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To the Graduate Council:

I am submitting herewith a dissertation written by Rebekah Daniele McCarty entitled "Optimal Tax Risk and Firm Value." 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.

Bruce K. Behn, Major Professor

We have read this dissertation and recommend its acceptance:

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Accepted for the Council:
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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

Optimal Tax Risk and Firm Value

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

Rebekah Daniele McCarty
May 2012

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ABSTRACT

I use the tax reserve data available from FIN 48 to investigate whether equity market value and tax risk exhibit a concave association, consistent with an optimal level of tax risk from an equity valuation standpoint. I find a concave association between tax risk and firm value which suggests firm value is increasing in tax risk at a diminishing rate until an optimal level is reached, after which firm value is decreasing in tax risk. I do not find evidence of excessive risk taking in the context of tax avoidance. Instead almost all firms in my sample are below the average implied optimal level of tax risk. Tax risk impacts firm value not only through its effect on expectations about future cash flows but also through its effect on the cost of equity capital. I also document a higher average optimal level of tax risk for firms where the CEO is not the chairman of the board, consistent with an agency view of tax avoidance. I find that institutional ownership levels moderate the association between tax risk and firm value but the average optimal level of tax risk does not vary with institutional ownership.

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1. INTRODUCTION

In the wake of recent accounting scandals and the financial crisis that began in 2007 investors have become increasingly concerned about excessive risk taking by high-level managers and CEOs. In the interest of increased short-term profits and stock prices, managers often engage in "risky activities that may be adverse to the interest of long-term investors and society" (Strine 2009). These activities may include excessive risk from increased leverage, investments in overly risky projects, or other speculative activities. While often overlooked, tax risk is an important type of risk that can generate significant costs (Wilson 2009) not only in terms of monetary penalties but also reputational damage. Tax risk is the degree of risk or uncertainty of sustainability inherent in a firm's tax positions. The potential costs from IRS detection and reversal of uncertain and risky tax positions create incentives to curb excessive risk taking. However, investors prefer some degree of tax risk despite the potential costs, since riskier tax planning activities provide opportunities for higher cash tax savings and higher after-tax earnings. In this paper, I use the tax reserves disclosed under FASB Interpretation No. 48 (FIN 48) to explore the association between tax risk and firm equity valuations.

Researchers have examined the relation between firm value and tax avoidance with mixed results.[1] While some studies have found firm value to be increasing in tax avoidance (Desai and Dharmapala 2009a; Koester 2011; Song and Tucker 2008), others have found negative market reactions to certain types of tax avoidance (Desai and Hines 2002; Hanlon

[1] Tax avoidance refers to "the reduction of explicit taxes" (Hanlon and Heitzman 2010, p.137) and encompasses all forms of tax planning regardless of uncertainty or risk. Tax avoidance includes but is not limited to tax risky positions. Most of the literature to-date has focused on tax avoidance in general or on "tax aggressiveness" which is similar in concept to tax risk.

and Slemrod 2009). The literature examining the agency perspective of tax avoidance and the role of governance (Desai and Dharmapala 2006, 2007, 2009a, 2009b; Chen et al. 2010) has provided deeper insights but has not been able to fully explain the association between firm value and tax avoidance.

I build on this literature by examining three aspects of the association between firm value and tax risk. First, I investigate the possibility of an optimal level of tax risk. Many researchers have alluded to or directly noted the likelihood of an optimal level of tax avoidance or tax aggressiveness (Balakrishnan et al. 2011; Brown et al. 2011; Cheng et al. 2011; Chyz et al. 2011; Crocker and Slemrod 2005; De Waegenaere et al. 2010; Hanlon and Slemrod 2009). From a theoretical standpoint, tax risk is accompanied by both costs and benefits which suggests an optimal level occurs where the marginal benefits equal the marginal costs. If there is some optimal level of tax risk from an equity valuation standpoint then the empirical relation between firm value and tax risk should be concave. All of the previous studies have relied on linear associations between tax risk and firm value or non-linearities due to mitigating factors such as governance. My study fills this gap in the literature by examining whether the relation between firm equity value and tax risk is concave, consistent with an optimal level of tax risk.

Second, I examine whether the association between firm value and tax risk is at least partially driven by a positive association between tax risk and the cost of equity capital. To my knowledge, no study has directly examined whether tax avoidance affects firm value only through expectations about future cash flows (numerator) or also through the discount rate applied to them, the cost of equity capital (denominator). Analyzing the specific mechanism

through which tax risk affects firm value is important for a thorough understanding of the relation between tax risk and firm value. If tax risk impacts not only expectations about future cash flows but also the cost of capital, the implication is that investors require compensation for information uncertainty caused by tax risk.

Lastly, I examine whether the associations between tax risk and firm value and tax risk and the cost of capital are attenuated by governance. According to an agency view of tax avoidance, tax risk facilitates managerial diversion because managers can justify obscurity on the premise that proprietary costs of tax risk need to be protected (Desai and Dharmapala 2006, 2007, 2009b). In this framework, governance restrains managerial opportunism that is afforded by tax risk (Desai and Dharmapala 2009a). If equity investors believe governance restrains managerial opportunism afforded by tax risk, then governance should moderate the association between tax risk and firm value and the association between tax risk and the cost of capital.

I find a concave association between firm value and tax risk that is robust to several specifications including a two-stage least squares estimation to correct for endogeneity. I find little evidence of excessive risk taking in the context of tax avoidance. In fact, almost all of the firms in my sample are below the average optimal level of tax risk, consistent with research that suggests firms under utilize tax saving strategies (Balakrishnan et al. 2011; Desai and Dharmapala 2009a; Rego and Wilson 2011; Weisbach 2002). The firms in my sample would have to increase their tax reserves by at least $733 billion, cumulatively, to get all firms to the average optimal level of tax risk. I find a positive association between tax risk and the equity cost of capital which implies that the association between firm value and tax

risk is driven not only by the effect of tax risk on expectations about future cash flows but also its effect on the discount rate applied to cash flows. Lastly, I find mixed evidence for the agency view of tax avoidance. Investors of firms where the CEO is not the chairman of the board are willing to bear more tax risk than investors of other firms. Institutional ownership also moderates the association between tax risk and firm value but the average optimal level of tax risk does not vary with institutional ownership. The results are mixed regarding whether the association between tax risk and the cost of capital is attenuated, or even eliminated, for better governed firms.

This study contributes to the accounting literature in several ways. First, my study answers several calls to research. Shackelford and Shevlin (2001) call for more research into tax aggressiveness, and Graham et al. (2011) call for more research regarding the equity valuation of tax reserves. A deeper, more refined understanding of this relation is needed given the mixed results from prior research. This is the first study to examine whether a concave association between firm value and tax risk is descriptive of the true nature of investor perceptions of tax risk. This is also the first study to directly investigate the relation between tax risk and the equity cost of capital.[2] I provide evidence in support of previous concerns that companies are below the optimal level of tax risk and provide an estimate of the economic impacts of the shortage. Lastly, I provide evidence regarding the agency view of tax avoidance and the impact governance has on the relation between tax risk and firm value.

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[2] In the context of earnings quality, Dhaliwal et al. (2008) examine the association between book-tax differences and the cost of equity capital. Although not the focus of the study, book tax differences have been used extensively to proxy for tax avoidance. My study is the first to examine the association between tax risk, a specific type of tax avoidance, and the cost of equity capital.

From a practical standpoint, policy makers and managers can use the results of this study as empirical evidence regarding how investors perceive tax risk. Although other stakeholders and concerns drive the decision to engage in risky tax behavior and my estimations are specific to my sample of firms, the economic magnitude of my results suggests that at least some firms are not taking full advantage of tax savings opportunities from an equity investor's standpoint.[3]

Understanding how shareholders view tax risk is pertinent for both managers and for policy makers. Tom Neubig and Balvinder Sangha, partners in the Quantitative Economics and Statistics practice of Ernst & Young LLP, argue that "it is imperative that strong corporate governance processes recognize this [tax] risk and that corporate boards and senior management deliberately decide how much tax risk is consistent with the overall corporate risk profile to satisfy shareholder expectations" (Neubig and Sangha 2004). The question for managers, then, is how does tax risk fit into overall firm risk and how do investors perceive tax risk? Managing the tradeoff between the costs inherent in risky tax transactions and the potential benefits is a difficult task. Finding the "optimal" level of tax risk depends on many factors including the risk preferences of each company's investors. My study provides important insights regarding those preferences.

In Section 2, I provide definitions and a brief background, a review of prior research, and the hypothesis development. Section 3 describes the research design, and Section 4 provides a description of the sample. I provide the main results in Section 5 and outline various additional analyses in Section 6. Section 7 concludes.

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[3] I report only the implied average optimal level of tax risk from an equity stakeholder's perspective and concede that there are other important determinants of tax behavior.

2. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Tax Risk and FIN 48

I define tax avoidance following Hanlon and Heitzman (2010) as "the reduction of explicit taxes" (p.137). Tax avoidance includes all types of managerial efforts and transactions intended to reduce the firm's taxes, whether clearly legal, uncertain, or illegal. Recent studies have proposed tax avoidance as a continuum of tax planning activities where highly certain (with regards to ultimate sustainability) transactions lie towards the left and highly uncertain transactions towards the right (Hanlon and Heitzman 2010; Lisowsky 2010; Lisowsky et al. 2011). For example, investments in municipal bonds (certainly legal) might be to the far left and tax evasion (which is illegal tax avoidance) would be to the far right (Hanlon and Heitzman 2010).

I define tax risk with respect to the position a firm's tax transactions have along such a continuum. Tax risk is the degree of risk or uncertainty of sustainability inherent in a firm's tax positions. Rego and Wilson (2011) state, "uncertain (i.e., aggressive or risky) tax positions are those that are supported by a relatively weak set of facts and are thus, less likely to be sustained upon audit" (p.4).[4] Using this definition, tax risk can also be understood as a subset of tax avoidance where the technical support and thus the ultimate sustainability for the tax position are less than certain.[5]

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[4] "Tax aggressiveness" has also been used in this literature to describe tax avoidance that is less than certain. Conceptually, it is similar to tax risk. However, given the varied definitions of tax aggressiveness, I limit my use of the term to descriptions of prior research and citations of previous findings.

[5] In this study, I use the term "tax risk" to describe both the degree of risk and also a subset of tax avoidance. I use "certain tax avoidance" to describe tax avoidance where the tax risk is very low or zero.

Tax risk is a construct that has been recognized in recent academic research (Brown et al. 2011; Chyz 2011; Chyz et al. 2011; Hanlon and Slemrod 2009; Rego and Wilson 2011) as well as in the business community (Neubig and Sangha 2004). To operationalize tax risk, I follow Brown et al. (2011) and use a firm's tax reserve disclosed under the requirements of FASB Interpretation No. 48 (FIN 48), *Accounting for Uncertainty in Income Taxes*, effective for year ends beginning after December 15, 2006.[6]

FIN 48 requires companies to disclose their unrecognized tax benefits and a roll-forward of the main components from the prior year. The balance of unrecognized tax benefits represents a liability (the tax reserve) for any positions taken on tax returns that might be questioned and potentially overturned by tax authorities. FIN 48 requires assessment of all tax positions using a two-step process. First the company must decide whether the tax position is "more-likely-than-not" to be sustained upon audit by tax authorities (and including potential litigation and appeals). Tax positions that do not meet the "more-likely-than-not" threshold require an offsetting reserve for the entire amount of the tax benefit. Positions that meet the "more-likely-than-not" threshold are measured as "the largest amount of tax benefit that is greater than 50 percent likely of being realized . . ." (FASB 2006). The difference between the tax benefit realized and this measured amount, if any, is recorded in the financial statements as the tax reserve.

The tax reserve is a better proxy for tax risk than extant measures of tax avoidance that rely on differences between book and taxable income or effective tax rates. Although many of these measures may be correlated with tax risk (Alexander et al. 2009; Cazier et al.

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[6] After the FASB codification in June 2009, the provisions of FIN 48 are now included in ASC 740-10.

2009; Frischmann et al. 2008), they do not specifically capture the degree of risk in a company's tax positions.[7] Tax reserves, on the other hand, explicitly capture those tax positions that are less likely to be sustained. Lisowsky et al. (2011) find that the ending balance of tax reserves is a predictor of tax shelters, a particularly aggressive form of tax avoidance. Other researchers have proposed using the tax reserve as a general proxy for tax aggressiveness (Alexander et al. 2009; Cazier et al. 2009; Frischmann et al. 2008; Hanlon and Heitzman 2010; Rego and Wilson 2011).

However, researchers have expressed concern about the measurement error inherent in using the tax reserve to proxy for tax risk given the reserve's susceptibility to managerial manipulation (Alexander et al. 2009; Cazier et al. 2009; Hanlon and Heitzman 2010; Koester 2011). Cazier et al. (2009) explain: " . . . if firms follow the recognition and measurement procedures prescribed by FIN 48, the amount of tax benefits recognized in the financial statements is a function of two factors: 1) how conservative the firm is in its financial reporting, and 2) how aggressive the firm is in its tax planning" (p.13). In fact, studies have found evidence of earnings management through the tax reserves although to a lesser extent in the post-FIN 48 period (Cazier et al. 2011; Gupta et al. 2011). Lisowsky et al. (2011) calculate a discretionary component of the tax reserve and find that it reduces but does not eliminate the usefulness of the reserve as a predictor of tax shelters, specifically. It is not

7 An alternative to book tax difference and effective tax rate measures is tax shelter probability scores. Although these scores reflect one of the most risky forms of tax avoidance they fail to account for any non-shelter risky tax transactions.

clear whether financial reporting tendencies are strong enough to negate the usefulness of the reserve as a general proxy for tax risk.[8]

Related Literature

A traditional view of corporate tax avoidance regards any activity that reduces cash payments for taxes as a value-enhancing transfer of wealth from the government to shareholders (Desai and Dharmapala 2009a). However, tax avoidance is not costless to the firm. Direct costs of implementing tax planning strategies include the time and resources of employees and fees paid to outside advisors (Rego and Wilson 2011). Tax risk – that is, risky forms of tax avoidance – is accompanied by additional benefits in the form of increased cash tax savings but also additional costs relative to certain tax avoidance. The additional costs include the potential for disallowance of tax savings, interest and penalties assessed by taxing authorities (Rego and Wilson 2011), accounting and legal costs for tax audits and litigation, the costs of obscuring the activities from tax authorities (Desai and Dharmapala 2009a), increases in future scrutiny from tax authorities (Koester 2011), and reputational and political costs from being considered a "poor corporate citizen" (Hanlon and Slemrod 2009; Rego and Wilson 2011; Watson 2011).

Recent literature grounded in agency theory has focused on another potential cost of tax risk – increased managerial diversion. Desai and Dharmapala (2006, 2007) argue that tax aggressiveness and managerial opportunism are complementary, and they call this perspective the "agency perspective on tax avoidance" (2007, p.3). Managers may claim that

[8] To address these concerns I control for financial reporting aggressiveness in the empirical design using discretionary accruals. I also employ an instrumental variables specification that controls for measurement error of the endogenous variable.

tax objectives necessitate obscurity related to their risky tax activities. They use this obscurity as a shield to participate in other types of opportunism or self-serving behavior (Desai and Dharmapala 2006, 2007, 2009b).[9]

Given the presence of the costs and benefits to tax risk, it is not clear how investors value tax risk. Researchers have provided mixed evidence on the equity valuation of tax avoidance in general and on the potential mitigating effects of governance in the presence of agency costs.[10] Desai and Dharmapala (2009a) examine a broad sample of publicly-traded companies and document a positive association between Tobin's Q and book-tax differences for firms with high levels of institutional ownership (and low levels of the Gompers et al. 2003 index) but no association in poorly governed firms. Within specific subsets of companies, some studies have documented a similar positive valuation of tax avoidance in well governed firms but no association in poorly governed firms (Cheng et al. 2011; Chyz et al. 2011). Other studies have found evidence supporting the view that investors are concerned about the increased managerial diversion afforded by tax avoidance but the results are mixed regarding whether tax avoidance is generally viewed positively (Wang 2010) or negatively (Dhaliwal et al. 2011).[11]

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[9] I refer to any activities "benefiting managers that are not in the interest of shareholders" (p. 172) as managerial diversion following Desai and Dharmapala (2009b). According to Wilson (2009), this may include "the excess consumption of perquisites or the pursuit of activities designed to mislead investors" (p. 970).

[10] Although several studies point to whether managers of high tax risk firms *actually* engage in increased managerial diversion (Blaylock 2011; Wang 2010; Dhaliwal et al. 2011), I limit my discussion to those studies that provide evidence about whether investors believe managers of high tax risk firms engage in increased managerial diversion since the latter are directly relevant to an equity valuation of tax risk. Other studies rely on firm behavior as a response to market demands to make inferences about investor perceptions regarding tax risk and agency costs (Chen et al. 2010; Desai and Dharmapala 2006; Seidman and Stomberg 2011).

[11] Results are also mixed regarding market reactions to participation in tax shelters specifically (Hanlon and Slemrod 2009; Wilson 2009).

A few studies have investigated the market valuation of the tax reserve using the first quarter of required disclosures. Song and Tucker (2008) find that the amount of firms' tax reserves is positively related to the market to book ratio. Frischmann et al. (2008) find a positive association between returns and the portion of the tax reserve that will impact the effective tax rate. Robinson and Schmidt (2011) find a positive market reaction to the 2007 first quarter tax reserve for large firms (S&P 500). For smaller firms (S&P 600) they find a positive reaction when disclosure quality is low and no reaction when disclosure quality is high, which suggests investors value tax risk but are also concerned about the proprietary costs of revealing too much information to taxing authorities.[12] To my knowledge, Koester (2011) is the only study that uses a broad sample of tax reserve data spanning several years to examine the association with firm value. Using tax reserve data from Compustat, she documents a positive association between firm stock price and the portion of the tax reserve expected to impact the effective tax rate, but only for companies with significant operations in tax havens.

Generally the results are mixed and often confusing given that certain subsets of firms seem to have no market reaction to tax avoidance. Based on the literature, it seems clear the association between tax risk and firm value is complex and warrants continued research. Regarding the agency view of tax avoidance, Blaylock (2011) notes there is not enough large

[12] This result suggests that financial reporting quality is an important variable when modeling the relationship between tax risk and firm value. I include firm size and the standard deviation of returns, both of which have been shown to be associated with disclosure quality in the annual report (Lang and Lundholm 1993). Following Robinson and Schmidt (2011) I also include a measure of debt which should be correlated with disclosure quality.

sample empirical evidence to determine conclusively whether it applies broadly in a U.S. setting.

In both the traditional tax avoidance literature and the agency view of tax avoidance, researchers have alluded to and often directly noted the possibility of an optimal level of tax avoidance (Balakrishnan et al. 2011; Brown et al. 2011; Cheng et al. 2011; Chyz et al. 2011; Crocker and Slemrod 2005; De Waegenaere et al. 2010; Hanlon and Slemrod 2009). Consistent with a typical optimization problem, investors want managers to maximize the benefits of tax avoidance net of the associated costs. More specifically, investors value tax risk until the marginal benefits no longer exceed the marginal costs. Hanlon and Slemrod (2009) label this level as "optimally aggressive" (p.126). If there is some optimal level of tax risk from an investor's perspective, firm value should be increasing at a diminishing rate until this optimal level is reached and decreasing in tax risk that goes beyond the optimal level. Empirically, this relation should manifest in a non-linear, concave association between firm value and tax risk. Despite the fact that researchers recognize the costs of tax avoidance and the implication of an optimal level, no study to-date has empirically investigated whether a concave relation exists.

Hypothesis Development

To demonstrate how tax risk affects firm value, I use a simplified equity valuation model. As shown in equation (1), firm value can be expressed as the expected value of future cash flows (C) divided by one plus a discount rate (r), where the discount rate is equal to the firm's cost of capital (i.e. the market's required rate of return).

$$Value = \sum_{i=1}^{T} \frac{C_i}{1 + r_i} \tag{1}$$

In a simple two period scenario equation (1) is reduced to

$$Value = \frac{C}{1 + r} \tag{2}$$

where the firm reveals the level of tax risk, R, at the beginning of period one and investors value the firm at the beginning of period one based on the observed level of R and expectations about cash flows during the time from period one to period two.[13] Holding pre-tax cash flows constant, future cash flows depend on whether the firm retains the expected tax savings from risky tax planning or whether taxing authorities disallow the tax savings and impose penalties. Following the spirit of the Hanlon and Slemrod (2009) model for tax sheltering, I express future cash flows in expected value terms as the sum of the probability of disallowance (p) times the net cash flows if tax savings are disallowed (D) and one minus the probability of disallowance times the net cash flows if tax savings are sustained (S).

$$p * (D) + (1 - p) * S \tag{3}$$

Koester (2011) details the ways tax risk impacts expectations about future cash flows. She describes three negative valuation effects. First, higher tax reserves increase the likelihood and thoroughness of audit and therefore the likelihood of disallowance for current year and prior tax positions. Also, riskier tax positions by definition have less technical support and are therefore more likely to be disallowed once discovered. Second, higher tax

[13] In this context, the period might be more than one year since tax returns are not filed until months after the financial year end and assessments of tax penalties often occur in later periods. The future cash flow implications, especially reputational penalties, of any one particular tax position might not fully manifest within one year.

reserves increase the likelihood and thoroughness of audit for future tax positions which means managers will either reduce future tax risk to avoid further scrutiny or incur greater costs to conceal the continued tax risk. Third, firms with high levels of tax risk might earn a negative reputation for being a "poor corporate citizen" which could affect future cash flows through relationships with customers and suppliers, increased Congressional scrutiny which leads to disallowance of tax preferences, or additional future costs if an unscrupulous manager is found to be engaging in other dishonest activities.

Koester (2011) also lists two positive valuation impacts of tax risk. First, firms engaging in high levels of tax risk may earn a positive reputation for being good stewards of firm resources. Second, if the benefits of tax risk are expected to be retained and current levels of tax risk are indicators about future levels of tax risk, then cash tax savings from both current tax positions and future tax positions should be higher.

Each of these valuation effects from tax risk can be incorporated in equation (3).[14] The first valuation effect noted by Koester (2011) relates to the probability of disallowance (p). To incorporate the others, let A represent the additional cash tax savings from engaging in risky tax avoidance and the positive reputation effects. If I is the after-tax cash flow assuming no risky tax planning then S=I+A. The additional cash tax savings and positive reputation effects are forfeited under the disallowance scenario. If the risky tax planning is discovered and disallowed, the firm will incur costs and penalties equal to f so that D=I-f. The costs and penalties may include expenses for litigation or tax audits, direct interest and

[14] Koester's (2011) second valuation effect is the probability of future scrutiny and its impact on manager behavior in future periods. I do not specifically incorporate this effect into the model because it is not relevant in this simplified two-period scenario.

penalties imposed by the taxing authority, or negative reputational penalties. The penalties are likely to be more severe when tax avoidance is riskier. Substituting these relationships into equation (3) yields the following:

$$p * (I - f) + (1 - p) * (I + A) \tag{4}$$

The probability of disallowance (p), the penalties (f), and the additional tax savings and positive reputation effects (A) are all increasing in tax risk as previously described. Expressing each of the terms in the model as its function of tax risk (R), equation (4) becomes:

$$p(R) * [I - f(R)] + [1 - p(R)] * [I + A(R)] \tag{5}$$

The impact of tax risk (R) on the expression is the first derivative as shown below.

$$-\frac{\partial f}{\partial R} * p(R) + \frac{\partial p}{\partial R} * [I - f(R)] - \frac{\partial p}{\partial R} * [I + A(R)] + \frac{\partial A}{\partial R} * [1 - p(R)] \tag{6}$$

Equation (6) simplifies to:

$$-\frac{\partial p}{\partial R} * [f(R) + A(R)] + \frac{\partial A}{\partial R} * [1 - p(R)] + -\frac{\partial f}{\partial R} * p(R) \tag{7}$$

Each of the partial derivative terms above are positive since penalties (f), additional cash tax savings (A), and the likelihood of disallowance (p) are increasing in tax risk. The result is that the first term of the expression is negative, the second is positive, and the last is negative. Therefore, it is not clear whether firm value is increasing or decreasing in tax risk. The direction depends on the relative magnitude of the three terms in the model. More importantly, the result demonstrates that the direction of the effect of tax risk on firm value depends on the level of tax risk (R), which indicates the relation is non-linear.

The second-order condition for a maximum, which would indicate that the non-linearity is specifically concave, requires the second derivative of the expression, shown below, to be negative.

$$-\frac{\partial^2 p}{\partial R^2} * [f(R) + A(R)] - 2\frac{\partial p}{\partial R} * \left[\frac{\partial f}{\partial R} + \frac{\partial A}{\partial R}\right] + \frac{\partial^2 A}{\partial R^2} * [1 - p(R)] + -\frac{\partial^2 f}{\partial R^2} * p(R) \tag{8}$$

For this expression to be negative, the following condition must be met:

$$\frac{\partial^2 A}{\partial R^2} * [1 - p(R)] < \frac{\partial^2 p}{\partial R^2} * [f(R) + A(R)] + 2\frac{\partial p}{\partial R} * \left[\frac{\partial f}{\partial R} + \frac{\partial A}{\partial R}\right] + \frac{\partial^2 f}{\partial R^2} * p(R) \tag{9}$$

Without knowing the specific form of the association between tax risk and the other parameters (A), (p), or (f), predictions about the second derivatives cannot be made. Whether the relation between tax risk and firm value is concave remains an empirical question. Based on the preceding discussion, there should be some optimal level of tax risk from equity investors' viewpoint where the marginal benefits of tax risk equal its marginal costs. This leads to my first hypothesis:

H1: There is a concave association between tax risk and firm value.

I may not find evidence of a concave association if there is no statistically significant relation at all between firm value and tax risk or if investors are unable to accurately glean any information from the FIN 48 disclosures. Also, it is possible that within the relevant range of my sample, the association between firm value and tax risk is purely linear. In other words, no firm in my sample has reached the level where investors believe the costs of tax risk outweigh its benefits.

It is also possible that tax risk affects the denominator of equation (2), the cost of equity capital through its impact on information uncertainty and information asymmetry.

There are three potential sources of information uncertainty and information asymmetry. First, risky tax avoidance creates information uncertainty since it is, by definition, less certain in terms of ultimate sustainability.[15] Second, Balakrishnan et al. (2011) explain that tax planning increases complexity in the organization which leads to increased information uncertainty and information asymmetry between investors if the complexity is not adequately communicated to stakeholders. Consistent with this argument, they find a positive association between tax aggressiveness and proxies for information uncertainty and information asymmetry. Last, according to an agency view of tax avoidance, information uncertainty and information asymmetry might also arise from investor perceptions about increased agency costs associated with tax risk.[16] Since information uncertainty and information asymmetry are associated with a higher cost of equity capital (Lang and Maffett 2011; Leuz and Wysocki 2008; Healy and Palepu 2001), it follows that tax risk should be associated with a higher cost of capital through its impact on these two constructs. Investors of tax risky firms will require a higher rate of return to compensate for the information uncertainty and information asymmetry generated from uncertain tax positions, increased organizational complexity, and increased agency costs.

H2: There is a positive association between tax risk and the implied cost of equity capital.

If tax risk is not associated with firm value (H1), then I do not expect an association between tax risk and the cost of capital. Results consistent with H1 but not H2 imply that tax

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[15] It could be argued that this particular source of information uncertainty is captured by the probability of disallowance (p) in the numerator of equation (2). I argue that tax risk affects investor perceptions of both the probability of disallowance (p) and also the dispersion of possible outcomes around (p), which reflects a denominator effect.

[16] Although Hanlon and Slemrod (2009) and Koester (2011) both allude to a numerator effect of increased agency costs, I predict a denominator effect consistent with other studies that refer to a price discount or a cost of capital effect (Balakrishnan et al. 2011; Chen et al. 2010; Dhaliwal et al. 2011;Wang 2010).

risk affects firm value through its impact on investor estimations of future cash flows but not through the discount rate. It is possible that uncertainty about tax outcomes, increased organizational complexity, and increased managerial opportunism associated with tax risk impact the numerator of equation (2) rather than the denominator, indicating that investors actually change their estimation of future cash flows rather than applying a higher discount rate. However, this would seem to contradict prior literature which finds a positive association between information uncertainty and the cost of equity capital.

If investors discount firm value due to information uncertainty and information asymmetry induced by tax risk, governance should attenuate this association to the extent better governed firms are more equipped to manage risks and restrain managers from engaging in excessive tax risk. Investors of well governed firms should also have less concern about increased managerial diversion because governance acts as a monitor to restrain managers. Investors should be willing to bear more risk since the associated costs of tax risk are lower in the presence of good governance. Therefore, the optimal level, where the marginal benefits equal the marginal costs, should be higher for better governed firms since information uncertainty and asymmetry costs are lower. This leads to my third and fourth hypotheses:

H3a: The implied average optimal level of tax risk is higher for well governed firms than for poorly governed firms.

H3b: The positive association between tax risk and the implied cost of equity capital is lower for well governed firms than for poorly governed firms.

3. RESEARCH DESIGN

Tax Risk and Firm Value

To examine the association between tax risk and firm value (H1), I estimate the following equation:

$$LOG_MKT_VALUE_{i,t} = \beta_0 + \beta_1 TAXRISK_{i,t} + \beta_2 TAXRISK_SQ_{i,t} + \beta_k Controls_{i,t} + \varepsilon_{i,t} \qquad (10)$$

$LOG_MKT_VALUE_{i,t}$[17]	= natural log of the market value of equity on the first business day after the 10-K filing date with available data following Koester (2011);
$TAXRISK_{i,t}$	= the balance of the tax reserve (liability for uncertain tax positions under FIN 48) at time t scaled by total assets and multiplied by 100;
$TAXRISK_SQ_{i,t}$	= TAXRISK squared;
$DISCR_ACCRUALS_{i,t}$	= pre-tax, performance adjusted discretionary accruals following Frank et al. (2009);
$FOREIGN_INCOME_{i,t}$	= absolute value of pre-tax foreign income or loss scaled by total assets;
$NOL_{i,t}$	= tax loss carry-forward scaled by total assets, or zero if missing;
$LT_DEBT_{i,t}$	= sum of long-term debt and debt in current liabilities scaled by total assets;
$SALES_GROWTH_{i,t}$	= average percentage change in sales over the last three years;
$LOSS_{i,t}$	= indicator equal to 1 if the current year income before extraordinary items is less than zero, and zero otherwise;
$STD_DEV_RETURNS_{i,t}$	= standard deviation of monthly returns for the last five years requiring data for at least 24 out of the last 60 months;
$LOG_AGE_{i,t}$	= natural log of the age of the firm measured using the number of years the firm has been covered by CRSP.

I use the ending balance in the tax reserve as my proxy for TAXRISK rather than the change in total reserve or the change in a specific component of the tax reserve. The ending

[17] The concave association between TAXRISK and firm value is robust to the following alternative specifications of firm value: raw market value of equity, market value of equity scaled by assets, log of the market value of equity scaled by assets, log of the market value of equity using CRSP prices (the main specification uses Compustat prices), Tobin's Q following the specification in Desai and Dharmapala (2009a) that excludes deferred taxes to avoid a mechanical association, and Tobin's Q using the standard Kaplan and Zingales (1997) specification.

balance is most appropriate in this setting because it reflects the firm's overall cumulative exposure to the additional costs associated with tax risk. I expect β_1 to be positive and β_2 to be negative if the association between tax risk and firm value is concave (H1).

I rely on literature examining the association between tax avoidance and/or governance and firm value (Adams and Santos 2006; Brown and Caylor 2006; Cheng et al. 2011; Desai and Dharmapala 2009a; Song and Tucker 2008; Wang 2010) to determine a set of control variables expected to be associated with firm value. All variables are defined in Appendix A. I also include year fixed effects and industry fixed effects based on the Fama-French twelve industry classification and cluster standard errors by firm.

It is possible that TAXRISK is endogenous due to measurement error from its susceptibility to manipulation, reverse causality, or an un-measurable omitted variable that impacts both TAXRISK and firm value. I test for endogeneity using the Durbin-Wu-Hausman test applied to an instrumental variables estimation. However it is difficult to find any instrument that is strongly associated with tax risk but not firm value except through its impact on tax risk and the other variables in the model (Adams and Santos 2006).

The lagged value of an endogenous variable can be an appropriate instrument, especially in cases of measurement error (Klassen and Laplante 2011; Greene 2003). Klassen and Laplante (2011) argue that "lagged values are good instruments if the underlying construct is more persistent" (p.16). I contend that tax risk is relatively persistent since managers typically engage in long-term tax planning efforts and employ similar tax strategies from year to year. The correlation coefficient between TAXRISK and its lag is 0.87 indicating a strong level of persistence.

To test for endogeneity I estimate model (10) using two-stage least squares where the first stage model is TAXRISK regressed on the lagged value of TAXRISK (and all the other control variables). The partial F test for the lagged value of tax risk in this first stage regression is statistically significant at 1575.36 and the R^2 of the model is 0.78 which suggests the lag is a strong instrument.[18] I substitute the predicted value of TAXRISK and the square of the predicted value into model (10). Wooldridge (2010) explains that this procedure does not produce consistent estimators since the square of the linear predicted value of tax risk is not the same as the predicted value of the square of tax risk. To correct for the inconsistency, I use Stata's bootstrapping option which produces standard errors by taking a number of different random samples from the data and re-estimating the parameters. Then a standard error is calculated as the sample standard deviation of the various estimates of the parameters (Wooldridge 2009). Wooldridge (2009) explains that bootstrapping is useful in various situations where the typical formulas for standard errors are not appropriate.

Applying the Durbin-Wu-Hausman test to this two-stage least squares estimation, I am unable to reject the null hypotheses that the regressors are exogenous. Although the results suggest endogeneity is not a concern, the validity of this test relies on good instruments. To the extent the lagged value of TAXRISK does not meet the requirements of a valid instrument, the test could be mis-specified. I provide results using both OLS and two-stage least squares. In addition, I estimate model (10) substituting lagged values of TAXRISK and TAXRISK_SQ for the contemporaneous values. This specification corrects for reverse causality since the prior year's tax reserve is not determined by the current year's

[18] Staiger and Stock (1997) explain that a first stage F statistic less than 10 is indicative of a weak instrument.

market value, but it does not correct for measurement error since any measurement error in TAXRISK should also affect the lag.

Tax Risk and Cost of Equity Capital (H2)

To examine the association between tax risk and cost of equity capital (H2), I estimate the following equation:

$$r_{i,t} = \alpha_0 + \alpha_1 TAXRISK_{i,t} + \alpha_2 BETA_{i,t} + \alpha_3 DISPERSION_{i,t} + \alpha_4 BOOK_TO_MARKET_{i,t} + \alpha_5 LEVERAGE_{i,t} + \alpha_6 LOG_ASSETS_{i,t} + \alpha_7 LT_GROWTH_PRED_{i,t} + \varepsilon_{i,t} \quad (11)$$

where r is the implied cost of equity capital on the closest IBES statistical period date occurring after the 10-K filing date. Botosan et al. (2011) test the construct validity of several of the literature's proxies for implied cost of equity capital. They find validity for only two measures, r_{PEG} and r_{DIV} and recommend researchers use these measures. Both measures are derived from a dividend discount model and a series of assumptions about abnormal earnings and earnings growth. R_{PEG} is the Price to Earnings-Growth ratio derived in Easton (2004) and r_{DIV} relies on the target price method from Botosan and Plumlee (2002). The two measures are defined in Appendix A, and I follow the Botosan et al. (2011) specification for both.

I control for BETA, the standard deviation of analyst earnings forecasts divided by the absolute value of the mean analyst forecast (DISPERSION), the book to market ratio (BOOK_TO_MARKET), LEVERAGE, LOG_ASSETS, and the analyst consensus long-term growth forecast (LT_GROWTH_PRED) following Ghoul et al. (2011). All variables are defined in Appendix A. I include year and industry fixed effects and cluster standard errors by firm.

Governance Cross Sectional Analyses (H3a and H3b)

To test whether the implied optimal level of tax risk is higher for well governed firms (H3a), I include a proxy for governance and interact it with both TAXRISK and TAXRISK_SQ. Similarly, I include each governance variable and its corresponding interaction in model (11) to examine whether the effect of tax risk on the cost of capital is attenuated by governance (H3b).

Results from these analyses are likely sensitive to the type of governance measure used. Desai and Dharmapala (2009a) and Chyz et al. (2011) find that institutional ownership and institutional ownership turnover are significant mitigating factors on the relation between tax avoidance and firm value. I use the percentage of shares held by institutional owners to control for monitoring of managerial behavior. I specify INST_OWN as 1 when the institutional ownership is greater than the sample mean of 67.0 percent and designate these as "well-governed" firms following Desai and Dharmapala (2009a). If investors of better monitored firms are less concerned about the potential agency costs of tax risk, then better monitored firms should have a higher implied optimal level of tax risk (H3a) and a weaker association between tax risk and the cost of capital (H3b).

While institutional owners may have greater incentives to monitor managerial behavior (Desai and Dharmapala 2009a), they also have different risk preferences. A higher implied optimal level of tax risk for firms with high levels of institutional ownership might reflect differences in risk preferences. Researchers have highlighted differences in tax aggressiveness driven by varying risk preferences (Badertscher et al. 2011; Chyz et al. 2011; Chen et al. 2010; Khurana and Moser 2009).

To supplement the governance analysis, I also employ a proxy for managerial entrenchment. Rego and Wilson (2011) argue that proxies for managerial entrenchment are most consistent with the agency view of tax avoidance from Desai and Dharmapala (2006) because managers who are insulated from removal are more likely to engage in diversion. Following Rego and Wilson (2011), I use an indicator variable equal to zero when the CEO is also the chairman of the board of directors (CEO_CHAIRMAN), which suggests increased managerial entrenchment. If investors believe entrenched managers are more likely to engage in diversion, then firms with a CEO who is not the chair should have a higher implied optimal level of tax risk (H3a) and a smaller association between tax risk and cost of equity capital (H3b).

4. SAMPLE AND DESCRIPTIVE STATISTICS

All tables are included in Appendix B. Table 1, Panel A outlines the sample selection. I start with all firm-years ending between December 16, 2007 (the effective date for FIN 48) and July 31, 2011 that are included in the CRSP-Compustat Merged Database. I exclude foreign firms, subsidiaries of other firms, utilities (SIC code 49), and financial services firms (SIC codes 60-69). I eliminate firms with a missing 10-K filing date, negative stockholder's equity, missing tax reserve data, and missing control variables. The full sample consists of 5,947 firm-year observations across five years. For the firm value regressions (H1 and H3a), I also require observations to have the lagged value of TAXRISK since it is used as an instrument in the two-stage least squares estimation. The final sample for the firm value regressions consists of 4,128 firm-year observations, which represents 1,784 unique firms across four years. For the cost of capital regressions (H2 and H3b), I require the necessary data to calculate the cost of capital estimates as well as additional control variables. The final sample for the cost of capital regressions consists of 2,273 firm-year observations, which represents 1,174 unique firms across four years. Table 1, Panel B contains an industry breakout of the firm value sample based on the Fama-French 12 industry classification. The highest concentration of firm-years is in the Business Equipment industry with 26.4 percent. This industry also has the highest average TAXRISK at 2.3 percent of assets.

Table 1, Panel C contains descriptive statistics for variables of interest and variables entering the models. The average tax reserve balance is about $58.2 million but the median is about $4.8 million suggesting some subset of firms with extremely large tax reserves. TAXRISK ranges from zero to 11.7 percent of assets, with an average value of 1.4 percent of

assets. The descriptive statistics for the tax reserve variables are very similar to Koester's (2011) sample which comes from Compustat and Cazier et al.'s (2011) sample which is hand collected from the income tax footnotes. Table 2, Panel A provides correlations for variables in model (10) and Panel B provides correlations for variables in model (11).

5. EMPIRICAL RESULTS

Tax Risk and Firm Value (H1)

Table 3 contains results from estimating model (10). I present the results excluding the squared term (col. 1), using OLS (col. 2), using OLS and a lagged value of tax risk (col. 3), and using the instrumental variables with bootstrapping method discussed in Section 3 (col. 4). Consistent with prior studies (Koester 2011; Song and Tucker 2008), I find a positive association between tax risk and market value when I exclude the squared term (col. 1). The similarity between the results using the quadratic OLS model (col. 2) and the lagged model (col. 3) suggests reverse causality is not a strong concern in this model.

I find evidence in support of H1 across all three specifications that employ a squared term (cols. 2-4). The positive coefficient on TAXRISK and the negative coefficient on TAXRISK_SQ indicate a concave association between tax risk and firm value. These results suggest equity investors value tax risk at a decreasing rate until the optimal level is reached, at which point increased tax risk is detrimental to equity valuation of the firm.

Following Adams and Santos (2006) I provide the argmax of each estimation and the percent of observations below the argmax. The argmax represents the average implied optimal level of tax risk in this particular sample of firms using the given model specification. It is calculated by taking the partial derivative of model (10) with respect to TAXRISK, setting it equal to zero, and solving for the optimal level. The result is $TAXRISK^*=\beta_1 / (-2*\beta_2)$. The average implied optimal TAXRISK ranges from 6.0 percent of assets using the IV with bootstrapping method (col. 4) to 6.3 percent using the lagged model (col. 3). Almost all firms in the sample are below the average implied optimal level which

suggests that most firms can afford to engage in riskier tax planning from an equity valuation standpoint.[19]

Row (c) of Table 3 shows the increase in tax reserves necessary for the average firm to adjust to the implied optimal level. This analysis is based only on those firms that are below the average optimal level. For the average firm below the optimal level, equity investors would be willing to bear at least $200.5 million more in total tax reserves. The last row (d) of Table 3 contains the cumulative increase that would be required in this sample to increase all firms from their current level of tax risk to the average implied optimal level. In the quadratic OLS specification (col. 2), for example, if all firms were to adjust their tax reserves as a percentage of assets to the optimal level, it would require a cumulative net increase of $753.9 billion in tax reserves. These results demonstrate that the extent of less-than-optimal tax behavior is economically important.

These results must be interpreted with caution. I do not assert that the optimal level of tax risk for all firms is any particular number, that the optimal level is only a function of equity investor preferences, or that all firms should adjust to the average optimal level of tax risk. The argmax is an estimate of the average implied optimal level of tax risk based on this specific sample of firms and their equity investors' preferences. Since different types of stakeholders will have different risk preferences, and each firm has a unique mix of stakeholders, there is not one optimal level of tax risk. Certainly the true optimal level of tax risk for each firm depends on other stakeholders and other factors beyond the equity

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[19] It is not surprising that prior research has often found a positive linear association between tax risk and firm value given that the association is positive for most firms since they are below the optimal level. However, linear models fail to account for the diminishing rate of the positive impact of tax risk on firm value until the optimal level is reached.

valuation. Managers will engage in less tax risk than what is preferred by equity investors if managers' perceptions of the associated costs are higher than investors' perceptions of those same costs. Also, the argmax is based on the estimated parameters of the model which may not equate to the true values of these parameters if the model is mis-specified. Nevertheless, these results suggest that the equity stakeholders perceive important benefits to tax risk and the potential impacts on firm value are economically significant.[20]

Tax Risk and Cost of Equity Capital (H2)

The results of estimating model (11) using both r_{PEG} and r_{DIV} are shown in Table 4. The control variables are in the direction predicted by the literature and the same as in Ghoul et al. (2011) although most are not significantly different from zero in the r_{DIV} model (col. 2). TAXRISK is weakly significant and positive in both specifications suggesting that investors require a higher rate of return in the presence of riskier tax strategies to compensate for increased information asymmetry and/or information uncertainty. This result provides some evidence that tax risk increases the equity cost of capital (H2) but additional research is warranted since this is the first study to examine the association between tax reserves and the cost of capital. Nevertheless, this result is important because it points to a more complicated relation between firm value and tax risk than has previously been explored. Tax risk impacts not only expectations about future cash flows but also the discount rate applied to those

[20] This analysis assumes managers comply with FIN 48 by appropriately recording and disclosing their contingent tax liabilities. An alternative explanation is that managers do not comply sufficiently with FIN 48 in disclosing their true potential tax liabilities, in which case investors are not able to accurately assess the level of tax risk.

expectations. Future work in this area should consider the implications from both aspects of this association.

Tax Risk, Firm Value, and Governance (H3a)

Table 5 contains the results of estimating model (10) with a control for governance and an interaction of governance with TAXRISK and TAXRISK_SQ. Column 1 shows the results when governance is defined using an indicator for institutional ownership levels above the sample mean and column 2 uses CEO/chair duality. The control variable coefficients have been suppressed but are consistent with results in Table 3.[21] TAXRISK and TAXRISK_SQ are significant in the predicted directions indicating the concave relation between tax risk and firm value holds with the inclusion of a governance control.

In rows (a) and (b) of Table 5, I calculate the implied average optimal level of tax risk for well governed firms and for poorly governed firms by setting the first partial derivative equal to zero and evaluating it when GOVERNANCE=1 and GOVERNANCE=0, respectively. Using the Delta method, I test the nonlinear hypothesis that these two values are equal. As shown, the implied optimal level in firms with high levels of institutional ownership (col. 1) is not statistically different from the optimal level in firms with low levels of institutional ownership (p-value=0.296). This result is not consistent with H3a and suggests that investors of firms with higher levels of institutional ownership are not necessarily willing to bear more tax risk, on average, than investors of firms with lower levels of institutional ownership.

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[21] The coefficient on NOL is not significantly different from zero in the CEO/Chair duality specification.

This result does not mean that institutional ownership has no impact on the relation between tax risk and firm value. In fact, the effect of governance on this association can only be determined by evaluating the results at a given level of TAXRISK. The differential impact governance has on this relation is determined by the linear combination of $\beta_4 + 2*\beta_5*$TAXRISK. In the institutional ownership specification (col. 1), this linear combination is (untabulated) negative and significant when TAXRISK is less than 1.3 percent and positive and significant at levels greater than 7.8 percent (and not significant otherwise). For those firms with TAXRISK less than 1.3 percent (68.0 percent of my sample), higher levels of institutional ownership attenuate the positive impact of tax risk on firm value suggesting that firms with less institutional ownership have more to gain from increases in risky tax strategies. For firms with very high levels of tax risk, higher levels of institutional ownership reduce the negative impact on firm value. Thus, it seems, institutional ownership actually does moderate the association between tax risk and firm value even if the average optimal level implied by this specification does not differ based on level of institutional ownership.

In the CEO/chair duality specification (col. 2), I find results consistent with H3b. Firms with a CEO who is also the chairman of the board have an average optimal level of 4.9 percent of assets while other firms have an average optimal level of 7.7 percent. The difference between the two is statistically significant which suggests that investors of firms where the CEO is more insulated from removal are willing to bear less tax risk. Perhaps investors perceive higher agency costs associated with tax risk when the CEO is protected from removal consistent with an agency view of tax avoidance. These higher agency costs shift the optimal level, where the marginal costs equal the marginal benefits.

Tax Risk, Cost of Equity Capital, and Governance (H3b)

Table 6 contains the results from estimating model (11) with interactions of governance with TAXRISK using both institutional ownership and CEO/chair duality. Institutional ownership and CEO/chair duality do not have an independent effect on the cost of equity capital but TAXRISK remains positively associated with the cost of capital in all specifications except the r_{PEG} model using CEO/chair duality as the proxy for governance (col. 2). I find evidence in support of H3b in only one of the four specifications. In the r_{DIV} specification (col. 3), TAXRISK has a statistically significant impact of the cost of capital only in firms with low levels of institutional ownership, consistent with such investors requiring a higher rate of return to compensate for increased agency costs and/or information uncertainty that arises from tax risk.[22] Investors of firms with high levels of institutional ownership do not appear to require such a premium either because they believe such firms can better manage risk or because these firms have good monitoring in place to restrain the managerial diversion afforded by tax risk. These results should be interpreted cautiously since the r_{PEG} model does not corroborate the findings. I am unable to document evidence of a cross sectional difference in the association between tax risk and the cost of capital due to CEO/ chair duality.

[22] The coefficient for well governed firms is 0.002 (but not statistically different from zero) and for poorly governed firms is 0.007. The interaction term (coefficient=-0.005) suggests the difference between the two groups is statistically significant. In the CEO/chair duality specification (col. 4), the effect for well governed firms is 0.008 and for poorly governed firms is 0.004. However this difference is not statistically significant as indicated by the coefficient on the interaction term.

6. ADDITIONAL ANALYSES

Industry-Adjusted Tax Risk

Given that firms in the same industry tend to engage in the same type of tax strategies, investors may assess firm-specific tax risk in relation to firms in the same industry. To examine this possibility, I calculate an industry-adjusted TAXRISK by subtracting the median for each firm's industry-year, based on two-digit SIC codes, from the TAXRISK value of the firm. All results are robust to the industry-adjusted variable except the coefficient on adjusted TAXRISK is not significant in the r_{PEG} model that examines institutional ownership (Table 6, col. 1). A positive average optimum would imply that, on average, investors prefer firms that are tax-riskier (i.e. more tax aggressive) than the median firm. The main results from this analysis suggest the average implied optimal level of TAXRISK is 5.4 percentage points greater than the industry median consistent with a positive valuation of tax risky firms and a concave association between firm value and industry-adjusted tax risk.

Sample Partitions

To investigate whether the results in Table 3 are driven by the influence of a particular subset of firms within the sample, I run separate regressions after excluding the top decile of TAXRISK observations. The concave association between tax risk and firm value persists. The average optimal level after excluding the top decile firms is 2.1 percent of assets, substantially lower than the 6.1 percent optimal level shown in Table 3, column 2. This result is not surprising given the skewed distribution of TAXRISK and suggests that for

many firms, the true optimal level is lower than what is suggested by an average optimal level that accounts for all firms in the sample. The evidence continues to point to a lack of excessive risk taking in the context of tax planning since 89.8 percent of the reduced sample observations have a TAXRISK value less than 2.1 percent. The top decile alone does not result in a sample large enough to yield statistically significant coefficients on TAXRISK and TAXRISK_SQ so I am unable to accurately interpret the average optimal level for this particular subset of firms.

To further analyze these differences, I compare the firms in the top tenth of TAXRISK to all the other observations in my sample. Table 7 provides t-tests of the differences across all variables used in model (10). As shown, risky tax firms tend to have more foreign sales, more net operating losses, less long-term debt, more volatility, and lower sales growth. High TAXRISK firms also tend to be younger firms and are more likely to be in a current year loss position.

Higher Order Polynomials

I also examine the possibility that the true association between tax risk and firm value is a higher order polynomial function. I successively add higher order TAXRISK variables to model (10) beginning with a cubed term until the coefficients on these terms are no longer statistically significant at conventional levels. All TAXRISK coefficients continue to be highly significant until addition of the seventh power, in which case only TAXRISK and TAXRISK_SQ remain significant. Figure 1 depicts the association between tax risk and firm value using the results of estimating model (10) as a sixth order polynomial function of TAXRISK. The implied average optimal level for the sample using this estimation is 5.4

percent of assets, relatively similar to the main result of 6.1 percent of assets (Table 3, col. 2). However, there appears to be another local maximum at 11.4 percent of assets. The graph suggests over 95.0 percent of firms in the sample (those with a TAXRISK less than 5.4 percent) are below the average optimal level and could likely expect increases in tax risk to improve firm value, all else constant. Consistent with my main results, for most firms, value is increasing in tax risk at a decreasing (although not constant) rate up to some optimum and decreasing in tax risk beyond that optimal level. However, for those firms with very high levels of TAXRISK (above 9.3), increases in risky tax strategies might actually improve firm value. These results provide further evidence that the relation between tax risk and firm value is extremely complex. Nevertheless, for most firms, the sixth order polynomial function corroborates the main findings using a simpler quadratic model which suggests the quadratic version may be a more efficient tool for future research.

Other Robustness Checks

The results of Table 3 using the quadratic OLS specification are also robust to the following alternative specifications: 1) dropping all firm-years with a current year loss (1,273 observations), 2) dropping all firm-years where TAXRISK equals zero (399 observations), 3) inclusion of a variable to control for stock option compensation, 4) inclusion of research and development expenses scaled by assets, 5) replacing STD_DEV_RETURNS with BETA, 6) inclusion of a binary proxy for merger and acquisition activity based on the Compustat footnote codes for the *sale* variable, and 7) inclusion of a control for intangible assets and goodwill, scaled by assets.

7. CONCLUSION

I investigate whether there is an optimal level of tax risk from an equity valuation standpoint. Using the tax reserve disclosed under FIN 48 to proxy for tax risk, I find a concave association between tax risk and firm value consistent with an optimal level of tax risk. These results indicate that investors value tax risk up to some level, at which point the costs become too excessive and increases in tax risk are detrimental to firm value. The average implied optimal level of tax risk in my sample ranges from a tax reserve balance of 6.0 percent of assets to 6.3 percent of assets. I do not find evidence of excessive risk taking in the context of tax avoidance. Instead almost all firms in my sample are below the average optimal level and it would take at least $733 billion in cumulative increases in tax reserves to get all firms to the optimal level. The average implied optimal level of tax risk from an equity valuation standpoint tends to be higher for firms with lower levels of managerial entrenchment indicating that investors of these firms are willing to bear more tax risk. The average optimal level does not vary with the level of institutional ownership although institutional ownership moderates the association between tax risk and firm value.

I also document a positive association between equity cost of capital and tax risk which indicates that at least part of the association between tax risk and firm value is driven by the discount rate applied to expectations about future cash flows. Consistent with an agency view of tax avoidance, investors likely require a higher rate of return in tax risky firms to compensate for additional agency costs associated with tax risk. The evidence is mixed on whether the positive association between tax risk and the cost of equity capital is attenuated, or even eliminated, for better governed firms.

My study is limited by the specific sample of firms employed and the time period of available data. My estimates of the implied optimal level of tax risk cannot necessarily be applied to other firms during other time periods but provide some evidence about the economic magnitude of the shortage of tax risky behavior from an equity investor standpoint. My sample period is marked by severe economic downturns making it less generalizable than samples spanning longer time windows. These results should also be interpreted cautiously given that each firm has a different true optimal level of tax risk based on its various stakeholders' preferences and its managers' concerns. Lastly, to the extent that managers do not fully comply with FIN 48 in reporting tax reserves, my results might be indicative of under-reserving rather than a shortage of tax risk. Nevertheless, the results strongly suggest there is an optimal level of tax risk from an equity valuation standpoint, although it is different for every firm. These results are not consistent with excessive risk taking in the context of tax avoidance, and the economic magnitudes I report corroborate prior concerns that managers may not be fully taking advantage of tax savings opportunities.

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APPENDIX A: VARIABLE DEFINITIONS

All continuous variables winsorized at one and ninety-nine percent unless otherwise noted. CRSP, Compustat, and IBES variable names in parentheses.	
Variables in Firm Value Model (10)	
LOG_MKT_VALUE	Natural log of the market value of equity in millions using the Compustat daily price (prccd) and shares outstanding (cshoc) on the first business day (within 5 days) after the 10-K filing date with available price data from Compustat. Observations where the filing date was greater than 150 days after the fiscal year end were deleted.
TAXRISK	The balance of the tax reserve (liability for uncertain tax positions under FIN 48) (txtubend) at time t scaled by total assets (at), mutiplied by 100 to get the actual percent.
TAXRISK_SQ	TAXRISK squared.
DISCR_ACCRUALS	Pre-tax, performance adjusted discretionary accruals following Frank et al. (2009). I estimate the following modified Jones model (Dechow et al. 1995) by two digit SIC code and fiscal year for all U.S. firms in compustat with positive total stockholders' equity except for utilities, financial services, and subsidiaries of other companies, requiring each regression to have at least 10 firm-year observations. $TACC_{it}=\alpha_0 + \alpha_1(\Delta REV_{it} - \Delta AR_{it}) + \alpha_2 PPE_{it} + \eta_{it}$ All variables are scaled by beginning of year assets (at) and winsorized at 1 and 99 percent, and $TACC_{it}=(EBEI_{it} + TTE_{it}) - [(CFO_{it} + ITP_{it}) - EIDO_{it}]$. $EBEI_{it}$ = earnings before extraordinary items from the statement of cash flow for firm i in year t (ibc); TTE_{it} = total tax expense for firm i in year t (txt); CFO_{it} = cash flow from operations for firm i in year t (oancf); ITP_{it} = income taxes paid from the statement of cash flow for firm i in year t (txpd); $EIDO_{it}$ = extraordinary items and discontinued operations from the statement of cash for firm i in year t (xidoc); ΔREV_{it} = change in sales (revt) for firm i from year t-1 to year t; ΔAR_{it} = change in accounts receivable for firm i from year t-1 to year t (-1*recch); PPE_{it} = gross property, plant, and equipment for firm i in year t (ppegt); and η_{it} = discretionary accruals for firm i in year t before adjusting for performance. Following Frank et al. (2009) I calculate accruals on a pre-tax basis as shown above. After obtaining discretionary accruals for each firm year, I match each firm-year by industry and by decile of current pre-tax return on assets (PTROA=pi/lag at). For each industry-PTROA decile, the median observation is excluded. For all other observations, DISCR_ACCRUALS is the difference between η and the median η for the industry-PTROA decile group.
FOREIGN_INCOME	Absolute value of pre-tax foreign income or loss (pifo), scaled by ending total assets (at) at time t, or 0 if missing.
NOL	Tax loss carryforward (tlcf), scaled by ending total assets (at) at time t, or 0 if missing.
LT_DEBT	Long term debt (dltt) plus debt in current liabilities (dlc) at time t, scaled by ending total assets (at) at time t.
SALES_GROWTH	The 3 year average of the percentage growth in sales (sale) for years t, t-1, and t-2.
LOSS	Indicator equal to 1 if current year income before extraordinary items (ib) is less than 0; equal to 0 otherwise.

Variables in Firm Value Model (10) Continued	
STD_DEV_RETURNS	The standard deviation of CRSP monthly returns (ret) for the last five years ending in year t, where each firm-year is required to have 24 out of 60 months of available return data.
LOG_AGE	Natural log of the age of the firm, measured as the number of years the firm has been covered by CRSP.

Variables in Cost of Capital Model (11)	
r_{PEG}	Following Botosan and Plumlee (2005) and Botosan et al. (2011): r_{PEG}=((eps$_5$-eps$_4$)/P$_0$)^(.5). Eps$_5$ (eps$_4$) is the 5 (4) year ahead analyst consensus median forecast of earnings on the closest IBES statistical period date (statpers) after the 10-K filing date. P$_0$ is the price from the Compustat daily security file (prccd) on the same day or within three days. I require eps$_5$>eps$_4$. If eps$_5$ is missing then I calculate it as eps$_4$*(1+LT_GROWTH_PRED). If eps$_4$ is missing then I calculate it as eps$_3$*(1+LT_GROWTH_PRED).
r_{DIV}	Following Botosan and Plumlee (2002) and Botosan et al. (2011): r_{DIV} solves the following equation: $P_0=\sum[(1+r_{DIV})^{-t} * dps_t] + [(1+r_{DIV})^{-5} * P_5]$ for time periods t=1 through t=5. Dps$_t$ is the *t*th-year ahead analyst consensus median forecast of dividends on the closest IBES statistical period date (statpers) after the 10-K filing date. P$_0$ is the price from the Compustat daily security file (prccd) on the same day or within 3 days. P$_5$ is the mean of the minimum (ptglow) and maximum (ptghigh) target price estimates from IBES.
BETA	The coefficient on monthly returns (ret) from regressing CRSP monthly returns on the value weighted market index (vwretd) NYSE/AMEX/Nasdaq for the last five years ending in year t, where each firm-year is required to have 24 out of 60 months of available return data.
DISPERSION	The standard deviation of one year ahead earnings forecasts for the current fiscal year t made within ninety days prior to the earnings announcement date, scaled by the absolute value of the mean consensus analyst forecast for the current fiscal year.
BOOK_TO_MARKET	Book value of equity divided by market value of equity (prcc_f*csho) at time t following the Ghoul et al. (2011) specification. Book value is shareholders equity (seq) plus deferred taxes (txdb) and investment tax credits (itcb) (if available) less the book value of preferred stock. Book value of preferred stock is defined using either the redemption (pstkr), liquidation (pstkl), or par value (pstk) (in that order) when available.
LEVERAGE	Long-term debt (dltt) divided by market value at year end (prcc_f*csho).
LOG_ASSETS	Natural log of assets (at) at time t.
LT_GROWTH_PRED	Mean long-term growth earnings forecast from IBES in June of the current fiscal year t. If the long-term growth prediction is missing, I calculate it as (eps$_5$-eps$_4$)/abs(eps$_4$) or (eps$_4$-eps$_3$)/abs(eps$_3$) or (eps$_3$-eps$_2$)/abs(eps$_2$).

Governance Variables	
CEO_CHAIRMAN	Indicator equal to 0 if the CEO is also listed as the chairman of the board of directors in Risk Metrics; equal to 1 if the firm is covered by Risk Metrics but the CEO is not the chairman; otherwise set to missing.
INST_OWN	Indicator equal to 1 if the percentage of shares held by institutional owners is greater than the sample mean; 0 otherwise. Data are from Thomson-Reuters 13F Data (TR-13F) as of the closest 13-F filing date that occurs before the 10-K filing, in all cases within the previous 365 days. Following Khurana and Moser (2009) I winsorize the top tail of the distribution at 1.

APPENDIX B: TABLES AND FIGURES

Table 1: Sample Selection and Descriptive Statistics

Panel A: Sample Selection	
CRSP/Compustat Merged U.S. firm-year observations during sample period	22,485
Less: utilities and financial services	(10,026)
Less: observations with negative total stockholder's equity	(626)
Less: observations where filing date is missing or greater than 150 days after year end*	(73)
Less: observations with missing tax reserve data	(4,211)
Less: observations with missing control variables	(1,602)
Preliminary Sample	5,947
Sample for H1: Firm Value Regressions	
Preliminary Sample	5,947
Less: observations with missing lagged tax reserve data for IV estimation	(1,819)
Final Sample For Firm Value Regressions (Tables 3 and 5)	4,128
Sample for H2: Cost of Capital Regressions	
Preliminary Sample	5,947
Less: observations with missing cost of capital estimates	(1,446)
Less: observations with missing control variables	(2,228)
Final Sample For Cost of Capital Regressions (Tables 4 and 6)	2,273

Panel B: Industry Distribution

Fama-French 12 Industries	Number	Percent of Sample	Mean TAXRISK
Consumer NonDurables	243	5.9	1.4%
Consumer Durables	116	2.8	1.3%
Manufacturing	622	15.1	1.2%
Oil, Gas, and Coal Extraction and Products	205	5.0	0.5%
Chemicals and Allied Products	142	3.4	1.0%
Business Equipment	1,088	26.4	2.3%
Telephone and Television Transmission	145	3.5	1.1%
Wholesale, Retail, and Some Services	528	12.8	0.8%
Healthcare, Medical Equipment and Drugs	510	12.3	1.3%
Other	529	12.8	0.9%
	4,128	100.0	1.4%

*The market value calculation requires a price around the date of the 10-K filing. I exclude firms where the 10-K filing occurs greater than 150 days after the fiscal year end since these firms would be considered late in their 10-K filing. Results are not sensitive to elimination of this filter.

Table 1: Continued

Panel C: Descriptive Statistics								
Variable	**N**	**Mean**	**S.D.**	**Min**	**25th**	**50th**	**75th**	**Max**
Variables of Interest								
Assets (millions)	4,128	3,996.9	10,340.9	13.0	220.3	747.2	2,556.4	69,588.0
Market value (millions)	4,128	3,935.2	11,625.4	6.8	165.9	618.9	2,241.8	89,732.2
Ending reserve (millions)	4,128	58.18	194.04	0.00	0.79	4.80	25.19	1,483.00
Variables in Firm Value Models (Tables 3 and 5)								
LOG_MKT_VALUE	4,128	6.42	1.98	1.91	5.11	6.43	7.72	11.40
TAXRISK*	4,128	1.37	2.00	0.00	0.21	0.68	1.65	11.70
DISCR_ACCRUALS	4,128	0.00	0.08	-0.27	-0.05	0.00	0.04	0.25
FOREIGN_INCOME	4,128	0.02	0.04	0.00	0.00	0.01	0.04	0.20
NOL	4,128	0.21	0.64	0.00	0.00	0.00	0.11	4.42
LT_DEBT	4,128	0.18	0.18	0.00	0.00	0.15	0.29	0.70
SALES_GROWTH	4,128	0.10	0.24	-0.28	-0.02	0.05	0.15	1.54
LOSS	4,128	0.31	0.46	0.00	0.00	0.00	1.00	1.00
STD_DEV_RETURNS	4,128	0.14	0.05	0.05	0.10	0.13	0.17	0.26
LOG_AGE	4,128	2.73	0.82	0.85	2.28	2.75	3.29	4.42
Variables in Cost of Capital Models (Tables 4 and 6)								
RPEG	2,273	0.13	0.11	0.00	0.09	0.11	0.14	1.18
RDIV	617	0.07	0.05	0.00	0.03	0.06	0.09	0.28
BETA	2,273	1.33	0.63	0.06	0.90	1.27	1.70	3.23
DISPERSION	2,273	0.17	0.56	0.00	0.01	0.03	0.09	4.24
BOOK_TO_MARKET	2,273	0.66	0.55	0.06	0.32	0.51	0.82	4.04
LEVERAGE	2,273	0.41	0.79	0.00	0.00	0.15	0.43	5.49
LOG_ASSETS	2,273	7.60	1.54	3.56	6.49	7.54	8.60	11.15
LT_GROWTH_PRED	2,273	0.18	0.24	0.02	0.11	0.14	0.19	2.33
Governance Variables								
CEO_CHAIRMAN	2,004	0.38	0.49	0.00	0.00	0.00	1.00	1.00
INST_OWN**	4,128	0.67	0.27	0.02	0.50	0.76	0.89	1.00

All variables are defined in Appendix A. All continuous variables are winsorized at one and ninety-nine percent. TAXRISK, FOREIGN_INCOME, NOL and LT_DEBT are scaled by assets. Note that CEO_CHAIRMAN is coded as a 0 if the CEO is also the chairman of the board in order to make it consistent with INST_OWN where better governance is represented by a 1 rather than a 0.
*TAXRISK is the ending tax reserve balance scaled by total assets and multipled by 100.
**This is the continuous version of the variable. For regression analysis, INST_OWN is coded as 1 if the value is above the mean for the sample and 0 otherwise.

Table 2: Spearman and Pearson Correlations

Panel A: Correlation Matrix for Firm Value Regressions (H1 and H3a)

Spearman below \ Pearson above (p-values shown below correlation coefficient)

	LOG_MKT_ VALUE	TAXRISK	DISCR_ ACCRUALS	FOREIGN_ INCOME	NOL	LT_DEBT	SALES_ GROWTH	LOSS	STD_DEV_ RETURNS	LOG_ AGE	CEO_ CHAIRMAN	INST_ OWN
LOG_MKT_ VALUE	1.000	0.039	-0.124	0.250	-0.237	0.112	0.031	-0.403	-0.487	0.251	-0.226	0.491
		0.013	<.001	<.001	<.001	<.001	0.044	<.001	<.001	<.001	<.001	<.001
TAXRISK	0.212	1.000	-0.024	0.184	0.263	-0.163	-0.060	0.127	0.026	-0.003	0.026	0.033
	<.001		0.125	<.001	<.001	<.001	0.000	<.001	0.094	0.824	0.247	0.032
DISCR_ ACCRUALS	-0.120	-0.081	1.000	-0.045	0.094	-0.006	-0.057	-0.034	0.090	0.055	-0.061	-0.180
	<.001	<.001		0.004	<.001	0.683	0.000	0.029	<.001	0.000	0.006	<.001
FOREIGN_ INCOME	0.313	0.333	-0.038	1.000	-0.032	-0.062	0.020	-0.094	-0.083	0.121	-0.058	0.073
	<.001	<.001	0.014		0.040	<.001	0.202	<.001	<.001	<.001	0.010	<.001
NOL	-0.115	0.096	0.036	0.076	1.000	-0.105	0.095	0.270	0.263	-0.095	0.073	-0.193
	<.001	<.001	0.021	<.001		<.001	<.001	<.001	<.001	<.001	0.001	<.001
LT_DEBT	0.186	-0.108	0.003	-0.026	0.013	1.000	-0.012	0.043	0.007	0.010	-0.073	0.065
	<.001	<.001	0.869	0.096	0.395		0.452	0.006	0.674	0.537	0.001	<.001
SALES_ GROWTH	0.130	-0.084	-0.127	0.014	-0.017	-0.030	1.000	-0.027	0.082	-0.230	-0.017	-0.028
	<.001	<.001	<.001	0.373	0.272	0.058		0.086	<.001	<.001	0.436	0.076
LOSS	-0.405	0.018	-0.027	-0.116	0.193	0.008	-0.175	1.000	0.360	-0.144	0.066	-0.224
	<.001	0.257	0.078	<.001	<.001	0.622	<.001		<.001	<.001	0.003	<.001
STD_DEV_ RETURNS	-0.493	-0.113	0.068	-0.151	0.199	-0.053	-0.038	0.368	1.000	-0.347	0.100	-0.302
	<.001	<.001	<.001	<.001	<.001	0.001	0.014	<.001		<.001	<.001	<.001
LOG_ AGE	0.238	0.085	0.069	0.172	-0.082	0.078	-0.233	-0.145	-0.340	1.000	-0.112	0.085
	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001
CEO_ CHAIRMAN	-0.223	-0.031	-0.059	-0.058	0.049	-0.090	-0.034	0.066	0.103	-0.119	1.000	-0.051
	<.001	0.164	0.008	0.009	0.028	<.001	0.127	0.003	<.001	<.001		0.022
INST_ OWN	0.520	0.153	-0.180	0.160	-0.064	0.106	0.054	-0.224	-0.297	0.083	-0.053	1.000
	<.001	<.001	<.001	<.001	<.001	<.001	0.001	<.001	<.001	<.001	0.017	

Table 2: Continued

Panel B: Correlation Matrix for Cost of Capital Regressions (H2 and H3b)

Spearman below \ Pearson above (p-values shown below correlation coefficient)

	r_{PEG}	r_{DIV}	BETA	DISPERSION	BOOK_TO_ MARKET	LEVERAGE	LOG_ ASSETS	LT_ GROWTH_ PREDICTION	CEO_ CHAIRMAN	INST_ OWN
r_{PEG}	1.000	0.086	0.201	0.170	0.228	0.221	-0.135	0.246	0.056	-0.093
		0.033	<.001	<.001	<.001	<.001	<.001	<.001	0.035	<.001
r_{DIV}	0.102	1.000	0.145	0.025	0.256	0.302	0.040	0.026	-0.032	-0.018
	0.011		0.000	0.534	<.001	<.001	0.320	0.524	0.490	0.660
BETA	0.219	0.128	1.000	0.133	0.184	0.149	-0.175	0.120	0.042	-0.006
	<.001	0.001		<.001	<.001	<.001	<.001	<.001	0.109	0.792
DISPERSION	0.102	0.035	0.310	1.000	0.192	0.185	-0.043	0.150	0.012	-0.048
	<.001	0.380	<.001		<.001	<.001	0.042	<.001	0.638	0.024
BOOK_TO_MARKET	0.082	0.154	0.224	0.296	1.000	0.545	0.008	-0.048	0.012	-0.055
	<.001	0.000	<.001	<.001		<.001	0.720	0.022	0.637	0.009
LEVERAGE	0.031	0.242	0.108	0.127	0.376	1.000	0.158	-0.033	-0.039	-0.068
	0.134	<.001	<.001	<.001	<.001		<.001	0.119	0.139	0.001
LOG_ASSETS	-0.177	0.117	-0.182	-0.118	0.023	0.421	1.000	-0.199	-0.197	0.126
	<.001	0.004	<.001	<.001	0.278	<.001		<.001	<.001	<.001
LT_GROWTH_PRED	0.303	0.051	0.166	0.091	-0.133	-0.279	-0.379	1.000	0.037	-0.119
	<.001	0.203	<.001	<.001	<.001	<.001	<.001		0.161	<.001
CEO_CHAIRMAN	0.066	-0.056	0.034	0.029	0.005	-0.105	-0.196	0.104	1.000	0.014
	0.012	0.220	0.198	0.265	0.843	<.001	<.001	<.001		0.598
INST_OWN	-0.038	-0.050	0.012	-0.062	0.010	0.049	0.137	-0.049	0.014	1.000
	0.071	0.215	0.583	0.003	0.636	0.019	<.001	0.020	0.598	

Table 3: Regressions of Log Market Value on TAXRISK (H1)

	(1) OLS Linear	(2) OLS Quadratic	(3) OLS Lag TAXRISK	(4) IV with Bootstrap
TAXRISK	0.119***	0.430***	0.423***	0.490***
	(5.541)	(9.427)	(9.246)	(13.506)
TAXRISK_SQ		-0.035***	-0.034***	-0.041***
		(-7.677)	(-7.533)	(-9.849)
DISCR_ACCRUALS	-2.049***	-1.896***	-1.947***	-1.867***
	(-6.409)	(-5.818)	(-6.015)	(-6.067)
FOREIGN_INCOME	9.061***	7.884***	7.915***	7.313***
	(9.756)	(8.514)	(8.538)	(9.133)
NOL	-0.232***	-0.185***	-0.194***	-0.226***
	(-4.602)	(-3.473)	(-3.748)	(-5.592)
LT_DEBT	1.577***	1.616***	1.590***	1.696***
	(7.889)	(8.167)	(7.999)	(12.572)
SALES_GROWTH	0.946***	0.957***	0.987***	1.035***
	(6.656)	(6.691)	(6.926)	(9.549)
LOSS	-0.899***	-0.897***	-0.868***	-0.979***
	(-12.799)	(-13.112)	(-12.696)	(-13.452)
STD_DEV_RETURNS	-16.747***	-16.361***	-16.244***	-16.087***
	(-19.793)	(-19.530)	(-19.378)	(-25.426)
LOG_AGE	0.167***	0.152***	0.147***	0.159***
	(3.597)	(3.280)	(3.189)	(6.202)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.460	0.477	0.477	0.475
N	4,128	4,128	4,128	4,128
(a) Argmax (Implied Optimum)		6.1	6.3	6.0
(b) Percent obs with TAXRISK<argmax		96.0%	96.2%	95.8%
(c) Average shortage of tax reserves (millions)		206.1	213.8	200.5
(d) Cumulative inc. in reserves (millions)		753,926	788,223	733,096

This table presents results for tests of model (10). All variables are defined in Appendix A. T-statistics are reported in parentheses below each coefficient. ***,**,* indicate the coefficient is significantly different from zero at the 1, 5, and 10 percent level, respectively, using a two tailed test of significance. All standard errors are clustered by firm except for column 4 which uses boostrapped standard errors. (a) is the average implied optimal level of TAXRISK, calculated as the coefficient on TAXRISK divided by -2 times the coefficient on TAXRISK_SQ. (b) is the percentage of observations in the sample that have a TAXRISK value below the argmax value. (c) is the difference between the argmax and average TAXRISK for those firms that are below the argmax, multiplied by the average level of assets, to get the average shortage in total tax reserves. (d) is the cumulative increase in total tax reserves required to get all firm-years to the argmax value of TAXRISK and includes the offsetting effect of firms with a TAXRISK higher than the argmax.

Table 4: Regressions of Cost of Capital on TAXRISK (H2)

	(1)	(2)
	r_{PEG}	r_{DIV}
TAXRISK	0.003*	0.003*
	(1.768)	(1.931)
BETA	0.019***	0.006
	(3.856)	(1.606)
DISPERSION	0.014*	-0.005
	(1.645)	(-1.223)
BOOK_TO_MARKET	0.027**	0.012
	(2.325)	(1.228)
LEVERAGE	0.020***	0.026**
	(2.655)	(2.274)
LOG_ASSETS	-0.007***	0.001
	(-4.360)	(0.363)
LT_GROWTH_PRED	0.102***	0.011
	(3.652)	(0.789)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Adjusted R-Squared	0.160	0.248
N	2,273	617

This table presents results for tests of model (11). All variables are defined in Appendix A. T-statistics are reported in parentheses below each coefficient. ***,**,* indicate the coefficient is significantly different from zero at the 1, 5, and 10 percent level, respectively, using a two tailed test of significance. All standard errors are clustered by firm.

Table 5: Regressions of Log Market Value on TAXRISK and Governance (H3a)

		(1)	(2)
		GOVERNANCE=1 if INST_OWN > mean	**GOVERNANCE=1 if CEO is not the Chairman**
β_1	TAXRISK	0.420***	0.388***
		(6.016)	(5.499)
β_2	TAXRISK_SQ	-0.037***	-0.040***
		(-5.806)	(-4.782)
β_3	GOVERNANCE	1.274***	-0.435***
		(13.365)	(-4.162)
β_4	TAXRISK_x_GOVERNANCE	-0.141*	-0.070
		(-1.759)	(-0.732)
β_5	TAXRISK_SQ_x_GOVERNANCE	0.015*	0.019*
		(1.926)	(1.768)
Controls		Yes	Yes
Year Fixed Effects		Yes	Yes
Industry Fixed Effects		Yes	Yes
Adjusted R-Squared		0.546	0.484
N		4,128	2,004
(a) Argmax for well governed $[(\beta_1+\beta_4)/(-2*(\beta_2+\beta_5))]$		6.5	7.7
(b) Argmax for poorly governed $[\beta_1/(-2*(\beta_2))]$		5.7	4.9
(c) F-statistic for Delta Method nonlinear test		1.09	4.43**
(d) p-value for difference in argmax		0.296	0.036

This table presents results for tests of model (10) based on the interaction of either institutional ownership or CEO/ chairman duality with TAXRISK and TAXRISK_SQ. All variables are defined in Appendix A. T-statistics are reported in parentheses below each coefficient. ***,**,* indicate the coefficient is significantly different from zero at the 1, 5, and 10 percent level, respectively, using a two tailed test of significance. All standard errors are clustered by firm.
(a) The optimal level of TAXRISK when GOVERNANCE=1
(b) The optimal level of TAXRISK when GOVERNANCE=0
(c) The F-statistic produced from the wald-type test of the null hypothesis that the implied argmax for well governed firms equals the implied argmax for poorly governed firms. The nonlinear test of parameters is performed using the Delta method. The null hypothesis is: $[(\beta_1+\beta_4)/(-2*(\beta_2+\beta_5))]= [\beta_1/(-2*(\beta_2))]$.
(d) The corresponding two-tailed p-value for the test above.

Table 6: Regressions of Cost of Capital on TAXRISK and Governance (H3b)

	(1)	(2)	(3)	(4)
	r_{PEG}		r_{DIV}	
	GOV=1 if INST_OWN > mean	GOV=1 if CEO is not the Chairman	GOV=1 if INST_OWN > mean	GOV=1 if CEO is not the Chairman
TAXRISK	0.007*	0.001	0.007***	0.004***
	(1.817)	(1.046)	(2.895)	(2.621)
GOVERNANCE	-0.004	0.006	-0.001	-0.006
	(-0.503)	(1.014)	(-0.201)	(-0.895)
TAXRISK_x_ GOVERNANCE	-0.005	0.001	-0.005*	0.004
	(-1.303)	(0.253)	(-1.780)	(1.019)
BETA	0.020***	0.015***	0.007*	0.006
	(3.910)	(2.646)	(1.732)	(1.322)
DISPERSION	0.014	0.013	-0.004	-0.006
	(1.593)	(1.303)	(-1.210)	(-1.292)
BOOK_TO_ MARKET	0.027**	0.002	0.013	0.011
	(2.303)	(0.177)	(1.280)	(1.131)
LEVERAGE	0.020***	0.020***	0.027**	0.026***
	(2.645)	(2.631)	(2.320)	(3.658)
LOG_ASSETS	-0.007***	-0.002	-0.000	0.004**
	(-4.361)	(-1.493)	(-0.042)	(2.574)
LT_GROWTH_ PRED	0.100***	0.062*	0.012	0.013
	(3.570)	(1.926)	(0.866)	(0.831)
Sum of coefficients on TAXRISK and TAXRISK_x_GOVERNANCE:				
Coefficient	0.002	0.002	0.002	0.008**
t-statistic	(1.180)	(0.660)	(1.270)	(2.060)
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.161	0.107	0.253	0.267
N	2,273	1,439	617	474

This table presents results for tests of model (11) based on the interaction of either institutional ownership or CEO/ chairman duality with TAXRISK. All variables are defined in Appendix A. T-statistics are reported in parentheses below each coefficient. ***,**,* indicate the coefficient is significantly different from zero at the 1, 5, and 10 percent level, respectively, using a two tailed test of significance. All standard errors are clustered by firm.

Table 7: Univariate Differences Between High and Low Tax Risk Firms

	All Other Observations	Top Decile of TAXRISK			
	Mean	Mean	Difference in groups	t-test of difference	p-value
ASSETS	3,927.922	4,618.815	-690.893	-1.069	0.286
LOG_MKT_VALUE	6.416	6.441	-0.025	-0.224	0.823
DISCR_ACCRUALS	-0.003	-0.009	0.006	1.110	0.268
FOREIGN_INCOME	0.023	0.045	-0.022	-8.207***	0.000
NOL	0.161	0.647	-0.486	-8.034***	0.000
LT_DEBT	0.193	0.099	0.093	12.818***	0.000
SALES_GROWTH	0.098	0.071	0.026	1.972**	0.049
LOSS	0.290	0.471	-0.181	-7.028***	0.000
STD_DEV_RETURNS	0.136	0.143	-0.008	-3.223***	0.001
LOG_AGE	2.738	2.622	0.116	2.911***	0.004
N	3,716	412			

This table presents t-tests of means across variables used for model (10). All variables are defined in Appendix A. ***,**,* indicate the coefficient is significantly different from zero at the 1, 5, and 10 percent level, respectively, using a two tailed test of significance.

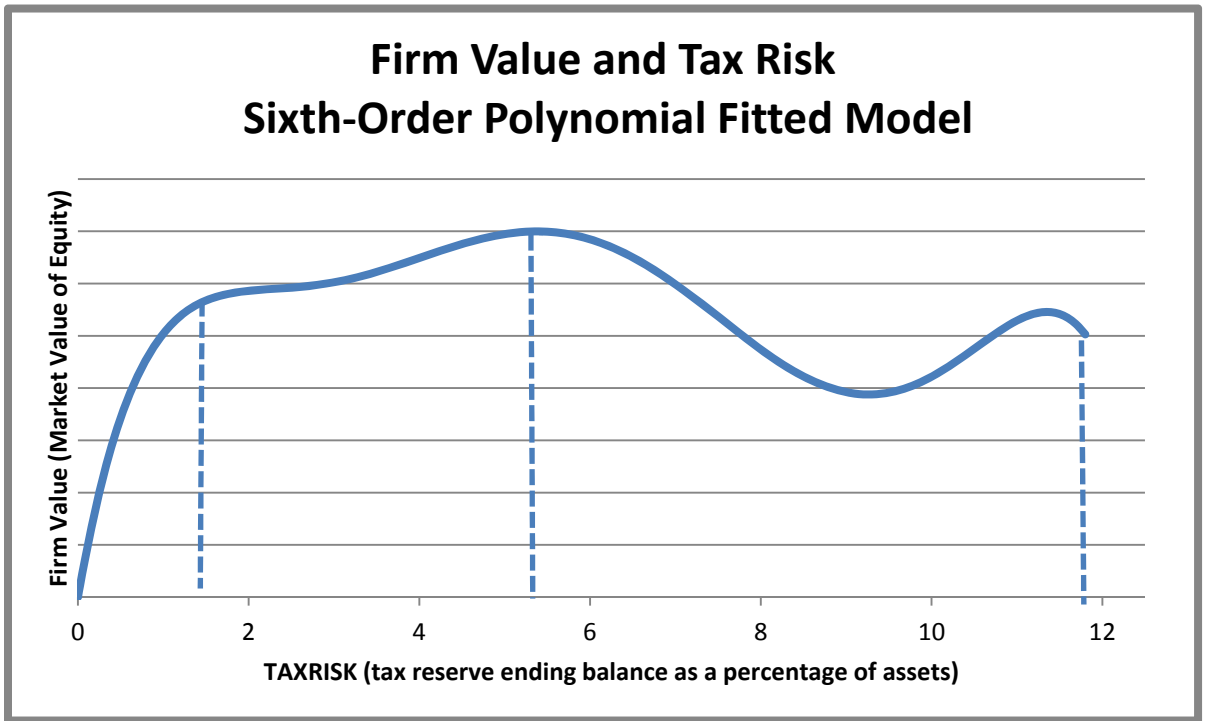

Figure 1: Firm Value and Tax Risk Sixth-Order Fitted Polynomial

Figure 1 is the graphical representation of the estimated coefficients of model (10) and including TAXRISK squared and TAXRISK to the third, fourth, fifth, and sixth powers.

VITA

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