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Miami, Florida

TWO ESSAYS USING DECOMPOSITION OF TAX EXPENSE

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by

Shujia Mei

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To: Dean William G. Hardin
College of Business

This dissertation, written by Shujia Mei, and entitled Two Essays Using Decomposition of Tax Expense, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Florida International University, 2023

DEDICATION

This dissertation is dedicated to my father, Yingdong Mei, who instilled in me a passion for lifelong learning from an early age. I believe you would be proud of me if you were still here.

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ABSTRACT OF THE DISSERTATION

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Miami, Florida

Professor Abhijit Barua, Major Professor

Tax expense is typically presented as a percentage ("effective tax rate") of pre-tax earnings. In this dissertation research, I use a decomposition approach that views tax expense as a function of both pre-tax earnings and tax rate. I examine the following two topics: (i) the valuation of tax expense, and (2) the accuracy of analysts' tax forecasts compared with that of their pre-tax earnings forecasts.

In the first essay, I examine how the association between the two decomposed components of tax expense surprises and stock returns explains the two competing roles of tax expense documented in Thomas and Zhang (2014): the proxy-for-profitability role and the matching role. To disentangle these two roles, I decompose tax expense surprise into two components: the pre-tax earnings surprise component ("PTE component") and the effective tax rate surprise component ("ETR component"). I then examine how these two decomposed components are associated with contemporaneous stock returns. The findings show that the PTE component mainly serves the proxy-for-profitability role of tax expense, while the ETR component is the main channel for the matching role. The manifestation of the proxy-for-profitability and matching roles through the respective components is conditional on several factors, such as (a) the strength of the relationship between nontax

variables (i.e., pre-tax earnings) and stock returns, (b) the significance of permanent book to tax differences, and (c) the level of tax avoidance and tax risks.

In the second essay, I examine how the accuracy of analysts' tax forecasts compares with that of their pre-tax earnings forecasts. The findings suggest that analysts, on average, face more challenges and uncertainty when forecasting taxes. In addition, I find that the relative accuracy of analysts' tax forecasts vs. their pre-tax earnings forecasts decreases with the increase in tax and firm complexity. The relative accuracy decreases for larger firms, potentially due to the availability of high-quality public information hindering analysts' efforts in acquiring private information that is the primary source for analysts' forecasts of taxes. However, with the increase in analysts following that enriches a firm's information environment, the relative accuracy of analysts' tax forecasts improves.

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ESSAY I: VALUATION OF TAX EXPENSE – A DECOMPOSITION APPROACH

I. INTRODUCTION

Prior studies investigating the association between tax expense and firm value find mixed evidence. Early studies show a negative relation between tax expense and stock returns, consistent with the notion that tax burden reduces firm value. However, subsequent studies document that tax expense, especially the current portion of it, contains information about a firm's future profitability beyond pre-tax earnings, and thus, shows a positive relation with firm value.[1] In this study, I decompose tax expense surprise (hereafter "tax surprise")[2] to extract two components and examine how those components are associated with stock returns to shed light on the seemingly contradictory relationship between tax expense and firm value.

The decomposition approach used in this study is built upon the framework proposed by Thomas and Zhang (2014). The framework views tax expense as assuming two competing roles—the proxy-for-profitability role that drives its positive relation with firm value and the matching role that drives a negative relation. Through the decomposition of tax expense into the two components, I examine whether one represents the proxy-for-profitability role and the other represents the matching role. By disentangling the two competing roles of tax expense, this study investigates how several factors such as tax avoidance, tax risk, and the significance of permanent book to tax differences influence the

[1] Prior studies documenting a negative association between tax expense (tax expense surprise) and price level (returns) include Lipe (1986), Amir et al. (1997), Ayers (1998), Dhaliwal et al. (2000), and studies finding positive association include Lev and Nissim (2004), Hanlon et al. (2005), Hanlon (2005).

[2] The tax expense surprise, calculated as the change in tax expense from year t-1 to year t, will be denoted as tax surprise throughout the paper for brevity.

proxy-for-profitability and matching roles of tax expense. Thus, I extend prior research on the value implications of tax expense by providing additional insights into the proxy-for-profitability and matching roles.

Tax expense is usually presented as a percentage defined as the effective tax rate (ETR) of pre-tax earnings. As such, annual changes in tax expense (i.e., surprises in tax expense), measured as the first difference in tax expense, can be generated through changes in pre-tax earnings and/or changes in ETR. Prior studies investigating valuation implications of tax expense typically employ regressions of returns on surprises in tax expense and other earnings variables (e.g, Lipe 1986). I decompose surprises in tax expense into two components—(a) changes in tax expense due to pre-tax earnings surprise (hereafter, PTE component) and (b) changes in tax expense due to ETR surprise (hereafter, ETR component).[3] Since tax expenses, especially the current portion of tax expenses, are calculated based on taxable income which is considered an alternative measure of firm performance, the magnitude of tax surprises not only represents potential cash outlay (liabilities) for taxes but also information about the future profitability. I argue that the PTE component of tax surprise, decomposed as change in pre-tax earnings multiplied by prior year ETR level, mainly represents the proxy-for-profitability role of tax expense, given ETR level is mainly driven by permanent book to tax differences, which is part of the total book to tax differences that are found to be associated with future profitability (Lev and Nissim 2004; Hanlon, Laplante, and Shevlin 2005; Ayers, Jiang, and Laplante 2009). I further argue that the ETR component of tax surprise is the main channel for the matching

[3] The process for decomposition is detailed at Part IV Research Design.

role of tax expense, since the ETR component captures the part of tax surprise due to change in ETR, which is found to be persistent and is negatively associated with future earnings (Schmidt 2006). Furthermore, managers put great emphasis on ETR to minimize firms' tax liability (U.S. Department of the Treasury 1999; McGill and Outslay 2004) given that income taxes represent significant costs of operating business, and that prior literature finds that managers engage in earnings management through ETR manipulation (Dhaliwal, Gleason, and Mills 2004; Comprix, Mills, and Schmidt 2012). The managers' emphasis on ETR and use of ETR as a tool for earnings management suggest that ETR change can impact earnings in a significant way and investors might respond positively (negatively) to the increases (decrease) in earnings induced by ETR change. The disentanglement of the two competing roles of tax expense through the two components of tax surprise reveals the mechanism through which tax expense serves the two competing roles.

To test the valuation implications of the two components of tax surprise, I follow the valuation model in Thomas and Zhang (2014) and regress annual holding period returns on the earnings surprise components, including pre-tax earnings (PTE) surprise and the PTE component and ETR component of tax surprise. I find that the coefficient on the PTE component is positive and statistically significant while the coefficient on the ETR component is not statistically significant. The finding is consistent with our hypothesis that the proxy-for-profitability role is mainly through the PTE component. However, the matching role is not manifested through the ETR component in the overall sample as hypothesized. To further validate the disentanglement of the two roles of tax expense through the PTE and ETR components of tax surprise, I examine how the coefficients on the PTE and ETR components change with the increasing relationship between nontax variables and future profitability. Following Thomas and Zhang (2014), I estimate the model in several successive truncated samples by gradually excluding observations with larger PTE surprises from wider sections of both tails PTE surprises distribution. Results show that the coefficient on the PTE component becomes less positive and insignificant, while that on the ETR component becomes more negative and significant as the truncated section widens from 1% to 10% of both tails. These results are consistent with Thomas and Zhang (2014) that the proxy-for-profitability of tax expense is suppressed while the matching role dominates as the relationship between PTE surprise and future profitability strengthens with the exclusion of extreme PTE surprises. Overall, these findings support my conjecture that the PTE component portrays the proxy-for-profitability role and the ETR component mainly manifests the matching role.

I then examine how tax avoidance and tax risk moderate the proxy-for-profitability role of tax surprise. Prior literature finds that taxable income is positively associated with contemporaneous stock returns due to incremental information contained about future profitability (Ayers et al. 2009; Hanlon et al. 2005). However, the information content of taxable income is impaired relative to book income for firm-years identified as engaging in tax avoidance due to the increase in book to tax differences, which reduce the informational value of taxable income. Since the proxy-for-profitability role in the PTE component stems from the incremental information in permanent book to tax differences about future performance, and prior literature finds that firms carry out aggressive tax planning through generating permanent book to tax differences (Wilson 2009; Frank, Lynch, and Rego 2009), I expect firms engaging in tax avoidance will likely experience a decrease in proxy-for-profitability role through the PTE component compared with firms not engaging in tax avoidance. Besides tax avoidance, practitioners and academics have increasingly focused on tax risk as a distinct dimension of tax outcome. Tax risk, measured as the volatility of annual cash or GAAP ETR, is likely to be associated with complex tax strategies that create uncertainty about future tax position (Drake, Lusch and Stekelberg 2019; Abernathy, Finley, Rapley, and Stekelberg 2021;). Thus, I expect tax risk to decrease the proxy-for-profitability role of tax expense. I find results consistent with the expectation that both tax avoidance and high tax risk decrease the proxy-for-profitability role of tax expense through the PTE component.[4]

Regarding the matching role, I conduct the cross-sectional test examining whether large magnitude of permanent book to tax differences impacts the matching role of tax expense through the ETR component. I find that markets respond more strongly to the ETR component of tax surprise when the change in ETR involves permanent book to tax differences that are of more significant magnitudes, as indicated by the negative coefficient on interaction term of the ETR component of tax surprise and the indicator variable for significant permanent book to tax differences.

Lastly, I examine how tax surprise generated through the change in valuation allowance affects the relation between the ETR component of tax surprise and contemporaneous stock returns. Recent literature finds that ETR change can be driven by change in the valuation allowance that is unrelated to the change in a firm's tax burden (Schwab et al. 2021). Valuation allowance is a contra-asset that offsets the deferred tax

[4] I use two measures of tax avoidance, one is 5-year Cash ETR and the other is 5-year current ETR, to examine how tax avoidance affects the proxy-for-profitability role of tax expense. I find results consistent with expectation that tax avoidance decreases the proxy-for-profitability role of tax expense when measuring tax avoidance using 5-year cash ETR but not when measuring using 5-year current ETR.

assets. ASC 740-10 requires the recording of a valuation allowance for financial accounting purposes if it's more likely than not that the benefits of the deferred tax assets will not be realized based on the management's expectation of future profitability. Valuation allowance is found to be associated with firms' future performance (Miller and Skinner 1998; Visvanathan 1998; Christensen, Paik, and Stice 2008; Jung and Pulliam 2006), as accrual of valuation allowance signals poor future performance and release of valuation allowance signals good future performance. As a result, I expect that the tax expense increase (decrease) from accrual (release) of valuation allowance will drive the ETR component of tax surprise to be negatively associated with contemporaneous stock returns. I find evidence consistent with the expectation that the ETR component of tax surprise generated by change in valuation allowance is negatively associated with contemporaneous stock returns. Such negative relation mainly reflects the signaling role of tax expense when tax surprise contains information about the change in valuation allowance that signals firms' future performance, which is distinct from the negative relation driven by the matching role of tax expense.

This study makes several contributions to the literature. First, it contributes to literature on value implications of tax expense. While Thomas and Zhang (2014) provide the framework and empirical evidence for tax expense assuming two competing roles and reconcile prior studies that find mixed evidence regarding the relationship between tax expense and firm value, I extend their study by disentangling the two roles of tax expense through specific components of tax surprise, thus allowing a better understanding of how tax expense maps into firm value. I also identify the circumstances under which the matching role of tax expense manifests through the ETR component, i.e., when proxy-for-profitability role of tax expense through PTE component is fully suppressed or when ETR change involves significant permanent book to tax differences. This responds to the call by Thomas and Zhang (2014) for more careful study of factors affecting the matching role of tax expense.

Second, this study identifies and documents an additional role of tax expense — signaling role — that stems from tax surprise containing information about firms' future performance through the change in valuation allowance. As recent literature finds that ETR can be affected not only by firms' tax liability, but by change in valuation allowance as well (Schwab et al. 2021; Drake et al. 2020), this study provides insights into how valuation allowance can affect the value implications of tax expense.

Finally, this study also provides additional evidence regarding how market participants price tax-related information, the implications of which is important to standard setters and policymakers. Tax Expense, as a substantial cost of operating business, involves complex calculation and requires applying extensive financial reporting rules. The reporting and disclosure of tax expense is considered opaque which impacts market participants' valuation of firms. The decomposition of tax surprise into the PTE component and the ETR component provides a framework to evaluate the impact from new standards. As FASB continues its effort to make disclosures for income taxes more useful and relevant, this decomposition framework can be applied to evaluate how certain disclosure requirements impact the valuation of tax expense.

II. BACKGROUND

Effective Tax Rate (ETR)

ETR, calculated as the ratio of a firm's tax expense to pre-tax earnings, captures the average rate of per dollar of tax expense on income and is widely used to measure a firm's tax burden. Tax expense can then be presented as pre-tax earnings multiplied by GAAP ETR. In the absence of reconciliation adjustments, GAAP ETR should be the same as statutory tax rate. The adjustments causing the ETR to deviate from the statutory tax rate mainly include permanent book to tax differences between GAAP income and taxable income (hereafter, permanent BTDs), rate differential items for earnings in jurisdictions that have a different rate than the U.S. statutory rate, tax credits, state and local income taxes, as well as change in the valuation allowance and tax reserves for uncertain tax positions.

Since tax return information remains confidential, researchers, policy makers and other corporate shareholders have relied on GAAP or other alternative forms of ETRs to measure tax planning effectiveness (Mills, Ericson and Maydew 1998; Rego 2003) and the magnitude of firms' tax avoidance (McGill and Outslay 2004; Dyreng, Hanlon and Maydew 2008; Dyreng et al. 2017; De Simone, Nickerson, et al. 2020). ETR significantly lower than 40% is deemed to be a result of tax avoidance whereas ETR higher than 40% suggests ineffective tax planning. ETR, when used as a measure for a firm's tax burden, mainly captures the effect of permanent BTDs, foreign tax rate differential, state and local tax as well as tax credits. While these items are a significant part of the reconciliation adjustments between statutory tax rate and effective tax rate, there are other items unrelated to a firm's tax burden that could affect ETR. Recent studies, extracting detailed reconciling adjustments disclosed in the tax footnote from the financial statements, provide more insights into how factors unrelated to a firm's tax burden can impact ETR and affect inferences drawn from using ETR as a proxy for tax avoidance (Drake et al. 2020; Christensen, Kenchington and Laux 2021; Schwab et al. 2021). Schwab et al. 2021 document factors largely unrelated to tax avoidance, such as valuation allowances and goodwill impairments, clustered at the tails of the ETR distribution (below 5% and above 40%). Drake et al. (2020) and Christensen et al. (2021) document the effect of valuation allowance releases and NOLs in lowering ETR. The understanding of ETR not merely as a measure for a firm's tax burden but also influenced by other factors has implications for valuation of tax expense.

Permanent Differences

Permanent BTDs are significant part of ETR reconciliation adjustments that cause ETR to differ from the statutory rate. Permanent BTDs are items included in GAAP income but never entered as taxable income or vice versa, in contrast to temporary book to tax differences which are items included in GAAP income and taxable income in different periods. For example, municipal bond interest included in GAAP income but not in taxable income is an example of permanent BTDs since municipal bond interest is permanently deducted from GAAP income to arrive at taxable income. Unlike temporary book to tax differences that cause taxable income to temporarily differ from GAAP income but do not change a firm's ETR and total tax expense, permanent BTDs do have an impact on a firm's ETR and total tax expense. Therefore, the tax planning strategies that generate favorite permanent BTDs — those that generate tax benefit that will not be reversed in the future and thus effectively increase the GAAP earnings —are considered ideal (U.S. Department of Treasury 1999; McGill and Outslay 2003, 2004; Boynton and Mills 2004). Graham et al. 2014 provides evidence through survey responses that firm executives prefer tax planning strategies that reduce tax expense and increase earnings per share.

Since tax return information remains confidential, the public has relied on the ETR reconciliation schedule – the schedule that reconciles the adjustments between statutory tax rate and ETR - in the tax footnotes of the financial statements in providing information about permanent BTDs. Due to high threshold that only requires reconciliation adjustments at least 5% of statutory tax rate to be disclosed in the ETR reconciliation, not all permanent BTDs are disclosed thus remain unknown. Researchers have mainly used financial information from computer-readable databases in calculating estimate permanent BTDs based on pre-tax income and various tax accounts. Since total permanent BTDs calculated this way might reflect items that are not related to tax planning strategies, such as state and local income taxes, tax credits, changes in tax reserves, etc., Frank et al. (2009) develops a measure to capture the discretionary portion of total permanent BTDs for aggressive tax reporting.

Valuation Allowance

The valuation allowance account is established to offset against deferred tax assets when managers believe that some or all deferred tax assets will not be realized. For example (ASC740-10), firms might have a deferred tax asset associated with net operating loss carryover from previous years that can be used to offset future taxable income. However, they might have experienced continuous losses in the recent year and are not expected to turn profits in the foreseeable future, resulting in a valuation allowance being recorded against the deferred tax assets. The valuation allowance can then be released in future periods when firms expect sufficient taxable income net of reversal of deferred tax liability to realize the benefits associated with the deferred tax assets. ASC 740 requires managers to assess future taxable income in determining the level of valuation allowance, thus the change in valuation allowance can be informative in assessing firms' future performance, as several studies document (Miller and Skinner 1998; Visvanathan 1998; Christensen, Paik, and Stice 2008; Jung and Pulliam 2006; Dhaliwal, Kaplan, Laux and Weisbrod 2013; Finley and Ribal 2019).

The change in valuation allowance is recorded as part of the tax expense, as the accrual (release) of valuation allowance results in current period's tax expense (benefit). Recent studies find that valuation allowance accrual (release) clusters at the higher (lower) tail of the ETR distribution . Specifically, valuation allowance release accounts for more than 40% of the deviation from the statutory tax rate for ETRs being less than 5% (Schwab et al. 2021). Drake et al. (2020) also document the GAAP ETR-decreasing effect of valuation allowance releases, cautioning against attributing a decrease in ETRs to tax avoidance. The value relevance of changes in valuation allowances, combined with the recent studies showing valuation allowance accruals and releases being significant component of ETR reconciliation adjustments, make it important to incorporate the impact of valuation allowance changes in examining the value implications of tax expense.

Tax Surprise Decomposition: Proxy-for-Profitability and Matching Components

I decompose tax surprise into two components by separating the magnitude of tax changes driven by PTE changes from the portion of tax changes due to ETR changes. The derivation of these two components is furnished below. Tax surprise can be written as Equation 1.1 below.

$$\Delta TAX_t = TAX_t - TAX_{t-1} \qquad 1.1$$

In Equation 1.1, TAX_t and TAX_{t-1} denote the tax expense recorded in year t and year t-1, respectively. ΔTAX_t represents the change in tax expense from year t-1 to year t. Since tax expense is calculated as pre-tax earnings multiplied by ETR, Equation 1.1 can be expanded to Equation 1.2 below.

$$\Delta TAX_t = PTE_t * ETR_t - PTE_{t-1} * ETR_{t-1} \qquad 1.2$$

Here, PTE_t and PTE_{t-1} stand for pre-tax earnings in year t and year t-1, respectively, while ETR_t and ETR_{t-1} represent the effective tax rate for year t and year t-1. I define PTE surprise in year t, ΔPTE_t and ETR surprise in year t, ΔETR_t as the first difference in PTE and ETR respectively, which are shown in Equations 1.3 and 1.4 as follows:

$$\Delta PTE_t = PTE_t - PTE_{t-1} \qquad 1.3$$

$$\Delta ETR_t = ETR_t - ETR_{t-1}$$

$$ETR_t = ETR_{t-1} + \Delta ETR_t \qquad 1.4$$

Now, plugging Equations 1.3 and 1.4 into Equation 1.2 and rearranging as follows, I derive Equation 1.5:

$$\Delta TAX_t = PTE_t * ETR_t - PTE_{t-1} * ETR_{t-1}$$

$$= PTE_t * \ (ETR_{t-1} + \Delta ETR_t) \ - PTE_{t-1} * ETR_{t-1}$$

$$= PTE_t * ETR_{t-1} + PTE_t * \Delta ETR_t - PTE_{t-1} * ETR_{t-1}$$

$$= \ (PTE_t - PTE_{t-1}) \ * ETR_{t-1} + PTE_t * \Delta ETR_t$$

$$= \ (PTE_t - PTE_{t-1}) \ * ETR_{t-1} + (ETR_t - ETR_{t-1}) * PTE_t \qquad 1.5$$

Equation 1.5 can be viewed as the sum of the following two components of tax surprise:

$$\text{PTE component} = (PTE_t - PTE_{t-1}) * ETR_{t-1}$$

$$\text{ETR component} = (ETR_t - ETR_{t-1}) * PTE_t$$

The PTE component of tax surprise is related to the change in tax expense, which is driven by the change in pre-tax earnings, assuming that the ETR remains constant between the prior and current year. On the other hand, the ETR component of tax surprise is related to the change in tax expense, which is driven by the ETR change between prior and current year.

III. PRIOR LITERATURE AND HYPOTHESES DEVELOPMENT

Tax expense is a substantial cost of operating business and a major component of a firm's earnings.[5] The significance of tax expense has led researchers to examine how it maps into firm value (Lev and Nissim 2004; Hanlon et al. 2005; Thomas and Zhang 2014). However, two streams of research investigating this issue have provided seemingly contradictory results on the relation between tax expense and firm value. Early research has mainly focused on tax expense as a matching cost of operating business and is negatively related to firms' valuation. Lipe (1986) examines the relationship between earnings components and returns, and finds a negative coefficient on tax surprise. Other

[5] The Tax Cuts and Jobs Act of 2017 reduced the corporate tax rate from 35% to 21%. There is also a one-time mandatory repatriation tax imposed on U.S. multinational entities on undistributed and deferred post-1986 foreign income. Since the sample period in this study ends in 2016, it does not include the post-change period. However, I expect the results to hold in the post-TCJA period. For 2017, the results might be impacted by the one-time repatriation tax, which is expected to reduce profitability role of tax expense.

studies examining the relationship between price levels and tax variables from the balance sheet, such as deferred tax assets and tax liabilities, generally find positive relationship between deferred tax assets and stock price and negative relationship between deferred tax liability and stock price (Amir et al. 1997; Ayers 1998; Dhaliwal et al. 2000). Since deferred tax assets represent a tax benefit and deferred tax liabilities represent a tax expense, these findings are consistent with the role of tax expense as a matching cost that reduces firm value.

Subsequent studies document the value relevance of tax expense in predicting future profitability. These studies examine that taxable income, which is used to calculate the current portion of tax expense, contains information about future profitability incremental to that contained in book income. Consistently, the current portion of tax expense has been shown to be positively associated with contemporaneous stock returns (Lev and Nissim 2004; Hanlon 2005; Hanlon et al. 2005).

To reconcile the variation in the sign of relation observed between tax expense and stock returns in these two streams of research, Thomas and Zhang (2014) provide a framework in which tax expense is viewed as assuming two competing roles – the proxy-for-profitability role and the matching role. The proxy-for-profitability role drives the positive relation between tax expense and contemporaneous stock returns, while the matching role explains the negative relation between tax expense and contemporaneous returns. Thomas and Zhang (2014) argue that the sign and magnitude of the coefficient on tax expense depends on the net effect from these two competing roles. They provide evidence suggesting that when current expectations of future profitability are controlled in the valuation model, the proxy-for-profitability role of tax expense is suppressed and the tax surprise is likely to have negative association with firm value. They further predict that, in the absence of adequate control for current expectations of future profitability in the valuation model, the association between tax expense and firm value depends on the net effect of the matching role and proxy-for-profitability role with the latter increasing (decreasing) with the strength of the relation between future profitability and tax variable such as tax expense (nontax variable such as pre-tax earnings).

In this study, I decompose the tax surprise into two components: (a) tax surprise due to surprise in pre-tax earnings; (b) tax surprise resulted from ETR surprise from prior year t-1 to current year t. As ETRs contain information about permanent BTDs, I hypothesize that the PTE component of tax surprise, as a function of pre-tax earnings surprises and prior year ETR, is the main channel through which the proxy-for-profitability role of tax expense manifests, thus driving the positive relationship between tax surprise and contemporaneous stock returns. Extant studies document how taxable income, which includes both temporary BTDs and permanent BTDs, contains information about firms' earnings growth and future performance incremental to book income, and therefore provides incremental information about firms' future profitability to the market (Lev and Nissim 2004; Hanlon et al. 2005; Ayers et al. 2009; Blaylock et al. 2020). Although prior studies mainly find total book to tax differences (including both temporary and permanent BTDs) have incremental value in predicting firms' future performance, we focus on permanent BTDs since permanent BTDs are the component of total book to tax differences that creates variation in tax expense and helps explain the proxy-for-profitability role of tax expense documented in Thomas and Zhang (2014).[6] Regarding the ETR component of tax surprise, which measures the effect on tax surprise resulting from ETR change from t-1 to t, I hypothesize that this component is the part of tax surprise mainly capturing the change in tax burden, thus reflecting the matching role of tax expense and driving the negative relationship between tax surprise and contemporaneous stock return. However, it remains unclear whether the ETR component will be negatively associated with contemporaneous stock returns due to the following reasons. First, prior research has shown permanent BTDs appear to have a transitory nature (Jackson 2014). Second, firms engage in last chance of earnings management through manipulating downward ETR for the fourth quarter (Dhaliwa et al. 2004) and the market can see through such earnings management of tax expense and discount the reward significantly (Gleason and Mill 2005). The prediction of the positive relationship between the PTE component of tax surprise and contemporaneous stock returns and the negative association between the ETR component and contemporaneous stock returns leads to my first hypothesis in the alternative form:

H1: ***The PTE (ETR) component of tax surprise is positively (negatively) associated with contemporaneous stock returns***.

Thomas and Zhang (2014) find that the direction of the association between tax surprise and firm value depends on the net effect of two competing roles—proxy-for-profitability role and matching role — with the proxy-for-profitability role increasing or decreasing conditional on the strength of the relation between pre-tax earnings and future profitability. Specifically, when pre-tax earnings surprise is more strongly associated with

[6] Temporary BTDs increase (decrease) current tax expense with an offset to deferred tax expense, thus do not impact the overall tax expense.

future profitability, hence stronger positive relationship with contemporaneous stock return, the proxy-for-profitability role of tax expense is suppressed and the matching role dominates, turning the coefficient for tax surprise to be negative. They find results consistent with their prediction that, as the positive relation between pre-tax earnings and future profitability strengthens, the coefficient on tax expense becomes less positive and eventually turns negative as observations from wider sections of both tails of pre-tax earnings distribution are excluded. Given the decomposition separates the profitability role from the matching role, I hypothesize that, when observations with larger pre-tax earnings surprises are excluded, the coefficient on the PTE component which is the main channel for the proxy-for profitability will be less positive and the coefficient on the ETR component for the matching role will turn more negative. My second hypothesis in alternative form is as follows:

H2: ***The association between contemporaneous stock returns and the PTE (ETR) component of tax surprise becomes less positive (more negative) as the pre-tax earnings capture more information about future profitability.***

Extant research also finds that certain factors can impact the ability for taxable income to predict future performance. Ayers et al. (2009) find that the information content of taxable income is less for firms engaging in more tax planning than that for other firms. Since firms often engage in earnings management and aggressive tax planning simultaneously (Frank et al. 2009), Chen, Dhaliwal, and Trombley (2012) further show that the informativeness of taxable income reduces with the presence of aggressive tax planning even after controlling for earnings management. Mayberry, McGuire and Omer (2015) find that smoothing taxable income, as part of overall tax avoidance strategy, either eliminates or reduces the information contained in taxable income. Since the information content of taxable income is contained in total book to tax differences including both permanent BTDs and temporary BTDs, I hypothesize that high tax-planning firms will likely experience a decrease in the proxy-for-profitability role through the PTE component. Furthermore, as a distinct dimension of tax outcome, tax risk has drawn attention from practitioners and academics. Tax risk, measured as annual cash or GAAP ETR volatility, refers to the uncertainty in tax outcome from tax planning and captures fluctuations in ETRs resulting from non-recurring tax planning strategies and/or the reversal of tax positions upon audits by tax authorities (Drake et al. 2019). Bratten, Gleason, Larocque, and Mills (2017) define tax complexity as the volatility of ETRs. Drake et al. (2019) find that higher tax risk is associated with more volatile and unpredictable future tax rates. Neuman et al. (2019) identified three sources of tax risk: economic risk, tax law uncertainty, and inaccurate information processing. I argue that the high tax risk, resulting from either aggressive non-sustainable tax planning strategies due to the uncertainty in tax law or inaccurate information processing will make tax expense less informative, decreasing the proxy-for-profitability role of tax expense through the PTE component. The predicted effect of tax avoidance and tax risk in decreasing the profitability role of tax expense through the PTE component leads to my third hypotheses:

H3a: ***The proxy-for-profitability role of the PTE component of tax expense is less pronounced for high tax-planning firms than for other firms.***

H3b: ***The proxy-for-profitability role of the PTE component of tax expense is less pronounced for high-tax risk firms than for other firms.***

I then turn attention to the factor that might impact the matching role of tax expense through the ETR component, which is the tax surprise generated through the ETR change from prior year to current year. ETRs reflect the effects of tax-planning and tax-optimization activities and managers increasingly focus on ETRs to improve firms' bottom lines and beat analysts' earnings forecasts (Dhaliwal et al. 2004; Comprix et al. 2006). Firms spent non-trivial resources in tax planning and several prior studies document the value relevance of tax saving strategies (Desai and Dharmapala 2009; Frank et al. 2009; Wilson et al. 2009; Drake et al. 2019). In addition, since anecdotal evidence suggests that firms engage in tax planning mainly through permanent BTDs (Frank et al. 2009), the effectiveness of tax planning is then mainly reflected in the magnitudes of permanent BTDs. Since the ETR component of tax surprise reflects the change in firms' tax burden as a result of tax planning, I expect that the markets will react more strongly to the ETR component when the current period permanent BTDs are of more significant amounts, making the negative relationship between the ETR component of tax surprise and contemporaneous stock returns more pronounced. This leads to my fourth hypothesis:

H4: ***The matching role of the ETR component of tax surprise will be more pronounced when current year permanent BTDs are of more significant magnitudes.***

Lastly, as recent studies find that the valuation allowance that is unrelated to tax avoidance constitutes a significant part of ETR reconciling adjustments in the tails of the ETR distribution and might have a sizable effect on the ETR change from year to year, it is important to consider how the accrual and release of the valuation allowance impacts how the ETR component of tax surprise associates with contemporaneous stock returns. ASC 740 Income Taxes requires firms to consider future taxable income in assessing the realizability of deferred tax assets and increase/decrease the valuation allowance accordingly. Consistent with the requirement under ASC 740, prior research documents the association between valuation allowance and firms' future performance (Miller and Skinner 1998; Visvanathan 1998; Christensen, Paik, and Stice 2008; Jung and Pulliam 2006). Dhaliwal et al. (2013) develop an algorithm identifying loss firms establishing the valuation allowance in the year and find that the establishment of the valuation allowance signals the persistence of loss. Finley et al. (2019) examine profitable firms that release the valuation allowance and find that they have higher future earnings, compared with control firms that maintain the valuation allowance. These studies demonstrate that the accrual and release of the valuation allowance credibly signals firms' future performance to the markets and plausibly influences the relationship between tax surprise and contemporaneous stock returns. Therefore, given the tax expense increase (decrease) from the accrual (release) of the valuation allowance signals bad (good) news to the markets regarding firms' future performance, this likely drives the negative relation between the ETR component of tax surprise and contemporaneous stock returns. However, prior studies also find that tax disclosures are complex, and the complexity might impact how the markets incorporate and price the relevant tax information. Finley et al. (2019) find that investors are not timely in responding to the information content from the release of the valuation allowance. Therefore, it remains an empirical question whether the accrual and release of the valuation allowance drives the negative relationship between the ETR component of tax surprises and stock returns, which leads to my final hypothesis:

H5: Both *accrual and release of the valuation allowance drives the negative relationship between the ETR component of tax surprise and contemporaneous stock returns.*

IV. RESEARCH DESIGN

Sample Selection

Table 1.1 summarizes the sample selection procedure. The sample begins with all observations at the intersection of CRSP and Compustat from 1982 to 2016 with available data. The sample period starts with 1982 to be consistent with Thomas and Zhang (2014). The sample period ends in 2016 because of the passage of Tax Cuts and Jobs Act at the end of 2017, which changes the tax law significantly and introduced significant one-time items to the financial reporting of income taxes which might present complications for the study. The sample period effectively runs from 1992 for the test on the impact of tax avoidance given tax avoidance being measured with cash taxes paid which only becomes available on Compustat starting at 1988 and the measure requiring five consecutive years of data to calculate. For the tests of significant permanent BTDs and tax avoidance that use the measure of discretionary permanent BTDs, the sample period runs from 1991 following Frank et al. (2009) mainly because the book-tax gap began sometime in the early 1990s. The sample period for tests involving valuation allowance begin in 1994 following adoption of FAS 109 (currently ASC 740), which prescribes the current rules for accounting for income taxes (Finley et al. 2019).

<Insert Tables 1.1 and 1.2 Here>

Models and Variable Measurements

Valuation Model of Tax Surprise Components

To test Hypothesis 1 regarding the relationship between the two components of tax surprise with contemporaneous stock returns, I follow the Thomas and Zhang (2014) valuation model which regresses 12-month buy-and-hold contemporaneous stock returns on pre-tax earnings surprises, as well as the two components of tax surprises, as shown in Equation 1.6 below.

$$RET_t = \alpha_0 + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \quad 1.6$$

Following Thomas and Zhang (2014), the regressions are run for each year, which generate a distribution of coefficient estimates for each variable, the means of which are reported in the table as coefficients and the standard deviations are used to generate Fama–MacBeth (1973) t-statistics. The adjusted R^2 values reported are also means of the corresponding distribution generated by the annual regressions. The two variables of interests are: (a) PTE component of tax surprise (ΔTAX_PTE) which equals the pre-tax earnings surprise multiplied by the prior period ETR; (b) ETR component of tax surprise (ΔTAX_ETR) which equals the current period pre-tax earnings multiplied by the ETR change from the prior period to the current period. Based on the prediction that the PTE component is the part of tax surprise that proxies for the profitability role, whereas the ETR component is the part for the matching role, I expect the coefficient for PTE Component, α_2, to be positive and the coefficient for ETR component, α_3, to be negative. The valuation regression model also includes variables to control for other determinants of stock returns following Thomas and Zhang (2014), including the market value of equity at the end of prior period (MV_{t-1}), the book-to-market ratio at the end of prior period (BM_{t-1}), and stock returns over the preceding 12-month window(RET_{t-1}), computed from the end of the second month of the prior fiscal year to the end of the second month of the current fiscal year. All variables are defined in Appendix A.

To test Hypothesis 2, following Thomas and Zhang (2014), I run the same valuation regression model as Equation 1.6 on four truncated samples that exclude firm-year observations from increasingly wider sections of both tails of the pre-tax earnings distribution by year. The first truncated sample excludes firm-years with large pre-tax earnings surprises from the top and bottom 1% of pre-tax earnings surprises distribution by year, the second excludes firm-years from the top and bottom 2%, the third excludes the top and bottom 5% and the fourth truncated sample excludes the top and bottom 10%. I expect that, as observations from wider sections of both tails of pre-tax earnings surprise distribution are excluded, the proxy-for-profitability role of tax surprise through PTE component is suppressed, resulting in the coefficient for the PTE component, α_2, to become less positive and less significant. At the same time, as the matching role of tax surprise through the ETR component becomes stronger, the coefficient for the ETR component, α_3, would become more negative and more significant.

Valuation Model of Tax Surprise- Effects of Tax Avoidance and Tax Risk

To test Hypotheses 3a and 3b regarding the impact of tax avoidance and tax risk on the proxy-for-profitability role of the PTE component, I modify Equation 1.6 by incorporating indicator variables for tax avoidance (*TAX_AVOID*) and tax risk (*TAX_RISK*) and interact the indicator variables with the three earnings surprise components: pre-tax earnings surprise, PTE component of tax surprise, and ETR component of tax surprise. The modified equations are as follows:

$$RET_t = \alpha_0 + \delta_0 TAX\_AVOID + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \delta_1 \Delta PTE_t * TAX\_AOVID + \delta_2 \Delta TAX\_PTE_t * TAX\_AVOID + \delta_3 \Delta TAX\_ETR_t * TAX\_AVOID + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \quad 1.7$$

$$RET_t = \alpha_0 + \beta_0 TAX\_RISK + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \beta_1 \Delta PTE_t * TAX\_RISK + \beta_2 \Delta TAX\_PTE_t * TAX\_RISK + \beta_3 \Delta TAX\_ETR_t * TAX\_RISK + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \quad 1.8$$

Tax Avoidance (*TAX_AVOID*): Prior literature measures tax avoidance in different ways: (1) five-year current ETR which is calculated as the sum of current tax expense (total tax expense *TXT* minus total deferred tax *TXDI*) from year t-4 to year t over sum of pre-tax earnings (*PI*) less special items (*SPI*) over the corresponding period; (2) five-year cash ETR calculated as sum of cash tax payments (*TXPD*) from year t-4 to year t over pre-tax earnings (*PI*) less special items (*SPI*) over the corresponding period. I define tax avoidance (*TAX_AVOID*) as an indicator variable which equals 1 for firms in the lowest quintile of five-year current ETR or five-year cash ETR by year and two-digit SIC industry.

Tax Risk (*TAX_RISK*): Prior literature uses either GAAP ETR volatility or cash ETR volatility to measure tax risk (Abernathy, Finley, Rapley and Stekelberg 2021). I measure tax risk using GAAP ETR volatility since this study involves the examination of GAAP tax expense and the decomposition is based on GAAP ETR. I calculate tax risk measure as the standard deviation of the annual GAAP ETR over the period from t-4 to t and define the indicator variable for tax risk (*TAX_RISK*) as being equal 1 for firms at the highest quintile of tax risk measure for each year and two-digit SIC industry.

I expect that tax avoidance and tax risk both weaken the proxy-for-profitability role of tax expense, as indicated by negative coefficient efficient for the interaction term of the PTE component and *TAX_AVOID/TAX_RISK*.

Valuation Model of Tax Surprise- Effects of Book-to-Tax Differences

Hypothesis 4 predicts the matching role of ETR component of tax surprise to be more pronounced, in the case of more significant amounts of permanent BTDs, resulting in more negative relation between ETR component and contemporaneous stock returns, an indication of the markets' stronger response to the ETR change influenced by the effectiveness of tax planning through large permanent BTDs. To test this hypothesis, I modify Equation 1.6 by incorporating an indicator variable *LARGE_PERM*, which equals 1 for firms at the highest quintile of absolute value of total permanent BTDs for each year and two-digit SIC industry, then interacting the indicator variable with the three earnings components variables as follows:

$$RET_t = \alpha_0 + \gamma_0 LARGE\_PERM + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \gamma_1 \Delta PTE_t * LARGE\_PERM + \gamma_2 \Delta TAX\_PTE_t * LARGE\_PERM + \gamma_3 \Delta TAX\_ETR_t * LARGE\_PERM + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \qquad 1.9$$

In Equation 1.9, I also measure the size of permanent BTDs in terms of absolute value of discretionary permanent BTDs (*DTAX*), as prior research finds that nondiscretionary permanent BTDs are mainly driven by the differences between GAAP and tax law and are unrelated to effectiveness of tax planning (Frank et al. 2009). The discretionary permanent BTDs (*DTAX*) is measured following Frank et al. (2009) as the residuals from regression of total permanent BTDs on nondiscretionary items unrelated to tax planning that cause permanent differences and other statutory adjustments. The absolute value of *DTAX* then reflects the size of favorable and unfavorable discretionary permanent BTDs, both of which the markets are likely to respond more strongly to. Since the markets will respond more strongly to the ETR increase and decrease resulted from tax planning involving larger amounts of permanent BTDs, I expect the coefficient on ETR component of tax surprise α_3 to be significantly negative.

Valuation Model of Tax Surprise- Effects of Valuation Allowance

In Hypotheses 5a and 5b, I predict that the accrual and release of valuation allowance will drive the negative relation between the ETR component of tax surprise and contemporaneous stock returns, manifesting the signaling role of the ETR component of tax surprise. To test these hypotheses, I run the valuation regression models as Equations 1.10 and 1.11 shown below by including indicator variables for the accrual and release of valuation allowance, respectively, and interact the indicator variables with the three variables for earnings components.

$$RET_t = \alpha_0 + \theta_0 VA + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \theta_1 \Delta PTE_t * VA + \theta_2 \Delta TAX\_PTE_t * VA + \theta_3 \Delta TAX\_ETR_t * VA + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \quad 1.10$$

$$RET_t = \alpha_0 + \vartheta_0 VA\_RELEASE + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \vartheta_1 \Delta PTE_t * VA\_RELEASE + \vartheta_2 \Delta TAX\_PTE_t * VA\_RELEASE + \vartheta_3 \Delta TAX\_ETR_t * VA\_RELEASE + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \quad 1.11$$

Following Dhaliwal et al. (2013), I assign the indicator variable for establishment of valuation allowance equal to 1 for firm-years identified as materially increasing the valuation allowance and 0 otherwise. Firm-years are considered to be materially increasing the valuation allowance when they report negative income before extraordinary items (*IB*) and positive U.S. pre-tax income (*PIDOM*) while reporting positive deferred tax expense. This is because loss firms usually report a deferred tax asset for the loss and a deferred tax benefit for the period. The recording of deferred tax expense instead of deferred tax benefit then suggests a significant increase in the valuation allowance (Dhaliwal et al. 2013). I assign an indicator variable for release of valuation allowance following Finley et al. (2019) that identifies firm-years as having released the valuation allowance when they report net deferred tax assets (*TXNDB*) at the beginning of the period that suggests full valuation allowance, while reporting positive net deferred tax assets at the end of the period. I expect the coefficient on the ETR component of tax expense in Equations 1.10 and 1.11 α_3 to be significantly negative.

V. EMPRICIAL ANALYSIS

Descriptive Statistics

Table 1.3, Panel A contains descriptive statistics for the dependent variable of stock returns, the independent variables of various earnings components as well as the control variables used in the main analysis. Panel B presents descriptive statistics for the test variables used in the cross-sectional tests, including measures of tax avoidance, GAAP ETR volatility, permanent BTDs, as well as the accrual and release of valuation allowance.

The descriptive statistics for variables in the main analysis are consistent with those documented in Thomas and Zhang (2014). Almost 4% of firm-year observations in the sample are identified as having materially increased the valuation allowance, while almost 3% of the sample are identified as having released valuation allowance.

<Insert Table 1.3 Here>

Table 1.4 presents univariate correlations, which show the positive relationship between contemporaneous stock returns and surprises in various earnings components, including earnings surprise (ΔE_t), pre-tax earnings surprise (ΔPTE_t), tax surprise (ΔTAX_t), as well as the PTE component of tax surprise, with the only exception being the ETR component of tax surprise which is negatively associated with contemporaneous stock returns. This is consistent with the expectation that the PTE component of tax surprise mainly serves the profitability role while the ETR component of tax surprise mainly serves the matching role of tax expense.

<Insert Table 1.4 Here>

Tests for Hypotheses

Valuation of Tax Surprise Components

Table 1.5 shows the results for the first and second hypotheses. Column (1) presents the results of estimating the main valuation model on the full sample to examine how the two decomposed components of tax surprise are associated with contemporaneous stock returns. As expected, the coefficient on the PTE component of tax surprise shows a positive sign, suggesting that the PTE component of tax surprise contains the information about the firms' future profitability incremental to what is in pre-tax earnings, and thus is the main channel for the proxy-for-profitability role of tax expense. The coefficient for the ETR component of tax expense is not statistically significant, inconsistent with the hypothesis that the ETR component mainly serves the matching role of tax expense, thus driving the negative relation between tax surprise and contemporaneous stock returns. The insignificance of the coefficient for the ETR component may be due to investors viewing the portion of tax surprise resulting from ETR change as transitory (Jackson 2014).

Column (2) through Column (5) of Table 1.5 present the results for our second hypothesis regarding how the signs and magnitudes of the coefficients on the PTE and ETR components of tax surprise change with the strengthening of the relationship between pre-tax earnings and future profitability in the truncated subsamples. In each successive column, I exclude increasing number of observations from wider sections of both tails of the pre-tax earnings surprise distribution by year. I find that as the coefficient on pre-tax earnings surprise becomes more positive, the coefficient on the PTE component of tax surprise becomes less positive and turns insignificant as more observations from wider sections of both tails of the pre-tax earnings surprise distribution are excluded, while the coefficient on the ETR component of tax expense becomes negative and statistically significant in Column (5) as 10% of observations with large magnitudes of pre-tax earnings surprises from both tails are excluded. This is consistent with Thomas and Zhang's (2014) conjecture that the proxy-for-profitability role of tax surprise is suppressed and the matching role is manifested as the relationship between pre-tax earnings surprise and contemporaneous stock returns strengthens with the exclusion of observations with larger magnitudes of pre-tax earnings surprises. Specifically, the suppression of the proxy-for-profitability role is through the PTE component and the dominance of the matching role manifests through the

ETR component, consistent with what the disentanglement of the two roles of tax expense through the two decomposed components suggests.

<Insert Table 1.5 Here>

The Effects of Tax Avoidance and Tax Risk

Tables 1.6 and 1.7 show the results for the test of how high levels of tax avoidance and tax risk affect the proxy-for-profitability role of tax expense. Columns (1) and (2) of Table 1.6 present results using two measures of tax avoidance, including 5-year current ETR and 5-year cash ETR. I find a statistically significant negative coefficient for the interaction term of indicator variable of *TAX_AVOID* and the PTE component ΔTAX_PTE_t (-.386 at 10% significance level) when using 5-year cash ETR to measure the level of tax avoidance. This is consistent with the expectation that the proxy-for-profitability role of tax expense through the PTE component is less pronounced for firm-years with a high level of tax avoidance. However, the coefficient for the interaction term is negative but not statistically significant when using 5-year current ETR to measure tax avoidance. Also, note that the coefficients for the interaction term of *TAX_AVOID* and pre-tax earnings surprises per share ($\Delta PTEPS_t$) are positive (0.201 when using 5-year current ETR as tax avoidance measure and 0.122 when using 5-year cash ETR as tax avoidance measure) and are statistically significant at the 5% and 10% significance level, respectively. This can be interpreted as pre-tax earnings showing more predictability value over future profitability when the profitability role of tax expense is suppressed for high tax avoidance firms that, through engaging in tax avoidance, obscures the information contained in tax expense. The coefficients for the control variables $Log(MV_{t-1})$, BM_{t-1} *and* RET_{t-1} have the same signs as those shown in Thomas and Zhang 2014.

<Insert Table 1.6 Here>

Table 1.7 shows evidence consistent with the hypothesis that high tax risk also decreases the proxy-for-profitability role of tax expense, as indicated by the negative coefficient on the interaction of the PTE component ΔTAX_PTE_t and *TAX_RISK* (-.682 at 1% significance level). The magnitude of the negative coefficient for the interaction of tax risk and the PTE component largely offsets the positive coefficient of 0.666 for the PTE component, which suggests that the proxy-for-profitability role of tax expense is fully suppressed for firm-years with high tax risk. Similar to the results for tax avoidance test, the coefficient for the interaction of tax risk and PTE surprise is positive (0.108 at 5% significance level), indicating the strengthening of the relationship between PTE surprise and future profitability when the proxy-for-profitability role of tax expense is fully suppressed for firm-years with high tax risk. Again, the coefficients for the control variables $Log(MV_{t-1})$, BM_{t-1} *and* RET_{t-1} have the same signs as those shown in Thomas and Zhang 2014.

<Insert Table 1.7 Here>

The Effects of Book-to-Tax Differences

I next examine whether investors react more strongly to more significant amounts of permanent BTDs. Table 1.8 presents results that show that the coefficient for the ETR component of tax surprise — the component that mainly serves the matching role of tax expense — become negative for firm-years with larger magnitudes of permanent BTDs or discretionary permanent BTDs (-.435 when measuring permanent BTDs using absolute values and -.456 when using absolute values of discretionary permanent BTDs). These results are consistent with the hypothesis that investors treat permanent BTDs as being less transient and respond more strongly to them when the permanent BTDs are of more significant amounts. The coefficient for the interaction of PTE component and *LARGE_PERM* is also negative, largely offsetting the positive coefficient for the PTE component, suggesting the suppressing of the proxy-for-profitability role of tax expense for firm-years with large permanent BTDs. Although I do not predict the sign of the coefficient for the interaction term of *LARGE_PERM* and the PTE component, the negative coefficient seems consistent with what I would expect. Firms employ large amounts of permanent BTDs in avoiding taxes, resulting in a decrease in the proxy-for-profitability role of tax expense. The coefficient for the interaction of PTE surprise and *LARGE_PERM* is positive but not statistically significant, possibly due to PTE being less persistent and holding less predictability over future earnings in the presence of large permanent BTDs.

<Insert Table 1.8 Here>

The Effects of Valuation Allowance

Lastly, given that the extant research documents that ETR change from year to year contains significant information about the valuation allowance, I examine how both accrual and release of valuation allowance impacts the ETR component of tax surprise. Table 1.9 shows a negative coefficient on the interaction term of valuation allowance accrual and the ETR component of tax surprise (-.267 at 1% significance level), consistent with the hypothesis that the increase in tax expense from accrual of valuation allowance signals future poor performance, therefore driving the tax surprise to be negatively associated with contemporaneous stock returns. Similarly, I find a negative coefficient on the interaction term of the ETR component and the indicator variable for the release of VA (-2.003 at 10% significance level), as shown in Table 1.10, that suggests that the decrease of tax expense due to the release of valuation allowance signals future good performance and therefore drives the negative relationship between the ETR component of tax surprise and stock returns. The negative relationship between tax surprise and contemporaneous stock returns driven by the accrual or release of valuation allowance is distinct from the negative relationship driven by the matching role of tax expense, which I refer to as signaling role of tax expense.

<Insert Tables 1.9 and 1.10 Here>

Robustness Tests

Exclusion of Utilities and Financial Firms

For the main regression analysis of the 12-month stock returns on earnings components, the sample includes utility and financial firms following Thomas and Zhang (2014). Prior studies generally exclude utility (SIC codes 4900-4999) and financial (SIC codes 6000-6999) firms as firms in regulated industries might face financial reporting and tax incentives different from firms in other industries. I run the main regression analysis on the sample with the exclusion of utility and financial firms, the results are still consistent with those presented in Table 1.5.

Using Alternative Models

In the cross-sectional tests, I interact indicator variables with surprises in all earnings components, including pre-tax earnings surprises and the decomposed components of tax surprises. As robustness checks, I run alternative regression models with indicator variables interacting with only the decomposed components of tax surprises, which are the variables of interest. The results are mostly consistent as those generated from the models interacting indicator variables with all earnings components. Specifically, in Table 1.7 Column (2), it shows a negative coefficient (-.514) for the interaction term of tax risk and the PTE component, which is consistent with proxy-for-profitability role of tax expense being less pronounced for firm-years with high tax risk. Similarly, Table 1.8 Column (3) and (4) show results using the alternative models and find negative coefficients (-.456 and -.452) for the ETR component using two different measures of permanent book to tax differences. The results are consistent with stronger reaction to ETR component involving more significant amounts of permanent book to tax difference. The analyses of the effects of VA accrual/release also find consistent negative coefficients for the interaction term of indicator variables of VA accrual and VA release and ETR component. The only exception is regarding the effect of tax avoidance, for which I do not find a statistically significant negative coefficient for the interaction term of indicator variable of *TAX_AVOID* and PTE component, as shown in Table 1.6 Column (3) and (4).

VI. CONCLUSIONS

Extending prior literature on the valuation of tax expense, this study decomposes the overall tax surprise into the two components—PTE component driven by the pre-tax earnings surprise, and the ETR component driven by the ETR surprise. Through the decomposition, I examine how the two decomposed components help explain the two roles of tax expense — the proxy-for-profitability and the matching roles respectively. Through estimating the valuation regression model on the earnings components, I find that the PTE component mainly serves the proxy-for-profitability role of tax expense and drives the positive relationship between tax surprise and contemporaneous stock returns. Regarding the ETR component, I do not find it to be negatively associated with contemporaneous stock returns in the full sample. However, I do find that the ETR component demonstrates a negative relationship with contemporaneous stock returns through the matching role in subsamples when the proxy-for-profitability role of tax expense is fully suppressed with the exclusion of observations with larger magnitudes of pre-tax earnings surprises, and/or when the ETR component is generated through the change in ETR involving more significant amounts of permanent BTDs, consistent with investors reacting more strongly to firms achieving higher or lower ETR in the year compared with prior year with more significant amounts of permanent BTDs. In addition, I find that the proxy-for-profitability role through the PTE component is less pronounced for firm-years identified as having a high level of tax avoidance or a high level of tax risk measured as GAAP ETR volatility.

Lastly, drawing on the recent research on ETR containing information about valuation allowance that is unrelated to a firm's tax burden, I examine how the accrual and release of valuation allowance impact the relationship between the ETR component of tax surprise and contemporaneous stock returns. I find that the increase (decrease) in tax expense in the current year resulted from accrual (release) of valuation allowance signals the future poor (good) performance, therefore driving the negative relationship between the ETR component of tax surprise and contemporaneous stock returns. The negative relationship between tax surprise and contemporaneous stock returns resulted from the change in valuation allowance is driven by the signaling role of tax expense, which is distinct from the matching role of tax expense in the case of capturing information about change in tax burden.

In summary, this study contributes to our understanding of how tax expense maps into firm value, revealing the mechanism through which tax expense serves distinct roles and how various factors, such as tax avoidance, tax risk, as well as significance of permanent BTDs impact the respective roles of tax expense. In doing so, I respond to the call made by Thomas and Zhang (2014) to understand factors that might impact the proxy-for-profitability and matching roles of tax expense. This study also connects recent literature about the change in valuation allowance explaining a significant part of change in ETR with the valuation of tax expense to provide evidence regarding a third role—signaling role of tax expense.

Appendix A: Variables Definitions

Variables in the Main Model	
RET_t	The buy-and-hold stock returns over 12-month period starting from the end of the third month of year t to the end of the third month of year t+1.
$EARNINGS_t$	Earnings before extraordinary items (Compustat item IB) in year t.
ΔE_t	Changes in earnings per share (Compustat items IB/(CSHO x AJEX)) from year t-1 to year t scaled by stock price at the end of the third month of year t.
TAX_t	Tax expense (Compustat item TXT) in year t.
ΔTAX_t	Changes in tax expense per share (Compustat items TXT/(CSHO x AJEX)) from year t-1 to year t scaled by stock price at the end of the third month of year t.
PTE_t	Pre-tax earnings in year t, calculated as EARNINGS + TAX.
ΔPTE_t	Changes in pre-tax earnings PTE per share from year t-1 to year t scaled by stock price at the end of the third month of year t. Calculated as $\Delta E_t + \Delta TAX_t$.
ETR_t	Effective tax rate for year t, calculated as Compustat items TXT/(IB+TXT).
ΔTAX_PTE_t	The decomposed component of $\Delta TAXt$ that is related to change in pre-tax earnings per share from year t-1 to year t, calculated as $\Delta PTE_t * ETR_{t-1}$.
ΔTAX_ETR_t	The decomposed component of $\Delta TAXt$ that is related to change in ETR from year t-1 to year t, calculated as $PTE_t * \Delta ETR_t$
MV_{t-1}	The market value of equity 3 months after a firm's year-end at year t-1.
BM_{t-1}	The book-to-market ratio (Compustat items CEQ/(CSHO x PRCC_F)) at year t-1. Book value of equity is measured at the year of year t-1, while market value of equity is measured at the end of the third month at year t, calculated as the market value of equity at end of year t-1 multiplied by one plus the cumulative stock returns over the period from the beginning of the first month to the end of the third month at year t.
RET_{t-1}	12-month buy-and-hold stock returns for year t-1 with a 1-month lag relative to RET_t.
Tax Avoidance Proxies	
5-YEAR CURRENT ETR$_t$	Sum of current tax expense equal to total tax expense minus deferred tax expense (Compustat items TXT minus TXDI) over the five-year period from t- 4 through t, divided by pre-tax book income (Compustat item PI) summed over the corresponding period.
5-YEAR CASH ETR$_t$	Sum of the taxes paid in cash over the five-year period from t-4 through t (Compustat item TXPD), divided by the pre-tax book income (Compustat item PI) less special items (Compustat item SPI) summed over the corresponding period.
Tax Risk Measure	
GAAP ETR VOLATILITY$_t$	The standard deviation of GAAP ETR for the five-year period from year t-4 to year t. GAAP ETR is calculated as tax expense for the year divided by that year's pre-tax earnings (Compustat items TXT dividend by PI).
Permanent BTDs	

ABS_PERM_t	Absolute value of permanent book to tax differences PERMDIFF.
$DTAX_t$	Following Frank et al. (2009), discretionary permanent book to tax differences are residuals estimated from the model below by industry and year. The dependent variable is total permanent BTDs and the independent variables include nondiscretionary items known to drive permanent BTDs and other statutory adjustments captured by total permanent BTDs that are unrelated to tax planning activities. $$PERMDIFF_t = \alpha_0 + \alpha_1 INTANG_{it} + \alpha_2 UNCON_{it} + \alpha_3 MI_{it} + \alpha_4 CSTE_{it} + \alpha_5 \Delta NOL_{it} + \alpha_6 LAGPERM_{it} + \varepsilon_{it}$$ *PERMDIFF* = total book-tax differences – temporary book-tax differences, = [{*BI* – [(*CFTE*+*CFOR*)/*STR*-Δ*NOL*]} – (*DTE*/*STR*)] divided by total assets at year t-1; *BI* = pre-tax book income (PI); *CFTE* = current federal tax expense (Compustat item TXFED); *CFOR*= current foreign tax expense (Compustat item TXFO); *DTE* = deferred tax expense (Compustat item TXDI) *STR* = statutory tax rate; *INTANG* = goodwill and other intangibles divided by total assets at year t-1 (Compustat item INTAN); *UNCON* = income (loss) reported under the equity method divided by total assets at year t-1 (Compustat item ESUB); *MI* = income (loss) attributable to minority interest divided by total assets at year t-1 (Compustat item MII); *CSTE* = current state income tax expense divided by total assets at year t-1 (Compustat item TXS); Δ*NOL* = change in loss carryforward divided by total assets at year t-1 (Compustat item TLCF); *LAGPERM* = permanent BTD (*PERMDIFF)* at year t-1 divided by total assets at year t-2;
ABS_DTAX_t	Absolute value of discretionary permanent book to tax differences *DTAX*.
Valuation Allowance Variables	
$VA\_ACCRUAL_t$	Indicator variable that equals 1 for firm-years that report negative income before extraordinary items (Compustat item IB < 0) and non-positive U.S. pre-tax income (Compustat item PIDOM <= 0) while report positive deferred tax expense (Compustat item TXDFED > 0); 0 otherwise.
$VA\_RELEASE_t$	Indicator variable that equals 1 for firm-years that report zero net deferred tax assets (Compustat item TXNDB = 0) at the beginning of year t while report positive net deferred tax assets at the end of year t (Compustat item TXNDB > 0); 0 otherwise.

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TABLE 1.1
Sample Selection

	Main Model	5-Year Current ETR	5-Year Cash ETR
All observations at the intersection of Compustat and CRSP 1982 -2016	180,484	180,484	180,484
Less: observations with zero or negative assets	(3,744)	(3,744)	(3,744)
Less: other observations with insufficient data to calculate variables	(29,622)	(29,622)	(29,622)
Final Sample for Main Analysis	**147,118**	**147,118**	**147,118**
Less: utilities and financial firms		(31,810)	(31,810)
Less: negative pre-tax earnings and current tax expense		(53,987)	
Less: negative pre-tax earnings and cash tax payments			(62,155)
Less: other observations with insufficient data to calculate variables		(4,272)	(9,498)
Final Sample for Cross-sectional Tests		**57,049**	**43,655**

	PERM	Tax Risk	VA
All observations at the intersection of Compustat and CRSP 1982 -2016	180,484	180,484	180,484
Less: observations with zero or negative assets	(3,744)	(3,744)	(3,744)
Less: other observations with insufficient data to calculate variables	(29,622)	(29,622)	(29,622)
Final Sample for Main Analysis	**147,118**	**147,118**	**147,118**
Less: utilities and financial firms	(31,810)	(31,810)	(31,810)
Less: observations prior to 1991	(29,802)		
Less: observations prior to 1994			(17,147)
Less: other observations with insufficient data to calculate variables	(16,304)	(29,440)	
Less: observations with tax risk greater than 1	-	(6,094)	-
Final Sample for Cross-sectional Tests	**69,202**	**79,774**	**98,161**

TABLE 1.2
Sample Distribution

Panel A: Year distribution		
Year	**Observation**	**% Observation**
1982	3,599	2.45
1983	3,836	2.61
1984	3,847	2.61
1985	3,980	2.71
1986	4,082	2.77
1987	4,021	2.73
1988	4,175	2.84
1989	4,323	2.94
1990	4,294	2.92
1991	4,261	2.90
1992	4,195	2.85
1993	4,344	2.95
1994	4,942	3.36
1995	5,282	3.59
1996	5,521	3.75
1997	5,554	3.78
1998	5,564	3.78
1999	5,336	3.63
2000	5,086	3.46
2001	4,864	3.31
2002	4,726	3.21
2003	4,457	3.03
2004	4,255	2.89
2005	4,086	2.78
2006	4,025	2.73
2007	3,892	2.65
2008	3,789	2.58
2009	3,749	2.55
2010	3,566	2.42
2011	3,403	2.31
2012	3,313	2.25
2013	3,220	2.19
2014	3,167	2.15
2015	3,179	2.16
2016	3,185	2.16
Total	**147,118**	**100.00**

Panel B: Industry distribution		
Industry	**Observation**	**% Observation**
Agriculture, Forestry, Fishing	434	0.30
Mining	6,632	4.50
Construction	1,827	1.24
Manufacturing	61,583	41.86
Transportation & Public Utilities	12,769	8.67
Wholesale Trade	5,195	3.53
Retail Trade	9,308	6.33
Finance, Insurance, Real Estate	25,657	17.44
Services	22,256	15.14
Public Administration	1,457	0.99
Total	**147,118**	**100.00**

TABLE 1.3
Descriptive Statistics

Panel A: descriptive statistics for the main model

	n	Mean	Std. Dev.	Q1	Median	Q3
RET_t	147,118	0.171	0.858	(0.224)	0.059	0.365
ΔE_t	147,118	0.060	1.858	(0.028)	0.006	0.036
ΔPTE_t	147,118	0.074	1.934	(0.037)	0.009	0.052
ΔTAX_t	147,118	0.005	0.137	(0.008)	-	0.013
ΔTAX_PTE_t	147,118	(0.011)	0.198	(0.008)	0.000	0.009
ΔTAX_ETR_t	147,118	0.020	0.209	(0.002)	0.000	0.005
MVt	147,118	2,203	12,817	31	145	765
$EARNINGS_t$	147,118	102	976	(1)	4	34
PTE_t	147,118	158	1,324	(1)	6	51
TAX_t	147,118	55	448	0	2	18
BM_{t-1}	147,118	0.689	0.648	0.304	0.552	0.891
RET_{t-1}	147,118	0.178	0.912	-0.222	0.056	0.359
ETR	147,118	0.235	0.345	0.031	0.323	0.388

Panel B: descriptive statistics for variables used in cross-sectional models

	n	Mean	Std. Dev.	Q1	Median	Q3
$5\text{-}YEAR\ CURRENT\ ETR_t$	57,049	0.409	0.430	0.260	0.350	0.425
$5\text{-}YEAR\ CASH\ ETR_t$	43,655	0.321	0.329	0.181	0.282	0.365
$GAAP\ ETR\ VOLATILITY_t$	79,774	0.154	0.192	0.022	0.072	0.210
ABS_PERM_t	69,202	0.128	0.341	0.009	0.027	0.092
ABS_DTAX_t	69,202	0.088	0.150	0.012	0.034	0.094
$VA\_ACCRUAL_t$	98,161	0.036	0.186	0.000	0.000	0.000
$VA\_RELEASE_t$	98,161	0.025	0.157	0.000	0.000	0.000

All variables are defined in the Appendix.

TABLE 1.4
Correlations

	(1) *RETt*	(2) Δ*Et*	(3) Δ*PTEt*	(4) *ΔTAXt*	(5) *ΔTAX_PTEt*	(6) *ΔTAX_ETRt*	(7) *Log(MVt-1)*	(8) *BMt-1*	(9) *RETt-1*
1. RET_t									
2. ΔE_t	**0.07**								
3. ΔPTE_t	**0.07**	**0.95**							
4. ΔTAX_t	**0.08**	**0.27**	**0.39**						
5. ΔTAX_PTE_t	**0.07**	**0.33**	**0.37**	**0.50**					
6. ΔTAX_ETR_t	**-0.01**	**-0.08**	**0.01**	**0.27**	**-0.48**				
7. $Log(MV_{t-1})$	**-0.07**	**-0.04**	**-0.05**	**-0.04**	**0.04**	**-0.09**			
8. BM_{t-1}	**0.13**	**-0.01**	**-0.01**	**0.04**	**-0.04**	**0.08**	**-0.33**		
9. RET_{t-1}	**-0.07**	**-0.03**	**-0.03**	0.00	**0.02**	**-0.03**	**0.11**	**-0.21**	

Bold correlations are significant at least 5 percent level.

TABLE 1.5
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample	Full Sample	Truncate top and bottom			
			1%	2%	5%	10%
Intercept	0.152**	0.156**	0.150**	0.112**	0.091*	0.078
	(2.47)	(2.55)	(2.53)	(2.04)	(1.74)	(1.59)
$\Delta PTEPS_t$	0.110**	0.109**	0.194***	0.638***	1.293***	2.118***
	(2.65)	(2.65)	(3.52)	(7.50)	(9.98)	(12.35)
ΔTAX_t	0.364***					
	(4.57)					
ΔTAX_PTE_t		0.284***	0.280***	0.059	0.064	-0.146
		(4.37)	(3.18)	(0.98)	(0.53)	(-1.16)
ΔTAX_ETR_t		0.001	0.002	-0.097	-0.088	-0.287**
		(0.03)	(0.03)	(-1.56)	(-0.73)	(-2.31)
$Log(MV_{t-1})$	-0.011	-0.011	-0.011	-0.006	-0.003	-0.001
	(-1.45)	(-1.56)	(-1.49)	(-0.88)	(-0.44)	(0.16)
BM_{t-1}	0.070***	0.075***	0.078***	0.091***	0.094***	0.098***
	(4.81)	(5.16)	(5.25)	(6.50)	(6.84)	(6.55)
RET_{t-1}	-0.041	-0.042	-0.042	-0.034	-0.036	-0.043*
	(-1.43)	(-1.46)	(-1.45)	(-1.23)	(-1.35)	(-1.75)
Number of firm-year	147,118	147,118	145,251	141,274	132,434	117,726
Adjusted R Square	0.047	0.048	0.054	0.077	0.092	0.093

This table presents results for regression of 12-month stock returns on various components of earnings surprises for the full sample as well as truncated subsamples based on the following model.

$$RET_t = \alpha_0 + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE + \alpha_3 \Delta TAX\_ETR + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} \quad \text{(Equation 1.6)}$$

The full sample includes 147,118 firm-year observations with nonmissing variables from 1982 to 2016. Column (1) is the result for regression of 12-month stock returns on pre-tax earnings surprises and tax surprises and Column (2) is the result for regression of 12-month stock returns on pre-tax earnings surprises and the two decomposed components of the tax surprises. The subsequent column (3) through column (6) represent the subsamples excluding wider sections from both tails of the pre-tax income surprise distribution each year. All variables are defined in Appendix A.
Each year, all variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 35 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

TABLE 1.6
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises with Interaction with Tax Avoidance

	(1)	(2)	(3)	(4)
Intercept	0.201***	0.199***	0.200***	0.201***
	(4.84)	(4.29)	(4.77)	(4.29)
TAX_AVOID	0.004	0.043**	0.005	0.043**
	(0.55)	(2.77)	(0.76)	(2.58)
$\Delta PTEPS_t$	0.230**	0.264**	0.242**	0.286***
	(2.09)	(2.53)	(2.15)	(2.80)
$TAX\_AVOID * \Delta PTEPS_t$	0.210**	0.122***		
	(2.14)	(2.83)		
ΔTAX_PTE_t	0.606***	0.603**	0.551**	0.520**
	(2.81)	(2.76)	(2.64)	(2.66)
$TAX\_AVOID * \Delta TAX\_PTE_t$	-0.097	-0.386*	0.311*	-0.096
	(-0.61)	(-1.84)	(1.82)	(-0.66)
ΔTAX_ETR_t	0.290	0.225	0.260	0.169
	(1.53)	(1.03)	(1.48)	(0.85)
$TAX\_AVOID * \Delta TAX\_ETR_t$	-0.119	-0.084	0.126	0.159
	(-0.56)	(-0.40)	(0.56)	(0.99)
$Log(MV_{t-1})$	-0.013***	-0.015***	-0.013***	0.015***
	(-2.87)	(-3.01)	(-2.84)	(-2.99)
BM_{t-1}	0.073***	0.060***	0.073***	0.059***
	(4.06)	(3.12)	(4.04)	(3.12)
RET_{t-1}	-0.051	-0.066	-0.052	-0.065
	(-1.55)	(-1.65)	(-1.53)	(-1.64)
Number of firm-year	57,049	43,655	57,049	43,655
Adjusted R Square	0.084	0.089	0.080	0.086

This table presents results for regression of 12-month stock returns on various components of earnings surprises with the interaction with indicator variable of high tax avoidance with tax avoidance being measured using both 5-year current ETR (Column (1)) and 5-year cash ETR (Column (2)) based on the following model. The indicator variable of TAX_AVOID is defined as being at the lowest quintile of tax avoidance measure by year and industry.

$RET_t = \alpha_0 + \delta_0 TAX\_AVOID + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \delta_1 \Delta PTE_t * TAX\_AOVID + \delta_2 \Delta TAX\_PTE_t * TAX\_AVOID + \delta_3 \Delta TAX\_ETR_t * TAX\_AVOID + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t$ (Equation 1.7)

The sample includes 57,049 (using 5-year Current ETR measure) and 43,655 (using 50year Cash ETR measure) firm-year observations with nonmissing variables from 1982 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 35 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

TABLE 1.7
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises with Interaction with Tax Risk

	(1)	(2)	(3)
Intercept	0.193***	0.191***	0.189***
	(2.90)	(2.87)	(2.86)
TAX_RISK	-0.030**	-0.024*	-0.023*
	(-2.64)	(-1.90)	(-1.81)
$\Delta PTEPS_t$	0.078*	0.106**	0.119**
	(1.89)	(2.36)	(2.58)
$TAX\_RISK * \Delta PTEPS_t$	0.108**		
	(2.50)		
ΔTAX_PTE_t	0.666***	0.573***	0.341***
	(4.44)	(4.16)	(5.14)
$TAX\_RISK * \Delta TAX\_PTE_t$	-0.682***	-0.514***	
	(-3.71)	(-2.84)	
ΔTAX_ETR_t	0.003	-0.020	0.068
	(0.03)	(-0.21)	(1.12)
$TAX\_RISK * \Delta TAX\_ETR_t$	-0.063	-0.010	
	(-0.52)	(-0.08)	
$Log(MV_{t-1})$	-0.014*	-0.014*	-0.013*
	(-1.89)	(-1.87)	(-1.84)
BM_{t-1}	0.065***	0.065***	0.065***
	(3.67)	(3.68)	(3.71)
RET_{t-1}	-0.060*	-0.060*	-0.059*
	(-1.84)	(-1.83)	(-1.80)
Number of firm-quarter	79,774	79,744	79,744
Adjusted R Square	0.061	0.059	0.055

This table presents results for regression of 12-month stock returns on various components of earnings surprises with the interaction with indicator variable of high tax risk with tax risk being measured as GAAP ETR volatility for the period from year t-4 to t based on the following valuation model. The indicator variable of TAX_RISK is defined as being at the lowest quintile of tax risk measure by year and industry.

$$RET_t = \alpha_0 + \beta_0 TAX\_RISK + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \beta_1 \Delta PTE_t * TAX\_RISK + \beta_2 \Delta TAX\_PTE_t * TAX\_RISK + \beta_3 \Delta TAX\_ETR_t * TAX\_RISK + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \text{ (Equation 1.8)}$$

The sample includes 79,774 firm-year observations with nonmissing variables from 1982 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 35 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

TABLE 1.8
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises with Interaction with Significant Permanent Book to Tax Differences

	(1)	(2)	(3)	(4)
Intercept	0.231***	0.232***	0.222***	0.223***
	(3.13)	(3.16)	(3.03)	(-3.04)
LARGE_PERM	-0.032	-0.033	-0.016	-0.018
	(-1.44)	(-1.51)	(-0.86)	(-0.91)
$\Delta PTEPS_t$	0.145***	0.144**	0.125***	0.147**
	(3.00)	(2.73)	(2.85)	(-2.79)
$LARGE\_PERM * \Delta PTEPS_t$	0.002		0.055	
	(0.08)		(1.47)	
ΔTAX_PTE_t	0.466***	0.475***	0.507***	0.468***
	(4.17)	(3.99)	(4.31)	(-4.02)
$LARGE\_PERM * \Delta TAX\_PTE_t$	-0.435***	-0.456***	-0.490***	-0.452***
	(-2.96)	(-3.01)	(-3.61)	(-3.28)
ΔTAX_ETR_t	0.174	0.177	0.184	0.161
	(1.65)	(1.67)	(1.39)	(-1.21)
$LARGE\_PERM * \Delta TAX\_ETR_t$	-0.406***	-0.409***	-0.393**	-0.376*
	(-3.08)	(-3.12)	(-2.11)	(-2.04)
$Log(MV_{t-1})$	-0.021**	-0.021**	-0.020**	-0.020**
	(-2.35)	(-2.36)	(-2.25)	(-2.26)
BM_{t-1}	0.068***	0.068***	0.071***	0.070***
	(3.17)	(3.18)	(3.24)	(-3.20)
RET_{t-1}	-0.069*	-0.069*	-0.069*	-0.069*
	(-1.93)	(-1.92)	(-1.94)	(-1.92)
Number of firm-quarter	69,202	69,202	69,202	69,202
Adjusted R Square	0.056	0.056	0.056	0.056

This table presents results for regression of 12-month stock returns on various components of earnings surprises with the interaction with indicator variable of significant permanent book to tax differences with the magnitude of permanent book to tax differences being measured as both absolute value of permanent book to tax differences (Column (1)) and absolute value of discretionary permanent book to tax differences (Column (2)) based on the following regression model. The indicator variable of LARGE_PERM is defined as being at the lowest quintile of permanent book to tax differences measure by year and industry.

$$RET_t = \alpha_0 + \gamma_0 LARGE_{PERM} + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \gamma_1 \Delta PTE_t * LARGE\_PERM + \gamma_2 \Delta TAX\_PTE_t * LARGE\_PERM + \gamma_3 \Delta TAX\_ETR_t * LARGE\_PERM + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \text{ (Equation 1.9)}$$

The sample includes 69,202 firm-year observations with nonmissing variables from 1991 to 2016.All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 26 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

TABLE 1.9
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises with Interaction with Valuation Allowance Accrual

	(1)	(2)
Intercept	0.165*	0.166*
	(1.98)	(2.01)
VA	-0.221***	-0.225***
	(-5.26)	(-5.41)
$\Delta PTEPS_t$	0.159***	0.155***
	(3.06)	(3.12)
$VA * \Delta PTEPS_t$	-0.025	
	(-0.58)	
ΔTAX_PTE_t	0.371***	0.378***
	(3.86)	(4.07)
$VA * \Delta TAX\_PTE_t$	-0.498***	-0.573***
	(-4.83)	(-6.92)
ΔTAX_ETR_t	0.067	0.070
	(0.92)	(0.98)
$VA * \Delta TAX\_ETR_t$	-0.267***	-0.304***
	(-2.96)	(-3.84)
$Log(MV_{t-1})$	-0.013	-0.013
	(-1.30)	(-1.32)
BM_{t-1}	0.074***	0.074***
	(3.70)	(3.71)
RET_{t-1}	-0.066*	-0.067*
	(-1.74)	(-1.74)
Number of firm-quarter	98,161	98,161
Adjusted R Square	0.053	0.052

This table presents results for valuation regression on various earnings components with the interaction with indicator variable of valuation allowance accrual. The indicator variable of VA equals 1 for firm-years that report negative income before extraordinary items (Compustat item IB < 0) and non-positive U.S. pre-tax income (Compustat item PIDOM <= 0) while report positive deferred tax expense (Compustat item TXDFED > 0); 0 otherwise.

$$RET_t = \alpha_0 + \theta_0 VA + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX_{PTE_t} + \alpha_3 \Delta TAX_{ETR_t} + \theta_1 \Delta PTE_t * VA + \theta_2 \Delta TAX_{PTE_t} * VA + \theta_3 \Delta TAX_{ETR_t} * VA + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t \text{ (Equation 1.10)}$$

The sample includes 98,161 firm-year observations with nonmissing variables from 1994 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at p < 0.01, p < 0.05 and p < 0.10, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 23 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

TABLE 10
Regression of Contemporaneous 12-month Stock Returns on Components of Earnings Surprises with Interaction with Valuation Allowance Release

	(1)	(2)
Intercept	0.154*	0.155*
	(1.82)	(1.83)
VA_RELEASE	0.145**	0.181**
	(2.12)	(2.67)
$\Delta PTEPS_t$	0.148***	0.157***
	(3.02)	(3.09)
VA_RELEASE * $\Delta PTEPS_t$	1.233**	
	(2.73)	
ΔTAX_PTE_t	0.331***	0.319***
	(3.55)	(3.44)
VA_RELEASE * ΔTAX_PTEt	-2.885	-2.056
	(-1.43)	(-1.35)
ΔTAX_ETR_t	0.010	0.005
	(0.16)	(0.09)
VA_RELEASE * ΔTAX_ETR_t	-2.003*	-2.558**
	(-1.86)	(-2.31)
$Log(MV_{t-1})$	-0.012	-0.012
	(-1.20)	(-1.21)
BM_{t-1}	0.072***	0.071***
	(3.59)	(3.58)
RET_{t-1}	-0.065	-0.065
	(-1.71)	(-1.71)
Number of firm-quarter	98,161	98,161
Adjusted R Square	0.057	0.052

This table presents results for valuation regression on various earnings components with the interaction with indicator variable of valuation allowance release. Indicator variable of *VA_RELEASE* equals 1 for firm-years that report zero net deferred tax assets (Compustat item TXNDB = 0) at the beginning of year t while report positive net deferred tax assets at the end of year t (Compustat item TXNDB > 0); 0 otherwise.

$RET_t = \alpha_0 + \vartheta_0 VA\_RELEASE + \alpha_1 \Delta PTE_t + \alpha_2 \Delta TAX\_PTE_t + \alpha_3 \Delta TAX\_ETR_t + \vartheta_1 \Delta PTE_t * VA\_RELEASE + \vartheta_2 \Delta TAX\_PTE_t * VA\_RELEASE + \vartheta_3 \Delta TAX\_ETR_t * VA\_RELEASE + \alpha_4 Log(MV_{t-1}) + \alpha_5 BM_{t-1} + \alpha_6 RET_{t-1} + \varepsilon_t$ (Equation 1.11)

The sample includes 98,161 firm-year observations with nonmissing variables from 1994 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the stock returns. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests. The coefficient estimates are averages of annual estimates over 23 years; t-statistics in parentheses are Fama–MacBeth t-statistics.

ESSAY II: DO ANALYSTS UNDERSTAND TAXES? THE RELATIVE ACCURACY OF ANALYSTS'FORECASTS OF TAXES VERSUS PRE-TAX EARNINGS

I. INTRODUCTION

The extant literature provides mixed evidence regarding whether analysts understand the complexity surrounding tax expense and demonstrate the ability to incorporate tax-based information in their earnings forecast. Some studies find that analysts fail to incorporate tax law changes in their forecasts of earnings (Plumlee 2003, Kevin and Schoderbek 2000, Hoopes 2018). In addition, analysts fail to incorporate tax-related information, such as book-to-tax differences and deferred taxes associated with future earnings, in forecasting earnings (Amir and Sougiannis 1999, Weber 2009). However, two recent studies find evidence that analysts do understand taxes. Analysts forecast more accurately than management when given appropriate information and resources, especially when complexity increases (Bratten et al. 2017), and fully incorporate the implications of tax-based information when a firm's information environment is robust (Kim, Schmidt, Wentland 2020). These studies either provide indirect evidence regarding analysts' understanding of taxes by examining the association between overall forecast error and tax-related information (Plumlee 2003, Kevin and Schoderbek 2000, Hoopes 2018, Kim et al. 2020) or take a more direct approach by using data of analysts' disaggregated pre-tax earnings and net earnings forecasts to examine analysts' forecast error concerning effective tax rate (Bratten et al. 2017).

In this study, I examine how the accuracy of analysts' forecasts of taxes compares with that of their pre-tax earnings forecasts. Prior studies use forecast error in the effective tax rate (ETR) to measure analysts' tax forecast accuracy, consistent with the forecasts generating process undertaken by analysts that predicts tax expense by applying forecasted ETR to pre-tax earnings (Bratten et al., 2017). Although this approach seems reasonable, it does not allow for a direct comparison of the magnitudes of analysts' tax forecast errors vs. pre-tax earnings forecast errors. I use an approach that decomposes the forecast error in tax into two components — one component related to the forecast error in tax expense caused by the forecast error in pre-tax earnings and the other related to that caused by the forecast error in the effective tax rate (ETR). Only the component of forecast error in tax expense generated by the error in ETR indicates analysts' forecast accuracy and ability concerning taxes, thus representing the genuine tax forecast error. Through the decomposition approach, I separate the portion of forecast error in tax expense attributable to the forecast error in ETR. This approach allows for directly comparing the magnitudes of analysts' tax forecast errors with those of pre-tax earnings forecast errors.

Like Bratten et al. (2017), this study focuses on analysts' forecast errors related to the tax component instead of the overall net earnings forecast errors to examine analysts' understanding of taxes and how such knowledge translates into their tax forecast accuracy. What distinguishes this study from Bratten et al. (2017) is the decomposition of the overall forecast error into the forecast error related to pre-tax earnings and that of ETR, allowing for measuring the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings to fill a gap in extant literature. Another distinction from Bratten et al. (2017) is that they compare the relative forecast accuracy of analysts vs. management, while this study compares the relative forecast accuracy of analysts' forecasts of taxes vs. pre-tax earnings.

To examine how the accuracy of analysts' forecasts of taxes compares with that of their pre-tax earnings forecasts, I construct a relative accuracy measure *RelativeAccuracy*. First, I calculate the signed forecast errors in pre-tax earnings, tax expenses, and net earnings by subtracting the analysts' forecasts from the actual amounts. I then decompose the signed tax forecast errors into two components — one for the forecast error in tax expense caused by the forecast error in pre-tax earnings and the other caused by the error in ETR. The signed forecast errors are measured per share and scaled by the stock price at the end of the period for the forecast period. I then construct the relative accuracy measure in the following steps: (i) dividing the absolute values of the forecast errors in taxes due to errors in ETRs by the forecast errors in pre-tax earnings;[7] (ii) taking the logarithm function of the ratio obtained in (i) to normalize the skewness in the distribution of the raw ratios; (iii) multiplying the final logarithm value by negative one to show the increasing values for higher relative accuracy. The mean value of the relative accuracy measure is -0.983, suggesting that analysts, on average, face more challenges forecasting taxes.

I then run the OLS regression to regress the relative accuracy measure on various variables proxying for firms' tax complexity, general complexity, and information environment to examine how these factors impact the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings. I also include other control variables, including analysts' characteristics and other variables that are found to be associated with analysts' forest error. I find that the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings improves when the quarterly reporting of the year is not contaminated with

[7] I scale the forecast in both denominator and nominator by the respective forecasted amounts to account for pre-tax earnings and taxes exhibiting different scales.

discrete items, non-recurring tax-related charges recorded in the quarter as they incur. The relative accuracy decreases with the increase in tax and general complexity, specifically with the increase in the deviation of the firm's ETR from the statutory rate, the presence of foreign operations, the magnitude of R&D spending, and the leverage level.

Further, I posit that the firm's information environment also impacts the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings. Prior studies find that access to quality public information can hinder analysts' efforts in acquiring private information. Analysts might rely more on private information than public information for tax forecasts. Given that, the firm's information environment might impact the availability of accessibility of public information, thus affecting analysts' information acquisition behaviors. I find that the relative accuracy decreases for larger firms but improves with the increase in analysts following. This finding provides evidence that larger firms' better disclosure of public information hinders analysts' efforts in acquiring private information. In contrast, analysts following enriches the firm's information environment, improving analysts' tax forecasts.

In additional analyses, I examine whether analysts face more uncertainty in tax forecasting through relative dispersion, measured as the ratio of the standard deviation of analysts' tax forecasts over forecasts of pre-tax earnings. I find that analysts do face more uncertainty in forecasting taxes. I run the OLS regression of relative dispersion on the same determinants and control variables as in the primary analysis. The only tax complexity variable that makes analysts face more uncertainty in the tax forecasting task is the more significant deviation of the firm's ETR from the statutory rate. Regarding the information environment, I find that the uncertainty with tax forecasts increases for larger firms and decreases with the increase in analysts following.

I last explore whether analysts' forecasting ability related to taxes differs from their ability to forecast pre-tax earnings. The results suggest that analysts' forecasting ability related to taxes does differ from their ability to forecast pre-tax earnings. Although prior studies document Analysts' characteristics to explain individual analysts' forecast accuracy (e.g., Clement 1999), they are not as good a predictor of their tax forecast accuracy as past performance.

This study contributes to the literature in the following ways. First, this study complements prior studies on analysts' understanding of taxes. Several earlier studies exploit the setting of tax law changes and find that analysts do not fully understand taxes and do not incorporate the effects of tax law changes in their forecasts of earnings (Plumlee 2003, Kevin and Schoderbek 2000, Hoopes 2018). However, two recent studies find that analysts achieve better forecasting accuracy than management (Bratten et al. 2017) and can adequately incorporate tax-based information in earnings forecasts when a firm's information environment is robust (Kim et al. 2020). This study differs from Bratten et al. (2017) by investigating analysts' forecast accuracy in taxes relative to forecast accuracy in pre-tax earnings rather than comparing analysts' forecast accuracy with management's. Kim et al. 2020 examines how analysts process tax information relative to other earnings components by regressing the overall forecast error of earnings on the prior year's earnings components — cash flow, accruals, and tax component change of earnings. This study differs from Kim et al. 2020 in two aspects. First, Kim et al. 2020 use regression of overall forecast error in net earnings on the prior year's tax and non-tax information to examine analysts' differential in the incorporation of tax vs. non-tax information. I examine analysts' understanding of taxes by directly comparing the magnitudes of forecast errors in tax and pre-tax earnings components. Second, Kim et al. 2020 examine how a firm's information environment impacts analysts' incorporation of prior-year tax-based earnings information into their forecasts. In this study, I examine how the information environment affects the relative accuracy of analysts' forecasts of taxes versus pre-tax earnings.

Second, by examining the impact of the information environment on the relative accuracy of analysts' forecast of taxes versus pre-tax earnings, the study provides insight into how analysts use public information versus private information in their forecasts and how a firm's information environment impacts such behavior. Lundholm 1991 finds that changing a firm's disclosure requirements might change investors' incentive to acquire private information. Prior literature also examines the complements versus substitutes effects of common public versus private information, for which this study provides additional evidence.

Third, this study furthers our understanding of how analysts' forecast ability impacts tax forecast accuracy. Prior studies examining determinants for analysts' tax forecast error focus on firm-level characteristics. This study examines how analysts' innate forecasting ability affects their forecast accuracy related to taxes. Analysts play a vital role in capital markets (Brown 1993; Ramnath et al. 2008; Shane and Stock 2006), and understanding their forecasting ability has important implications for investors to make an ex-ante determination regarding relying on analysts to form market expectations.

Decomposition of Tax Forecast Error

The research design involves the decomposition of forecast error in tax into two components — one component related to the forecast error in tax expense caused by the forecast error in pre-tax earnings and the other related to that caused by the error in ETR. The derivation of these two components is furnished below. The forecast error in tax expense can be written as Equation 2.1 below.

$$FE\_TAX_t = A\_TAX_t - F\_TAX_t \quad 2.1$$

In Equation 2.1, FE_TAX_t represents the forecast error in tax expense with A_TAX_t and F_TAX_t representing actual tax expense recorded and tax expense forecast issued by analysts. As Equation 2.1 shows, forecast error in tax expense (FE_TAX_t) is calculated the difference between actual tax expense recorded (A_TAX_t) and the tax expense forecasts issued by forecasts (F_TAX_t). Since tax expense is calculated as pre-tax earnings multiplied by ETR, Equation 2.1 can be expanded to Equation 2.2 below.

$$FE\_TAX_t = A\_PTE_t * A\_ETR_t - F\_PTE_t * F\_ETR_t \quad 2.2$$

In Equation 2.2, A_ETR_t represents the actual effective tax rate calculated based on the actual tax expense recorded divided by pre-tax earnings, and F_ETR_t represents the forecasted effective tax rate based on the forecasted tax expense divided by pre-tax earnings. Similarly, I define forecast error in pre-tax earnings and ETR (FE_PTE_t and FE_ETR_t) as the difference between the actual and forecasted amounts, respectively, which are shown in Equations 2.3 and 2.4 as follows:

$$FE\_PTE_t = A\_PTE_t - F\_PTE_t \quad 2.3$$

$$FE\_ETR_t = A\_ETR_t - F\_ETR_t$$

$$A\_ETR_t = F\_ETR_t + FE\_ETR_t \quad 2.4$$

Now, plugging Equations 2.3 and 2.4 into Equation 2.2 and rearranging them as follows, I derive Equation 2.5:

$$FE\_TAX_t = A\_PTE_t * A\_ETR_t - F\_PTE_t * F\_ETR_t$$

$$= A\_PTE_t * \ (F\_ETR_t + FE\_ETR_t) \ - F\_PTE_t * F\_ETR_t$$

$$= A\_PTE_t * F\_ETR_t + A\_PTE_t * FE\_ETR_t - F\_PTE_t * F\_ETR_t$$

$$= \ (A\_PTE_t - F\_PTE_t) \ * F\_ETR_t + A\_PTE_t * FE\_ETR_t$$

$$= \ (A\_PTE_t - F\_PTE_t) \ * F\_ETR_t + (A\_ETR_t - F_{ETR_t}) * A\_PTE_t \quad 2.5$$

Equation 2.5 can be viewed as the sum of the following two components of forecast error in tax expense:

$$FE\_TAX\_PTE \ = \ (A\_PTE_t - F\_PTE_t) \ * F\_ETR_t$$

$$FE\_TAX\_ETR \ = \ (A\_ETR_t - F\_ETR_{t-1}) * A\_PTE_t$$

The *FE_TAX_PTE* component is related to the forecast error in tax expense caused by the forecast error in pre-tax earnings, given no forecast error in ETR. The *FE_TAX_ETR* component is the portion of forecast error in tax expense caused by the error in ETR.

II. PRIOR LITERATURE AND HYPOTHESES DEVELOPMENT

A large body of literature is devoted to understanding how analysts acquire and process accounting information and the vital role analysts' forecasts play in the capital markets (Brown 1993; Ramnath et al. 2008; Shane and Stock 2006). As sophisticated users of financial statements, analysts disseminate the information to the market participants to facilitate the price discovery process (Shores 1990; Ayers and Freeman 2003), as well as to attenuate the market's mispricing of prior accounting information (Bhushan 1994; Gleason and Lee 2003; Mendenhall 1991; Zhang 2008).

Over the past decade, there has been a trend for more additional disaggregated forecasts, including those for taxes. Prior research shows that the additional forecasts respond to investors' demand (DeFond and Hung 2003). As increasing number of analysts issue disaggregated pre- and after-tax earnings forecasts, extant literature finds that these disaggregated pre- and after-tax earnings forecasts provide value relevant information to the capital markets. Mauler (2019) finds that investors utilize both analysts' pre and after-tax earnings forecasts in evaluating firm performance and in helping them see through the earnings management through tax expenses. Baik et al. (2016) find that pre-tax income forecasts mitigate the tax expense anomaly documented by Thomas and Zhang (2011). The finding is consistent with analysts' implicit tax expense forecasts through disaggregated pre-tax and after-tax forecasts helping investors recognize the persistence of current tax surprises for future earnings.

The growing interest in disaggregated forecasts, including those for taxes, has drawn research on analysts' understanding of taxes and how they incorporate tax effects in earnings forecasts. The accuracy of analysts' tax forecasts might differ from pre-tax earnings forecasts for the following reasons. Income tax expense is not part of operating income, and the non-statutory change in effective tax rate from year to year is usually considered transitory. The notion that taxes are below the line item and transitory suggests analysts might not pay attention to the tax component of earnings as much as other more persistent components. At the same time, taxes remain substantial expenses, and some studies document taxable income as an alternative measure of financial earnings. Hence taxes remain important inputs to analysts' forecasts, and understanding tax effects will improve analysts' earnings forecasts. Second, the complexity of tax laws and financial reporting rules makes it hard to understand taxes and process tax-related information (McGill and Outslay 2004; Graham et al. 2012). Thus, whether analysts fully understand the implications of tax laws and financial reporting rules and incorporate relevant information in forecasting taxes remains an empirical question. Third, managers face proprietary costs when revealing private information to tax authorities through public tax disclosures, and such costs constrain firms' disclosure behaviors (Robinson and Schmidt 2013). Hence the information asymmetry between managers and external parties regarding taxes might be more significant than other accounting information. The above suggests that analysts might face more challenges and difficulty forecasting taxes.

The extant literature provides mixed evidence regarding whether analysts understand taxes and incorporate tax information in their forecasts. Exploiting the setting of tax law changes, some earlier studies find that analysts fail to incorporate such changes in their forecasts of earnings (Plumlee 2003; Kevin and Schoderbek 2000; Hoopes 2018). In addition, analysts do not seem to incorporate tax-related information, such as book-to-tax differences and deferred taxes that are shown to be associated with future earnings, in forecasting earnings (Amir and Sougiannis 1999; Weber 2009). However, two recent studies seem to find evidence that analysts do understand taxes and, when given appropriate information and resources, provide forecasts relatively more accurately than management, especially when complexity increases (Bratten et al. 2017) or fully incorporate the implications of tax-based information (Kim et al. 2020). What seems to be missing from the literature is how the accuracy of analysts' forecasts of taxes compares with that of analysts' forecasts of pretax amounts. This leads to the first hypothesis in the null form as follows:

H1: ***The accuracy of analysts' forecasts of taxes is not lower than that of analysts' forecasts of pre-tax earnings.***

A separate stream of research examines the determinants for analysts' forecast accuracy related to taxes and finds that firm complexity makes tax forecasting more difficult and decreases forecasting accuracy. Bratten et al. (2017) find that analysts' tax forecast accuracy decreases with an increase in tax complexity measures, such as recent changes in ETRs, volatility of ETRs, and the magnitude of permanent differences, as well as other general complexity measures, such as the presence of foreign operation, stock compensation expense, research and development expense, and the tax loss carryover. While complexity around taxes makes it harder to forecast taxes, prior literature has also found that tax complexity caused by a firm's tax avoidance activities might impact its information environment and transparency and makes it equally hard to forecast other components of earnings. Donelson et al. (2017) find that analysts' earnings forecast errors are significantly associated with transitory tax items that are strategically included in non-GAAP earnings. Francis et al. (2019) and Balakrishnan et al. (2019), using different measures for tax planning, both find that tax planning complicates firm operations and makes the tax rate and overall earnings more volatile, resulting in more significant analysts' forecast errors in overall earnings. Therefore, it remains an empirical question whether tax complexity will cause more significant forecast errors for taxes relative to pre-tax earnings. This leads to the second hypothesis stated in the null form.

H2: *Tax complexity will not affect the relative accuracy of analysts' forecasts of taxes.*

Prior literature also examines how firms' information environment impacts how analysts process information and their forecasting accuracy. Bloomfield (2002), Merton (1987), and Hirshleifer and Teoh (2003) find that "incomplete information" and "limited attention and processing power" can cause rational users of financial statements to underreact to accounting information. The improvement in the information environment, such as the quality of financial accounting information and the extent of external monitoring by analysts, will improve analysts' forecasts (Francis, LaFond, Olsson, and Schipper 2007; Weber 2009; Kim et al. 2021). Kim et al. (2021) find that analysts' ability to incorporate tax-based information in forecasting earnings improves and does not differ from their ability to process other (non-tax) earnings components when given access to appropriate information and resources.

At the same time, improving firms' information environment might not improve analysts' forecasting accuracy related to taxes vs. pre-tax earnings in a symmetric way. Prior literature examines analysts' behavior of relying on common public information versus making efforts to acquire private information (Lundholm 1991). To the extent that a larger firm with more analysts following might provide more disclosures to the public, this might have caused analysts to spend less effort acquiring private information. Since forecasting taxes requires more idiosyncratic information than forecasting pre-tax earnings, this might have caused the relative accuracy of analysts' forecasts of taxes to decrease. However, this belief might not hold if a better information environment helps analysts obtain more and better knowledge about the firm they follow. Using firm size and the number of analysts following to measure the information environment, my third hypotheses are then stated in the null form as follows:

H3a: ***The relative accuracy of analysts' forecasts of taxes does not decrease for larger firms.***

H3b: ***The relative accuracy of analysts' forecasts of taxes does not decrease for firms with more analysts following.***

III. RESEARCH DESIGN

Sample Selection

The sample combines I/B/E/S and Compustat from 2002 to 2016 because pre-tax earnings forecasts became more widely available in I/B/E/S after 2002 (Ertimur et al. 2001). The sample period ended in 2016 because of the passage of the Tax Cuts and Jobs Act at the end of 2017, which changed the tax law significantly and introduced significant one-time items to the financial reporting of income taxes which might present complications for the study. Following Bratten et al. (2017), I pair net income and pre-tax earnings forecasts issued by the same analyst for the same fiscal period (fpedats in I/B/E/S) on the same date (anndats in I/B/E/S) and infer each analyst's implied tax expense and ETR forecast. The sample includes only each analyst's latest forecast for the upcoming fiscal year t. From Compustat, I obtain variables necessary to calculate various variable measures. Following Clement (1999), I restrict the sample to analysts' forecasts issued by active analysts that supplied analysts during the first 11 months of the year. An analyst who issued a forecast outside the 11-month window might not follow the firm closely and is more likely to mimic other analysts' forecasts (Clement 1999). Following

Kim et al. (2020), I excluded observations with negative forecasted or actual pre-tax earnings and those with forecasted or actual ETR less than zero or greater than 100 percent. After deleting the observations with missing data to calculate variables, the final sample includes 74,820 analyst-firm-years.

[Insert Table 2.1 Here]

Methodology and Description of Variables

I compute the implied tax expense and effective tax rate forecasts by subtracting the net earnings forecast from the pre-tax earnings forecast. I calculated the forecast errors in pre-tax earnings (*FE_PTE*), net earnings (*FE_EARN*), tax expense (*FE_TAX*), as well as effective tax rate (*FE_ETR*) as the actual amount minus the forecasted amount. I decompose the forecast error in tax expense (*FE_TAX*) into two components — one for the portion of forecast error in tax caused by forecast error in pre-tax earnings (*FE_TAX_PTE*) and the other for the part caused by the forecast error in the effective tax rate (*FE_TAX_ETR*). Since the forecast error in both pre-tax earnings and in ETR can give rise to the forecast error in tax, the decomposition disentangles the portion of tax forecast error related to the error in ETR, which reflects the actual forecast error of tax. The component related to the forecast error in pre-tax earnings (*FE_TAX_PTE*) is presented as the forecast error in pre-tax earnings multiplied by forecasted ETR. The component related to the forecast error in ETR (*FE_TAX_ETR*) is the multiplication of actual pre-tax earnings and the forecast error in ETR. Following Bratten et al. (2017), I also calculate accuracy measures by taking the absolute values of various measures of forecast errors and multiplying by negative 1 with a larger value indicating better accuracy. I winsorize all continuous variables annually at the 1st and 99th percentile to reduce the effect of outliers.

To examine how the accuracy of analysts' forecasts of taxes compares with that of analysts' pre-tax earnings forecasts, I construct a variable *RelativeAccuracy* to measure the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings. I calculate *RelativeAccuracy* as the absolute value of the component of forecast error in tax due to the error in ETR (*FE_TAX_ETR*) over the absolute value of the forecast error in pre-tax earnings (*FE_PTE*). The denominator and numerator for the relative accuracy measure are then scaled by their respective forecasted amounts to account for their exhibiting different scales. The relative accuracy measure is then converted into a logarithm function to address the skewness of the raw measure and multiplied by negative 1 to assign a larger value to indicate higher relative accuracy of the analyst's tax forecast vs. pre-tax earnings.

$$LogRelativeAccuracy = -LOG\left[\frac{ABS\left(\frac{FE\_TAX\_ETR}{F\_TAX}\right)}{ABS\left(\frac{FE\_PTE}{F\_PTE}\right)}\right] \qquad 2.6$$

The sample mean of *LogRelativeAccuracy* being less than zero would suggest that the analysts have more difficulty forecasting taxes on average.

To examine the second and the third hypotheses of how complexity and information environment impact the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings, I estimate the following regression using OLS. I include industry and year fixed effects and cluster the standard errors at firm level.

$$LogRelativeAccuracy_{i,j,t} = \alpha_0 + \alpha_1 CLEAN_{i,t} + \mathrm{A}\sum Tax\ Complexity + \mathrm{B}\sum General\ Complexity + \mathrm{C}\sum Information\ Environment + \mathrm{D}\sum Analyst\ Chracteristics + \mathrm{E}\sum Controls + Industry_j + Year_t + \varepsilon_{i,j,t} \qquad 2.7$$

The dependent variable of *LogRelativeAccuracy* is constructed, as previously explained, to measure the accuracy of analysts' forecasts of taxes relative to pre-tax earnings. Following Bratten et al. (2017), I proxy for complexity with various tax and general complexity measures. The first variable for tax complexity is *CLEAN*, defined similarly to Bratten et al. (2017). *CLEAN* is an indicator variable that equals 1 when none of the quarterly GAAP effective tax rates during the annual forecast period is contaminated with discrete tax items. ASC 740-270 Interim Reporting requires firms to record the estimate annual income tax expense based on the estimated pre-tax earnings for the year generated during the ordinary course of business. However, tax items unrelated to the earnings generated during the ordinary business or deemed extraordinary and non-recurring must be separately recorded as discrete items for interim reporting purposes. The presence of discrete items makes it harder for analysts to forecast taxes, and the absence of discrete items will likely improve the accuracy of analysts' forecasts of taxes. Therefore, I expect the coefficient to be positive for the variable *CLEAN*. I also include other tax complexity variables that might increase the difficulty of tax forecasting task, including *absΔETR* for the change in ETR from year to year, *absPermDiff* for the deviation of GAAP ETR from the statutory tax rate, *CompExp* for the presence of stock-based compensation, *Foreign* to indicate whether a firm has a foreign operation, *RDS* to measure firms' R&D spending, as well as *TLCF* to indicate the presence of tax loss carryover. The definitions for these variables are explained in more detail in Appendix 1. The tax complexity reflects the extent of tax avoidance activity and other firm operations that generate complexity in taxes and volatility in tax rates, making it harder for analysts to forecast taxes. At the same time, prior studies also find that a firm's tax avoidance can complicate its operation and increase the overall forecast error (Ballakishnan et al. 2019; Bratten et al. 2017). Therefore, I expect negative coefficients for tax complexity variables but do not rule out the possibility that some coefficients might be positive. The next set of variables is related to a firm's general complexity – book-to-market ratio (*BM*), firm leverage (*LEV*), and the number of segments (*SEGMENTS*). Since general complexity might increase the difficulty of forecasting both pre-tax earnings and taxes, I do not predict signs for the coefficients for these two variables.

Next, to examine how the information environment impacts the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings, I include two variables – *LOG_ANF* and *SIZE* – to proxy for a firm's information environment. The analysts following (LOG_ANF) is included as a proxy for information environment because prior literature cites analyst coverage as a component of firms' information environments (Shores 1990; Skinner 1990; Brennan and Hughes 1990; Bhushan 1989). Size is included as another proxy for a firm's information environment because firm size is positively associated with the richness of firms' information environment as larger firms are found to provide more disclosures (Lang and Lundholm 1993). I predict negative signs for the coefficients given the argument that larger firms and firms with more analysts following might have a better disclosure policy, hindering analysts' efforts in researching and acquiring private information.

Following Bratten et al. (2017), I include control variables related to analyst characteristics and firm operation. The following analyst characteristics used to proxy for analysts' ability are calculated following Clement (1999): broker size (*BSIZE*), the analyst's forecasting experience with the firm (*FEXP*), the frequency with which the analyst update the forecast for the firm (*FREQ*), the analyst's general forecasting experience (*GEXP*), the length of time between the analyst's last forecast and fiscal year-end (*DAGE*), and the number of firms (*NCOS*) and industries (*NINDS*) followed by the analysts. I also include control variables such as income from discontinued operations (*DI*), preferred dividend (*DVP*), equity method income (*EI*), non-controlling interest (*MI*), and extraordinary income (*XI*).

IV. RESULTS

Descriptive Statistics

Table 2.2 presents the year and industry distribution of the final sample of 74,820 analyst-firm-years. Table 2.3 Panel A reports descriptive statistics for the actual/forecasted amounts of pre-tax earnings, taxes, and net earnings, as well as the forecast errors and accuracy measures. Descriptive statistics for the two components of the forecast errors and accuracy measures for tax expense are also presented. The mean values of forecast errors are of relatively small magnitudes due to the netting of positive and negative forecast errors. The accuracy measures, thus, provide a better measurement of analysts' forecasting ability. The mean value of tax forecast accuracy due to ETR is -0.003, about one-third of the forecast accuracy of pre-tax earnings. Given that the tax expense is, on average, 30% of pre-tax earnings, the descriptive statistics show that tax forecast accuracy due to ETR is similar to the pre-tax earnings forecast accuracy.

[Insert Table 2.2 Here]

Table 2.3 Panel B reports descriptive statistics for the relative accuracy measures (*RelativeAccuracy* and *LogRelativeAccuracy*). Due to the right-skewed distribution of

RelativeAccuracy, it is transformed using a logarithmic function, which is then multiplied by negative one to have a larger value indicating higher relative accuracy. The mean value of *LogRelativeAccuracy* is less than zero, suggesting that analysts achieve lower accuracy for tax forecasts relative to forecasts of pre-tax earnings. Table 2.3 Panel B also presents descriptive statistics for other variables used in the main regression analysis and additional tests. The descriptive statistics are close to those from prior studies. Roughly 33% of the observations recorded discrete items in any quarter of the firm's fiscal year.

[Insert Table 2.3 Here]

Table 2.4 presents Pearson correlations among the variables used in the main tests. As expected, LogRelativeAccuracy is positively associated with *CLEAN* while negatively associated with some other variables for complexity, such as *AbsΔETR*, *AbsPermDiff*, *ETR_STD*, *FOREIGN*, *RDS*, *LOSS*, *TLCF*, *SEGMENTS* as well as *LEV*.

[Insert Table 2.4 Here]

Primary Results

Table 2.3 reports that the mean value of LogRelativeAccuracy is -0.983, suggesting that, on average, analysts have more difficulty forecasting taxes, and the average accuracy of analysts' forecasts of taxes is lower than that of pre-tax earnings. In Table 2.5, I present the results of estimating the OLS model per Equation 2.7. As expected, *CLEAN* shows a positive and statistically significant coefficient ($p < .01$), indicating that the absence of discrete items being recorded in quarterly financials makes the tax forecasting task easier for analysts resulting in higher relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings. The coefficients for tax complexity variables show mixed results; some have negative signs, while others have positive signs, but most are not statistically significant. However, only three variables related to tax complexity show negative and statistically significant coefficients consistent with the expectation, including the deviation from the statutory tax rate (*AbsPermDiff*), the presence of foreign operation (*FOREIGN*), as well as R&D spending (*RDS*). Among variables related to general complexity, the coefficient for firm leverage (LEV) is negative and statistically significant. The other complexity variables do not show statistically significant coefficients.

Regarding the impact of firms' information environment on the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings, the results show that firm size is negatively associated with relative accuracy. This is consistent with the expectation that larger firms might provide more disclosures that could hinder analysts' efforts in research and acquiring private information about the firm they cover, which then hurts the relative accuracy of tax forecasts due to tax forecasts requiring more of the idiosyncratic and private information about the firm. However, contrary to the prediction, analysts' coverage is positively associated with relative accuracy, which suggests that the relative accuracy of analysts' forecast of taxes improves with the increase in analyst following.

[Insert Table 2.5 Here]

Additional Analyses

In additional analyses, I test how the dispersion of analysts' forecasts of taxes compares with that of pre-tax earnings to examine whether analysts face more uncertainty in forecasting taxes than forecasting pre-tax earnings. I also explored whether analysts' forecasting ability regarding taxes differs from their ability to forecast pre-tax earnings and whether analysts that achieve higher accuracy for tax forecasts also provide more accurate forecasts for overall earnings.

Tax Forecast Dispersion

I use the OLS model, as shown in Equation 2.8, to examine how tax complexity, firm general complexity, and information environment impact the relative dispersion of analysts' forecast of taxes versus pre-tax earnings. *RELATIVE DISPERSION* is measured as the standard deviation of analysts' forecast of taxes by analysts following a particular firm for a specific annual forecast period divided by the standard deviation of their pre-tax earnings forecasts. The explanatory variables used are the same as those used in the main analysis. I find a negative coefficient for CLEAN, consistent with the notion that the absence of discrete items deemed extraordinary and non-recurring in quarterly reporting decreases the uncertainty surrounding the firm's tax issues and decreases the dispersion of analysts' forecasts of taxes relative to pre-tax earnings. *AbsPermDiff*, as a tax complexity measure that measures the magnitude of deviation of firms' effective tax rates from the statutory rate, is positively associated with the relative dispersion measure among other tax and general complexity measures. However, the other two tax complexity measures, *LOSS* and *RDS*, are shown to be negatively associated with the relative dispersion measure. This might be due to analysts herding at the time of increasing tax complexity. Regarding the variables related to the information environment, *SIZE* is positively associated with relative dispersion, while *LOG_ANF* is negatively associated with relative dispersion.

$$RelativeDispersion_{i,j,t} = \alpha_0 + \alpha_1 CLEAN_{i,t} + \mathrm{A}\sum Tax\ Complexity + \mathrm{B}\sum General\ Complexity + \mathrm{C}\sum Information\ Environment + \mathrm{D}\sum Analyst\ Chracteristics + \mathrm{E}\sum Controls + Industry_j + Year_t + \varepsilon_{i,j,t} \quad 2.8$$

[Insert Table 2.6 Here]

Analysts' Forecasting Ability for Taxes vs. Pre-tax Earnings

I then examine whether analysts' tax forecasting ability differs from their ability to forecast pre-tax earnings. I first measure analysts' forecasting performance following Clement (1999) and Brown (2001). The proportional mean absolute forecast errors (*PMAFE*) are calculated for both pre-tax earnings, the component of tax due to ETR error, and net earnings and then are used to measure analysts' forecasting performance relative to other analysts following the same firm. *PMAFE* is calculated as follows:

$$PMAFE_{ijt} = DAFE_{ijt}/AFE_{jt}, \qquad 2.9$$

In Equation 2.9, $DAFE_{ijt}$ is measured as the distance between the absolute forecast error for analyst i's forecast of firm j for year t (AFE_{ijt}) and the mean absolute forecast error by all analysts forecasting for firm j for year t (AFE_{jt}). The *PMAFE* calculated for pre-tax earnings, the component of tax due to ETR error, and net earnings are annotated as *PMAFE_PTE*, *PMAFE_TAX*, and *PMAFE_EARN*. They measure how analysts' forecast error on these earnings components compares with other analysts' following the same firm for that year, with a smaller value indicating better accuracy.

I sorted *PMAFE_PTE*, *PMAFE_TAX*, and *PMAFE_EARN* by year from the lowest quintile (most accurate) to the highest quintile (least accurate) and then summarized the number of observations in a two-by-two table. The results show that the number of analysts ranked in the same performance quintile is 22,269 out of the sample size of 74,820. The results suggest that analysts' forecasting ability for pre-tax earnings might differ from that for tax, and the analyst that issues an accurate or less accurate forecast of pre-tax earnings might not have the same performance on the tax forecast.

I then used the following OLS models to understand better the factors that impact analysts' tax forecasting ability. Clement (1999) finds that analysts' forecast accuracy is positively associated with their years of experience (a proxy for analyst ability and skills) and employers' size (a proxy for resources available) and negatively associated with the number of firms and industries followed by the analyst (a proxy for busyness). Brown 2001 finds that analysts' past performance is as good a predictor as analysts' characteristics for analysts' forecasting performance. I ran two OLS regression models for both analysts' forecasts of taxes and pre-tax earnings (*PMAFE_PTE* and *PMAFE_TAX*), one based on the analysts' characteristics and the other based on past forecast accuracy (Clement 1999; Brown 2001).

$$PMAFE = \gamma_1 DAGE + \gamma_2 BSIZE + \gamma_3 FREQ + \gamma_4 FEXP + \gamma_5 GEXP + \gamma_6 NCOS + \gamma_7 INDS + \mu \qquad 2.10$$

$$PMAFE = \beta_1 DAGE + \beta_2 LPMAFE + \sigma \qquad 2.11$$

The results show that analysts' characteristics are poor predictors of analysts' tax forecast accuracy, given that the model has an adjusted R^2 of 0.03. The analyst's past tax forecast accuracy seems a better predictor with the adjusted R^2 of 0.068. The results contrast with those for pre-tax earnings forecasts that show analysts' characteristics explain almost 19% of analysts' forecasts accuracy. Taken together, I conclude that analysts' forecasting ability regarding taxes differs from their ability to forecast pre-tax earnings, and past accuracy better predicts analysts' forecast accuracy than analysts' characteristics. This might be due to analysts relying more on private information and possessing relevant tax experience.

[Insert Tables 2.7 and 2.8 Here]

Robustness Tests

In the main sample, I deleted observations with extreme effective tax rates (less than 0% or larger than 100%) or negative pre-tax earnings, significantly decreasing the sample size. I have run the main analysis on the sample, including those deleted observations, and the results still hold.

V. CONCLUSIONS

Although earlier studies find that analysts ignore taxes, recent literature provides contrary evidence. They find that analysts understand taxes, and they don't just mimic management's ETR estimates. Analysts deviate more from management and improve on management's estimates when tax complexity increases. Despite prior literature examining analysts' understanding of and attention to taxes, no studies have documented how the accuracy of analysts' forecasts of taxes compares with that of analysts' pre-tax earnings forecasts.

I examine how the accuracy of analysts' forecasts of taxes compares to that of analysts' pre-tax earnings. Using the disaggregated pre-tax forecasts to calculate the implied tax expense forecasts, I develop a relative accuracy measure that directly compares the magnitudes of analysts' forecast errors in taxes vs. pre-tax earnings. The findings suggest that analysts, on average, face more challenges and uncertainty when forecasting taxes. In addition, I find that the relative accuracy of analysts' forecasts of taxes vs. pre-tax earnings decreases with the increase in tax and firm complexity. The relative accuracy decreases for larger firms, possibly due to the availability of quality public information hindering analysts' efforts in acquiring private information that is the primary source foranalysts' forecasts of taxes. However, with the increase in analysts following that enriches the firm's information environment, the relative accuracy of analysts' forecasts of taxes improves.

This study is the first that documents how the accuracy of analysts' forecasts of taxes compares with that of pre-tax earnings forecasts, shedding light on the issue regarding analysts' understanding of taxes as important intermediaries of the capital market. The relative accuracy measure also provides a way to assess how accounting standards might impact the accuracy of analysts' forecasts of taxes relative to their forecasts of pre-tax earnings, the implications of which are essential for policymaking and standard setting.

Appendix B Variables Definitions

Variables Definitions	
Variables for Actual, Forecasted Pre-Tax Earnings, Taxes and Net Earnings, Forecasted Errors and Accuracy Measures (scaled by number of shares and stock price at the end of the forecast period)	
A_PTE =	Actual pre-tax earnings per I/B/E/S detail annual data.
F_PTE =	Forecasted pre-tax earnings per I/B/E/S detail annual data.
A_TAX =	Actual pre-tax earnings minus actual net earnings per I/B/E/S detail annual data.
F_TAX =	Forecasted pre-tax earnings minus forecasted net earnings per I/B/E/S detail annual data.
A_EARN=	Actual net earnings per I/B/E/S detail annul data.
F_EARN =	Forecasted net earnings per I/B/E/S detail annual data.
A_ETR =	Actual tax expense *A_TAX* divided by actual pre-tax earnings *A_PTE*.
F_ETR =	Forecasted tax expense *F_TAX* divided by forecasted pre-tax earnings *F_PTE*.
FE_PTE =	Decomposition of overall forecast error into the portion related to the forecast error in pre-tax earnings per Appendix 2.
FE_TAX =	Decomposition of overall forecast error into the portion related to the forecast error in effective tax rate per Appendix 2.
FE_EARN =	Actual net earnings *A_EARN* minus forecasted net earnings *F_EARN*
FE_ETR=	Forecasted ETR *F_ETR* minus actual ETR *A_ETR*.
ACCURACY_PTE =	Absolute value of *FE_PTE* multiplied by -1.
ACCURACY_TAX =	Absolute value of *FE_TAX* multiplied by -1.
ACCURACY_EARN =	Absolute value of *FE_EARN* multiplied by -1.
Variables OLS Regressions	
RELATIVE ACCURACY =	Negative of log [(*FE_TAX*/*F_TAX*)/(*FE_PTE*/*F_PTE*)]
RELATIVE DISPERSION=	Dispersion of *FE_TAX* divided by dispersion of *FE_PTE*.
CLEAN =	An indicator variable that equals 1 for firm-year where quarterly GAAP ETR (TXTQ divided by PIQ in Compustat) and the I/B/E/S actual implied ETR differ by less than 0.5 percent for all the first three quarters for the annual forecast period, and equals 0 otherwise.
AbsETR_CHANGE =	The absolute value of the change in GAAP ETR from year t-1 to year t.

absPermDiff =	The absolute value of the difference between firm's GAAP ETR and statutory tax rate for year t.
CompExp =	Firm j's year t-1 stock compensation expense (STKCO in Compustat) plus implied option expense (XINTOPT in Compustat divided by 0.65), if any, scaled by total assets (AT in Compustat).
Foreign =	An indicator variable that equals 1 if firm has non-zero pre-tax foreign income (PIFO in Compustat) in year t-1, and 0 otherwise.
RDS =	R&D spending (Compustat item XRD) divided by sales (Compustat item SALE) in year t-1. The variable is set to 1 if R&D spending exceeds sales.
TLCF =	An indicator variable equals 1 if the firm has non-zero tax loss carryforwards (TLCF in Compustat) in year t, and 0 otherwise.
BM =	Book value (Compustat item CEQ) as of the end of fiscal year t-1 divided by market value (Compustat item CSHO multiplied by PRCC_C) as of the end of fiscal year t-1.
LEV =	Leverage of firm j as of the end of year t-1, calculated as long-term debt (DLTT in Compustat) scaled by total assets (AT in Compustat)
SIZE =	Log value of market value (Compustat item CSH multiplied by PRCC_C).
LOG_ANF =	Log value of the number of I/B/E/S analysts issuing EPS forecast for the firm during year t.
DI =	Indicator variable that equals 1 if there is non-zero discontinued operations during year t-1, and equals 0 otherwise.
DVP =	Indicator variable that equals 1 if there is non-zero preferred dividend during year t-1, and equals 0 otherwise.
EI =	Indicator variable that equals 1 fi there is non-zero equity method income (ESUB in Compustat) during year t-1, and equals 0 otherwise.
MI =	Indicator variable that equals 1 if there is non-zero non-controlling interest (MI in Compustat) during year t-1, and equals 0 otherwise.
XI =	Indicator variable that equals 1 fi there is non-zero extraordinary income (XI in Compustat) during year t-1, and equals 0 otherwise.
BSIZE =	The number of analysts associated with the brokerage house that the analysts worked at for the year minus the mean number of analysts associated with the brokerage house that the analysts following the company for the year worked at.

DAGE =	The forecast age of the analysts minus the mean forecast age of all analysts following the company for the year. Forecast age is the number of days between the analyst's last forecast for the year and the year-end.
FEXP =	The number of years the analysts had been in the database issuing forecasts for the company minus the mean value of the number of years of firm experience of all analysts following the company for the year.
FREQ =	The total number of forecasts that the analyst issues for the company for the year minus the mean number of forecasts by all analysts following the company for the year.
GEXP =	The number of years the analysts had been in the database issuing forecasts for any firm minus the mean value of the years of general experience of all analysts following the company for the year.
NCOS =	The number of firms that the analyst follows for the year minus the mean number of firms followed by all analysts following the company for the year.
NINDS =	The number of industries the analyst follows for the year minus the mean number of industries followed by all analysts following the company for the year.
PMAFE =	$DAFE_{ijt}/AFE_{jt}$ $DAFE_{ijt}$ is measured as the distance between the absolute forecast error for analyst i's forecast of firm j for year t (AFE_{ijt}) and the mean absolute forecast error by all analysts forecasting for firm j for year t (AFE_{jt})
LPMAFE =	Prior year *PMAFE*.

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TABLE 2.1

Sample Selection

Observations with I/B/E/S pre-tax and after-tax forecasts available for 2002 - 2016	193,271
Less: observations without a matching record in Compustat	(21,989)
Less: observations for analyst forecasts released more than 12 months prior to period end or with less than 30-day forecast horizon	(54,435)
Less: observations with forecasted or actual ETR less than 0 or greater than 100%	(18,430)
Less: observations with negative forecasted and/or actual pre-tax earnings	(1,621)
Less: observations missing data to calculate variables	(21,976)
Final Sample	74,820

TABLE 2.2

Sample Distribution

Panel A: Year distribution		
Year	Observation	% Observation
2002	1,279	1.71
2003	2,966	3.96
2004	4,154	5.55
2005	4,672	6.24
2006	5,181	6.92
2007	5,011	6.70
2008	4,643	6.21
2009	4,817	6.44
2010	6,717	8.98
2011	7,111	9.50
2012	6,318	8.44
2013	6,017	8.04
2014	5,975	7.99
2015	5,436	7.27
2016	4,523	6.05
Total	**74,820**	**100.00**

Panel B: Industry distribution		
Industry	Observation	% Observation
Agriculture, Forestry, Fishing	173	0.23
Mining	2,925	3.91
Construction	1,090	1.46
Manufacturing	30,599	40.90
Transportation & Public Utilities	6,002	8.02
Wholesale Trade	2,436	3.26
Retail Trade	8,494	11.35
Finance, Insurance, Real Estate	5,405	7.22
Services	17,457	23.33
Public Administration	239	0.32
Total	74,820	100.00

TABLE 2.3

Descriptive Statistics

Panel A: Descriptive statistics for Actual, Forecasted Pre-tax Earnings, Taxes and Net Earnings, Forecast Errors and Accuracy Measures

	n	Mean	Std. Dev.	Q1	Median	Q3
A_PTE_t	74,820	3.514	3.575	1.384	2.609	4.482
F_PTE_t	74,820	3.475	3.451	1.390	2.578	4.468
A_TAX_t	74,820	1.115	1.143	0.373	0.812	1.465
F_TAX_t	74,820	1.110	1.091	0.388	0.821	1.469
A_EARN_t	74,820	2.384	2.442	0.947	1.761	3.024
F_EARN_t	74,820	2.351	2.377	0.938	1.730	2.989
A_ETR_t	74,820	0.309	0.108	0.259	0.331	0.376
F_ETR_t	74,820	0.315	0.104	0.267	0.340	0.380
FE_PTE_t	74,820	0.001	0.016	-0.003	0.001	0.004
FE_TAX_t	74,820	0.000	0.009	-0.002	0.000	0.002
$FE\_TAX\_PTE_t$	74,820	0.000	0.005	-0.001	0.000	0.001
$FE\_TAX\_ETR_t$	74,820	0.000	0.006	-0.001	0.000	0.000
FE_EARN_t	74,820	0.001	0.010	-0.001	0.001	0.003
FE_ETR_t	74,820	-0.006	0.069	-0.018	-0.003	0.005
$ACCURACY\_PTE_t$	74,820	-0.009	0.015	-0.010	-0.004	-0.001
$ACCURACY\_TAX_t$	74,820	-0.005	0.008	-0.005	-0.002	-0.001
$ACCURACY\_TAX\_PTE_t$	74,820	-0.003	0.005	-0.003	-0.001	0.000
$ACCURACY\_TAX\_ETR_t$	74,820	-0.003	0.006	-0.003	-0.001	0.000
$ACCURACY\_EARN_t$	74,820	-0.006	0.010	-0.006	-0.002	-0.001
$ACCURACY\_ETR_t$	74,820	-0.037	0.064	-0.038	-0.012	-0.004

All variables are defined in the Appendix.

TABLE 2.3

Descriptive Statistics Continued

Panel B: Descriptive Statistics for Additional Variables in Regression Analyses						
	n	**Mean**	**Std. Dev.**	**Q1**	**Median**	**Q3**
$RelativeAccuracy_t$	74,820	4.850	14.506	0.288	1.014	2.970
$LogRelativeAccuracy_t$	74,820	-0.983	0.974	-1.379	-0.700	-0.253
$RelativeDispersion_t$	74,820	0.614	0.504	0.355	0.469	0.765
$Abs\Delta ETR_{t-1}$	74,820	0.320	1.185	0.010	0.033	0.129
$AbsPermDiff_{t-1}$	74,820	0.200	0.609	0.024	0.053	0.155
ANF_t	74,820	18.807	10.307	11.000	17.000	25.000
BM_{t-1}	74,820	0.415	0.286	0.223	0.354	0.549
$BSIZE_t$	74,820	0.012	0.458	-0.480	0.222	0.409
$CLEAN_t$	74,820	0.327	0.469	0.000	0.000	1.000
$CompExp_{t-1}$	74,820	0.016	0.031	0.004	0.008	0.018
$DAGE_t$	74,820	-2.130	75.599	-50.842	-22.750	24.750
DI_{t-1}	74,820	0.177	0.381	0.000	0.000	0.000
DV_{t-1}	74,820	0.052	0.222	0.000	0.000	0.000
EI_{t-1}	74,820	0.247	0.431	0.000	0.000	0.000
ETR_STD_{T-1}	74,820	0.177	0.732	0.005	0.015	0.053
$FEXP_t$	74,820	-0.020	2.249	-1.500	-0.444	1.000
$FOREIGN_{t-1}$	74,820	0.618	0.486	0.000	1.000	1.000
$FREQ_t$	74,820	-0.182	1.625	-1.263	-0.111	0.857
$GEXP_t$	74,820	-0.045	3.533	-2.474	-0.800	1.571
LEV_{t-1}	74,820	0.180	0.180	0.007	0.143	0.285
$LOSS_{t-1}$	74,820	0.088	0.284	0.000	0.000	0.000
MI_{t-1}	74,820	0.275	0.447	0.000	0.000	1.000
$NCOS_t$	74,820	-0.143	3.885	-2.769	-0.333	2.192
$NINDS_t$	74,820	-0.076	1.456	-0.973	-0.250	0.667
RDS_{t-1}	74,820	0.049	0.078	0.000	0.000	0.080
$SEGMENTS_t$	74,820	2.389	1.512	1.000	2.000	3.000
$SIZE_{t-1}$	74,820	8.018	1.487	6.955	7.945	9.089
$TLCF_{t-1}$	74,820	0.539	0.498	0.000	1.000	1.000
XI_{t-1}	74,820	0.032	0.176	0.000	0.000	0.000

All variables are defined in the Appendix.

TABLE 2.4

Pearson Correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *LogRelativeAccuracy$_t$*							
(2) *RelativeDispersion$_r$*	**-0.141**						
(3) *AbsΔETR$_{t-1}$*	**-0.027**	-0.005					
(4) *AbsPermDiff$_{t-1}$*	**-0.042**	0.000	**0.681**				
(5) *ANF$_t$*	**-0.025**	**-0.036**	**-0.035**	**-0.021**			
(6) *BM$_{t-1}$*	**0.028**	0.004	**0.055**	**0.046**	**-0.208**		
(7) *BSIZE$_t$*	**-0.015**	0.005	-0.004	-0.005	**0.024**	0.000	
(8) *CLEAN$_t$*	**0.111**	**-0.102**	**-0.076**	**-0.082**	**-0.033**	**-0.130**	-0.006
(9) *CompExp$_{t-1}$*	-0.006	**-0.050**	**0.054**	**0.073**	**0.131**	**-0.161**	-0.003
(10) *DAGE$_t$*	**0.093**	-0.001	0.000	0.002	0.000	0.001	**-0.045**
(11) *DI$_{t-1}$*	**-0.020**	**0.063**	0.003	0.001	**-0.058**	**0.106**	**0.016**
(12) *DV$_{t-1}$*	**-0.017**	**0.040**	**0.014**	**0.019**	**-0.026**	**0.083**	**0.014**
(13) *EI$_{t-1}$*	**-0.030**	**0.076**	0.005	-0.004	-0.003	**0.083**	**0.018**
(14) *ETR_STD$_{t-1}$*	**-0.028**	**-0.008**	**0.539**	**0.715**	**-0.039**	**0.059**	-0.004
(15) *FEXP$_t$*	0.003	0.005	0.002	0.002	-0.004	0.003	**0.084**
(16) *FOREIGN$_{t-1}$*	**-0.125**	-0.007	**0.044**	**0.054**	**0.195**	**-0.060**	**0.008**
(17) *GEXP$_t$*	0.000	0.003	-0.001	-0.001	-0.003	**0.007**	**0.108**
(18) *LEV$_{t-1}$*	**-0.025**	**0.079**	**0.054**	**0.046**	**-0.088**	**-0.074**	**0.008**
(19) *LOSS$_{t-1}$*	**-0.041**	**-0.032**	**0.172**	**0.229**	**-0.037**	**0.139**	-0.006
(20) *MI$_{t-1}$*	**-0.052**	**0.104**	**-0.021**	**-0.011**	-0.001	**0.070**	**0.013**
(21) *NCOS$_t$*	**-0.022**	**0.008**	0.000	0.003	**-0.034**	0.006	**0.144**
(22) *NINDS$_t$*	-0.007	**0.008**	-0.001	0.002	**-0.020**	**0.012**	**0.021**
(23) *RDS$_{t-1}$*	**-0.110**	**-0.073**	**0.093**	**0.131**	**0.218**	**-0.142**	**-0.009**
(24) *SEGMENTS$_t$*	**-0.041**	**0.053**	**-0.014**	**-0.019**	**0.025**	**0.109**	**0.024**
(25) *SIZE$_{t-1}$*	**-0.068**	**0.054**	**-0.095**	**-0.085**	**0.670**	**-0.271**	**0.039**
(26) *TLCF$_{t-1}$*	**-0.070**	**0.014**	**0.078**	**0.082**	**0.010**	**0.025**	**-0.010**
(27) *XI$_{t-1}$*	**0.019**	0.005	**-0.015**	**-0.014**	**0.012**	**0.038**	0.007

Bold correlations are significant at least 5 percent level.

TABLE 2.4

Pearson Correlation Continued

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(8) *CLEAN$_t$*							
(9) *CompExp$_{t-1}$*	**-0.022**						
(10) *DAGE$_t$*	-0.002	-0.002					
(11) *DI$_{t-1}$*	**-0.088**	**-0.120**	0.000				
(12) *DV$_{t-1}$*	**-0.067**	**-0.071**	-0.001	**0.058**			
(13) *EI$_{t-1}$*	**-0.148**	**-0.140**	0.000	**0.125**	**0.069**		
(14) *ETR_STD$_{T-1}$*	**-0.079**	**0.037**	0.001	**0.008**	**0.029**	**0.008**	
(15) *FEXP$_t$*	-0.002	0.001	**0.033**	0.002	0.001	-0.002	0.002
(16) *FOREIGN$_{t-1}$*	**-0.218**	**0.078**	0.005	**0.028**	**-0.076**	**0.044**	**0.048**
(17) *GEXP$_t$*	**-0.007**	0.000	**0.008**	0.002	0.003	0.004	0.001
(18) *LEV$_{t-1}$*	**-0.107**	**-0.209**	0.001	**0.104**	**0.131**	**0.180**	**0.052**
(19) *LOSS$_{t-1}$*	**-0.111**	**0.172**	0.001	**0.009**	**0.012**	**-0.010**	**0.191**
(20) *MI$_{t-1}$*	**-0.287**	**-0.158**	0.000	**0.124**	**0.052**	**0.346**	-0.007
(21) *NCOS$_t$*	**-0.008**	0.004	**-0.154**	0.002	-0.004	0.002	0.002
(22) *NINDS$_t$*	**-0.008**	0.005	**-0.080**	-0.002	0.001	0.003	0.002
(23) *RDS$_{t-1}$*	**-0.147**	**0.487**	0.002	**-0.135**	**-0.112**	**-0.154**	**0.092**
(24) *SEGMENTS$_t$*	**-0.108**	**-0.180**	-0.001	**0.152**	**0.069**	**0.215**	0.005
(25) *SIZE$_{t-1}$*	**-0.077**	**-0.098**	-0.003	**0.071**	**0.047**	**0.168**	**-0.086**
(26) *TLCF$_{t-1}$*	**-0.138**	**0.031**	0.006	**0.029**	**-0.011**	**0.021**	**0.081**
(27) *XI$_{t-1}$*	**-0.008**	**-0.018**	-0.004	**0.049**	**0.086**	**0.045**	0.000

Bold correlations are significant at least 5 percent level.

TABLE 2.4

Pearson Correlation Continued

	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(15) $FEXP_t$							
(16) $FOREIGN_{t-1}$	-0.003						
(17) $GEXP_t$	**0.689**	0.000					
(18) LEV_{t-1}	-0.006	**-0.100**	-0.004				
(19) $LOSS_{t-1}$	0.000	**0.054**	-0.001	**0.063**			
(20) MI_{t-1}	-0.001	**0.125**	-0.002	**0.176**	**-0.022**		
(21) $NCOS_t$	**0.214**	0.001	**0.326**	-0.005	0.000	**0.008**	
(22) $NINDS_t$	**0.129**	-0.004	**0.224**	-0.005	0.004	0.001	**0.62**
(23) RDS_{t-1}	0.004	**0.275**	0.003	**-0.258**	**0.224**	**-0.181**	-0.003
(24) $SEGMENTS_t$	**-0.007**	**0.152**	-0.002	**0.100**	**-0.038**	**0.235**	0.004
(25) $SIZE_{t-1}$	-0.003	**0.277**	0.000	**0.054**	**-0.159**	**0.172**	**-0.029**
(26) $TLCF_{t-1}$	**0.010**	**0.219**	0.004	**0.053**	**0.079**	**0.04**	0.006
(27) XI_{t-1}	-0.002	**-0.042**	-0.002	**0.057**	0.004	**0.022**	-0.003

Bold correlations are significant at least 5 percent level.

TABLE 2.4

Pearson Correlation Continued

	(22)	*(23)*	*(24)*	*(25)*	*(26)*	*(27)*
(22) $NINDS_t$						
(23) RDS_{t-1}	0.000					
(24) $SEGMENTS_t$	-0.005	**-0.156**				
(25) $SIZE_{t-1}$	**-0.022**	**0.025**	**0.266**			
(26) $TLCF_{t-1}$	**0.009**	**0.161**	**0.034**	**0.011**		
(27) XI_{t-1}	-0.001	**-0.047**	**0.056**	**0.042**	**-0.059**	

Bold correlations are significant at least 5 percent level.

TABLE 2.5

OLS Regression Modeling the Relative Accuracy of

Analysts' Forecasts of Taxes vs. Pre-tax Earnings

		Dependent Variable = LogRelativeAccuracy	
	Expected Sign	Coefficient	t-statistic
Intercept		-0.044	-0.31
$CLEAN_t$	+	0.127***	6.95
Other Tax Complexity			
$Abs\Delta ETR_{t-1}$	-	0.003	0.31
$AbsPermDiff_{t-1}$	-	-0.042*	-1.65
$CompExp_{t-1}$	-	0.530	1.15
ETR_STD_{T-1}	-	0.017	0.98
$FOREIGN_{t-1}$	-	-0.058**	-2.49
$LOSS_{t-1}$	-	-0.058	-1.57
RDS_{t-1}	-	-0.772***	-3.06
$TLCF_{t-1}$	-	-0.025	-1.23
General Complexity			
BM_{t-1}	?	0.004	0.10
LEV_{t-1}	?	-0.198***	-3.27
$SEGMENTS_t$	?	-0.003	-0.38
Analysts' Characteristics			
$BSIZE_t$	?	-0.017**	-2.32
$FEXP_t$	?	0.002	0.78
$FREQ_t$	?	-0.009***	-3.76
$GEXP_t$	?	0.001	0.42
$DAGE_t$	?	0.001***	20.15
$NCOS_t$	?	-0.002**	-2.03
$NINDS_t$	?	0.005	1.54
Information Environment			
LOG_ANF_t	+	0.005**	2.52
$SIZE_{t-1}$	-	-0.044***	-3.54
Controls			
DI_{t-1}	?	-0.028	-1.39
DV_{t-1}	?	-0.115***	-3.43
EI_{t-1}	?	-0.016	-0.72
MI_{t-1}	?	-0.019	-0.88
XI_{t-1}	?	-0.046	-1.22
Industry, Year Fixed Effects Included		Yes	
Number of firm-year-analyst		74,820	
Adjusted R^2		0.069	

This table presents results for regression of relative accuracy measure of analysts' forecasts of taxes vs. pre-tax earnings (*LogRelativeAccuracy*) on variables related to tax complexity, firm general complexity, firms' information environment, analysts' characteristics as well as the other control variables. I include industry and year fixed effects to control for inter-temporal and cross-industry differences and cluster the standard errors at firm level.

$$LogRelativeAccuracy_{i,j,t} = \alpha_0 + \alpha_1 CLEAN_{i,t} + \mathrm{A}\sum Tax\ Complexity + \mathrm{B}\sum General\ Complexity + \mathrm{C}\sum Information\ Environment + \mathrm{D}\sum Analyst\ Chracteristics + \mathrm{E}\sum Controls + Industry_j + Year_t + \varepsilon_{i,j,t} \quad \text{(Equation 2.7)}$$

The sample includes 74,820 firm-year-analyst observations with nonmissing variables from 2002 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the indicator variables. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests.

TABLE 2.6

OLS Regression Modeling the Relative Dispersion of Analysts' Forecasts of Taxes vs. Pre-tax Earnings

		Dependent Variable = ***RelativeDispersion***	
	Expected Sign	Coefficient	t-statistic
Intercept		0.709***	6.00
$CLEAN_t$	-	-0.072***	-5.14
Other Tax Complexity			
$Abs\Delta ETR_{t-1}$	+	-0.005	-0.90
$AbsPermDiff_{t-1}$	+	0.022*	1.78
$CompExp_{t-1}$	+	0.142	0.56
ETR_STD_{T-1}	+	-0.015	-1.59
$FOREIGN_{t-1}$	+	-0.027	-0.94
$LOSS_{t-1}$	+	-0.043**	-2.22
RDS_{t-1}	+	-0.335***	-2.58
$TLCF_{t-1}$	+	-0.005	-0.40
General Complexity			
BM_{t-1}	?	0.013	0.52
LEV_{t-1}	?	0.071	1.59
$SEGMENTS_t$	?	-0.003	-0.56
Analysts' Characteristics			
$BSIZE_t$	?	0.001	26.00
$FEXP_t$	?	0.001	1.12
$FREQ_t$	?	0.005***	4.53
$GEXP_t$	?	-0.001	-1.28
$DAGE_t$	?	0.000***	3.18
$NCOS_t$	?	0.000	0.13
$NINDS_t$	?	0.001	1.15
Information Environment			
LOG_ANF_t	-	-0.003***	-3.68
$SIZE_{t-1}$	+	0.025***	3.38
Controls			
DI_{t-1}	?	0.043***	3.02
DV_{t-1}	?	0.036*	1.79
EI_{t-1}	?	0.020	1.42
MI_{t-1}	?	0.047***	3.18
XI_{t-1}	?	0.011	0.44
Industry, Year Fixed Effects Included		Yes	
Number of firm-year-analyst		74,820	
Adjusted R^2		0.059	

This table presents results for regression of relative dispersion measure of analysts' forecasts of taxes vs. pre-tax earnings (*RelativeDispersion*) on variables related to tax complexity, firm general complexity, firms' information environment, analysts' characteristics as well as the other control variables. I include industry and year fixed effects to control for inter-temporal and cross-industry differences and cluster the standard errors at firm level.

$$RelativeDispersion_{i,j,t} = \alpha_0 + \alpha_1 CLEAN_{i,t} + \mathrm{A} \sum Tax\ Complexity + \mathrm{B} \sum General\ Complexity + \mathrm{C} \sum Information\ Environment + \mathrm{D} \sum Analyst\ Chracteristics + \mathrm{E} \sum Controls + Industry_j + Year_t + \varepsilon_{i,j,t} \quad \text{(Equation 2.8)}$$

The sample includes 74,820 firm-year-analyst observations with nonmissing variables from 2002 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the indicator variables. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests.

TABLE 2.7

Number of Observations in Each Rank of PMAFE_TAX and PMAFE_PTE

	PMAFE_TAX				
PMAFE_PTE	RANK_0	RANK_1	RANK_2	RANK_3	RANK_4
RANK_0	4,992	3,998	2,961	2,031	1,688
RANK_1	3,839	4,052	3,199	2,557	1,994
RANK_2	2,513	2,989	3,654	3,079	2,064
RANK_3	2,070	2,291	3,041	3,593	3,173
RANK_4	1,914	2,226	2,179	2,745	5,978
TOTAL	15,328	15,556	15,034	14,005	14,897

This table shows the results of sorting the full sample of 74,820 firm-year-analyst observations by the values for *PMAFE_TAX* and *PMAFE_PTE* and counting the number of observations in the two-by-two table. RANK_0 is the lowest quintile indicating most accurate proportional mean absolute forecast error, while RANK_4 is the highest quintile indicating least accurate proportional mean absolute forecast error. The results show that the observations that are in the same rank for both *PMAFE_TAX* and *PMAFE_PTE* total 22,269 (sum of diagonal).

TABLE 2.8

Regression of Proportional Mean Absolute Forecast Error (*PMAFE*)

Analysts' Characteristics Model vs. Past Performance Model

	DV = *PMAFE_TAX*	**DV = *PMAFE_TAX***	**DV= *PMAFE_PTE***	**DV = *PMAFE_PTE***
	(1)	**(2)**	**(3)**	**(4)**
Intercept	-0.177	-0.179	-0.064	-0.109
	(-1.16)	(-1.20)	(-0.46)	(-0.74)
LAG_PMAFE_TAX		0.270***		
		(48.21)		
LAG_PMAFE_PTE				0.294***
				(43.45)
DAGE	0.002***		0.005***	
	(25.24)		(68.23)	
BSIZE	0.032***		-0.012	
	(3.12)		(-1.24)	
FREQ	-0.001		-0.008***	
	(-0.23)		(-2.35)	
FEXP	-0.004*		-0.004*	
	(-1.52)		(-1.41)	
GEXP	0.001		0.000	
	(0.73)		(0.08)	
NCOS	0.000		-0.003**	
	(-0.13)		(-2.12)	
NINDS	0.000		0.005*	
	(-0.04)		(1.32)	
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Number of firm-quarter	32,059	32,059	32,059	32,059
Adjusted R Square	0.030	0.068	0.189	0.055

This table presents results for regression of proportional mean absolute forecast error (*PMAFE*) in taxes and pre-tax earnings using both analysts' characteristics model and past performance model. I include industry and year fixed effects to control for inter-temporal and cross-industry differences and cluster the standard errors at firm level.

$PMAFE = \gamma_1 DAGE + \gamma_2 BSIZE + \gamma_3 FREQ + \gamma_4 FEXP + \gamma_5 GEXP + \gamma_6 NCOS + \gamma_7 INDS + \mu$ (Equation 2.10)

$PMAFE = \beta_1 DAGE + \beta_2 LPMAFE + \sigma$ (Equation 2.11)

The sample includes 32,590 firm-year-analyst observations with nonmissing variables from 2002 to 2016. All variables are defined in Appendix A. All variables are winsorized at the 1 and 99 percent level except for the indicator variables. ***, **, * Indicate significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively, using two-tailed tests.

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PUBLICATIONS AND PRESENTATIONS

Mei, Sue (2023), Valuation of Tax Expense – A Decomposition Approach. (Working paper presented at 2021 AAA/Deloitte Foundation/J. Michael Cook Doctoral Consortium, 2022 FIU School of Accounting Research Workshop, scheduled to be presented in 2023 American Accounting Association Annual Meeting)