after the end of the fiscal year and lasts 12 months. A *t*-test for the null hypothesis that the hedge return is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	High EQ	*Low EQ*	*Hedge return*	*t-statistic*
EQ1-2	1.2742	0.1742	1.1001	1.1689
EQ3-4	1.3063	0.5851	0.7212	0.7045
EQ5-6	1.8066	-1.0568	2.8634	2.7967***
EQ1-6	0.7978	0.5566	0.2412	0.2818
EQ7-8	2.7806	-0.1956	2.9762	3.0888***

Panel C – Controlling for the interaction between earnings quality measures

Panel C reports one-year hedge returns (as described in section 3.2) obtained after controlling for the interaction between pairs of earnings quality measure. Specifically, for each pair of measures *i* and *j* and for each year, we first group firms in four portfolios based on *i*, then we rank the firms in quartile portfolios based on *j*; we pool all observations together and we compute hedge returns as the mean difference between excess returns in the top and in the bottom quartile portfolios of *j*. The columns indicate the measures by which firms are sorted first; the rows show the measures for which hedge returns are then computed. A *t*-test for the null hypothesis that the hedge return is zero is reported. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

	EQ1	EQ2	EQ3	EQ4	EQ5	EQ6	EQ7	EQ8
EQ1	-	0.8820	0.7772	0.6153	1.3185	1.0755	0.9286	1.4486
EQ2	-0.4005	-	-0.1771	-0.2122	-0.2393	-0.3730	0.0836	-0.2752
EQ3	0.3392	0.7881	-	-0.5074	0.6445	-0.6665	1.1558	0.9118
EQ4	-0.0310	0.5131	0.2676	-	0.4892	-0.0021	1.2113	0.5655
EQ5	3.0429***	2.8306***	2.5285***	2.3845**	-	1.1938	2.7460***	2.6429***
EQ6	3.0885***	2.8946***	2.4568***	2.1698**	1.6593*	-	3.5343***	3.1521***
EQ7	3.2609***	3.1176***	3.1884***	3.3900***	3.5468***	3.4349***	-	2.0941**
EQ8	2.3608**	2.5154***	2.3463**	2.2114**	2.2220**	1.8353**	0.5927	-