8-2014

Deferred Tax Assets and Credit Risk

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To the Graduate Council:

I am submitting herewith a dissertation written by Scott David White entitled "Deferred Tax Assets and Credit Risk." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

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Deferred Tax Assets and Credit Risk

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Scott David White
August 2014

Abstract

This paper examines the impact of deferred tax assets on firm creditworthiness. Specifically, I investigate whether the proportion of a firm's total assets that are composed of deferred tax assets is associated with Standard & Poor's credit ratings. The benefits associated with deferred tax assets are primarily realized through deductions from future taxable income. If declines in financial performance lead to a subsequent default, deferred tax assets may provide no value to creditors seeking recovery of their investment. I document a significant negative association between deferred tax assets and credit ratings. The evidence is consistent with credit market participants incorporating the risk associated with deferred tax assets into their assessment of credit risk and suggests that deferred tax assets may adversely affect the quality of a firm's balance sheet. Additionally, I find that the magnitude of the association is strongest for a subsample of firms rated just above or below investment grade (i.e. BBB-/BB+) where credit risk is particularly sensitive.

Table of Contents

List of Tables

Section I: INTRODUCTION

This study extends recent research analyzing the effects of book-tax differences on a firm's credit risk (Crabtree and Maher 2009; Ayers et al. 2010; Edwards 2011; Gallemore 2011) and investigates a fundamental question that has not been addressed in prior studies: Is the proportion of total assets comprised of deferred tax assets associated with a firm's credit risk?[1] The process of accounting for book-tax differences, as prescribed by SFAS 109, creates deferred tax assets and liabilities on the balance sheet. Prior research in this area finds evidence that book-tax differences convey information regarding the quality of earnings reported on the income statement as well as signals of future profitability. By focusing specifically on deferred tax assets, this study attempts to provide insight into the impact of book-tax differences on the quality of a firm's balance sheet.[2] I predict that increases in deferred tax assets are associated with higher levels of credit risk. Creditors are particularly concerned with the downside risk of a firm. If declines in financial performance lead to a subsequent default, the benefits of deferred tax assets, which are primarily realized through deductions from future taxable income, may provide no value to creditors seeking recovery of their investment.

In order to test the relation between deferred tax assets and credit risk, I use an ordered logit model to determine whether firms with higher levels of deferred tax assets are associated with lower credit ratings. The model includes controls for size,

[1] The balance sheet reports the estimated net realizable value of deferred tax assets. The independent
[2] This study does not examine the impact of deferred tax liabilities. Credit market participants tend to be conservative in their interpretation of financial information (Pettit et al. 2004). I expect credit analysts to be more concerned with the overstatement of assets than the overstatement of liabilities. In untabulated analyses I partition the sample based on whether a firm's net deferred tax position is a deferred tax asset or a deferred tax liability. I find that inferences remain unchanged regardless of a firm's net deferred tax position.

profitability, leverage, firm risk, accruals quality, the ability to repay debt, and book-tax differences.

Investigating the impact of deferred tax assets on credit ratings is important for several reasons. First, deferred tax positions are substantial for many firms. Poterba et al. (2011) document that more than 40 percent of their sample firms reported a net deferred tax position that exceeded 5 percent of total assets and nearly 10 percent of sample firms reported a net deferred tax position in excess of 10 percent of total assets. Second, the role of credit rating agencies as gatekeepers to the capital markets has become increasingly important. "The provision of credit, particularly in the U.S., has shifted away from commercial banks to the rated capital markets in recent years" (Pettit et al. 2004). Credit ratings play an essential role in contracting because they are viewed as efficient benchmarks of creditworthiness (Frost 2007). Both credit rating upgrades and downgrades are associated with significant stock market reactions (Jorion et al. 2005). Finally, in a survey of chief financial officers, "a good credit rating" was listed as one of the most important factors influencing capital structure decisions (Graham and Harvey 2001).

I document a significant negative association between deferred tax assets and credit ratings.[3] The evidence is consistent with credit market participants incorporating the risk associated with deferred tax assets into their assessment of credit risk. The model estimates that moving from the first to the third quartile of deferred tax assets decreases the probability of a credit rating upgrade by 15.6 percent (from 9.2 percent to 7.8 percent), and increases the probability of a rating downgrade by 18.0 percent (from 9.7

[3] To estimate an ordered logit model with credit ratings as the dependent variable, I convert the Standard & Poor's letter ratings to a numeric scale ranging from 1 to 22 where D=1 and AAA=22

percent to 11.4 percent). In additional analysis, I examine a subsample of 429 firm-years with a credit rating that sits on the threshold between investment grade and speculative grade. For these firms, moving from the first to the third quartile of deferred tax assets decreases the probability of a credit rating upgrade by 19.4 percent (from 9.1 percent to 7.4 percent), and increases the probability of a rating downgrade by 24.7 percent (from 5.8 percent to 7.2 percent).

This study contributes to prior literature in several ways. I add to existing research in accounting for income taxes by examining whether the proportion of total assets comprised of deferred tax assets is associated with credit risk. The results suggest that deferred tax assets may adversely impact the quality of a firm's balance sheet when evaluated from the perspective of a creditor. Academics have called for research that examines the use of tax information in the financial statements by credit market participants (Graham et al. 2012; Hanlon and Heitzman 2010). In 2012, U.S. corporate debt issuances exceeded $1.325 trillion compared to U.S. equity proceeds totaling $244.5 billion (Thomson Financial 2012). Despite the relative weight of the debt capital markets, the majority of research in accounting for income taxes continues to focus on equity investors. Holthausen and Watts (2001) suggest that equity investors and lenders are not likely to utilize financial statement information in the same manner.

This paper extends prior literature examining the impact of book-tax differences on credit risk. Several recent studies find evidence consistent with large book-tax differences signaling lower earnings quality, which results in a decline in creditworthiness (Crabtree and Maher 2009; Ayers et al. 2010). However, Wilson (2010) and Guenther (2011) urge caution in interpreting the findings of these studies and state

that additional research is needed to clarify their results. Instead of focusing on the signals that book-tax differences convey regarding earnings persistence and future profitability, this study attempts to fill a gap in the literature by examining the balance sheet implications of deferred tax assets and their impact on firm creditworthiness.[4] In assessing the potential for recovery in the event of insolvency, credit analysts must assess the quality of the assets available to satisfy the claims of creditors. Deferred tax assets represent future tax deductions. If firms facing conditions of economic stress are unable to generate taxable income, then the benefits of deferred tax assets cannot be realized and are therefore of little value to creditors. Finally, this study contributes to the broad literature of researchers modeling the credit rating process by documenting a potentially significant determinant of credit ratings and providing additional evidence of how accounting information is used in the rating process.

The remainder of the paper is organized as follows. The next section presents background information, reviews the related literature, and develops the study's hypothesis. Section III describes the research design. I discuss the sample selection process in Section IV. Section V presents the results and findings, and I conclude with a summary and discussion in Section VI.

[4] Ayers et al. (2010) find a negative association between large *positive* changes in book-tax differences and credit ratings changes. They find a similar relation with large *negative* changes in book-tax differences. The authors suggest that large positive changes in book-tax differences may signal decreased earnings quality or off-balance-sheet financing.

Section II: BACKGROUND, MOTIVATION, AND HYPOTHESIS DEVELOPMENT

Credit ratings

In order to examine the impact of deferred tax assets on the creditworthiness of firms, I use credit ratings as a proxy for credit risk. Credit ratings and rating agencies serve a gatekeeping role in the capital markets and have a significant impact on firms' access to, and cost of, capital (Pettit et al. 2004). Credit ratings are opinions about credit risk. They reflect the rating agency's assessment of the ability of an issuer to meet its financial obligations, the relative likelihood of default, and the likelihood of recovery in the event of default. The major rating categories used by Standard & Poor's are AAA, AA, A, BBB, BB, B, CCC, CC, C, and D where AAA, the highest rating, represents "extremely strong capacity to meet financial commitments" and D represents default (Standard & Poor's 2013). Standard & Poor's will modify ratings from AA to CCC with the addition of a plus (+) or minus (-) sign in order to designate relative standing within a major rating category. Credit market participants generally consider ratings of BBB- or higher to be investment grade while ratings of BB+ or lower are considered to be speculative grade.

Accounting for income taxes

Firms report two different measures of profitability. Pre-tax book income is reported to financial statement users, such as investors and creditors, and is calculated based on Generally Accepted Accounting Principles (GAAP). Taxable income is the basis for determining corporate tax liabilities. Taxable income is reported to taxing authorities and is calculated according to the Internal Revenue Code (IRC). While both

profitability measures utilize accrual accounting, the differing objectives of GAAP and the IRC lead to differential treatment of certain transactions. These book-tax differences can be either permanent or temporary in nature. Permanent book-tax differences describe revenues and expenses that are included in one measure of income, but are completely excluded from the other. Permanent differences cause effective tax rates to differ from statutory rates. While researchers have made strides in estimating permanent differences, they are difficult to measure (Hanlon 2005).

Temporary differences refer to revenues and expenses that are included in both book income and taxable income, but in different time periods. The consequence of these timing differences is that the tax bases of assets or liabilities are not equal to their reported amounts in the financial statements. However, by definition, temporary differences should reverse in subsequent time periods. SFAS No. 109 prescribes a balance sheet approach to accounting for income taxes. Firms must recognize deferred tax assets and liabilities for all temporary differences. If the reversal of a temporary difference is associated with future taxable amounts, then firms will recognize a deferred tax liability. Alternatively, a deferred tax asset is recognized when the reversal of a temporary difference will produce future deductible amounts.

Prior literature

The pricing of tax information by equity market participants has been an active area of research (Graham et al. 2012). Early research on the valuation impact of deferred tax positions was motivated by the passage of SFAS 109.[5] Amir and Sougiannis (1999) find that deferred tax assets from tax loss carryforwards are valued positively as assets.

[5] SFAS 109 is effective for firm-years beginning after December 15, 1992. SFAS 109 is now classified as ASC 740 under FASB's new codification system.

However, they find two conflicting effects that influence the valuation of investors. There is a measurement effect stemming from the fact that deferred tax assets represent future tax savings. There is also an information effect because the presence of a loss carryforward from prior years serves as a signal regarding the probability of future losses.

Amir et al. (1997) examine the separate components of deferred tax assets and document significant variation in their valuation coefficients. For example, they find that deferred tax assets related to restructuring charges, have larger valuation coefficients than deferred tax assets related to employee benefits. In contrast, the valuation coefficient is close to zero for deferred tax liabilities related to depreciation, which indicates investors do not believe they are true liabilities. The authors conclude that the results provide evidence consistent with investors valuing deferred taxes based on a function of when the deferred tax accounts reverse. These findings illustrate the complexity associated with valuing deferred tax assets. However, subsequent research has identified serious weaknesses in the models employed by the valuation relevance literature (Holthausen and Watts 2001). Therefore, the inferences drawn from these studies may be unreliable. Consequently, a review of the literature by Graham et al. (2012) conclude that it remains an open question as to whether or not the deferred tax accounts are priced by equity market participants.

The idea that the valuation impact of a deferred tax position is dependent upon when the deferred tax account will reverse has also been advocated in financial statement analysis textbooks. A theoretical model developed by Guenther and Sansing (2000) challenges this assertion. Their model of firm value demonstrates that the timing of expected deferred tax reversals should not affect the value of the firm. Instead, they

show that the valuation of deferred tax assets and liabilities depends on whether they originate from a transaction that is included in GAAP income before or after its inclusion in taxable income.

Laux (2013) tests the theoretical predictions of Guenther and Sansing (2000) by examining whether deferred tax assets and liabilities provide incremental information about future tax payments. His primary finding suggests that there is an asymmetrical association between deferred taxes and future tax payments. Motivated by evidence that deferred tax positions arising from revenues and expenses included in GAAP income after taxable income are not associated with future tax payments, Laux (2013) suggests that the benefit of providing information on deferred tax positions may not exceed the cost of supplying and using the information.

In summary, there is some evidence that deferred tax assets are value relevant. However, it is not clear that equity market participants properly price the information provided in the deferred tax accounts. The extant literature suggests that not all deferred tax assets are value relevant and therefore may not truly be assets to the firms that report them. It is reasonable to assume that the uncertain nature of the information conveyed by deferred tax positions is also problematic for credit market participants, especially the agencies that rate the credit risk of a particular debt issuance.

In contrast to the literature discussed above, which focuses on equity investors, this paper examines the impact of deferred tax assets on credit market participants. While analyzing how equity market participants price tax information is important, tax information can also affect debt contracts and debt markets. Given that U.S. corporate

debt issuances exceeded $1.325 trillion in 2012 (Thomson Financial 2012), the impact of tax information on the pricing of debt could potentially be significant.

Recent studies have examined the association between book-tax differences and firm credit risk (Crabtree and Maher 2009; Ayers et al. 2010). These papers are motivated by the negative signal that large book-tax differences convey regarding earnings quality and persistence (Hanlon 2005). They find that large book-tax differences are associated with higher levels of credit risk. Wilson (2009, 2010) urges caution in interpreting the results presented in Crabtree and Maher (2009) and Ayers et al. (2010). He calls for additional research to determine what is driving the association between book-tax differences and credit ratings. Specifically, he suggests disaggregating total book-tax difference into its individual components. My study attempts to fill a gap in the literature identified by Wilson (2009, 2010) by focusing on deferred tax assets, which represent a temporary portion of book-tax differences. I propose that deferred tax assets convey information concerning the strength of a firm's financial position.

In a study most similar to mine, Gallemore (2011) investigates the credit risk associated with the deferred tax asset component of bank regulatory capital. He hypothesizes that banks that have a larger proportion of regulatory capital composed of deferred tax assets will be more likely to fail. He employs a hazard model to test a sample of commercial banks and finds that the proportion of regulatory capital composed of deferred tax assets is positively associated with the risk of bank failure during the recent financial crisis. Gallemore (2011) attributes his findings to the fact that the benefits of deferred tax assets cannot be realized unless banks generate positive taxable income.

Hypothesis development

The common story in the literature on book-tax differences and credit risk is that the primary information conveyed to credit market participants in the accounting treatment of book-tax differences is a signal of earnings quality and future profitability. I propose that deferred tax assets convey valuable information about a firm's balance sheet and financial position. While equity investors hope to realize the benefits associated with the upside of profitable firms, creditors, and consequently credit analysts for ratings agencies such as Standard & Poor's, are primarily concerned with the downside risk of the firm. While there is some evidence that deferred tax assets are value relevant for equity investors, it is not clear that they provide a substantial buffer against downside risk for creditors. Credit market participants may use and interpret financial information in a different manner than their equity market counterparts (Holthausen and Watts 2001). In fact, Pettit et al. (2004) claim that the complexity and uncertainty of the information environment leads credit analysts to be extremely conservative in their interpretation of financial information.

Rating agencies do not provide comprehensive disclosure of the process used to determine creditworthiness. However, in an attempt to increase transparency, Standard & Poor's publishes criteria and guidance that governs the analytic basis for assigning credit ratings. One of the key ratios used to determine a firm's creditworthiness is a basic measure of leverage. Standard & Poor's criterion specifically states, "the nature and valuation of a company's asset mix is critical to determining the appropriate leverage for a given level of risk" (Standard & Poor's 2008). Their guidance explains that credit analysts make "analytical adjustments" to better reflect the reality of a firm's financial

performance and position. Standard & Poor's states that some of these adjustments are routine while others are made on a firm-by-firm basis. According to their published criteria, one potential adjustment to financial statement measures such as total assets and stockholder's equity is "the amount of deferred tax assets unlikely to be realized" (Standard & Poor's 2008). The level of deferred tax assets relative to total assets could clearly impact the denominator of a firm's leverage ratio.

The rating criteria developed by Standard & Poor's also includes an analysis of the varying conditions of economic stress that a firm can potentially withstand without defaulting on its financial obligations (Standard & Poor's 2013). In order to survive adverse economic conditions, firms need a level of assets that is sufficient to satisfy their liabilities and avoid default. In assessing the potential for recovery in the event of insolvency, credit analysts must assess the quality of the assets available to satisfy the claims of creditors. Deferred tax assets represent future tax deductions. If firms facing conditions of economic stress are unable to generate taxable income, then the benefits of deferred tax assets cannot be realized and are therefore of little value to creditors. Accordingly, I hypothesize the following:

> *Credit risk is increasing in the proportion of total assets that are composed of deferred tax assets.*

If credit analysts believe that the benefits associated with deferred tax assets are likely to be realized, then I would not expect to find an association between deferred tax assets and credit risk.

Section III: RESEARCH DESIGN

To examine the hypothesized association between deferred tax assets and credit ratings, I estimate the following ordered logit regression model:[6]

$$\begin{aligned} RATING_{it+1} = {} & \beta_0 + \beta_1 DTA_{it} + \beta_2 SIZE_{it} + \beta_3 LOSS_{it} + \beta_4 NUMLOSS_{it} + \beta_5 EARN_{it} \\ & + \beta_6 CFO_{it} + \beta_7 INT\_COV_{it} + \beta_8 BTM_{it} + \beta_9 LEV_{it} + \beta_{10} R\&D_{it} \\ & + \beta_{11} CAP\_INT_{it} + \beta_{12} STD\_ROA_{it} + \beta_{13} STD\_RET_{it} + \beta_{14} SUB_{it} \\ & + \beta_{15} AQ_{it} + \beta_{16} PBTD_{it} + \beta_{17} NBTD_{it} + \beta_{18} VA_{it} + \beta_{19} INTAN_{it} \\ & + \beta_{20} RATING_{it} + \Sigma\beta_{FF48} Industry_{jt} + \Sigma\beta_t Year_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

Variable definitions:

$RATING_{it+1}$ — Firm *i*'s Standard & Poor's domestic long-term issuer credit rating (splticrm) in year *t* + 1. Standard & Poor's letter ratings are assigned a number from 1 to 22 where AAA=22 (highest rating) and D=1 (lowest rating).

DTA_{it} — Firm *i*'s deferred tax assets in year *t,* scaled by total assets (at) at the end of year *t*. Deferred tax assets (txndba) are measured net of the valuation allowance.

$SIZE_{it}$ — The size of firm *i* in year *t*. Size is measured as the natural logarithm of total assets (at) at the end of year *t*. (I am just curious why you used at instead of TA?

$LOSS_{it}$ — Equal to 1 if firm *i*'s basic earnings per share before extraordinary items (epspx) is less than zero in year *t*; zero otherwise.

$NUMLOSS_{it}$ — Firm *i*'s number of continuous prior periods with a reported loss ($LOSS_{it}$ = 1).

$EARN_{it}$ — Firm *i*'s earnings before extraordinary items (ib) in year *t,* scaled by total assets (at) at the end of year *t* - 1.

CFO_{it} — Firm *i*'s operating cash flow (oancf) in year *t*. Cash flow from operations is scaled by total assets (at) at the end of year *t* - 1.

INT_COV_{it} — Firm *i*'s times-interest-earned ratio in year *t*. INT_COV_{it} is calculated as the natural logarithm of (1 + times-interest-earned

[6] The model is estimated with clustered robust standard errors to correct for heteroskedasticity and serial dependence (Rogers 1993).

ratio). The times-interest-earned ratio is equal to operating income before depreciation and interest expense (oibdp + xint) divided by interest expense (xint), all measured at the end of year *t*.

BTM_{it} — Firm *i*'s book-to-market ratio in year *t*. The book-to-market ratio is the natural logarithm of firm *i*'s book value of equity (ceq) divided by its market value of equity (csho*prcc_f), both measured at the end of year *t*.

LEV_{it} — Firm *i*'s leverage in year *t*. Leverage is equal to long-term debt (dltt) scaled by total assets (at) at the end of year *t*.

$R\&D_{it}$ — Firm *i*'s research and development expense (xrd) in year *t,* scaled by total assets (at) at the end of year *t*.

CAP_INT_{it} — Firm *i*'s capital intensity in year *t*. Capital intensity is equal to property, plant, and equipment net of depreciation (ppent) scaled by total assets (at) at the end of year *t*.

STD_ROA_{it} — Firm *i*'s standard deviation of ROA in year *t*. Firm *i*'s standard deviation of ROA in year *t* is calculated using five years of data from year $t - 4$ to year *t*. ROA is equal to net income before extraordinary items (ib), scaled by total assets (at) at the end of year $t - 1$.

STD_RET_{it} — The standard deviation of daily stock returns for firm *i* in year *t*.

SUB_{it} — An indicator variable for firm-years with subordinated debt. Equal to 1 for firm-years with a positive value for subordinated debt (ds) in year *t*; zero otherwise.

AQ_{it} — Firm *i*'s accruals quality in year *t*. Accruals quality is estimated using the methodology described in Francis et al. (2005). Discretionary accruals are calculated based on the model developed by Dechow and Dichev (2002) and amended by McNichols (2002). Discretionary accruals are equal to firm *i*'s residuals from regressing total current accruals on cash flows from year $t - 1$, current cash flows from year *t*, cash flows from year $t + 1$, changes in revenue, and property, plant, and equipment for firm *i*'s Fama and French (1997) industry group. Accruals quality is measured as the standard deviation of discretionary accruals for the five-year period from year $t - 4$ to year *t*.

BTD_{it} — Firm *i*'s book-tax difference in year *t* scaled by total assets (at) at the end of year $t - 1$. The book-tax difference is equal to book income minus taxable income. Book income is pre-tax book

	income (pi) minus minority interest (mii). Taxable income is estimated as the sum of federal tax expense (txfed) and foreign tax expense (txfo) divided by the top U.S. statutory tax rate minus the change in net operating loss carryforward (tlcf). If federal or foreign tax expense is missing, tax expense is calculated as total income tax expense (txt) minus deferred income tax expense (txdi).
$PBTD_{it}$	Decile rank of firm-years when BTD_{it} is greater than or equal to zero; zero otherwise.
$NBTD_{it}$	Decile rank of the absolute value of BTD_{it} for firm-years when BTD_{it} is less than zero; zero otherwise.
VA_{it}	An indicator variable that represents a material increase in the deferred tax asset valuation allowance. The measure, developed by Dhaliwal et al. (2013), is equal to 1 for firm-years with accounting losses (pi < 0) in year *t* and zero or positive deferred tax expense (txfed >= 0) in year *t*; zero otherwise.
$INTAN_{it}$	Firm *i*'s intangible assets (intan) in year *t* scaled by total assets (at) at the end of year *t*.
$RATING_{it}$	Firm *i*'s Standard & Poor's domestic long-term issuer credit rating (splticrm) in year *t.* Standard & Poor's letter ratings are assigned a number from 1 to 22 where AAA=22 (highest rating) and D=1 (lowest rating).
$Industry_{jt}$	Equal to 1 if firm *i* is a member of industry *j* in year *t*; zero otherwise. Firms are assigned to industry categories using the Fama and French (1997) industry classification.
$Year_t$	Equal to 1 if observation *i* is in year *t*; zero otherwise.

The dependent variable ($RATING_{it+1}$) represents firm *i*'s Standard & Poor's domestic long-term issuer credit rating in year $t + 1$. Standard & Poor's uses a letter rating system that ranges from AAA (the highest rating, indicating extremely strong capacity to meet financial commitments) to D (the lowest rating, indicating default on financial commitments). In order to estimate the model presented above, I convert the letter ratings to a numeric scale ranging from 1 to 22 where D=1 and AAA=22.

Consistent with prior literature, ratings are measured at year $t + 1$ to provide reasonable assurance that all of the explanatory variables (measured at time t) are available to credit analysts at time $t + 1$.[7] I utilize an ordered logit model because ordinary least squares estimation is not appropriate for ordinal dependent variables such as credit ratings. The intervals between the different letter ratings assigned by Standard and Poor's are not likely to be equal.[8]

The primary variable of interest is DTA_{it}, which represents firm i's deferred tax assets in year t, net of the valuation allowance, scaled by total assets. I hypothesize that increasing levels of deferred tax assets will be associated with lower credit ratings. Therefore, I expect a negative coefficient on DTA_{it}. This result would provide evidence that the rating agency's assessment of credit risk is increasing in the proportion of total assets that are composed of deferred tax assets.

A large number of credit rating studies in the extant literature build upon the work of Kaplan and Urwitz (1979). The authors developed a foundational model for understanding the determinants of credit ratings. They find that credit ratings are associated with measures of firm size, leverage, profitability, firm risk, and the subordination status of the issue. To control for size, I include the natural logarithm of

[7] In additional analysis, I use a contemporaneous measure of credit ratings ($RATING_{it}$) as the dependent variable. Edwards (2011) finds evidence that credit rating analysts are able to gain access to private information through their exclusion from Regulation FD in order to make more timely changes in their credit ratings.

[8] In untabulated analysis, I use an ordered logit model to regress changes in credit ratings on changes in deferred tax assets and a vector of control variables for my full sample of firms. Inferences from this estimation are consistent with the levels specification. Because credit ratings are notoriously "sticky" (Pettit et al. 2004), a changes specification would potentially provide a more powerful test of my hypothesis. However, while an ordered logit model is appropriate for ordinal dependent variables, such as credit ratings, it is not clear that it would be appropriate for a dependent variable that is measured as a change in credit rating. For example, a rating downgrade from A+ to A- would be coded as a (-2) while a downgrade from BBB- to BB+ would be coded as a (-1). However, the downgrade from BBB- to BB+ may be more significant because it represents the change from an investment grade rating to a non-investment grade rating.

total assets in year t ($SIZE_{it}$). I expect to find a positive association between $RATING_{it+1}$ and $SIZE_{it}$.[9] To control for leverage, I include a measure of long-term debt (LEV_{it}). I expect to find a negative coefficient on LEV_{it}. I control for profitability by including an indicator variable equal to 1 if a firm has negative book income in the current year ($LOSS_{it}$), and a measure of earnings ($EARN_{it}$). I expect to find a negative association between $RATING_{it+1}$ and $LOSS_{it}$ and a positive association between $RATING_{it+1}$ and $EARN_{it}$. Additionally, to control for firms that have a continuous record of performance, I include $NUMLOSS_{it}$, which counts the number of continuous prior periods with a reported loss. I expect a negative coefficient on $NUMLOSS_{it}$. To control for the relation between firm risk and credit ratings, I include proxies for operating uncertainty STD_ROA_{it}, return volatility STD_RET_{it}, and growth opportunities $R\&D_{it}$. I expect a negative coefficient on all three of the variables that proxy for firm risk. I also control for firms that carry subordinated debt (SUB_{it}). I expect a negative association between SUB_{it} and $RATING_{it+1}$.

Francis et al. (2005) find that lower accruals quality is associated with lower credit ratings. To control for accruals quality, I include a measure that captures the standard deviation of a firms discretionary accruals (AQ_{it}). Higher levels of AQ_{it} are associated with lower accruals quality. Consistent with prior research, I expect to find a negative association between AQ_{it} and $RATING_{it+1}$. Crabtree and Maher (2009) and Ayers et al. (2010) find that book-tax differences are associated with credit ratings. I include measures of both positive ($PBTD_{it}$) and negative book-tax differences ($NBTD_{it}$). These controls are important because their presence in the model will make it possible to

[9] Inferences from estimating Equation (1) do not change if the log of market value of equity is used as a measure of size.

determine whether or not the relation between deferred tax assets and credit ratings is incremental to the information content of total book-tax differences. I expect the coefficients on $PBTD_{it}$ and $NBTD_{it}$ to be negative. I also control for capital intensity (CAP_INT_{it}). I expect a positive coefficient on CAP_INT_{it} because firms with greater capital intensity potentially present lower risk to creditors (Edwards 2011). To control for firms' ability to repay debt and general performance, I include cash flow from operations (CFO_{it}), interest coverage (INT_COV_{it}), and the book-to-market ratio (BTM_{it}). I expect positive coefficients on CFO_{it} and INT_COV_{it} and a negative coefficient on BTM_{it}.

The variable of interest, DTA_{it}, is measured net of a valuation allowance. Behn et al. (1998) find that the valuation allowance is positively associated with financial distress and material contingent liabilities. Since data on the valuation allowance is not machine readable, I use an indicator variable (VA_{it}) developed by Dhaliwal et al. (2013) to estimate firm-years with a material increase in the valuation allowance. Edwards (2011) finds evidence that material increases in the valuation allowance represent an implicit management forecast of poor future performance. Therefore I expect a negative coefficient on VA_{it}.

I include $INTAN_{it}$ to control for intangible assets. I predict a negative coefficient for $INTAN_{it}$ because intangible assets could potentially have no realizable value for creditors in the event of default. Because of the sticky nature of credit ratings, I include a control for the rating in year t ($RATING_{it}$). Finally, I include industry ($Industry_{jt}$) and year ($Year_t$) indicator variables to control for industry-specific and time characteristics.

Section IV: SAMPLE SELECTION

I test my hypothesis by examining a sample of firms covered by Standard & Poor's domestic long-term issuer credit ratings for the years 1993 to 2011. Data collection begins in 1993 to provide reasonable assurance that all firms have adopted SFAS 109. Consistent with prior literature examining the information content of tax accounts reported in the financial statements, I exclude firms classified as financial institutions (SIC codes 6000-6999), public utilities (SIC codes 4900-4999), and firms incorporated outside of the United States (Ayers et al. 2010; Crabtree and Maher 2009). The basis for excluding these firms is the fact that they face different regulatory, financial reporting, and tax issues relative to the remaining population of Compustat firms. I obtain Standard & Poor's credit rating data from the Compustat Ratings file. Financial accounting data is obtained from the Compustat Fundamentals Annual file. Returns data is collected from the Center for Research in Security Prices.

Table 1 outlines the details of the sample selection process. I begin with 36,764 firm-years for which Compustat reports Standard & Poor's credit ratings during my sample time period. I exclude 15,618 observations related to financial institutions, utilities, and firms incorporated outside the U.S. I lose 7,517 observations for firms missing data on my variable of interest, deferred tax assets.[10] I remove an additional 8,910 firm-years with insufficient information to calculate various control variables. The final sample consists of 4,719 firm-year observations.

[10] Poterba et al. (2011) hand collect tax data for a sample of 81 "super firms" and note that Compustat has been slow to encode and backfill data on deferred tax positions from the tax footnote.

Section V: RESULTS

Main results

Table 2 presents descriptive statistics for my sample. All continuous variables are winsorized at the 1st and 99th percentiles. The mean and median level of credit rating corresponds to a rating of BBB-. The sample includes firms with ratings from D through AAA. In untabulated analysis, the data shows that credit ratings remain constant in approximately 75 percent of the firm-year observations. The mean (median) level of deferred tax assets is 5.7 percent of total assets (4.8 percent of total assets).

Table 3, panel A, presents the results of estimating the ordered logit regression. I observe a negative and significant association between *DTA* and future credit ratings (coefficient = -2.850, p-value < 0.001). This finding provides support for my hypothesis that credit risk is increasing in the proportion of total assets that are composed of deferred tax assets. The evidence is consistent with credit market participants incorporating the risk associated with deferred tax assets into their assessment of credit risk and suggests that credit analysts do not value deferred tax assets as assets. The pseudo R^2 of the model is 61.86% and the majority of the coefficients on the control variables are consistent with expectations and prior research. The exceptions are a positive and significant coefficient on *NUMLOSS*, a positive but insignificant coefficient on *R&D*, a positive but insignificant coefficient on *STD_ROA*, and a positive and insignificant coefficient on *SUB*.

In order to assess the economic significance of the impact of deferred tax assets on credit ratings, I examine the difference in predicted probabilities of ratings upgrades and downgrades when the level of deferred tax assets moves from the first to the third

quartile of *DTA*, holding all other variables constant at their mean values. Table 3, panel B, demonstrates that moving from the first to the third quartile of *DTA* decreases the average firm's probability of a credit rating upgrade from 9.2 percent to 7.8 percent, which is associated with a 15.6 percent proportional decrease in the probability of an upgrade in year $t + 1$. Additionally, moving from the first to the third quartile of *DTA* increases the average firm's probability of a credit rating downgrade from 9.7 percent to 11.4 percent, which is associated with an 18.0 percent proportional increase in the probability of a downgrade in year $t + 1$.

Table 4, panel A presents the results of estimating a variation of the ordered logit regression with a contemporaneous measure of the dependent variable ($RATING_t$). I find a negative and significant association between *DTA* and contemporaneous credit ratings (coefficient = -2.575, p-value = 0.003). This finding is consistent with my hypothesis and provides evidence that credit rating analysts potentially have access to private information that enables them to make more timely changes in their ratings. The pseudo R^2 of the model is 63.96% and the majority of the coefficients on the control variables are consistent with expectations and prior research.

Table 4, panel B, presents the difference in predicted probabilities of ratings upgrades and downgrades when the level of deferred tax assets moves from the first to the third quartile of *DTA*, holding all other variables constant at their mean values. For the average firm, a move from the first to the third quartile of *DTA* is associated with a 15.5 percent proportional decrease in the probability of a credit rating upgrade in year *t* and an 18.0 percent proportional increase in the probability of a downgrade during year *t*.

Additional analysis

The consequences of a credit rating change for firms just above or below the threshold for investment grade debt may be particularly significant.[11] In additional analysis, I estimate the following ordered logit changes specification for a subsample of 429 firm-years with a BBB- rating ($RATING = 13$):

$$\begin{aligned}\Delta RATING_{it+1} &= \beta_0 + \beta_1 \Delta DTA_{it} + \beta_2 \Delta SIZE_{it} + \beta_3 LOSS_{it} + \beta_4 NUMLOSS_{it} \\ &+ \beta_5 \Delta EARN_{it} + \beta_6 \Delta CFO_{it} + \beta_7 \Delta INT\_COV_{it} + \beta_8 \Delta BTM_{it} + \beta_9 \Delta LEV_{it} \\ &+ \beta_{10} \Delta R\&D_{it} + \beta_{11} \Delta CAP\_INT_{it} + \beta_{12} \Delta STD\_ROA_{it} + \beta_{13} \Delta STD\_RET_{it} \\ &+ \beta_{14} SUB_{it} + \beta_{15} \Delta AQ_{it} + \beta_{16} \Delta PBTD_{it} + \beta_{17} \Delta NBTD_{it} + \beta_{18} VA_{it} \\ &+ \beta_{19} \Delta INTAN_{it} + \Sigma \beta_{FF48} Industry_{jt} + \Sigma \beta_t Year_{it} + \varepsilon_{it} \qquad (2)\end{aligned}$$

Table 5, panel A, presents the results of estimating the ordered logit changes specification. I observe a negative and significant association between ΔDTA and changes in future credit ratings (coefficient = -21.75, p-value = 0.009). This finding is consistent with my hypothesis and provides evidence concerning the impact of deferred tax assets on credit risk. The pseudo R^2 of the model is 14.13% and the majority of the coefficients on the control variables are consistent with expectations and prior research. Table 6, panel A, presents similar results and inferences (ΔDTA coefficient = -32.16, p-value < 0.001) from regressing contemporary changes in credit ratings ($\Delta RATING_t$) on changes in deferred tax assets (ΔDTA).

In order to assess the economic significance of the impact of changes in deferred tax assets on changes in credit ratings, I examine the difference in predicted probabilities of ratings upgrades and downgrades when the change in deferred tax assets moves from the first to the third quartile of ΔDTA, holding all other variables constant at their mean values. Table 5, panel B, demonstrates that moving from the first to the third quartile of

[11] Credit market participants generally consider ratings of BBB- or higher ($RATING_t >= 13$) to be investment grade while ratings of BB+ or lower ($RATING_t <= 12$) are considered to be speculative grade.

ΔDTA decreases the average firm's probability of a credit rating upgrade from 9.1 percent to 7.4 percent, which is associated with a 19.4 percent proportional decrease in the probability of an upgrade in year $t + 1$. Additionally, moving from the first to the third quartile of *ΔDTA* increases the average firm's probability of a credit rating downgrade from 5.8 percent to 7.2 percent, which is associated with a 24.7 percent proportional increase in the probability of a downgrade in year $t + 1$. Table 6, panel B, shows that, for the average firm, a move from the first to the third quartile of *ΔDTA* is associated with a 36.3 percent proportional decrease in the probability of a credit rating upgrade in year t and a 56.7 percent proportional increase in the probability of a downgrade during year t.

Section VI: CONCLUSION

This paper examines the relation between deferred tax assets and firm credit risk. Deferred tax assets may impact firm creditworthiness for at least two reasons. First, prior literature has documented conflicting evidence on the value relevance of deferred tax assets and whether or not these assets are priced by equity investors. Second, credit market participants are particularly concerned with a firm's downside risk. Deferred tax assets are inherently risky because their benefits are primarily realized through deductions from future taxable income. If a borrower's financial performance declines, deferred tax assets may provide no value to a creditor seeking to recover their investment in the event of default.

Using an ordered logit model, I regress Standard & Poor's credit ratings on deferred tax assets and a vector of control variables. I find a significant negative association between deferred tax assets and credit ratings. The evidence is consistent with credit market participants incorporating the risk associated with deferred tax assets into their assessment of credit risk and suggests that credit analysts do not value deferred tax assets as assets. The model estimates that moving from the first to the third quartile of deferred tax assets decreases the probability of a credit rating upgrade by 15.6 percent and increases the probability of a rating downgrade by 18.0 percent.

Credit ratings serve as a key metric for capital market participants. This study responds to calls for additional research on the extent to which credit market participants utilize the tax information disclosed in the financial statements. I extend the literature investigating the impact of book-tax differences on credit risk by contributing to our understanding of the balance sheet implications of accounting for income taxes.

Additionally, this study contributes to the broad literature of researchers modeling the credit rating process by documenting a potentially significant determinant of credit ratings.

The results of this study are subject to limitations. All firms in the sample elected to have their creditworthiness evaluated by Standard & Poor's. This potential sample selection issue may limit the generalizability of my results. Therefore, the associations and inferences from my tests may not be applicable to a broader population of Compustat firms.

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APPENDIX

TABLE 1
Sample selection

	Firm-years
Compustat observations with Standard & Poor's credit ratings	36,764
Less: financial institutions, utilities, and firms incorporated outside the U.S.	(15,618)
Less: observations with insufficient data to calculate deferred tax assets	(7,517)
Less: observations with insufficient data to calculate control variables	(8,910)
Final sample	4,719

TABLE 2
Descriptive Statistics

Variable	N	Mean	Std Dev	Min	25%	50%	75%	Max
$RATING_{t+1}$	4,719	12.809	3.523	1	10	13	15	22
$RATING_t$	4,719	12.904	3.482	1	10	13	15	22
DTA	4,719	0.057	0.042	0	0.026	0.048	0.077	0.216
SIZE	4,719	8.324	1.254	5.796	7.412	8.207	9.115	11.668
LOSS	4,719	0.172	0.377	0	0	0	0	1
NUMLOSS	4,719	0.430	1.257	0	0	0	0	13
EARN	4,719	0.050	0.072	-0.203	0.016	0.049	0.087	0.262
CFO	4,719	0.114	0.074	-0.047	0.064	0.105	0.156	0.355
INT_COV	4,719	2.304	0.799	0.824	1.728	2.195	2.724	5.050
BTM	4,719	0.462	0.494	-1.769	0.248	0.423	0.659	2.314
LEV	4,719	0.294	0.197	0.001	0.161	0.254	0.379	1.066
RND	4,719	0.016	0.032	0	0	0	0.017	0.157
CAP_INT	4,719	0.397	0.267	0.030	0.183	0.340	0.576	1.235
STD_ROA	4,719	0.045	0.046	0.004	0.016	0.029	0.055	0.271
STD_RET	4,719	0.026	0.014	0.010	0.017	0.023	0.031	0.085
SUB	4,719	0.205	0.404	0	0	0	0	1
AQ	4,719	0.176	0.383	0.009	0.031	0.059	0.134	2.665
PBTD	4,719	4.021	3.593	0	0	4	7	10
NBTD	4,719	1.672	2.913	0	0	0	3	10
VA	4,719	0.081	0.272	0	0	0	0	1
INTAN	4,719	0.195	0.192	0	0.039	0.138	0.298	0.775

Notes: This table presents sample descriptive statistics. $RATING_{t+1}$ is Standard & Poor's one-year ahead credit rating. $RATING_t$ is Standard & Poor's current year credit rating. *DTA* is deferred tax assets scaled by total assets. *SIZE* is the natural logarithm of total assets. *LOSS* is an indicator variable equal to 1 if basic EPS before extraordinary items is less than zero, and zero otherwise. *NUMLOSS* is the number of continuous prior periods with a reported loss. *EARN* is earnings before extraordinary items scaled by lagged total assets. *CFO* is operating cash flow scaled by lagged total assets. *INT_COV* is the times-interest-earned ratio. *BTM* is the book-to-market ratio. *LEV* is equal to long-term debt scaled by total assets. *R&D* is research and development expense scaled by lagged total assets. *CAP_INT* is property, plant, and equipment net of depreciation scaled by total assets. *STD_ROA* is the standard deviation of ROA over the past five years. *STD_RET* is the standard deviation of daily stock returns. *SUB* is an indicator variable equal to 1 for firm-years with subordinated debt, and zero otherwise. *AQ* is accruals quality, measured as the standard deviation of discretionary accruals for the past five years. *PBTD* is the decile rank of book-tax differences for firm-years with positive book-tax differences, and zero otherwise. *NBTD* is the decile rank of the absolute value of book-tax differences for firm-years with negative book-tax differences, and zero otherwise. *VA* is an indicator variable equal to 1 for firm-years with a material increase in the deferred tax asset valuation allowance, and zero otherwise. *INTAN* is equal to intangible assets scaled by total assets.

TABLE 3
Regression of future credit ratings on deferred tax assets

Panel A: Dependent variable $RATING_{t+1}$

	Predicted sign	Coefficient	P-value
DTA	-	-2.850***	0.000
SIZE	+	0.178***	0.000
LOSS	-	-0.449***	0.001
NUMLOSS	-	0.0868***	0.006
EARN	+	3.060***	0.000
CFO	+	3.027***	0.000
INT_COV	+	0.074	0.308
BTM	-	-0.747***	0.000
LEV	-	-1.721***	0.000
R&D	-	2.168	0.200
CAP_INT	?	-0.246	0.233
STD_ROA	-	0.532	0.507
STD_RET	-	-7.121*	0.088
SUB	-	0.190**	0.012
AQ	-	-0.154*	0.069
PBTD	-	-0.010	0.333
NBTD	-	-0.007	0.656
VA	-	-0.155	0.358
INTAN	-	-0.158	0.497
RATING	+	2.799***	0.000
INDUSTRY EFFECTS			Yes
YEAR EFFECTS			Yes
N			4,719
Psuedo R^2			61.86%

Panel B: Probability of a Credit Rating Change in Year t + 1

	Probability of an upgrade	Probability of a downgrade
DTA: 1st quartile	9.2%	9.7%
DTA: 3rd quartile	7.8%	11.4%
Change in probability	-1.4%	1.7%
Proportional change	-15.6%	18.0%

Notes: Panel A presents results for the estimation of Equation (1). All variables are defined in Table 2. *, ** and *** next to the coefficient estimates indicate a 10%, 5% and 1% significance level, respectively, using two-tailed tests. Panel B presents the changes in predicted probabilities of credit rating upgrades and downgrades as a result of moving between the first and third quartiles of deferred tax assets, holding all other variables constant at the sample mean.

TABLE 4
Regression of contemporaneous credit ratings on deferred tax assets

Panel A: Dependent variable $RATING_t$

	Predicted sign	Coefficient	P-value
DTA	-	-2.575***	0.003
SIZE	+	0.229***	0.000
LOSS	-	-0.416***	0.007
NUMLOSS	-	0.028	0.389
EARN	+	6.626***	0.000
CFO	+	-0.051	0.944
INT_COV	+	0.481***	0.000
BTM	-	-0.532***	0.000
LEV	-	-1.764***	0.000
R&D	-	-0.235	0.899
CAP_INT	?	0.019	0.931
STD_ROA	-	0.218	0.813
STD_RET	-	-53.83***	0.000
SUB	-	0.184**	0.029
AQ	-	0.023	0.800
PBTD	-	-0.004	0.736
NBTD	-	0.012	0.481
VA	-	-0.141	0.437
INTAN	-	-0.155	0.523
$RATING_{t-1}$	+	2.820***	0.000
INDUSTRY EFFECTS			Yes
YEAR EFFECTS			Yes
N			4,719
Psuedo R^2			63.96%

Panel B: Probability of a Credit Rating Change in Year t

	Probability of an upgrade	Probability of a downgrade
DTA: 1st quartile	7.4%	7.5%
DTA: 3rd quartile	6.2%	8.9%
Change in probability	-1.1%	1.4%
Proportional change	-15.5%	18.0%

Notes: Panel A presents results for the estimation of Equation (1) modified for a contemporaneous measure of the dependent variable. All variables are defined in Table 2. *, ** and *** next to the coefficient estimates indicate a 10%, 5% and 1% significance level, respectively, using two-tailed tests. Panel B presents the changes in predicted probabilities of credit rating upgrades and downgrades as a result of moving between the first and third quartiles of deferred tax assets, holding all other variables constant at the sample mean.

TABLE 5
Regression of changes in future credit ratings on changes in deferred tax assets

Panel A: Dependent variable $\Delta RATING_{t+1}$

	Predicted sign	Coefficient	P-value
ΔDTA	-	-21.75***	0.009
ΔSIZE	+	2.119*	0.066
LOSS	-	0.103	0.843
NUMLOSS	-	-0.314**	0.043
ΔEARN	+	5.433	0.268
ΔCFO	+	1.972	0.327
ΔINT_COV	+	0.457	0.361
ΔBTM	-	-1.795**	0.010
ΔLEV	-	-4.421***	0.008
ΔR&D	-	-14.790	0.627
ΔCAP_INT	?	1.539	0.379
ΔSTD_ROA	-	2.969	0.736
ΔSTD_RET	-	-0.620	0.977
SUB	-	0.311	0.400
ΔAQ	-	-1.378	0.302
ΔPBTD	-	-0.029	0.622
ΔNBTD	-	0.001	0.987
VA	-	-0.482	0.418
ΔINTAN	-	-1.791	0.581
INDUSTRY EFFECTS			Yes
YEAR EFFECTS			Yes
N			429
Psuedo R^2			14.13%

Panel B: Probability of a Credit Rating Change in Year t + 1 for Firms Rated BBB-

	Probability of an upgrade	Probability of a downgrade
ΔDTA: 1st quartile	9.1%	5.8%
ΔDTA: 3rd quartile	7.4%	7.2%
Change in probability	-1.8%	1.4%
Proportional change	-19.4%	24.7%

Notes: Panel A presents results for the estimation of Equation (2). All variables are defined as listed in Table 2 but are modified where appropriate for the changes specification. *, ** and *** next to the coefficient estimates indicate a 10%, 5% and 1% significance level, respectively, using two-tailed tests. Panel B presents the changes in predicted probabilities of credit rating upgrades and downgrades as a result of moving between the first and third quartiles of changes in deferred tax assets, holding all other variables constant at the sample mean.

TABLE 6

Regression of changes in contemporaneous credit ratings on changes in deferred tax assets

Panel A: Dependent variable $\Delta RATING_t$

	Predicted sign	Coefficient	P-value
ΔDTA	-	-32.16***	0.000
ΔSIZE	+	-2.199	0.101
LOSS	-	-1.251	0.205
NUMLOSS	-	-0.139	0.612
ΔEARN	+	-8.387**	0.047
ΔCFO	+	-0.882	0.655
ΔINT_COV	+	2.243***	0.000
ΔBTM	-	-1.122*	0.099
ΔLEV	-	-2.802	0.138
ΔR&D	-	-14.560	0.642
ΔCAP_INT	?	3.195	0.105
ΔSTD_ROA	-	-26.86**	0.018
ΔSTD_RET	-	-22.770	0.250
SUB	-	0.445	0.385
ΔAQ	-	-1.546	0.224
ΔPBTD	-	0.054	0.362
ΔNBTD	-	0.071	0.237
VA	-	0.219	0.845
ΔINTAN	-	-0.586	0.901
INDUSTRY EFFECTS			Yes
YEAR EFFECTS			Yes
N			429
Psuedo R^2			20.82%

Panel B: Probability of a Credit Rating Change in Year t for Firms Rated BBB-

	Probability of an upgrade	Probability of a downgrade
ΔDTA: 1st quartile	5.6%	4.0%
ΔDTA: 3rd quartile	3.5%	6.2%
Change in probability	-2.0%	2.3%
Proportional change	-36.3%	56.7%

Notes: Panel A presents results for the estimation of Equation (2) modified for a contemporaneous measure of the dependent variable. All variables are defined as listed in Table 2 but are modified where appropriate for the changes specification. *, ** and *** next to the coefficient estimates indicate a 10%, 5% and 1% significance level, respectively, using two-tailed tests. Panel B presents the changes in predicted probabilities of credit rating upgrades and downgrades as a result of moving between the first and third quartiles of changes in deferred tax assets, holding all other variables constant at the sample mean.

Vita

Scott White was born in St. Louis, MO, to David and Susan White. He is the first of four children: Pamela, Jonathan, and Laura. He attended Brown Elementary School in Florissant, MO and graduated from Parkway West High School in Ballwin, MO. He attended the University of Missouri-Columbia and graduated in 2001 with Bachelor of Science and Masters of Accountancy degrees. He married Megan Butler in 2005. He accepted a graduate research assistantship at the University of Tennessee-Knoxville in 2009. His first son, David, was born in 2012. Scott graduated with a Doctor of Philosophy degree in 2014.