Accrual reversals and cash conversion*

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Abstract

We estimate the firm-level rate at which working capital accruals convert into future cash flows. These conversion rates determine the expected cash value of a dollar of working capital accruals and can therefore be used to improve the comparability of accruals across firms. For firms whose accrual innovations reverse within one year, we find that, on average, a one dollar innovation to accruals translates into 95 cents of cash flow in the subsequent fiscal year. We find that the relation between working capital accruals and annual returns increases with the rate at which accrual innovations convert to cash flows. Moreover, when accrual innovations convert more quickly and completely to cash flows, firms are less likely to receive an Accounting and Auditing Enforcement Release (AAER) from the SEC.

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1. Introduction

When accountants include accruals in the calculation of earnings, there is an implicit notion that a dollar of accruals converts into a dollar of cash flows. We demonstrate, in the context of working capital accruals, that firms vary in this respect—a dollar of accruals can be worth more in some firms than in others. In absolute terms, a dollar of accruals can be worth more or less than a dollar of cash, depending on the firm's accounting policies, composition of accruals, estimation errors, and manipulation. For example, if a firm systematically over-estimates (under-estimates) the allowance for doubtful accounts, then a dollar of accounts receivable will convert, in expectation, into more (less) than a dollar of future cash flows. When the expected cash value of a dollar of accruals varies across firms, the simple addition of accruals and cash flows reduces the comparability of earnings.

We propose a methodology to estimate, at the firm-level, the expected cash value of a dollar of working capital accruals. These expected cash values can be used to adjust accruals to increase their comparability across firms. To estimate expected cash values, we leverage a mechanical property of accrual accounting: any accrual must eventually reverse, either by converting into cash flows or by being written off. As an example, consider accounts receivable. When a payment for a sale shifts from one financial reporting period to the subsequent period, this shift affects accruals in both periods by the same amount but with opposite signs. The accrual in the first period increases by the sale amount—an effect we term the "innovation." In the subsequent period, after the receivable is paid off (or written off), the accrual decreases by the amount of the sale—an effect we refer to as the "reversal."

From a statistical perspective, the mechanical relation between current innovations and subsequent reversals implies that working capital accruals follow a moving average process. If accrual innovations fully reverse in one year, then a single moving average term with a coefficient of negative one describes the reversal. Reversals that occur over multiple years can be described by multiple moving average terms whose coefficients sum to negative one.

We find that 73% of the firms in our sample have an estimated $MA(1)$ coefficient that is indistinguishable from negative one, which corresponds to accrual innovations fully reversing within one year. If we allow for multiple moving average terms (i.e., $MA(2)$ or $MA(3)$), we find that the sum of the estimated moving average coefficients converges to negative one for 95% of our sample. These results provide support for modeling firm-level accrual reversals as a moving average process.[1]

The moving average regression allows us to identify the unexpected portion of a period's accrual innovation—the accrual "shock"—as the regression residual.[2] These accrual shocks underpin our estimation of each firm's cash "conversion rate" (i.e., the expected cash value of a one dollar accrual innovation). For each firm, we regress future cash flows on the estimated accrual shocks and interpret the slope coefficient as the firm's conversion rate. We find that the distribution of our estimated conversion rates has significant mass close to one, indicating that, for the typical firm, accrual innovations almost fully convert into cash flows within one year. The estimated rate at which accrual innovations convert into cash flows is greater than one for some firms. Although this could be simply dismissed as estimation noise, we believe that the conversion rate can truly be greater than one for some firms. That is, a one dollar innovation to accruals converts into more than one dollar of cash flows within one year. Such a rate can occur when the firm is systematically unconditionally conservative in estimating future gains associated with the current assets.

We next examine whether accruals with high estimated conversion rates have stronger associations with returns than accruals with low estimated conversion rates. Consistent with our measure capturing the expected cash value of accruals, we find that the association between accruals and annual returns increases in the cash conversion rate. As a final step, we validate our cash conversion measure by examining whether it is associated with the likelihood that a firm receives an Accounting and Auditing Enforcement Release ("AAER"), which the Securities and Exchange Commission issues after concluding an investigation of misconduct. We explore this association under the intuition that a low conversion rate is indicative of poor financial reporting, which can include earnings management. We find that the rate at which a firm's accrual innovations convert

[1]These findings provide evidence that OLS regressions of accruals on firm fundamentals likely have negatively autocorrelated errors, thereby requiring a standard error adjustment.

[2]Unlike many previous studies (e.g. Jones (1991), Dechow and Dichev (2002)), we do not interpret these residuals as evidence of earnings management or "discretionary" accruals. In our framework, they arise naturally from unexpected timing differences between economic transactions and cash receipts or disbursals.

into cash flows is negatively associated with the likelihood that the firm receives an AAER. We further study the link between the *speed* of reversals and AAER issuances. Consistent with the possibility that slower reversals are the result of delayed write-offs, we find that AAERs are more likely for firms with slower reversal speeds.[3]

We contribute to the accounting literature along multiple dimensions. First, we explicitly model accruals as a stochastic process. Our approach allows us to distinguish between the current innovation and the reversal of the past innovation. We demonstrate, analytically and empirically, that accrual reversals can be captured using a moving average specification. For 95% of the firms in our sample, we find full reversal within three years.[4] Moreover, including the moving average term in the accrual regression doubles explanatory power as measured by Adjusted R^2. These findings contrast with the results of Allen, Larson, and Sloan (2013). They find that the reversal of accrual innovations is limited to "good" accruals, which they define as accruals predicted by the Dechow-Dichev model. At the same time, they find no evidence of reversals in accrual estimation errors, which represent half of the accrual volatility in their setting.

The cash conversion rate can replace traditional discretionary accrual measures in their role as proxies for accrual quality (e.g., Jones, 1991; Dechow and Dichev, 2002). A benefit of using the cash conversion rate as a measure of accrual quality is that it is not contaminated by operating volatility. The inability to separate accrual quality from operating volatility has been a major concern regarding the traditional measures (for example, McNichols, 2002; Kothari, Leone, and Wasley, 2005; Hribar and Nichols, 2007; Wysocki, 2009; Ball, 2013).

We also extend prior research that examines the time series structure of accruals, cash flows, and earnings. For example, Dechow, Kothari, and Watts (1998) propose a model that explains the serial and cross-correlations of accruals, cash flows, and earnings. In their model, sales follow a random

[3] Note that "speed" and "rate" are not synonymous in the context of our study. We use "speed" in reference to accrual reversals, where the reversal speed is defined by the number of years required for a complete reversal. We use "rate" in reference to cash conversion, where the conversion rate is defined as the expected cash value of a one dollar accrual innovation. In particular, a "complete reversal" does *not* imply that the accrual innovation fully converted into cash—it could have been written off.

[4] In a related study, Dechow, Hutton, Kim, and Sloan (2012) examine the timing of accrual reversals around AAER events.

walk, and shocks to sales are the only source of uncertainty. Similar to Jones (1991), they assume a deterministic relationship between sales and working capital.[5] This deterministic relationship, along with a random walk in sales, allows for a simple temporal structure in the three accounting series. We extend this approach by introducing another source of uncertainty. Specifically, we allow for innovations to working capital that represent timing differences. Timing differences occur when cash receipts or disbursals are temporally separated from associated economic transactions. To the extent such events are random, they represent an additional source of uncertainty. Such uncertainty breaks the deterministic link between sales and working capital.

In addition, we contribute to the literature on the temporal structure of accounting variables (e.g., Dechow, 1994). The motivations for this literature include the prediction of future cash flows and the analysis of why earnings outperform cash flows in predicting future cash flows. In the second stage of our analysis, we revisit the prediction of future cash flows and find that we improve the predictive ability of the model by including estimated shocks to working capital as a regressor.

Finally, it is worth relating our measure to the empirical result that accruals and cash flows are negatively correlated. Dechow (1994) attributes this negative correlation to the "natural" smoothing role of accruals. Subsequent research attributes cross-sectional variation in this correlation to earnings management and differences in accrual quality (for example, Leuz, Nanda, and Wysocki, 2003). In our model, the negative correlation arises naturally because shocks to working capital enter accruals and cash flows with opposite signs. Cross-sectional variation in the correlation is determined by the relative magnitude of working capital shocks to sales shocks, thereby limiting the ability of the correlation to capture accrual quality.

There are several caveats to our cash conversion estimates. First, we estimate the conversion rates for accrual shocks rather than for entire accruals. Hence, we estimate the conversion rate only for the unexpected portion of accruals. We do so because statistically reversals can be identified only for shocks and not for entire accruals. As discussed by Allen, Larson, and Sloan (2013), when a reversing accrual is replaced by a new accrual of the same magnitude, there is no effect on the

[5]For an additional example of this assumption, see Barth, Cram, and Nelson (2001).

level of total accruals and therefore no variation useful for the statistical estimation of reversals or cash conversion. In principle, the expected and unexpected components of accruals can convert into cash at different rates. One should keep this caveat in mind when interpreting our results.

Second, we estimate average conversion rates over the firm's recorded history. Our methodology works best if conversion rates are stationary. This may not be the case if, for example, cash conversion rates vary through time in response to changes in firms' strategies and macroeconomic conditions. Our estimates do not capture such changes.

Third, our approach emphasizes the expected cash value of accruals. Under our valuation perspective, a higher conversion rate always implies higher value regardless of whether the rate is smaller or greater than one. However, from the perspective of comparing the cash and non-cash components of earnings, one could argue that the *ideal* conversion rate is precisely one, because when accruals are combined with cash flows to calculate earnings, the scale of both components of earnings needs to be the same. We do not take this position and instead interpret our measure as purely directional, with a higher conversion rate corresponding to higher expected cash value.

2. Variation in cash conversion rates

Prior research (e.g., Dechow and Dichev, 2002) typically assumes that the average conversion rate of a dollar of accruals to cash is one. However, there are many reasons why there could be variation in the average conversion rate. We discuss several scenarios below.

2.1. Financial reporting choices

Financial reporting choices that affect the conversion rate can be broadly described as a degree of unconditional conservatism in managerial estimates relating to working capital. For example, the bad debt allowance can be used to inflate or deflate accounts receivable at the manager's discretion (e.g., Jackson and Liu, 2010). If the manager systematically classifies 40% of accounts receivable as bad debt whereas the actual collection rate is on average 75%, then the conversion rate for accounts receivable will be 75/(100-40), or 1.25. If, on the other hand, the manager allows for no bad debt and the actual collection rate is 75%, the conversion rate would be 0.75. As follows from this example, more conservative reporting choices correspond to higher conversion rates. However, this is only the case for current assets.

In the case of current liabilities, the logic reverses: more unconditionally conservative choices result in the overstatement of current liabilities, so that subsequent cash payouts are smaller in absolute magnitude than the original accruals associated with them. That is, more conservative reporting choices correspond to lower conversion rates for current liabilities. One could plausibly argue that, in accounting for current liabilities, managers have less reporting discretion than for current assets, and any variation in cash conversion estimates primarily represents estimation noise. In particular, there is little, if any, discretion in reporting the dominant component of current liabilities—accounts payable—for which the conversion rate should be close to one. In fact, when we estimate conversion rates for accounts payable only, a larger fraction of estimates is indistinguishable from one compared to the other components of working capital.

Nonetheless, there are components of current liabilities for which managers have reporting discretion. In particular, when a firm records a product warranty liability, it must estimate future expenses covered by the warranty. Hence, the manager's reporting choices will affect the conversion rate of the warranty accrual.[6]

Conditional conservatism may or may not affect cash conversion rates depending on the timing of a write down. If a firm writes down a current asset, such as inventory, in the same year that the accrual is booked, a write down will lead to a higher cash conversion rate if cash is collected in the subsequent year. This happens because a smaller accrual converts into the same amount of cash. In contrast, if the firm writes down the current asset in the same year that cash is collected, the write down will have no effect on the cash conversion rate, because the conversion rate depends on

[6] Empirically, as we decompose working capital into its components (accounts payable, accounts receivable, inventory,...), the overall estimation results become noisier. One notable result pertaining to component-specific cash conversion rates is that conversion rates for current liabilities are negatively correlated with conversion rates for current assets, implying that firms more conservative on the asset side are also more conservative on the liability side. At this point, our conclusion is that although there can be potential benefits in studying component-specific conversion rates, they are outweighed by the cost of increased estimation noise.

the prior year's ending accrual. Thus, firms that write down assets in a more timely fashion will, ceteris paribus, have higher conversion rates.

2.2. Inventory

It is convenient to distinguish two types of shocks to working capital operating through the firm's inventory—procurement shocks and sales shocks. Consider a firm that spends \$50 of cash on January 1 of every year on inventory. It sells the inventory to a single client for \$100 of cash on December 31 of the same year. The net cash flow of the firm in steady state is \$50 and it has no accruals in the normal course of business.

In the context of this example, a procurement shock would occur if the firm purchased inventory for year t one day earlier, on December 31 of the year $t-1$. The net cash flow in year $t-1$ would be zero (\$100 of revenue minus \$50 for inventory purchased on January 1 and \$50 for inventory purchased on December 31), and in year t it would be \$100 (\$100 of revenue and no cash outflow for inventory). In this case, the period $t-1$ inventory shock would be \$50, which is the difference between actual inventory of \$50 and the steady state inventory of \$0. Similarly, the period t shock to net cash flow would also be \$50, which is the difference between the period's net cash flow of \$100 and the steady state net cash flow of \$50. The cash conversion rate in this case would therefore be equal to one.

For this same firm, a sales shock would occur if the sale of inventory takes place on January 1 of year $t+1$ instead of December 31 of year t. In this case, there will be no sales in period t and \$50 worth of inventory at the end of year t. Hence, the net cash flow of year t would be negative \$50. At the end of year $t+1$, there will be no inventory and sales in year $t+1$ would be \$200. Thus, net cash flow for year $t+1$ would be \$150. In this example, every dollar of the inventory shock translates into two dollars of net cash flow in the subsequent period (i.e., the cash conversion rate is two).

In both of the above scenarios, economic events resulted in a \$50 shock to inventory. However, the cash conversion rates associated with these shocks differ—a rate of one for the procurement shock and a rate of two for the sales shock.[7]

2.3. Accounting estimation errors

Unlike unconditional conservatism, accounting estimation errors do not represent any particular "bias" in accruals. Hence, one might conclude that estimation errors have no effect on the average cash conversion rate. Nonetheless, the effect is there and is akin to the attenuation bias caused by measurement error in a regressor—it drives the conversion rate toward zero. However, unlike traditional measurement error in a regressor, accounting estimation errors do not lead to a biased statistical *estimate* of the conversion rate. Instead, they drive the *actual* conversion rate toward zero, because the accounting estimation error is a part of the reported accrual that does not convert into cash.

An important caveat is that our approach estimates the cash conversion rate for unexpected accruals. To the extent that estimation errors reside solely in unexpected accruals, they may lead to a divergence between the cash conversion rates for expected and unexpected accruals. For example, if 100% of unexpected accruals are accounting estimation errors, then the actual conversion rate for unexpected accruals will be zero, because estimation errors are unrelated to future cash flows. At the same time, the firm can have a perfectly predictable level of accruals for which the cash conversion rate will be one (e.g., $100 dollars of accruals always converts into $100 of cash in the subsequent year).

3. Accrual reversals

In this Section, we outline the mechanics of accrual reversals and our approach to identifying accrual shocks. The central assumption in our specification is that the balances of working capital

[7] Neither sales shocks nor procurement shocks generate a plausible scenario where the firm continually fails to recoup inventory purchases. The lack of a justified write down can, however, lead to a conversion rate lower than one. For example, assume that there is inventory at the end of the year that will have to be sold at a discount from cost in the subsequent year. If the firm does not write down this inventory at the end of the year, the cash conversion rate will be less than one.

accounts cannot be perfectly predicted based other accounting variables, such as sales and earnings. We distinguish between expected levels of working capital (e.g., accounts receivable, accounts payable, and inventory), which represent expectations based on other observable variables, and innovations to the levels of working capital that represent new information and which are independent and identically distributed across periods.

For example, the levels of the working capital accounts[8] can be specified as follows:

$$\begin{aligned} AR_t &= \overline{AR}_t + \varepsilon_{AR,t} \\ INV_t &= \overline{INV}_t + \varepsilon_{INV,t} \\ AP_t &= \overline{AP}_t + \varepsilon_{AP,t}, \end{aligned}$$

in which $\overline{AR}_t$, $\overline{INV}_t$, and $\overline{AP}_t$ represent expectations based on other observable accounting variables commonly used in the literature (e.g., sales). Note that these conditional expectations are not forecasts in a predictive sense. Instead, they represent a summary of all information about working capital account balances contained in other observable, contemporaneous accounting variables. In particular, the conditioning variables can include earnings and sales that are contemporaneous with accruals.[9]

The level of working capital can then be expressed as:

$$\begin{aligned} WC_t &= AR_t + INV_t - AP_t \\ &= (\overline{AR}_t + \overline{INV}_t - \overline{AP}_t) + (\varepsilon_{AR,t} + \varepsilon_{INV,t} - \varepsilon_{AP,t}). \end{aligned}$$

This equation can be simplified as:

$$WC_t = \overline{WC}_t + \varepsilon_t, \tag{1}$$

[8]Working capital is the difference between current assets and current liabilities. For expository purposes, we use just accounts receivable, inventory, and accounts payable in this example. In our empirical analyses, we use a comprehensive measure of working capital accruals based on Dechow and Dichev (2002).

[9]Note, however, that we cannot condition on both cash flows and earnings given the identity that accruals equal earnings minus cash flows.

in which $\overline{WC}_t$ represents period t's expected level of working capital and the accrual shock $\varepsilon_t = \varepsilon_{AR,t} + \varepsilon_{INV,t} - \varepsilon_{AP,t}$. In our specification, accrual shocks capture information in accruals that is incremental to that included in observable accounting variables. The shocks can arise from fundamental sources (such as random delays in payments) as well as actions by the manager (i.e., estimation errors or earnings management).

If we re-express equation (1) in changes, then:

$$\Delta WC_t = WC_t - WC_{t-1} = \Delta \overline{WC}_t - \varepsilon_{t-1} + \varepsilon_t. \tag{2}$$

In what follows we refer to ΔWC_t as period t's "accrual." Note that in this equation, period t's accrual includes the current period's shock, ε_t, as well as the reversal of the prior period's shock, ε_{t-1}. This specification requires that shocks are independent across periods.

From a statistical perspective, it is convenient to think about the reversal of ε_{t-1} in terms of a moving average process. Complete reversal of ε_{t-1} in year t corresponds to a moving average coefficient equal to negative one. However, innovations might not necessarily reverse in the subsequent year. For example, if a firm keeps uncollectable accounts on the books for multiple years before writing them off, the reversal will spread over multiple years. For these firms, complete reversal implies that the sum of multiple moving average coefficients converges to negative one.

As a simple example that focuses on just one working capital account, consider a firm with a fixed level of annual revenue that faces uncertainty about when it collects payment for this revenue, but all payments are collected within a year. For such a firm, the accounts receivable accrual will be stochastic even though revenue is deterministic. As an example of a negative shock, consider a customer that typically buys on credit but in this period pays cash. This cash purchase would represent a negative shock to accounts receivable. A positive shock would be a customer who typically pays cash but buys on credit in this period. At the end of the fiscal year, the level of the accounts receivable accrual, AR_t, will equal the unpaid balance for the year's transactions. Hence, the change in the accounts receivable accrual, ΔAR_t, will equal the current year's unpaid balance minus last year's unpaid balance. Thus, ΔAR_t can be described by the following moving average process:

$$\Delta AR_{i,t} = \alpha_i + \phi X_{i,t} + \theta_i \varepsilon_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

where α_i represents firm i's average change in accounts receivable, $X_{i,t}$ represents control variables, $\varepsilon_{i,t}$ represents the period's shock to accounts receivable, and $\varepsilon_{i,t-1}$ represents the prior period's shock to accounts receivable with θ_i determining the extent to which the prior period's shock reverses.

4. Empirical approach

We describe in this Section our empirical approach to estimating both accrual reversals and the cash conversion rate. We begin our empirical analysis by estimating accrual shocks on a firm-by-firm basis using the following moving average specification:

$$\Delta WC_{i,t} = \alpha_i + \phi_i X_{i,t} + \theta_i \varepsilon_{i,t-1} + \varepsilon_{i,t}, \tag{4}$$

where α_i represents firm i's average change in working capital, $X_{i,t}$ represents control variables, $\varepsilon_{i,t}$ represents the period's shock to working capital accruals, and $\varepsilon_{i,t-1}$ represents the prior period's shock to working capital accruals with θ_i determining the extent to which the prior period's shock to accruals reverses. If firm i's working capital accruals fully reverse within one year, then θ_i will be close to negative one.

Shocks to accruals eventually reverse in one of two ways—either into cash flows or as a write-off. To estimate the propensity of these shocks to convert into cash flows rather than being written off, we regress next year's operating cash flows on the estimated accrual shocks. We run these regressions at the firm-level and interpret the coefficient on the accrual shock as the firm-specific conversion rate (i.e. the expected cash value of a dollar of accruals):

$$CFO_{i,t+1} = \alpha_i + \beta_i \hat{\varepsilon}_{i,t} + \gamma_i X_{i,t} + \eta_{i,t+1}, \tag{5}$$

where i indexes firms, t indexes fiscal years, CFO represents cash flows, α represents average levels of cash flows, X and γ represent control variables and their coefficients, and η represents the error term. Firm i's cash conversion rate is β_i, which is the coefficient on the estimated accrual shock, $\hat{\varepsilon}_{i,t}$. This coefficient measures the extent to which a particular firm's accrual shocks translate into next year's cash flows.

This specification allows the estimated cash conversion rate to vary across firms. Given that earnings are calculated as the sum of cash flows and accruals (which implicitly assumes a cash conversion rate of one), one might expect that the estimated cash conversion rate ($\hat{\beta}_i$) would be close to one for all firms. However, as we discuss in Section 2, financial reporting choices, inventory, and estimation errors can drive variation in cash conversion rates.

Our working capital measure includes deferred revenue along with current assets and other current liabilities. Relative to accruals that are followed by a cash receipt or payment, deferred revenue is less intuitive with respect to the cash conversion rate. The logic for deferred revenue is that a positive shock to deferred revenue constitutes a negative accrual shock, which is associated with a negative shock to the subsequent period's cash flow. Conditional on next period's earnings, overall cash flows will be lower than usual because the cash associated with the deferred revenue shock was received in the previous period.[10]

If our specification for accruals reversals and cash conversion is descriptive, then we would expect several empirical regularities. First, the distribution of estimated moving average coefficients in the $MA(1)$ specification will have substantial mass at negative one. Second, for the subset of firms with estimated moving average coefficients that differ from negative one in the $MA(1)$ specification, moving average terms in the $MA(q)$ specification will sum to negative one. Third, the mass of the estimated cash conversion rates will be close to one.

Further, we propose several applications of our cash conversion measure, which can be considered validations of our approach. First, we examine whether equity markets place higher value on

[10] Cash has already been received when the firm books a deferred revenue accrual. Hence, deferred revenue is unlikely to be a driver of heterogeneity in cash conversion rates across firms. However, it could be a major determinant of the *timing* of accrual reversals, which we examine in later empirical analysis.

accruals that have greater expected cash value. Second, we examine whether low cash conversion rates are associated with lower financial reporting quality as proxied by receiving an AAER.

5. Data and variables

Our sample consists of non-financial firms from the Compustat Annual Fundamentals Merged file. To construct our working capital accruals measure, we follow Hribar and Collins (2002) and use Compustat's Statement of Cash Flows data. We require non-missing firm-year observations for total assets (AT), operating cash flows (CFO), revenue (REVT), costs of goods sold (COGS) income before extraordinary items (IB), change in accounts receivable (RECCH), and change in inventory (INVCH). Following Dechow and Dichev (2002), we drop firms with fewer than eight years of data. Finally, we require that the moving average regression converges. Our sample selection process leads to a sample of 74,148 firm-years from 5,206 unique firms over the period 1987–2013.

We define working capital accruals (ΔWC) as the sum of changes in accounts receivable, inventory, and other assets (net of liabilities) less the sum of changes in accounts payable and taxes payable. From Compustat, this measure can be constructed as:

$$\Delta WC = -(RECCH + INVCH + APALCH + TXACH + AOLOCH). \tag{6}$$

We set missing values of APALCH, AOLOCH, and TXACH equal to zero. This measure of working capital accruals is based on the cash flow statement and is identical to that used in Dechow and Dichev (2002). We differ, however, in that we do not scale our measure by average total assets. Given that our estimation of firm-level conversion rates is based on firm-level time series regressions, there is no benefit to scaling. Moreover, because we do not scale, our measure of cash conversion has a simple economic interpretation—the extent to which a one dollar innovation to accruals converts into future cash flows. If we were to follow prior research and deflate by total assets, we would lose this simple economic interpretation.

To validate the cash conversion and accrual quality measures, we further employ stock return data from CRSP and AAER issuance data from UC Berkeley's Center for Financial Reporting & Management.

6. Results

6.1. Moving average regressions

We start by estimating equation (4) on firm-by-firm basis. In the regressions, we include several variables to control for $\Delta\overline{WC}_t$: revenue (REVT); cost of goods sold (COGS); selling, general, and administrative expenses (XSGA) to capture supply and demand shocks; and special items (SPI) to capture write-offs and other one time events. We take these variables from Compustat and set missing values of XSGA and SPI equal to zero. We find similar results if we exclude special items and if we estimate the regressions with no control variables. Our empirical specification is then:

$$\Delta WC_{i,t} = \alpha_i + \phi_{1,i}REVT_{i,t} + \phi_{2,i}COGS_{i,t} + \phi_{3,i}SGA_{i,t} + \phi_{4,i}SPI_{i,t} + \sum_{j=1}^{q} \theta_{i,j}\varepsilon_{i,t-j} + \varepsilon_{i,t}, \quad (7)$$

where $\varepsilon_{i,t}$ represents firm i's accrual innovation in period t and q represents the number of moving average terms. The results for these regressions are presented in Table 2.

Panel A presents descriptive statistics for the distributions of the estimated coefficients when we allow for only one moving average term (i.e., $q = 1$). The median coefficient on the moving average term is negative one and continues to be negative one up to the 73^{rd} percentile, implying that for the majority of firms, an accrual shock fully reverses within one year. The coefficients on revenue, cost of goods sold, and selling, general, and administrative expenses are consistent with intuition. A one dollar increase in revenue is, on average, associated with a 24-cent increase in accruals. Similarly, one dollar increases in costs of goods sold and selling, general, and administrative expenses are, on average, associated with 23- and 25-cent decreases in accruals. With respect to special items, (which includes write-offs,) a one dollar decrease is, on average, associated with a 10-cent decrease in accruals. In terms of explanatory power, the moving average regressions have an average adjusted

R^2 of 0.423. If we estimate ordinary least squares regressions with the same control variables, but exclude the moving average term, the average adjusted R^2 drops by over half.

Panel B presents the convergence of the sum of moving average coefficients, θ_i, as we vary the number of moving average terms (q). If we allow for one moving average term, the coefficient is within ± 0.01 of negative one for 3,656 of the 5,026 firms in our sample (73%). For the remaining 1,370 firms, if we re-estimate the regressions allowing for two moving average terms (i.e., $q = 2$), the sum of the two moving average coefficients is indistinguishable from negative one for 783 firms. Similarly, if we allow for three moving average terms for the remaining 587 firms, the sum of the coefficients is indistinguishable from negative one for 313 firms. Overall, if we allow for up to three moving average terms, the sum of the moving average coefficients is indistinguishable from negative one for 95% of the sample.

There appears to be an industry effect with respect to the number of moving average terms required for the coefficient sum to converge to negative one. For example, if we allow for only one moving average term, the coefficient is indistinguishable from negative one for 77% of retail firms and 57% of firms in defense and airplane manufacturing.[11] We attribute these differences in part to operating cycles. Retail firms likely have short operating cycles, thereby leading to reversals within one year. In contrast, defense contractors and airplane manufacturers likely have longer operating cycles that lead to longer term reversals. However, we cannot rule out the possibility that the number of required moving average terms reflects the extent to which firms delay writing off accruals. We examine this alternative interpretation in Section 6.4.

Next, we restrict our analysis to the subset of firms for which the moving average coefficient is indistinguishable from negative one when we allow for only one moving average term (i.e., $q = 1$). We restrict our analysis to this sample in order to reduce measurement error in the estimates of the accrual innovations. For example, if the results in Panel B of Table 2 arise from cross-sectional variation in operating cycle, then regressions that allow for only one moving average term are misspecified for firms with moving average coefficients distinguishable from negative one. Our

[11] Industries are defined using the Fama and French 48 industry classification.

approach is sensitive to measurement error because our estimated accrual innovations serve as regressors in the next set of regressions. Measurement error would cause attenuation bias in our estimates of the cash conversion rate. We explore the effect of measurement error in section 8.3 and find evidence inconsistent with measurement error substantially attenuating our estimates of the cash conversion rate.

For this restricted sample, Panel C presents the distributions of the coefficient estimates for the control variables. The means and medians presented in Panel C are close to those presented in Panel A. For example, in Panel C, the means are 0.22, −0.22, −0.23, and 0.09 for revenue, cost of goods sold, selling, general, and administrative expenses, and special items as compared to 0.24, −0.23, −0.25, and 0.10 in Panel A.

6.2. Conversion into cash flows and income

We next estimate our measure of the cash conversion rate—the rate at which accrual shocks convert into future cash flows. To do so, we estimate firm-by-firm regressions based on the specification presented in equation (5). Prior research suggests that income before extraordinary items is an ideal forecaster of future cash flows (e.g., Dechow, Kothari, and Watts, 1998; Ball, Sadka, and Sadka, 2009). Thus, in our cash flow regressions, we include income before extraordinary items as a control variable. This leads to the following empirical specification:

$$CFO_{i,t+1} = \alpha_i + \beta_i \hat{\varepsilon}_{i,t} + \gamma_i IB_{i,t} + \eta_{i,t+1}, \tag{8}$$

where $\hat{\varepsilon}_{i,t}$ is firm i's estimated accrual shock for period t taken from equation (7). Our measure of the cash conversion rate, β_i, measures the extent to which an accrual shock converts to cash flows in the subsequent year.

Panel A of Table 3 presents the coefficient estimates from these regressions. The mean and median estimates of cash conversion are significantly greater than zero and close to one (0.95 and 0.97), implying that for the typical firm, a one dollar shock to accruals converts to 95–97 cents in the subsequent year. Moreover, these results suggest that estimated accrual innovations provide explanatory power in the prediction of cash flows that is incremental to income before extraordinary items. In an untabulated test, we find similar results if we use the same controls as those included in the moving average regressions and if we exclude income before extraordinary items. The mean and median coefficients on income are 0.43 and 0.31, implying that for the typical firm, a dollar of income is associated with 31–43 cents of cash flow in the subsequent year. These estimates are similar in magnitude to those presented in Dechow, Kothari, and Watts (1998, Table 4).

When an accrual innovation is written-off in the following year, the write-off reduces income. Consistent with our predictions, Panel B of Table 3 shows that accrual innovations are negatively associated with future earnings. In terms of economic magnitude, on average, nine cents of a one dollar accrual innovation is written-off in the subsequent year. Furthermore, we find that the rates at which accrual innovations convert into cash flows and earnings are highly correlated ($\rho = 0.46$), suggesting that higher rates of cash conversion can be attributed, in large part, to lower rates of accrual write-offs.

6.3. Relation with returns

We next examine whether the accruals of firms with higher cash conversion rates have higher contemporaneous associations with returns than firms with low conversion rates. To do so, we estimate the following regression specification:

$$r_{i,t} = \alpha + \beta CashFlow_{i,t} + \phi CR_i + \gamma Accruals_{i,t} + \delta Accruals_{i,t} \times CR_i + Controls + \epsilon_{i,t}, \qquad (9)$$

where $r_{i,t}$ is firm i's return for year t, $CashFlow_{i,t}$ is firm i's cash flows from operation deflated by the market value of equity for year t, $Accruals_{i,t}$ is firm i's accruals deflated by the market value of equity for year t, and CR_i is a measure of the rate at which accruals convert into future cash flows. We use two formulations of CR_i, an indicator variable which takes a value of one if a firm's estimated conversion rate exceeds one and a continuous variable defined by the percentile rank of the firm's estimated conversion rate. As controls, we include in the regressions the natural logarithm of the firm's market value of equity and the natural logarithm of the firm's book-to-market ratio.

Panel A of Table 4 presents descriptive statistics for the variables used in the regressions. Accounting variables and returns are Winsorized at the 2.5% and 97.5% levels. We Winsorize at this higher level compared to the previous and subsequent analyses due to the increased kurtosis arising from deflating by the market value of equity. Panel B presents the results. The dependent variable in the regressions is the buy-and-hold annual return starting four days after the prior fiscal year's earnings announcement and ending three days after the current fiscal year's earnings announcement. Columns (1) through (3) present baseline regressions that include cash flows and accruals on their own and together. Cash flows are positively and significantly associated with returns both on their own and when they are included along with accruals. In contrast, accruals are significantly positive only when included along with cash flows.

In columns (4) and (5), we add the cash conversion rate measures along with their interactions with accruals. For both cash conversion rate measures, the coefficients on accruals remain significant and positive but attenuate in these specifications. In addition, the main effects on the cash conversion rate measures are negative and significant while the interactions between accruals and the cash conversion rate measures are positive and significant. In terms of economic significance, if a firm moves from the lowest to the highest percentile of cash conversion, then the estimated association of accruals and returns increases by approximately 118%.

6.4. AAERs

We use AAERs to validate our measure under the intuition that a lower cash conversion rate is likely associated with the firm having lower quality financial reporting, which can include earnings management. During the sample period, 2.8% of firms received at least one AAER. Table 5 presents logit regressions that evaluate the association between a firm's cash conversion rate and likelihood the firm receives an AAER.

We estimate the logit regressions with and without industry fixed effects (based on the 48 Fama and French industries) to control for industry effects. We examine this link using two measures of the cash conversion rate: the estimated rate Winsorized at 1% and 99%; the percentile rank of the estimated conversion rate. In specifications (1) through (4), we analyze only those firms for which reversals occur within one year. In specifications (5) through (8), we include the entire sample. Consistent with the notion that a lower cash conversion rate is indicative of weaker financial reporting, the coefficient on cash conversion is negative and statistically significant at the 0.05 or 0.01 level, across all regressions. Moreover, the coefficients on the cash conversion measure change only slightly when we include industry fixed effects, suggesting that cross-industry differences do not drive heterogeneity in conversion rates.[12]

We next explore the relation between AAERs and the number of moving average terms required to fully capture the reversal of an accrual innovation. It could be that long (greater than one year) operating cycles lead to the requirement for more than one moving average term. An alternative interpretation is that some firms fail to write-off "bad" accruals in a timely fashion. Such firms instead keep these working capital accruals on their balance sheets for extended periods of time, despite their low probability of eventual cash conversion. If this is the case, then the likelihood of receiving an AAER should increase in the number of required moving average terms. When we examine this prediction in Table 6, we find that the likelihood of receiving an AAER increases monotonically in the number of moving average terms required to fully capture the reversal of an accrual innovation.[13]

7. Relation with prior research

The discretionary accrual literature seeks to explain accruals via other accounting variables (e.g., sales and property, plant & equipment). Under this traditional approach, accrual quality is defined as the ability of these other accounting variables to explain variation in accruals and all *residual volatility* is interpreted as "low" quality accruals (see Gerakos, 2012).

Ironically, the traditional approach assumes that high quality accruals have no informational

[12] We find similar results if we estimate an ordinary least square regression that uses the proportion of years that received an AAER as the dependent variable.

[13] Again, we find similar results if we estimate an ordinary least square regression that uses the proportion of years that received an AAER as the dependent variable.

value because all information is contained in the other accounting variables. This assumption contrasts with the Financial Accounting Standards Board's view of accrual accounting:

> Information about enterprise earnings based on accrual accounting generally provides a better indication of an enterprise's present and continuing ability to generate favorable cash flows than information limited to financial effects of cash receipts and payments. (Financial Accounting Standards Board, 1978)

Consistent with accruals having informational value, Subramanyam (1996) finds that discretionary accruals are positively associated with annual returns. The information in accruals could relate to timing differences between transactions and payments or to underlying economic performance. For example, inventory can increase if the firm purchases raw materials for the next fiscal year. Alternatively, inventory can increase (decrease) if the firm experiences a negative (positive) demand shock. In either case, the traditional approach classifies such accruals as low quality.

Dechow and Dichev (2002) present a framework that is most closely related to our approach. They focus on the link between accruals and cash flows and propose a measure that is aimed at capturing the conversion of accruals into cash flows. They focus on the portion of accruals related to future cash realizations and view it as a noisy estimate of future cash receipts or disbursals. The main conceptual distinction between their approach and our approach is that they are interested in how noisy the conversion process is (i.e., the residual variance), while we are interested in the extent of conversion (i.e., what proportion of accrual innovations translates into future cash flows, on average). From a statistical perspective, Dechow and Dichev (2002) are primarily interested in the variance due to accounting errors. While the cash conversion rates that we estimate are also affected by accounting errors, as we discuss in the previous section, other factors (financial reporting choices, noise, and inventory) can also affect conversion rates.

Nikolaev (2014) extends the general framework developed by Dechow and Dichev (2002). He specifies multiple moment conditions that allow him to identify different components of cash flow variance. Specifically, he separates performance shocks, payment timing shocks, and accounting error and then proceeds to construct a measure of accrual quality based on the portion of accrual volatility attributable to accounting error. This extension allows him to isolate operating volatility from other sources of uncertainty in cash flows and accruals, thereby addressing one of the important issues with the original Dechow and Dichev measure. Nonetheless, this measure is based on the premise that accounting *noise* (i.e., residual volatility) is the key determinant of accrual quality. In contrast, we are interested in systematic biases generated by different accounting practices.

8. Additional analyses

8.1. Shock to the level of working capital

To specify the moving average structure of accruals, we assume that shocks to the level of working capital are transitory. However, for 13% of the firms in our sample, shocks to the level of working capital are significantly autocorrelated. In additional analysis, we therefore drop all firms with significant autocorrelations in shocks to the level of working capital. For this restricted sample, we find that both the proportion of firms for which the first moving average term is indistinguishable from negative one and the average rate of cash conversion remains unchanged.

8.2. Correlation between accrual shocks and contemporaneous income

In the regressions used to estimate our cash conversion rate measure, we include income before extraordinary items. Hence, correlations between accrual innovations and income can mechanically affect our cash conversion estimates. In untabulated analyses, we find that the average correlation between the accrual innovations and contemporaneous income is close to zero, suggesting that such correlations do not affect our cash conversion estimates. To further evaluate this effect, we exclude income before extraordinary items from the cash conversion regressions and find similar results.

8.3. Measurement error

Our cash conversion measure is based on the slope coefficient linking accrual shocks to future cash flows. Thus, measurement error in the estimated accrual innovations could attenuate our cash conversion rate estimate. Given that the distribution of estimated conversion rates has considerable mass around one, it seems unlikely measurement error/attenuation bias plays a large role in driving heterogeneity in our conversion rate estimates—such bias would pull the the distribution towards zero. However, we employ one additional test to further quell this concern. We identify "extreme" shocks, defined as shocks that are more than one standard deviation away from a firm's average shock. Under the intuition that extreme shocks are more likely to contain measurement error, we test whether extreme shocks convert at a significantly lower rate than non-extreme shocks. Results for this analysis are presented in Table 7. We find no evidence that extreme shocks convert at a different rate than non-extreme shocks, suggesting that measurement error does not play a large role.[14]

9. Conclusion

We estimate the rate at which accrual shocks convert into future cash flows. For firms whose accrual shocks reverse within one year, we find that, on average, a one dollar innovation to accruals translates into 95 cents of cash flow in the subsequent fiscal year. We find that accruals are more highly correlated with contemporaneous returns for firms with higher conversion rates. We also find that our conversion rate estimates are associated with AAER issuances, with lower conversion rates predictive of greater AAER likelihoods.

There are several caveats to our approach. First, it is based on firm-level moving average regressions and therefore requires lengthy time series. Second, our measure is at the firm-level, not the firm-year-level. It is therefore of limited applicability in settings such as examining whether a firm increased accruals to meet or beat an analyst forecast. One novel feature of our cash conversion measure is that it is not based on the residual variance of accruals and is therefore not contaminated by operating volatility. This has been a major disadvantage of traditional measures of earnings

[14] The sample size for this analysis drops from 3,656 to 3,517 because 39 firms lack sufficient variation in $\hat{\varepsilon}_{i,t}$ to identify the coefficients on $Extreme_{i,t}$ and the interaction between $Extreme_{i,t}$ and $\hat{\varepsilon}_{i,t}$.

management and accrual quality (e.g., Jones and Dechow-Dichev). In fact, one could consider the cash conversion rate to be an alternative measure of accrual quality.

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Table 1: Descriptive statistics

This table presents descriptive statistics for the full sample. The sample consists of non-financial firms with at least eight years of data in the interval of 1987–2013 and that have non-missing values of RECCH, INVCH, REVT, COGS, IB, CFO and AT. We set missing values of APALCH, TXACH, AOLOCH, XSGA, and SPI to zero. Δ Working capital is calculated as the sum of changes in accounts receivable (RECCH), inventory (INVCH) and other net assets (AOLOCH) less the sum of changes in accounts payable (APALCH) and taxes payable (TXACH). Operating cash flows (CFO), revenue (REVT), costs of goods sold (COGS), and income (IB) are all as available in Compustat. Number of years is the number of annual observations by firm between 1987 and 2013. Panel A presents summary statistics and Panel B presents Spearman correlations. Variables are neither deflated nor Winsorized.

Panel A: Summary statistics

Variables	N	Mean	SD	Q1	Median	Q3
Δ Working capital	74148	14.085	286.584	−2.441	0.896	9.798
Operating cash flows	74148	273.828	1581.806	0.206	10.586	77.611
Revenue	74148	2413.124	11961.872	42.020	194.723	933.553
Cost of goods sold	74148	1626.977	8960.396	23.338	114.846	578.798
SG&A	74148	418.971	1969.081	10.182	39.168	166.327
Special items	74148	−29.031	468.173	−2.779	0.000	0.000
Income	74148	119.646	1005.747	−1.732	4.019	36.035
Number of years	5026	14.842	5.500	10.000	13.000	19.000

Panel B: Spearman correlations

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	Δ Working capital	1.000						
(2)	Operating cash flows	−0.024	1.000					
(3)	Revenue	0.185	0.774	1.000				
(4)	Cost of goods sold	0.178	0.721	0.977	1.000			
(5)	SG&A	0.158	0.640	0.857	0.790	1.000		
(6)	Special items	0.028	−0.130	−0.219	−0.203	−0.246	1.000	
(7)	Income	0.225	0.698	0.619	0.572	0.491	0.127	1.000
(8)	Number of years	0.025	0.143	0.140	0.147	0.097	0.082	0.167

Table 2: Moving average regressions

This table presents coefficient estimates from firm-specific moving average regressions for working capital accruals. Panel A presents descriptive statistics for the estimated moving average regression coefficients for the entire sample. Panel B depicts the rate at which the sum of moving average coefficients converge to -1 if we allow for multiple moving average terms. Panel C presents descriptive statistics for the control variable coefficient estimates for the subset of firms for which the coefficient on a single moving average term is within 0.01 of -1. For all three panels, the generalized estimating equation is:

$$\Delta WC_{i,t} = \alpha_i + \phi_{1,i} REVT_{i,t} + \phi_{2,i} COGS_{i,t} + \phi_{3,i} SGA_{i,t} + \phi_{4,i} SPI_{i,t} + \sum_{j=1}^{q} \theta_{i,j} \varepsilon_{i,t-j} + \varepsilon_{i,t},$$

where i indexes firms, t indexes years, and q denotes the number of moving average terms. In Panels A and C, q is fixed at 1. The sample is from 1987–2013. Variables are neither deflated nor Winsorized. Reported coefficients are Winsorized at the 1% and 99% levels.

Panel A: MA(1) coefficient estimates

Variables	N	Mean	SD	Q1	Median	Q3
Moving average term	5026	−0.614	0.682	−1.000	−1.000	−0.288
Revenue	5026	0.237	0.722	−0.078	0.170	0.526
Cost of goods sold	5026	−0.226	0.982	−0.628	−0.162	0.166
SG&A	5026	−0.252	1.320	−0.719	−0.182	0.201
Special items	5026	0.099	2.328	−0.326	0.066	0.582
Adj. R^2	5026	0.423	0.436	0.262	0.502	0.700

Panel B: Convergence of the moving average coefficients

Moving average terms	N	$\Sigma\theta_{i,j} = -1$	$\Sigma\theta_{i,j} \neq -1$	Proportion	Cum. proportion
1	5026	3656	1370	0.73	0.73
2	1370	783	587	0.57	0.88
3	587	313	274	0.53	0.95

Panel C: MA(1) coefficient estimates conditional on $\theta_{i,1} = -1$

Variables	N	Mean	SD	Q1	Median	Q3
Revenue	3656	0.224	0.744	−0.096	0.159	0.518
Cost of goods sold	3656	−0.216	1.007	−0.627	−0.154	0.178
SG&A	3656	−0.227	1.361	−0.712	−0.169	0.237
Special items	3656	0.090	2.461	−0.350	0.062	0.620
Adj. R^2	3656	0.517	0.365	0.389	0.573	0.740

Table 3: Conversion into cash flows and income

This table presents descriptive statistics for coefficient estimates from firm-specific time series regressions that measure the rates at which accrual shocks convert into the next year's cash flows and income before extraordinary items. The sample is the subset of 3,656 firms for which, in the firm-specific MA(1) regression, the estimated coefficient on the lagged residual (accrual shock) is within 0.01 of -1. The estimating equations are:

$$\begin{aligned} CFO_{i,t+1} &= \alpha_i + \beta_i \hat{\varepsilon}_{i,t} + \gamma_i IB_{i,t} + \eta_{i,t+1}, \\ IB_{i,t+1} &= \alpha_i + \beta_i \hat{\varepsilon}_{i,t} + \gamma_i IB_{i,t} + \eta_{i,t+1}, \end{aligned}$$

where i indexes firms, t indexes years, and $\hat{\varepsilon}_{i,t}$ is a residual from a firm-specific MA(1) regression based on equation (7), representing a shock to working capital accruals. The sample is from 1987–2013. Variables are neither deflated nor Winsorized. Panel A presents the estimated coefficients from the cash flow regressions and Panel B presents the estimated coefficients from the income regressions. Reported coefficients are Winsorized at the 1% and 99% levels.

Panel A: Cash flow regressions

Variables	N	Mean	SD	Q1	Median	Q3
$\hat{\varepsilon}_t$	3656	0.954	1.515	0.348	0.965	1.550
Income	3656	0.428	1.114	0.019	0.310	0.772

Panel B: Income regressions

Variables	N	Mean	SD	Q1	Median	Q3
$\hat{\varepsilon}_t$	3656	−0.088	2.163	−0.712	−0.110	0.417
Income	3656	0.431	0.854	0.089	0.402	0.710

Table 4: Relation with stock returns

This table presents descriptive statistics and regressions that examine the relation between annual stock returns and cash conversion rates. Panel A presents descriptive statistics for the variables used in the regressions. We deflate accounting variables by the firm's market value at the beginning of the fiscal year. Accounting variables and returns are Winsorized at the 2.5% and 97.5% levels. We Winsorize at this higher level compared to the previous and subsequent analyses due to the increased kurtosis arising from deflating by the market value of equity. Panel B presents regressions of stock returns on the firm's cash flows, accruals, and interactions between accruals and the firm's estimated conversion rate. In each specification, the dependent variable is the annualized buy-and-hold return. We use two measures of the cash conversion rate: an indicator for whether the conversion rate is greater than or equal to one; the firm's percentile rank. Standard errors, presented are parentheses, are clustered by year.

Panel A: Descriptive statistics

Variables	N	Mean	SD	Q1	Median	Q3
Cash flows	42676	0.118	0.247	0.011	0.078	0.161
Accruals	42676	0.010	0.124	−0.020	0.007	0.044
Annual return	42676	0.143	0.618	−0.258	0.039	0.381
log(Size)	42676	12.160	2.059	10.666	12.023	13.524
log(BTM)	42676	−7.526	1.072	−8.111	−7.536	−6.994

Panel B: Annual return regressions

Variables	(1)	(2)	(3)	(4)	(5)
Cash flows	0.397***		0.491***	0.492***	0.491***
	(0.048)		(0.058)	(0.058)	(0.058)
Accruals		0.189	0.472***	0.403***	0.299*
		(0.116)	(0.133)	(0.141)	(0.154)
High cash conversion				−0.018***	
				(0.005)	
High cash conversion × Accruals				0.150***	
				(0.044)	
Cash conversion percentile					−0.034***
					(0.009)
Cash conversion percentile × Accruals					0.352***
					(0.092)
log(Size)	−0.028***	−0.020**	−0.030***	−0.031***	−0.031***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
log(BTM)	−0.001	0.050**	−0.012	−0.012	−0.012
	(0.023)	(0.023)	(0.025)	(0.025)	(0.025)
Constant	0.433*	0.761***	0.363	0.373	0.382
	(0.218)	(0.208)	(0.234)	(0.234)	(0.234)
Observations	42676	42676	42676	42676	42676
Adj. R^2	0.034	0.017	0.042	0.042	0.042

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Association with AAERs

This table presents estimates of the extent to which the cash conversion and accrual quality measures explain AAERs. We use logit regressions in which the dependent variable is an indicator for whether the firm receives at least one AAER over the sample period. Regressions are estimated with and without industry fixed effects where industry measured using the Fama and French 48 industry classification. In each panel, the sample for the first four specifications consists of the set of 3,656 firms for which the estimated moving average coefficient on the lagged residual is not distinguishable from negative one. The final four specifications use the full sample. The sample is from 1987–2013. In even numbered specifications (those with industry fixed effects) we report smaller sample sizes because some firms either lack an industry assignment or reside in industries which receive zero AAERs over our sample period, and are thus excluded from the analysis.

Probability of at least one AAER (Logit)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash conversion rate	−0.131**	−0.151**			−0.149***	−0.160***		
	(0.064)	(0.069)			(0.053)	(0.056)		
Cash conversion rate p-tile			−0.899**	−0.986***			−1.053***	−1.080***
			(0.355)	(0.371)			(0.282)	(0.290)
Constant	−3.435***	−4.108***	−3.041***	−3.711***	−3.320***	−3.471***	−2.906***	−3.013***
	(0.109)	(1.009)	(0.211)	(1.025)	(0.081)	(1.017)	(0.143)	(1.023)
Industry fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Sample	$\theta_i = -1$	$\theta_i = -1$	$\theta_i = -1$	$\theta_i = -1$	Full	Full	Full	Full
Observations	3656	3109	3656	3109	5026	4780	5026	4780
Pseudo R-squared	0.004	0.031	0.007	0.034	0.005	0.031	0.010	0.035

* p<0.1, ** p<0.05, *** p<0.01

Table 6: Time to reversal and AAERs

This table presents estimates of the relation between AAERs and the number of moving average terms required for their sum to be indistinguishable from negative one. The dependent variable is an indicator for whether the firm receives at least one AAER over the sample period. All regressions are estimated using logit. Regressions are estimated with and without industry fixed effects with industry measured using the Fama and French 48 industry classification. The sample is from 1987–2013. In column (2) (with industry fixed effects) we report smaller sample sizes because somes firm either lack an industry assignment or reside in industries which receive zero AAERs over our sample period, and are thus excluded from the analysis.

Moving average terms	(1)	(2)
2 Lags	0.209	0.190
	(0.220)	(0.221)
3 Lags	0.684**	0.621**
	(0.269)	(0.272)
4+ Lags	0.825***	0.850***
	(0.270)	(0.273)
Constant	−3.541***	−3.675***
	(0.100)	(1.019)
Industry fixed effects	No	Yes
Observations	5026	4780
Pseudo R-squared	0.009	0.033

* p<0.1, ** p<0.05, *** p<0.01

Table 7: Measurement error

This table presents descriptive statistics for coefficient estimates from firm-specific time series regressions that measure the rates at which accrual shocks convert into the next year's cash flows and allow the conversion to vary with the size of the accrual shock. The sample is the subset of firms for which, in the firm-specific MA(1) regression, the estimated coefficient on the lagged residual (accrual shock) is within 0.01 of negative one. The estimating equation is:

$$CFO_{i,t+1} = \alpha_i + \beta_i \hat{\varepsilon}_{i,t} + \phi_i Extreme_{i,t} + \delta_i \hat{\varepsilon}_{i,t} \times Extreme_{i,t} + \gamma_i IB_{i,t} + \eta_{i,t+1},$$

where i indexes firms, t indexes years, and $\hat{\varepsilon}_{i,t}$ is a residual from a firm-specific MA(1) regression based on equation (7), representing a shock to working capital accruals, and $Extreme_{i,t}$ is an indicator variable which takes a value of one if $\hat{\varepsilon}_{i,t}$ is more than one standard deviation from the average for firm i. The sample is from 1987–2013. Variables are neither deflated nor Winsorized. Reported coefficients are Winsorized at the 1% and 99% levels. The sample shrinks to 3,517 because some firms do not have enough extreme shocks to identify the coefficients.

Variables	N	Mean	SD	Q1	Median	Q3
$\hat{\varepsilon}_{i,t}$	3517	1.130	8.391	−1.125	0.795	2.702
$\hat{\varepsilon}_{i,t} \times Extreme_{i,t}$	3517	−0.140	11.526	−2.322	0.168	2.614
$IB_{i,t}$	3517	0.409	0.782	0.003	0.324	0.800