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# Center for Financial Markets & Policy

## Assessing Tax Accrual Quality

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# Assessing Tax Accrual Quality

Abstract:
This paper develops a measure of income tax expense accrual quality. Following the framework of Dechow and Dichev (2002), we examine the extent to which the financial statement accrual for book tax expense maps into tax-related cash flows. We argue that the quality of a firm's tax accrual is decreasing in the magnitude of estimation error associated with the accrual, and that tax accrual quality has implications for earnings quality over and above working capital accruals quality. We estimate tax accrual quality (TaxAQ) as the standard deviation of the residuals from firm-specific regressions of a firm's tax expense accrual on past, present, and future cash taxes paid. We next evaluate the construct validity of our new measure. We find that lower tax accrual quality is associated with higher pre-tax earnings volatility, greater uncertain tax positions, discontinued operations and extraordinary items, option grants, and the presence of tax-related internal control weaknesses, consistent with our expectations. We conclude by providing an application of our new measure, documenting that firms with lower tax accrual quality have lower overall earnings quality.

## 1. Introduction

This paper develops a measure of income tax expense accrual quality (TaxAQ) by examining the extent to which the accrual for book tax expense maps into tax-related cash flows. Financial accounting uses accruals to adjust the recognition of cash inflows and outflows so that recognized revenues and expenses better reflect a firm's economic performance. Prior research finds that contemporaneous stock returns are more strongly related to earnings than cash flows (Dechow 1994), consistent with accrual-based earnings being a better measure of economic performance relative to cash flows. However, "accruals are frequently based on assumptions and estimates that, if wrong, must be corrected in future accruals and earnings" (Dechow and Dichev 2002, p.36). These assumptions and estimation errors, and the related corrections that occur in future periods, add noise to the beneficial role of accruals, such that the quality of accruals (and therefore earnings) is decreasing in the magnitude of these assumption and estimation errors. We apply the logic of the Dechow and Dichev (2002) (hereafter DD) model to the income tax expense accrual. Like other accruals, the tax expense accrual adjusts a firm's recognition of cash outflows to taxing authorities to better reflect a firm's tax obligation based on the firm's current period economic performance, regardless of when the obligation is paid.

Following Hribar and Collins (2002), we define the tax accrual as the difference between tax expense (an income statement account) and cash taxes paid (the account's related cash flow). Following DD, we define tax expense accrual quality (TaxAQ) as the standard deviation of the residuals from firm-specific regressions of a firm's tax expense accrual on prior, current, and future period cash taxes paid. We include additional independent variables to the DD-based model to control for the long-term portion of the deferred tax accrual that is not expected to map into tax-related cash flows in years $t$-1 through $t$+1 (e.g., new property purchases) to reduce measurement error (McNichols 2002). Adding these controls increases the ability of the model's residuals to capture only tax accrual estimation error. When a firm's tax expense does not (eventually) equal its cash outflow to the taxing authorities, a firm's tax expense accrual is considered to be of lower quality.

Similar to the DD measure, our measure of tax expense accrual quality captures both unintentional and intentional estimation error. The tax expense accrual is comprised of many different types of sub-accounts that require estimation, managerial judgment and discretion (e.g., changes in tax reserves for uncertain tax positions, establishing and reversing a valuation allowance for deferred tax assets, the choice to designate foreign earnings as permanently reinvested or not, etc.). Prior research finds that some of these sub-accounts show evidence of earnings management (Schrand and Wong 2003, Krull 2004, Frank and Rego 2006, Cazier et al. 2012).

In addition to estimation error that arises from intentional earnings management, the managerial judgment and discretion in estimating the amount of these sub-accounts can also give rise to unintentional estimation errors. A May 29, 2012 Wall Street Journal article reports that 28 percent of CFOs cite financial reporting for income taxes as their firm's greatest tax risk (Murphy 2012), highlighting the challenges managers face when estimating the income tax accrual. For example, uncertain tax positions reflect the inherent uncertainty in applying tax statutes to estimate the amount of taxable income, the jurisdiction and accounting period in which this income is taxable, and the relevant tax rate that should be applied, all of which affect the tax accrual. In addition to intentional and unintentional errors, the tax expense accrual in period *t* also includes timing differences between when expenses and revenues are recognized for book versus tax purposes (e.g., accelerated depreciation). As we are interested in total estimation error in the tax accrual, separating TaxAQ into an intentional and unintentional component is beyond the scope of this paper.

We next establish the construct validity of our new TaxAQ measure. We posit that tax accrual quality is lower when (1) pre-tax book income is more volatile, (2) uncertain tax positions are larger, (3) tax-related internal control weaknesses are present, (4) discontinued operations and extraordinary items are larger, and (5) employee stock option (ESO) grants are greater. The first three construct validity tests relate to estimation error in the tax accrual, and the remaining two construct validity tests relate to mis-mapping between tax expense and cash taxes paid as the result of financial reporting standards. More specifically, volatile pre-tax earnings make future period pre-tax earnings (and differences between pre-tax earnings and taxable income) more difficult to estimate, increasing estimation error in the income tax expense accrual. Uncertain tax positions capture the uncertainty in assessing the amount, when, where, and at what rate income is taxable, again increasing estimation error in the tax accrual. Tax-related internal control weaknesses, which are documented deficiencies in how the tax accrual is estimated, are expected to be associated with greater estimation error.

Financial reporting standards require tax expense to be allocated across four categories (continuing operations, discontinued operations, extraordinary items, and items charged directly to shareholders' equity), meaning the tax expense reported on a firm's income statement reflects only the taxes associated with continuing operations (FAS 109, ¶¶ 35-36, now codified as ASC 740-20). Because the tax effects of discontinued operations, extraordinary items, and items charged directly to shareholders' equity will affect cash taxes paid but not tax expense, we expect firms with larger values of these items to have lower tax accrual quality. We also identify an accounting standard revision (FAS 123-R *Share-Based Payment*) that changes the recognition of the tax effects of employee stock option (ESO) costs from an item charged directly to shareholders' equity to an item recognized on the income statement. As this standard change improved the mapping between tax expense and cash taxes paid, we examine if tax accrual quality for firms with large ESO costs improved post-FAS 123-R. We find evidence that tax accrual quality is lower when pre-tax book income is more volatile, tax-related internal control weaknesses are present, and uncertain tax positions and discontinued operations/extraordinary items are larger. We also find that firms in industries with greater ESO grants have lower tax accrual quality and that firms with more option grants experience an improvement in tax accrual quality post-FAS 123-R, consistent with our expectations.

We believe our measure of tax accrual quality broadens the set of information being used by researchers to determine accruals quality and could be of use in better understanding the properties of earnings, which are important for valuation purposes. We illustrate the usefulness of our measure by examining the relation between tax accrual quality and overall earnings quality. We find that tax accrual quality is positively related to pre-tax earnings persistence (one measure of earnings quality), and that this relation is incremental to the relation between DD's working capital accruals quality measure and pre-tax earnings persistence. Additional tests show that tax accrual quality affects pre-tax earnings persistence through the accrual component (and not the cash flow component) of earnings, consistent with our prediction.

Our study answers McNichols' (2002) call for more research that focuses on a specific accruals as opposed to aggregate accruals, as this "can permit a more complete characterization of the relation between accruals and cash flows, and can potentially result in a better understanding of the role played by estimation error... potentially allow[ing for a] better understanding of the forces shaping management's choices and their relation to the measurement error in earnings” (p. 68). We focus on the tax expense accrual for financial accounting because the accrual is generalizable (e.g., every for-profit firm is subject to income tax) and large in magnitude. In our sample, mean tax expense is 25 percent of pre-tax book income and four percent of revenues. We are able to examine this accrual’s mapping into cash flows more precisely relative to other individual accruals because firms are required to separately disclose total tax-related cash flows made during the year (SFAS No. 95 Statement of Cash Flows, now codified as ASC 230-10-50-2). The ability to match an individual account's accrual and cash flows increases the likelihood of creating a meaningful account-specific accrual quality measure.

In addition, the tax accrual is subject to a different estimation process relative to other accruals. The people involved in preparing a firm's tax return are often involved in (or responsible for) the accrual estimation process. While all accruals are subject to some level of estimation error, the tax accrual is potentially subject to greater estimation error because of the additional complexity required in comparing the difference between economic performance as measured by financial reporting principles and economic performance as measured by legislative tax statutes, administrative practices, and judicial case law which differ across each individual jurisdiction in which a firm has economic nexus (Hanlon and Heitzman 2010). Finally, prior research shows that the tax accrual is estimated last in the financial statement preparation process, making it particularly subject to discretion and manipulation (Dhaliwal et al. 2004; Gleason and Mills 2008).

Our study differs from DD in several ways. We are able to map a specific accrual to its specific cash flows, while DD map a subset of accruals to a cash flow measure that captures all of a firm's operating activities. While DD include the change in taxes payable in their measure of working capital accruals, this account does not include the effects of deferred taxes, the valuation allowance for deferred tax assets, reserves for uncertain tax positions, etc. As these effects are captured by our tax accrual measure, we believe our measure is more comprehensive for assessing tax accrual quality relative to DD.

This paper makes a contribution to both the financial accounting and tax accounting literatures. A measure of tax accrual quality aids in our understanding of the magnitude of estimation error that occurs in the tax expense accrual. As the tax accrual affects earnings dollar for dollar, when the tax accrual is of low quality, earnings are also expected to be of lower quality. Many studies document the determinants and consequences of earnings quality (Dechow et al. 2010), and understanding the extent to which a firm's tax accrual quality affects its overall earnings quality contributes to the earnings quality determinants literature. In addition, the tax accounting literature often uses portions of the tax accrual to infer something about a firm's taxable income. Income tax expense is one of the only sources of information to most investors about a firm's taxable income, providing a link between publicly available financial statements and confidential tax returns. Researchers, analysts, and investors often use the current portion of a firm's tax expense (an accrual-based number) to derive an estimate of a firm's taxable income. To the extent the accrual component of current tax expense is of low quality, a researcher's estimate of taxable income is expected to be of low quality, potentially impacting inferences from tax studies that use estimated taxable income in their empirical specifications. We are examining the implication of this conjecture in concurrent work.

Our paper proceeds as follows. Section 2 provides background information about the richness of our particular research setting and discusses related literature. Section 3 discusses our research design choices, Section 4 presents our empirical findings, and Section 5 concludes.

## 2. Background

*2.1 Why focus on the book tax expense accrual?*

Our study answers the call of Healy and Whalen (1999) and McNichols (2002) for more analysis of individual accruals, as the accrual generating process is better understood at an individual account level. We focus on the book tax expense accrual versus another account-specific accrual for several reasons. First, in contrast to studies that focus on an industry-specific individual accrual (like Petroni's (1992) study on property-casualty loan-loss reserve estimates), our tax expense accrual quality measure is widely applicable because all for-profit firms are subject to income tax on their pre-tax profits and are required to accrue for income tax expense (or benefit) each period. In addition, our analysis includes financial service (SIC 6000-6999) and utility (SIC 4900-4999) firms. Firms from these two industries are often excluded in studies that examine the quality of earnings implications of financial reporting for income taxes (e.g., Phillips et al. 2003; Lev and Nissim 2004; Hanlon 2005). Because tax accrual quality is measured at a firm-level, our measure can be used to study all industries.[1]

Second, while some accruals quality studies focus on accounts such as the allowance for bad debt (McNichols and Wilson 1988; Cecchini et al. 2012) or warranty reserve (Cohen et al. 2011), income tax expense is often of a larger dollar magnitude relative to other individual accounts studied. While Cecchini et al. (2012) report that mean bad debt expense is 1.2 percent of sales (Table 5) and Cohen et al. (2011) report that mean warranty expense is 1.4 of sales in their respective samples, mean income tax expense is 4 percent of sales in our sample. Third, U.S. GAAP requires cash taxes paid during the current period to be disclosed on a firm's

[1] Untabulated analyses indicate that financial and non-financial firms have similar tax accrual quality while utility firms have significantly lower tax accrual quality relative to non-utility firms.

statement of cash flows (ASC 230-10-50-2), allowing us to assess the extent to which the tax expense accrual maps into cash outflows specifically associated with this account. This account-level cash flow information is generally not available for the vast majority of other transactions that require accrual estimates.[2]

Fourth, in practice the tax expense accrual is often estimated (or significantly reviewed by) by a firm's external tax return preparer, as this external person is best suited to asses a firm's permanent and temporary book/tax differences. In contrast, other types of accruals are generally estimated and/or reviewed only by internal personnel during the financial statement preparation process. Because the process and people involved in the tax expense accrual estimation process differ substantially from the process and people involved in estimating a firm's non-tax accruals, it is useful to analyze the tax expense accrual separately.

Fifth, the nature of the tax expense accrual differs from other accruals that affect net income. While economic uncertainty in a firm's individual operations increases estimation error in all types of accruals (Dechow and Dichev 2002), the estimation error in the tax accrual may be driven not only by operating uncertainty but also by uncertainty in the application of domestic and international legislative statutes, administrative practices, and judicial case law to the firm's specific facts and circumstances. In addition, future changes in federal, foreign, and state tax rates affect the extent to which deferred taxes recorded in the current period map into cash taxes paid in another period. These types of uncertainties typically do not exist for non-tax accruals,

[2] U.S. GAAP does require firms in some industries to disclose the realization of some accrual estimates. For example, DD note that "property-casualty insurance firms provide information about their accrual estimates, the subsequent cash flow realizations, and the resulting estimation errors (e.g., Petroni 1992; Anthony and Petroni 1997; Beaver and McNichols 1998)" (p.41, footnote 2). Beginning in 2003, FIN 45 requires firms to disclose warranty expense accruals and reductions in warranty liabilities due to payments made to claimants (Cohen et al. 2011). Finally, some researchers do attempt to estimate the realization of specific accruals from firms' financial statements. For example, Cecchini et al. (2012) examine bad debt estimates and their subsequent realizations.

indicating estimation error in the tax expense accrual is likely to operate differently from non-tax accruals. Finally, the tax accrual is often prepared last in the accrual accounting preparation process, making this accrual particularly susceptible to manipulation (Dhaliwal et al. 2004; Frank and Rego 2006; Gleason and Mills 2008).

### *2.2 Prior research on accruals quality*

Accruals models are prevalent in accounting, beginning with Healy (1985), DeAngelo (1986), and McNichols and Wilson (1988). Jones (1991) proposed the first accruals model, which divided accruals into discretionary and non-discretionary components. The Jones model was subsequently modified by Dechow et al. (1995) and Kothari et al. (2005), and the modified models have been used in hundreds of papers as a proxy for accrual earnings management. DD introduced an accruals quality measure that examined the extent to which current period working capital accruals map into past, current, and future period operating cash flows, where firms with weak mapping were considered to have low accruals quality (AQ). Poor AQ has been found to be associated with internal control weaknesses over financial reporting (Doyle et al. 2007), higher cost of equity capital (Francis et al. 2005; Aboody et al. 2005), more frequent and profitable insider trading (Aboody et al. 2005), analysts' firm-specific risk ratings (Lui et al. 2007), less over- and under-investment (Biddle et al. 2009), and lower managerial ability (Demerjian et al. 2012). Using alternative techniques, researchers have also considered estimation error in specific accruals such as the allowance for bad debt accrual (McNichols and Wilson 1988; Cecchini et al. 2012), loan loss reserves (Petroni 1992; Beaver and McNichols 1998), and warranty reserves (Cohen et al. 2011). In contrast to these studies, we focus on the income tax account – a specific account that is economically material for all profitable firms.

*2.3 Prior research on the income tax expense accrual*

Prior research in the tax literature finds evidence of earnings management through various components of the tax accrual. Specifically, researchers have found evidence of earnings management through the effective tax rate used to calculate tax expense (Dhaliwal et al. 2004), changes in the valuation allowance for deferred tax assets (Schrand and Wong 2003; Frank and Rego 2006), changes in the reserve for uncertain tax positions (Cazier et al. 2012), and the designation of foreign earnings as permanently reinvested (Krull 2004). In addition, Phillips et al. 2003) find that the deferred tax expense account can be used to identify earnings management in non-tax accounts when estimates are treated differently for tax purposes versus book purposes. Hanlon (2005) finds that large temporary differences between book income and taxable income are associated with less persistence earnings. Greater earnings management through individual components of the tax accrual should result in lower tax accrual quality.

An advantage of our measure is that it is a summary measure of estimation error across all tax accrual sub-accounts, which is helpful because managers may not use the same input account to manage their tax accrual each period, making individual account-level analysis challenging. Considering only one tax account sub-account could lead to a Type II error if a researcher is investigating earnings management through tax accrual input account A (e.g., the valuation allowance) in year *t* and a manager switches to managing earnings through tax accrual input account B (e.g., designating foreign earnings as permanently reinvested) in year *t*+1.[3] Rather than establishing the existence of earnings management in the tax accrual, our paper creates a measure of the pervasiveness of total estimation error in the tax accrual, both

[3] We acknowledge that our measure also suffers from a Type II error if a manager manages earnings through the tax accrual in year *t* and through a non-tax accrual in year *t*+1.

intentional and unintentional. As both types of errors decrease the usefulness of accruals, we do not attempt to distinguish them.

A good portion of the tax accounting literature focuses on tax avoidance (e.g., the minimization of tax liabilities). In contrast, tax accrual quality captures estimation error through the inability of the tax accrual to map into the past, present, and future tax payments. A firm that engages in extensive tax avoidance can have high or low tax accrual quality, and a firm that does not avoid taxes at all can also have high or low tax accrual quality. However, Frank et al. (2009) find that tax avoidance is associated with financial reporting aggressiveness, and it is possible that tax avoidance combined with aggressive financial reporting choices (such as failing to accrue for uncertain tax positions) can lead to lower tax accrual quality. In addition, we include large book-tax differences (following Hanlon 2005) as an additional explanatory variable in our earnings persistence tests to ensure our measure is capturing more than differences between book income and taxable income.[4]

## 3. Research Design and Hypotheses Development

### *3.1 Defining Tax Accrual Quality (TaxAQ)*

Dechow and Dichev (2002) estimate an empirical measure of accruals quality (AQ) by examining the extent to which changes in current period changes in working capital accruals map into past, current, and future period cash flow from operations. The authors' theoretical basis for this research design is based on the following: "(1) accruals are temporary adjustments that delay or anticipate the recognition of realized cash flows plus an estimation error term; (2) accruals are

[4] While we find that tax accrual quality is positively associated with absolute book-tax differences as expected, multiple regression analysis reveals tax accrual quality and book-tax differences have distinct implications for earnings persistence.

negatively related to current cash flows and positively related to past and future cash flows; and (3) the error term captures the extent to which accruals map into cash flow realizations...[so that the error term] can be used as a measure of accrual and earnings quality" (40).

We apply the authors' research design to our study of income tax expense accrual quality by measuring the extent to which the income tax accrual in the current period maps into tax-related cash flows in the past, present, and future periods. These modifications yield the following equation:

**(1a)** $\mathbf{TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \varepsilon_t}$

The dependent variable TaxACC is the current period income tax accrual, which is defined as the difference between current period tax expense (TE) for financial statement purposes and current period tax-related cash outflows (CTP). All variables are described in detail in the Appendix. Our income statement approach to defining TaxACC as the difference between the income statement expense and tax-related cash outflows is consistent with Hribar and Collins' (2002) definition of an accrual as the difference between an income statement revenue/expense and its related cash in/outflow. Variables are scaled by total assets in period *t*, and we winsorize all variables at the $1^{st}$ and $99^{th}$ percentiles by year to mitigate the effect of outliers. The regression residuals reflect the income tax expense accrual in period *t* ($TaxACC_t$) unrelated to cash outflow realizations to the taxing authorities in periods *t*-1 through *t*+1 ($CTP_{t-1}$, $CTP_t$, and $CTP_{t+1}$). The standard deviation of these residuals is our firm-level measure of tax expense accrual quality (TaxAQ). We multiply the variable values by negative one so higher values of TaxAQ indicate higher tax accrual quality.

If we took a balance sheet approach to defining $TaxACC_t$, we would use the current period change in taxes payable as our dependent variable in our empirical analysis (which is one component of DD's change in working capital accruals measure).[5] This approach would omit the effects of deferred taxes accrued in the current period, changes in the valuation allowance for deferred tax assets, and changes in reserves for uncertain tax positions, as these changes affect $TaxACC_t$ but not the taxes payable account. As we want to capture the mapping (or lack thereof) of these accrual components into cash taxes paid in our tax accrual quality (TaxAQ) measure, we believe an income statement approach in defining the income tax expense accrual as the difference between total tax expense for book purposes and cash taxes paid this period is more appropriate for purposes of our study.

The balance sheet approach to financial accounting for income taxes required by SFAS No. 109 Accounting for Income Taxes (now codified as ASC 740) requires firms to record deferred tax assets and deferred tax liabilities when there are temporary differences between the financial accounting and tax bases of assets and liabilities (commonly referred to as “temporary book/tax differences” in the tax accounting literature). Transactions that give rise to deferred tax liabilities result in a higher total tax expense relative to cash taxes paid this period, increasing the tax accrual. Vice versa, reversals of deferred tax liabilities result in a lower total tax expense relative to cash taxes paid this period, decreasing the tax accrual. Transactions that give rise to deferred tax assets result in lower total tax expense relative to cash taxes paid this period, decreasing the tax accrual. Vice versa, reversals of deferred tax assets result in a higher total tax expense relative to cash taxes paid, increasing the tax accrual. As the theoretical construct, our income tax accrual quality measure should measure unexplainable estimation error in the tax

[5] To see this, the taxes payable account is: opening balance + current tax expense = cash taxes paid + closing balance. Rearranging, closing balance – opening balance = current tax expense – cash taxes paid, or Δtax payable = current tax accrual. Untabulated analysis reveals that the correlation between our tax accrual measure and the change in taxes payable (COMPUSTAT item $TXP_t – TXP_{t+1}$) is 0.28.

accrual, and deferred tax assets and liabilities give rise to explainable estimation error. Thus, we want to control for systematic reasons the tax accrual in period *t* does not map into cash taxes paid in periods *t*-1 through *t*+1 and remove this known source of estimation error from the residual.

Specifically, we know that the deferred component of tax expense (from the establishment of a deferred tax liability) will not map into cash flows in *t*-1 or *t*, and only a portion of this deferred component will map into cash flows in *t*+1. We want to control for this type of systematic mis-mapping so the Equation 1a regression residuals (our variable of interest) only captures unexplained estimation error.[6] Ideally, we would like to control for the most common and economically significant items that increase long-term deferred tax liabilities and assets. As components of deferred tax assets and liabilities are not readily available in any machine readable database, we look to Raedy et al. (2011) to determine which differences are of the largest magnitude and most prevalent.

Raedy et al. (2011) hand-collect deferred tax components for Fortune 250 firms from 1993 through 2007. Table 1 of their paper shows that the largest components of annual deferred tax expense relate to timing differences in (1) depreciating plant, property, and equipment, (2) amortizing intangible assets, (3) deducting employee benefits, and (4) establishing and utilizing tax net operating losses. In Raedy et al.'s (2011) sample, the mean annual increase (decrease) in deferred tax expense related to these four items is 166, 75, (54), and (49) million, respectively. We proxy for the largest component of deferred tax expense (e.g., depreciation timing

[6] In our sample, median (mean) deferred tax expense is 8 (16) percent of total tax expense.

differences) using current period cash outflows related to capital expenditures (CAPX).[7] While proxies for the second and third largest components are unavailable in machine-readable format, we are able to capture the fourth largest component affecting deferred tax with the current period change in net operating losses (ΔNOL).[8] We would like to control for all transactions which affect deferred tax expense in the current period but do not affect tax-related cash flows in periods *t*-1 through *t*+1 to increase the likelihood the regression residuals capture only non-systematic estimation error). Unfortunately, we are unable to capture additional components affecting deferred tax expense without hand-collecting data for the entire population of COMPUSTAT firms.

Modifying Equation 1a to include these two components of deferred taxes yields the following equation:

**(1b)** $\mathbf{TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 CAPX_t + \beta_5 \Delta NOL_t + \varepsilon_t}$

Our tax accrual quality measure (TaxAQ) is the standard deviation of the residuals from firm-level estimates of Equation 1b over eight-year rolling windows, similar to the DD approach.

While the inclusion of CAPX and ΔNOL in the regression model is useful, these variables only capture a portion of deferred tax expense that does not map into cash taxes paid in periods *t*-1 through *t*+1. An alternate way to control for items that affect the tax accrual in period *t* but do not affect CTP in periods *t*-1 through *t*+1 is to include the change in long-term deferred tax liabilities (ΔDTL_LT) and long-term deferred tax assets (ΔDTA_LT) as control variables.

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[7] We expect the current period cash expenditures on capital assets to better capture the magnitude of depreciation timing differences relative to the level of plant, property, and equipment, as the largest depreciation timing differences occur the first year an asset is placed into service.

[8] We would like to capture the difference between financial reporting (expenses) and tax reporting (deductions, which generally correspond to cash payments) for these two items. However, there are no Statement of Cash Flow variables in COMPUSTAT that capture current period expenditures on intangible assets or defined benefit plan cash contributions.

SFAS 109 classifies individual deferred tax assets (liabilities) as current or long-term based on the current or long-term classification of the underlying asset (liability) to which the deferred asset (liability) relates. If a deferred asset (liability) does not relate to an underlying asset (liability), the deferred tax asset is classified according to the expected reversal date of the temporary difference. Thus, the long-term portion of changes in deferred tax assets (liabilities) captures both temporary differences related to long-term assets (liabilities) regardless of the item's reversal date and temporary differences that give rise to a tax benefit (future taxable amount) unrelated to a balance sheet asset (liability) expected to reverse after *t*+1. As we only want to control for the latter, including $\Delta DTA\_LT_t$ ($\Delta DTL\_LT_t$) as a control variable captures the deferred portion of tax expense that does not map into cash taxes paid in *t*-1 through *t*+1 with error.[9]

This alternate approach yields the following equation:

**(1c)** $$\mathbf{TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t}$$

Our alternate tax accrual quality measure (TaxAQ2) is the standard deviation of the residuals from firm-level estimates of Equation 1c. Given the two sources of measurement error in $\Delta DTL\_LT_t$ and $\Delta DTA\_LT_t$ described above, it is not ex-ante clear whether TaxAQ or TaxAQ2 will yield better estimates of tax accrual quality.[10]

[9] Including ΔDTA_LT (ΔDTL_LT) as an independent variable controls for the portion of deferred tax assets (liabilities) reclassified from long-term to short-term status. As we do not want to control for this reclassified portion (because the related tax accrual will map into cash taxes paid from *t*-1 to *t*+1), including ΔDTA_LT (ΔDTL_LT) over-controls for a small amount estimation error we would like to capture in our tax accrual quality variable.

[10] Another alternate research design is to include additional years of lag and lead cash payments as independent variables when estimating Equation 1a. When we expand the number of years of cash tax payments to *t*-3 to *t*+3, we find that only $CTP_{t-2}$ is significantly different from zero in a pooled regression (untabulated). Thus, expanding the periods of cash tax payments does not appear to be a useful way to reduce systematic measurement error in the regression residuals.

*3.2 Evaluating Construct Validity*

This section discusses how we evaluate the construct validity of our measure of tax accrual quality. We establish construct validity to increase confidence that TaxAQ and TaxAQ2 capture what we purport the measures capture. Our first hypothesis relates to how tax accrual quality relates to pre-tax earnings volatility. Firms make quarterly income tax payments in advance (e.g., two weeks before the quarter begins) based on managers' estimate of what taxable income is going to be in the future quarter. When a firm's pre-tax earnings are volatile, it is difficult to predict the firm's future period pre-tax earnings, resulting in firms making ex-ante cash tax payments on an estimate of taxable income that is more likely to deviate from the firm's ex-post realized income. This volatility decreases the extent to which a firm's tax expense accrual maps into its cash taxes paid, leading to the following hypothesis:[11]

*H1a: Tax accrual quality is negatively associated with pre-tax earnings volatility.*

Our second construct validity hypothesis relates to how tax position uncertainty affects tax accrual quality. Conceptually, larger magnitudes of uncertain tax positions represent greater uncertainty when estimating total tax expense, potentially leading to greater estimation error in the tax accrual. This argument suggests that firms with a greater number and/or magnitude of uncertain tax positions have lower tax accrual quality. The establishment and reversal of uncertain tax positions typically weakens the relation between the tax accrual and cash taxes paid.

[11] For similar reasons, we also expect revenue volatility to be negatively associated with tax accrual quality. Revenue volatility is highly correlated with pre-tax earnings volatility (0.99) in our sample, making the relation between TaxAQ and revenue volatility qualitatively similar to the reported related between TaxAQ and pre-tax earnings volatility (untabulated).

For example, when a firm accrues a tax-related contingent liability for uncertain tax positions, increasing tax expense with no impact on cash taxes paid until the position is disallowed by the taxing authorities. Uncertain tax positions are not associated with an immediate cash outflow, weakening the relation between tax expense and cash taxes paid this period. If the uncertain tax position is disallowed in a future period, the firm will remove its tax-related contingent liability and increase cash taxes paid, increasing the relation between tax expense and cash taxes paid in that future period. However, if the uncertain tax position is never disallowed, the firm reverses the tax expense accrual and the tax-related contingent liability so the tax expense accrual decreases with no corresponding tax payment, weakening the relation between tax expense and cash taxes paid.[12] Formally stated,

*H1b: Tax accrual quality is negatively associated with uncertain tax positions.*

Our third construct validity hypothesis relates to how tax-related internal control weaknesses are expected to be associated with tax accrual quality. An internal control weakness (ICW) is "a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that [it is] reasonably possible [or probable] that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis" (Appendix A, Item A7 of Auditing Standard No. 5, PCAOB 2007). Doyle et al. (2007) find that working capital accruals quality estimated using the DD model is negatively related to the presence of any type of ICW. We extend this logic to a tax setting. Prior research finds that tax-related ICWs are one of the most prevalent account-specific ICWs (Bauer 2011). Documented deficiencies in the processes related to how current and deferred tax expense are

[12] Uncertain tax position data are available after 2006 and thus our tests of this hypothesis are restricted to this time period.

estimated (e.g., a tax-related ICW) are more likely to be observed in firms where tax accrual quality is low.[13] This yields the following hypothesis:

> *H1c: Tax accrual quality is negatively associated with tax-related internal control weaknesses*.

Our final three construct validity tests exploit a financial reporting standard requirement that tax expense is allocated across four categories: continuing operations, discontinued operations, extraordinary items, and items charged directly to shareholders' equity (FAS 109, ¶¶ 35-36). Because the tax effects of discontinued operations, extraordinary items, and items charged directly to shareholders' equity affect cash taxes paid but not tax expense, we expect firms with larger values of these items to have worse tax accrual quality. With respect to the first two items we predict the following:

> *H1d: Tax accrual quality is negatively associated with discontinued operations and extraordinary items.*

With respect to the last item, there are many types of transactions charged directly to shareholders' equity (e.g., changes in accounting principles, corrections of errors, tax effect of employee stock option exercises pre-FAS 123-R, foreign currency translation adjustments, fair market value changes of available-for-sale marketable securities, etc.) that have the potential to affect a firm's tax accrual quality. We focus on employee stock options (ESOs) because this transaction is expected to affect a large number of firms and have a large impact on tax accrual quality. Pre-FAS 123-R, ESOs were recognized for financial reporting purposes at their intrinsic value (i.e., zero for firms granting options at the firm's current stock price) and firms received a

[13] Tax-related internal controls over financial reporting weakness data are available after 2003.

tax return deduction equal to the ESOs' exercise value when ESOs were exercised.[14] This asymmetric treatment gave rise to a permanent book-tax difference. While permanent book tax differences generally have no effect on tax accrual quality (because tax expense and cash taxes paid are affected in the same direction and amount), the financial reporting treatment for ESOs reduced APIC instead of tax expense (i.e. it was not recorded as a permanent difference). This asymmetric financial reporting treatment resulted in tax expense (and the tax accrual) persistently being overstated relative to cash taxes paid for firms with option exercises.

Post FAS 123-R, firms began recognizing ESOs for financial reporting purposes at their fair value over the options' vesting period. As firms still received a tax return deduction for ESOs at their exercise date and value, the difference between the financial reporting effect and tax return effect of ESOs changed from an unrecorded permanent difference to a recorded temporary difference, reducing the mis-mapping between tax expense and cash taxes paid. Thus, we expect to see an improvement in tax accrual quality post FAS 123-R for firms with large ESO grant values.[15] This leads to our fifth and sixth construct validity predictions:

*H1e: Tax accrual quality is negatively associated with ESO grants.*

*H1f: Tax accrual quality improves post-FAS 123-R for firms with greater ESO grants.*

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[14] See Hanlon and Shevlin (2002) for a more in-depth discussion of the accounting for the income tax benefits of employee stock options before FAS 123-R.

[15] Note that the mis-mapping between tax expense and cash taxes paid is not completely resolved post-FAS 123-R for two reasons. First, there is a timing difference between the recognition of ESO-related costs for financial reporting (vesting period) versus tax reporting (exercise date). Second, ESOs have different measurement bases for financial reporting (fair value) versus tax reporting (exercise value). These measurement bases are typically not equal. As an extreme example, ESOs that are underwater and expire unexercised will be reflected as an expense on the income statement (and affect tax expense) post-FAS 123-R but will never receive a tax deduction (and therefore never affect cash taxes paid).

*3.3 Assessing the Relation between Tax Accrual Quality and Earnings Quality*

We next demonstrate how our newly created tax accrual quality measure is useful to researchers by examining the extent to which tax accrual quality is related to overall earnings quality. If the tax expense accrual is of lower quality, earnings are also expected to be of lower quality. Therefore, our final prediction is as follows:

*H2: Tax accrual quality is positively associated with earnings quality.*

We assess the relation between tax accrual quality and earnings quality by including TaxAQ as a determinant of a firm's earnings persistence, a commonly used proxy to assess earnings quality (Dechow et al. 2010). We use the following equation to estimate firm-specific measures of earnings persistence:

**(2a)** $$\mathbf{PTBI_{t+1} = \beta_0 + \beta_1 PTBI_t + \varepsilon_{t+1}}$$

where PTBI is pre-tax book income and $\beta_1$ is our measure of a firm's pre-tax earnings persistence. We estimate this regression by firm over eight-year rolling windows. A pre-tax measure of earnings is used instead of an after-tax measure to avoid a mechanical relation between tax accrual quality and earnings quality, as tax expense directly affects after-tax earnings dollar for dollar.

We regress the firm-specific estimated pre-tax earnings persistence parameters from Equation 2a ($\beta_1$) on TaxAQ and other earnings persistence determinants in the following equation:

**(2b)** $$\mathbf{\beta_1 = \gamma_{industry} + \gamma_{year} + \gamma_1 TaxAQ + \gamma_2 GROWTH + \gamma_3 AQ + \gamma_4 SI + \gamma_5 BTD + \gamma_6 SIZE + \varepsilon}$$

GROWTH is the percentage change in revenue from year *t*-1 to *t* truncated to a maximum of 100 percent (Fairfield et al. 1996). Working capital accruals quality (AQ) is the standard deviation of the error term from estimating firm-specific regressions of the change in working capital accruals on cash flow from operations in *t*-1, *t*, and *t*+1, change in sales revenue, and the level of plant, property and equipment (Dechow and Dichev 2002; Francis et al. 2005). SI is an indicator variable equal to one if negative special items are greater than two percent of assets and equal to zero otherwise (Dechow and Ge 2006). BTD is an indicator variable equal to one if the difference between book income and estimated taxable income is in the highest or lowest quartile by year and equal to zero otherwise (Hanlon 2005; Wilson 2009), and SIZE is the log of total assets. As we require eight firm-year observations to estimate TaxAQ, we estimate AQ and pre-tax earnings persistence (the $\beta_1$ from Equation 2a) and calculate the average value of GROWTH, SI, SIZE, and BTD over the same eight-year rolling window periods. Prior research suggests $\boldsymbol{\gamma}_2 > 0$ and $\boldsymbol{\gamma}_3$, $\boldsymbol{\gamma}_4$, and $\boldsymbol{\gamma}_5 < 0$. We make no prediction as to the direction of $\boldsymbol{\gamma}_6$. As H2 predicts higher tax accrual quality is associated with higher earnings quality, $\boldsymbol{\gamma}_1$ is expected to be > 0.

Earnings are comprised of cash flows and accruals, and tax accrual quality is expected to be related to earnings quality through the accrual portion (and not the cash flow portion) of earnings. To test this prediction, we estimate firm-specific accruals and cash flows persistence parameters using the following regression:

**(2c)** $$\mathbf{PTBIt_{+1} = \lambda_0 + \lambda_1 PTBI\_ACC_t + \lambda_2 PT\_CFO + \varepsilon_{t+1}}$$

where PTBI is pre-tax book income, PT_CFO is cash flows from operating activities before cash taxes are paid, and PTBI_ACC is total pre-tax accruals (measured as the difference between pre-tax book income and pre-tax cash flows from operations). The coefficient $\lambda_1$ ($\lambda_2$) is our measure of a firm's pre-tax accruals (cash flows) persistence. We re-estimate Equation 2b using the firm-specific estimated pre-tax accruals (cash flows) persistence parameters from Equation 2c as the dependent variable. We predict a positive relation between pre-tax accruals persistence and TaxAQ but do not expect a positive relation between pre-tax cash flows and TaxAQ.

## 4. Empirical Findings

### *4.1 Sample Selection*

Our sample selection is summarized in Table 1. We begin with the Compustat universe of firms with annual data from 1993 through 2011. Our sample begins in 1993 to coincide with the implementation of FAS 109 (now codified in ASC 740) to ensure consistent financial reporting for income taxes over the sample period. We require firms to have non-missing values for Equation 1b variables ($TaxACC_t$, $CTP_t$, and $CAPX_t$), the first construct validity test examining the relation between TaxAQ and pre-tax book income volatility, and Equations 2a and 2c variables ($PTBI_t$, $ACC_t$, and $CFO_t$). This screen yields a sample of 99,372 firm-year observations. Our next screen follows the DD requirement that all firms have at least eight consecutive years of data in order to obtain a minimum of eight regression residuals per firm to calculate TaxAQ (yielding 67,510 firm-year observations). Our final screen requires data to calculate AQ following Francis et al. (2005), yielding 51,962 firm-year observations relating to 3,871 unique firms.

### *4.2 Descriptive Statistics*

In Panel A of Table 2 we tabulate descriptive statistics for our regression variables. The mean and median book tax accrual (TaxACC) values are positive, consistent with tax expense (TE) exceeding cash taxes paid (CTP). The mean and median values of ∆DTA_LT and ∆DTL_LT are also positive, reflecting average annual growth in firms' long-term deferred tax assets and liabilities. While the mean market capitalization for our sample firms is $3.5 billion, market capitalization for the median ($75^{th}$ percentile) firm is only $322 million ($1.5 billion), suggesting a handful of large firms are heavily skewing this variable's distribution to the right.

Panel B of Table 2 presents the correlations between the Equation 1b and 1c variables. We discuss the Spearman correlations for brevity. As predicted, $TaxACC_t$ is negatively correlated with $CTP_t$ ($\rho$ = -0.09) and positively correlated with $CTP_{t+1}$ ($\rho$ = 0.17). In contrast to our expectations, $TaxACC_t$ is negatively correlated with $CTP_{t-1}$ ($\rho$ = -0.02). Dechow and Dichev (2002) similarly find that the current period change in working capital in period *t* is not positively associated with cash flows from operations in *t*-1 without controlling for cash flows from operations in period *t* (their Panel B of Table 2). We find that after controlling for $CTP_t$, the partial correlation between $TaxACC_t$ and $CTP_{t-1}$ is 0.06 and significant at the one percent level (untabulated).[16] Consistent with our predictions, $TaxACC_t$ is positively correlated with the control variables CAPX ($\rho$ = 0.09) and ΔDTA_LT ($\rho$ = 0.30) and negatively correlated with ΔNOL ($\rho$ = -0.07) and ΔDTA_LT ($\rho$ = -0.16).

*4.3 Estimating Tax Accrual Quality (TaxAQ and TaxAQ2)*

Table 3 presents the regression results from estimating Equation 1b. Like AQ, the theoretical basis for TaxAQ is at the firm-level because the extent to which the income tax accrual maps into cash taxes paid is likely to differ across firms. Following DD, we also present industry-specific and pooled regression results because our firm-specific time series is relatively short, potentially yielding noisy TaxAQ estimates at the firm level.

[16] Dechow and Dichev (2002) explain the need to control for $CFO_t$ because "$\Delta WC_t$ is negatively correlated with $CFO_t$, and $CFO_t$ is positively correlated with [$CFO_{t-1}$], which counteracts the expected positive relation between $\Delta WC_t$ and [$CFO_{t-1}$]" (p.42).

We use robust regression with industry and year fixed effects to estimate a pooled specification of Equation 1b. Results for the pooled regression in Panel A of Table 3 reveals the tax accrual ($TaxACC_t$) is positively related to prior period cash tax flows ($CTP_{t-1}$), future period cash flows ($CTP_{t+1}$), and capital expenditures ($CAPX_t$) and negatively related to current period cash tax flows ($CTP_t$), with all relations significant at greater than the one percent level. These findings are consistent with our predictions. Surprisingly, the tax accrual is not related to the change in net operating loss carryforwards ($\Delta NOL_t$) at significant levels in the pooled specification. An adjusted $R^2$ of 81% indicates the model has high explanatory power. Industry-specific coefficient estimates from an OLS regression specification are presented in Panel B. Inferences at the industry level are similar to inferences from the pooled regression.[17]

The firm-specific OLS regression results in Panel C reveal the mean firm exhibits the predicted relations between TaxACC and all independent variables excluding $CTP_{t-1}$ (although the $CTP_{t-1}$ coefficient is positive for the median firm in our sample). The adjusted $R^2$ for the mean (median) firm is 34% (39%), suggesting the model is better specified at the firm-level relative to an industry-level (mean adjusted $R^2$ of 22%) estimation approach.[18] Given the stronger theoretical basis and better empirical fit of our firm-level specification, our construct validity and earnings quality tests are conducted using firm-level estimates of tax accrual quality.

Table 4 presents the regression results from estimating Equation 1c to calculate an alternate measure of tax accrual quality (TaxAQ2). The pooled regression results in Panel A show that $TaxACC_t$ is positively related $CTP_{t-1}$, $CTP_{t+1}$, and $\Delta DTL\_LT_t$ and negatively related to

[17] T-statistics in Panel B (C) are determined based on the distribution of the 411 (3,871) coefficients obtained from regressions at the industry (firm) level and ignore any cross-sectional correlation in the data, suggesting the results should be viewed as descriptive rather than definitive.
[18] DD report mean (median) adjusted $R^2$ coefficients for their firm-specific change in working capital accruals quality regressions of 0.47 (0.55) in their Panel A of Table 3.

$CTP_t$ and $\Delta DTA\_LT_t$, consistent with our predications and the findings in Panel A of Table 3. These relations hold for the industry-level and firm-level analyses presented in Panels B and C of Table 4. The adjusted $R^2$ reported in each panel of Table 4 is higher relative to its Table 3 counterpart because ΔDTA_LT and ΔDTL_LT more comprehensively control for systematic reasons why TaxACC does not map into cash taxes paid in *t*-1 through *t*+1 relative to CAPX and ΔNOL. However, this is achieved at the cost of over-controlling for the potential estimation error in the extent to which decreases in $DTA\_LT_t$ and $DTL\_LT_t$ affect $CTP_{t+1}$ (as explained in Section 3.1).

### *4.4 Construct Validity Tests*

Table 5 details the results of testing our first four construct validity hypotheses. To ensure our tax accrual quality measure is capturing an aspect of accrual quality that is distinct from DD's working capital accruals quality measure, we assess the relation between the four variables used in our construct validity tests (PTBI_VOL, TAX_RESERVE, TAX_ICW, and DISC&EXTRA) and both TaxAQ and AQ. Panel A reports that the mean pre-tax book income volatility value is nearly twice as large as the variable value at the 75th percentile, reflecting high skewness in the data. The mean reserve for uncertain tax positions is 1.7 percent of total assets, and only ten percent of firms report a tax-related internal control weakness. Discontinued operations and extraordinary items are on average 0.9 percent of total revenues, and the median firm reports zero discontinued operations and extraordinary items. The mean AQ value is larger in magnitude than the mean TaxAQ and TaxAQ2 values, consistent with working capital accruals quality capturing estimation error in multiple accounts while tax accrual quality captures estimation error in only a single account.

Panel B of Table 5 presents the Pearson and Spearman correlations between our first four construct validity variables and our tax accrual and working capital accruals quality measures. Only Spearman correlations (presented in the upper right portion of the matrix) are discussed for brevity. TaxAQ and TaxAQ2 are highly correlated ($\rho$ = 0.80), and both variables are negatively correlated with pre-tax earnings volatility ($\rho$ = -0.56), uncertain tax positions ($\rho$ = -0.15), tax-related internal control weaknesses ($\rho$ = -0.11), and discontinued/extraordinary items ($\rho$ = -0.12). These correlations are consistent with hypotheses 1a through 1d. The correlation matrix also shows that both TaxAQ and TaxAQ2 are significantly correlated with AQ ($\rho$ = 0.48 and $\rho$ = 0.41, respectively). Thus, it is not surprising that all four construct validity test variables are also negatively correlated with AQ.

To determine if TaxAQ captures a unique aspect of accrual quality distinct from AQ, we assess the relation between each of the construct validity variables (PTBI_VOL, TAX_RESERVE, TAX_ICW, and DISC&EXTRA) and tax accrual quality after controlling for working capital accruals quality. In Panel C of Table 5 we individually regress each variable on TaxAQ, AQ, and the control variable SIZE. While prior research finds a negative relation between earnings volatility and AQ (DD 2002), we have no a priori reason to expect AQ to be associated with uncertain tax positions, tax-related internal control weaknesses, or discontinued operations/special items.[19]

The regression results presented in Panel C of Table 5 are estimated using robust regression. Our first construct validity test examines the relation between pre-tax earnings volatility and tax accrual quality. Column 1 reports that pre-tax earnings volatility is negatively

[19] If discontinued operations and extraordinary items are associated with other large write-offs that affect working capital accounts, it is possible that AQ is negatively associated with DISC&EXTRA.

related to TaxAQ at greater than the one percent level, consistent with H1a. We also find that pre-tax earnings volatility is negatively related to AQ at greater than the one percent level, confirming DD's finding. Our second construct validity test examines the relation between uncertain tax positions and tax accrual quality. Column 2 reports that uncertain tax positions are associated with lower tax accrual quality, consistent with H1b.[20] However, we also find that uncertain tax positions are also associated with lower working capital accruals quality, contrary to our expectations. It is possible that firms with tax reserves are likely to also have non-tax reserves, the latter of which could be included in working capital accruals. The results from our third construct validity test are presented in Column 3. We find that the presence of tax-related internal control weaknesses is negatively related to tax accrual quality but unrelated to working capital accruals quality, highlighting that TaxAQ captures a dimension of tax accrual quality distinct from AQ.

Column 4 reports on the relation between tax accrual quality and discontinued and extraordinary items. In our empirical tests we want to proxy for the impact of discontinued and extraordinary items on a firm's tax return, as this gives rise to the mis-mapping between tax expense and cash taxes paid. Therefore, we use the value of discontinued operations and extraordinary items as reported on the Statement of Cash Flows (as opposed to the Income Statement) because a cash-based value is a better approximation of the amount recorded on a firm's tax return relative to an accrual-based value.[21] We find that larger absolute values of

[20] Note that TAX_RESERVE (TAX_ICW) variable values are only available after 2006 (2003), yielding a final sample with non-missing TaxAQ and TAX_RESERVE (TAX_ICW) values for 1,827 (2,612) observations.
[21] As the operating section of the Statement of Cash Flows using the indirect method reconciles after-tax income from continuing operations (which does not include discontinued operations and extraordinary items) to cash flows from all operating activities, the discontinued operations and extraordinary items values on the Statement of Cash Flows are cash flow values, not the difference between an accrual-based and cash-based value.

discontinued operations/extraordinary items are associated with lower tax accrual quality and unrelated to working capital accruals quality, again illustrating that TaxAQ is distinct from AQ. Columns 5 through 8 report similar inferences between our construct validity test variables and tax accrual quality after replacing TaxAQ with TaxAQ2.

In sum, the finding that greater pre-tax earnings volatility, uncertain tax positions, tax-related internal control weaknesses, and discontinued and extraordinary items are associated with lower tax accrual quality is consistent with our predictions. Further, the finding that tax-related internal control weaknesses and discontinued and extraordinary items are unrelated to working capital accrual quality strengthens our confidence in the ability of our measure to capture an aspect of tax accrual quality that DD's measure of working capital accrual quality does not.

Table 6 presents tests of our remaining two construct validity tests, which examine the relation between ESOs and tax accrual quality, as well as a change in this relation post-FAS 123-R. We use an industry specification in this test because we do not have enough time-series data pre- and post-FAS 123-R to estimate TaxAQ and TaxAQ2 at the firm level. We estimate TaxAQ and TaxAQ2 by industry over both the pre- and post-FAS 123-R periods and require firms to have two observations in each time period. We capture the pre- (post-) FAS 123-R period using firms with fiscal year-ends between June 16, 2004 and June 15, 2006 (June 16, 2006 and June 15, 2008) to focus on time periods surrounding the standard change and avoid time periods that might have underwater options. We use the pre-FAS 123-R option grant data (OPT_GRANTS) from EXECUCOMP as a proxy for post-FAS 123R option exercises, as post FAS 123-R option grant data are not available from this database.[22]

[22] While pre-FAS 123-R option grants proxy for option exercises in the post FAS 123-R period, holding option grants constant across the pre- and post-periods could induce error. ESO grants declined after FAS 123-R

Panel A of Table 6 reports descriptive statistics for the sub-sample of firms with available ESO data used in our final two construct validity tests. SIZE, TaxAQ, and TaxAQ2 mean and median values for this sub-sample of firms are similar in magnitude to the values reported for our full sample of firms in Panel A of Table 5. During the four-year period centered on the FAS 123-R effective date, mean ESO grants (OPT_GRANTS) are 2.1 percent of revenue. Panel B of Table 6 presents regression results for the relation between Tax AQ (Tax AQ2) and options grants in the pre- and post-FAS 123R periods after controlling for size. In Column 1 the coefficient on OPT_GRANTS is negative and significant at the five percent level, suggesting that firms with larger option grant values have lower tax accrual quality. This finding is consistent with H1e. In Column 2 the coefficient on POST_123R*OPT_GRANTS is positive and significant at the five percent level, suggesting that firms with larger option grant values experienced an improvement in tax accrual quality after FAS 123-R. This is consistent with H1f. Columns 3 and 4 report similar results using TaxAQ2.

In unreported tests, we repeat the Table 6 analysis using DD's measure of working capital accruals quality as the dependent variable. We find that firms with greater option grants have lower working capital accruals quality but no evidence of an improvement post FAS 123-R, highlighting that our TaxAQ measure is distinct from DD's AQ measure. Generally, the results presented in Table 6 suggest that firms with larger option grant values have lower tax accrual quality and experience an improvement in tax accrual quality post-FAS 123-R (when the

(Choudhary 2011), so the improvement in the tax accrual quality we expect to observe could be related to a reduction in option grants. Since post FAS 123-R option grant data for all employees are not available from EXECUCOMP to rule out this possible explanation, in untabulated tests we replace OPT_GRANTS with the value of option exercises scaled by revenue. This proxy yields results consistent with those reported in Panel B of Table 6. However, the alternate proxy is imprecise as it only relates to ESO grants to the top 5 executives.

differences between how ESOs are treated for financial reporting versus tax reporting purposes changes from an unrecorded permanent difference to a recorded temporary difference).

*4.5 Earnings and Accruals Persistence Tests*

Our final tests examining the relation between tax accrual quality and earnings persistence are presented in Table 7. Panel A reports descriptive statistics for the variables used in our earnings persistence regressions. The mean firm-specific pre-tax earnings persistence parameter estimate is 0.44 and the mean firm-specific pre-tax accruals (cash flows) persistence parameter is 0.34 (0.57).[23] Mean and median values for the control variables AQ, SI, GROWTH, BTD, and SIZE appear reasonable and in line with prior research.

Panel B presents the correlations between our pre-tax earnings and accruals persistence variables of interest. The PTBI persistence parameter ($\beta_1$) and PT_ACC persistence parameter ($\lambda_1$) are positively correlated with both tax accrual quality proxies (TaxAQ and TaxAQ2) as well as working capital accruals quality (AQ) and growth (GROWTH) and negatively correlated with large negative special items (SI), consistent with our predictions. We find that earnings and accruals persistence are decreasing in firm size (SIZE). While our univariate correlation shows earnings and accruals persistence are increasing in large book-tax differences (BTD), contrary to our expectation, we find a negative relation in our regression analysis below. We find that these variables have the same relation to cash flows persistence ($\lambda_2$), although the correlation

[23] Untabulated results from estimating a pooled regression using our sample yield a pre-tax earnings persistence parameter of 0.62 and reveal that pre-tax cash flows are more persistent than pre-tax accruals (persistence parameters of 0.82 and 0.41, respectively). These parameters are comparable to Hanlon (2005). She reports a pre-tax earnings persistence parameter of 0.68 (her Panel A of Table 3) and similarly finds that pre-tax cash flows are more persistent than pre-tax accruals (persistence parameters of 0.75 and 0.49, respectively, as reported in her Panel A of Table 4).

coefficients are smaller in magnitude relative to the earnings and accruals persistence correlation coefficients.

Panel C of Table 7 presents the results from estimating Equation 2b using robust regression. Column 1 shows that pre-tax earnings persistence is positively and significantly related to TaxAQ at greater than a one percent significance level. We also find that AQ and GROWTH (SI and BTD) are associated with higher (lower) pre-tax earnings persistence, consistent with our expectations. We find that SIZE, a variable for which we had no directional prediction, is positively associated with pre-tax earnings persistence. Column 2 repeats the analysis with TaxAQ2 and yields similar inferences. We next assess the relation between pre-tax accruals persistence and tax accrual quality. Both the TaxAQ (TaxAQ2) and AQ coefficient are significantly different from zero at the one percent level in Column 3 (4), consistent with both accruals quality measures affecting pre-tax earnings persistence through the accrual component of earnings.

Our final analysis examines the relation between pre-tax cash flows persistence and the two accruals quality measures. As accruals quality should not affect earnings persistence through the cash flow component of earnings, we do not expect to observe a positive and significant coefficient on TaxAQ (TaxAQ2) or AQ in Column 5 (6). Consistent with our expectations, we do not find a positive relation between the persistence of pre-tax cash flows and any accruals quality measure.[24] This strengthens our confidence that TaxAQ is not simply capturing volatility in a firm's underlying operations, as volatility in the firm's operations should affect both earnings

[24] To ensure results are not sensitive to the regression method, we replicate Panel C of Table 7 using an OLS regression specification and clustering standard errors by firm and year. Inferences with respect to TaxAQ, TaxAQ2, and AQ are the same as those presented for the pre-tax earnings and accruals persistence tests (Columns 1 through 4). In regard to the pre-tax cash flows persistence tests, we find that AQ becomes insignificant in Column 5 while TaxAQ2 becomes positive and significant at the one percent level in Column 6.

and cash flow persistence. In sum, tax accrual quality is informative with respect to a firm's overall earnings and accruals quality and is incremental to working capital accruals quality.

## 5. Conclusion

This paper develops a measure of income tax accrual quality (TaxAQ) by examining the extent to which the financial statement tax accrual maps into past, current, and future period cash taxes paid. While accruals aid firms in presenting revenues and expenses that better reflect a firm's economic performance relative to cash inflows and outflows, "accruals are frequently based on assumptions and estimates that, if wrong, must be corrected in future [period] accruals and earnings" (Dechow and Dichev 2002, p. 36). Greater estimation error in the tax account manifests as poorer mapping of the tax accrual into cash taxes paid, resulting in lower tax accrual quality. We validate our tax accrual quality measure by documenting that lower tax accrual quality is associated with greater pre-tax earnings volatility, larger uncertain tax positions and discontinued operations/extraordinary items, and the presence of tax-related internal control weaknesses, consistent with our predictions. We also find that tax accrual quality is lower for firms with greater ESO grants and improves post FAS 123-R as the result of a change in accounting standard improving the mapping between tax expense and cash taxes paid. Our measure is expected to be useful to researchers in better understanding properties of earnings, which is important for valuation purposes. We illustrate the usefulness of our measure by documenting that tax accrual quality is positively related to pre-tax earnings persistence and that the relation is incremental to working capital accruals quality. We also find that tax accrual quality affects earnings persistence through the persistence of accruals and not cash flows, consistent with expectations.

We are currently considering other ways in which our measure can be used. One possibility is to separate our tax accrual quality measure into an innate and a discretionary component following Francis et al. (2005). We expect the discretionary component to be associated with earnings management through the tax accrual. Another possibility is to investigate if tax accrual quality is useful in determining whether an accrual-basis tax avoidance proxy (e.g., accrual-basis effective tax rate, book/tax differences, etc.) or cash-basis tax avoidance proxy (e.g., cash-basis effective tax rate) is more informative with respect to a firm’s tax avoidance activities. Hanlon and Heitzman (2010) note that "a primary issue in the empirical tax avoidance literature is the researcher's definition and measurement of tax avoidance" (p.128-9), and with an increasing number of tax avoidance proxies available many recent papers use multiple accrual-basis and tax-basis measures in their empirical analysis (Chen et al. 2010; Rego and Wilson 2012). We predict that cash-basis proxies are more useful in assessing a firm's tax avoidance activity when a firm’s tax accrual quality is low. Evidence consistent with this prediction would suggest that tax researchers could use a firm's tax accrual quality to determine if an accrual or cash-basis tax avoidance proxy is more appropriate for their study and sample of firms.

**Appendix: Variable Definitions**

| Variable | Definition |
|---|---|
| $\beta_1$ | Pre-tax earnings persistence parameter from a firm-specific estimate of Equation 2a ($PTBI_{t+1} = \beta_0 + \beta_1 PTBI_t + \varepsilon_{t+1}$) |
| $\lambda_1$ | Accrual persistence parameter from a firm-specific estimate of Equation 2c ($PTBI_{t+1} = \lambda_0 + \lambda_1 PT\_ACC_t + \lambda_2 PT\_CFO + \varepsilon_{t+1}$) |
| AQ | Standard deviation of the residuals from firm-specific estimates of $\Delta WC_t = \alpha + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \beta_4 \Delta REV_t + \beta_5 PPE_t + \varepsilon_t$, multiplied by -1 so larger values indicate better tax accrual quality [following Francis et al. 2005]. A minimum of eight residuals per firm is required to estimate AQ. |
| $BTD_t$ | Mean number of years a firm's book-tax difference is in the top or bottom quintile by year, measured over 8 year rolling windows. Book-tax differences are measured as pre-tax book income (PI) less minority interest (MII) less estimated taxable income, scaled by total assets (AT) [following Wilson 2009]. Estimated taxable income is current federal tax expense ($TXFED_t$) plus current foreign tax expense ($TXFO_t$), grossed up by the federal statutory tax rate (÷ 0.35), less the change in net operating loss carryforward ($TLCF_t – TLCF_{t-1}$) |
| $CAPX_t$ | Capital expenditures from the statement of cash flows ($CAPX_t$) |
| $CTP_t$ | Cash taxes paid ($TXPD_t$) |
| $DISC\&EXTRA_t$ | Absolute value of discontinued and extraordinary items from the Statement of Cash Flows ($XIDOC_t$), scaled by revenue ($REV_t$) |
| GROWTH | Mean annual percentage change in revenue (($REVT_t – REVT_{t-1}$) ÷ $REVT_{t-1}$) truncated at a maximum of 100 percent, measured over 8 year rolling windows |
| $MVE_t$ | Market value of equity = common shares outstanding ($CSHO_t$) multiplied by end of fiscal year stock price per share ($PRCC\_F_t$) |
| OPT_GRANTS | Fair value of options granted to all employees ((EXECUCOMP $BLKSHVAL_t$ ÷ 1,000) ÷ (EXECUCOMP $PCTTOTOPT_t$ ÷ 100) scaled by revenue ($REV_t$). Estimated at the industry level for fiscal years ending between June 16, 2004 and June 15, 2006 (the two years prior to the FAS 123-R effective date). BLKSHVAL is divided by 1,000 because values are in thousands and COMPUSTAT data are in millions. We divide PCTTOTOPT by 100 to convert values to a percentage format. |
| $POST\_123R_t$ | Indicator variable set equal to one for fiscal years ending after 6/15/2006 (FAS 123-R effective date), and set equal to zero otherwise. |
| $PT\_ACC_t$ | Accrual component of earnings ($PTBI_t – PT\_CFO_t$) |
| $PT\_CFO_t$ | Cash flow from operations ($OANCF_t$) less cash taxes paid ($TXPD_t$) |
| $PTBI_t$ | Pre-tax book income ($PI_t$) |
| PTBI_VOL | Standard deviation of pre-tax book income ($PI_t$) divided by total assets ($AT_t$), measured over 8 year rolling windows |
| $REV_t$ | Total revenue ($REVT_t$) |

| | |
|---|---|
| $SI_t$ | Mean number of years a firm has a large negative special item, defined as ((SPI ÷ AT) < -2%), measured over 8 year rolling windows [following Dechow and Ge 2006] |
| $SIZE_t$ | Mean log of total assets ($AT_t$), measured over 8 year rolling windows |
| $TA_t$ | Total assets ($AT_t$) |
| $TaxACC_t$ | Total tax accrual, defined as tax expense ($TXT_t$) less cash taxes paid ($TXPD_t$) |
| TaxAQ | Standard deviation of the residuals from firm-specific estimates of Equation 1b ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 CAPX_t + \beta_5 \Delta NOL_t + \varepsilon_t$), multiplied by -1 so larger values indicate better tax accrual quality. A minimum of eight residuals per firm is required to estimate TaxAQ. |
| TaxAQ2 | Standard deviation of the residuals from firm-specific estimates of Equation 1c ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t$), multiplied by -1 so larger values indicate better tax accrual quality. A minimum of eight residuals per firm is required to estimate TaxAQ2. |
| TAX_ICW | Indicator variable set equal to one if a firm reports a tax-related internal control weakness ($IC\_IS\_EFFECTIVE_t$ = 'N' and $NOTEFF\_ACC\_REAS\_KEYS_t$ = '41'from Audit Analytics' SOX 404 Internal Controls database) in any year in our sample period for which data are available (2004 – 2010), and set equal to zero otherwise. |
| TAX_RESERVE | Mean uncertain tax benefits ($TXTUBEND_t$) scaled by total assets ($AT_t$) across the years in our sample period for which data are available (2007 – 2010) |
| $TE_t$ | Tax expense ($TXT_t$) |
| $\Delta DTA\_LT_t$ | Change in the long-term portion of the deferred tax asset ($TXDBA_t$ - $TXDBA_{t-1}$). If $TXDBA_t$ is missing and $TXDB_t$ is not equal to missing, $TXDBA_t$ is reset to zero (N= 25,413) |
| $\Delta DTL\_LT_t$ | Change in the long-term portion of the deferred tax liability ($TXDB_t$ - $TXDB_{t-1}$). If $TXDB_t$ is missing and $TXDBA_t$ is not equal to missing, $TXDB_t$ is reset to zero (N= 551) |
| $\Delta NOL$ | Change in the net operating loss for tax purposes ($TLCF_t$ - $TLCF_{t-1}$). If $TLCF_t$ is missing the variable is reset to zero (N= 19,420) |

All variable source names in parentheses refer to COMPUSTAT unless otherwise stated.

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**Table 1: Sample Selection**

| | |
|---|---|
| COMPUSTAT universe of firm-year observations (1993 – 2011) | 180,755 |
| Less: Observations with missing values required to estimate Equation 1b variables $TaxACC_t$, $CTP_{t-1, t, t+1}$, $CAPX_t$, and $\Delta NOL_t$ (COMPUSTAT items $TXT_t$, $TXPD_{t-1, t, t+1}$, $CAPX_t$, $TLCF_{t-1,t}$, and $AT_t$) | (79,116) |
| | 101,639 |
| Less: Observations with missing values for the pre-tax earnings volatility (COMPUSTAT item $PI_t$) construct validity test and Equations 2a and 2c variables $PTBI_t$, $PT\_ACC_t$, and $PT\_CFO_t$ (COMPUSTAT items $PI_{t, t+1}$ and $OANCF_t$) | (2,267) |
| | 99,372 |
| Less: Firms with less than 8 years of annual data to estimate TaxAQ | (31,862) |
| | 67,510 |
| Less: Firms with insufficient data to estimate AQ | (15,548) |
| **Final number of firm-year observations** | **51,962** |
| **Final number of firms** | **3,871** |

## Table 2: Descriptive Statistics and Correlations

Panel A: Descriptive Statistics

| Variables | N | Mean | P25 | P50 | P75 | S.D. |
|---|---|---|---|---|---|---|
| Total Assets$_t$ ($TA_t$) | 51,962 | 3,178 | 78 | 374 | 1778 | 11,450 |
| Revenue$_t$ ($REV_t$) | 51,962 | 2,697 | 79 | 378 | 1,523 | 10,933 |
| Pre-tax Book Income$_t$ ($PTBI_t$) | 51,962 | 141 | 0 | 11 | 71 | 946 |
| Market Value of Equity$_t$ ($MVE_t$) | 51,962 | 3,474 | 57 | 322 | 1,521 | 17,253 |
| Tax Expense$_t$ ($TE_t$) | 51,962 | 0.023 | 0.002 | 0.019 | 0.039 | 0.056 |
| Current Tax Expense ($CTE_t$) | 49,664 | 0.024 | 0.002 | .0146 | 0.036 | 0.099 |
| Deferred Tax Expense ($DTE_t$) | 49,664 | 0.000 | -0.004 | 0.000 | 0.007 | 0.107 |
| Tax Accrual$_t$ ($TaxACC_t$) | 51,962 | 0.002 | -0.005 | 0.001 | 0.011 | 0.051 |
| Cash Taxes Paid$_t$ ($CTP_t$) | 51,962 | 0.021 | 0.002 | 0.012 | 0.032 | 0.032 |
| Cash Taxes Paid$_{t-1}$($CTP_{t-1}$) | 51,962 | 0.020 | 0.002 | 0.012 | 0.029 | 0.032 |
| Cash Taxes Paid$_{t+1}$($CTP_{t+1}$) | 51,962 | 0.026 | 0.002 | 0.013 | 0.035 | 0.210 |
| Capital Expenditures$_t$ ($CAPX_t$) | 51,962 | 0.059 | 0.021 | 0.041 | 0.073 | 0.065 |
| Change in Net Operating Loss ($\Delta NOL_t$) | 51,962 | 0.491 | 0 | 0 | 0 | 78.092 |
| Change in Long-Term Deferred Tax Liabilities$_t$ ($\Delta DTL\_LT_t$) | 49,967 | 0.002 | 0 | 0 | 0.004 | 0.019 |
| Change in Long-Term Deferred Tax Assets$_t$ ($\Delta DTA\_LT_t$) | 49,967 | 0.001 | 0 | 0 | 0 | 0.020 |

Panel B: Pearson\Spearman Correlations

| | $TaxACC_t$ | $CTP_t$ | $CTP_{t-1}$ | $CTP_{t+1}$ | $CAPX_t$ | $\Delta NOL_t$ | $\Delta DTL\_LT_t$ | $\Delta DTA\_LT_t$ |
|---|---|---|---|---|---|---|---|---|
| $TaxACC_t$ | - | **-0.09** | **-0.02** | **0.17** | **0.09** | **-0.07** | **0.30** | **-0.16** |
| $CTP_t$ | **-0.14** | - | **0.70** | **0.72** | **0.16** | **-0.10** | **0.03** | **0.03** |
| $CTP_{t-1}$ | **-0.05** | **0.68** | - | **0.56** | **0.14** | **-0.04** | 0.01 | **0.03** |
| $CTP_{t+1}$ | **0.14** | **0.70** | **0.52** | - | **0.12** | **-0.13** | **0.06** | **0.02** |
| $CAPX_t$ | **0.06** | **0.08** | **0.06** | **0.05** | - | **-0.03** | **0.13** | -0.01 |
| $\Delta NOL_t$ | **-0.02** | **-0.10** | **-0.08** | **-0.10** | **-0.03** | - | **-0.04** | **0.04** |
| $\Delta DTL\_LT_t$ | **0.27** | **-0.03** | **-0.03** | **0.01** | **0.12** | **-0.04** | - | **-0.06** |
| $\Delta DTA\_LT_t$ | **-0.23** | 0.00 | 0.00 | 0.00 | **-0.02** | 0.01 | **-0.04** | - |

Notes: All variables are defined in the Appendix. All variables in Panel A except TA, REV, PTBI, and MVE are scaled by total assets. As the data are used to estimate firm-specific regressions of TaxAQ and TaxAQ2, the data in Panel A are not winsorized or truncated. In Panel B, correlations significant at the five percent level (using two-tailed p-values) are in **bold**. Pearson correlation coefficients are reported on winsorized data to mitigate the influence of outliers.

**Table 3: Estimating Tax Accrual Quality (TaxAQ)**

$$\mathbf{TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 CAPX_t + \beta_5 \Delta NOL_t + \varepsilon_t}$$

Panel A: Pooled Regression

| **Variable** | **Prediction** | **Coefficient** |
|---|---|---|
| Intercept | ? | -0.002*** |
| | | *(-1.84)* |
| $CTP_{t-1}$ | + | 0.061*** |
| | | *(27.39)* |
| $CTP_t$ | - | -0.412*** |
| | | *(-182.96)* |
| $CTP_{t+1}$ | + | 0.326*** |
| | | *(463.87)* |
| $CAPX_t$ | + | 0.027*** |
| | | *(27.52)* |
| $\Delta NOL_t$ | - | -0.000 |
| | | *(-0.15)* |
| Year and Industry Indicators | | Yes |
| N | | 51,961 |
| Adj. $R^2$ | | 81% |

Panel B: Industry Specific Regression (411 industries)

| **Variable** | **Prediction** | **Mean** | **P25** | **P50** | **P75** | **Standard Deviation** |
|---|---|---|---|---|---|---|
| Intercept | ? | 0.000 | -0.003 | 0.000 | 0.004 | 0.010 |
| $CTP_{t-1}$ | + | 0.077*** | -0.069 | 0.064 | 0.183 | 0.380 |
| $CTP_t$ | - | -0.487*** | -0.684 | -0.479 | -0.294 | 0.396 |
| $CTP_{t+1}$ | + | 0.345*** | 0.203 | 0.345 | 0.477 | 0.273 |
| $CAPX_t$ | + | 0.025** | -0.026 | 0.023 | 0.076 | 0.227 |
| $\Delta NOL_t$ | - | 0.013 | -0.019 | 0.000 | 0.013 | 0.274 |
| Adj. $R^2$ | | 25% | 9% | 22% | 37% | 0.231 |

Panel C: Firm Specific Regression (3,871 firms)

| **Variable** | **Prediction** | **Mean** | **P25** | **P50** | **P75** | **Standard Deviation** |
|---|---|---|---|---|---|---|
| Intercept | ? | 0.002*** | -0.008 | 0.001 | 0.013 | 0.040 |
| $CTP_{t-1}$ | + | -0.061** | -0.272 | 0.013 | 0.285 | 1.967 |
| $CTP_t$ | - | -0.581*** | -0.899 | -0.537 | -0.149 | 1.970 |
| $CTP_{t+1}$ | + | 0.262*** | 0.013 | 0.270 | 0.592 | 2.02 |
| $CAPX_t$ | + | 0.059*** | -0.111 | 0.025 | 0.216 | 0.733 |
| $\Delta NOL_t$ | - | -0.015** | -0.031 | 0.000 | 0.006 | 0.476 |
| Adj. $R^2$ | | 34% | 5% | 39% | 67% | 0.431 |

Notes: All variables are defined in the Appendix. We use robust regression with industry (2-digit SIC code) and year fixed effects to estimate the pooled regression (Panel A). Robust regression iteratively assigns weights to individual observations in order to mitigate the influence of outliers, meaning some observations may receive a weight of 0. Industry-level regressions are estimated using OLS at the 4-digit SIC code level (Panel B), and firm-level regressions are estimated using OLS (Panel C). Parameter estimates in Panel B and C are winsorized to mitigate the influence of outliers. T-statistics are presented in parentheses below each coefficient. ***, **, and * indicate significance at the 1%, 5%, and 10% respectively using a t-test to determine whether the distribution of coefficients are different from zero (one-tailed for directional predictions).

**Table 4: Estimating Tax Accrual Quality – alternate specification (TaxAQ2)**

$$\mathbf{TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t}$$

Panel A: Pooled Regression

| Variable | Prediction | Coefficient |
|---|---|---|
| Intercept | ? | -0.001 |
| | | *(-1.08)* |
| $CTP_{t-1}$ | + | 0.065*** |
| | | *(29.76)* |
| $CTP_t$ | - | -0.401*** |
| | | *(-180.61)* |
| $CTP_{t+1}$ | + | 0.320*** |
| | | *(468.09)* |
| ΔDTL_LT | + | 0.306*** |
| | | *(104.15)* |
| ΔDTA_LT | - | -0.307*** |
| | | *(107.39)* |
| Year and Industry Indicators | | Yes |
| N | | 48,785 |
| Adj. $R^2$ | | 84% |

Panel B: Industry Specific Regression (395 Industries)

| Variable | Prediction | Mean | P25 | P50 | P75 | S.D. |
|---|---|---|---|---|---|---|
| Intercept | ? | -0.000 | -0.002 | 0.002 | 0.007 | 0.050 |
| $CTP_{t-1}$ | + | 0.062*** | -0.066 | 0.058 | 0.192 | 0.499 |
| $CTP_t$ | - | -0.412*** | -0.646 | -0.453 | -0.222 | 0.572 |
| $CTP_{t+1}$ | + | 0.323*** | 0.153 | 0.320 | 0.474 | 0.504 |
| ΔDTL_LT | + | 0.300*** | -0.025 | 0.269 | 0.592 | 0.490 |
| ΔDTA_LT | - | -0.481*** | -0.792 | -0.544 | -0.177 | 0.644 |
| Adj. $R^2$ | | 56% | 38% | 58% | 73% | 0.260 |

Panel C: Firm Specific Regression (3,708 firms)

| Variable | Prediction | Mean | P25 | P50 | P75 | S.D. |
|---|---|---|---|---|---|---|
| Intercept | ? | 0.004*** | -0.003 | 0.002 | 0.010 | 0.017 |
| $CTP_{t-1}$ | + | 0.045** | -0.216 | 0.036 | 0.299 | 1.361 |
| $CTP_t$ | - | -0.516*** | -0.859 | -0.501 | -0.139 | 1.346 |
| $CTP_{t+1}$ | + | 0.301*** | 0.036 | 0.271 | 0.580 | 1.355 |
| ΔDTL_LT | + | 0.429*** | 0.000 | 0.147 | 0.697 | 2.002 |
| ΔDTA_LT | - | -0.293*** | -0.482 | 0.000 | 0.000 | 2.263 |
| Adj. $R^2$ | | 45% | 19% | 51% | 78% | 0.410 |

Notes: All variables are defined in the Appendix. We use robust regression with industry (2-digit SIC code) and year fixed effects to estimate the pooled regression (Panel A). Robust regression iteratively assigns weights to individual observations in order to mitigate the influence of outliers, meaning some observations may receive a weight of 0. Industry-level regressions are estimated using OLS at the 4-digit SIC code level (Panel B), and firm-level regressions are estimated using OLS (Panel C). Parameter estimates in Panel B and C are winsorized to mitigate the influence of outliers. T-statistics are presented in parentheses below each coefficient. ***, **, and * indicate significance at the 1%, 5%, and 10% respectively using a t-test to determine whether the distribution of coefficients are different from zero (one-tailed for directional predictions).

**Table 5: Construct Validity Tests Part 1 - Tax Accrual Quality and Firm Characteristics**

Panel A: Descriptive Statistics (firm-level observations)

| **Variables** | **N** | **Mean** | **P25** | **P50** | **P75** | **S.D.** |
|---|---|---|---|---|---|---|
| TaxAQ | 3,864 | -0.015 | -0.017 | -0.010 | -0.005 | 0.019 |
| TaxAQ2 | 3,692 | -0.013 | -0.015 | -0.008 | -0.005 | 0.017 |
| AQ | 3,864 | -0.034 | -0.041 | -0.022 | -0.013 | 0.040 |
| PTBI_VOL | 3,864 | 0.254 | 0.032 | 0.062 | 0.131 | 3.367 |
| TAX_RESERVE | 1,828 | 0.017 | 0.002 | 0.007 | 0.017 | 0.100 |
| TAX_ICW | 2,612 | 0.100 | 0.000 | 0.000 | 0.000 | 0.300 |
| DISC&EXTRA | 3,864 | 0.009 | 0.000 | 0.000 | 0.003 | 0.062 |
| SIZE | 3,864 | 6.123 | 4.523 | 6.269 | 7.814 | 2.421 |

Panel B: Pearson\Spearman Correlations

| | TaxAQ | TaxAQ2 | AQ | PTBI VOL | TAX RESERVE | TAX ICW | DISC& EXTRA | SIZE |
|---|---|---|---|---|---|---|---|---|
| TaxAQ | **-** | **0.80** | **0.48** | **-0.56** | **-0.15** | **-0.11** | **-0.12** | **0.23** |
| TaxAQ2 | **0.81** | **-** | **0.41** | **-0.46** | **-0.14** | **-0.09** | **-0.09** | **0.22** |
| AQ | **0.29** | **0.30** | **-** | **-0.70** | **-0.12** | **-0.13** | **-0.13** | **0.40** |
| PTBI_VOL | **-0.20** | **-0.20** | **-0.70** | **-** | **0.12** | **0.11** | **0.09** | **-0.41** |
| TAX_RESERVE | **-0.14** | **-0.10** | **-0.07** | **0.15** | **-** | **0.15** | 0.03 | **0.16** |
| TAX_ICW | **-0.10** | **-0.07** | **-0.06** | 0.04 | **0.16** | **-** | **0.05** | **-0.08** |
| DISC&EXTRA | **-0.05** | **-0.06** | **-0.20** | **0.22** | 0.01 | -0.01 | **-** | 0.04 |
| SIZE | **0.22** | **0.26** | **0.56** | **-0.46** | 0.01 | **-0.05** | **-0.14** | **-** |

Panel C: Regression Results

$$\mathbf{Y = \beta_0 + \beta_1 TaxAQ\ (\text{or } TaxAQ2) + \beta_2 AQ + \beta_3 SIZE + \varepsilon_t}$$

| | Y= | PTBI VOL | TAX RESERVE | TAX ICW | DISC& EXTRA | | PTBI VOL | TAX RESERVE | TAX ICW | DISC& EXTRA |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pred. | [1] | [2] | [3] | [4] | | [5] | [6] | [7] | [8] |
| Intercept | ? | 0.016*** | -0.002*** | -1.169*** | 0.000 | | 0.017*** | -0.002** | -1.154*** | 0.000 |
| | | *(8.58)* | *(-2.18)* | *(-7.52)* | *(0.33)* | | *(8.33)* | *(-2.25)* | *(-7.32)* | *(0.68)* |
| TaxAQ | - | -1.090*** | -0.037*** | -4.956*** | -0.002*** | | | | | |
| | | *(-41.15)* | *(-3.08)* | *(-2.67)* | *(-4.84)* | | | | | |
| TaxAQ2 | - | | | | | | -0.834*** | -0.045*** | -3.772** | -0.001*** |
| | | | | | | | *(-25.71)* | *(-2.73)* | *(-1.68)* | *(-3.01)* |
| AQ | ? | -1.705*** | -0.021*** | -0.869 | -0.000 | | -1.868*** | -0.020** | -1.271 | -0.000 |
| | | *(-110.78)* | *(-2.62)* | *(-0.76)* | *(-0.36)* | | *(-114.30)* | *(-2.54)* | *(-1.10)* | *(-0.21)* |
| SIZE | ? | -0.002*** | 0.001** | -0.031* | 0.000*** | | -0.001*** | 0.001** | -0.033* | 0.000*** |
| | | *(-6.45)* | *(11.51)* | *(-1.69)* | *(7.24)* | | *(-5.72)* | *(11.28)* | *(-1.74)* | *(7.01)* |
| N | | 3,862 | 1,827 | 2,612 | 3,864 | | 3,691 | 1,716 | 2,474 | 3,864 |
| Adj. $R^2$ | | 87% | 7% | | 2% | | 54% | 7% | | 2% |
| Pseudo $R^2$ | | | | 1% | | | | | 1% | |

Notes: All variables are defined in the Appendix. In Panel B, correlations significant at the five percent level (using two-tailed p-values) are in **bold**. Pearson correlation coefficients are reported on winsorized data to mitigate the influence of outliers. We use robust regression to estimate the results presented in Columns 1 through 4 of Panel C. Robust regression iteratively assigns weights to individual observations in order to mitigate the influence of outliers, meaning some observations may receive a weight of 0. We use probit regression to estimate the results presented in Columns 5 and 6, as the dependent variable is truncated at zero. We use the vce(robust) option in STATA to confirm our probit results are robust to outliers. T-statistics are presented in parentheses below each coefficient. ***, **, and * indicate significance at the 1%, 5%, and 10% respectively using a t-test to determine whether the distribution of coefficients are different from zero (one-tailed for directional predictions).

**Table 6: Construct Validity Test Part 2 - Tax Accrual Quality and ESO Grants**

Panel A: Descriptive Statistics

| | **N** | **Mean** | **P25** | **P50** | **P75** | **S.D.** |
|---|---|---|---|---|---|---|
| TaxAQ | 146 | -0.011 | -0.013 | -0.008 | -0.004 | 0.012 |
| TaxAQ2 | 146 | -0.008 | -0.010 | -0.006 | -0.004 | 0.007 |
| POST_123R | 146 | 0.500 | 0.000 | 0.500 | 1.000 | 0.501 |
| OPT_GRANTS | 146 | 0.021 | 0.004 | 0.008 | 0.028 | 0.031 |
| POST_123R*OPT_GRANTS | 146 | 0.009 | 0.00 | 0.000 | 0.008 | 0.021 |
| SIZE | 146 | 7.798 | 6.981 | 7.594 | 8.479 | 1.135 |

Panel B: Regression Analysis

$$\textbf{TaxAQ} \text{ (or } \textbf{TaxAQ2}) = \alpha_1 + \alpha_2 \textbf{POST\_123R} + \alpha_3 \textbf{OPT\_GRANTS} + \alpha_4 \textbf{POST\_123R*OPT\_GRANTS} + \alpha_5 \textbf{SIZE} + \varepsilon$$

| | | Y = TaxAQ | Y = TaxAQ | Y = TaxAQ2 | Y = TaxAQ2 |
|---|---|---|---|---|---|
| | Pred. | [1] | [2] | [3] | [4] |
| Intercept | ? | -0.013*** | -0.013*** | -0.009*** | -0.009*** |
| | | *(0.003)* | *(0.003)* | *(0.003)* | (0.003) |
| POST_123R | ? | | 0.000 | | 0.000 |
| | | | *(0.256)* | | *(0.24)* |
| OPT_GRANTS | - | -0.0125*** | -0.139*** | -0.112*** | -0.138*** |
| | | *(0.014)* | *(0.016)* | *(0.013)* | *(0.014)* |
| POST_123R * OPT_GRANTS | + | | 0.0815*** | | 0.0849** |
| | | | *(0.026)* | | *(0.023)* |
| SIZE | ? | 0.001** | 0.001*** | 0.000 | 0.001* |
| | | *(0.0004)* | *(0.0004)* | *(0.0003)* | *(0.000)* |
| | | | | | |
| N | | 146 | 146 | 146 | 146 |
| Adj. $R^2$ | | 43% | 46% | 41% | 49% |

Notes: The tax accrual proxy TaxAQ is the standard deviation of the residuals from an industry specific (4 digit sic code) estimation of Equation 1b ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 CAPX_t + \beta_5 \Delta NOL_t + \varepsilon_t$). The tax accrual proxy TaxAQ2 is the standard deviation of the residuals from an industry-specific estimation of Equation 1c ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t$). POST_123R is an indicator variable set equal to one for fiscal years ending after 6/15/2006 (when FAS 123-R became effective), and set equal to zero otherwise. OPT_GRANTS is the pre-123R fair value of options granted to all employees, scaled by revenue. We hold OPT_GRANTS values constant in the pre- and post-123R periods as these data are not available from EXECUCOMP after 2006. Both TaxAQ and TaxAQ2 are estimated pre- and post-123R at the industry level using a constant sample of firms. The pre-123R (post-123R) time period includes firms with fiscal year-ends between 6/16/2004 and 6/15/2006 (6/16/2006 and 6/15/2008). We use robust regression, which iteratively assigns weights to individual observations in order to mitigate the influence of outliers, meaning some observations may receive a weight of 0. T-statistics are presented in parentheses below each coefficient. ***, **, and * indicate significance at the 1%, 5%, and 10% respectively using a t-test to determine whether the distribution of coefficients are different from zero (one-tailed for directional predictions).

**Table 7: Pre-tax Earnings, Accruals, and Cash Flows Persistence Tests**

Panel A: Descriptive Statistics

| **Variables** | **N** | **Mean** | **P25** | **P50** | **P75** | **S.D.** |
|---|---|---|---|---|---|---|
| $PTBI_t$ | 19,433 | -0.040 | -0.003 | 0.060 | 0.118 | 4.174 |
| $PT\_ACC_t$ | 19,433 | -0.120 | -0.095 | -0.005 | -0.016 | 3.627 |
| $PT\_CFO_t$ | 19,433 | 0.080 | 0.005 | 0.106 | 0.168 | 1.048 |
| PTBI Persistence Parameter ($\beta_1$) | 19,433 | 0.436*** | 0.114 | 0.426 | 0.734 | 0.517 |
| PT_ACC Persistence Parameter ($\lambda_1$) | 19,433 | 0.339*** | -0.049 | 0.283 | 0.678 | 0.744 |
| PT_CFO Persistence Parameter ($\lambda_2$) | 19,433 | 0.569*** | 0.176 | 0.598 | 0.974 | 0.961 |
| TaxAQ | 19,433 | -0.012 | -0.014 | -0.008 | -0.004 | 0.016 |
| TaxAQ2 | 18,009 | -0.011 | -0.012 | -0.007 | -0.004 | 0.015 |
| AQ | 19,433 | -0.024 | -0.029 | -0.016 | -0.009 | 0.029 |
| SI | 19,433 | 0.176 | 0.000 | 0.111 | 0.300 | 0.174 |
| GROWTH | 19,433 | 0.142 | 0.044 | 0.101 | 0.188 | 0.175 |
| BTD | 19,433 | 0.391 | 0.125 | 0.375 | 0.600 | 0.283 |
| SIZE | 19,433 | 6.174 | 4.720283 | 6.281 | 7.688 | 2.256 |

Panel B: Pearson\Spearman Correlations

| | PTBI | PT_ACC | PT_CFO | $\beta_1$ | $\lambda_1$ | $\lambda_2$ | TaxAQ | TaxAQ2 | AQ | SI | GROWTH | BTD | SIZE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PTBI | - | **0.42** | **0.72** | **0.20** | **0.13** | **0.10** | **0.06** | **0.04** | **0.27** | **-0.29** | **0.11** | **0.21** | **-0.22** |
| PT_ACC | **0.69** | - | **-0.19** | **0.04** | **0.04** | -0.01 | **0.08** | **0.05** | **0.09** | **-0.16** | **-0.00** | **0.05** | **-0.14** |
| PT_CFO | **0.72** | **0.04** | - | **0.17** | **0.10** | **0.11** | 0.00 | 0.00 | **0.25** | **-0.20** | **0.11** | **0.22** | **-0.17** |
| $\beta_1$ | **0.13** | **0.06** | **0.13** | - | **0.68** | **0.64** | **0.18** | **0.14** | **0.25** | **-0.27** | **0.13** | **0.10** | **-0.24** |
| $\lambda_1$ | **0.10** | **0.05** | **0.10** | **0.65** | - | **0.24** | **0.13** | **0.10** | **0.17** | **-0.23** | **0.10** | **0.04** | **-0.18** |
| $\lambda_2$ | **0.04** | -0.01 | **0.06** | **0.57** | **0.19** | - | **0.08** | **0.07** | **0.09** | **-0.07** | **0.08** | **0.08** | **-0.09** |
| TaxAQ | **0.11** | **0.10** | **0.06** | **0.16** | **0.11** | **0.04** | - | **0.80** | **0.37** | **-0.28** | **0.03** | **0.19** | **-0.27** |
| TaxAQ2 | **0.11** | **0.09** | **0.09** | **0.13** | **0.09** | **0.06** | **0.78** | - | **0.35** | **-0.24** | 0.01 | **0.21** | **-0.23** |
| AQ | **0.38** | **0.23** | **0.34** | **0.2** | **0.14** | **0.06** | **0.31** | **0.31** | - | **-0.42** | 0.01 | **0.46** | **-0.51** |
| SI | **-0.27** | **-0.19** | **-0.21** | **-0.25** | **-0.21** | **-0.06** | **-0.24** | **-0.21** | **-0.32** | - | **-0.09** | **-0.06** | **0.38** |
| GROWTH | **-0.08** | **-0.07** | **-0.04** | **0.05** | **0.04** | **0.02** | **0.02** | 0.01 | **-0.11** | **-0.03** | - | **0.13** | **0.06** |
| BTD | **0.31** | **0.16** | **0.29** | **0.10** | **0.04** | **0.07** | **0.21** | **0.27** | **0.49** | **-0.04** | **0.03** | - | **-0.26** |
| SIZE | **-0.29** | **-0.19** | **-0.24** | **-0.22** | **-0.15** | **-0.08** | **-0.3** | **-0.27** | **-0.51** | **0.37** | **0.16** | **-0.29** | - |

Panel C: Explaining Earnings and Accruals Persistence

$$\mathbf{Y} = \gamma_{\mathbf{industry}} + \gamma_{\mathbf{year}} + \gamma_1\mathbf{TaxAQ}\ (\text{or } \mathbf{TaxAQ2}) + \gamma_2\mathbf{GROWTH} + \gamma_3\mathbf{AQ} + \gamma_4\mathbf{SI} + \gamma_5\mathbf{SIZE} + \gamma_6\mathbf{BTD} + \varepsilon$$

| | | Pre-Tax Earnings Persistence ($Y = \beta_1$) | | | Pre-Tax Accruals Persistence ($Y = \lambda_1$) | | | Pre-Tax Cash Flows Persistence ($Y = \lambda_2$) | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | Pred. | [1] | [2] | Pred. | [3] | [4] | Pred. | [5] | [6] |
| TaxAQ | + | 1.448*** | | + | 1.557*** | | n/s | -0.044 | |
| | | *(7.06)* | | | *(5.91)* | | | *(-0.15)* | |
| TaxAQ2 | + | | 1.050*** | + | | 1.210*** | n/s | | 0.446 |
| | | | *(4.62)* | | | *(4.15)* | | | *(1.35)* |
| AQ | + | 1.151*** | 1.074*** | + | 1.245*** | 1.163*** | n/s | -0.368* | -0.363* |
| | | *(8.66)* | *(7.91)* | | *(7.26)* | *(6.68)* | | *(-1.89)* | *(-1.84)* |
| SI | - | -0.524*** | -0.511*** | - | -0.502*** | -0.483*** | ? | -0.306*** | -0.282*** |
| | | *(-25.99)* | *(-24.40)* | | *(-19.43)* | *(-17.94)* | | *(-10.39)* | *(-9.26)* |
| GROWTH | + | 0.206*** | 0.222*** | + | 0.155*** | 0.185*** | + | 0.148*** | 0.139*** |
| | | *(11.27)* | *(11.77)* | | *(6.63)* | *(7.66)* | | *(5.53)* | *(5.09)* |
| BTD | - | -0.132*** | -0.152*** | - | -0.171*** | -0.192*** | - | -0.032 | -0.045** |
| | | *(-9.60)* | *(-10.70)* | | *(-9.69)* | *(-10.55)* | | *(-1.58)* | *(-2.17)* |
| SIZE | ? | 0.008*** | 0.008*** | ? | -0.007*** | -0.007*** | ? | 0.029*** | 0.027*** |
| | | *(5.08)* | *(4.58)* | | *(-3.48)* | *(-2.99)* | | *(11.85)* | *(10.53)* |
| N | | 19,433 | 18,009 | | 19,433 | 18,009 | | 19,433 | 18,009 |
| Adj. $R^2$ | | 14% | 13% | | 9% | 9% | | 6% | 6% |

Notes: The earnings persistence proxy $\beta_1$ is from a firm-specific estimate of Equation 2a ($PTBI_{t+1} = \beta_0 + \beta_1 PTBI_t + \varepsilon_{t+1}$). The accruals persistence proxy $\lambda_1$ is from a firm-specific estimate of Equation 2c ($PTBI_{t+1} = \lambda_0 + \lambda_1 PT\_ACC_t + \lambda_2 PT\_CFO + \varepsilon_{t+1}$). The tax accrual proxy TaxAQ is the standard deviation of the residuals from firm-specific estimates of Equation 1b ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 CAPX_t + \beta_5 \Delta NOL_t + \varepsilon_t$). The tax accrual proxy TaxAQ2 is the standard deviation of the residuals from firm-specific estimates of Equation 1c ($TaxACC_t = \beta_0 + \beta_1 CTP_{t-1} + \beta_2 CTP_t + \beta_3 CTP_{t+1} + \beta_4 \Delta DTL\_LT_t + \beta_5 \Delta DTA\_LT_t + \varepsilon_t$). All variables are defined in the Appendix. In Panel A only the mean values of $\beta_1$, $\lambda_1$, and $\lambda_2$ are tested for statistical significance. In Panel B, correlations significant at the five percent level (using two-tailed p-values) are in **bold**. Pearson correlation coefficients are reported on winsorized data to mitigate the influence of outliers. We use robust regression with industry (2-digit SIC code) and year fixed effects to estimate the results presented in Panel C. Robust regression iteratively assigns weights to individual observations in order to mitigate the influence of outliers, meaning some observations may receive a weight of 0. T-statistics are presented in parentheses below each coefficient. ***, **, and * indicate significance at the 1%, 5%, and 10% respectively using a t-test to determine whether the distribution of coefficients are different from zero (one-tailed for directional predictions).