Assessing Earnings and Accruals Quality: U.S. and International Evidence

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Abstract

This paper examines the properties and validity of “accounting quality” proxies derived from the Dechow and Dichev (DD, 2002) accruals model. I analytically demonstrate that the underlying DD model has limited ability to distinguish between manipulated and “high quality” accruals. My empirical analyses show that prior validations of the DD model have significant limitations and the model cannot empirically distinguish between discretionary and non-discretionary accruals. Overall, the DD model does not appear to reliably capture “high quality accruals” and, in some settings, will even reverse rank firms’ earnings quality. Implications for current and future research are discussed.

Keywords: Accounting quality, Accruals, Cash flow, Earnings quality, International

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1. Introduction

This paper examines the empirical validity of “accounting quality” measures derived from the Dechow and Dichev (DD, 2002) accruals model. Accounting information quality is of central importance to investors, standards setters, and other stakeholders. While accounting quality is multi-dimensional (see, for example, Schipper and Vincent, 2003), researchers have recently focused on the DD discretionary accruals model as a catch-all proxy for firms’ accruals quality, earnings quality, accounting quality, and overall information quality. Numerous accounting studies use “quality” measures derived from the DD model to test various economic hypotheses including the association between information quality and cost of capital (see, for example, Francis, LaFond, Olsson, and Schipper, 2005, and Ecker, Francis, Kim, Olsson, and Schipper, 2006) and the association between information quality and investment efficiency (see, for example, Biddle and Hillary, 2006, and Raman, Shivakumar, and Tamayo, 2008).

While the DD model has been quickly and widely adopted,¹ there is a paucity of evidence on the analytical and empirical validity of the model.² It is unclear whether the model reliably captures “accounting quality” of U.S. and international firms. In this study, I present analytical and empirical tests of the DD regression model that suggest that: (i) the model has limited ability to distinguish between manipulated versus “high quality”, (ii) the model often displays empirical properties indistinguishable from a random decomposition of working capital accruals, (iii) prior empirical validations of the model have serious limitations, (iv) accounting quality measures

derived from the DD model (and its extensions) show weak and often contradictory associations with other measures of accounting quality for U.S. and international firms.

My analytical and empirical investigation of the DD model reveals fundamental limitations in the model. These findings are relevant because the model is widely used and becoming a *de facto* empirical benchmark for accounting quality. Numerous studies directly use the model without limited prior validation and then draw arguably questionable inferences about difference in or the importance of accounting quality for U.S. and international firms.

The structure of the paper is as follows. In section 2, I dissect and analytically evaluate the DD model. My analyses suggest that the DD model cannot distinguish between “high quality” accruals that are associated with operating cash flows and opportunistic discretionary accruals that are also associated with operating cash flows. I also demonstrate that a strong negative contemporaneous correlation between accruals and cash flow from operations is consistent with both opportunistic discretionary earnings management as well as “high quality” accruals.

Section 3 describes the U.S. and international samples used to empirically test and benchmark the DD accruals model. In section 4, I use the U.S. data sample to re-evaluate previous claims that correlations with firms’ “innate” characteristics confirm that the DD model captures accounting quality. I show that firms’ “innate” characteristics have the *same* correlations with both the absolute variability of residuals from the DD and the absolute variability of explained DD accruals. These findings contradict the claims of Dechow and Dichev (2002) and Francis, LaFond, Olsson, and Schipper (2005) that their “innate” tests confirm that the DD model captures “high quality accruals”. My evidence suggests that (1) the DD model randomly decomposes accruals rather than separating high and low quality accruals,
and (2) the absolute variability of accruals residuals from the DD model is a flawed measure of accruals quality.³

In section 5, I investigate the negative contemporaneous relation between current accruals and cash flows and examine its implications for earnings quality. Dechow (1994) is among the first to systematically document a strong negative correlation between firms’ accruals and cash flows. This accruals property has generally been viewed as a means by which accruals increase the informativeness of a firm’s earnings (see, for example, Dechow, Kothari, and Watts, 1998). Using samples of U.S. and international firms, I find that a firm’s overall earnings quality declines when there is a stronger negative correlation between its current accruals and cash flows. This evidence suggests that a strong negative correlation between current accruals and cash flows may distort earnings’ ability to capture true firm performance (see, for example, Skinner and Myers, 2007, and Leuz, Nanda, and Wysocki, 2003). Moreover, I find that in both U.S. and international samples the negative contemporaneous association between accruals and cash flows dominates the DD model and may undermine its ability to capture accounting quality.

Finally, I benchmark the properties of the DD model relative to previously-validated accounting quality measures. I find that the DD model exhibits weak and inconsistent relations with fundamental earnings attributes for a broad sample of U.S. firms. The DD model also shows counter-intuitive associations with previously-validated measures of earnings quality and country-level institutional factors related to high quality accounting numbers. The inability of the DD model to correctly capture earnings/accruals quality for U.S. and international firms appears to be driven by the fact that the model strongly reflects the contemporaneous negative association between accruals and cash flows.

³ See also Hribar and Nichols (2007) and Liu and Wysocki (2007).
To address the limitations of the DD accruals model, I suggest a simple modification to the original DD model to capture the incremental association between current accruals and past and future cash flows over and above the association between current accruals and current cash flows. This modification removes the confounding effect of the strong negative correlation between current accruals and current cash flows. The modified accruals model displays robust and intuitive associations with fundamental earnings attributes associated with high earnings quality for U.S. firms. The modified model also displays correct and robust associations with country-level earnings quality attributes and institutional factors for 30 countries.

2. A dissection of the DD model

In this section, I re-examine the theoretical underpinnings of the DD empirical regression model of working capital accruals. I identify important limitations of the empirical model and demonstrate that it cannot distinguish between “high quality” accruals, measurement error, and opportunistic discretionary accruals.

2.1 The baseline DD model

Dechow and Dichev’s (2002) theoretical model of working capital accruals is simple and intuitive. They define the determinants of working capital accruals in period $t$ as:

\[ A_t = CF_{t-1}^t - (CF_{t+1}^{t+1} + CF_t^{t+1}) + CF_{t+1}^t + \varepsilon_{t+1}^t - \varepsilon_{t-1}^t \]  

(1)

where $A_t$ captures working capital accruals in period $t$. The cash flows terms, $CF_j^k$, are net cash flows received (paid) in period $j$, but recognized in income in period $k$. The error terms $\varepsilon_{t+1}^t$ and
\( \varepsilon_{t-1} \) are adjustments for estimation errors and their corrections. If all cash flow components \( (CF_t, CF_{t+1}, CF_t^{i-1}, and CF_{t+1}^{i}) \) are observable, then one can estimate the following regression model:

\[
A_t = \alpha + \beta_1*CF_{t-1} + \beta_2*(CF_{t+1} + CF_{t-1}) + \beta_3*CF_{t+1} + \varepsilon_t
\]  

(2)

Dechow and Dichev (2002) focus on the ability of this model to detect estimation errors in accruals. They argue that if there are no estimation errors and no measurement errors, then the estimated coefficients of model (2) should be \( \beta_1=\beta_3=1, \) and \( \beta_2=-1. \) Moreover, the regression \( R^2 \) should be 100% and residual variance should be zero. I analytically confirm these predicted properties in section (A3) of Appendix A.

At this point, it is important to highlight that equation (2) can be viewed as a model of non-discretionary accruals driven by exogenously-classified cash flow transactions. If the classifications of the cash flow transactions are exogenous, then the unexplained portion of working capital accruals in period \( t \) should be related to either estimation errors, or discretionary (and possibly opportunistic) accrual choices, or both. In other words, the DD model should hypothetically capture the determinants of non-discretionary accruals, \( NDA_t, \) as:

\[
NDA_t = f (CF_{t-1}, CF_{t+1}^{i}, CF_{t-1}^{i}, CF_{t+1}^{i})
\]  

(3)

2.2 An analytical assessment of the “empirical” DD model

As Dechow and Dichev (2002) note, it is infeasible to empirically estimate the theoretical version of their model (i.e., equation (2)). This limitation arises because firms’ public financial
reports do not contain enough information to determine the cash flows directly related to working capital accruals (i.e., $CF_{t-1}$, $CF_{t+1}^{t-1}$, $CF_{t+1}^{t-1}$, and $CF_{t+1}^{t+1}$). Therefore, one must estimate regression model (2) using substitute cash flow measures that are available. In general, the empirical regression model will take the form:

$$A_t = \alpha + \beta_1*C_{t-1} + \beta_2*C_t + \beta_3*C_{t+1} + \varepsilon_t$$  \hspace{1cm} (4)

where $C_k$ is a cash flow measure for period $k$. Dechow and Dichev suggest that suitable cash flow measures are cash flows from operations. Therefore, the empirical version of their model is:

$$A_t = \alpha + \beta_1*CFO_{t-1} + \beta_2*CFO_t + \beta_3*CFO_{t+1} + \varepsilon_t$$  \hspace{1cm} (4a)

where $CFO_k$ is cash flow from operations in period $k$. As noted by Dechow and Dichev (2002), the operating cash flow terms in equation (4a) capture the constructs in theoretical model (i.e., equation (2)) with “measurement error”. The measurement error components are highlighted in bold below:

$$CFO_{t-1} = CF_{t-1}^{t-1} + (CF_{t-1}^{t-1} + CF_{t-1}^{t-2})$$  \hspace{1cm} (4a-1)

$$CFO_t = (CF_{t+1}^{t+1} + CF_{t+1}^{t-1}) + (CF_t^{t})$$  \hspace{1cm} (4a-2)

$$CFO_{t+1} = CF_{t+1}^{t+1} + (CF_{t+1}^{t+1} + CF_{t+1}^{t+2})$$  \hspace{1cm} (4a-3)

For example, the “measurement error” in current cash flow from operations, $CFO_t$, is the cash flow ($CF_t^t$) received and recognized in earnings in period $t$ that does not generate working
capital accruals. The presence of these “measurement errors” will bias the regression coefficients toward zero and reduce the regression $R^2$ relative to a regression model that includes the “correct” cash flows directly linked to working capital accrual transactions. Dechow and Dichev use simulations to demonstrate these measurement error effects. I use analytical techniques as an alternate way to quantify the impact of the measurement error on the regression results (see section (A3) of Appendix A). The effects of measurement error on the empirical DD model are summarized in the table on the next page (see, “Empirical model: No discretionary accruals”).

The obvious problem with the empirical DD model is that the “measurement error” problem reduces the ability of the model to correctly categorize firms’ accounting quality. Furthermore, it is possible that the measurement error may be correlated with other firm characteristics (such as firm risk) which can lead to incorrect inferences about the relation between accounting quality and a firm characteristic such as firm risk (see, for example, Francis, LaFond, Olsson and Schipper, 2005).

I now highlight a previously unrecognized and potentially more damaging problem with the empirical DD model. This problem occurs when managers’ discretionary accrual choices are correlated with, or even determined by, the “measurement error” components of firms’ operating cash flows. In sections (A4) and (A5) of Appendix A, I analyze a very likely scenarios where a manager uses opportunistic discretionary accruals ($DA_t$) to manage or smooth earnings to offset shocks to current period cash flows ($CF_t$).

Dechow and Dichev (2002) assume that current period cash transactions ($CF_t$) are merely “measurement error” in the empirical regression. However, a manager that uses opportunistic discretionary accruals to offset shocks to current cash flows will mechanically create a negative association between $CF_t$ and both discretionary accruals ($DA_t$) and total
working capital accruals ($A_t$). Therefore, if the DD model is used to measure a firm’s accruals quality, then the following regression is estimated:

$$A_t = NDA_t + DA_t = \alpha + \beta_1*CFO_{t-1} + \beta_2*CFO_t + \beta_3*CFO_{t+1} + \varepsilon_t \quad (5)$$

The analytical analyses in sections (A5) and (A6) of Appendix A show that the empirical DD model will assign a higher accounting quality rating to firms that systematically engage in opportunistic earnings management and smoothing activities compared to firms that do not engage in these activities. A summary of the analytical evaluations are as follows:

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<tr>
<td>Coefficient $\beta_1$</td>
<td>1</td>
<td>$1/3$</td>
<td>$2/3$</td>
<td>$1/2$</td>
</tr>
<tr>
<td>Coefficient $\beta_2$</td>
<td>-1</td>
<td>$-2/3$</td>
<td>$-1$</td>
<td>$-5/6$</td>
</tr>
<tr>
<td>Coefficient $\beta_3$</td>
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<td>$1/3$</td>
<td>$1/3$</td>
<td>$1/3$</td>
</tr>
<tr>
<td>Regression $R^2$</td>
<td>100%</td>
<td>$50%$</td>
<td>$77.8%$</td>
<td>$77.8%$</td>
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<tr>
<td>Var(Residuals)</td>
<td>$v\varepsilon_0$</td>
<td>$v\varepsilon_0$</td>
<td>$(2/3)v\varepsilon_0$</td>
<td>$(2/3)v\varepsilon_0$</td>
</tr>
<tr>
<td>Var(Earnings)</td>
<td>$v\chi_0$</td>
<td>$v\chi_0$</td>
<td>$v\chi_0$</td>
<td>$(5/6)v\chi_0$</td>
</tr>
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These results show that the DD model is quite effective in explaining total working capital accruals (i.e., non-discretionary + discretionary accruals), but this is of little use if one is trying to detect earnings management or assess accruals quality. Finally, the simulations in Appendix A show that a strong negative correlation between contemporaneous accruals and cash flow from operations may indicate systematic earnings management and low quality earnings (see, for example, Leuz, Nanda and Wysocki, 2003). In the following sections, I further analyze this problem by examining the empirical properties of the DD model.
3. Sample Selection and Descriptive Statistics

To complement the analytical analyses in section 2 and Appendix A, I also benchmark the properties of the DD accruals quality model using two samples. The first sample, described in section 3.1, is comprised of 19,385 firm-year observations for 1,703 U.S. firms between 1987 and 2006. This sample is similar to the sample used by Dechow and Dichev (2002). The second sample, described in section 3.2, is comprised 47,908 firm-year observations from 30 countries between 1993 and 2006.

3.1 U.S. Sample

Table 1 summarizes the main sample used in the empirical analyses. The sample is obtained from the Compustat industrial and research files between 1987 and 2006. Similar to Dechow and Dichev (2002), I use cash flow from operations from the Statement of Cash Flows reported under Financial Accounting Standard No. 95 (SFAS No. 95, FASB 1987). The sample is restricted to firms with complete data on assets, earnings, cash flow from operations, changes in accounts receivable, and changes in inventory. Similar to Dechow and Dichev (2002), I truncate the most extreme 1% of cash flow from operations, earnings, and changes in working capital, and require at least one year of past and future cash flows and earnings associated with current period working capital accruals. Also similar to Dechow and Dichev (2002), I require at least eight years of data to estimate firm-specific regressions. These restrictions reduce the sample to 19,385 firm-year observations for 1,703 firms. My final sample of firm-year observations is larger than Dechow and Dichev (2002) because the sample period extends to 2006, but the number of firm observations is slightly smaller than Dechow and Dichev because of the additional stock return data requirements for my data sample.
Cash flow from operations, \( CFO_t \), for U.S. firms is Compustat item 308. Working capital accruals in year \( t \) (\( WCAcc_t \)) are computed as \( \Delta AR_t + \Delta Inv_t - \Delta AP_t - \Delta TP_t + \Delta Other Assets_t \), where \( AR_t \) is accounts receivable, \( Inv_t \) is inventory, \( AP_t \) is accounts payable, and \( TP_t \) is taxes payable in year \( t \). Specifically, \( WCAcc_t \) is calculated from Compustat items as \( \Delta WC_t = -(item \ 302 + item \ 303 + item \ 304 + item \ 305 + item \ 307) \). I calculate earnings after short-term accruals, but before long-term accruals as \( Earn_t = CFO_t + WCAcc_t \). All variables are scaled by lagged total assets.

Panel A of Table 1 shows that cash flows, accruals and earnings numbers are similar to those reported in Dechow and Dichev (2002). The Pearson correlations reported in Panel B are also consistent with Dechow and Dichev. Specifically, there is a strong positive contemporaneous correlation between \( Earn_t \) and \( CFO_t \) (0.718), a positive contemporaneous correlation between \( Earn_t \) and \( WCAcc_t \) (0.330), and a negative contemporaneous correlation between \( CFO_t \) and \( WCAcc_t \) (-0.431). I also find an economically insignificant unconditional correlation between current accruals, \( WCAcc_t \), and past and future cash flows from operations, \( CFO_{t-1} \) and \( CFO_{t+1} \). This finding is also consistent with the results in Dechow and Dichev.

3.2 International Sample

Table 2 summarizes the international sample. The sample is obtained from the Worldscope database which contains data from annual reports of publicly-traded companies around the world. To be included in the sample, a country must have at least 150 firm-year observations. A firm-year observation is included if there are at least four consecutive years of income statement and balance sheet data to calculate past, present, and 12 future cash flow from operations and working capital accruals. These four consecutive years of financial data must include total sales, operating earnings, changes in accounts receivable, and changes in inventory. Similar to the U.S. sample, I truncate the most extreme 1\% of firm-year observations of scaled
cash flow from operations, earnings, and changes in working capital within each country. All observations are scaled by lagged sales rather than assets because of the large variation in asset intensity, and asset recognition rules and choices within and across firms in this international sample. These differences in reported assets can potentially lead to spurious results if one uses variables scaled by total assets (see, for example, Wysocki, 2004). These data requirements leave a sample of 47,908 firm-year observations across 30 countries. Operating income ($Earn_t$) is used to measure earnings to avoid capturing systematic differences in other non-operating income across firms and countries. I calculate working capital accruals ($WCAcc_t$) and cash flow from operations ($CFO_t$) using the balance sheet method because most international firms do not consistently report cash flow statements. Following Dechow et al. (1995), I calculate changes in non-cash working capital as $WCAcc_t = (\Delta CA_t - \Delta Cash_t) - (\Delta CL_t - \Delta STD_t - \Delta TP_t)$. The variables are defined as: $\Delta CA_t =$ change in total current assets, $\Delta Cash_t =$ change in cash/cash equivalents, $\Delta CA_t =$ change in total current liabilities, $\Delta STD_t =$ change in short-term debt included in current liabilities, $\Delta TP_t =$ change in income taxes payable in year $t$. If a firm does not report information on taxes payable or short-term debt, then the change in both variables is assumed to be zero. Similar to Leuz, Nanda, and Wysocki (2003), I approximate cash flow from operations, $CFO_t$, for the sample of international firms as the difference between operating income, $Earn_t$, and working capital accruals, $WCAcc_t$, in year $t$.

The data in Panel A of Table 2 shows cash flow and earnings numbers that slightly smaller in magnitude than those reported in Table 1 for the U.S. sample. On the other hand, working capital accruals for international firms are, on average, slightly larger than the number reported by U.S. firms. The mean Pearson correlations across countries reported in Panel B are also similar to the numbers reported for U.S. firms. A notable difference is that the
contemporaneous correlation between current earnings \((Earn_t)\) and cash flow from operations \((CFO_t)\) is only 0.417 for the international sample whereas it is 0.722 for the U.S. sample. On the other hand, the persistence of reported earnings, \(corr(Earn_t,Earn_{t+1})=0.680\), is actually higher for the international firms than U.S. firms which have a lower persistence number of 0.668. This difference appears to be explained by greater earnings smoothing activities using accruals for firms in the international sample. In particular, the contemporaneous correlation between working capital accruals \((WCAcc_t)\) and cash flow from operations \((CFO_t)\) has a large mean value of -0.776 in the international sample, while the U.S. sample has a negative correlation of -0.431. This is consistent with the earnings management evidence in Leuz, Nanda, and Wysocki (2003) that suggests that U.S. firms smooth earnings less than other firms around the world.

4. Do empirical tests of firms’ “innate” characteristics validate the DD model?

Prior research attempts to show that DD model capture earnings quality by correlating the variability of the model residuals with firms’ “innate” characteristics. For example, Dechow and Dichev (2002) predict and test the correlations between \(sresid\) (the firm-specific standard deviation of the residuals from the DD model) and specific firm characteristics. In particular, they predict that if \(sresid\) captures accounting quality, then it should be associated with the length of the firm’s operating cycle (+), firm size (-), sales volatility (+), cash flow volatility (+), working capital accrual volatility (+), earnings volatility (+), loss frequency (+), and the magnitude of accruals (+). Dechow and Dichev (2002) find empirical evidence supporting these predictions and they therefore claim that it confirms that the DD model captures firms’ accounting quality. Francis, LaFond, Olsson and Schipper (2005) go further and claim that a regression of \(sresid\) on these factors captures a firm’s “innate” accounting quality.
It is questionable whether correlating these firm characteristics with the absolute variation of residuals from the DD model tells us anything about accruals quality. For example, McNichols (2002) notes that relating the absolute variation in accrual residuals “to the absolute magnitude of accruals, and to the standard deviation of sales, cash flows, accruals, and earnings, are likely to be induced mechanically, and that variability in the residuals is increasing in accruals, which in turn is correlated with variability in sales, cash flows, and earnings” (p. 64). McNichols (2002) also suggests that the correlation results would be more readily interpretable if the relative variance of the errors (i.e. the regression R²) were systematically correlated with firm characteristics.⁴

In addition to McNichols’ critique, I claim that the correlation between $s_{resid}$ and various firm characteristics provides only partial and circumstantial evidence that $s_{resid}$ is a valid accounting quality proxy. To demonstrate this, I will momentarily accept the assertion that the DD model correctly decomposes working capital accruals into a “low quality” component (i.e. the regression residual) and a “high quality” component (i.e., the model predicted value of accruals). If this decomposition is correct, then the firm characteristics listed above should not only be correlated with $s_{resid}$, but they should be consistently correlated with the variability of accruals explained by the DD model. Specifically, the variability of explained accruals from the DD model should have the opposite correlations with “innate” firm characteristics compared to the predicted correlations with $s_{resid}$. To illustrate this point, consider the simple case where all firms have the same variability of total working capital accruals. By definition, the variance of total working capital accruals equals the variance of explained accruals from the DD model plus the variance of residuals from the DD model. It immediately follows that the cross-sectional

⁴ On the other hand, Gu (2004) discusses the problems with making comparisons of regression R²'s across samples.
correlation between a firm characteristic and the variance of residual accruals will be mirrored by an opposite correlation between the firm characteristic and the variance of explained accruals.

I test these extended cross-sectional predictions using correlation tests similar to those presented in Dechow and Dichev (2002) and Francis, LaFond, Olsson and Schipper (2005). Panel A of Table 3 summarizes the sample descriptive statistics of the eight “innate” firm characteristics. The descriptive statistics in my sample are very similar to those reported in Dechow and Dichev (2002). In Panel B, I replicate the simple correlations between $s_{resid}$ and the series of “innate” firm characteristics. The first row of Panel B shows that correlations between $s_{resid}$ and the eight firm characteristics are very similar to those predicted and documented by Dechow and Dichev (2002). I then compute the correlations between $std_{expl}$ (the standard deviation of explained accruals from the DD model) and the same firm characteristics. Interestingly, the correlations are almost exactly the same as those found for $s_{resid}$ rather than the opposite which would be expected if the DD model decomposed accruals into high quality and low quality components. These similar associations are also observed Panel C which presents multiple regression tests for both $s_{resid}$ and $std_{expl}$. These findings contradict the contention of Dechow and Dichev (2002) and Francis, LaFond, Olsson and Schipper (2005) that their correlation tests directly confirm that the DD model identifies “high quality accruals”.

As a specific example, I analyze the logic behind the predicted correlations between firm size, $s_{resid}$, and $std_{expl}$. First, if smaller firms are expected to have lower accounting quality, then Dechow and Dichev predict and find larger absolute variability of accruals residuals for these small firms. Second, if the exact same logic is applied to the explained part of accruals, then these smaller firms should also exhibit lower absolute variability in the explained accruals from the DD model. The empirical evidence does not support this prediction. It should be
noted that if you have some doubts about the logic of the second statement listed above, then should have exactly the same doubts about the first statement listed above. In conclusion, we observe exactly the same associations between the firm characteristics and absolute variability of explained and residual accruals. This contradictory evidence forces us to conclude that either: (i) the DD model randomly decompose accruals rather than separating high and low quality accruals, or (ii) correlation tests between “innate” firm characteristics and the absolute variability of residual accruals are uninformative about the validity of the DD model, or (iii) the absolute variability of accrual residuals is an inappropriate measure of accruals quality, or (iv) all of the above.

5. Empirical benchmarking of the DD model

In the section, I benchmark the properties of the DD model for U.S. and international firms. I specifically focus on the contemporaneous correlation between accruals and cash flows as major factor that affects the usefulness of the DD accruals model.

5.1 Analyzing the contemporaneous association of accruals and cash flows

The negative contemporaneous correlation between cash flows and accruals is a widely-observed property of accounting numbers (see, for example, Dechow, 1994). In this sub-section, I examine the negative correlation between a firm’s current accruals and cash flows, $\text{Corr}(\text{CFO}_t, \text{WCAcc}_t)$, where $\text{WCAcc}_t$ is the change in non-cash working capital (i.e. working capital accruals), and $\text{CFO}_t$ is cash flow from operations in period $t$.

There is an on-going debate whether this negative correlation helps improve or undermines the usefulness of earnings as a measure of firm performance. On one hand, prior
research argues that the negative correlation between accruals and cash flows reflects the smoothing of temporary components of cash flows and therefore improves earnings quality. This smoothing arises from the timing and matching principles of an accrual accounting system where accruals record real economic transactions (see, for example, Dechow, 1994 and Dechow, Kothari and Watts, 1998). On the other hand, smoothing can also arise from managers opportunistically using accruals to misrepresent firm performance and risk. Therefore, a strong negative correlation between cash flows and accruals can reflect earnings management (see, for example, Myers and Skinner, 2007, Leuz, Nanda and Wysocki, 2003, and Burgstahler, Hail and Leuz, 2006). In fact, Leuz, Nanda and Wysocki (2003) argue that if a typical accounting system underreacts to economic shocks, and if managers use accruals to signal performance, then this would induce a less negative or even positive correlation between cash flows and accrual.

These competing explanations for the correlation between cash flows and accruals have polar opposite implications for earnings quality. Ironically, prior research directly or indirectly uses the correlation between cash flows and accruals as a proxy for earnings quality. However, there is little systematic evidence whether this correlation actually captures high or low earnings quality. This paper attempts to fill this void by benchmarking the correlation between cash flows and accruals against three common measures of earnings quality. The first earnings quality benchmark is earnings persistence, Persist. It is calculated as the firm-specific Pearson correlation between current and future earnings, Earn_t and Earn_{t+1}. Dechow and Dichev (2002) also use earnings persistence as a measure of earnings quality to assess the validity of their original accruals model. The second earnings property is the ability of current reported earnings to predict future cash flow from operations, Predict. If investors ultimately value future cash flows, then the predictive ability of current earnings for future cash flows is an important
earnings quality metric for investors (see, for example, Finger, 1994; and Barth, Cram and Nelson, 2001). The predictive measure is calculated as the firm-specific Pearson correlation between current earnings, \( \text{Earn}_t \), and future cash flow from operations, \( \text{CFO}_{t+1} \). The third earnings quality measure, \( \text{ERC} \), captures the association between current reported annual earnings, \( \text{Earn}_t \), and contemporaneous annual stock returns, \( \text{Ret}_t \). Firms’ annual stock returns are calculated over the same fiscal period as their earnings and are inclusive of dividends paid during the year.

5.2 A decomposition of the “empirical” DD model

The empirical version of the DD model (equation (4a)) attempts to capture the extent to which working capital accruals map into operating cash flow realizations. DD summarize accruals quality as the inverse of \( s_{resid} \), the standard deviation of the residuals from model (4a). Higher values of \( s_{resid} \) indicate lower earnings quality because less of the variation in current accruals is explained by past, present and future cash flow from operations. It should be noted that an alternate way to quantify accruals quality from the DD model is to measure the explanatory power (Adjusted \( R^2 \)) of regression model (4a) (see, for example, McNichols, 2002). In the DD framework, a high explanatory power of model (4a) would indicate high accruals quality.

A very desirable feature of the DD accruals quality model is that it captures the association between current accruals and past and future cash flows. If current accruals act to recognize real (realized) cash transactions from prior or subsequent periods, then one should observe a positive association between current accruals and past and future period cash flow from operations. These two attributes of accruals had not been previously modeled in the
literature (Dechow and Dichev, 2002). However, the DD model also captures the negative contemporaneous association between accruals and cash flows. The negative contemporaneous association between accruals and cash flows is problematic for the DD model because it can simply reflect firms’ opportunistic earnings smoothing activities, the antithesis of ‘quality’.

To investigate the potential confounding effect arising from the contemporaneous association between accruals and cash flows, I dissect the DD accruals model by comparing the incremental explanatory power of past and future cash flows over and above the explanatory power of current cash flows. This dissection provides insights into the properties of the individual cash flow components of the DD model. I first examine the basic contemporaneous association between working capital accruals and cash flows from operations. I estimate a restricted version of the DD model as follows:

\[ i_t = b_0 + b_2 CFO_t + \varepsilon_i \]  

(4b)

Regression model (4b) captures the contemporaneous association between accruals and cash flows in isolation. Prior research documents a strong negative relation between contemporaneous accruals and cash flows (see, for example, Dechow, 1994, and Dechow, Kothari and Watts, 1998). A nice feature of this simple regression model is that there is one-to-one link between square of the slope coefficient and the model’s coefficient of determination (R^2). A stronger negative association between accruals and cash flows implies a higher model R^2 and vice versa.

To allow a comparison between regression models (4a) and (4b), I examine both the adjusted R^2 and the standard deviation of the residuals (sresid) of the regression models. These measures can be used to determine what fraction of the explanatory power of the DD accruals
model (i.e. model $(4a)$) is caused by the contemporaneous negative association between accruals and cash flows (i.e. captured by the restricted model $(4b)$). This is important because the contemporaneous negative association between accruals and cash flows may capture opportunistic earnings smoothing rather than fundamental accruals quality. A greater explanatory power of current cash flows for current accruals would increase the overall explanatory power of the DD accruals model. However, this high explanatory power is unlikely to reflect fundamental accruals quality and, therefore, inhibits the ability of the DD accruals quality model to truly capture earnings and accruals quality.

If current cash flow component of the DD model either adds noise or reflects poor accruals quality, then it would be advantageous to “remove” the effect of current cash flows from the regression model. However, the simple exclusion of current cash flows from the DD regression model is problematic. In particular, Dechow and Dichev (2002) explain and show that current working capital accruals have a very weak unconditional association with past and future cash flows. To verify the weak unconditional association, I estimate a regression that only includes past and future cash flow from operations as determinants of current accruals:

$$A_t = b_0 + b_1 CFO_{t-1} + b_2 CFO_{t+1} + \varepsilon_t$$  \hspace{1cm} (4c)

Even though past and future cash flows are vitally important for assessing accruals quality, it is expected that regression model $(4c)$ will have weak explanatory power for current working capital accruals. The weak unconditional relation between accruals and past and future cash flows suggests the necessity to condition on current cash flow realizations to capture the other components that truly reflect accruals quality. In fact, the full DD model attempts to do this
by including past, future and current cash flows as explanatory variables (see regression model (4a)).

5.3. Modified measures of accruals quality

In this section, I present a simple solution to the limitations of the DD accruals quality model. On one hand, it is desirable to remove the confounding effects of current cash flows in regression model (4a). On the other hand, it is necessary to condition on current cash flows to overcome the weak unconditional association between current accruals and past and future cash flows in model (4c). A simple solution to this problem is to examine the incremental explanatory power of past and present cash flows over and above the explanatory power of current cash flows for current accruals. This can be easily measured by comparing the explanatory power of regression model (4a) with the explanatory power of restricted regression model (4b). Dechow and Dichev (2002) show that current accruals are significantly associated with past and future cash flows in regression model (4a). However, they do not investigate how much of the variation in accruals is explained by past and future cash flows incremental to that of current cash flows. I outline three possible metrics to capture the incremental explanatory power of past and future cash flows over that of current cash flows:

\[
\text{Accruals Quality Metric 1} = \text{Adjusted } R^2[\text{Model 4a}] - \text{Adjusted } R^2[\text{Model 4b}]
\]

\[
\text{Accruals Quality Metric 2} = \frac{\text{Adjusted } R^2[\text{Model 4a}]}{\text{Adjusted } R^2[\text{Model 4b}]}
\]

\[
\text{Accruals Quality Metric 3} = \frac{s\text{resid}[\text{Model 4b}]}{s\text{resid}[\text{Model 4a}]}
\]

where regression models (4a) and (4b) are estimated for the same sample of observations and \(s\text{resid}\) is the standard deviation of the regression residuals (see, Dechow and Dichev, 2002). These three related metrics capture accruals quality through the incremental relative explanatory power of past, current, and future accruals compared to the explanatory power of current cash flows.
flows in isolation. In all cases, a higher value of a metric is interpreted as indicating a stronger relative association between current accruals and past and future cash flows (i.e. higher accruals quality).

5.4. Empirical results

In this section, I analyze the relation between the correlation of cash flows and accruals and benchmark measures of earning quality including earnings persistence, the predictive ability of earnings for future cash flows, and the contemporaneous association between earnings and stock returns. The goal of this analysis is to determine if a strong negative contemporaneous correlation between cash flows and accruals is associated with high or low earnings quality. I then apply a similar benchmarking exercise to the original DD accruals quality model and for three new modified accruals quality metrics that remove the confounding effect of firms’ earnings smoothing activities that potentially corrupt the DD model (see section 5.3). All accruals metrics are benchmarked against widely-used and previously-validated variables that capture accounting quality or factors that influence accounting quality.

5.4.1 Association between corr(cash flows, accruals) and earnings quality measures

Table 4 presents the association between three common measures of earnings quality for U.S. firms and the contemporaneous correlation of cash flows and accruals. The three firm-specific measures of earnings quality are Persist, Predict, and ERC. A higher value of these measures is suggestive of higher earnings quality. If a stronger negative correlation between cash flows and accruals (i.e. $corr(CFO_t, WCAcc_t)$) improves earnings quality, then it should be negatively related to the three earnings quality measures. Interestingly, I find that $corr(CFO_t, WCAcc_t)$ is unrelated to earnings persistence. Moreover, $corr(CFO_t, WCAcc_t)$ has a significant
positive association with the predictive ability of current earnings for future cash flows (Predict) and with ERC. These findings suggest that a stronger negative correlation between cash flows and accruals (i.e. smoothing) leads to lower earnings quality.

The findings for this sample of 1,703 U.S firms are consistent with the international results of Leuz, Nanda and Wysocki (2003). They also present evidence suggesting that a stronger negative correlation between cash flows and accruals is associated with higher levels of earnings management and lower earnings quality.

5.4.2 Accrual quality metrics for U.S. sample

The evidence in Table 4 suggests that a strong negative correlation between cash flows and accruals can reduce earnings quality. Therefore, I next turn to an evaluation of the DD model of accruals/earnings quality which captures the negative correlation between cash flows and accruals. Table 5 presents the estimates of regression models based on the original DD model and restricted versions of the DD model. Panel A summarizes the pooled regression results for the 19,385 firm-year observations and Panel B summaries the average firm-specific results estimated for each of the 1,703 firms in the U.S. sample.

In Panel A, the first row summarizes the pooled estimation of the original DD accruals model (model (4a)) where current working capital accruals are regressed on past, present, and future cash flow from operations. The coefficients and statistical significance of the regression model are very similar to those reported in Dechow and Dichev (2002). The coefficients on past, present and future cash flows are 0.21, -0.48, and 0.20, respectively. The overall explanatory power of the model, as captured by the adjusted R², is 30.5% and the standard deviation of the residuals, sresid, is 0.053. It should be noted that the adjusted R² and sresid are, by construction,
negatively-related with each other. In row 2 of Panel A, a restricted version of the original DD model (model (4b)) is estimated where the only determinant of working capital accruals is contemporaneous cash flow from operations. It can be seen that this simple model has strong explanatory power with an adjusted $R^2$ of 19.7% and $sresid$ is 0.068. This restricted model suggests that close to two-thirds of the explanatory power of the full DD model (i.e. model (4a)) is explained by the negative contemporaneous correlation between accruals and cash flows. This can be problematic if this negative contemporaneous correlation reflects firms’ use of accruals to opportunistically smooth reported earnings. In particular, DD argue that a high explanatory power (which equates to a low value of $sresid$) implies high accruals quality. On the other hand, the high explanatory power of the DD model may be largely attributable to firms’ opportunistic earnings smoothing activities which are the antithesis of high quality earnings.

To remove the potentially confounding effects of earnings smoothing from the DD model, I estimate a reduced-form regression model that only includes past and future cash flows as determinants of working capital accruals. This model is presented in row 3 of Table 5. Similar to the findings of Dechow and Dichev (2002), there is essentially no association between current accruals and past and future cash flows. This confirms the need to capture the incremental relative explanatory power of past and future cash flows over and above the explanatory power of current cash flows. For descriptive purposes, I quantify the average incremental explanatory power of past and future cash flows by comparing the adjusted $R^2$ from the full DD accruals regression (model (4a)) with the adjusted $R^2$ from the restricted accruals regression (model (4b)). For the overall pooled sample of 19,385 observations, the adjusted $R^2$ increases from 19.7% to 30.5% when past and future cash flows are added to the basic model of that only includes
contemporaneous cash flows ($CFO_t$) as a determinant of working capital accruals ($WCAcc_t$). Based on the F-test, the 10.8% increase in the adjusted $R^2$ is statistically significant.

I re-estimate the accruals models using firm-specific regressions for the sample of 1,703 firms are summarized in Panel B of Table 5. The regression results for models (4a), (4b), and (4c) are summarized in rows 1-3, respectively, of Panel B. The results parallel the pooled regressions findings with slightly higher average explanatory power for both models (4a) and (4b). The restricted version of the DD model (i.e., model (4b)) explains an average of 27.2% of the variation in firms’ working capital accruals compared with 45.6% for the unrestricted model (i.e. model (4a)). Given that over a majority of the explanatory power of model (4a) is explained by current cash flows, this again raises the concern that much of the explanatory power of the full DD accruals model is attributable to firms’ smoothing activities. If this negative contemporaneous correlation between accruals and cash flows reflects opportunistic earnings smoothing, then the DD model will be a poor measure of accruals and earnings quality. On the other hand, a metric that captures the incremental explanatory power of past and future cash flows for accruals does not suffer from this problem. For the firm-specific regressions, the average incremental explanatory power of past and future cash flows over and above current cash flows is 18.4%.

5.4.3 Benchmarking accruals quality models for U.S. sample

In the prior subsection, I demonstrate that a sizable fraction of the explanatory power of the original DD accruals model is attributable to the negative contemporaneous association between accruals and cash flow from operations. If this contemporaneous component does not capture accruals quality, then it can handicap the DD model in capturing accruals quality. In section 5.3, I outline three simple alternate metrics of accruals quality based on the incremental
relative explanatory power of past and future for current accruals. In this sub-section, I compare how the original DD model and the three alternate metrics relate to fundamental earnings properties that are generally associated with high quality earnings for U.S. firms.

I use three fundamental earnings properties, Persist, Predict, and ERC, as benchmarks for earnings quality. Table 6 presents the correlations between the DD accruals measures, the three modified accruals quality metrics, and the three fundamental earnings properties for the 1,656 firms in the sample. The original DD metrics are summarized by -$1*sresid$ (the negative of the standard deviation of DD regression residuals) and the adjusted $R^2$ from the DD regression model. The three modified metrics capture the incremental relative explanatory power of past and future cash flows as the either the difference or ratio of adjusted $R^2$’s between regression models $(4a)$ and $(4b)$ or the ratio of the $sresid$ from model $(4b)$ to the $sresid$ from model $(4a)$. In all cases, a higher value of a metric is interpreted as higher accruals quality.

I first investigate whether the original DD accruals quality measures are associated with the three fundamental earnings attributes of Persist, Predict, and ERC. The key findings are presented in the lower left corner of the correlation matrix. The original DD accruals quality measures exhibit only a weak positive association with the fundamental earnings attributes. Both -$1*sresid$ and the $Adj R^2$ from the original DD model have a statistically significant correlation with earnings persistence which is consistent with the findings documented in Dechow and Dichev (2002). However, Predict and ERC show essentially insignificant associations with the original DD metrics. This result is not that surprising given the strong association between the original DD metrics and the correlation between cash flows and accruals ($corr(CFO, WCAcc)$). It appears that the original DD metrics are essentially captures the smoothing of cash flows with accruals.
I next proceed to validate whether the three modified accruals metrics are better able to capture firms’ earnings quality. Again, I compare the modified accruals metrics with the three fundamental earnings quality attributes of Persist, Predict, and ERC. These associations are reported in the lower right corner of the correlation matrix in Table 6. In all cases, the new modified metrics have a strong positive and significant association with each of the fundamental earnings quality attributes. This suggests that the three incremental relative explanatory power metrics are strongly and positively related to measures of “high quality” earnings. This evidence suggests that the measures from original DD accruals quality model are poor proxies for accruals and earnings quality for U.S. firms. Moreover, the modified accruals quality metrics (based on the incremental relative explanatory power of past and future cash flows for accruals) have a very strong positive association with traditional measures of fundamental earnings quality.

5.4.4 Accrual quality metrics for international sample

Table 7 presents the estimates of accruals regressions for international firms based on the original DD model and restricted versions of the DD model. Panel A summarizes the pooled firm-year regression results and Panel B summaries the mean country-specific results estimated for each of the 30 countries.

In Panel A, the first row summarizes the estimation of the original DD pooled regression model (i.e. model (4a)) where current working capital accruals are regressed on past, present, and future cash flow from operations. The results of the regression model are similar to the U.S. results reported in Table 5. The overall model explanatory power as captured by the adjusted $R^2$ is 46.3%, which is slightly higher than the U.S. sample. It should be noted that, according to the DD model, a higher overall explanatory power (or lower $sresid$) from model (4a) implies higher
earnings quality. The higher explanatory power for the international sample suggests that the original DD model may not truly capture accruals quality because U.S. firms are generally considered to have better earnings quality than firms form other countries in the world (see, for example, Hung, 2001, Leuz, Nanda, and Wysocki, 2003 and Bhattacharya, Daouk, and Welker, 2003). To check for the possible confounding effect of earnings smoothing, a restricted version of the original DD model is estimated in row 2 of Panel A. This estimate of model (4b) includes contemporaneous cash flow from operations as the sole determinant of working capital accruals. It can be seen that this simple model has strong explanatory power with an adjusted $R^2$ of 29.6%. The estimates of the restricted model suggest that over half of the explanatory power of the full DD model (i.e. model (4a)) is explained by the negative contemporaneous correlation between accruals and cash flows in this international sample. If this contemporaneous correlation captures poor-quality accruals in the DD model, then this would explain why the original DD model has higher explanatory power for international firms compared to U.S. firms. These empirical results again suggest that the anomalously-high explanatory power of DD model for international firms may be attributable to widespread earnings smoothing activities in countries outside the U.S.

To remove the potentially confounding effects of earnings smoothing from the DD model, I examine the average incremental explanatory power of past and future cash flows for accruals. This is calculated by comparing the adjusted $R^2$ from the full DD accruals regression (model (4a)) with the adjusted $R^2$ from restricted accruals model (model (4b)). For the overall pooled sample of 47,908 international firm-years, the adjusted $R^2$ increases from 29.6% to 46.3%. Based on the F-test, this 16.7% increase is statistically significant. To determine if the pooled regression results are robust, I re-estimate the accruals models using country-specific regressions for the sample of 30 countries. These results are summarized in Panel B of Table 7.
The 30 country regressions are separate pooled regressions of firm-year observations within each country. The average regression results for models (4a), (4b), and (4c) are summarized in rows 1-3, respectively, of Panel B. The results parallel the regressions findings presented in Panel A. The restricted version of the DD model (i.e., model (4b) explains an average of 39.6% of the variation in firms’ current working capital accruals within each country. On the other hand, the incremental explanatory power of past and future cash flows is an average of 11.4% higher for all countries in the sample.

5.4.5 Benchmarking accruals quality models for international sample

In this sub-section, I examine the how the quality measures from the original DD model compare with previously-validated country-level earnings management and opacity measures, and country-level institutional factors associated with earnings quality. I also examine the association of the three modified accruals quality metrics with the same country-level earnings management/opacity measures and country-level institutional factors.

The country-level earnings management and opacity metrics are obtained from Leuz, Nanda, and Wysocki (2003) and Bhattacharya, Daouk and Welker (2003). The first earnings management measure, Aggregate EM Score, is the overall earnings management score tabulated from four earnings management measures from Leuz, Nanda and Wysocki (2003). This overall score captures earnings smoothing relative to cash flows, the use of accruals to offset cash flow shocks, the extent of accruals use, and extent of loss avoidance. Given that the DD accruals quality measure may (unknowingly) capture earnings smoothing, I also use the Leuz, Nanda, and Wysocki (2003) measure of smoothing as the second earnings management measure. This measure is labeled EM – Smoothing and is the international ranking of the spearman correlation
between accruals and cash flows for firms within each country. The third earnings management measure, $[\text{Accruals}]$, is the average ratio of absolute working capital accruals to absolute cash flow from operations for each country from Leuz, Nanda, and Wysocki (2003). Finally, the *Earnings Opacity* metric is tabulated from Bhattacharya, Daouk and Welker (2003). The four country-level institutional factors relating to earnings quality are also tabulated from previous international studies. Prior research has shown that these factors relate to overall earnings quality (see, for example, Hung, 2001, Leuz, Nanda, and Wysocki, 2003, and Wysocki, 2004). The studies show that the four institutional variables, namely high quality accounting standards, better disclosure rules, strong investor protection, and effective legal enforcement, reduce firms’ incentives and ability to distort reported earnings. The first country-level institutional variable is *Accounting Standards*. This variable measures the inclusion or omission of 90 items from firms’ annual reports and is tabulated for a large number of countries in La Porta et al (1998). The second variable, *Filing Disclosure*, captures a country’s mandated stock exchange disclosure filing requirements tabulated by La Porta et al (2003). The third and fourth institutional variables are *Investor Rights* and *Legal Enforcement*. Both of these variables reflect the laws and enforcement of laws that protect the rights of outside investors. *Investor Rights* is the anti-director rights index tabulated by La Porta et al (1998) and *Legal Enforcement* is the mean score of three legal variables also tabulated by La Porta et al (1998).

Table 8 presents the correlations between the original DD accruals measures, the three modified accruals quality metrics, the country-level earnings quality proxies, and the institutional factors for the 30 countries in the sample. Again, the modified metrics capture the *incremental* relative explanatory power for accruals as the difference or ratio of the adjusted $R^2$ of regression models (4a) and (4b) or the ratio of the $sresid$ from model (9) to the $sresid$ from model (4a). The
original DD metrics are summarized by \(-1*sresid\) (the negative of the standard deviation of regression residuals) and the adjusted R\(^2\) from a regression of current accruals on past, present and future cash flows (i.e. model (4a)).

The upper left quadrant of the correlation matrix summarizes the correlations between modified accruals quality metrics and the four measures of earnings management and opacity. In all cases, a negative correlation is expected between the accruals quality metrics and earnings management/opacity because the latter reflect low earnings quality. For all of the modified accruals quality metrics, there is a strong and statistically significant negative correlation with the earnings management/opacity measures. This suggests that the modified accruals quality metrics correctly capture earnings quality attributes.

For comparative purposes, I next examine the correlations of the earnings management/opacity measures with the original DD accruals quality measures. Again, if the original DD model captures accruals quality, then one should expect negative relations amongst the variables. However, one observes very mixed results for the original DD metrics in the upper right quadrant of the correlation matrix. First, the DD metrics exhibit inconsistent positive associations with the Leuz, Nanda and Wysocki (2003) aggregate earnings management score. The DD metrics also exhibit inconsistent positive associations with the \(EM – Smoothing\) measure. These results suggest that the original DD model may be partially capturing (opportunistic) earnings smoothing rather than accruals quality. Again, the negative contemporaneous association between accruals and cash flows appears to be the culprit. On the other hand, the DD model exhibits the predicted negative association with the absolute accruals measure, \(|Accruals|\), from Leuz, Nanda and Wysocki (2003). This is consistent with the finding of Dechow and Dichev (2002) that \(sresid\) is highly correlated with absolute working capital
accruals. Finally, the quality measures from the original DD model (as measured by \(-I*sresid\) or \(Adj \, R^2\)) have essentially no correlation with the earnings opacity measure from Bhattacharya, Daouk, and Welker (2003). Together these empirical findings suggest that the original DD model does not capture accounting quality for international firms. On the other hand, the modified accruals quality metrics (based on the incremental relative explanatory power of past and future cash flows for current accruals) display consistent and appropriate associations with previously-validated earnings management/opacity variables.

I next turn to the institutional factors that are related to earnings quality. The accounting standards, disclosure, investor rights, and enforcement variables are predicted to be positively related to accounting quality because these variables limit the incentives and ability of firms to distort reported earnings. The lower left quadrant of the correlation matrix shows that all of the modified accruals quality metrics have a strong and statistically significant positive correlation with Accounting Standards, Filing Disclosure, Investor Rights, and Legal Enforcement. This is consistent with the predicted values for these correlations. On the other hand, the correlations between the original DD metrics and these four institutional variables have the wrong sign. In other words, the original DD metrics appear to capture poor earnings/accruals quality. As a result, high values of the original DD metrics are found in countries with weak institutional factors that lead to poor quality financial numbers.

6. Conclusion

This paper examines the empirical validity of “accounting quality” measures derived from the Dechow and Dichev (DD, 2002) accruals model. Accounting researchers have recently focused on the DD discretionary accruals model as a catch-all proxy for firms’ accruals quality, earnings quality, accounting quality, and overall information quality. However, there is scant
evidence to date about the model’s validity and whether it reliably captures “accounting quality” of U.S. and international firms. In this study, I present analytical and empirical assessments of the DD model that suggest that: (i) the model has limited ability to distinguish between discretionary and non-discretionary accruals, (ii) the model displays empirical properties indistinguishable from a random decomposition of working capital accruals, and (iii) accounting quality measures derived from the DD model show weak and often contradictory associations with other measures of accounting quality for U.S. and international firms. I present suggestions for empirical alternatives and directions for future research.

I also re-examine the negative contemporaneous correlation between cash flows and accruals and its implications for earnings quality. I address the on-going debate whether this negative correlation is associated with high or low earnings quality. Using samples of U.S. and international firms, I empirically show that average earnings quality decreases as the correlation between current cash flows and current accruals becomes more negative. This finding has important implications for research studies that directly or indirectly use the correlation between cash flows and accruals to measure earnings quality. Specifically, the widely-used Dechow and Dichev (DD, 2002) earnings quality model is dominated by the negative contemporaneous correlation between cash flows and accruals.

I show that the DD accruals quality model displays either weak or inconsistent relations with fundamental earnings attributes and institutional factors associated with high-quality earnings for U.S. and international firms. In addition, I show that the DD model can lead to incorrect inferences about earnings and accruals quality. As a solution to this problem, I present and test a simple modification of the DD model that captures the incremental association between accruals and past and future cash flows. My tests show that this simple modification to
the original DD model results in a superior proxy of accruals quality for U.S. and international firms.
References


Table 1
Descriptive statistics and correlations for U.S. sample

The U.S. data sample consists of 19,385 firm-year observations for 1,703 firms between 1987 to 2006. Cash flow from operations (CFO) is item 308 from Compustat statement of cash flows. Working capital accruals (WCAcc) equals \( \Delta AR + \Delta Inv - \Delta AP - \Delta TP + \Delta Other Assets \) (net), where AR is accounts receivable, Inv is inventory, AP is accounts payable, and TP is taxes payable. Earnings before long-term accruals (Earn) equals CFO + ΔWC. All variables are scaled by lagged total assets.

Panel A: Descriptive statistics for U.S. sample

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Lower Quartile</th>
<th>Upper Quartile</th>
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<tbody>
<tr>
<td>Cash from operations (CFO)</td>
<td>0.070</td>
<td>0.105</td>
<td>0.022</td>
<td>0.123</td>
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<tr>
<td>Working capital accruals (WCAcc)</td>
<td>0.016</td>
<td>0.088</td>
<td>-0.018</td>
<td>0.053</td>
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<td>Earnings before long-term accruals (Earn)</td>
<td>0.086</td>
<td>0.097</td>
<td>0.051</td>
<td>0.144</td>
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</tbody>
</table>

Panel B: Pearson correlations for U.S. sample

<table>
<thead>
<tr>
<th></th>
<th>CFO(_t)</th>
<th>WCAcc(_t)</th>
<th>CFO(_{t+1})</th>
<th>CFO(_{t-1})</th>
<th>Earn(_{t+1})</th>
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<tbody>
<tr>
<td>Earn(_t)</td>
<td>0.718*</td>
<td>0.330*</td>
<td>0.563*</td>
<td>0.561*</td>
<td>0.668*</td>
</tr>
<tr>
<td>CFO(_t)</td>
<td>-0.431*</td>
<td>0.544*</td>
<td>0.548*</td>
<td>0.593*</td>
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</tr>
<tr>
<td>WCAcc(_t)</td>
<td>-0.011*</td>
<td>0.012*</td>
<td>0.062*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFO(_{t+1})</td>
<td></td>
<td></td>
<td>0.459*</td>
<td>0.716*</td>
<td></td>
</tr>
<tr>
<td>CFO(_{t-1})</td>
<td></td>
<td></td>
<td></td>
<td>0.476*</td>
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* indicates significance at <0.01 level.
Table 2
Descriptive statistics and correlations for international sample

The international data sample consists of 47,908 firm-year observations for 30 countries between 1993 to 2006. Working capital accruals ($WCA_{acc}$) equals $(\Delta CA_t - \Delta Cash_t) - (\Delta CL_t - \Delta STD_t - \Delta TP_t)$, where $\Delta CA_t$ = change in total current assets, $\Delta Cash_t$ = change in cash/cash equivalents, $\Delta CL_t$ = change in total current liabilities, $\Delta STD_t$ = change in short-term debt included in current liabilities, $\Delta TP_t$ = change in income taxes payable in year $t$. $Earn_t$ is operating earnings. Cash flow from operations ($CFO_t$) equals $Earn_t - WCA_{acc}$. All variables are scaled by lagged total sales. Pearson correlations are calculated within each country and the mean correlations across all countries are presented in Panel B.

Panel A: Descriptive statistics for international sample

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Lower Quartile</th>
<th>Upper Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash from operations ($CFO$)</td>
<td>0.049</td>
<td>0.091</td>
<td>0.010</td>
<td>0.116</td>
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<tr>
<td>Working capital accruals ($WCA_{acc} = \Delta WC$)</td>
<td>0.017</td>
<td>0.082</td>
<td>-0.025</td>
<td>0.068</td>
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<tr>
<td>Earnings before long-term accruals ($Earn$)</td>
<td>0.066</td>
<td>0.079</td>
<td>0.018</td>
<td>0.129</td>
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Panel B: Mean Pearson correlations across countries

<table>
<thead>
<tr>
<th></th>
<th>$CFO_t$</th>
<th>$WCA_{acc}$</th>
<th>$CFO_{t+1}$</th>
<th>$CFO_{t-1}$</th>
<th>$Earn_{t+1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Earn_t$</td>
<td>0.417*</td>
<td>0.408*</td>
<td>0.389*</td>
<td>0.371*</td>
<td>0.689*</td>
</tr>
<tr>
<td>$CFO_t$</td>
<td>-0.776*</td>
<td>0.391*</td>
<td>0.363*</td>
<td>0.366*</td>
<td></td>
</tr>
<tr>
<td>$WCA_{acc}$</td>
<td></td>
<td>0.120</td>
<td>0.091</td>
<td>0.159</td>
<td></td>
</tr>
<tr>
<td>$CFO_{t+1}$</td>
<td></td>
<td></td>
<td>0.366*</td>
<td></td>
<td>0.415*</td>
</tr>
<tr>
<td>$CFO_{t-1}$</td>
<td></td>
<td></td>
<td></td>
<td>0.287*</td>
<td></td>
</tr>
</tbody>
</table>

* indicates significance of mean correlations across countries at 0.05 level.
Table 3
Descriptive statistics and correlations between “accruals quality” (sresid), variation in “explained” accruals (stdexpl) and selected firm characteristics for U.S. sample

The U.S. data sample consists of 19,385 firm-year observations for 1,703 firms between 1987 to 2006.

Panel A: Descriptive statistics for U.S. sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>StdDev</th>
<th>Lower Quartile</th>
<th>Upper Quartile</th>
</tr>
</thead>
<tbody>
<tr>
<td>StdDev DD residuals (sresid)</td>
<td>0.030</td>
<td>0.026</td>
<td>0.010</td>
<td>0.038</td>
</tr>
<tr>
<td>StdDev explained WCAcc from DD (stdexpl)</td>
<td>0.028</td>
<td>0.024</td>
<td>0.009</td>
<td>0.036</td>
</tr>
<tr>
<td>Average operating cycle</td>
<td>137</td>
<td>64</td>
<td>86</td>
<td>187</td>
</tr>
<tr>
<td>Log (Total Asset)</td>
<td>5.61</td>
<td>2.18</td>
<td>3.79</td>
<td>7.12</td>
</tr>
<tr>
<td>Std. Dev. of Sale</td>
<td>0.24</td>
<td>0.23</td>
<td>0.09</td>
<td>0.30</td>
</tr>
<tr>
<td>Std. Dev. of CFO</td>
<td>0.063</td>
<td>0.046</td>
<td>0.030</td>
<td>0.081</td>
</tr>
<tr>
<td>Std. Dev. of WCAcc</td>
<td>0.054</td>
<td>0.037</td>
<td>0.023</td>
<td>0.076</td>
</tr>
<tr>
<td>Std. Dev. of Earnings</td>
<td>0.055</td>
<td>0.047</td>
<td>0.022</td>
<td>0.068</td>
</tr>
<tr>
<td>Fraction of negative earnings for each firm</td>
<td>0.14</td>
<td>0.020</td>
<td>0</td>
<td>0.12</td>
</tr>
<tr>
<td>Average</td>
<td>0.057</td>
<td>0.041</td>
<td>0.024</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Panel B: Pearson Correlations between StdDev of Residual or Predicted WCAcc (sresid or stdexpl) and selected firm characteristics (n=1,703, * indicates significance at <0.01 level)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>sresid = StdDev[residual WCAcc from DD model]</td>
<td>0.30*</td>
<td>-0.57*</td>
<td>0.36*</td>
<td>0.63*</td>
<td>0.76*</td>
<td>0.82*</td>
<td>0.67*</td>
</tr>
<tr>
<td>stdexpl = StdDev[explained WCAcc from DD model]</td>
<td>0.27*</td>
<td>-0.55*</td>
<td>0.43*</td>
<td>0.69*</td>
<td>0.70*</td>
<td>0.86*</td>
<td>0.62*</td>
</tr>
</tbody>
</table>

Panel C: Regressions of StdDev of Residual or Predicted WCAcc (sresid or stdexpl) on selected firm characteristics (n=1,703)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Frac NegEarn</th>
<th>StdDev Sales</th>
<th>Average WCAcc</th>
<th>Average Op. Cycle</th>
<th>Log (Total Assets)</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>sresid = StdDev[residual WCAcc from DD model]</td>
<td>0.05 (&lt;0.01)</td>
<td>0.007 (&lt;0.01)</td>
<td>0.35 (0.05)</td>
<td>-0.003 (&lt;0.01)</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>stdexpl = StdDev[explained WCAcc from DD model]</td>
<td>0.04 (&lt;0.01)</td>
<td>0.009 (&lt;0.01)</td>
<td>0.33 (0.17)</td>
<td>-0.004 (&lt;0.01)</td>
<td>0.61</td>
<td></td>
</tr>
</tbody>
</table>
Table 4
Assessing the properties of the contemporaneous correlation of cash flows and accruals for U.S. sample

The sample consists of 1,703 observations of firm-specific correlations of financial variables between 1987 and 2006. Cash flow from operations ($CFO_t$) is item 308 from Compustat statement of cash flows. Working capital accruals ($WCAcc_t$) equals $\Delta AR_t + \Delta Inv_t - \Delta AP_t - \Delta TP_t + \Delta Other Assets (net)_t$, where AR is accounts receivable, Inv is inventory, AP is accounts payable, and TP is taxes payable. Earnings before long-term accruals ($Earn_t$) equals $CFO_t + WCAcc_t$. All variables are scaled by lagged total assets. The benchmark properties of earnings quality are earnings persistence, “Persist”: $\delta = \text{corr}(Earn_t, Earn_{t+1})$, the predictive ability of current earnings for future cash flow from operations, “Predict”: $\phi = \text{corr}(Earn_t, CFO_{t+1})$, and the association between stock returns and earnings, “ERC: $\theta = \text{corr}(Earn_t, Ret_t)$. $Ret_t$ is the annual stock return including dividends for fiscal year $t$.

+++: The (-) sign indicates that a negative correlation would be predicted if a strong negative contemporaneous correlation between cash flows and accruals implies “high” quality earnings.

<table>
<thead>
<tr>
<th>Pearson correlations between firms’ accrual-cash flow correlation and earnings properties</th>
<th>“Persist”</th>
<th>“Predict”</th>
<th>“ERC”</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{corr}(CFO_t, WCAcc_t)$</td>
<td>0.04 ( - )++</td>
<td>0.17* ( - )++</td>
<td>0.13* ( - )++</td>
</tr>
<tr>
<td>$\delta = \text{corr}(Earn_t, Earn_{t+1})$</td>
<td>0.86*</td>
<td>0.45*</td>
<td></td>
</tr>
<tr>
<td>$\phi = \text{corr}(Earn_t, CFO_{t+1})$</td>
<td></td>
<td>0.39*</td>
<td></td>
</tr>
</tbody>
</table>

* indicates significance of mean correlations across countries at 0.05 level.
Table 5
U.S. regressions of the change in working capital on past, present, and future cash flow from operations

The U.S. data sample consists of 19,385 firm year observations for 1,703 firms between 1987 to 2006. Cash flow from operations (CFO) is item 308 from Compustat statement of cash flows. Working capital accruals (WCAcc, ΔWC) equals ΔAR + ΔInv - ΔAP - ΔTP + ΔOther Assets (net), where AR is accounts receivable, Inv is inventory, AP is accounts payable, and TP is taxes payable. Earnings before long-term accruals (Earn) equals CFO + WCAcc. The variable sresid is the standard deviation of the residuals from regression model. All variables are scaled by lagged total assets.

\[
\begin{align*}
WCAcc_t &= \alpha + \beta_1CFO_{t-1} + \beta_2CFO_t + \beta_3CFO_{t+1} + \varepsilon_t \quad (1) \\
WCAcc_t &= \alpha + \beta_2CFO_t + \varepsilon_t \quad (2) \\
WCAcc_t &= \alpha + \beta_1CFO_{t-1} + \beta_3CFO_{t+1} + \varepsilon_t \quad (3)
\end{align*}
\]

Panel A: Pooled regressions (19,385 U.S. firm-year observations)

<table>
<thead>
<tr>
<th></th>
<th>Intercept (t-stat)</th>
<th>$\beta_1$ (t-stat)</th>
<th>$\beta_2$ (t-stat)</th>
<th>$\beta_3$ (t-stat)</th>
<th>Adj. $R^2$</th>
<th>Diff Adj. $R^2$ (1) - (2)</th>
<th>Sresid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (1)</td>
<td>0.02 (30.44)</td>
<td>0.21 (-71.30)</td>
<td>-0.48 (26.59)</td>
<td>0.20</td>
<td>30.5%</td>
<td>10.8%</td>
<td>0.053</td>
</tr>
<tr>
<td>Model (2)</td>
<td>0.04 (52.48)</td>
<td>-0.45 (-49.09)</td>
<td></td>
<td></td>
<td>19.7%</td>
<td></td>
<td>0.068</td>
</tr>
<tr>
<td>Model (3)</td>
<td>0.01 (11.25)</td>
<td>0.003 (0.42)</td>
<td></td>
<td>0.002 (0.22)</td>
<td>0.0%</td>
<td></td>
<td>0.079</td>
</tr>
</tbody>
</table>

Panel B: Means of firm-specific regressions (1,703 U.S. firms)

<table>
<thead>
<tr>
<th></th>
<th>Intercept (t-stat)</th>
<th>$\beta_1$ (t-stat)</th>
<th>$\beta_2$ (t-stat)</th>
<th>$\beta_3$ (t-stat)</th>
<th>Adj. $R^2$</th>
<th>Diff Adj. $R^2$ (1) - (2)</th>
<th>Sresid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (1)</td>
<td>0.03 (22.17)</td>
<td>0.19 (-53.23)</td>
<td>-0.59 (11.47)</td>
<td>0.17</td>
<td>45.6%</td>
<td>18.4%</td>
<td>0.032</td>
</tr>
<tr>
<td>Model (2)</td>
<td>0.05 (25.45)</td>
<td></td>
<td>-0.53 (38.95)</td>
<td></td>
<td>27.2%</td>
<td></td>
<td>0.045</td>
</tr>
<tr>
<td>Model (3)</td>
<td>0.03 (13.44)</td>
<td>0.01</td>
<td></td>
<td>-0.01 (0.06)</td>
<td>1.0%</td>
<td></td>
<td>0.055</td>
</tr>
</tbody>
</table>
Table 6
Benchmarking accrual quality models for U.S. sample

The sample consists of 1,703 firm observations of accruals quality estimated from firm-specific regressions. The three accruals quality metrics are based on the relative incremental explanatory power of accruals model (1) compared to accruals model (2). Accruals model (1) is a firm-specific regression of $\Delta WC_t = \alpha + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1}$. Accruals model (2) is a firm-specific regression of $\Delta WC_t = \alpha + \beta_2 CFO_t$. The accruals quality metrics are calculated as follows:

\[
\text{Accruals Quality Metric (i)} = \text{Adjusted } R^2[\text{Model 1}] - \text{Adjusted } R^2[\text{Model 2}]
\]
\[
\text{Accruals Quality Metric (ii)} = \frac{\text{Adjusted } R^2[\text{Model 1}]}{\text{Adjusted } R^2[\text{Model 2}]}
\]
\[
\text{Accruals Quality Metric (iii)} = \frac{\text{sresid}[\text{Model 2}]}{\text{sresid}[\text{Model 1}]}
\]

where sresid is the standard deviation of the residuals from accruals model (1) or (2). The value of sresid and the Adjusted $R^2$ are also calculated for accruals model (1) to capture accruals quality from the original Dechow and Dichev (DD, 2002) accruals model. “Smooth” captures the firm-specific correlation between cash flows and working capital accruals, $\text{corr}(\text{CFO}_t, \text{WCAcc}_t)$. The benchmark properties of earnings quality are earnings persistence, “Persist”: $\delta = \text{corr}(\text{Earn}_t, \text{Earn}_{t+1})$, the predictive ability of current earnings for future cash flow from operations, “Predict”: $\phi = \text{corr}(\text{Earn}_t, \text{CFO}_{t+1})$, and the association between stock returns and earnings, “ERC: $\theta = \text{corr}(\text{Earn}_t, \text{Ret}_t)$. The definition of the earnings and cash flow variables are presented in Table 1. $\text{Ret}_t$ is the annual stock return including dividends for fiscal year $t$.

**Pearson correlations between firms’ accruals quality metrics and earnings properties**

<table>
<thead>
<tr>
<th></th>
<th>Original DD Model</th>
<th>Modified Accrual Quality Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pred Sign -1*sresid</td>
<td>Adj $R^2$</td>
</tr>
<tr>
<td>“Smooth” $\text{corr}(\text{CFO}_t, \text{WCAcc}_t)$</td>
<td>0.44*</td>
<td>0.39*</td>
</tr>
<tr>
<td>“Persist” $\delta = \text{corr}(\text{Earn}<em>t, \text{Earn}</em>{t+1})$</td>
<td>+</td>
<td>0.12*</td>
</tr>
<tr>
<td>“Predict” $\phi = \text{corr}(\text{Earn}<em>t, \text{CFO}</em>{t+1})$</td>
<td>+</td>
<td>0.10*</td>
</tr>
<tr>
<td>“ERC” $\theta = \text{corr}(\text{Earn}_t, \text{Ret}_t)$</td>
<td>+</td>
<td>0.05</td>
</tr>
</tbody>
</table>

* indicates significant correlation at 0.05 level.
Table 7
International sample regressions of the change in working capital on past, present, and future cash flow from operations

The international data sample consists of 47,908 firm-year observations for 30 countries between 1993 to 2006. Working capital accruals ($WC_{t} = \Delta WC_{t}$) equals $(\Delta CA_{t} - \Delta Cash_{t}) - (\Delta CL_{t} - \Delta STD_{t} - \Delta TP_{t})$, where $\Delta CA_{t}$ = change in total current assets, $\Delta Cash_{t}$ = change in cash/cash equivalents, $\Delta CL_{t}$ = change in total current liabilities, $\Delta STD_{t}$ = change in short-term debt included in current liabilities, $\Delta TP_{t}$ = change in income taxes payable in year $t$. $Earn_{t}$ is operating earnings. Cash flow from operations ($CFO_{t}$) equals $Earn_{t} - WC_{Acc_{t}}$. The variable $sresid$ is the standard deviation of the residuals from regression model. All variables are scaled by lagged total sales.

$$WC_{Acc_{t}} = \alpha + \beta_1CFO_{t-1} + \beta_2CFO_{t} + \beta_3CFO_{t+1} + \epsilon_t \quad (1)$$

$$WC_{Acc_{t}} = \alpha + \beta_2CFO_{t} + \epsilon_t \quad (2)$$

$$WC_{Acc_{t}} = \alpha + \beta_1CFO_{t-1} + \beta_3CFO_{t+1} + \epsilon_t \quad (3)$$

**Panel A: Pooled regressions (47,908 firm-year observations across 30 countries)**

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>Adj. $R^2$</th>
<th>Diff $\text{Adj.}R^2$</th>
<th>sresid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model (1)</strong></td>
<td>0.01</td>
<td>0.16</td>
<td>-0.62</td>
<td>0.14</td>
<td>46.3%</td>
<td>16.7% (F=1296)</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>(17.89)</td>
<td>(24.32)</td>
<td>(-56.73)</td>
<td>(23.04)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model (2)</strong></td>
<td>0.02</td>
<td></td>
<td>-0.56</td>
<td></td>
<td>29.6%</td>
<td></td>
<td>0.051</td>
</tr>
<tr>
<td></td>
<td>(26.44)</td>
<td></td>
<td>(-51.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model (3)</strong></td>
<td>0.03</td>
<td>0.01</td>
<td></td>
<td>0.02</td>
<td>0.0%</td>
<td></td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td>(9.07)</td>
<td>(1.63)</td>
<td></td>
<td>(1.04)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Panel B: Means of country-specific regressions (30 countries)**

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>Adj. $R^2$</th>
<th>Diff $\text{Adj.}R^2$</th>
<th>sresid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model (1)</strong></td>
<td>0.04</td>
<td>0.21</td>
<td>-0.71</td>
<td>0.16</td>
<td>51.0%</td>
<td>11.4%</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>(1.77)</td>
<td>(2.58)</td>
<td>(-3.05)</td>
<td>(2.17)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model (2)</strong></td>
<td>0.04</td>
<td></td>
<td>-0.68</td>
<td></td>
<td>39.6%</td>
<td></td>
<td>0.044</td>
</tr>
<tr>
<td></td>
<td>(1.96)</td>
<td></td>
<td>(2.94)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model (3)</strong></td>
<td>0.04</td>
<td>-0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>2.0%</td>
<td></td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>(1.65)</td>
<td>(0.26)</td>
<td>(0.31)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8
Pearson correlations: Accruals metrics and international accounting/institutional factors

The sample consists of 30 country observations of accruals quality estimated from country-specific regressions. The 3 accruals quality metrics capture the relative incremental explanatory power of accruals model (1) compared to accruals model (2). Accruals model (1) is a regression of \( \text{WC_{Acc}} = \alpha + \beta_1 \text{CFO}_{t-1} + \beta_2 \text{CFO}_t + \beta_3 \text{CFO}_{t+1} \). Accruals model (2) is a regression of \( \text{WC_{Acc}} = \alpha + \beta_2 \text{CFO}_t \). The accruals quality metrics are calculated as follows:

\[
\text{Accruals Quality Metric (i)} = \text{Adjusted } R^2[\text{Model 1}] - \text{Adjusted } R^2[\text{Model 2}]
\]

\[
\text{Accruals Quality Metric (ii)} = \frac{\text{Adjusted } R^2[\text{Model 1}]}{\text{Adjusted } R^2[\text{Model 2}]}
\]

\[
\text{Accruals Quality Metric (iii)} = \frac{s\text{resid}[\text{Model 2}]}{s\text{resid}[\text{Model 1}]}
\]

where \( s\text{resid} \) is the standard deviation of the residuals from accruals model (1) or (2). The value of \( s\text{resid} \) and the Adjusted \( R^2 \) are calculated for accruals model (1) to capture accruals quality from the Dechow and Dichev (DD, 2002) accruals model. 

**Aggregate EM Score** is the aggregate earnings management score tabulated from 4 earnings management measures from Leuz, Nanda, and Wysocki (2003). EM - Smoothing is the country’s spearman correlation between accruals and cash flows from Leuz, Nanda, and Wysocki (2003). EM - Accruals is absolute working capital accruals scaled by absolute cash flows from Leuz, Nanda, and Wysocki (2003). Earnings Opacity is the earnings opacity measure from Bhattacharya, Daouk, and Welker (2003). Accounting Standards measures the inclusion or omission of 90 items from companies’ annuals reports in each country from La Porta et al. (1998). Filing Disclosure captures a country’s mandated stock exchange disclosure filing requirements from La Porta et al. (2003). Investor Rights is the anti-director rights index from La Porta et al. (1998). Legal Enforcement is the means score of three legal variables from La Porta et al. (1998). Book-Tax Conformity is the alignment of a country’s tax and financial reporting rules from Hung (2001).

<table>
<thead>
<tr>
<th>Pred</th>
<th>Original DD Model</th>
<th>Modified Accrual Quality Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Adj R²</td>
</tr>
<tr>
<td><strong>Earnings Quality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate EM Score (LNW, 2003)</td>
<td>-</td>
<td>0.12</td>
</tr>
<tr>
<td>EM - Smoothing (LNW, 2003)</td>
<td>-</td>
<td>0.24</td>
</tr>
<tr>
<td>EM - Accruals (LNW, 2003)</td>
<td>-</td>
<td>-0.33*</td>
</tr>
<tr>
<td>Earnings Opacity (BDW, 2003)</td>
<td>-</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Institutional Factors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounting Standards (LLSV, 1998)</td>
<td>+</td>
<td>-0.18</td>
</tr>
<tr>
<td>Filing Disclosure (LLS, 2003)</td>
<td>+</td>
<td>-0.07</td>
</tr>
<tr>
<td>Investor Rights (LLSV, 1998)</td>
<td>+</td>
<td>-0.22</td>
</tr>
<tr>
<td>Legal Enforcement (LLS, 1998)</td>
<td>+</td>
<td>-0.03</td>
</tr>
<tr>
<td>Book-Tax Conformity (Hung, 2001: # = 21)</td>
<td>-</td>
<td>0.21</td>
</tr>
</tbody>
</table>

* * indicates significant correlation at 0.05 level.
APPENDIX A
Analytical Assessment of Dechow and Dichev (2002) Accruals Model

In this appendix, I present an analytical evaluation of the Dechow and Dichev (DD, 2002) model. First, I outline a framework for the regression model and present simplifying assumptions to make the analysis more tractable. Second, I investigate the base-line properties of the “theoretically correct” DD model. Third, I quantify the measurement error problems of the empirical DD model. Finally, I investigate a previously overlooked and potentially serious problem with the empirical DD model. The problem arises when managers’ discretionary accrual choices are correlated with current period cash flows. I evaluate how this affects both the properties of the empirical DD model and any inferences one may draw about “accruals quality”.

A summary of my analytical results is as follows:

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<td>2/3</td>
<td>1/2</td>
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<tr>
<td>Coefficient $\beta_2$</td>
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<td>-5/6</td>
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<td>50%</td>
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<tr>
<td>Var(Earnings)</td>
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(A1) Base-line regression model

Dechow and Dichev’s (2002) empirical regression model of working capital accruals, $A_t$, can be expressed as follows:

$$A_t = \alpha + \beta_1 C_{t-1} + \beta_2 C_t + \beta_3 C_{t+1} + \varepsilon_t \quad (4)$$

where

(i) $C_{t-1}$, $C_t$, and $C_{t+1}$ are lagged, current, and future period cash flow measures;

(ii) $A_t$ are working capital accruals in period $t$ defined as $CF_{t-1} - CF_t - CF_{t+1} + CF_{t+1}$; and

(iii) $CF_j$ are cash flows received/paid in period $j$, but recognized in net income in period $k$.

Without loss of generality, I assume that all variables are measured relative to their mean. Therefore, the regression intercept, $\alpha$, equals zero. The OLS normal equations of regression model (4) give the estimated coefficients for $\beta_1, \beta_2,$ and $\beta_3$:

$$\hat{\beta}_1 = \frac{\sigma(A_t, C_{t-1}) - \hat{\beta}_2 \sigma(C_{t-1}, C_t) - \hat{\beta}_3 \sigma(C_{t-1}, C_{t+1})}{\sigma^2(C_{t-1})}$$

$$\hat{\beta}_2 = \frac{\sigma(A_t, C_t) - \hat{\beta}_1 \sigma(C_{t-1}, C_t) - \hat{\beta}_3 \sigma(C_t, C_{t+1})}{\sigma^2(C_t)}$$
\[ \hat{\beta}_3 = \frac{\sigma(A_t, C_{t+1}) - \hat{\beta}_1 \sigma(C_{t-1}, C_{t+1}) - \hat{\beta}_2 \sigma(C_t, C_{t+1})}{\sigma^2(C_{t+1})} \]

The estimated variance of the regression residuals, \( e_t \), is:

\[ \hat{\sigma}^2(e_t) = \frac{1}{N-1} \sum e_t^2 = \frac{1}{N-1} \left[ \sum A_t^2 - \hat{\beta}_1 \sum A_t C_{t-1} - \hat{\beta}_2 \sum A_t C_t - \hat{\beta}_3 \sum A_t C_{t+1} \right] \]

In the DD framework, a lower residual variance implies higher accruals quality. The explanatory power of the regression (\( R^2 \)) can be expressed as:

\[ R^2 = \frac{\sum A_t^2 - \sum e_t^2}{\sum A_t^2} \]

(A2) **Simplifying assumptions for analytical evaluation**

For simplicity and clarity of analysis, I make the following assumptions about cash flow properties:

(i) Cash flows are uncorrelated over time (i.e., \( \sigma(C_{t-1}, C_t) = \sigma(C_t, C_{t+1}) = \sigma(C_t, C_{t+1}) = 0 \)). Therefore, the estimated slope coefficients from model (1) simplify to:

\[ \hat{\beta}_1 = \frac{\sigma(A_t, C_{t-1})}{\sigma^2(C_{t-1})}, \hat{\beta}_2 = \frac{\sigma(A_t, C_t)}{\sigma^2(C_t)}, \hat{\beta}_3 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} \]

(ii) The time-series variability of cash, accrued, and deferred transactions are equal. Specifically, \( \Sigma(CF_j^j)^2 = \Sigma(CF_j^j)^2 = \Sigma(CF_j^j)^2 = K \), where \( K \) is a strictly positive constant.

(A3) **The DD regression with no measurement error:**

According to the theoretical version of DD model, the “correct” cash flow measures (with respect to working capital accruals) that should be used in regression model (4) are:

\[ C_{t-1} = CF_{t-1}^t, \quad C_t = CF_{t-1}^t + CF_{t+1}^{t+1}, \quad C_{t+1} = CF_{t+1}^t \]

If these cash flow measures are used, then:

\[ \hat{\beta}_1 = \frac{\sigma(A_t, C_{t-1})}{\sigma^2(C_{t-1})} = \frac{\sigma(A_t, CF_{t-1}^t)}{\sigma^2(CF_{t-1}^t)} = \frac{\sigma(CF_{t-1}^t - CF_{t-1}^{t+1} + CF_{t+1}^{t+1}, CF_{t+1}^{t+1})}{\sigma^2(CF_{t+1}^{t+1})} = 1, \]
\[ \hat{\beta}_2 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} = \frac{\sigma(A_t, CF_{t-1} + CF_{t+1})}{\sigma^2(CF_{t-1} + CF_{t+1})} = \frac{\sigma(CF_{t-1} - CF_{t-1} - CF_{t+1} + CF_{t+1}, CF_{t-1} + CF_{t+1})}{\sigma^2(CF_{t-1} + CF_{t+1})} \]

\[ = -\frac{\sigma(CF_{t-1} + CF_{t+1}, CF_{t+1})}{\sigma^2(CF_{t+1})} = -1, \]

\[ \hat{\beta}_3 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} = \frac{\sigma(CF_{t-1} - CF_{t-1} - CF_{t+1} + CF_{t+1})}{\sigma^2(CF_{t+1})} = \frac{\sigma(CF_{t-1}, CF_{t+1})}{\sigma^2(CF_{t+1})} = 1 \]

Similarly, the variance of the regression residuals will be equal to zero:

\[ \hat{\sigma}^2(e_{it}) = \frac{1}{N-1} \sum e^2_{it} = \frac{1}{N-1} \left[ \sum A^2_t - \hat{\beta}_1 \sum A_t C_{t-1} - \hat{\beta}_2 \sum A_t C_t - \hat{\beta}_3 \sum A_t C_{t+1} \right] \]

\[ = \frac{1}{N-1} \left[ \sum A^2_t - \sum A_t C_{t-1} + \sum A_t C_t - \sum A_t C_{t+1} \right] = \frac{1}{N-1} \left[ \sum A^2_t - \sum A_t (C_{t-1} - C_t + C_{t+1}) \right] \]

\[ = \frac{1}{N-1} \left[ \sum A^2_t - \sum A_t (CF_{t-1} - CF_{t-1} - CF_{t+1} + CF_{t+1}) \right] = \frac{1}{N-1} \left[ \sum A^2_t - \sum A_t A_t \right] = 0 \]

The explanatory power of the regression is also 100%:

\[ R^2 = \frac{\sum A^2_t - \sum e^2_{it}}{\sum A^2_t} = \frac{\sum A^2_t - 0}{\sum A^2_t} = 1 \]

\[(A4) \text{ Empirical DD model – Measurement error of using CFO}\]

DD argue that using cash flows from operations (CFO) as cash flow measures in regression model (4) leads to measurement error problems. In particular,

\[ C_{t-1} = CFO_{t-1} = CF_{t-1} + CF_{t-1} + CF_{t-1} \]

\[ C_t = CFO_t = CF_{t+1} + CF_{t+1} + CF_{t+1} \]

\[ C_{t+1} = CFO_{t+1} = CF_{t+1} + CF_{t+1} + CF_{t+1} \]

where the “bolded” cash flow components are considered measurement error with respect to the determinants of working capital accruals. DD use simulations to demonstrate show that using operating cash flows in the regression will bias the slope coefficients to zero and decrease the regression R². I confirm these findings use an analytical approach:

\[ \hat{\beta}_1 = \frac{\sigma(A_t, C_{t-1})}{\sigma^2(C_{t-1})} = \frac{\sigma(CF_{t-1} - CF_{t-1} - CF_{t+1} + CF_{t+1}, CF_{t-1} + CF_{t+1})}{\sigma^2(CF_{t-1} + CF_{t+1})} \]

\[ = \frac{\sigma^2(CF_{t-1})}{\sigma^2(CF_{t-1}) + \sigma^2(CF_{t+1}) + \sigma^2(CF_{t+1})} = \frac{1}{3}, \]

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\[ \hat{\beta}_2 = \frac{\sigma(A_t, C_t)}{\sigma^2(C_t)} = \frac{\sigma(CF_{t+1} - CF_t) - CF_{t-1} + CF_{t+1} + CF_{t+1} + CF_{t+1} + CF_{t+1}}{\sigma^2(CF_{t-1} + CF_{t+1} + CF_t)} \]

\[ = -\frac{\sigma(CF_{t-1} + CF_{t+1}, CF_t)}{\sigma^2(CF_{t-1}) + \sigma^2(CF_{t+1}) + \sigma^2(CF_t)} = -\frac{2}{3} \]

\[ \hat{\beta}_3 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} = \frac{\sigma(CF_{t-1} - CF_t) - CF_{t-1} + CF_{t+1} + CF_{t+1} + CF_{t+1} + CF_{t+1}}{\sigma^2(CF_{t-1} + CF_{t+1} + CF_t)} \]

\[ = \frac{\sigma^2(CF_{t+1})}{\sigma^2(CF_{t-1}) + \sigma^2(CF_{t+1}) + \sigma^2(CF_{t+1})} = \frac{1}{3} \]

The sum of squared regression residuals is no longer zero:

\[ \hat{\sigma}^2(e_t) = \frac{1}{N-4} \left[ \sum e_t^2 \right] = \frac{1}{N-1} \left[ \sum A_t^2 - \hat{\beta}_1 \sum A_t \sum C_t - \hat{\beta}_2 \sum A_t \sum C_{t-1} - \hat{\beta}_3 \sum A_t \sum C_{t+1} \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_t^2 - \frac{1}{3} \sum A_t C_{t-1} + \frac{2}{3} \sum A_t C_t - \frac{1}{3} \sum A_t C_{t+1} = \sum A_t^2 - \frac{1}{3} \sum A_t (C_{t-1} - 2C_t + C_{t+1}) \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_t^2 - \frac{1}{3} \sum A_t (CF_{t-1} - 2CF_t - 2CF_{t+1} + CF_{t+1} + CF_{t+1} + CF_{t+1}) \right] \rightarrow \text{See note below} \]

\[ = \frac{1}{N-4} \left[ \sum A_t^2 - \frac{1}{3} \sum A_t (CF_{t-1} - 2CF_t - 2CF_{t+1} + CF_{t+1}) \right] = \frac{1}{N-4} \left[ \frac{2}{3} \sum A_t^2 - \frac{1}{3} \sum A_t (-CF_{t-1} - CF_{t+1}) \right] \]

\[ = \frac{1}{N-4} \left[ \frac{2}{3} (4K) - \frac{1}{3} (2K) \right] = \frac{2K}{N-4} = v e_0 \]

*Based on assumptions in section (A2), the components of accruals are uncorrelated with \( CF_{t+1}, CF_{t+1}, CF_t, CF_{t+1}, \) and \( CF_{t+1} \).

The regression explanatory power drops to 50%:

\[ R^2 = \frac{\sum A_t^2 - \sum e_t^2}{\sum A_t^2} = \frac{4K - 2K}{4K} = \frac{1}{2} \]

Also, I capture the time series variability of earnings \((X_t)\) as:
\[
\hat{\sigma}^2(X_i) = \frac{1}{N-1} \sum X_i^2 = \frac{1}{N-1} \sum (C_i + A_i)^2 \\
= \frac{1}{N-1} \sum (CF_{t+1}^i + CF_{t-1}^i + CF_t^i) + \frac{1}{N-1} \sum (CF_{t+1}^i - CF_{t-1}^i + CF_t^i))^2 \\
= \frac{1}{N-1} \sum (CF_{t+1}^i + CF_{t+1}^i + CF_t^i)^2 = \frac{1}{N-1} \sum (CF_{t+1}^i)^2 + (CF_{t+1}^i)^2 + (CF_t^i)^2 = \frac{3K}{N-1} = \nu x_0
\]

(A5) Empirical DD mode with opportunistic earnings management

As outlined in the section (A4), the empirical DD model uses cash flows from operations as explanatory variables. In this section, I examine the impact of opportunistic earnings management on the outputs from the empirical DD model. Specifically, I examine the impact of a manager’s decision to completely offset a positive or negative shock to cash flows received and recognized in period t (i.e. \(CF_t^i\)). For example, the manager may wish to:

(i) Perfectly offset a negative shock to current period cash flow (\(CF_t^i\)) by creating a fictitious discretionary accrual that will offset the decline in operating performance in period t. The manager may use this opportunistic earnings management to maintain or increase her earnings-based bonus in period t.

(ii) Defer a positive shock to current period cash flow (\(CF_t^i\)) by creating a fictitious discretionary accrual to increase expected reported earnings in period t+1. For example, the manager may wish to report good performance prior to an planned equity issuance at the end of period t+1.

Consistent with the short term nature of working capital accruals, I assume that the fictitious discretionary accrual reverses in the subsequent period. Therefore, the discretionary accrual in period t equals:

\[DA_t = -CF_t^i + CF_{t,t-1}^i\]

where the first component (-\(CF_t^i\)) perfectly offsets the shock to current period cash flow, and the second part (\(CF_{t,t-1}^i\)) reflects the reversal of the discretionary accrual made in period t-1. Therefore,

\[A_t = NDA_t + DA_t = (CF_{t,t}^i - CF_{t,t-1}^i - CF_{t+1}^i + CF_{t+1,t}^i) + (-CF_t^i + CF_{t,t-1}^i)\]

It should be noted that this particular earnings management strategy does not change the time-series variability of reported earnings:
\[ \hat{\sigma}^2(X_t) = \frac{1}{N-1} \sum X_t^2 = \frac{1}{N-1} \sum (C_t + A_t)^2 \]
\[ = \frac{1}{N-1} \sum \left[ (CF_t^{t+1} + CF_t^{t-1} + CF_t^t) + [CF_{t-1}^t - CF_{t-1}^{t-1} - CF_{t-1}^{t+1} + CF_{t+1}^t - CF_{t+1}^{t-1}] \right]^2 \]
\[ = \frac{1}{N-1} \sum (CF_t^{t+1} + CF_t^{t-1} + CF_t^t)^2 = \frac{1}{N-1} \sum \left( (CF_t^{t+1})^2 + (CF_t^{t-1})^2 + (CF_t^t)^2 \right) = \frac{3K}{N-1} = \nu x_0 \]

The impact of the estimated regression slope coefficients is as follows:

\[ \hat{\beta}_1 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} = \frac{\sigma(CF_t^{t+1} - CF_t^{t-1} - CF_t^t + CF_{t-1}^t, CF_{t+1}^t - CF_{t-1}^{t-1} + CF_{t+1}^{t-1} + CF_{t+1}^{t+1})}{\sigma^2(CF_{t-1}^t + CF_{t-1}^{t+1} + CF_{t+1}^t)} \]
\[ = \frac{\sigma^2(CF_{t-1}^t) + \sigma^2(CF_{t-1}^{t+1})}{\sigma^2(CF_{t-1}^t) + \sigma^2(CF_{t-1}^{t+1}) + \sigma^2(CF_{t+1}^t)} = \frac{2}{3} \]

\[ \hat{\beta}_2 = \frac{\sigma(A_t, C_t)}{\sigma^2(C_t)} = \frac{\sigma(CF_t^{t+1} - CF_t^{t-1} + CF_t^t - CF_t^{t-1}, CF_{t+1}^t - CF_{t-1}^{t+1} + CF_{t+1}^{t-1} + CF_{t+1}^t)}{\sigma^2(CF_{t-1}^t + CF_{t-1}^{t+1} + CF_t^t)} \]
\[ = -\frac{\sigma(CF_t^{t-1} + CF_t^{t+1} + CF_t^t, CF_{t-1}^t + CF_{t+1}^t + CF_{t-1}^{t+1})}{\sigma^2(CF_{t-1}^t) + \sigma^2(CF_{t-1}^{t+1}) + \sigma^2(CF_t^t)} = \frac{-[\sigma^2(CF_t^{t-1}) + \sigma^2(CF_t^{t+1}) + \sigma^2(CF_t^t)]}{\sigma^2(CF_{t-1}^t) + \sigma^2(CF_{t-1}^{t+1}) + \sigma^2(CF_t^t)} = -1 \]

\[ \hat{\beta}_3 = \frac{\sigma(A_t, C_{t+1})}{\sigma^2(C_{t+1})} = \frac{\sigma(CF_t^{t+1} - CF_t^{t-1} + CF_t^t - CF_t^{t-1}, CF_{t+1}^t + CF_{t-1}^{t+1} + CF_{t+1}^{t-1} + CF_{t+1}^{t+2})}{\sigma^2(CF_{t-1}^t + CF_{t-1}^{t+1} + CF_t^t)} \]
\[ = \frac{\sigma^2(CF_{t+1}^t)}{\sigma^2(CF_{t+1}^t) + \sigma^2(CF_{t+1}^{t+1}) + \sigma^2(CF_{t+1}^{t+2})} = \frac{1}{3} \]

In summary, the estimated coefficients are \( \beta_1 = 2/3, \beta_2 = -1, \) and \( \beta_3 = 1/3. \) In general, the estimated are **more** similar to coefficients from the “theoretically correct” model of a firm with perfect accruals quality. In other words, this type of opportunistic earnings management produces DD regression coefficients that would lead one to infer that such a firm has “high quality” accruals. This is clearly a serious shortcoming of the DD model.

I next examine the estimated variance of regression residuals which DD argue is a direct measure of accruals quality:
\[
\sigma^2(e_i) = \frac{1}{N-4} \left[ \sum e_i^2 \right] = \frac{1}{N-1} \left[ \sum A_i^2 - \hat{\beta}_1 \sum A_i C_{t-1} - \hat{\beta}_2 \sum A_i C_t - \hat{\beta}_3 \sum A_i C_{t+1} \right] \\
= \frac{1}{N-4} \left[ \sum A_i^2 - \frac{2}{3} \sum A_i C_{t-1} + \sum A_i C_t - \frac{1}{3} \sum A_i C_{t+1} \right] = \frac{1}{N-1} \left[ \sum A_i^2 - \frac{1}{3} \sum A_i (2C_{t-1} - 3C_t + C_{t+1}) \right] \\
= \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{3} \sum A_i (2CF_{t-2} + 2CF_{t-1} + 2CF_t - 3CF_{t-1} - 3CF_t - 3CF_{t+1} + CF_{t+1} + CF_{t+2}) \right] \\
= \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{3} \sum (CF_{t-1} - CF_{t-1} - CF_{t+1} + CF_t - CF_{t-1} + CF_t + CF_{t+1})(2CF_{t-1} - 3CF_{t-1} - 3CF_{t+1} + CF_{t+1}) \right] \\
= \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{3} \sum A_i (2CF_{t-1} - 3CF_{t-1} - 3CF_{t+1} + CF_{t+1} + 2CF_{t-1} - 3CF_t) \right] \rightarrow \text{See note below} * \\
= \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{3} \sum A_i - \frac{1}{3} \sum A_i (CF_{t-1} - 2CF_{t-1} - 2CF_{t+1} + CF_{t+1} - 2CF_t) \right] \\
= \frac{1}{N-4} \left[ \frac{2}{3} \sum A_i^2 - \frac{1}{3} \sum A_i (CF_{t-1} - 2CF_{t-1} - 2CF_{t+1} + CF_{t+1} - 2CF_t) \right] \\
= \frac{1}{N-4} \left[ \frac{2}{3} (6) - \frac{1}{3} (8K) \right] = \frac{4/3 K}{N-4} = (2/3)ve_0
\]

*Based on assumptions in section (A2), the components of accruals (=DA+NDA) are uncorrelated with \(CF_{t-i}^i\), \(CF_{t-i}^{i+1}\), and \(CF_{t-i}^{i+2}\).

Therefore, the residual variance is actually lower for a firm that engages in opportunistic earnings management compared to a firm that does not use discretionary accruals. This means that the DD model misclassifies poor-quality accruals as high-quality accruals. Similarly, the model explanatory power can be calculated as:

\[
R^2 = \frac{\sum A_i^2 - \sum e_i^2}{\sum A_i^2} = \frac{6K - \frac{4}{3} K}{6K} = \frac{7}{9}
\]

Again, this value is higher than the \(R^2\) of a firm with no earnings management.

(A6) Empirical DD model with opportunistic earnings smoothing

In this section, I examine the impact of opportunistic earnings smoothing on the outputs from the empirical DD model. Specifically, I examine the impact of a manager’s decision to smooth half of a positive or negative shock to cash flows received and recognized in period \(t\) (i.e. \(CF_t^i\)). This cash flow shock would be spread across the current and subsequent reporting period. The manager may wish to do this to underreport the true variability and risk of the firms operating performance. The discretionary smoothing accruals in period \(t\) take the form:

\[
DA_t = -\frac{1}{2} CF_t^i + \frac{1}{2} CF_{t-1}^{t-1}
\]
where the first component \((\frac{1}{2}CF_i^t)\) offsets the half of the shock to current period cash flow, and the second part \((\frac{1}{2}CF_{i-1}^t)\) reflects the reversal of the discretionary accrual made in period \(t-1\). Therefore,

\[
A_t = NDA_t + DA_t = (CF_{i-1}^t - CF_i^t - CF_{i+1}^t + CF_{i+2}^t) + (-\frac{1}{2}CF_i^t + \frac{1}{2}CF_{i-1}^t)
\]

This earnings smoothing strategy does reduce the time-series variability of reported earnings:

\[
\hat{\sigma}^2(X_t) = \frac{1}{N-1} \sum X_t^2 = \frac{1}{N-1} \sum (C_t + A_t)^2
\]

\[
= \frac{1}{N-1} \sum ([CF_i^t + CF_{i-1}^t + CF_{i+1}^t] + [CF_i^t - CF_{i-1}^t - CF_{i+1}^t - \frac{1}{2} CF_i^t + \frac{1}{2} CF_{i-1}^t])^2
\]

\[
= \frac{1}{N-1} \sum (CF_i^t + CF_{i+1}^t - \frac{1}{2} CF_i^t + \frac{1}{2} CF_{i+1}^t)^2
\]

\[
= \frac{1}{N-1} \sum \left(\frac{1}{4}(CF_i^t)^2 + \frac{1}{4}(CF_{i+1}^t)^2 + \frac{1}{4}(CF_i^t)^2 + \frac{1}{4}(CF_{i+1}^t)^2\right) = \frac{2.5K}{N-1} = (5/6)v_{x_0}
\]

The impact of the estimated regression slope coefficients is as follows:

\[
\hat{\beta}_1 = \frac{\sigma(A_t, C_{i-1})}{\sigma^2(C_{i-1})} = \frac{\sigma(CF_i^t - CF_{i-1} - CF_{i+1} + CF_{i+2})}{\sigma^2(CF_i^t + CF_{i+1}^t + CF_{i-1}^t)} = \frac{1}{2}
\]

\[
\hat{\beta}_2 = \frac{\sigma(A_t, C_i)}{\sigma^2(C_i)} = \frac{\sigma(CF_i^t - CF_{i-1} - CF_{i+1} + CF_{i+2})}{\sigma^2(CF_i^t + CF_{i+1}^t + CF_{i-1}^t)}
= \frac{\sigma(CF_i^t + CF_{i+1}^t + \frac{1}{2} CF_i^t + \frac{1}{2} CF_{i+1}^t + CF_{i+2}^t) - \sigma(CF_i^t + CF_{i+1}^t + \frac{1}{2} CF_i^t + \frac{1}{2} CF_{i+1}^t)}{\sigma^2(CF_i^t + CF_{i+1}^t + CF_{i-1}^t)} = \frac{1}{2}\sigma^2(CF_i^t) = \frac{5}{6}
\]

\[
\hat{\beta}_3 = \frac{\sigma(A_t, C_{i+1})}{\sigma^2(C_{i+1})} = \frac{\sigma(CF_i^t - CF_{i-1} - CF_{i+1} + CF_{i+2})}{\sigma^2(CF_i^t + CF_{i+1}^t + CF_{i-1}^t)}
= \frac{\sigma^2(CF_i^t)}{\sigma^2(CF_i^t + CF_{i+1}^t + CF_{i-1}^t)} = \frac{1}{2}
\]

In summary, the estimated coefficients are \(\beta_1=1/2\), \(\beta_2=-5/6\) and \(\beta_3=1/3\). Again, the estimated are more similar to coefficients for the “theoretically correct” model of a firm with perfect accruals quality. In other words, this type of opportunistic earnings smoothing produces DD regression.
coefficients that would lead one to infer that such a firm has “high quality” accruals. This again demonstrates a serious shortcoming of the DD model.

The estimated variance of regression residuals is:

\[ \hat{\sigma}^2(e_i) = \frac{1}{N-4} \left[ \sum e_i^2 \right] = \frac{1}{N-1} \left[ \sum A_i^2 - \hat{\beta}_1 \sum A_i C_{i-1} - \hat{\beta}_2 \sum A_i C_i - \hat{\beta}_3 \sum A_i C_{i+1} \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{2} \sum A_i C_{i-1} + \frac{5}{6} \sum A_i C_i - \frac{1}{3} \sum A_i C_{i+1} \right] = \frac{1}{N-1} \left[ \sum A_i^2 - \frac{1}{6} \sum A_i (3C_{i-1} - 5C_i + 2C_{i+1}) \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{6} \sum A_i (3CF_{i-1} - 5CF_{i-1} - 5CF_{i-1} + 2CF_{i+1} + 2CF_{i+1} + 2CF_{i+1}) \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{6} \sum A_i (2CF_{i-1} - 4CF_{i-1} + 4CF_{i+1} + 2.5CF_{i-1} - 4.5CF_{i+1}) \right] \]

\[ = \frac{1}{N-4} \left[ \sum A_i^2 - \frac{1}{6} \sum A_i (2CF_{i-1} - 4CF_{i-1} + 4CF_{i+1} + 2.5CF_{i-1} - 4.5CF_{i+1}) \right] \]

\[ = \frac{1}{N-4} \left[ 5 \sum A_i^2 - \frac{1}{6} \sum A_i (4.5K - (4/3)K) \right] = \frac{(4/3)K}{N-4} = \frac{(2/3)\sigma^2}{N-4} \]

Therefore, the residual variance is actually lower for a firm that engages in opportunistic earnings smoothing compared to a firm that does not use opportunistic discretionary accruals. Again, the DD model misclassifies poor-quality accruals as high-quality accruals. Similarly, the model explanatory power can be calculated as:

\[ R^2 = \frac{\sum A_i^2 - \sum e_i^2}{\sum A_i^2} = \frac{4.5K - (4/3)K}{4.5K} = \frac{7}{9} \]

Again, this value is higher than the \( R^2 \) of a firm with no opportunistic earnings smoothing.