Comparison of Abnormal Accrual Estimation Procedures in the Context of Investor Mispricing

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Abstract

Existing research provides a number of different procedures for estimating abnormal accruals. Using variations of the Jones (1991) model and the Dechow-Dichev (2002) model, we estimate abnormal accruals using 22 models. Also, based on procedures employed in existing research, we identify three dichotomous choices for measuring accruals and two dichotomous choices for estimating the regression model. In combination, these alternatives result in a total of 704 abnormal accrual estimation procedures (i.e., 22 abnormal accrual models for 32 (= 2^5) accrual measurement/regression approach combinations). For each of these estimation procedures, we measure the relation between current abnormal accruals and future abnormal returns to identify a 'best' approach in modeling abnormal accruals in the context of investor mispricing. Currently, there is no clear consensus in the literature as to which abnormal accrual estimation procedure is best. With so many alternatives available, a large-scale comparison is warranted.

We find that about half of the estimation procedures provide evidence consistent with investor mispricing of abnormal accruals. In general, we find greater evidence of investor mispricing when abnormal accrual estimation procedures 1) use total accruals rather than working capital accruals as the dependent variable, 2) measure accruals from the statement of cash flows rather than the balance sheet, 3) scale accruals by average total assets rather than beginning total assets, 4) estimate the regression model by-firm rather than cross-sectionally within industry, and 5) include an intercept in the regression model rather than exclude it. The abnormal accrual estimation procedure that produces the greatest evidence of mispricing involves a firm-specific regression (including an intercept) of total accruals, as measured from the statement of cash flows and scaled by average total assets, on current operating cash flows. This simple procedure for estimating abnormal accruals has not been employed in previous research. We call for future research to investigate whether this model performs well in other settings.

Our paper contributes to the literature by demonstrating that alternative measures and regression procedures are important in evaluating the performance of specific abnormal accruals models in the context of mispricing. Our empirical findings provide guidelines for researchers in estimating abnormal accruals if mispricing is an important element in their investigation. We identify a best-performing model to detect mispricing, which should be of interest to investors, regulators and researchers.

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1. Introduction

Abnormal (or discretionary) accruals have been used by numerous accounting studies in various research contexts, especially in the earnings management literature.[1] Currently, there is no clear consensus among researchers as to the "best" procedure for estimating abnormal accruals. Existing studies provide so many different alternatives for estimating abnormal accruals that comparing results across studies is difficult. As we will demonstrate in this paper, not only do researchers differ as to the choice of the abnormal accrual model (e.g. Jones' model and its variations), they also differ as to the measures of accruals (e.g. total accruals or working capital accruals) and regression approaches to estimate the model (e.g. by firm or cross-sectionally within industry). These differences may be unimportant as long as they result in similar statistical significance for an investigation. However, if they do not result in similar conclusions, then understanding differences in abnormal accrual estimation procedures has importance. To illustrate, Sloan (1996) documents mispricing of accruals by investors, and Xie (2001) shows that this mispricing is attributable primarily to the abnormal component of accruals. Desai, Rajgopal, and Venkatachalam (2004), however, find no evidence of the mispricing of abnormal accruals once controlling for operating cash flows. One explanation for their results is that managing accruals does not have a significant adverse effect on stock prices. An alternative explanation is that abnormal accruals are mispriced by the market but the abnormal accrual

[1] Prior research has used the terms "abnormal" or "discretionary" accruals to label the difference between reported and expected accruals. In this paper, we use the term "abnormal" as it is less suggestive as to whether unusual accruals arise from intentional versus unintentional actions of managers.

estimation procedure chosen by Desai, Rajgopal, and Venkatachalam (2004) does not capture the portion of abnormal accruals that are mispriced.

Motivated by these mispricing studies, we propose to evaluate multiple measures of abnormal accruals in the context of mispricing. Abnormal accruals that are mispriced have greater economic significance than do abnormal accrual that are manipulated by managers but not mispriced by the market. It is the economic significance in the context of investor mispricing that we use to evaluate the 'best' abnormal accrual estimation procedure.[2] We do not claim that the abnormal accrual estimation procedure that best identifies mispricing necessarily best measures accruals used by managers to manipulate earnings. If managers manage earnings but the market ignores the managed accruals (i.e. does not misprice), then managed accruals do not have economic significance from the perspective of pricing stocks and would not be identified by our best models. We are interested in which estimation procedures discover the portion of accruals that has a significant economic impact on market prices. Abnormal accruals that lead to inefficient capital allocation will be the ones of most interest to investors, financial statement preparers, auditors, and standard setters. It should, therefore, be of interest to accounting researchers to identify which abnormal accrual estimation procedures produce evidence most consistent with investor mispricing.

In estimating abnormal accruals, prior research generally employs a regression of some accrual measure on independent variables perceived to capture the normal level of accruals. The residual from such a regression is used as the estimate of abnormal accruals. Researchers differ

[2] Alternative procedures to compare abnormal accrual models include simulations using rejection rate benchmarks (Dechow, Sloan, and Sweeney 1995; Kothari, Leone, and Wasley 2005), time-series patterns (Hansen 1996), contemporaneous relation with returns (Guay, Kothari, and Watts 1996), and ability to predict accruals (Thomas and Zhang 2000). Guay, Kothari, and Watts (1996) compare abnormal accrual models using the contemporaneous relation between returns and earnings under the assumption of market efficiency (p. 91). We relax the assumption of market efficiency.

on the choice of independent variables, the dependent variable, and the regression approach. Based on previous literature, we select 22 abnormal accrual models that differ as to the independent variables used in the regression. These independent variables include variables used by early studies (typically Jones or Modified Jones model) and variables used in more recent studies, such as operating performance and operating cash flows. Differences in the dependent variable in the abnormal accrual model relate to the use of 1) total accruals versus working capital accruals, 2) measuring accruals from the statement of cash flows versus the balance sheet, and 3) scaling variables by average total assets versus beginning total assets. Differences in regression approaches relate to 1) estimation by firm or cross-sectionally within industry and 2) including an intercept versus suppressing the intercept. The five dichotomous choices related to the measurement of accruals and the regression approach generate 32 (= 2^5) possible combinations for estimating a given abnormal accrual model. To be systematic, we apply all 32 combinations to the 22 abnormal accrual models identified. This results in a total of 704 abnormal accrual estimation procedures examined in the context of mispricing. With the literature providing so many alternatives for estimating abnormal accruals, a large-scale comparison is warranted and provides a benchmark for researchers to move forward in this area.

We find that not all abnormal accrual estimation procedures result in similar conclusions. Choices in accrual measurement and regression approach appear to incrementally affect the relation between current abnormal accruals and future abnormal returns. Specifically, the use of data from the statement of cash flows (as opposed to changes in balance sheet accounts) and estimation by firm (as opposed to cross-sectionally within industry) appear to be the two choices with the greatest impact. In addition, abnormal accrual models differ substantially in their ability to relate to future abnormal returns. Most of the estimation procedures provide evidence of a significant relation between abnormal accruals and future abnormal returns. However, only about one-half of the estimation procedures continue to show evidence of a significant relation when controlling for other factors. A surprising result is that of the 22 abnormal accrual models the simplest one produces the most evidence of investor mispricing, when combined with the appropriate regression approach. This same simple abnormal accrual model, however, is among the worst when combined with a suboptimal regression approach. This result highlights the need for researchers to be aware that differences in estimation procedures can produce different results and conclusions.

In the next section, we describe the different abnormal accrual models, accrual measurements, and regression approaches examined in this study. We also detail the tests of investor mispricing applied to the 704 estimation procedures. In section 3, we outline the sample and data, and section 4 reports results. Summary and conclusions are provided in section 5.

2. Research Design Choices

2.1. Models of Abnormal Accruals

Financial accounting researchers generally agree that accrual earnings afford a more accurate representation of the firm's current performance than do cash flows alone (Beaver 1989; Dechow 1994; Cheng, Liu and Schaefer 1996, Dechow, Kothari, and Watts 1998; Liu, Nissim, and Thomas 2002). However, accruals offer management the ability to opportunistically manipulate reported earnings (Watts and Zimmerman 1986; Healy and Wahlen 1999). Beyond intentional manipulation by management, accruals are also subject to estimation risk which makes them inherently more uncertain than are operating cash flows (Dechow and Dichev 2002). Misestimation of accruals by management, even if unintentional, creates noise in reported earnings (Healy 1996). Therefore, while earnings seek to better capture underlying economic events, the accrual component of earnings presents a challenge to financial statement users. Accruals that differ from their "normal" amount (i.e., abnormal accruals) may signal lower quality earnings and mislead financial statement users (Dechow, Sloan, and Sweeney 1996; Teoh, Welch, and Wong 1998a,b; Defond and Park 2001; Xie 2001). The task of financial statement users is to identify which accruals are abnormal.

Understanding the extent to which accruals deviate from their expected amount has received considerable attention by accounting researchers, and numerous estimation procedures have been proposed. The purpose of our paper is to compare these alternative procedures. Early studies attempt to measure the quality of accruals using simpler measures such as total accruals (e.g., Healy 1985) and the change in total accruals (e.g., DeAngelo 1986). More recent research attempts to estimate the firm's normal level of accruals by regressing accruals on certain financial variables expected to relate to normal accruals (e.g., change in revenues, operating earnings, operating cash flows, etc.). The residual from such a regression represents abnormal accruals. In this section, we discuss the different abnormal accrual estimation models to be employed in our analyses. Because of the large number of models employed in our analyses and because these models are generally well-understood by accounting researchers, our discussion is brief and we refer readers to the original papers for more detailed discussion. The abnormal accrual models examined in this study can be broadly classified as stemming from two studies: 1) those derived from the Jones (1991) model and 2) those derived from the Dechow-Dichev (2002) model.

Jones (1991) estimates normal accruals in year t ($NACC_t$) as a function of the change in revenues in year t (ΔREV_t) and property, plant, and equipment in year t (PPE_t). The model also includes the inverse of the scale (S) variable.[3]

$$NACC_t = f(\Delta REV_t, PPE_t, 1/S) \quad \text{(J1)}$$

We consider a form of the Jones model which does not allow for property, plant, and equipment to explain normal accruals. Excluding property, plant, and equipment may be more appropriate in estimating abnormal accruals from working capital.

$$NACC_t = f(\Delta REV_t, 1/S) \quad \text{(J2)}$$

Dechow, Sloan and Sweeney (1995) propose a modification to the Jones model (J1) by subtracting the change in receivables (ΔREC) from ΔREV.[4]

$$NACC_t = f(\Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(MJ1)}$$

Dropping PPE from the model, we test a variation of the modified Jones model.

$$NACC_t = f(\Delta REV_t - \Delta REC_t, 1/S) \quad \text{(MJ2)}$$

Kothari, Leone, and Wasley (2005) suggest that the modified Jones model can be improved upon by controlling for a firm's return on assets (ROA). In calculating normal accruals, we estimate abnormal accruals by including ROA in year t (KLW1) into the Jones model and the modified Jones model.

$$NACC_t = f(ROA_t, \Delta REV_t, PPE_t, 1/S) \quad \text{(KLW1 + J1)}$$

$$NACC_t = f(ROA_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(KLW1 + MJ1)}$$

[3] As will be discussed in the next section, the scale variable used in prior research has typically been either beginning total assets or average total assets. We will consider each of these. Researchers also differ on whether the model should be estimated cross-sectionally within industry or by firm, with or without an intercept, for total accruals or working capital accruals, or based on data from changes in balance sheet accounts or from the statement of cash flows. These choices will be discussed in the next section. In this section, we generically discuss models in terms of the variables to be used in calculating normal accruals.

[4] The model of Dechow, Sloan and Sweeney (1995) is commonly referred to as the modified Jones model.

As an alternative control for firm performance, Kothari, Leone, and Wasley (2005) suggest ROA in year t-1 (KLW2).

$$NACC_t = f(ROA_{t-1}, \Delta REV_t, PPE_t, 1/S) \qquad \text{(KLW2 + J1)}$$

$$NACC_t = f(ROA_{t-1}, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \qquad \text{(KLW2 + MJ1)}$$

Dechow and Dichev (2002) devise a model for calculating abnormal accruals based on the assumption that normal accruals will ultimately be realized as operating cash flows (OCF). They propose a model for estimating abnormal accruals which maps current accruals into operating cash flows for last year, the current year, and next year.

$$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1}) \qquad \text{(DD1)}$$

Note that the Dechow-Dichev model utilizes operating cash flows in year t+1 in estimating normal accruals. Our tests relate to evidence of investor mispricing. Since investors' current information set does not include operating cash flows in year t+1, they may not be able to estimate abnormal accruals this way. Because of this, there is a potential look-ahead bias of using operating cash in year t+1 in the estimation of normal accruals. To control for this, we exclude OCF_{t+1}.

$$NACC_t = f(OCF_{t-1}, OCF_t) \qquad \text{(DD2)}$$

We also consider a simpler model which uses using only OCF_t (DD3) and a longer times-series model of OCF in year t to t-2 (DD4).

$$NACC_t = f(OCF_t) \qquad \text{(DD3)}$$

$$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t) \qquad \text{(DD4)}$$

McNichols (2002) suggests that the Dechow-Dichev model and the modified Jones model be combined. We combine models J1 and MJ1 with the four variations of the Dechow-Dichev model, creating eight combined models.[5]

$$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1}, \Delta REV_t, PPE_t, 1/S) \quad \text{(DD1 + J1)}$$

$$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1}, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(DD1 + MJ1)}$$

$$NACC_t = f(OCF_{t-1}, OCF_t, \Delta REV_t, PPE_t, 1/S) \quad \text{(DD2 + J1)}$$

$$NACC_t = f(OCF_{t-1}, OCF_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(DD2 + MJ1)}$$

$$NACC_t = f(OCF_t, \Delta REV_t, PPE_t, 1/S) \quad \text{(DD3 + J1)}$$

$$NACC_t = f(OCF_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(DD3 + MJ1)}$$

$$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t, \Delta REV_t, PPE_t, 1/S) \quad \text{(DD4 + J1)}$$

$$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(DD4 + MJ1)}$$

The final cash flow models that we consider employ the Jones (J1) and modified Jones (MJ1) models and the *change* in OCF in year t (Kasznik 1999).

$$NACC_t = f(\Delta OCF_t, \Delta REV_t, PPE_t, 1/S) \quad \text{(DD5 + J1)}$$

$$NACC_t = f(\Delta OCF_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S) \quad \text{(DD5 + MJ1)}$$

Table 1, Panel A provides a summary of the 22 abnormal accrual models examined. For all of the models, NACC are estimated using regression analyses. Abnormal accruals are then estimated by subtracting normal accruals from reported accruals (i.e., the regression residual). However, not only has prior research relied on different models for estimating normal accruals, differences exist in which measure of accruals to use as the dependent variable and which regression approach to use to estimate the model. In the next sections, we discuss these differences.

[5] Rees, Gill, and Gore (1996) add current operating cash flows to the modified Jones model in calculating abnormal accruals, as in our model DD3+MJ1.

2.2. Measurement of Accruals

Three differences in prior research in measuring accruals for estimating abnormal accruals are the (1) use of total accruals versus working capital accruals, (2) use of accruals as reported on the statement of cash flows versus accruals estimated from changes in balance sheet accounts, and (3) scaling all variables by average total assets versus beginning total assets. Table 1, Panel B summarizes the accrual measurement choices.

There is reason to believe that each of these choices can affect results. First, total accruals will capture management manipulation or estimation error in both current and long-term accruals. Working capital accruals can only capture the effects in current amounts. Richardson, Sloan, Soliman, and Tuna (2004) find that estimation error of accruals is significant for both current and non-current assets and liabilities. Therefore, total accruals should provide a more comprehensive measure of abnormal accruals.

We expect data from the statement of cash flows (rather than the balance sheet) to better estimate actual abnormal accruals. Prior research shows numerous inaccuracies in the articulation of balance sheets accounts to reflect underlying cash flows. (Bahnson, Miller, and Budge 1996; Hribar and Collins 2002). If investors are misled by certain accruals, then the balance sheet approach is less likely to capture this effect (or capture it with noise).

Finally, it is common practice for researchers to scale regression variables to control for heteroskedasticity. The choice of scale variable (e.g., average versus beginning total assets) could have an effect. Since accruals occur throughout the period, average assets may provide a better measure of the magnitude of accruals relative to total assets at the time of their occurrence.

For high (low) growth firms, scaling by beginning total assets would likely inflate (deflate) the measure of accruals.

2.3. Regression Approaches

The two choices related to estimating the regression model that we examine include (1) estimation by firm versus cross-sectionally within industry and (2) inclusion versus exclusion of an intercept in the model. Table 1, Panel C summarizes the regression approaches.

Estimation by firm is likely to better capture underlying abnormal accruals than will estimation cross-sectionally within industry. While firms within an industry will generally have similar characteristics, accruals are likely to be somewhat idiosyncratic across firms. Forcing the estimation procedure to produce a cross-sectionally constant parameter will limit the ability of the model to allow for differences across firms. If the normal accrual generation process differs across firms, then coefficients in the abnormal accrual model will be biased toward zero. Related to this, we expect the presence of an intercept to improve performance of the model. Firms are likely to have a non-zero amount of normal accruals and allowing an intercept in the model will capture this amount. Forcing the average amount of accruals into slope coefficients could bias results.

Any combination of the three dichotomous accrual measurement choices from section 2.2 and two dichotomous regression approaches in this section can be employed by the researcher in estimating an abnormal accrual model. The 32 possible accrual measurement/regression approach combinations (= 2^5) intersected with the 22 abnormal accrual models discussed in section 2.1 provides the 704 estimation procedures considered in this paper.

2.4. Measuring the Relation between Current Abnormal Accruals and Future Abnormal Returns

The explicit purpose of our paper is to evaluate abnormal accrual models on the basis of their relation with future abnormal returns. To measure the relation between current abnormal accruals and future abnormal returns, we consider several tests. Basing conclusions on several tests provides the advantage of not over-relying on a single approach. Tests involving unobservable measures (i.e., abnormal accruals and abnormal returns) are inherently subject to estimation error and providing results across multiple approaches helps to alleviate some of this uncertainty. In addition, the different approaches employed can provide unique insights and therefore help in making stronger conclusions.

Our first test of investor mispricing involves a simple regression of abnormal returns in year t+1 on the decile rank of abnormal accruals in year t:

$$\textit{Abnormal Return}_{t+1} = \alpha + \beta_1(\textit{-Rank of Abnormal Accruals}_t) + \varepsilon_{t+1} \tag{1}$$

In each year, abnormal accruals are ranked evenly into deciles from 0 to 9. These ranks are divided by 9 to create a variable ranging from 0 to 1. We multiply the decile rank by -1 so that β_1 is expected to be positive. The coefficient is interpreted as the return to a zero-investment hedge portfolio, *assuming a linear relation across the deciles*. Thus, more positive values of β_1 imply greater mispricing identified by the estimation procedure. As the abnormal returns may not be linear across deciles, we also calculate the hedge portfolio abnormal returns by taking a long position in firms in the most negative abnormal accruals decile and a short position in firms in the most positive abnormal accruals decile:

$$\textit{Annual Hedge Abnormal Return}_{t+1} = \textit{Low Decile Return}_{t+1} - \textit{High Decile Return}_{t+1} \tag{2}$$

In interpreting the results of (1) and (2), an important caveat is that a significant relation with future abnormal returns may *not* be evidence of investor mispricing. The estimation procedures examined in this study may rank firms according to cross-sectional differences in risk, instead of identifying abnormal accruals that are mispriced by investors. Since firms with greater risk are expected to earn a higher rate of return, a relation between future abnormal returns could be found in the absence of investor mispricing. While we attempt to control for cross-sectional differences in risk by using risk-adjusted returns in our analyses, it is always the case that "other" risk factors may provide the explanation. Finding that abnormal accrual estimation procedures identify cross-sectional differences in risk is interesting in itself and may be useful in many research settings, but that is not the purpose of this paper. We are interested in identifying abnormal accruals which appear to relate to investors' inability to accurately understand the implication of current earnings for future earnings (i.e., earnings quality), causing securities to be temporarily mispriced. Therefore, we deem it important to determine whether results occur because of risk-based explanations or investor mispricing.

Bernard, Thomas and Wahlen (1997) propose two tests to disentangle whether the relation between an earnings variable in t and abnormal returns in t+1 is the results of cross-sectional differences in risk or investor mispricing. First, they suggest that anomalous returns from a hedge portfolio are more representative of investor mispricing when the annual return is consistently positive. A hedge portfolio that produces a positive return because of cross-sectional differences in risk will show variability in annual returns (i.e., some years will be positive while others will be negative). Therefore, we also examine the number of years that the hedge portfolio produces positive returns:

$$\textit{Years Hedge Positive}_{t+1} = \textit{Number of positive annual hedge abnormal returns}_{t+1} \quad (3)$$

Bernard, Thomas, and Wahlen (1997) further suggest that if anomalous results occur due to investor mispricing and this mispricing is related to an earnings-based anomaly, the abnormal returns should be concentrated around future earnings release dates. It is the release of future earnings when investors should realize any prior mispricing, and prices will correct. We consider the hedge portfolio announcement period return:

$$\textit{Hedge Annc. Return}_{t+1} = \textit{Low Decile Annc. Return}_{t+1} - \textit{High Decile Annc. Return}_{t+1} \quad (4)$$

The announcement period return is measured as the 12-day abnormal return, comprising of four three-day returns surrounding the quarterly earnings announcements. We examine the percentage of the hedge portfolio returns that occurs during the announcement dates. The announcement interval (i.e., twelve days) makes up approximately five percent of the annual interval. If the relation with returns in year t+1 is the result of an earnings-based anomaly, then the portion of abnormal returns occurring at the earnings announcement should be greater than five percent. If the anomalous results are risk-based, then abnormal returns are more likely to occur evenly throughout the period and not concentrate around earnings announcement dates.

We also consider the extent to which abnormal accruals relate to longer-term abnormal returns. If mispricing of abnormal accruals occurs in year t, then it is not likely that the mispricing will take several years to correct. It is more likely that any mispricing will primarily be corrected in the following year when earnings are released. For example, Stober (1992) finds that the Ou and Penman (1989) *Pr* trading strategy produces abnormal returns for up to 72 months. This result is more consistent with *Pr* proxying for the effects of unidentified risk factors. We determine whether abnormal accruals are related to longer-term returns by examining the hedge portfolio abnormal returns in years t+2 and t+3: [6]

$$\textit{Annual Hedge Abnormal Return}_{t+2} = \textit{Low Decile Return}_{t+2} - \textit{High Decile Return}_{t+2} \quad (5)$$

[6] We do not use these two tests to rank the performance of our abnormal accruals estimation procedures; however, we show results for these two tests to provide additional evidence on whether our estimation procedures are capturing cross-sectional differences in risk or mispricing.

$$\textit{Annual Hedge Abnormal Return}_{t+3} = \textit{Low Decile Return}_{t+3} - \textit{High Decile Return}_{t+3} \quad (6)$$

Finally, we consider the extent to which abnormal accruals relate to future abnormal returns, after controlling for other variables. If mispricing relates to abnormal accruals, then abnormal accruals should remain significantly related to future abnormal returns in the presence of other variables. We estimate the following model:

$$\textit{Annual Abnormal Return}_{t+1} = \alpha + \beta_1(\textit{-Rank of Abnormal Accrual}_t) + \beta_n \textit{Control}_{n,t} + \varepsilon_{t+1} \quad (7)$$

In our tests, we include three control variables: 1) operating cash flows-to-price ratio, 2) sales growth, and 3) book-to-market ratio. Each of these variables have been shown by prior research to explain future abnormal returns (e.g., Lakonishok, Shleifer, and Vishny 1994; Desai, Rajgopal, and Venkatachalam 2004).[7] Firms with higher operating cash flows-to-price, higher book-to-market ratios, and lower sales growth are labeled "value" stocks and have historically outperformed "glamour" stocks. Researchers differ on whether these findings relate to investor mispricing (e.g., Lakonishok, Shleifer, and Vishny 1994; La Porta, Lakonishok, Shleifer, and Vishny 1997; Dechow and Sloan 1997) or compensation for risk (Fama and French 1992, 1996; Doukas, Kim, and Pantzalis 2002). Desai, Rajgopal, and Venkatachalam (2004) report that the accrual anomaly persists after controlling for the book-to-market ratio and sales growth, but not after controlling for the operating cash flows-to-price ratio. They further show that this result holds for abnormal accruals. We determined the robustness of this result across our estimation procedures.

In summary, we are interested in the relation between current abnormal accruals and future abnormal returns. We examine this relation using seven tests. Each of these tests is performed for our 704 estimation procedures.

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[7] In additional tests, we also control for market beta. Results when including this additional control variable are very similar to those reported.

3. Data, Sample Procedures, and Descriptive Statistics

Our sample selection is similar to Desai, Rajgopal and Venkatachalam (2004). The sample includes all firm-year observations that have necessary financial data from Compustat and stock return data from CRSP. Since our analysis involves the comparison of accruals from the statement of cash flows versus the balance sheet and some of our models require two past years of operating cash flow data, our sample period begins in 1989.[8] Our financial data end in 2002. Since we require one year of future data for operating cash flows, our sample period ends in 2001. We exclude firms with SIC codes 6000-6999 and eliminate observations with negative book values and with sales less than 1 million. We adopt flexible sample composition, as we have many different abnormal accrual models and estimation procedures. We do, however, require the sample composition to be constant within each accrual measurement/regression approach combination. In other words, within each of the 32 accrual measurement/regression approach combinations, we require that a firm-year observation have necessary data to calculate all 22 abnormal accrual models. For balance sheet-based measures, we have approximately 44,200 observations with an average of 3,400 per year. For statement of cash flows-based measures, we have approximately 25,000 observations with an average of 1,900 per year.

In estimating total accruals, working capital accruals, and operating cash flows, we follow Desai, Rajgopal, and Venkatachalam (2004) for balance sheet information and Hribar and Collins (2002) for statement of cash flows information. Our balance sheet measures are calculated as (with Compustat data item numbers in parentheses):

1. Working capital accruals = (#4 - #1 - #5 + #34 + #71) = change in current assets - change in cash - change in current liabilities + change in short-term debt + change in taxes payable

[8] The first year of operating cash flow data is 1987.

2. Total accruals = working capital accruals - depreciation expense (#14)
3. Operating cash flows = operating income (#178) + depreciation expense (#14) - working capital accruals

Our statement of cash flows measures are calculated as:

1. Working capital accruals = - (#302 + #303 + #304 + #305 + #307) = - (increase in accounts receivable + increase in inventory - decrease in accounts payable - decrease in income taxes payable + increase in other current net assets)
2. Total accruals = income before extraordinary items (#18) - operating cash flows (#308-#124)
3. Operating cash flows = #308 - cash flows related to the extraordinary items (#124)

Return on assets (ROA) are measured as income before extraordinary items divided by beginning total assets. The control variables used in our studies are similar to those used in Desai, Rajgopal, and Venkatachalam (2004). Sales growth is the average of annual growth in sales over the previous three years; book-to-market ratio is the ratio of the fiscal year-end book value of equity to the market value at the end of the third month after fiscal year end; operating cash-flow-to-price ratio is the operating cash flows (estimated from balance sheet or reported from cash flow statement) over the market value at the end of the third month after fisical year-end. Year-ahead abnormal returns are calculated as the twelve-month buy-and-hold size-adjusted return beginning three months after the year end.[9], [10]

For each estimation of abnormal accruals, we calculate seven measures of the relation between current abnormal accruals and future abnormal returns in each year and then calculate the mean across the 13-year sample period. Descriptive statistics of the means for our seven measures are provided in Table 2. The distributions show variation across the 704 estimation

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[9] We use Eventus to generate size-adjusted return. Eventus uses the equally-weighted method to calculate size-portfolio returns. Many studies calculate returns beginning three months after fiscal year end. Our results are similar when we change the return calculation period to begin four months after the fiscal year end. Based on an untabulated analysis, we find that calculating returns thee months after the year end (instead of four months) results in a higher correlation with the return extending from the first quarter's earnings announcement through the fourth quarter's earnings announcement. We choose to use the return interval beginning three months after the fiscal year end to better align with the year-to-year announcement return.

[10] In the regression analyses, we winsorize size-adjusted returns greater than 225 percent. Less than 1 percent of our observations were winsorized. We do not winsorize for our hedge return analyses.

procedures. The first column reports the estimated coefficient from equation (1). As expected, the mean coefficient is positive (0.1071). In fact, all of the estimation procedures result in a positive relation with future abnormal returns, and 90.9 percent of the coefficients are significant at the .05 level. The hedge portfolio abnormal returns have a mean of 17.43 percent and are significant for 92.2 percent of the estimation procedures.[11] The mean number of years out of 13 that the hedge portfolio produces a positive return is 11.4. The fourth column in Table 2 shows that a substantial portion of the annual hedge portfolio abnormal returns occurs around earnings announcement dates. The hedge portfolio's average announcement period abnormal return of 3.92 percent is approximately 22.5 percent of the hedge portfolio's average annual abnormal return. Since the earnings announcement dates consist of approximately 5% of the annual interval, this result is consistent with a disproportionate correcting of prices around future earnings announcement dates.[12]

The annual hedge portfolio abnormal returns in years t+2 and t+3 are lower than that in year t+1. The mean annual hedge portfolio abnormal returns in years t+2 and t+3 are 8.49 percent and 1.29 percent, respectively. Only, 38.6 percent and 1.8 percent, respectively, are significantly positive. The lack of long-term abnormal returns to current abnormal accruals is consistent with investor mispricing in the current period being corrected in the next one to possibly two years. The final column reports the coefficient from equation (7). After controlling for book-to-market ratio, sales growth, and operating cash flows-to-price ratio, most of the estimation procedures result in a positive coefficient, although only 51.8 percent are significant.

[11] Comparison of the mean hedge portfolio abnormal return of 17.43 percent for test (2) and the mean coefficient of only .1071 from test (1) suggests that the abnormal returns across decile portfolios are not linear. However, test (1) produces only slightly less statistically significant evidence, as approximately the same percentage of observations are significant at the .05 level.

[12] Untabulated analysis reveals that nearly all (98.7 percent) of the estimation procedures have a ratio of announcement period abnormal returns to annual abnormal returns greater than five percent.

This result highlights the differences in conclusions that can be reached across alternative estimation procedures. In the next section, we provide detailed analyses to determine which of the estimation procedures provide greater evidence of a relation with future abnormal returns, distinguishing between investor mispricing and cross-sectional differences in risk, and which remain significant when controlling for other factors.

4. Results

In this section we first provide results of the accrual anomaly to establish consistency with prior research (Sloan 1996) and as a benchmark of whether alternative estimation procedures affect conclusions. We then analyze the effects of alternative accrual measurements and regression approaches (across abnormal accrual models) and the effects of alternative abnormal accrual models (across accrual measurements and regression approaches). Finally, we examine the interaction of abnormal accrual models, accrual measurements, and regression approaches to identify the estimation procedures that provide the most (and least) evidence of investor mispricing.

4.1. Accrual Anomaly

We begin by first examining the accrual anomaly. Sloan (1996) concludes that investors over-estimate the persistence of current accruals, leading to a negative relation between current accruals and future abnormal returns.[13] We examine the accrual anomaly for our sample of firms

[13] Zach (2003) provides a number of alternative measurement and sampling approaches to determine the robustness of the accrual anomaly. He finds that certain factors (e.g., mergers, divestitures, abnormal return calculation, return interval, and non-NYSE/AMEX firms) play a part in explaining the accrual anomaly. However, he concludes that "a substantial portion of it [the accrual anomaly] remains unexplained."

using (1) total accruals and (2) working capital accruals. Each accrual measure is calculated using data from (1) the statement of cash flows or (2) changes in balance sheet accounts.[14]

Table 3 provides results of our seven tests of the relation between current accruals and future abnormal returns. The average annual coefficient for test (1) is significantly positive, regardless of the measurement of accruals. The coefficient is slightly greater when using data from the statement of cash flows, consistent with findings in Hribar and Collins (2002). The next two columns provide abnormal returns to the hedge portfolio and the number of years (out of 13) that the hedge portfolio produces a positive abnormal return. Hedge portfolio abnormal returns are greater for total accruals. The greatest evidence of investor mispricing occurs for total accruals calculated using data from the statement of cash flows. The hedge portfolio for these accruals produces an average annual abnormal return of 23.58 percent and generates a positive return in all thirteen years.[15] As shown by the fourth column, the announcement period abnormal return for this hedge portfolio is 6.12 percent. Approximately 26 percent of annual abnormal return occurs during earnings announcements, which comprise approximately 5 percent of the annual interval.

The fifth and sixth columns report the relation between current accruals and abnormal returns in years t+2 and t+3. If predictable returns in t+1 are due to mispricing being corrected, then we would not expect to see a relation with longer-term returns. Such a relation would be more indicative of accruals proxying for cross-sectional differences in risk. In year t+2, the hedge portfolio returns are smaller than in year t+1 but still substantial. By year t+3, hedge

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[14] For this analysis, we scale accruals by average total assets. Conclusions are unaffected when scaling by beginning total assets.

[15] Our conclusions from Table 3 are similar to those in Sloan (1996), who uses total accruals from the balance sheet to measure the accrual anomaly. One difference in replicating his results is that our hedge portfolio abnormal return is approximately twice as great as his (our 20.1 percent versus his 11.2 percent). One explanation for this is the different time periods examined. He investigates the period 1962-1991, whereas we investigate 1989-2001. Untabulated results show that our abnormal return is 13.9 percent for the 1989-1991 period compared to 22.0 percent for the 1992-2001 period.

portfolio returns are close to zero. This result suggests that mispricing has been corrected by the end of the second year. The final column of Table 3 considers whether the accrual anomaly remains once controlling for other variables. We control for the book-to-market ratio, sales growth, and operating cash flows-to-price ratio. Consistent with results in Desai, Rajgopal, and Venkatachalam (2004), the accrual anomaly is subsumed by other factors. Untabulated results reveal that it is the operating cash flows-to-price ratio, rather than the book-to-market ratio or sales growth, that subsumes the accrual anomaly. In summary, we find similar evidence of investor mispricing across four alternative measures of accruals with some preference for total accruals as measured using the statement of cash flows. However, the accrual anomaly is subsumed by other variables, regardless of the measurement approach.

4.2. Alternative Accrual Measurements and Regression Approaches

In this section, we adjust reported accruals to derive abnormal accruals and consider whether alternative accrual measurements and regression model specifications affect conclusions regarding the relation between abnormal accruals and investor mispricing. As detailed earlier, we consider five dichotomous choices: (1) total accruals versus working capital accruals, (2) data from the statement of cash flows versus the balance sheet, (3) scaling by average versus beginning total assets, (4) estimation by firm versus cross-sectionally within industry, and (5) estimation with versus without an intercept. We estimate the incremental effects of these choices using the following model:

$$TEST_{m,a,r} = \alpha + \beta_1 TA_a + \beta_2 SCF_a + \beta_3 AVG_a + \beta_4 FIRM_r + \beta_5 INT_r + \varepsilon_{m,a,r} \qquad (8)$$

$TEST_{m,a,r}$ = measures from one of the seven tests used to examine the relation between current abnormal accruals and future abnormal returns for abnormal accrual model *m*, accrual measure *a*, and regression approach *r*. For example, the first model provides a regression of the average annual coefficients from test (1) on five indicator variables for the 704 estimation procedures. The second model provides a regression of the average annual hedge portfolio abnormal returns from test (2) on the five indicator variables, and so on. TA = 1 if the regression approach uses total accruals, 0 if working capital accruals. SCF = 1 if accruals are measured using the statement of cash flows, 0 if using the balance sheet. AVG = 1 if the scale variable is average total assets, 0 if beginning total assets. FIRM = 1 if firm-specific estimation, 0 if cross-sectional within industry estimation. INT = 1 if the regression approach includes an intercept, 0 if no intercept. Values of 1 for the indicator variables are expected to result in a greater relation between abnormal accruals and future abnormal returns and thus are expected to be positive.

Results are reported in Table 4. The five choices matter, as indicated by the significance of the indicator variables. The first column reports the incremental impact of the choices on the coefficient from test (1). Use of total accruals (TA), statement of cash flows (SCF), firm-specific estimation (FIRM), and with intercept (INT) significantly enhances the positive coefficient. The choice of scale variable (AVG) is positive but not significant.

For the annual hedge portfolio abnormal return in year t+1 and the number of positive annual hedge portfolio abnormal returns, all indicator variables are significantly positive. All but INT are significant for year t+1 earnings announcement abnormal returns. The final column shows that after controlling for other anomalies, the choices continue to have an impact on the relation between current abnormal accruals and year-ahead abnormal returns. AVG is positive but not significant. Recall that in Table 3, the accrual anomaly was subsumed by other variables. In Table 4, we find evidence that the extent to which abnormal accruals relate to future abnormal returns depends on choices made by the researcher. These results further reinforce the ability of alternative regression approaches to estimate abnormal accruals in the context of investor mispricing.

For the hedge portfolio returns in year t+2 and year t+3, TA is significantly positive and the other indicator variables are either insignificant or significantly negative. Recall that if the market misprices accruals, we should observe no (or at least lower) longer-term hedge portfolio abnormal returns. SCF and FIRM have negative coefficients for year t+2 hedge portfolio abnormal returns, but have the most positive coefficient for year t+1 hedge portfolio abnormal returns. This implies that these measures are helpful in identifying the abnormal accruals that were mispriced in year t.

The results in Table 4 suggest that, across abnormal accrual models, evidence of investor mispricing is greatest when researchers choose to measure accruals as total accruals from the statement of cash flows, scale by average total assets, and estimate firm-specific regression models with an intercept. In the next section, we examine which abnormal accrual models best identify investor mispricing.

4.3. Alternative Abnormal Accrual Models

As listed in Table 1 Panel A, we examine 22 abnormal accrual models. To summarize the results for 22 abnormal accrual models for seven tests of their relation with future abnormal returns, we do the following. Within each of the 32 accrual measurement/regression approach combinations we rank the abnormal accrual models from 1 (highest) to 22 (lowest) for each of the seven test measures. A rank of 1 (22) indicates that abnormal accrual model *m* has the most (least) positive test measure compared to all other abnormal accrual models for that accrual measurement/regression approach combination. The ranking of abnormal accrual models is then repeated for the other 31 accrual measurement/regression approach combinations. Therefore, each abnormal accrual model receives 32 rankings, one for each accrual measurement/regression approach combination. We average the 32 ranks and order the abnormal accrual models from high to low using their average rank. The abnormal accrual model with the highest rank is deemed to provide the most evidence of investor mispricing, across the accrual measurement/regression approach combinations. We implement this ranking of abnormal accrual models for each of our seven tests.

Results are reported in Table 5. Models are shown in the order of the average of the ranks of tests (1), (2), (3), (4), and (7). This provides an approximate sorting of the ability of abnormal accrual models to identify investor mispricing, with equal weight being given to the five tests most indicative of investor mispricing. Those models at the top (bottom) are more (less) indicative of investor mispricing. The reader can easily reorder the abnormal accrual models based on the rankings of any of the individual tests.

As reported in Table 5, the model that best associates current abnormal accruals with future abnormal returns is the Dechow-Dichev model (DD1) and its combinations with the modified Jones model (DD1+MJ1) and Jones model (DD1+J1). These are the top three models in terms of their rank decile coefficient with and without controlling for other factors, number of positive annual hedge portfolio abnormal returns, and announcement period abnormal returns. These models rank first, second, and fifth, respectively, for the average hedge portfolio abnormal return in year t+1. The ranks for these three models are much higher for hedge portfolio abnormal returns in years t+2 and t+3 (i.e., tests (5) and (6)). While the DD1 models result in the greatest evidence of investor mispricing, they may also suffer from look-ahead bias since operating cash flows in year t+1 is used in the estimation of abnormal accruals. Investors do not know year t+1 operating cash flows in year t and therefore may not be able to calculate abnormal accruals in the same way. More importantly, managers do not know perfectly the firm's future cash flows, and abnormal accruals based on the DD1 models will capture managers' estimation errors due to uncertainty. For earnings management studies that are interested in measuring managers' abnormal accruals, the DD1 model may contain larger errors. Of the models that do not include t+1 information to estimate abnormal accruals, the three showing the greatest evidence of mispricing are the modified Jones model (MJ1), the modified Jones model excluding property, plant and equipment (MJ2), and the Dechow-Dichev model which includes only operating cash flows in year t (DD3). For descriptive purposes, we also report in Table 6 actual amounts for each of the seven tests across the 22 abnormal accrual models.

4.4. Intersection of Abnormal Accrual Models, Accrual Measurements, and Regression Approaches

To this point, we have analyzed the separate effects of choices related to abnormal accrual models, accrual measurements, and regression approaches. In this section, we provide specific evidence as to which combination of these choices provides the greatest evidence of investor mispricing. We exclude the Dechow-Dichev models that include operating cash flows in year t+1 in the estimation of abnormal accruals (i.e., DD1 and its variations). Of the 608 possible estimation procedures (19 abnormal accrual models, 8 accrual measurements, and 4 regression approaches), we provide statistics for the 20 most significant based on the average of the ranks of tests (1), (2), (3), (4), and (7), as in Table 5.[16]

[16] When DD1 and its variations are included in the analyses, the DD1 model (or one of its variations) appears ten times in the top 20 performing combinations. These results are available from the authors upon request. The top performing DD1 combination finishes fourth best. The top three combinations are those shown in Table 7.

The results are reported in Table 7. A modification of the Dechow-Dichev model, which includes only operating cash flows in year t (DD3) or some variation of it, occurs 13 times in the most significant 20. The hedge portfolio produces positive abnormal returns consistently across years, and a significant portion of this return occurs during earnings announcements. The significance remains once controlling for other anomalies, and there does not appear to be a long-term relation with abnormal returns. Desai, Rajgopal, and Venkatachalam (2004) report that the operating cash flows-to-price ratio subsumes the relation between abnormal accruals and future abnormal returns (see their Table 9 Panel C). To test this, they employ the modified Jones model using total accrual data from the balance sheet scaled by average total assets. The modified Jones model is estimated cross-sectionally within industry and presumably with no intercept. Similar to their results, we find that when not controlling for the operating cash flows-to-price ratio, this model produces a significant relation between abnormal accruals and future abnormal returns ($t = 3.14$). Once we control for the operating cash flows-to-price ratio, these abnormal accruals are no longer significantly related to future abnormal returns ($t = 1.27$). Thus, we are able to replicate their conclusions, but as reported in Table 7 (and in Table 2), we find that these conclusions do not hold for many abnormal accrual estimation procedures.

The estimation procedures that are most significant are those using data from the statement of cash flows and firm-specific estimation. Inclusion of an intercept is also a fairly common characteristic among the best estimation procedures. The performance of the DD3 model is surprising. Recall that this model measures normal accruals as a function of a single variable – current operating cash flows. Abnormal accrual models examined in many previous research papers are more sophisticated in terms of using more than one variable (e.g., Jones model) and additional variables (e.g., DD3+MJ1). Our results suggest, however, that a simple model of the firm-specific relation between total accruals (from the statement of cash flows) and current operating cash flows produces the most consistent evidence of investor mispricing.

In Table 8, we examine the 20 least significant estimation procedures, based on the average rank of tests (1), (2), (3), (4), and (7). Here we find another interesting result. The DD3 model and its variations comprise eight of the 20 least significant estimation procedures. The three choices that these eight estimation procedures have in common are the use of accrual data from the balance sheet, scaling by beginning total assets, and cross-sectional estimation. The cross-sectional relation between accruals and operating cash flows provides no evidence of investor mispricing, whereas the results in Table 7 suggest that the firm-specific relation is superior. The results for the DD3 model in Tables 7 and 8 highlight the importance of understanding the interaction of the abnormal accrual model, accruals choices, and regression approaches. Another characteristic of the 20 least significant estimation procedures is the use of cross-sectional estimation for variations of the Dechow-Dichev model and the use of firm-specific estimation for models controlling for current operating earnings (i.e., KLW1+J1 and KLW1+MJ1). The relation between accruals and operating cash flows is better measured at the firm level, whereas the relation between accruals and current return on assets is better measured in the cross-section within industry.

To further summarize, we consider the performance of the regression approaches involving only cross-sectional estimation and abnormal accruals models (excluding those with t+1 variables) for two reasons. Many studies do not estimate firm-specific regressions due to data availability. In addition, the firm-specific regression employed in our study uses all available observations for a firm and this procedure is not implementable unless we assume stable coefficients.[17] This analysis of the cross-sectional approaches involves 304 estimation procedures (19 abnormal accrual models, 8 accrual measurements, and 2 regression approaches). Table 9 reports results of the 20 most significant cross-sectional regression approaches. The results are less suggestive of investor mispricing but still significant. DD3 no longer provides the best performing model, but is instead replaced by modified Jones model (MJ1). The DD3 model is still represented in the top 20 list, indicating that the superior performance of a simple model like DD3 in Table 7 is not due solely to a potential look-ahead bias of firm-specific models. Table 9 reveals that for the cross-sectional models the most common characteristic is the use of total accruals from the statement of cash flows.

For additional descriptive purposes, Table 10 provides a list of the most significant and least significant accrual measurement/regression approach combinations for each of the 22 abnormal accrual models. We identify the most and least significant accrual measurement/regression approach combinations in two ways: 1) the average of the ranks of tests (1), (2), (3), and (4) and 2) the rank of test (7). For all of the 'best' accrual measurement/regression approach combinations, the coefficient for test (7) is significant. This coefficient is not significant for any of the 'worst' combinations, other than for the DD1 model and its variations. The final column represents the percentage of accrual measurement/regression approach combinations within each abnormal accrual model that has an average annual coefficient from test (7) significant at the .05 level. The 32 accrual measurement/regression approach combinations are estimated for each abnormal accrual model. Thus, a reported percentage of, say, 50 percent would suggest that 16 of the 32 accrual measurement/regression

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[17] Due to data availability of cash flows (a total of 13 annual observations), we cannot conduct firm-specific regression based on up-to-date data for each year. If there is a look-ahead bias, the superior performance should be related to earlier years. A closer examination of the performance of our time-series model for earlier and latter years show us that this is not the case.

approach combinations produce a significant coefficient for test (7) for that abnormal accrual model. This table is provided as a reference to researchers to determine whether, for a given abnormal accrual model, their choice of accrual measurement/regression approach is the one most likely to find statistically significant evidence of mispricing.

5. Summary

To date, the literature has provided a multitude of approaches to estimating abnormal accruals. These approaches differ based on (1) which independent variables to include in a model of normal accruals, (2) which measure of accruals to use as the dependent variable, and (3) how to estimate the regression model. In our paper, we examine 22 abnormal accrual models, three dichotomous choices for measuring accruals, and two dichotomous choices for estimating the regression model. The choices for accrual measurement involve (1) total accruals versus working capital accruals, (2) accruals as measured from the statement of cash flows versus the balance sheet, and (3) accruals scaled by average total assets versus beginning total assets. The choices related to the regression approach involve (1) estimation by firm versus cross-sectionally within industry and (2) inclusion of an intercept versus no intercept. The five dichotomous choices for accrual measurement and regression approach result in 32 possible combinations for which to estimate a given abnormal accrual model. Combined with the 22 abnormal accrual models, we examine 704 (= 22 x 32) abnormal accrual estimation procedures in the context of investor mispricing. Our analyses of investor mispricing involve seven tests of the relation between a firm's current abnormal accruals and future abnormal returns. Each of these seven tests offers unique insights into investor mispricing, which provides the basis for more reliable conclusions.

Prior research has not provided such a comprehensive approach to investor mispricing across alternative abnormal accrual estimation procedures.

We find that conclusions regarding the mispricing of abnormal accruals are affected by the researcher's choice of abnormal accrual model, measurement of accrual, and regression approach. Only about one-half of the estimation procedures provide consistent evidence of the mispricing of abnormal accruals. We detail which estimation procedures provide the most and least evidence of mispricing in a variety settings.

This paper is motivated by the fact that a vast amount of research exists in this area and there is a need to provide comparison across a wide range of estimation procedures. In addition, prior research has provided conflicting results and an understanding of differences in estimation procedures may help to resolve these issues. Our decision to compare abnormal accrual estimation procedures in the context of investor mispricing will be meaningful to financial statement users, preparers, and standard setters. These parties are interested in identifying abnormal accruals, occurring intentionally because of management manipulation or unintentionally because of the inherent uncertainty with estimating accruals, that have a significant impact on stock prices. We do not claim necessarily to provide the best way to measure the accruals used by managers to manipulate earnings. Accruals that are managed but not mispriced are economically less important and will not be identified by our research design. We are interested in which accruals lead to mispriced securities.

Our paper contributes by providing a guideline for researchers in estimating abnormal accruals, especially if the researcher's interest relates to market pricing. We propose a new procedure for estimating abnormal accruals that has the potential to enhance our understanding of earnings management and market mispricing.

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Table 1. Summary of the abnormal accrual estimation procedures examined.

Panel A: Abnormal accrual models.[a]

Choices		Coding
1.	$NACC_t = f(\Delta REV_t, PPE_t, 1/S)$	(J1)
2.	$NACC_t = f(\Delta REV_t, 1/S)$	(J2)
3.	$NACC_t = f(\Delta REV_t - \Delta REC_t, PPE_t, 1/S)$	(MJ1)
4.	$NACC_t = f(\Delta REV_t - \Delta REC_t, 1/S)$	(MJ2)
5.	$NACC_t = f(ROA_t, \Delta REV_t, PPE_t, 1/S)$	(KLW1 + J1)
6.	$NACC_t = f(ROA_t, \Delta REV_t - \Delta REC_t, PPE_t, 1/S)$	(KLW1 + MJ1)
7.	$NACC_t = f(ROA_{t-1}, \Delta REV_t, PPE_t, 1/S)$	(KLW2 + J1)
8.	$NACC_t = f(ROA_{t-1}, \Delta REV_t - \Delta REC_t, PPE_t, 1/S)$	(KLW2 + MJ1)
9.	$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1})$	(DD1)
10.	$NACC_t = f(OCF_{t-1}, OCF_t)$	(DD2)
11.	$NACC_t = f(OCF_t)$	(DD3)
12.	$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t)$	(DD4)
13.	$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1}, \Delta REV_t, PPE_t, 1/S)$	(DD1 + J1)
14.	$NACC_t = f(OCF_{t-1}, OCF_t, OCF_{t+1}, \Delta REV_t – \Delta REC_t, PPE_t, 1/S)$	(DD1 + MJ1)
15.	$NACC_t = f(OCF_{t-1}, OCF_t, \Delta REV_t, PPE_t, 1/S)$	(DD2 + J1)
16.	$NACC_t = f(OCF_{t-1}, OCF_t, \Delta REV_t – \Delta REC_t, PPE_t, 1/S)$	(DD2 + MJ1)
17.	$NACC_t = f(OCF_t, \Delta REV_t, PPE_t, 1/S)$	(DD3 + J1)
18.	$NACC_t = f(OCF_t, \Delta REV_t – \Delta REC_t, PPE_t, 1/S)$	(DD3 + MJ1)
19.	$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t, \Delta REV_t, PPE_t, 1/S)$	(DD4 + J1)
20.	$NACC_t = f(OCF_{t-2}, OCF_{t-1}, OCF_t, \Delta REV_t – \Delta REC_t, PPE_t, 1/S)$	(DD4 + MJ1)
21.	$NACC_t = f(\Delta OCF_t, \Delta REV_t, PPE_t, 1/S)$	(DD5 + J1)
22.	$NACC_t = f(\Delta OCF_t, \Delta REV_t – \Delta REC_t, PPE_t, 1/S)$	(DD5 + MJ1)

(Table 1 continued on the next page)

Table 1 (continued). Summary of the abnormal accrual estimation procedures examined.

Panel B: Accrual measurements.[b]

Choices	Alternatives (coding)	
1. Accrual measure	Total Accruals (TA)	Working Capital Accruals (WC)
2. Source of accruals	Statement of Cash Flows (SCF)	Balance Sheet (BS)
3. Scale variable	Average Total Assets (AVG)	Beginning Total Assets (BEG)

Panel C: Regression approaches.[c]

Choices	Alternatives (coding)	
1. Parameter estimate	Firm-specific (FIRM)	Cross-sectional within industry (IND)
2. Include intercept	Yes (INT)	No (NOINT)

[a] Abnormal accruals are defined as reported accruals less normal accruals (NACC) as estimated by the model. REV = revenue, PPE = Property, plant, and equipment, S = scale variables (average or beginning total assets), REC = receivables, ROA = return on assets, and OCF = operating cash flows. Models with "J" are based on the Jones (1991) model, "MJ" on the modified Jones model (Dechow, Sloan and Sweeney 1995), "KLW" on the Kothari, Leone, and Wasley (2005) model, and "DD" on the Dechow-Dichev (2002) model.
[b] There are three dichotomous choices in measuring accruals, resulting in eight combinations.
[c] There are two dichotomous choices in regression approaches, resulting in four combinations. The 22 abnormal accrual models, eight accrual measurements, and four regression approaches result in a combination of 704 abnormal accrual estimation procedures.

Table 2. Descriptive statistics for tests of the relation between current abnormal accruals and future abnormal returns across estimation procedures (N=704).[a]

	Coef (1)[b]	Annual Hedge Abnormal $Return_{t+1}$ (2)[c]	Years Hedge Positive (3)[d]	Hedge Annc. $Return_{t+1}$ (4)[e]	Annual Hedge Abnormal $Return_{t+2}$ (5)[c]	Annual Hedge Abnormal $Return_{t+3}$ (6)[c]	Coef with Controls (7)[b]
Mean	0.1071	0.1743	11.3864	0.0392	0.0849	0.0129	0.0848
Std	0.0338	0.0435	1.1458	0.0132	0.0567	0.0410	0.0415
Minimum	0.0064	0.0579	7.0000	-0.0003	-0.1030	-0.1381	-0.0164
P10	0.0619	0.1194	10.0000	0.0231	0.0125	-0.0367	0.0348
P25	0.0851	0.1458	11.0000	0.0313	0.0462	-0.0111	0.0535
Median	0.1078	0.1720	11.0000	0.0384	0.0815	0.0130	0.0831
P75	0.1290	0.2023	12.0000	0.0477	0.1227	0.0378	0.1131
P90	0.1461	0.2313	13.0000	0.0568	0.1620	0.0611	0.1350
Maximum	0.2206	0.3243	13.0000	0.0798	0.2311	0.1622	0.2242
% significant at the .05 level	90.9	92.2	82.4	94.9	38.6	1.8	51.8

[a] The 704 estimation procedures consist of 22 abnormal accrual models, eight accrual measurements, and four regression approaches (see Table 1). For each estimation procedure, annual results for the period 1989-2001 are averaged.
[b] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[c] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[d] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[e] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 3. Relation between current accruals and year-ahead abnormal returns.[a]

	Coef (1)[b]	Annual Hedge Abnormal $Return_{t+1}$ (2)[c]	Years Hedge Positive (3)[d]	Hedge Annc. $Return_{t+1}$ (4)[e]	Annual Hedge Abnormal $Return_{t+2}$ (5)[c]	Annual Hedge Abnormal $Return_{t+3}$ (6)[c]	Coef with Controls (7)[b]
Total accruals from the:							
Balance Sheet	0.0979 (3.447)	.2010	11	.0479	.1784	-.0242	0.0491 (0.9046)
Cash Flow Stmt	0.1151 (4.580)	.2358	13	.0612	.2013	.0359	0.0831 (1.599)
Working capital accruals from the:							
Balance Sheet	0.0949 (3.784)	.1807	10	.0461	.1311	-.0365	0.0445 (0.870)
Cash Flow Stmt	0.1107 (6.077)	.1739	12	.0564	.0493	-.0094	0.0681 (1.415)

[a] Abnormal returns are measured as size-adjusted returns over the twelve-month period beginning three months after the fiscal year end. Accruals are measured as either total accruals or working capital accruals and are derived using either changes in balance sheet accounts or the statement of cash flows.
[b] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model. t-statistics based on the mean of the annual cross-sectional coefficients are reported in parentheses.
[c] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[d] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[e] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 4. Regressions of the relation between future abnormal returns and current abnormal accruals on indicator variables for alternative accrual measurements and regression approaches (N = 704).[a]

	Dependent Variables						
Independent Variables[b]:	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
Constant	0.0805*	0.1363*	10.8807*	0.0300*	0.1028*	0.0160*	0.0518*
TA	0.0048*	0.0136*	0.1648*	0.0042*	0.0324*	0.0176*	0.0065*
SCF	0.0218*	0.0256*	0.4091*	0.0026*	-0.0383*	-0.0085*	0.0224*
AVG	0.0024	0.0080*	0.1591*	0.0020*	0.0066	-0.0059*	0.0008
FIRM	0.0195*	0.0176*	0.3239*	0.0079*	-0.0286*	-0.0051	0.0302*
INT	0.0046*	0.0111*	0.0455	0.0019*	-0.0079*	-0.0044	0.0060*
R^2	0.1992	0.1775	0.0623	0.1353	0.2676	0.0689	0.2173

[a] Abnormal returns are measured as size-adjusted returns over the twelve-month period beginning three months after the fiscal year end. Abnormal accruals are measured using 22 abnormal accrual models across 32 combinations of five dichotomous accrual measurements/regression approaches, resulting in 704 estimation procedures.

[b] TA = 1 if the regression approach uses total accruals, 0 if working capital accruals. SCF = 1 if data are derived from the statement of cash flows, 0 if from the balance sheet. AVG = 1 if the scale variable is average total assets, 0 if beginning assets. FIRM = 1 if the regression is estimated by firm, 0 if cross-sectional by industry. INT = 1 if the regression model includes an intercept, 0 if no intercept. See Table 1.

[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.

[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.

[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.

[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

* Indicates that the coefficient is significant at the .05 level using a two-tailed t-test.

Table 5. Rank of the average performance of each abnormal accrual model within accrual measurement/regression approach combinations.[a]

Abnormal Accrual Model:[b]	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
DD1	1.0	1.0	1.0	2.0	3.0	8.5	1.0
DD1+MJ1	2.0	2.0	2.5	1.0	7.5	21.0	2.0
DD1+J1	3.0	5.0	2.5	3.0	11.0	20.0	3.0
MJ1	4.0	4.0	7.0	11.0	16.0	6.0	6.0
MJ2	6.0	3.0	5.0	7.0	9.0	5.0	11.0
DD3	8.0	6.0	9.0	4.0	2.0	10.0	9.0
DD3+MJ1	5.0	9.5	12.0	9.0	7.5	2.0	4.0
DD2+MJ1	9.0	12.5	14.0	8.0	6.0	11.0	7.0
DD2	15.0	12.5	11.0	6.0	4.0	3.0	12.0
KLW2+MJ1	10.0	7.5	4.0	17.0	18.0	15.0	19.0
J2	11.0	7.5	8.0	16.0	15.0	16.0	17.0
DD3+J1	7.0	20.0	16.0	12.0	13.0	4.0	5.0
DD5+MJ1	13.0	9.5	19.0	13.0	12.0	13.0	10.0
KLW1+MJ1	17.0	11.0	6.0	21.0	21.0	19.0	16.0
DD4+MJ1	12.0	18.0	18.0	10.0	5.0	8.5	14.0
DD2+J1	16.0	17.0	21.0	15.0	14.0	12.0	8.0
J1	14.0	14.0	15.0	19.0	19.0	14.0	15.0
DD4	22.0	19.0	20.0	5.0	1.0	1.0	20.0
DD5+J1	20.0	15.0	22.0	18.0	17.0	17.0	13.0
KLW2+J1	18.0	16.0	13.0	20.0	20.0	18.0	22.0
DD4+J1	19.0	22.0	17.0	14.0	10.0	7.0	18.0
KLW1+J1	21.0	21.0	10.0	22.0	22.0	22.0	21.0

[a] Within each of the 32 accrual measurement/regression approach combinations, abnormal accrual models are ranked from 1 (highest) to 22 (lowest) for each of the seven test measures. The accrual model's rank is then averaged across the 32 accrual measurement/regression approach combinations. Amounts shown are the ranks (from 1 to 22) of the average ranks within each test measure. The order of the models is based on the average rank of tests (1), (2), (3), (4), and (7).
[b] See Table 1 for model descriptions.
[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 6. Average relation between current abnormal accruals and future abnormal returns across accrual measurement/regression approach combinations.[a]

Abnormal Accrual Model:[b]	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
DD1	0.1596	0.2344	12.3438	0.0551	0.1273	0.0237	0.1529
DD1+MJ1	0.1453	0.2189	12.0000	0.0523	0.0982	-0.0056	0.1350
DD1+J1	0.1363	0.1957	11.9688	0.0502	0.0864	-0.0009	0.1261
MJ1	0.1137	0.1949	11.6250	0.0384	0.0721	0.0165	0.0819
MJ2	0.1097	0.1965	11.7500	0.0402	0.0913	0.0213	0.0768
DD3	0.1068	0.1857	11.4688	0.0453	0.1339	0.0217	0.0891
DD3+MJ1	0.1165	0.1781	11.3438	0.0428	0.1020	0.0344	0.0998
DD2+MJ1	0.1056	0.1712	11.1875	0.0417	0.1019	0.0145	0.0907
DD2	0.1021	0.1654	11.2813	0.0445	0.1193	0.0400	0.0861
KLW2+MJ1	0.1023	0.1824	11.7500	0.0334	0.0585	0.0007	0.0693
J2	0.1020	0.1803	11.6250	0.0347	0.0783	0.0075	0.0673
DD3+J1	0.1090	0.1584	11.0938	0.0396	0.0912	0.0314	0.0922
DD5+MJ1	0.0991	0.1699	11.0000	0.0375	0.0863	0.0088	0.0767
KLW1+MJ1	0.0897	0.1666	11.7813	0.0246	0.0230	-0.0066	0.0541
DD4+MJ1	0.1017	0.1603	10.9375	0.0397	0.1013	0.0213	0.0854
DD2+J1	0.0993	0.1543	10.7188	0.0389	0.0856	0.0109	0.0849
J1	0.1012	0.1694	11.1875	0.0328	0.0602	0.0020	0.0674
DD4	0.0946	0.1534	10.9063	0.0460	0.1292	0.0396	0.0780
DD5+J1	0.0916	0.1508	10.7500	0.0358	0.0626	0.0014	0.0694
KLW2+J1	0.0907	0.1588	11.3750	0.0287	0.0505	-0.0029	0.0564
DD4+J1	0.0952	0.1452	10.9688	0.0389	0.0907	0.0248	0.0794
KLW1+J1	0.0831	0.1443	11.4375	0.0218	0.0174	-0.0207	0.0464

[a] For each of the 32 accrual measurement/regression approach combinations, the relation with future abnormal returns is measured using the 22 abnormal accrual models. Amounts shown represent average relations across the 32 accrual measurement/regression approach combinations.
[b] See Table 1 for model descriptions.
[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 7. Average relation between current abnormal accruals and future abnormal returns for the most significant 20 estimation procedures, excluding abnormal accrual models that employ data in year t+1.[a]

Abnormal Accrual Model:[b]	Accrual Measurement/ Regression Approach:[b]	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
DD3	TA-SCF-AVG-FIRM-INT	0.2206	0.3243	13	0.0798	0.2095	0.0316	0.2242
DD3	TA-SCF-BEG-FIRM-INT	0.2058	0.2848	13	0.0769	0.2026	0.0782	0.2085
DD3+MJ1	TA-SCF-BEG-FIRM-INT	0.1813	0.3029	13	0.0725	0.1365	-0.0219	0.1781
DD3+J1	TA-SCF-BEG-FIRM-INT	0.1609	0.2822	13	0.0700	0.1405	0.0478	0.1572
DD4	TA-SCF-AVG-FIRM-INT	0.1880	0.2316	13	0.0796	0.1749	0.0329	0.1887
DD3+MJ1	WC-SCF-BEG-FIRM-INT	0.1730	0.2455	13	0.0570	0.1655	0.0477	0.1650
MJ2	TA-SCF-AVG-FIRM-INT	0.1525	0.2788	13	0.0583	0.1324	0.0497	0.1350
DD3+MJ1	WC-SCF-BEG-FIRM-NOINT	0.1685	0.2398	13	0.0546	0.1135	0.0539	0.1623
DD3+MJ1	TA-SCF-AVG-FIRM-INT	0.1621	0.2143	13	0.0687	0.1545	0.1327	0.1579
DD3+MJ1	WC-SCF-AVG-FIRM-NOINT	0.1740	0.2198	13	0.0563	0.1139	0.1073	0.1658
DD2+MJ1	TA-SCF-BEG-FIRM-INT	0.1500	0.2174	13	0.0666	0.0722	0.0997	0.1423
DD4+MJ1	TA-SCF-BEG-FIRM-INT	0.1431	0.2271	13	0.0595	0.0847	0.0791	0.1347
MJ2	TA-SCF-BEG-FIRM-INT	0.1360	0.2857	13	0.0576	0.1042	-0.0483	0.1182
DD3	WC-SCF-BEG-FIRM-INT	0.1766	0.2777	12	0.0620	0.1415	0.0930	0.1757
DD3+J1	WC-SCF-BEG-FIRM-INT	0.1615	0.2590	13	0.0462	0.1313	0.0156	0.1539
MJ1	TA-SCF-AVG-FIRM-INT	0.1372	0.2746	13	0.0509	0.1123	0.0168	0.1135
DD4	TA-SCF-BEG-FIRM-INT	0.1763	0.2141	12	0.0718	0.1495	0.1017	0.1744
DD3+MJ1	TA-SCF-AVG-FIRM-NOINT	0.1594	0.1919	13	0.0558	0.1388	0.0017	0.1529
DD3+MJ1	WC-BS-BEG-FIRM-INT	0.1420	0.2006	13	0.0516	0.1080	0.0549	0.1323
DD3	TA-BS-AVG-FIRM-INT	0.1435	0.2290	12	0.0597	0.1902	0.0610	0.1420

[a] The relation between current abnormal accruals and future abnormal returns is estimated separately across estimation procedures, excluding abnormal accrual models that employ data in year t+1 (i.e., DD1 models). This results in a total of 608 estimation procedures (19 abnormal accrual models, eight accrual measurements, and four regression approaches). Within each of the seven tests, estimation procedures are rank from 1 (high) to 608 (low) based on the reported amount. Amounts shown are the 20 estimation procedures with the highest average rank for tests (1), (2), (3), (4), and (7).

[b] See Table 1 for model descriptions, accrual measurements, and regression approaches.
[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 8. Average relation between current abnormal accruals and future abnormal returns for the least significant 20 estimation procedures, excluding abnormal accrual models that employ data in year t+1.[a]

Abnormal Accrual Model:[b]	Accrual Measurement/ Regression Approach:[b]	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
KLW1+J1	WC-SCF-AVG-FIRM-INT	0.0491	0.0579	9	-0.0003	-0.0198	-0.1381	0.0082
DD3+J1	WC-BS-BEG-IND-INT	0.0378	0.0934	8	0.0220	0.0564	0.0201	0.0193
DD3+MJ1	WC-BS-BEG-IND-INT	0.0276	0.0846	7	0.0246	0.0595	0.0406	0.0094
KLW1+MJ1	WC-SCF-AVG-FIRM-INT	0.0513	0.0873	10	0.0038	-0.0245	-0.0632	0.0124
DD3+J1	TA-BS-BEG-IND-NOINT	0.0469	0.0963	9	0.0222	0.1334	0.0122	0.0307
DD3+J1	WC-BS-BEG-IND-NOINT	0.0521	0.1108	9	0.0212	0.1044	-0.0386	0.0267
KLW1+J1	WC-SCF-BEG-FIRM-INT	0.0592	0.0937	10	0.0015	-0.0372	-0.1140	0.0248
KLW2+J1	WC-SCF-AVG-FIRM-INT	0.0519	0.1242	10	0.0044	0.0554	-0.0859	0.0142
DD3+J1	TA-BS-BEG-IND-INT	0.0575	0.1040	9	0.0229	0.1011	0.0521	0.0338
DD4	WC-BS-BEG-IND-NOINT	0.0341	0.1157	9	0.0298	0.1598	0.0327	0.0045
DD4+MJ1	WC-SCF-BEG-IND-INT	0.0571	0.0922	9	0.0227	0.0388	0.0555	0.0394
DD4+J1	WC-BS-BEG-IND-INT	0.0478	0.1028	8	0.0295	0.1301	0.0402	0.0304
DD3+MJ1	TA-BS-BEG-IND-NOINT	0.0486	0.1191	9	0.0268	0.1204	0.0229	0.0302
KLW2+J1	WC-BS-BEG-IND-INT	0.0704	0.1129	9	0.0170	0.0628	-0.0104	0.0348
DD4+MJ1	WC-BS-BEG-IND-INT	0.0459	0.1026	9	0.0314	0.1295	0.0333	0.0256
J1	TA-BS-BEG-IND-NOINT	0.0576	0.0831	10	0.0243	0.1292	0.0684	0.0275
DD3+MJ1	TA-BS-BEG-IND-INT	0.0476	0.1061	10	0.0268	0.1019	0.0581	0.0234
DD3+MJ1	WC-BS-BEG-IND-NOINT	0.0507	0.1224	10	0.0229	0.1064	-0.0118	0.0234
DD5+MJ1	WC-BS-BEG-IND-INT	0.0552	0.1315	8	0.0242	0.0637	0.0361	0.0309
DD4+MJ1	TA-BS-BEG-IND-INT	0.0538	0.1213	9	0.0272	0.1480	0.0530	0.0336

[a] The relation between current abnormal accruals and future abnormal returns is estimated separately across estimation procedures, excluding abnormal accrual models that employ data in year t+1 (i.e., DD1 models). This results in a total of 608 estimation procedures (19 abnormal accrual models, eight accrual measurements, and four regression approaches). Within each of the seven tests, estimation procedures are rank from 1 (high) to 608 (low) based on the reported amount. Amounts shown are the 20 estimation procedures with the lowest average rank for tests (1), (2), (3), (4), and (7).

[b] See Table 1 for model descriptions, accrual measurements, and regression approaches.
[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 9. Average relation between current abnormal accruals and future abnormal returns for the top 20 estimation procedures among cross-sectional analyses, excluding abnormal accrual models that employ data in year t+1.[a]

Abnormal Accrual Model:[b]	Accrual Measurement/ Regression Approach:[b]	Coef (1)[c]	Annual Hedge Abnormal $Return_{t+1}$ (2)[d]	Years Hedge Positive (3)[e]	Hedge Annc. $Return_{t+1}$ (4)[f]	Annual Hedge Abnormal $Return_{t+2}$ (5)[d]	Annual Hedge Abnormal $Return_{t+3}$ (6)[d]	Coef with Controls (7)[c]
MJ1	TA-SCF-AVG-IND-NOINT	0.1328	0.2481	13	0.0505	0.0570	0.0845	0.1082
J1	TA-SCF-AVG-IND-NOINT	0.1325	0.2416	13	0.0486	0.0634	0.0748	0.1092
KLW2+J1	TA-SCF-AVG-IND-NOINT	0.1278	0.2245	13	0.0463	0.0528	0.0513	0.1059
KLW2+MJ1	TA-SCF-AVG-IND-NOINT	0.1251	0.2306	13	0.0464	0.0650	0.0302	0.1013
KLW2+J1	TA-SCF-AVG-IND-INT	0.1244	0.2622	13	0.0447	0.0469	-0.0030	0.0977
J2	TA-SCF-AVG-IND-NOINT	0.1299	0.2530	12	0.0464	0.0758	0.0644	0.1090
DD4+J1	TA-SCF-BEG-IND-NOINT	0.1341	0.2041	13	0.0387	0.1205	0.0286	0.1144
DD3	WC-SCF-AVG-IND-INT	0.1293	0.1826	13	0.0488	0.0763	-0.0129	0.0971
KLW1+J1	TA-SCF-AVG-IND-NOINT	0.1454	0.2412	13	0.0350	0.0463	0.0530	0.1202
DD2+J1	TA-SCF-AVG-IND-NOINT	0.1345	0.2187	12	0.0419	0.1611	0.0429	0.1083
MJ1	WC-SCF-BEG-IND-INT	0.1488	0.2336	12	0.0388	-0.0018	0.0529	0.1096
KLW2+MJ1	TA-SCF-BEG-IND-NOINT	0.1285	0.2151	13	0.0386	0.0601	0.0390	0.1043
DD4+J1	TA-SCF-AVG-IND-NOINT	0.1157	0.2138	13	0.0455	0.1306	0.0076	0.0918
KLW1+MJ1	TA-SCF-AVG-IND-NOINT	0.1442	0.2307	12	0.0382	0.0398	0.0650	0.1184
MJ1	TA-SCF-BEG-IND-INT	0.1536	0.2504	12	0.0369	0.1074	0.1365	0.1115
DD5+J1	TA-SCF-BEG-IND-NOINT	0.1484	0.2222	12	0.0379	0.1058	0.0472	0.1231
J2	TA-SCF-AVG-IND-INT	0.1251	0.2376	12	0.0439	0.0743	-0.0129	0.0948
DD4+MJ1	TA-SCF-BEG-IND-NOINT	0.1222	0.1899	13	0.0408	0.1404	0.0066	0.1039
DD2+MJ1	TA-SCF-AVG-IND-NOINT	0.1316	0.2104	12	0.0406	0.1696	0.0447	0.1051
MJ2	WC-SCF-AVG-IND-INT	0.1245	0.1773	13	0.0456	0.0269	-0.0086	0.0906

[a] The relation between current abnormal accruals and future abnormal returns is estimated separately across estimation procedures, excluding abnormal accrual models that employ data in year t+1 (i.e., DD1 models) and estimated using firm-specific regressions (i.e., FIRM). This results in a total of 304 estimation procedures (19 abnormal accrual models, eight accrual measurements, and two regression approaches). Within each of the seven tests, estimation procedures are rank from 1 (high) to 304 (low) based on the reported amount. Amounts shown are the 20 estimation procedures with the highest average rank for tests (1), (2), (3), (4), and (7).

[b] See Table 1 for model descriptions, accrual measurements, and regression approaches.
[c] "Coef" represents the average annual coefficient in a regression of year-ahead abnormal returns on decile ranks of current abnormal accruals. Decile ranks are 0 to 9, scaled by 9 and multiplied by -1. "Coef with Controls" represents the coefficient on decile ranks of current abnormal accruals when book-to-market ratio, sales growth, and operating cash flows-to-price ratio are included in the model.
[d] Hedge portfolio abnormal returns in year t+1, t+2, and t+3 are calculated by taking a long (short) position in the lowest (highest) current abnormal accrual decile.
[e] This represents the number of years (out of a possible 13) that the hedge portfolio produced a positive abnormal return in year t+1.
[f] Announcement period abnormal returns are calculated as the twelve day abnormal returns, consisting of the four three-day periods surrounding earnings announcements in year t+1.

Table 10. The most and least significant accrual measurement/regression approach combinations for each abnormal accrual model.[a]

	Most significant accrual measurement/regression approach combination based on:		Least significant accrual measurement/regression approach combination based on:		
Abnormal Accrual Model	Average of the ranks of tests (1), (2), (3), and (4)[b]	Rank of test (7)[b]	Average of the ranks of tests (1), (2), (3), and (4)[b]	Rank of test (7)[b]	Test (7) %Sig[c]
1. J1	TA-SCF-BEG-FIRM-INT*	TA-SCF-AVG-IND-NOINT*	TA-BS-BEG-IND-NOINT	WC-BS-BEG-IND-NOINT	37.5
2. J2	TA-SCF-BEG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	15.6
3. MJ1	TA-SCF-AVG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-NOINT	62.5
4. MJ2	TA-SCF-AVG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	TA-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	37.5
5. KLW1+J1	TA-SCF-AVG-IND-NOINT*	TA-SCF-AVG-IND-NOINT*	WC-SCF-AVG-FIRM-INT	TA-SCF-AVG-FIRM-NOINT	12.5
6. KLW1+MJ1	TA-SCF-AVG-IND-NOINT*	TA-SCF-AVG-IND-NOINT*	WC-SCF-AVG-FIRM-INT	TA-SCF-BEG-FIRM-INT	12.5
7. KLW2+J1	TA-SCF-AVG-IND-INT*	TA-SCF-AVG-IND-NOINT*	WC-SCF-AVG-FIRM-INT	WC-SCF-AVG-FIRM-INT	18.8
8. KLW2+MJ1	TA-SCF-AVG-IND-NOINT*	TA-SCF-BEG-IND-NOINT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	34.4
9. DD1	WC-BS-BEG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	TA-SCF-BEG-IND-INT*	TA-SCF-BEG-IND-INT*	100.0
10. DD2	TA-SCF-AVG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-BS-BEG-IND-NOINT	WC-BS-BEG-IND-NOINT	50.0
11. DD3	TA-SCF-AVG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	34.4
12. DD4	TA-SCF-AVG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-BS-BEG-IND-NOINT	WC-BS-BEG-IND-NOINT	43.8
13. DD1+J1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-SCF-BEG-IND-INT*	TA-SCF-BEG-IND-INT*	100.0
14. DD1+MJ1	WC-BS-BEG-FIRM-INT*	WC-BS-AVG-FIRM-NOINT*	TA-SCF-BEG-IND-INT*	TA-SCF-BEG-IND-INT*	100.0
15. DD2+J1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-AVG-IND-NOINT	65.6
16. DD2+MJ1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-SCF-BEG-IND-INT	WC-BS-AVG-IND-NOINT	59.4
17. DD3+J1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	56.3
18. DD3+MJ1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	53.1
19. DD4+J1	TA-SCF-BEG-FIRM-INT*	TA-SCF-BEG-FIRM-INT*	WC-BS-BEG-IND-INT	WC-BS-AVG-IND-NOINT	62.5
20. DD4+MJ1	TA-SCF-BEG-FIRM-INT*	TA-SCF-AVG-FIRM-INT*	WC-SCF-BEG-IND-INT	WC-BS-AVG-IND-NOINT	62.5
21. DD5+J1	TA-SCF-BEG-IND-NOINT*	TA-SCF-BEG-IND-NOINT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	59.4
22. DD5+MJ1	TA-BS-BEG-FIRM-INT*	TA-SCF-BEG-IND-NOINT*	WC-BS-BEG-IND-INT	WC-BS-BEG-IND-INT	62.5

[a] See Table 1 for a description of the abnormal accrual models, accrual measurements, and regression approaches.
[b] Tests used to rank accrual measurement/regression approach combinations are described in Table 2.
[c] This column represents the percentage of accrual measurement/regression approach combinations within each abnormal accrual model with average annual coefficients from test (7) significant at the .05 level. The 32 accrual measurement/regression approach combinations are estimated for each abnormal accrual model. Thus, a reported percentage of, say, 50 percent would suggest that 16 of the 32 accrual measurement/regression approach combinations produce a significant coefficient for test (7) for that abnormal accrual model.
* The average annual coefficient for test (7) is significant at the .05 level using a two-tailed t-test.