THE INTERACTION OF INCENTIVE AND OPPORTUNITY IN CORPORATE TAX AVOIDANCE: EVIDENCE FROM FINANCIALLY CONSTRAINED FIRMS

by

KAISHU WU

A DISSERTATION

Presented to the Department of Accounting
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 2018

DISSERTATION APPROVAL PAGE

Student: Kaishu Wu

Title: The Interaction of Incentive and Opportunity in Corporate Tax Avoidance: Evidence from Financially Constrained Firms

This dissertation has been accepted and approved in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Accounting by:

Dr. David A. Guenther	Chairperson
Dr. Linda K. Krull	Core Member
Dr. Ryan J. Wilson	Core Member
Dr. Caroline E. Weber	Institutional Representative

and

Sara D. Hodges	Interim Vice Provost and Dean of the Graduate School

Original approval signatures are on file with the University of Oregon Graduate School.

Degree awarded June 2018

DISSERTATION ABSTRACT

Kaishu Wu

Doctor of Philosophy

Department of Accounting

June 2018

Title: The Interaction of Incentive and Opportunity in Corporate Tax Avoidance: Evidence from Financially Constrained Firms

I hypothesize and find that the variation in corporate tax avoidance is jointly determined by firms' incentive and opportunities to avoid taxes. Specifically, the positive relation between financial constraints (my proxy for an incentive to avoid taxes) and tax avoidance is significantly stronger for firms with high tax planning opportunities (TPO), where TPO is the distance between a firm's actual and predicted ETRs. I further show that firms with TPOs based on high permanent (temporary) book-tax differences exhibit more permanent (temporary) book-tax differences under financial constraints. From a risk perspective, I find no evidence that financially constrained firms with low TPO exhibit more tax risk but some evidence that those with high TPO do so. In general, the findings in this paper provide evidence consistent with an incentive-opportunity interaction story to help explain differences in corporate tax avoidance.

CURRICULUM VITAE

NAME OF AUTHOR: Kaishu Wu

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:

University of Oregon, Eugene
Zhejiang Gongshang University, Hangzhou, China

DEGREES AWARDED:

Doctor of Philosophy, Accounting, 2018, University of Oregon
Master of Accounting, 2011, University of Oregon
Bachelor of Business Administration, 2010, Zhejiang Gongshang University

AREAS OF SPECIAL INTEREST:

Taxation, Financial Reporting

PROFESSIONAL EXPERIENCE:

Accounting Specialist, Levi Strauss & Co., 8 Months

Tax Consultant, Duncan & Duncan CPAs, 2 Months

GRANTS, AWARDS, AND HONORS:

Robin and Roger Best Research Award, University of Oregon, 2017

University of Oregon Accounting Doctoral Fellowship, University of Oregon, 2013-2018

Student Achievement Award presented by the Federation of Schools of Accountancy, University of Oregon, 2011

PUBLICATIONS:

Guenther, D., R. Wilson and K. Wu. 2019. Tax Uncertainty and Incremental Tax Avoidance. *The Accounting Review*, Forthcoming.

ACKNOWLEDGMENTS

I wish to express unparalleled appreciation to Professor David Guenther, without whose continuous guidance and encouragement the completion of this dissertation would have been much more difficult. He is a true academic and the kind of person that makes the world a better place. I give special thanks to my other committee members, Professors Linda Krull, Caroline Weber and Ryan Wilson, for their invaluable comments and corrections. I am also grateful for all the financial supports provided by the School of Accounting and the Lundquist College of Business at the University of Oregon. At last, I attribute the prosperity of my life to the never-failing love of my partner, Xige Xia.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

It is well documented in the tax avoidance literature that incentives induce managers to engage in high levels of tax avoidance (Rego and Wilson 2012; Law and Mills 2015; Edwards, Schwab and Shevlin 2016; Armstrong, Blouin, Jagolinzer and Larcker 2015; Cheng, Huang, Li and Stanfield 2012). Incentives such as equity compensation and financial constraints induce managers to pursue additional earnings and/or cash flows by improving firms' tax efficiency.[1] In that sense, the flexibility to improve tax efficiency, which I refer to as tax planning opportunity (hereafter TPO), is necessary when additional tax avoidance is desirable under incentives. In other words, incentive and TPO must both be present for additional tax avoidance to take place. In this paper, I examine the incentive-opportunity interaction argument by investigating whether incentives are more effective when managers have more TPO. A positive relation between incentive and tax avoidance conditional on TPO is consistent with the notion that the incentive to avoid tax, along with the availability of TPO, jointly plays an important role in helping explain variation in tax avoidance.

A large and growing body of research studies the factors that affect tax avoidance. While most studies examine the determinants of tax avoidance individually[2], it is equally important to investigate the interactions between determinants (Hanlon and Heitzman

[1] I refer to the extent to which a firm's tax planning activities contribute to maximizing shareholders' value as tax efficiency.

[2] A common set of controls, first introduced by Chen, Chen, Cheng and Shevlin (2010), is used in most studies examining cross-sectional variation in tax avoidance.

2010[3]). While the effect of incentives on tax avoidance has been broadly examined in the literature, the role that opportunity plays in this relationship has not been explicitly studied. Understanding the variation in tax avoidance from an incentive-opportunity perspective is decision-relevant for managers, board directors, policy makers, and regulators. It is important for managers to know whether exerting additional efforts would result in more tax avoidance with regard to the level of opportunities. Although managers set the tone at the top regarding tax avoidance strategies, they may have impractical expectations on tax outcomes since the details are usually left to in-house tax specialists or tax consultants to figure out. Similarly, given existing evidence that managers need incentives to avoid taxes, board directors might be interested in understanding the conditions under which managers' responses to incentives are stronger. Finally, policy makers and regulators need to understand that the interaction of incentive and opportunity creates high levels of tax avoidance, and regulatory restrictions on either factor may contribute to the reduction of tax avoidance.

The tax avoidance literature has documented various incentives for managers to engage in tax avoidance. These incentives include equity compensation (Rego and Wilson 2012; Kim, Quinn and Wilson 2017), institutional ownership (Cheng, Huang, Li and Stanfield 2012; Bird and Karolyi 2017; Khan, Srinivasan and Tan 2017), board intervention (Armstrong, Blouin, Jagolinzer and Larcker 2015), analyst cash flow forecast (Ayers, Call and Schwab 2017) and financial constraints (Chen and Lai 2012; Law and Mills 2015; Edwards, Schwab and Shevlin 2016). In this paper I rely on

[3] "Finally, tax avoidance may be highly idiosyncratic and determined by a number of factors and interactions, not all of which can be measured" (Hanlon and Heitzman 2010, p. 145).

financial constraints as the incentive for tax avoidance for the following reasons. First, tax avoidance is broadly defined as any activity that reduces cash tax payments. Cash tax payments can be reduced by exploiting either permanent book-tax differences, temporary book-tax differences, or both. Financial constraints provide a setting where both types of book-tax differences can be studied because it provides managers an explicit reason to pursue cash tax savings even without financial reporting benefit. Edwards, Schwab and Shevlin (2016) find a positive association between financial constraints and cash tax savings where a substantial portion of savings is attributable to deferral-based (i.e., temporary) tax planning strategies. Without an explicit need for cash, managers tend to pursue tax planning strategies that lower both GAAP ETR[4] and Cash ETR (Armstrong, Blouin and Larcker 2012[5]; Graham, Hanlon, Shevlin and Shroff 2014[6]), which is only accomplished by exploiting permanent book-tax differences.

Second, financially constrained firms likely do not have the option to increase tax-favored investments to avoid tax, which makes the cause of increased tax avoidance less confounding. For instance, investments in R&D allow firms to claim tax credits which would reduce firms' ETR, but such investments are more likely driven by firms' overall business strategies rather than tax considerations. In other words, increased tax avoidance achieved with additional tax-favored investments may result from altering a firm's business strategies. However, since increasing R&D investments is difficult for firms that are financially constrained, increased tax avoidance exhibited by financially

[4] ETR stands for Effective Tax Rate.
[5] Although the authors study compensation incentives applied to tax directors instead of top management, it can be argued that top managers could also be incentivized to pursue financial reporting benefits and reduce only GAAP ETR. See Footnote 5 below.
[6] In their survey, 47 percent of the executives state that top management values GAAP ETR more than Cash ETR and 37 percent state that they are equally valued.

constrained firms is more likely to be a reflection of intentional tax planning activities. Third, a research design based on financial constraints allows the exploitation of within firm variations as firms move in and out of being constrained, whereas research designs based on equity compensation and board characteristics depend mostly on cross-firm variations.

The key measure in this paper is a firm's TPO. Conventionally, firms with certain characteristics that allow them to achieve low ETR are said to have more opportunities to avoid tax. For example, R&D intensive and multinational firms are believed to be more able to avoid tax (Rego 2003). In this paper, however, TPO represents a firm's capacity to pursue additional tax avoidance without changing those characteristics, rather than a firm's total capacity to achieve low ETR with those characteristics subject to change. When incentivized to increase tax avoidance managers have two alternatives. One is to increase investments in tax-favored assets such as R&D, PP&E, and foreign operations. I refer to this alternative as *structure-based avoidance*. The other alternative is to pursue extra tax savings within the scope of current investment levels by, for example, acting more aggressively in taking tax credits or setting transfer prices. I refer to this alternative as *classification-based avoidance*. Since I follow existing cross-sectional tax avoidance studies and control for the factors that contribute to structure-based avoidance (e.g. R&D, PP&E, leverage, foreign income), my TPO measure is classification-based. Also, similar to the reasons I choose financial constraints as the incentive, classification-based opportunities are more likely pursued with tax considerations and are less difficult for financially constrained to take advantage of, relative to structure-based opportunities.

One example for each type of tax avoidance is provided in Cheng, Huang, Li and Stanfield (2012), where the authors find that hedge fund activism drives managers to avoid more taxes. In one example, the existing CEO of PDL Biopharma Inc. is criticized for not effectively utilizing tax credits which are considered to be "a readily exploitable company asset". The eligibility of investments for tax credits is based on their classification for tax purposes, so the choice to use tax credits falls into the definition of classification-based avoidance. In the other example, the hedge fund suggests that the target firm, Sybase Inc., take advantage of its stable revenue and increase its leverage to reduce taxes. Increasing leverage falls into the definition of structure-based avoidance.[7] In my setting, increasing leverage is likely not an option for financially constrained firms.

Following Kim, McGuire, Savoy and Wilson (2017), I calculate firms' expected ETR for the past five years based on common determinants of tax avoidance and use the distance between actual and expected ETRs as the proxy for TPO. Since expected ETR represents the average level of classification-based avoidance given a firm's investment structure, TPO reflects the opportunities to improve tax efficiency by engaging in additional classification-based avoidance. A large positive TPO indicates that the firm has substantial potential to improve tax efficiency. Similarly, a large negative TPO means that the firm has little room to improve. According to the argument that incentive and TPO jointly determine the level of tax avoidance, I expect the positive relation between financial constraints and tax avoidance to be stronger (weaker) for the firms with higher (lower) TPO.

[7] I acknowledge that although increased leverage will produce tax savings because interest is deducted from taxable income, it would not reduce a firm's ETR since interest also reduces pretax book income.

I include my TPO measure and estimate its moderating effect on the relation between tax avoidance and financial constraints. Regression results suggest that, when faced with financial constraints, firms with higher TPO avoid significantly more taxes. In other words, the positive relation between financial constraints and tax avoidance is more prominent for the firms with higher TPO. Economically, the magnitude of this positive relation increases by 175% with one standard deviation increase in TPO. When firm fixed-effects are included, the effect grows to 426%. Change analysis provides consistent but weaker results. To obtain more clear identification, I employ two settings where a sub-set of firms experiences an exogenous increase in financial constraints. Results from Difference-in-Difference design show that the causality between financial constraints and tax avoidance is significantly stronger for the firms with high TPO. Next, I re-construct TPO based on firms' permanent and temporary book-tax differences (BTDs) and re-estimate the main regressions with the dependent variables being replaced with either type of BTD. Results suggest that firms with TPO based on high permanent (temporary) BTDs exploit more permanent (temporary) BTDs under financial constraints.

Finally, I investigate whether firms with low TPO adopt risky tax strategies and expose themselves to more tax risk.[8] Based on the notion that firms only turn to risky tax strategies after they exhaust all the safe ones, I expect a positive relation between financial constraints and tax risk when TPO is low. Following three recent studies (Dyreng, Hanlon and Maydew 2017; Guenther, Matsunaga and Williams 2017; Guenther, Wilson and Wu 2017), I find little evidence consistent with my expectation. Taken

[8] Following recent studies examining tax risk/uncertainty, such as Dyreng, Hanlon and Maydew (2017), I define tax risk as the likelihood that current tax positions be challenged and ultimately overturned by the tax authorities in the future.

together, empirical results suggest that incentive and opportunities jointly determine the level of tax avoidance, and tax risk does not result from low opportunity firms being incentivized to avoid taxes.

My paper makes four important contributions to the tax avoidance literature. First, I provide new evidence that a firm's level of tax avoidance depends jointly on the manager's incentive to generate tax savings under financial constraints and the amount of TPO available to the firm. This result helps researchers further understand the source of the variation in corporate tax avoidance. It also informs managers, policy makers, board directors and other practitioners whose tax related decision-making depends critically on their understanding of the driving forces behind tax avoidance. Second, I further show that firms with TPO in permanent (temporary) BTDs take advantage of permanent (temporary) BTDs under financial constraints, a result that is also new to the literature. Third, I find that firms with low opportunity do not appear to adopt risky tax strategies to increase tax avoidance under financial constraints. This finding complements concurrent studies on tax risk by suggesting that tax risk/uncertainty does not result from low opportunity firms being incentivized to avoid more taxes. Fourth, I introduce the concepts of structure-based and classification-based tax avoidance and argue that what prior cross-sectional tax avoidance studies find is variation in classification-based tax avoidance, since structure-based tax avoidance is usually controlled for. The distinction between structure- and classification-based tax avoidance resonates to the hierarchy of tax responses proposed by Slemrod (1990) in economics, where tax payers respond to tax law changes by either varying their accounting responses or changing their real economic

behaviors. This distinction indicates a new research avenue in tax avoidance – what do firms do exactly to increase classification-based tax avoidance?

The remainder of this paper proceeds as follows. Section 2 summarizes the related literature and develops the hypotheses. Section 3 describes the research design with the definitions of key variables and the main regression model. Sections 4 and 5 present the sample selection procedure and empirical results. Section 6 presents tax risk tests. Section 7 presents an array of supplemental tests. Section 8 concludes.

CHAPTER II

RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

Tax researchers have exerted continuous efforts to identify the determinants of corporate tax avoidance. Early studies have associated tax avoidance to firm characteristics such as firm size (Zimmerman 1983), capital structure (Gupta and Newberry 1997), profitability (Gupta and Newberry 1997), foreign operations (Rego 2003; Wilson 2009), and presence in tax havens (Dyreng and Lindsey 2009). In addition to firm attributes, attention has also been brought to managers' personal attributes. Following Dyreng, Hanlon and Maydew (2010) which show that individual managers have a significant effect on tax avoidance but fail to associate such effect to any biographical characteristics, subsequent studies have found tax avoidance to be related to managers' political affiliation (Christensen, Dhaliwal, Boivie and Graffin 2014), personal tax aggressiveness (Chyz 2013), narcissism (Olsen and Stekelberg 2016), and military background (Law and Mills 2017).

Other than managers' personal attributes, recent studies have identified settings where more or less incentive is imposed to managers to avoid taxes. In terms of monetary incentives, Phillips (2003) finds that compensating business-unit managers on an after-tax basis leads to lower ETRs. Similarly, Armstrong, Blouin and Larcker (2012) find a negative relation between tax directors' incentive compensation and firms' GAAP ETR. Consistently, Robinson, Sikes and Weaver (2010) find that evaluating a tax department as a profit center is associated with lower ETRs than evaluating it as a cost center. With regard to equity ownership, Kim, Quinn and Wilson (2017) document a greater level of tax avoidance after managers mandatorily adopt the firm's ownership. Drawing on

managers' risk preferences, Rego and Wilson (2012) find that equity risk incentives provided by stock options motivate managers to undertake risky tax strategies. These studies suggest that monetary incentives motivate managers to engage in high levels of tax avoidance.

Non-monetary incentives of tax avoidance are usually associated with firms' ownership structure and board characteristics. Different ownership structures and board make-ups lead managers to have different preferences in exerting efforts and assuming risk when making tax avoidance decisions. Chen, Chen, Cheng and Shevlin (2010) find that family firms are less tax aggressive due to non-tax costs arising from agency problems. McGuire, Wang and Wilson (2014) find that managers entrenched with dual-class ownership perform at a sub-optimal level by avoiding less taxes. From the risk perspective, Badertscher, Katz and Rego (2013) find that firms with concentrated ownership and control avoid less taxes due to risk-aversion. Using hedge fund intervention as a setting for ownership change, Cheng, Huang, Li and Stanfield (2012) find that firms targeted by hedge fund activists exhibit lower levels of tax avoidance before hedge fund intervention and experience increases in tax avoidance after. The relation between board characteristics and tax avoidance is subtler. Armstrong, Blouin, Jagolinzer and Larcker (2015) find that board independence and board financial expertise are positively related to tax avoidance when the levels of tax avoidance are low but are negatively related to tax avoidance when the levels of tax avoidance are high.

Another important incentive for the managers to engage in more tax avoidance is financial constraints. Financial constraints refer to the frictions that prevent firms from funding all desired investments (Lamont, Polk, and Saá-Requejo 2001). Guided by the

prediction that financially constrained firms have higher costs of external financing and are more likely to generate funds internally to finance future investment opportunities, existing studies have consistently identified a positive relation between financial constraints and tax avoidance. Using alternative measures for financial constraints and tax avoidance, Chen and Lai (2012) find that financially constrained firms engage in more tax avoidance. Consistently, Edwards, Schwab and Shevlin (2016) predict and find that an increase in financial constraints leads firms to increase internally generated funds via tax planning. They further find that this association is greatest among firms with low cash reserves and that firms pursue cash tax savings without exploiting financial reporting benefit. Law and Mills (2015) find that financially constrained firms, defined as the firms that use more negative words in their annual reports, pursue more aggressive tax planning strategies both contemporaneously and in the future.

When examining the cross-sectional differences in tax avoidance, almost all studies control for tax-related firm characteristics, such as industry, firm size, MTB, leverage, R&D, PP&E and tax haven operations, because these characteristics largely determine a firm's capacity to avoid taxes. I refer to the scope of tax avoidance determined by those firm characteristics as *structure-based avoidance*, since it is based on firms' investment structures. Within the scope of structure-based tax avoidance, managers still have the flexibility to choose to avoid more or less taxes. For example, two firms with exactly the same R&D investment conditions could end up with different R&D credits, since managers can act more or less aggressive in classifying certain investments as R&D and claiming R&D credits (Skaife, Swenson and Wangerin 2013). I refer to this type of tax avoidance as *classification-based avoidance*. Since structure-

based tax avoidance is always controlled for, I argue that the relationship between incentives and tax avoidance documented by prior studies is attributable to the variations in classification-based tax avoidance.

In this paper specifically, I argue that the positive relation between tax avoidance and financial constraints, with other incentives alike, is more prominent for the firms that previously under-exploit classification-based avoidance. In other words, financial constraints incentivize managers to improve efficiency in classification-based tax avoidance to generate extra tax savings and fund operations, and such improvement is more available to the firms that previously under-exploit classification-based tax avoidance. Based on tax-related firm characteristics, Kim, McGuire, Savoy and Wilson (2017) develop a model to predict firms' optimal ETR and investigate how quickly firms converge to the optimum. What Kim et al. (2017) essentially predict is the average level of classification-based avoidance conditional on a firm's investment structure. I argue that the positive relation between financial constraints and tax avoidance is stronger for the firms that have previously been below the predicted level of classification-based avoidance. In other words, faced with financial constraints, firms with previous lower-than-predicted classification-based avoidance avoid more taxes. I refer to the distance between a firm's actual ETR and predicted ETR as TPO.

H1a: All else equal, the positive relation between financial constraints and tax avoidance is stronger (weaker) among firms with more (less) TPO.

However, empirical evidence consistent with H1a may not necessarily be found because financially constrained firms with less TPO may pursue tax planning strategies that are more risky/aggressive and avoid no less than the firms with more TPO.

Specifically, under the call of financial constraints, firms that have not under-exploited classification-based avoidance in the past may take more risk to pursue tax savings and step further beyond the predicted level of classification-based avoidance. In other words, financial constraints may always be able to induce managers to pursue extra tax savings by pushing for more risk-taking, and the positive relation between financial constraints and tax avoidance may not be a function of the level of opportunities. Prior studies support this argument. Rego and Wilson (2012) provide evidence that equity risk incentives induce managers to undertake more risky tax planning strategies. Similar to equity compensation, firms faced with financial constraints may also alter their risk attitude. Consistently, Law and Mills (2015) find that financially constrained firms pursue more aggressive tax planning strategies. Therefore, I add H1b in null form.

H1b: All else equal, the positive relation between financial constraints and tax avoidance is unrelated to TPO.

CHAPTER III

RESEARCH DESIGN

The TPO measure

Following Kim et al. (2017), I predict a firm's optimal Cash ETR (CETR) from the past five years (t-5 to t-1) based on firm characteristics including firm size, ROA, leverage (LEV), net operating loss (NOL), change in NOL, foreign income (Foreign), capital intensity (PP&E), equity income (Equity), R&D expense and market-to-book ratio (MTB).[9] All predictors are the average from the past five years (t-5 to t-1). All of them are defined in Appendix A. Five-year CETR is used because it provides a more inclusive picture for a firm's overall tax planning activities.[10] In order to reflect cross-industry and time-serial differences in the determination of CETR, I sort firm-years into Fama-French 12 industries[11] and three-year periods (1987-1996; 1997-2006; 2007-2016). One regression is estimated for each industry-period combination since I expect the associations between firm characteristics and CETR (i.e., regression coefficients) to differ across industries and evolve over time.

[9] Using prediction models to compute optimal values has precedents in accounting research. For example, Core and Guay (1999) use a prediction model to calculate firms' optimal equity incentive levels.
[10] I do not use annual Cash ETR because Dyreng et al. (2008) find that annual Cash ETRs are not very good predictors for long-run tax avoidance.
[11] Later in the supplemental tests I use FF17 and FF48 and find similar results.

$$CETR_{t-5,t-1}$$

$$= \theta_0 + \theta_1 Size_{avg(t-5,t-1)} + \theta_2 ROA_{avg(t-5,t-1)} + \theta_3 LEV_{avg(t-5,t-1)}$$

$$+ \theta_4 NOL_{avg(t-5,t-1)} + \theta_5 \Delta NOL_{avg(t-5,t-1)} + \theta_6 Foreign_{avg(t-5,t-1)}$$

$$+ \theta_7 PP\&E_{avg(t-5,t-1)} + \theta_8 Equity_{avg(t-5,t-1)} + \theta_9 R\&D_{avg(t-5,t-1)}$$

$$+ \theta_{10} MTB_{avg(t-5,t-1)}$$

$$+ \varepsilon \qquad (1)$$

where

$$CETR_{t-5,t-1} = \frac{TXPD_{t-5,t-1}}{PI_{t-5,t-1} - SPI_{t-5,t-1}}$$

Both the numerator and the denominator are required to be positive, which means firms included in the prediction model could have years with negative cash tax paid or pre-tax book income, but the total cash tax paid/pre-tax book income over five years must be positive.

The TPO measure in year t is the difference between actual CETR and predicted ETR from the five years prior to year t, the latter of which is calculated using the coefficients (θ_0 *to* θ_{10}) obtained from estimating Equation (1). In other words, TPO is the regression residual from Equation (1). Higher TPO indicates higher level of opportunities.[12]

$$TPO_t = CETR_{t-5,t-1} - \widehat{CETR_{t-5,t-1}}$$

The Measure of Tax Avoidance

[12] Negative TPO means that the firm over-used its opportunities in the past.

Following prior studies investigating the relation between financial constraints and tax avoidance (Edwards et al. 2016; Law and Mills 2015), I use one-year Cash ETR[13] as the measure for tax avoidance. Again, TXPD and PI-SPI are both required to be positive.

$$CETR1_t = \frac{TXPD_t}{(PI - SPI)_t}$$

Measures of Financial Constraints

Since prior studies use different proxies for financial constraints and there is little consensus in the finance literature as to which proxy is the best[14], I use eight financial constraint measures: a dividend dummy, the HP index (Pierce and Hadlock 2010), the WW index (Whited and Wu 2006), the KZ index (Kaplan and Zingales 1997), the Z-score (Altman 1968), predicted bond rating, negative words in 10-K, and debt service ratio. The definition for each of the constraint measures follows.

a. Dividend dummy. It is equal to one for the firms paying any common dividend (DVC) or preferred dividend (DVP), zero otherwise. The intuition is that firms able to pay dividends are likely not subject to financial constraints. The variable is multiplied by negative one so it is increasing in financial constraints.

[13] I use one-year Cash ETR because it is most sensitive to the change in financial constraints. Three-year or five-year Cash ETRs are stickier.
[14] See, for example, Hadlock and Pierce (2010) for a discussion.

b. The HP index. It is based on two factors: firm size and firm age, where size is inflation-adjusted book assets and age is the number of years a firm is listed in Compustat with non-missing stock price.

$$HP\ index = -0.737 \times Size + 0.043 \times Size^2 - 0.040 \times Age$$

c. The WW index. It is based on a firm's operating cash flow, dividend activity, long-term leverage, size, sales growth and industry average sales growth.

$$WW\ index$$
$$= -0.091 \times \left(\frac{IB + DP}{AT}\right) - 0.062 \times Dividend\ paying\ indicator + 0.021 \times \frac{DLTT}{AT}$$
$$- 0.044 \times Ln(AT) + 0.102 \times Avg\ industry\ sales\ growth - 0.035 \times Sales\ growth$$

d. The KZ index. It is based on a firm's cash flow, Tobin's Q, debt-to-equity ratio, dividend payment and cash holdings.

$$KZ\ index = -1.00 \times \left(\frac{IB + DP}{lagPPENT}\right) + 0.28 \times \left(\frac{AT + PRCC_F \times CSHO - CEQ - TXDB}{AT}\right)$$
$$+ 3.13 \times \left(\frac{DLTT + DLC}{DLTT + DLC + SEQ}\right) - 39.36 \times \left(\frac{DVC + DVP}{lagPPENT}\right)$$
$$- 1.31 \times \left(\frac{CHE}{lagPPENT}\right)$$

e. The Z-score. It is based a firm's profitability, working capital, sales, retained earnings and equity-debt ratio.

$$Z_{score} = -1 \times \left\{3.3 \times \left(\frac{PI + XINT}{AT}\right) + 1.2 \times \left(\frac{WCAP}{AT}\right) + \left(\frac{SALE}{AT}\right) + 1.4 \times \left(\frac{RE}{AT}\right)\right.$$
$$\left. + 0.6 \times \left(\frac{CSHO \times PRCC_F}{LT}\right)\right\}$$

f. Bond ratings. Data regarding bond ratings are obtained from Mergent FISD database. I convert categorical bond ratings (e.g. AAA, BB-, D) into

numerical scores (e.g. 10, 4, 0) according to a bond rating conversion table available online.[15] Numerical bond ratings are then multiplied by -1 so higher values indicate higher levels of financial constraints. To overcome data limitation on bond rating, I follow Equation (5) in Barth, Beaver and Landsman (1998) and predict a bond rating for every firm-year.

g. Negative words in 10-K. The ratio of negative words to total words in a firm's 10-K. This is the main constraint measure in Law and Mills (2015). Example of negative words are "loss, against, limited, adverse, impaired". [16]

h. Debt service ratio (DSR). A measure of current cash flow available to pay current debt obligations. $DSR = (DLC + XINT)/EBITDA$

For the convenience of stating economic significance of my main finding and conducting subsequent tax risk tests, I apply principal factor analysis and use the first component as an all-in-one measure for financial constraints.

Main Regression

To test H1a/H1b I estimate the following regression. I regress a firm's one-year Cash ETR (CETR1) on TPO, financial constraints and the interaction term between the two, along with a set of control variables. The same set of variables from Equation (1), at year t, are used as controls. These variables control for a firm's structure-based avoidance

[15] See the table at http://multiple-markets.com/3ratingschart.htm.
[16] Data are obtained from Bill McDonald's webpage: https://www3.nd.edu/~mcdonald/

and the uncontrolled variation is for financial constraints, TPO, and the interaction between the two to explain.

$$CETR1_{i,t} = \beta_0 + \beta_1 TPO_{i,t} + \beta_2 Constraint_{i,t} + \beta_3 Constraint_{i,t} \times TPO_{i,t} + \Sigma Controls_{i,t} + \Sigma Industry\ FE + \Sigma Year\ FE + \varepsilon_{i,t} \quad (2)$$

I expect β_1 to be positive because firms with more TPO, meaning the firms where classification-based avoidance for the past years is below prediction, will likely continue the trend and keep paying more tax in the current year. I have no expectation on β_2 due to the existence of the interaction term. The variable of interest is the interaction term. A negative β_3 is consistent with H1a and an insignificant β_3 is consistent with H1b.

CHAPTER IV

SAMPLE SELECTION

Most of my data are available from Compustat. The sample period is 1987-2016. I start with 1987 because it is the first year firms are required to disclose cash tax paid (Compustat item TXPD).[17] Loss firms are excluded because tax avoidance studies typically limit their samples to firms with positive cash tax paid and pretax book income.[18] Cash ETR measures are winsorized at 0 and 1. All other continuous variables are winsorized at 1% and 99%. The sample size varies from 21,835 to 44,285 observations with different financial constraint proxies. Sample selection procedure is presented in Table 1.

[17] Since the calculation of TPO requires TXPD for the past five years, I use Current Tax Expense (TXS) to substitute for TXPD for the years with missing TXPD.

[18] Loss firms face different tax planning incentives than profitable firms. For loss firms, one of the few common tax planning considerations is loss carry-backward/forward. For profitable firms, tax planning becomes much more complex and include the considerations for R&D credits, depreciation and amortization, transfer pricing and so on. Therefore, profitable firms provide a better setting for answering my research question. Also, Cash ETRs calculated for observations with negative cash tax paid and/or pretax income may add bias to the results. For example, a firm could have a loss in consolidated financial statement but pay some tax in a foreign affiliate. In such case, cash tax paid would be positive and pretax income would be negative, resulting in a negative Cash ETR that would artificially suggest high tax avoidance.

CHAPTER V

DESCRIPTIVE STATISTICS AND REGRESSION RESULTS

Descriptive Statistics and Main Results

Table 2 shows the descriptive statistics for the variables included in the main regressions. The average one-year Cash ETR (CETR1) is 29.4%. The mean TPO is close to zero because it is the average residual from the prediction model. All continuous financial constraint measures have zero mean because they are all mean adjusted, which makes the interpretation of regression results easier.

Table 3, Panel A shows the Pearson/Spearman correlations among the variables included in the main regressions. CETR1 and TPO are positively correlated, meaning that firms with more TPO continue to pay more taxes. Size, ROA, MTB, R&D, intangible, equity income, NOL, leverage, PP&E and foreign income are all negatively related to CETR1, which is consistent with prior studies. Panel B shows the correlations among all eight financial constraint proxies. The correlations between HP index and WW index and between HP index and predicted bond rating are relatively high. In general, Panel B suggests that different proxies capture different dimensions of financial constraints.

Table 4, Panel A shows the results from estimating Equation (2) as a pooled OLS regression, using eight individual financial constraint measures and one comprehensive measure (PCA). PCA is the first principal component from the previous eight constraint measures. The coefficient on TPO ($\beta 1$) is positive and significant in all columns, meaning that firms with more TPO from the past five years continue to pay more taxes in the current year. The coefficient on Constraint ($\beta 2$) is negative and significant in six of the

nine columns, consistent with the notion that financially constrained firms avoid more taxes.[19] Consistent with H1, the coefficient (β3) on the interaction term, Constraint×TPO, is negative and significant in seven of the nine columns. This is consistent with the expectation that the positive relation between financial constraints and tax avoidance (i.e. the negative relation between financial constraints and CETR1) is stronger for the firms with high TPO. In terms of economic significance, Column (9) shows that the relation between financial constraints and tax avoidance (at mean Constraint) is 174.8% stronger with one standard deviation[20] increase in TPO (-0.046×0.152/-0.004=1.748).

To address the potential omitted variable problem, Table 4, Panel B shows the results with firm fixed-effects. TPO is negative and significant in three of the nine columns. This means that for a given firm, there is some evidence that high TPO is associated with low current ETR. Since TPO is positive without firm fixed-effects, it means that the positive association between TPO and current ETR only exists cross-sectionally. Constraint is negative and significant in most of the columns. The interaction between Constraint and TPO is negative and significant in six of the nine columns, consistent with the results obtained from pooled OLS regressions. Column (9) shows that, with firm fixed-effects, the relation between constraints and tax avoidance is 425.6% stronger with one standard deviation increase in TPO (-0.028×0.152/-0.001=4.256).

[19] One might argue since the negative association between financial constraints and tax avoidance exists even when TPO is zero, having opportunity to avoid tax is not a necessary condition. However, TPO is a relative measure and having a zero TPO only means the firm is at the average level of classification-based avoidance. It does not literally mean the firm has no opportunity.

[20] The standard deviation of TPO for the observations included in Column (9) is 0.152, which is not shown in Table 2 because Table 2 shows the descriptives for a bigger sample.

An alternative way to address the potential omitted variable problem is to use change analysis. In change analysis, all the variables are measured in first difference except for TPO. The implication from change analysis is slightly different than that from level analysis: it suggests when there is a change in the level of financial constraints, whether it is the high TPO firms that avoid more taxes. One problem with change analysis is that some constraint proxies barely change from one year to the next. For example, HP index changes very little from year to year since it is based on firm size and age. Similarly, firms' bond ratings also tend to change little from one year to another. In that sense, dividend payment is a better measure for change analysis since it is a binary variable that clearly suggests when financial constraints are on/off. Table 4, Panel C shows the results. TPO is negative and significant in all the columns, meaning that firms with high TPO experience declines in Cash ETR thereafter. ΔConstraint is negative and significant in three of the nine columns. Notably, ΔKZ and ΔZ being negative and significant is consistent with Edwards et al. (2016), where change analysis is also used. The interaction term is negative in eight of the nine columns, of which four columns are significant. Consistent with my expectation, dividend is negative and significant whereas HP index and predicted bond rating are insignificant.[21] In sum, change analysis provides weaker yet consistent results.

Most of the control variables are significant in the expected directions, but some of them flip when firm fixed-effects are included or change analysis is used. ROA, MTB,

[21] In untabulated change analyses I find that when ΔConstraint is defined as a dummy variable with arbitrary cutoffs, more columns become significant. For example, predicted bond rating becomes negative and significant at 10% level when ΔConstraint is defined as equal to 1 for top 10% changes in Constraint. WW index and PCA become negative and significant when ΔConstraint is equal to 1 for top 2% changes in Constraint. This is consistent with the argument that the year-to-year change in many constraint proxies is tiny.

Intangible, equity earnings, NOL, and foreign income are negatively associated with ETR with and without firm fixed-effects. Size, R&D, Leverage and PP&E are negatively related to ETR only without firm fixed-effects. In change analysis, what is unexpected is that ΔR&D, Δleverage and ΔPP&E are actually positively associated with ΔCETR. Importantly, obtaining results consistent with H1 with all the controls suggests that the additional tax avoidance exhibited by financially constrained firms stems from classification-based avoidance, as opposed to structure-based avoidance, because any additional structure-based avoidance would have been reflected on the controls such as leverage and R&D. Since almost all prior studies examining cross-sectional differences in tax avoidance control for structure-based avoidance, groups with higher levels of tax avoidance likely are engaged in classification-based tax avoidance.

Two Exogenous Shocks to Financial Constraints

A scenario where the level of financial constraints is exogenously increased for some firms provides clearer identification to test my hypotheses. In 2006, the Pension Protection Act (PPA) was signed into law, which requires firms to fully fund their pension plans in seven years. Since firms were previously required to fund 90% of their plans in 30 years, PPA significantly accelerates near term cash outflows, for the firms with severely underfunded pension plans in particular. Ruah (2006) finds that capital expenditures decline with the implementation of PPA and this effect is particularly evident among firms that are already financially constrained. In terms of market reaction, Campbell et al. (2010) find that equity valuation effect of PPA is more negative for firms with larger underfunded pension plans and larger capital expenditure needs. Most

recently, Campbell et al. (2017) find that increased financial constraints caused by PPA leads firms to avoid more taxes. Relying on this exogenous shock in financial constraints, I expect firms with more underfunded pension plans to avoid more taxes as a channel to provide internal cash flows, and this effect is more pronounced for the firms with higher levels of TPO.

Following Campbell et al. (2010), I identify firms' pension plan funding status by comparing the fair value of their total pension assets to their total projected pension liabilities at the end of 2006.[22] I employ a difference-in-difference model where firms in the bottom tercile of funding status are defined as treated firms and the ones in the top tercile as control firms. Since firms are required to fully fund their plans in seven years, I use a balance sample period from 1999 to 2013 with the years after 2006 being *Post* years. Since PPA mandates firms to contribute to under-funded pension plans and firms' contributions to pension plans are tax deductible, a pension-adjusted Cash ETR has to be used to avoid capturing a mechanical reduction in Cash ETR. To do so, I follow Campbell et al. (2010) and add back 35% of pension contribution[23] to the Cash Tax Paid (TXPD) and Pension Expense (XPR) to Pretax Income (PI). A pension-adjusted Cash ETR reflects the level of tax planning excluding pension activities. I expect the interaction between *Treated* and *Post* to be more negative as the level of TPO increases.

Results from the difference-in-difference model are reported in Table 4, Panel D. Overall, the interaction between *Treated* and *Post* is negative and marginally significant (t=-1.624), consistent with increased financial constraints leading firms to avoid more

[22] Pension data for 2006 are obtained from Compustat Legacy.
[23] Pension contribution data are obtained from Compustat – Pension Section.

taxes. Consistent with my expectation, the interaction term is statistically insignificant for low and median TPO groups, but negative and strongly significant (t=-2.448) when TPO is high.

I use the 2008 Financial Crisis as the other setting where the level of financial constraints is exogenously increased. Cohn and Wardlaw (2016) find that increased financial constraints caused by the Financial Crisis lead to increased workplace injuries, as firms become cash-constrained and invest less in workplace safety. Following Cohn and Wardlaw (2016), I define firms with top-tercile Long-term Debt Due in 1 Year (DD1) as treated firms and the ones in the bottom-tercile as controls. Firms with more debt due in one year at the onset of the Financial Crisis would have difficulty refinancing their debts and would thus face a negative cash-flow shock. Following Cohn and Wardlaw (2016), I code 2006 and 2007 as pre years and 2008 as the post year. I expect treated firms to avoid more taxes in the post period and this effect is more pronounced for the firms with more TPO.

Results are reported in Table 4, Panel E. Overall, the interaction between *Treated* and *Post* is marginally significant (t=-1.294). However, the term becomes more significant (t=-1.786) for the high TPO group. In sum, results consistent with H1a are verified in two settings where an increase in financial constraints is clear and exogenous.

Five-year Cash ETR Falsification Test

In order to illustrate that my TPO measure includes additional information and is not merely a reflection of high low Cash ETR, I use Cash ETR from the past five years in

place of TPO and perform a falsification test based on aforementioned exogenous shocks in financial constraints. Finding similar results with Cash ETR as TPO would suggest TPO does not provide incremental information to high/low Cash ETR. Results for the falsification test are shown in Table 4, Panel F and G. In the PPA setting, although the interaction term is marginally significant (t=-1.624) for the full sample, it is not significant for any of the TPO groups. Similarly in the Financial Crisis setting, the interaction term is marginally significant overall (t=-1.294) but not significant for any of the sub-groups. Therefore, Cash ETR falsification test suggests that my TPO measure does contain incremental information.

Book-Tax Difference Based TPO

My TPO measure is based on the difference between expected and actual ETRs. A commonly used alternative measure of firms' tax avoidance is book-tax differences (BTD). BTD is calculated as the difference between pretax book income and estimated taxable income, where estimated taxable income is current federal tax expense (TXFED) plus current foreign tax expense (TXFO) grossed up by 35%, then scaled by lagged total assets. A larger BTD indicates higher level of tax avoidance. In this section, I construct my TPO measure on the difference between expected BTD and actual BTD from the past five years to confirm that firms with more BTD-based TPO exhibit more BTD when financially constrained. Furthermore, I break down total BTD into permanent and temporary BTDs and investigate whether firms with high permanent- (temporary-) based

TPO engage in more permanent- (temporary-) based tax avoidance under financial constraints. Temporary BTD is deferred tax expense (TXDI) grossed up by 35% and scaled by lagged total assets. Permanent BTD is the difference between total BTD and temporary BTD. All three BTD variables are defined in Appendix A.

$$Total\ BTD = \frac{PI - (TXFED + TXFO)/35\,\%}{Lagged\ Total\ Assets}$$

$$Temporary\ BTD = \frac{TXDI/35\,\%}{Lagged\ Total\ Assets}$$

$$Permanent\ BTD = Total\ BTD - Temporary\ BTD$$[24]

Predicted BTD is computed using the same predictors in Equation (1). A predicted BTD greater than actual BTD indicates more TPO. The same set of predictors are also used to predict permanent and temporary BTDs because most of the firm characteristics that predict temporary differences also predict permanent differences.

Results are reported in Table 5. All the specifications are with firm fixed-effects. In Panel A, the coefficient on the interaction term (β3) is positive and significant all the columns, suggesting that firms with more BTD-based TPO exhibit more BTD under financial constraints, relative to the firms with less BTD-based TPO. This is consistent with the results obtained when tax avoidance and TPO are based on ETR. In Panel B, the dependent variable and TPO are both based on permanent BTD. β3 is positive and

[24] Similar to ETR-based TPO, BTD-based TPO in year t is computed based on five years prior to year t. Similar to ETR-based tests, BTD in year t is used as the dependent variable. Equations are not shown with different year subscripts for brevity.

significant in all columns, meaning that firms with high permanent BTD-based TPO exploit more permanent BTD when financially constrained. In Panel C, the dependent variable and TPO are both based on temporary BTD. Similar to Panel B, β3 is positive and significant in most of the columns. This suggests that firms with high temporary BTD based TPO exploit more temporary BTD when financially constrained, a result consistent with Edwards et al. (2016).

In sum, BTD-based tests confirm the results from ETR-based tests[25], and further show that firms with high TPO in terms of permanent (temporary) BTD exploit more of permanent (temporary) BTD to increase tax savings when faced with financial constraints.

[25] ETR and BTD based tests are not necessarily independent. Guenther (2014) examines the differences between ETR and BTD as tax avoidance measures. He argues that BTD scaled by pretax income is statistically equivalent to ETR.

CHAPTER VI

EXAMINING TAX RISK FOR LOW TOP FIRMS

Main regression results shown in Table 4 suggest that, inconsistent with H1b, financially constrained firms with low TPO are unable to engage in risky/aggressive classification-based avoidance to the extent that makes them avoid no less than the firms with high TPO. In this section, I directly test tax risk[26] by investigating whether financially constrained firms with low TPO exhibit more tax risk. Low TPO firms under financial constraints could exhibit more tax risk because they are already beyond the average level of classification-based avoidance and to avoid more tax means to step further beyond the average level by increasing aggressiveness. I follow three contemporaneous studies that examine firms' tax risk.

Dyreng, Hanlon and Maydew (2017)'s Test

Dyreng, Hanlon and Maydew (2017) study the relation between tax avoidance and tax uncertainty and find that the positive relation between the two is driven by firms with more patent filings and tax haven operations. They use a firm's increases in UTB due to current year positions (UTB_ADDS, Compustat item TXTUBPOSINC) as the indicator of uncertainty, as the FASB Accounting for Income Taxes (ASC 740, formerly known as FIN 48) requires that managers reflect the tax positions that do not meet the more-likely-than-not threshold (i.e. uncertain tax positions) in their firms' Unrecognized Tax Benefits (UTB) reserves. Prior studies show that the level of UTB reserves is

[26] While tax risk has alternative meanings in the literature, the tax risk here is based on the sustainability of tax positions. Tax positions that have a high probability of being overturned by the tax authority contain more tax risk. I use proxies used in prior studies to measure tax risk.

indicative of the riskiness associated with a firm's tax positions (Lisowsky, Robinson and Schmidt 2013; Ciconte, Donohoe, Lisowsky and Mayberry 2016).

Following Dyreng et al. (2017), I estimate Equation (3) where I regress current year's additions to UTB (UTB_ADDS) on TPO, financial constraints and the interaction between the two, with the standard set of controls. The first component of principal component analysis is used as the constraint measure. To the extent that low TPO firms engage in more risky tax avoidance but not enough for them to avoid the same as high TPO firms, I expect the interaction term to be negative as it suggests positive relation between tax risk and constraints is weaker (stronger) when TPO is high (low).

$$UTB\_ADDS_{i,t} = \beta_0 + \beta_1 TPO_{i,t} + \beta_2 Constraint_{i,t} + \beta_3 Constraint_{i,t} \times TPO_{i,t} + \Sigma Controls_{i,t} + \Sigma Industry\ FE + \Sigma Year\ FE + \varepsilon_{i,t} \quad (3)$$

Results are shown in Table 6. In Column (1), the interaction term is positive and significant, suggesting that high TPO firms, when financially constrained, exhibit more tax risk. This result is inconsistent with the notion that low TPO firms pursue more risky tax strategies under financial constraints and suggests that tax risk could stem from converging toward the average level of classification-based avoidance. In Column (2), the interaction term becomes insignificant when firm fixed-effects are included.

Guenther, Wilson and Wu (2017)'s Test

Guenther, Wilson and Wu (2017) apply a set of equations first used in a finance study (Chang, Dasgupta, Wong and Tao 2014) and decompose a firm's total potential tax (pre-tax book income multiplied by statutory tax rate, plus state tax) into cash tax paid

and tax avoided. They then break down tax avoided into the safe component, which they term "conventional" tax avoidance, and the uncertain component. The uncertain component is the part of tax avoidance that ends up in the firm's UTB reserves. By comparing the conventional component with the uncertain component using an uncertain ratio[27], Guenther, Wilson and Wu (2017) find that in the settings where firms engage in more tax avoidance (including financial constraints), additional tax avoidance is not necessarily associated with more uncertain tax avoidance that cause increases to a firm's UTB reserves. They therefore conclude that additional tax avoidance is not necessarily more uncertain in terms of the sustainability of tax positions. The details of their methodology are shown in Appendix B.

To investigate whether low TPO firms under financial constraints engage in more tax avoidance by assuming more risk, I apply the set of equations to my sample. Merging the sample with the observations used in Guenther, Wilson and Wu (2017) generates 4,196 observations. Great amount of observations is lost because Guenther, Wilson and Wu (2017) only include tax avoiders and estimating the equations requires firms to report non-missing current increases in UTB reserves (TXTUBPOSINC).

I assign observations to a two-by-two matrix with high/low TPO and high/low financial constraints partitions and estimate Equation (4a) – (4d) (shown in Appendix B) for each of the four partitions. The first component of principal component analysis is again used as the constraint measure. An increase in uncertain ratio from Low TPO/Low Constraint to Low TPO/High Constraint is consistent with the idea that low TPO firms

[27] Uncertain ratio is uncertain tax avoided as a percentage of total tax avoided (uncertain + conventional). See Appendix B for details.

exhibit more tax risk when financial constraints call for more tax avoidance. Table 7 show the results. The uncertain ratio increases from 1.3% to 2.0% from Low TPO/Low Constraint to Low TPO/High Constraint. However, the ratio increases from 2.6% to 10.3% when TPO is high, meaning that high TPO firms, when faced with financial constraints, exhibit much more tax risk than low TPO firms. This is consistent with the results shown in Table 6.

Guenther, Matsunaga and Williams (2017)'s Test

One problem with the method used by both Dyreng et al. (2017) and Guenther, Wilson and Wu (2017) is that additional tax avoidance may actually be more uncertain than it appears in UTB reserves because managers may refrain from recording tax reserves to retain financial reporting benefit. To address this problem, I follow another paper investigating the riskiness of corporate tax avoidance. Guenther, Matsunaga and Williams (2017) examine whether current tax avoidance is associated with future tax risk and overall firm risk, where the volatility of future Cash ETR is used as the proxy for future tax risk. Using a variety of tax avoidance measures, Guenther, Matsunaga and Williams (2017) find no evidence that tax avoidance is related to future tax risk. Applying the same regression model, I examine whether financially constrained firms with low TPO exhibit greater future ETR volatility by estimating Equation (5). The first component of principal component analysis is used as the constraint measure.

$$CETR\ Volatility_{t+1,t+5}$$

$$= \beta_0 + \beta_1 TPO_{i,t} + \beta_2 Constraint_{i,t} + \beta_3 TPO_{i,t} \times Constraint_{i,t}$$

$$+ \Sigma Controls_{i,t} + \Sigma Industry\ FE + \Sigma Year\ FE$$

$$+ \varepsilon_{i,t} \qquad (5)$$

I expect the coefficient on the interaction term (β3) to be negative if financially constrained firms with low TPO exhibit more future tax risk. Results are shown in Table 8. The interaction term is insignificant with and without firm fixed-effects, meaning that financially constrained firms with low TPO do not exhibit greater future tax risk. TPO is positive and significant but it becomes negative when firm fixed-effects are added. These results suggest that TPO is positively related to future ETR volatility cross-sectionally but negatively related to it within firms.

CHAPTER VII

SUPPLEMENTAL TESTS

Cash Flow Based ETR

The measure of tax avoidance, CETR, is basically a ratio of cash tax paid to pretax book income. Therefore, firms not avoiding tax (numerator effect) but inflating book income (denominator effect) would be mistaken as tax avoiders by CETR. Further, financially constrained firms do have the motivation to inflate book income. Linck, Netter and Shu (2013) find that financially constrained firm use discretionary accruals to signal positive prospects, which enables them to raise external capital for investments. To address the concern that my main results are due to financially constrained firms inflating book income, I follow Guenther, Krull and Williams (2014) and use cash flow based ETR as the measure of tax avoidance. I also calculate my TPO measure based on cash flow based ETR. Specifically, operating cash flow (OANCF) is used in replacement of pretax book income (PI) as the denominator as operating cash flow is immune to accrual-based earnings management. I am able to obtain similar results using cash flow based measures.

Quartile-based Regressions

The main empirical evidence of this paper is provided by the interaction term between incentive and opportunity. As an alternative approach, I split the sample into TPO quartiles and re-estimate the pooled OLS regression for each quartile. Consistent with the results obtained when the interaction term is included, quartile-based regressions

show that the relation between CETR and financial constraints becomes more negative as the level of TPO increases.

Alternative TPO Measures

With the concern that my TPO measure, based on Fama-French 12 industry classification, may compare firms with very different business natures, I re-construct my TPO measure based on Fama-French 17 and 48 industry classifications. The main results stay qualitatively the same.

The Exclusion of Financial and Utility Firms

Accounting research usually excludes financial (SIC 6000-6999) and utility firms (SIC 4900-4999) from their sample as those firms are subject to different regulations and incentives. While I do not expect the interaction between financial constraints and TPO to be different for those firms in a particular way, I nonetheless exclude them and re-run the tests as a robustness check. Results remain qualitatively the same.

Non-incentive Falsification Test

The basic argument in this paper is that financial constraints incentivize managers to take full advantage of TPO. In that sense, firm characteristics that facilitate tax avoidance, but do not strengthen managers' will to generate tax savings, should not motivate managers to explore more TPO. Studies find that internal information environment and product market power facilitate firms' ability to avoid taxes. Gallemore and Labro (2015) argue that good internal information environment facilitates information collection and cross-department coordination and helps firms avoid more taxes. Kubick, Lynch, Mayberry and Omer (2015) argue that firms with strong product

market power avoid more taxes due to more stable profit stream and stronger shield against adverse tax outcomes.

To test whether my main results are genuinely due to the interaction between incentive and TPO, I replace financial constraints with internal information and product market power measures. Following Gallemore and Labro (2015) and Kubick et al. (2015), I use earnings announcement speed, management forecast error and internal control weakness as the proxies for internal information and price-cost margin as the proxy for product market power. Obtaining the same results with those measures will suggest my main results to be spurious. Table 9 shows the results with firm fixed-effects. In general, internal information and product market power are negatively related to ETR, although two of the proxies are statistically insignificant. Most importantly, two of the interaction terms are strongly positive and significant, whereas only one interaction term is weakly negative and significant. Overall, non-incentive falsification test shows results consistent with the notion that non-incentive firm characteristics do not motivate managers to exploit additional TPO.

CHAPTER VIII

CONCLUSION

In this paper I introduce the concepts of structure-based and classification-based tax avoidance and argue that the documented relationship between incentives and tax avoidance is attributable to the variations in classification-based tax avoidance. I then investigate the conjecture that the incentive to avoid taxes and the availability of tax planning opportunities (TPO) jointly explain the variations in corporate tax avoidance. Following prior studies, I choose financial constraints as the proxy for tax avoidance incentives and use the distance between a firm's actual and predicted ETRs as the TPO measure. I find that the positive relation between financial constraints and tax avoidance documented by prior studies is significantly stronger for firms with higher TPO. I further show that firms with more permanent (temporary) book-tax differences (BTD) based TPO exhibit more permanent (temporary) BTD when faced with financial constraints. Finally, I find little evidence that financially constrained firms with low opportunities are exposed to more tax risk. My paper suggests researchers and practitioners to take opportunity factor into account when considering the relationship between incentive and tax avoidance.

APPENDIX A

VARIABLE DEFINITIONS

Variable	Definition
CETR1	One-year cash effective tax rate, calculated as TXPD/(PI-SPI) where TXPD>0 and (PI-SPI)>0
CETR5	Five-year cash effective tax rate, calculated as ΣTXPD/Σ(PI-SPI) where ΣTXPD>0 and Σ(PI-SPI)>0
TPO	A firm's tax planning opportunity, which is the difference between a firm's actual and predicted ETR from the past five years. Predicted ETR is calculated using Kim et al. (2017)'s model. A prediction regression is estimated for each FF12 industry-period combination.
Dividend dummy	Dummy variable equal to one is the firm pays any common dividend (DVC) or preferred dividend (DVP), zero otherwise. It is multiplied by negative one so it is increasing in financial constraints.
HP index	Financial constraint index developed by Hadlock and Pierce (2010), calculated as (-0.737*size)+(0.043*size^2)-(0.040*age). Size is the natural logarithm of inflation-adjusted book assets. Age is the number of years a firm is listed in Compustat with non-missing stock price. Book asset is winsorized at 4.5 billion and age in winsorized at 37 years.
WW index	Financial constraint index developed by Whited and Wu (2006), calculated as -0.091*(IB+DP)/AT-0.062*dividend paying indicator+0.021*DLTT/AT-0.044*Ln(AT)+0.102*Average yearly sales growth at three-digit SIC level-0.035*(firm's sales growth).
KZ index	Financial constraint index developed by Kaplan and Zingales (1997), calculated as -1*[(IB+DP)/lagPPENT]+0.28*[(AT+PRCC_F*CSHO-CEQ-TXDB)/AT]+3.13*[(DLTT+DLC)/(DLTT+DLC+SEQ)]-39.36*[(DVC+DVP)/lagPPENT]-1.31*(CHE/lagPPENT)
Z-Score	Financial constraint measure developed by Altman (1968), calculated as -1*{3.3*[(PI+XINT)/AT]+1.2*(WCAP/AT)+(SALE/AT)+1.4*(RE/AT)+0.6*[(CSHO*PRCC_F)/LT]}
Bond rating	Bond rating data are from Mergent FISD. Categorical bond ratings are converted to numerical based on standards from http://multiple-markets.com/3ratingschart.htm. Predicted bond ratings are based on the prediction model used in Barth et al. (1998), p19.
Negative words	The ratio of negative words to total words in a firm's 10-K, obtained from Bill McDonald's website. Examples of negative words: impairment, adverse, limit, constraint.
Debt service ratio	Short-term debts (DLC)+interest expense (XINT)/earnings before interest, tax, depreciation and amortization (EBITDA)
Size	The natural logarithm of AT
PP&E	PPENT scaled by lagged AT

R&D	XRD scaled by lagged AT, with missing XRD replaced with zero
Foreign income	PIFO scaled by lagged AT, with missing PIFO replaced with zero
NOL	Indicator variable equal to one is TLCF is non-zero and non-missing, zero otherwise
ΔNOL	Change in the amount of NOL
MTB	Market-to-book ratio, calculated as (CSHO*PRCC_F)/CEQ
ROA	Net income (NI) scaled by lagged total assets (AT)
Intangible	Intangible assets (INTAN) scaled by lagged total assets (AT)
Equity Income	Equity income in earnings (ESUB) scaled by lagged total assets
Leverage	Leverage, calculated as (DLTT+DLC)/AT
Potential Tax	Tax liability a firm potentially bears, calculated as (PI*35%+TXS)/lagged AT
Conventional	Potential Tax avoided via conventional tax avoidance, calculated as Potential Tax less Uncertain plus Settlement less Cash Tax Paid. Uncertain, Settlement, and Cash Tax Paid are defined below.
Uncertain	Potential Tax avoided via uncertain tax avoidance, calculated as UTB increase in current positions (TXTUBPOSINC) scaled by lagged AT
Settlement	UTB decrease due to settlements with the IRS, calculated as UTB settlements (TXTUBSETTLE) scaled by lagged AT
Cash Tax Paid	Taxes paid in cash, calculated as TXPD/lagged AT
Vol_CETR1	The standard deviation of one-year Cash ETR from year t+1 to year t+5
PROA	Pre-tax return on assets, calculated as PI/AT
Vol_PROA	The standard deviation of PTBI scaled by lagged total assets from year t+1 to year t+5
Discaccrual	The square of discretionary accruals, where discretionary accruals are estimated using the Modified-Jones method from Dechow et al (1996). It is based on all available Compustat observations.
Vol_Special Item	The standard deviation of SPI scaled by lagged total assets from year t+1 to year t+5
Vol_OCF	The standard deviation of OANCF scaled by lagged total assets from year t+1 to year t+5
ETBSO	Excess tax benefit of stock options (TXBCOF+TXBCO)
Vol_ETBSO	The standard deviation of ETBSO scaled by lagged total assets from year t+1 to year t+5
TLCF	Net operating loss carry-forward scaled by lagged total assets; TLCF is set to 0 is missing.
Ch_TLCF	The change in TLCF
Total book-tax difference (BTD)	PI-(TXFED+TXFO)/35%, where PI refers to pre-tax book income, TXFED refers to current federal tax expense, and TXFO refers to current foreign tax expense. It is then scaled by lagged total assets.
Temporary BTD	TXDI/35% scaled by lagged total assets, where TXDI refers to total deferred tax expense.
Permanent BTD	Total BTD-Temporary BTD

Earnings announcement speed (IIQ1)	The number of days between fiscal year end and annual earnings announcement day, multiplied by -1. See Gallemore and Labro (2015).
Managerial forecast error (IIQ2)	The absolute value of management's last EPS estimate minus actual EPS, multiplied by -1. See Gallemore and Labro (2015).
Internal control weakness (IIQ3)	Indicator variable equal to zero if firm reported a Section 404 material weakness in current fiscal year; one otherwise. See Gallemore and Labro (2015).
PCM	Price-cost margin: (SALE-COGS-XSGA)/SALE minus industry (two-digit SIC) value-weighted average (based on sales). OIADP (operating income after depreciation) is used when COGS/XSGA is missing. See p701 of Kubick et al. (2015).

APPENDIX B

THE SET OF EQUATIONS FROM GUENTHER ET AL. (2017)

In Guenther, Wilson and Wu (2017), the set of equations is constructed based on the idea of potential tax, which is equal to pre-tax book income multiplied by statutory tax rate, plus state tax expense. It represents a firm's total tax liability based on its pre-tax book income, without tax avoidance.

$$Potential\ Tax = Pretax\ Book\ Income\ \times 35\% + State\ Tax$$

A firm's potential tax can either be paid out in cash, or be avoided.

$$Potential\ Tax = Cash\ Tax\ Paid + Tax\ Avoided$$

When tax is avoided, it's either avoided using conventional or uncertain strategies.

$$Potential\ Tax = Cash\ Tax\ Paid + Conventional + Uncertain$$

Uncertain is the increases in UTB reserves due to current tax positions (TXTUBPOSINC). Conventional is the plug. Since Cash Tax Paid (TXPD) includes federal tax, state tax and cash tax settlements paid for tax positions taken in prior years, Settlement (TXTUBSETTLE) has to be taken out from Cash Tax Paid so Tax Avoided is not under-estimated. Conventional and Uncertain represent the parts of taxes avoided via conventional and uncertain strategies.

$$Potential\ Tax = Conventional + Uncertain - Settlements + Cash\ Tax\ Paid$$

Regressing each component on the right side of the equation on potential tax sets up four equations. Each β represents the percentage of potential tax that gets either

avoided with conventional strategies, avoided with uncertain strategies, or paid out in cash. All the βs should sum to one. Each equation is estimated separately.

$$Conventional_{it} = \beta_0^C + \beta^C PotentialTax_{it} + \beta Controls + \varepsilon_{it}^C \quad (4a)$$

$$Uncertain_{it} = \beta_0^U + \beta^U PotentialTax_{it} + \beta Controls + \varepsilon_{it}^U \quad (4b)$$

$$Settlements_{it} = \beta_0^{Sett} + \beta^{Sett} PotentialTax_{it} + \beta Controls + \varepsilon_{it}^{Sett} \quad (4c)$$

$$CashTaxPaid_{it} = \beta_0^{CTP} + \beta^{CTP} PotentialTax_{it} + \beta Controls + \varepsilon_{it}^{CTP} \quad (4d)$$

The indicator of tax risk is $\frac{\beta^U}{\beta^C+\beta^U}$, the uncertain ratio. Guenther, Wilson and Wu (2017) examine whether high levels of tax avoidance are more uncertain by comparing this ratio cross-sectionally. A higher percentage suggests more risk associated with a firm's tax positions.

APPENDIX C

TABLES

Table 1 Sample Selection

	Firm-years with CETR5 1987-2016	102,211
less	Firm-years with negative TXPD or negative PI-SPI	-27,485
less	Firm-years with missing TPO or any missing controls	-30,441
	Number of firm-years	44,285
	Number of unique firms	5,407

This table shows the sample selection procedure for the main regressions.

Table 2 Descriptive Statistics

Variable	N	Mean	Std. Dev.	P10	Q1	Median	Q3	P90
CETR1	44,285	0.294	0.205	0.059	0.158	0.273	0.375	0.505
BTD	55,209	-0.038	0.180	-0.192	-0.039	0.006	0.034	0.071
Permanent BTD	55,209	-0.037	0.183	-0.186	-0.016	0.004	0.021	0.054
Temporary BTD	55,209	-0.001	0.050	-0.041	-0.011	0.000	0.014	0.041
TPO	44,285	-0.011	0.157	-0.190	-0.101	-0.016	0.054	0.135
Dividend Dummy	44,285	-0.600	0.490	-1.000	-1.000	-1.000	0.000	0.000
HP index	44,269	0.000	0.666	-0.938	-0.552	0.010	0.435	0.874
WW index	44,274	0.000	0.101	-0.138	-0.072	0.002	0.073	0.134
KZ index	41,909	0.000	7.627	-9.928	-0.956	2.860	4.534	5.402
Z-score	40,617	0.000	3.949	-3.853	-0.812	1.020	2.287	3.181
Predicted Bond Rating	44,283	0.000	1.626	-2.242	-1.155	0.017	1.166	2.161
Negative Words	25,461	0.000	0.004	-0.006	-0.003	0.000	0.003	0.006
Debt Service Ratio (DSR)	42,238	0.000	0.657	-0.447	-0.381	-0.210	0.094	0.607
PCA (first component of principal component analysis)	21,835	0.000	1.811	-2.100	-0.975	0.106	1.225	2.160
Size	44,285	6.502	2.022	3.850	5.046	6.459	7.889	9.256
PP&E	44,285	0.626	0.414	0.149	0.293	0.543	0.903	1.223
R&D	44,285	0.025	0.046	0.000	0.000	0.000	0.030	0.089
Foreign Income	44,285	0.016	0.034	0.000	0.000	0.000	0.020	0.061
NOL	44,285	0.299	0.458	0.000	0.000	0.000	1.000	1.000
ΔNOL	44,285	0.000	0.033	-0.008	0.000	0.000	0.000	0.009
ROA	44,285	0.174	0.093	0.078	0.110	0.154	0.216	0.295
MTB	44,285	2.623	2.353	0.889	1.305	1.953	3.092	4.939
Equity Income	44,285	0.001	0.004	0.000	0.000	0.000	0.000	0.002
Leverage	44,285	0.213	0.173	0.000	0.052	0.200	0.333	0.442
Intangible	44,285	0.148	0.201	0.000	0.000	0.059	0.225	0.442
UTB Additions	6,566	0.001	0.002	0.000	0.000	0.001	0.002	0.004
Conventional	4,196	0.017	0.028	0.002	0.006	0.013	0.022	0.034
Uncertain	4,196	0.002	0.004	0.000	0.000	0.001	0.002	0.004
Settlement	4,196	0.001	0.023	0.000	0.000	0.000	0.001	0.002
Cash Tax Paid	4,196	0.029	0.025	0.004	0.011	0.022	0.039	0.063
PROA	5,475	0.093	0.122	-0.040	0.036	0.090	0.156	0.233
Vol_PROA	5,475	0.056	0.049	0.013	0.022	0.041	0.075	0.120
Discaccrual (discretionary accrual)	5,475	0.724	3.114	-0.511	-0.027	0.092	0.470	2.853
Vol_Special Item	5,475	0.024	0.034	0.001	0.004	0.010	0.029	0.067
Vol_OCF	5,475	0.043	0.032	0.013	0.021	0.034	0.055	0.083
Vol_ETBSO	5,475	0.001	0.002	0.000	0.000	0.000	0.001	0.003
ETBSO	5,475	0.002	0.005	0.000	0.000	0.000	0.001	0.005
Chg_TLCF	5,475	0.000	0.065	-0.028	0.000	0.000	0.000	0.027
TLCF	5,475	0.062	0.153	0.000	0.000	0.000	0.047	0.180
IIQ1	40,100	0.000	0.073	-0.082	-0.032	0.006	0.039	0.058
IIQ2	3,720	0.000	0.000	0.750	-0.948	-0.203	0.282	0.487
IIQ3	15,754	0.000	0.207	0.045	0.045	0.045	0.045	0.045
PCM	41,268	0.000	0.098	-0.102	-0.060	-0.015	0.041	0.117

This table presents the descriptive statistics for all the variables. Variables are defined in Appendix A.

Table 3 Correlations in Main Regression

Panel A

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CETR1	1	0.303	-0.107	-0.094	0.004	-0.084	-0.085	-0.075	-0.027	-0.163	0.074	-0.061	-0.021	-0.083
2. TPO	0.206	1	-0.106	0.030	0.075	0.012	-0.009	-0.007	0.019	-0.023	0.047	-0.027	0.028	0.024
3. PCA	-0.056	-0.043	1	-0.319	-0.011	-0.07	0.150	0.073	-0.115	0.110	-0.044	-0.143	-0.241	-0.052
4. Size	-0.091	0.008	-0.324	1	-0.034	0.218	-0.045	0.261	0.191	0.144	0.075	0.332	0.110	0.282
5. ROA	-0.101	0.021	0.012	-0.064	1	0.512	0.070	0.026	-0.054	-0.086	-0.033	-0.128	0.200	0.111
6. MTB	-0.104	-0.006	-0.036	0.150	0.448	1	0.194	0.148	0.023	0.045	-0.015	-0.104	-0.050	0.208
7. R&D	-0.078	-0.008	0.225	-0.092	0.112	0.178	1	0.118	-0.041	0.146	-0.011	-0.260	-0.239	0.311
8. Intangible	-0.075	-0.019	0.083	0.226	0.022	0.080	0.016	1	0.034	0.257	0.032	0.109	-0.351	0.216
9. Equity income	-0.041	0.007	-0.079	0.103	-0.042	0.037	-0.053	-0.018	1	0.022	0.016	0.094	0.068	0.080
10. NOL	-0.114	0.011	0.110	0.138	-0.087	0.040	0.108	0.224	-0.005	1	-0.168	0.020	-0.158	0.188
11. ΔNOL	0.059	0.027	-0.024	0.074	-0.026	-0.003	-0.007	0.072	-0.002	-0.124	1	0.043	0.020	0.000
12. Leverage	-0.032	-0.012	-0.117	0.295	-0.134	-0.027	-0.272	0.156	0.023	0.028	0.049	1	0.275	-0.053
13. PP&E	-0.046	0.013	-0.221	0.114	0.173	-0.069	-0.236	-0.326	0.031	-0.147	0.020	0.249	1	-0.126
14. Foreign income	-0.098	0.017	-0.023	0.227	0.190	0.215	0.226	0.089	0.039	0.154	0.017	-0.093	-0.100	1

Table 3 (Continued) Correlations among Financial Constraint Proxies

Panel B

	1	2	3	4	5	6	7	8
1. HP index	1	0.820	0.006	0.138	0.412	0.845	-0.338	0.051
2. WW index	0.819	1	0.095	0.176	0.543	0.945	-0.333	0.072
3. KZ index	-0.062	0.044	1	0.478	0.214	0.091	0.242	-0.056
4. Z score	0.271	0.347	0.236	1	0.023	0.229	0.083	0.138
5. Dividend	0.400	0.506	0.168	0.007	1	0.504	-0.137	0.178
6. Predicted bond rating	0.844	0.923	0.011	0.350	0.466	1	-0.345	0.063
7. Debt service ratio	-0.078	-0.077	0.050	-0.048	-0.011	-0.087	1	-0.145
8. Negative words	0.044	0.067	-0.091	0.096	0.172	0.057	-0.032	1

Panel A of this table shows Pearson (lower diagonal) / Spearman (upper diagonal) correlations among the variables included in the main regression. PCA is the first principal component of all eight financial constraint proxies. Panel B shows the Pearson (lower diagonal) / Spearman (upper diagonal) correlations among all eight financial constraint proxies. All the variables are defined in Appendix A.

Table 4 Main Regression Results (Pooled OLS)

Panel A

	Dependent variable: CETR1								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Dividend	HP index	WW index	KZ index	Z-score	Predicted bond rating	Negative words	Debt coverage ratio	PCA
TPO	0.197***	0.291***	0.308***	0.264***	0.262***	0.312***	0.277***	0.269***	0.304***
	(15.95)	(23.46)	(25.47)	(22.61)	(23.05)	(25.89)	(16.75)	(23.11)	(16.66)
Constraint	-0.022***	-0.014***	-0.160***	0.000**	-0.000	-0.024***	-1.181***	0.024***	-0.004***
	(-7.88)	(-4.57)	(-3.83)	(2.23)	(-0.91)	(-7.59)	(-2.92)	(7.45)	(-2.82)
Constraint × TPO	-0.157***	-0.125***	-1.127***	0.000	0.001	-0.073***	-7.624**	-0.030**	-0.046***
	(-7.29)	(-6.99)	(-11.05)	(0.32)	(0.45)	(-11.65)	(-2.00)	(-2.25)	(-6.66)
Size	-0.003***	-0.005***	-0.009***	-0.001	-0.001	-0.021***	-0.003***	-0.001	-0.004***
	(-4.22)	(-4.20)	(-4.34)	(-1.59)	(-1.04)	(-7.85)	(-2.61)	(-1.51)	(-3.20)
ROA	-0.225***	-0.220***	-0.238***	-0.216***	-0.241***	-0.286***	-0.197***	-0.194***	-0.221***
	(-13.53)	(-13.13)	(-14.25)	(-12.41)	(-12.55)	(-16.02)	(-9.72)	(-11.13)	(-9.25)
MTB	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.003***	-0.002***
	(-5.35)	(-5.13)	(-5.14)	(-4.28)	(-4.39)	(-5.65)	(-2.99)	(-4.28)	(-2.71)
R&D	-0.229***	-0.255***	-0.254***	-0.249***	-0.258***	-0.232***	-0.315***	-0.248***	-0.324***
	(-6.76)	(-7.59)	(-7.54)	(-7.19)	(-7.28)	(-6.94)	(-7.13)	(-7.06)	(-6.74)
Intangible	-0.030***	-0.031***	-0.031***	-0.031***	-0.035***	-0.025***	-0.037***	-0.020***	-0.036***
	(-4.10)	(-4.33)	(-4.33)	(-4.15)	(-4.48)	(-3.44)	(-4.40)	(-2.70)	(-3.97)
Equity earnings	-1.980***	-1.948***	-1.913***	-1.597***	-1.830***	-1.939***	-1.484***	-2.065***	-0.873**
	(-6.29)	(-6.16)	(-6.09)	(-4.96)	(-5.36)	(-6.15)	(-3.63)	(-6.44)	(-2.08)
NOL	-0.031***	-0.033***	-0.033***	-0.033***	-0.033***	-0.033***	-0.029***	-0.032***	-0.029***
	(-10.44)	(-10.98)	(-11.19)	(-10.68)	(-10.57)	(-11.17)	(-8.12)	(-10.49)	(-7.77)
ΔNOL	0.348***	0.351***	0.351***	0.363***	0.342***	0.348***	0.256***	0.346***	0.281***
	(10.15)	(10.17)	(10.12)	(9.94)	(9.53)	(10.11)	(6.73)	(9.60)	(6.48)
Leverage	-0.039***	-0.046***	-0.039***	-0.052***	-0.033***	-0.018*	-0.052***	-0.091***	-0.029*
	(-4.16)	(-4.90)	(-4.14)	(-5.23)	(-2.93)	(-1.81)	(-4.33)	(-8.03)	(-1.95)
PP&E	-0.026***	-0.025***	-0.025***	-0.027***	-0.022***	-0.025***	-0.026***	-0.018***	-0.021***
	(-5.84)	(-5.59)	(-5.73)	(-5.51)	(-4.49)	(-5.63)	(-4.58)	(-3.99)	(-3.43)
Foreign income	-0.221***	-0.231***	-0.221***	-0.229***	-0.238***	-0.220***	-0.182***	-0.223***	-0.203***
	(-5.32)	(-5.62)	(-5.41)	(-5.31)	(-5.46)	(-5.45)	(-3.76)	(-5.17)	(-3.94)
Constant	0.430***	0.457***	0.487***	0.437***	0.431***	0.562***	0.430***	0.433***	0.436***
	(18.58)	(19.19)	(19.11)	(17.48)	(17.76)	(20.26)	(17.15)	(18.98)	(15.31)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No	No	No	No
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-square	0.128	0.128	0.132	0.122	0.121	0.134	0.118	0.127	0.116

N	44,285	44,269	44,274	41,909	40,617	44,283	25,461	42,238	21,835

This table shows pooled OLS regression results from estimating Equation (2). Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Constraint × TPO) is determined by one-tailed test.

Table 4 (Continued) Main Regression Results (Firm Fixed-Effect)

Panel B

	Dependent variable: CETR1								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Dividend	HP index	WW index	KZ index	Z-score	Predicted bond rating	Negative words	Debt coverage ratio	PCA
TPO	-0.057***	-0.007	0.012	-0.026**	-0.017	0.015	-0.020	-0.019*	-0.008
	(-3.91)	(-0.62)	(1.03)	(-2.22)	(-1.42)	(1.32)	(-1.35)	(-1.68)	(-0.50)
Constraint	-0.010**	-0.067***	0.038	0.000	-0.001**	-0.012**	-0.297	0.046***	-0.001
	(-2.17)	(-5.50)	(0.60)	(1.41)	(-2.04)	(-2.31)	(-0.62)	(11.42)	(-0.54)
Constraint × TPO	-0.086***	-0.096***	-0.816***	-0.000	0.002	-0.053***	-5.937**	-0.012	-0.028***
	(-4.22)	(-6.31)	(-7.74)	(-0.02)	(0.72)	(-7.87)	(-2.10)	(-0.84)	(-3.43)
Size	0.010***	-0.003	0.013***	0.013***	0.013***	0.002	0.015***	0.009**	0.017***
	(2.83)	(-0.65)	(2.74)	(3.38)	(3.50)	(0.36)	(2.96)	(2.50)	(2.95)
ROA	-0.434***	-0.430***	-0.432***	-0.430***	-0.455***	-0.462***	-0.409***	-0.375***	-0.395***
	(-18.87)	(-18.61)	(-18.59)	(-17.82)	(-17.65)	(-18.15)	(-14.28)	(-15.81)	(-11.80)
MTB	-0.002**	-0.002***	-0.002**	-0.001**	-0.002***	-0.002***	-0.002**	-0.002**	-0.002*
	(-2.43)	(-2.66)	(-2.47)	(-2.09)	(-2.61)	(-2.64)	(-2.23)	(-2.41)	(-1.72)
R&D	0.166**	0.165**	0.159*	0.193**	0.123	0.160*	0.102	0.092	-0.000
	(1.98)	(2.00)	(1.91)	(2.25)	(1.38)	(1.93)	(0.87)	(1.02)	(-0.00)
Intangible	-0.025**	-0.023**	-0.025**	-0.023**	-0.029**	-0.022**	-0.024*	-0.024**	-0.023*
	(-2.28)	(-2.16)	(-2.36)	(-2.06)	(-2.48)	(-1.99)	(-1.83)	(-2.12)	(-1.67)
Equity earnings	-2.896***	-2.879***	-2.878***	-2.788***	-3.012***	-2.871***	-2.484***	-3.030***	-2.259***
	(-7.57)	(-7.52)	(-7.58)	(-7.15)	(-7.35)	(-7.56)	(-4.88)	(-7.81)	(-4.29)
NOL	-0.024***	-0.024***	-0.024***	-0.023***	-0.023***	-0.024***	-0.017***	-0.024***	-0.014***
	(-6.19)	(-6.19)	(-6.34)	(-5.81)	(-5.75)	(-6.33)	(-3.63)	(-5.93)	(-2.77)
ΔNOL	0.225***	0.228***	0.225***	0.233***	0.230***	0.224***	0.172***	0.226***	0.218***
	(6.82)	(6.89)	(6.76)	(6.65)	(6.61)	(6.77)	(4.60)	(6.54)	(5.09)
Leverage	0.015	0.014	0.012	0.010	0.027	0.025	-0.006	-0.058***	-0.006
	(1.06)	(0.99)	(0.86)	(0.69)	(1.62)	(1.63)	(-0.32)	(-3.75)	(-0.26)
PP&E	0.005	0.001	0.005	0.006	0.009	0.007	0.018	0.002	0.023*
	(0.62)	(0.06)	(0.62)	(0.69)	(0.95)	(0.82)	(1.51)	(0.17)	(1.87)
Foreign income	-0.619***	-0.614***	-0.620***	-0.636***	-0.609***	-0.614***	-0.644***	-0.618***	-0.661***
	(-10.48)	(-10.40)	(-10.66)	(-10.41)	(-9.93)	(-10.51)	(-8.82)	(-10.12)	(-8.43)
Constant	0.363***	0.482***	0.354***	0.355***	0.357***	0.424***	0.314***	0.380***	0.301***
	(16.61)	(15.40)	(12.10)	(15.65)	(15.40)	(12.79)	(9.46)	(16.52)	(8.22)
Industry FE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

R-square	0.060	0.063	0.063	0.059	0.060	0.063	0.058	0.068	0.056
N	44,285	44,269	44,274	41,909	40,617	44,283	25,461	42,238	21,835

This table show regression results from estimating Equation (2), with firm fixed-effects. Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Constraint × TPO) is determined by one-tailed test.

Table 4 (Continued) Main Regression Results (Change Analysis with TPO level)

Panel C	Dependent variable: ΔCETR1								
	(1) No Dividend	(2) HP index	(3) WW index	(4) KZ index	(5) Z-score	(6) Predicted bond rating	(7) Negative words	(8) Debt coverage ratio	(9) PCA
TPO	-0.307***	-0.301***	-0.307***	-0.316***	-0.307***	-0.309***	-0.288***	-0.302***	-0.295***
	(-30.57)	(-17.68)	(-29.74)	(-30.34)	(-28.88)	(-28.39)	(-20.61)	(-29.21)	(-18.87)
ΔConstraint	-0.016**	-0.058	-0.021	-0.001**	-0.003***	0.001	-0.280	0.053***	-0.004
	(-2.21)	(-1.59)	(-0.24)	(-2.51)	(-4.16)	(0.10)	(-0.45)	(9.41)	(-1.32)
ΔConstraint × TPO	-0.118**	0.105	-0.321	-0.007**	-0.009*	-0.041	-7.414*	-0.004	-0.015
	(-2.31)	(0.44)	(-0.64)	(-2.07)	(-1.59)	(-1.05)	(-1.51)	(-0.11)	(-0.72)
ΔSize	-0.034***	-0.047***	-0.035***	-0.034***	-0.028***	-0.033***	-0.045***	-0.042***	-0.047***
	(-4.16)	(-4.70)	(-3.81)	(-4.00)	(-3.49)	(-3.45)	(-3.84)	(-5.02)	(-4.04)
ΔROA	-0.790***	-0.791***	-0.790***	-0.806***	-0.832***	-0.786***	-0.694***	-0.725***	-0.702***
	(-23.86)	(-23.86)	(-23.66)	(-23.52)	(-22.98)	(-21.22)	(-15.85)	(-21.26)	(-13.89)
ΔMTB	-0.001	-0.001	-0.001	-0.001	-0.002*	-0.001	-0.003***	-0.001	-0.003***
	(-1.46)	(-1.49)	(-1.42)	(-1.47)	(-1.92)	(-1.41)	(-2.89)	(-1.33)	(-2.61)
ΔR&D	0.225**	0.226**	0.227**	0.235*	0.224*	0.226**	0.224	0.190	0.190
	(1.98)	(1.98)	(1.99)	(1.91)	(1.76)	(1.99)	(1.35)	(1.48)	(0.91)
ΔIntangible	0.060***	0.062***	0.060***	0.065***	0.060***	0.060***	0.051***	0.065***	0.060***
	(4.22)	(4.35)	(4.21)	(4.38)	(4.00)	(4.16)	(3.06)	(4.34)	(3.39)
ΔEquity earnings	-3.792***	-3.800***	-3.805***	-3.549***	-3.878***	-3.790***	-3.926***	-3.782***	-3.390***
	(-6.66)	(-6.68)	(-6.64)	(-6.15)	(-6.32)	(-6.65)	(-5.16)	(-6.65)	(-4.45)
ΔNOL	-0.016***	-0.016***	-0.016***	-0.018***	-0.012**	-0.016***	-0.016**	-0.014***	-0.015**
	(-3.06)	(-3.00)	(-3.03)	(-3.28)	(-2.30)	(-3.04)	(-2.42)	(-2.61)	(-2.08)
ΔCh_NOL	0.068**	0.071**	0.070**	0.068*	0.084**	0.069**	0.055	0.076**	0.097**
	(2.02)	(2.08)	(2.06)	(1.84)	(2.37)	(2.04)	(1.41)	(2.13)	(2.10)
ΔLeverage	0.085***	0.082***	0.085***	0.089***	0.113***	0.083***	0.077***	-0.012	0.080***
	(4.31)	(4.17)	(4.27)	(4.36)	(5.14)	(3.79)	(2.95)	(-0.54)	(2.60)
ΔPP&E	0.068***	0.069***	0.068***	0.074***	0.072***	0.068***	0.045***	0.058***	0.057***
	(5.63)	(5.71)	(5.59)	(5.97)	(5.66)	(5.52)	(2.74)	(4.75)	(3.37)
ΔForeign income	-0.852***	-0.846***	-0.851***	-0.884***	-0.861***	-0.850***	-0.822***	-0.868***	-0.825***
	(-10.70)	(-10.63)	(-10.69)	(-10.46)	(-10.34)	(-10.68)	(-8.46)	(-10.65)	(-7.68)
Constant	0.007	0.005	0.007	0.002	0.003	0.007	0.016	0.001	0.019
	(0.41)	(0.29)	(0.40)	(0.09)	(0.16)	(0.40)	(0.56)	(0.05)	(0.57)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No	No	No	No	No	No

Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
N	35,582	35,569	35,574	33,251	32,405	35,580	18,635	33,636	15,645
R-Square	0.099	0.099	0.099	0.101	0.100	0.099	0.095	0.108	0.093
Period	1987-2015								

This table shows first-difference change analysis regression results from estimating Equation (2). Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (ΔConstraint × TPO) is determined by one-tailed test.

Table 4 (Continued) Difference-in-Difference, Pension Protection Act of 2006

Panel D	Dependent variable: CETR1 (Excluding Pension Contribution)			
	(1)	(2)	(3)	(4)
	All	Low TPO	Medium TPO	High TPO
Treated	0.023***	0.028**	-0.004	0.024**
	(2.82)	(2.15)	(-0.38)	(1.99)
Post	-0.009	-0.023**	-0.022**	-0.004
	(-1.33)	(-2.20)	(-2.17)	(-0.42)
Treated × Post	-0.016*	0.004	0.011	-0.037***
	(-1.62)	(0.26)	(0.84)	(-2.45)
Size	-0.005***	-0.008***	-0.004*	-0.002
	(-2.59)	(-3.22)	(-1.73)	(-0.57)
ROA	-0.020	-0.130*	-0.147**	-0.058
	(-0.44)	(-1.75)	(-2.40)	(-0.97)
MTB	-0.001	0.000	-0.002	-0.001
	(-1.40)	(0.14)	(-1.44)	(-1.28)
R&D	-0.098	-0.134	-0.102	-0.206
	(-0.69)	(-0.67)	(-0.61)	(-0.92)
Intangible	-0.049***	-0.047*	-0.052***	-0.019
	(-2.88)	(-1.79)	(-2.65)	(-0.86)
Equity earnings	-1.107***	0.113	-1.871***	-1.862**
	(-2.60)	(0.15)	(-3.05)	(-2.53)
NOL	-0.011*	-0.017**	-0.017**	-0.007
	(-1.85)	(-2.00)	(-2.36)	(-0.69)
ΔNOL	0.143**	0.166*	0.026	0.009
	(2.10)	(1.88)	(0.20)	(0.07)
Leverage	-0.019	-0.063**	0.025	0.006
	(-0.87)	(-2.04)	(0.88)	(0.18)
PP&E	-0.035***	-0.024	-0.044***	-0.017
	(-3.24)	(-1.49)	(-2.94)	(-1.03)
Foreign income	-0.118	-0.266**	-0.098	-0.045
	(-1.48)	(-2.09)	(-1.05)	(-0.43)
Industry FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Cluster	Firm	Firm	Firm	Firm
R-square	6,268	2,090	2,089	2,089
N	0.059	0.097	0.098	0.062

This table shows regression results from estimating the following difference-in-difference model: $CETR1=\beta_0+\beta_1 Treated+\beta_3 Post+\beta_3 Treated\times Post+\Sigma Controls+\Sigma Industry\ FE+\varepsilon$. Each column presents a different TPO partition. Treated are equal to 1 for the firms in the bottom tercile of pension funding status and 0 for the ones in the top tercile. Post is equal to 1 for the years after 2006 and 0 otherwise. All other variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Treated × Post) is determined by one-tailed test.

Table 4 (Continued) Difference-in-Difference, Financial Crisis of 2008

Panel E	Dependent variable: CETR1			
	(1)	(2)	(3)	(4)
	All	Low TPO	Medium TPO	High TPO
Treated	0.016	0.032*	-0.001	0.024
	(1.46)	(1.81)	(-0.06)	(1.25)
Post	0.013	0.022	-0.019	0.005
	(1.35)	(1.08)	(-1.42)	(0.29)
Treated × Post	-0.018*	-0.027	0.019	-0.045**
	(-1.29)	(-0.97)	(0.81)	(-1.79)
Size	-0.005*	-0.012***	-0.007*	-0.001
	(-1.76)	(-2.78)	(-1.74)	(-0.26)
ROA	-0.124**	-0.234***	-0.110	-0.257***
	(-2.40)	(-2.84)	(-1.36)	(-2.99)
MTB	-0.002	-0.000	-0.007***	0.003
	(-0.93)	(-0.09)	(-2.98)	(0.82)
R&D	-0.363***	-0.398**	-0.199	-0.273
	(-2.99)	(-2.29)	(-1.11)	(-1.29)
Intangible	-0.037	-0.023	-0.057*	-0.035
	(-1.62)	(-0.69)	(-1.66)	(-0.86)
Equity earnings	-1.449**	-0.650	-0.190	-3.822***
	(-2.06)	(-0.52)	(-0.17)	(-4.38)
NOL	-0.018*	-0.016	-0.016	-0.025
	(-1.95)	(-1.02)	(-1.26)	(-1.56)
ΔNOL	0.297***	0.213**	0.426**	0.202
	(3.76)	(2.31)	(2.09)	(1.18)
Leverage	-0.049	-0.004	-0.058	-0.029
	(-1.47)	(-0.08)	(-1.30)	(-0.55)
PP&E	-0.007	-0.036	-0.008	0.000
	(-0.42)	(-1.32)	(-0.36)	(0.02)
Foreign income	-0.333***	-0.350**	-0.276	-0.376**
	(-2.94)	(-2.31)	(-1.49)	(-2.14)
Industry FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Cluster	Firm	Firm	Firm	Firm
N	3,083	1,028	1,028	1,027
R-squared	0.095	0.103	0.156	0.118

This table shows regression results from estimating the following difference-in-difference model: $CETR1=\beta_0+\beta_1 Treated+\beta_3 Post+\beta_3 Treated\times Post+\Sigma Controls+\Sigma Industry\ FE+\varepsilon$. Each column presents a different TPO partition. Treated are equal to 1 for the firms in the top tercile of long-term debt due in one year and 0 for the ones in the bottom tercile. Post is equal to 1 for 2008 and 0 for 2006 and 2007. All other variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Treated × Post) is determined by one-tailed test.

Table 4 (Continued) Difference-in-Difference, Pension Protection Act of 2006 - CETR5 as TPO Falsification

Panel F	Dependent variable: CETR1 (Excluding Pension Contribution)			
	(1)	(2)	(3)	(4)
	All	Low TPO	Medium TPO	High TPO
Treated	0.023***	0.029**	-0.003	0.015
	(2.82)	(2.06)	(-0.33)	(1.37)
Post	-0.009	-0.017	-0.004	-0.001
	(-1.33)	(-1.54)	(-0.52)	(-0.13)
Treated × Post	-0.016*	0.003	0.002	-0.017
	(-1.62)	(0.20)	(0.15)	(-1.06)
Size	-0.005***	-0.004	-0.002	0.001
	(-2.59)	(-1.56)	(-1.03)	(0.27)
ROA	-0.020	-0.179**	0.011	-0.105*
	(-0.44)	(-2.51)	(0.21)	(-1.70)
MTB	-0.001	0.000	-0.001	-0.002
	(-1.40)	(0.25)	(-1.33)	(-1.30)
R&D	-0.098	0.245	-0.236	0.026
	(-0.69)	(1.11)	(-1.58)	(0.11)
Intangible	-0.048***	-0.040	-0.060***	-0.024
	(-2.88)	(-1.60)	(-3.55)	(-1.04)
Equity earnings	-1.107***	-0.101	-0.720	-2.669***
	(-2.60)	(-0.14)	(-1.47)	(-3.26)
NOL	-0.011*	0.001	-0.017**	-0.005
	(-1.85)	(0.15)	(-2.58)	(-0.52)
ΔNOL	0.143**	0.083	0.097	0.083
	(2.10)	(0.91)	(0.93)	(0.65)
Leverage	-0.019	-0.069**	-0.010	0.069**
	(-0.87)	(-2.19)	(-0.42)	(2.16)
PP&E	-0.035***	-0.020	-0.036***	-0.001
	(-3.24)	(-1.29)	(-2.93)	(-0.06)
Foreign income	-0.118	-0.283**	-0.220**	-0.034
	(-1.48)	(-2.52)	(-2.31)	(-0.28)
Industry FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Cluster	Firm	Firm	Firm	Firm
R-square	6,268	2,090	2,089	2,089
N	0.059	0.100	0.069	0.057

This table shows regression results from estimating the following difference-in-difference model: $CETR1=\beta_0+\beta_1 Treated+\beta_3 Post+\beta_3 Treated\times Post+\Sigma Controls+\Sigma Industry\ FE+\varepsilon$. Each column presents a different TPO partition. Treated are equal to 1 for the firms in the bottom tercile of pension funding status and 0 for the ones in the top tercile. Post is equal to 1 for the years after 2006 and 0 otherwise. All other variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Treated × Post) is determined by one-tailed test.

Table 4 (Continued) Difference-in-Difference, Financial Crisis of 2008 - CETR5 as TPO Falsification

Panel G	Dependent variable: CETR1			
	(1)	(2)	(3)	(4)
	All	Low TPO	Medium TPO	High TPO
Treated	0.016	0.016	0.023	0.027
	(1.46)	(0.81)	(1.49)	(1.43)
Post	0.013	0.022	0.011	0.007
	(1.35)	(1.17)	(0.68)	(0.44)
Treated × Post	-0.018*	-0.017	-0.016	-0.034
	(-1.29)	(-0.66)	(-0.64)	(-1.27)
Size	-0.005*	-0.005	-0.005	-0.002
	(-1.76)	(-1.29)	(-1.33)	(-0.50)
ROA	-0.124**	-0.241***	-0.094	-0.241***
	(-2.40)	(-3.04)	(-1.32)	(-2.64)
MTB	-0.002	0.001	-0.002	0.003
	(-0.93)	(0.16)	(-0.72)	(0.60)
R&D	-0.363***	-0.335**	0.080	-0.502*
	(-2.99)	(-2.04)	(0.48)	(-1.95)
Intangible	-0.037	-0.019	-0.041	-0.028
	(-1.62)	(-0.53)	(-1.30)	(-0.68)
Equity earnings	-1.449**	-0.080	-0.159	-3.710***
	(-2.06)	(-0.05)	(-0.25)	(-2.74)
NOL	-0.018*	0.002	-0.021	-0.014
	(-1.95)	(0.15)	(-1.57)	(-0.88)
ΔNOL	0.297***	0.210**	0.340	0.201
	(3.76)	(2.19)	(1.44)	(1.38)
Leverage	-0.049	-0.021	-0.012	-0.030
	(-1.47)	(-0.43)	(-0.24)	(-0.50)
PP&E	-0.007	-0.029	-0.006	0.014
	(-0.42)	(-1.16)	(-0.23)	(0.51)
Foreign income	-0.333***	-0.428***	-0.375**	-0.268
	(-2.94)	(-3.53)	(-2.57)	(-1.16)
Industry FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Cluster	Firm	Firm	Firm	Firm
N	3,083	1,028	1,028	1,027
R-squared	0.095	0.117	0.094	0.105

This table shows regression results from estimating the following difference-in-difference model: $CETR1=\beta_0+\beta_1 Treated+\beta_3 Post+\beta_3 Treated\times Post+\Sigma Controls+\Sigma Industry\ FE+\varepsilon$. Each column presents a different TPO partition. Treated are equal to 1 for the firms in the top tercile of long-term debt due in one year and 0 for the ones in the bottom tercile. Post is equal to 1 for 2008 and 0 for 2006 and 2007. All other variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (Treated × Post) is determined by one-tailed test.

Table 5 Book-Tax Differences Regression Results (Total BTD)

Panel A	Dependent variable: current year BTD								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Dividend	HP index	WW index	KZ index	Z-score	Predicted bond rating	Negative words	Debt coverage ratio	PCA
TPO	0.053***	0.005	-0.008	0.040**	0.032**	-0.021	0.062***	0.021	0.087***
	(2.94)	(0.293)	(-0.48)	(2.46)	(2.02)	(-1.39)	(2.92)	(1.36)	(4.16)
Constraint	0.009***	-0.008	-0.340***	-0.002***	-0.002***	0.005*	-0.166	0.002***	-0.006***
	(4.54)	(-1.29)	(-11.95)	(-10.71)	(-7.77)	(1.70)	(-0.78)	(7.73)	(-6.59)
Constraint × TPO	0.114***	0.043**	0.609***	0.011***	0.011***	0.043***	19.420***	0.013**	0.036***
	(4.51)	(2.55)	(5.25)	(7.81)	(7.34)	(6.12)	(4.99)	(2.32)	(6.71)
Size	0.002	-0.000	-0.015***	0.000	-0.001	0.006**	0.001	0.001	-0.006**
	(1.51)	(-0.217)	(-6.75)	(0.09)	(-0.69)	(2.08)	(0.51)	(0.66)	(-2.57)
ROA	0.624***	0.624***	0.582***	0.622***	0.613***	0.638***	0.614***	0.614***	0.584***
	(55.34)	(55.32)	(49.34)	(54.62)	(52.36)	(48.46)	(38.30)	(52.83)	(33.58)
MTB	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.000*	-0.001***	-0.001***
	(-3.87)	(-3.82)	(-5.45)	(-4.05)	(-5.78)	(-3.78)	(-1.84)	(-4.23)	(-3.60)
R&D	-0.451***	-0.450***	-0.447***	-0.450***	-0.458***	-0.448***	-0.487***	-0.451***	-0.464***
	(-17.16)	(-17.12)	(-16.80)	(-17.00)	(-16.46)	(-16.99)	(-13.78)	(-15.89)	(-11.43)
Intangible	-0.025***	-0.023***	-0.028***	-0.025***	-0.017***	-0.028***	-0.004	-0.020***	0.003
	(-3.78)	(-3.58)	(-4.36)	(-3.84)	(-2.70)	(-4.34)	(-0.47)	(-3.07)	(0.41)
Equity earnings	1.428***	1.401***	1.309***	1.345***	1.418***	1.412***	0.969***	1.381***	0.965***
	(8.19)	(8.15)	(7.83)	(7.41)	(7.50)	(8.09)	(3.70)	(7.89)	(3.66)
NOL	0.007***	0.007***	0.007***	0.007***	0.006***	0.007***	0.006***	0.007***	0.005***
	(4.56)	(4.96)	(5.06)	(4.76)	(3.97)	(4.69)	(3.31)	(4.46)	(2.85)
ΔNOL	-0.065***	-0.065***	-0.069***	-0.062***	-0.068***	-0.066***	-0.056***	-0.071***	-0.055***
	(-12.96)	(-12.90)	(-13.09)	(-12.39)	(-12.65)	(-12.93)	(-8.78)	(-12.91)	(-7.59)
Leverage	-0.079***	-0.077***	-0.066***	-0.065***	-0.059***	-0.082***	-0.084***	-0.081***	-0.052***
	(-13.33)	(-13.19)	(-11.27)	(-10.49)	(-9.47)	(-13.13)	(-10.47)	(-13.81)	(-5.60)
PP&E	-0.028***	-0.029***	-0.032***	-0.023***	-0.028***	-0.029***	-0.025***	-0.028***	-0.025***
	(-6.70)	(-6.90)	(-7.81)	(-5.52)	(-6.42)	(-7.03)	(-4.08)	(-6.72)	(-4.01)
Foreign income	0.216***	0.220***	0.219***	0.192***	0.219***	0.217***	0.278***	0.235***	0.293***
	(6.15)	(6.28)	(6.46)	(5.47)	(6.28)	(6.27)	(6.79)	(6.54)	(7.29)
Constant	-0.063***	-0.049***	0.031**	-0.060***	-0.055***	-0.085***	-0.069***	-0.058***	-0.029*
	(-6.97)	(-3.60)	(2.54)	(-6.50)	(-5.84)	(-5.67)	(-4.82)	(-6.37)	(-1.90)
Industry FE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-Squared	0.500	0.500	0.493	0.515	0.501	0.501	0.487	0.487	0.474
N	55,209	55,172	54,743	51,877	49,202	55,209	31,656	52,062	26,380

This table shows regression results from estimating Equation (2). The dependent variable is total book-tax differences (BTD). TPO is the residual from estimating Equation (1) with total BTD as the dependent variable. Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 5 (Continued) Book-Tax Differences Regression Results (Permanent BTD)

Panel B	Dependent variable: current year PBTD								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Dividend	HP index	WW index	KZ index	Z-score	Predicted bond rating	Negative words	Debt coverage ratio	PCA
TPO	0.168***	0.110***	0.091***	0.132***	0.116***	0.084***	0.190***	0.120***	0.179***
	(8.19)	(6.68)	(5.82)	(7.70)	(6.63)	(5.38)	(8.63)	(6.81)	(8.12)
Constraint	0.009***	-0.011*	-0.404***	-0.002***	-0.001***	0.005	0.398*	0.003***	-0.006***
	(4.36)	(-1.69)	(-13.54)	(-10.47)	(-6.17)	(1.47)	(1.67)	(8.22)	(-5.41)
Constraint × TPO	0.145***	0.044**	0.641***	0.008***	0.010***	0.045***	19.320***	0.016***	0.031***
	(4.90)	(2.40)	(5.20)	(4.40)	(6.09)	(5.55)	(5.02)	(2.74)	(4.70)
Size	0.007***	0.003	-0.014***	0.005***	0.005***	0.010***	0.007**	0.006***	0.000
	(4.07)	(1.36)	(-6.52)	(2.72)	(3.15)	(3.16)	(2.46)	(3.57)	(0.01)
ROA	0.618***	0.618***	0.572***	0.604***	0.591***	0.634***	0.627***	0.602***	0.577***
	(50.35)	(50.22)	(44.62)	(48.93)	(46.57)	(41.61)	(34.09)	(47.18)	(29.26)
MTB	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001**	-0.001***	-0.001***
	(-3.55)	(-3.52)	(-5.28)	(-3.73)	(-5.01)	(-3.49)	(-2.06)	(-3.80)	(-3.41)
R&D	-0.370***	-0.369***	-0.370***	-0.383***	-0.392***	-0.368***	-0.391***	-0.372***	-0.400***
	(-12.98)	(-12.95)	(-12.82)	(-13.59)	(-13.37)	(-12.98)	(-9.88)	(-12.10)	(-9.12)
Intangible	-0.026***	-0.024***	-0.029***	-0.026***	-0.023***	-0.030***	-0.010	-0.024***	-0.005
	(-3.79)	(-3.54)	(-4.44)	(-3.95)	(-3.47)	(-4.35)	(-1.09)	(-3.53)	(-0.54)
Equity earnings	1.057***	1.025***	0.914***	0.936***	1.057***	1.044***	0.683**	1.045***	0.807***
	(6.07)	(6.01)	(5.49)	(5.28)	(6.05)	(5.99)	(2.41)	(6.16)	(2.84)
NOL	0.005***	0.005***	0.005***	0.005***	0.004**	0.005***	0.004*	0.005***	0.003
	(2.93)	(3.38)	(3.42)	(3.23)	(2.50)	(3.07)	(1.70)	(3.07)	(1.56)
ΔNOL	-0.068***	-0.068***	-0.071***	-0.063***	-0.070***	-0.068***	-0.058***	-0.074***	-0.056***
	(-11.34)	(-11.27)	(-11.47)	(-11.04)	(-11.58)	(-11.38)	(-7.18)	(-11.65)	(-6.36)
Leverage	-0.079***	-0.076***	-0.062***	-0.061***	-0.060***	-0.082***	-0.092***	-0.080***	-0.057***
	(-12.73)	(-12.46)	(-10.35)	(-9.62)	(-9.18)	(-11.56)	(-10.22)	(-13.12)	(-5.70)
PP&E	-0.031***	-0.032***	-0.037***	-0.027***	-0.031***	-0.033***	-0.026***	-0.031***	-0.027***
	(-7.40)	(-7.59)	(-9.10)	(-6.31)	(-6.96)	(-7.84)	(-3.75)	(-7.11)	(-4.17)
Foreign income	0.151***	0.157***	0.153***	0.136***	0.170***	0.154***	0.236***	0.169***	0.278***
	(3.92)	(4.08)	(4.11)	(3.63)	(4.55)	(4.06)	(4.98)	(4.32)	(6.07)
Constant	-0.075***	-0.056***	0.037***	-0.074***	-0.076***	-0.101***	-0.091***	-0.074***	-0.053***
	(-8.26)	(-4.14)	(3.03)	(-7.92)	(-8.10)	(-5.50)	(-5.43)	(-8.00)	(-3.15)
Industry FE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
R-squared	0.447	0.447	0.445	0.469	0.451	0.448	0.413	0.431	0.408
N	55,209	55,172	54,743	51,877	49,202	55,209	31,656	52,062	26,380

This table shows regression results from estimating Equation (2). The dependent variable is permanent book-tax differences (PBTD). TPO is the residual from estimating Equation (1) with PBTD as the dependent variable. Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 5 (Continued) Book-Tax Differences Regression Results (Temporary BTD)

Panel C	Dependent variable: current year TBTD								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	No Dividend	HP index	WW index	KZ index	Z-score	Predicted bond rating	Negative words	Debt coverage ratio	PCA
TPO	0.344***	0.302***	0.296***	0.318***	0.300***	0.299***	0.370***	0.300***	0.397***
	(16.88)	(18.37)	(18.01)	(18.46)	(17.15)	(18.20)	(15.40)	(17.69)	(14.35)
Constraint	-0.002	0.001	0.027***	0.000	-0.000*	-0.001	-0.654***	-0.000***	0.000
	(-1.56)	(0.42)	(3.29)	(1.14)	(-1.70)	(-0.80)	(-4.98)	(-2.69)	(0.064)
Constraint × TPO	0.117***	0.036*	0.575***	0.002	0.005**	0.018**	17.630***	0.004	0.016*
	(3.85)	(1.77)	(4.14)	(0.91)	(2.10)	(2.21)	(3.49)	(0.57)	(1.81)
Size	-0.004***	-0.003***	-0.002***	-0.004***	-0.005***	-0.004***	-0.004***	-0.004***	-0.004***
	(-5.90)	(-3.32)	(-3.30)	(-5.10)	(-6.34)	(-4.10)	(-3.98)	(-5.85)	(-3.00)
ROA	0.011***	0.011***	0.014***	0.012***	0.015***	0.008	-0.002	0.015***	0.006
	(2.66)	(2.66)	(3.28)	(2.92)	(3.32)	(1.61)	(-0.38)	(3.54)	(0.82)
MTB	0.000	0.000	0.000	-0.000	-0.000	0.000	0.000	0.000	0.000
	(0.38)	(0.42)	(0.43)	(-0.01)	(-0.10)	(0.40)	(1.39)	(0.33)	(1.13)
R&D	-0.043***	-0.043***	-0.048***	-0.041***	-0.045***	-0.042***	-0.058***	-0.047***	-0.062***
	(-5.27)	(-5.27)	(-5.25)	(-4.83)	(-4.92)	(-5.18)	(-4.55)	(-5.05)	(-3.71)
Intangible	0.006*	0.005*	0.006**	0.007**	0.007**	0.006**	0.009**	0.006**	0.012**
	(1.89)	(1.86)	(1.97)	(2.10)	(2.42)	(1.97)	(2.23)	(2.21)	(2.41)
Equity earnings	0.332***	0.334***	0.355***	0.370***	0.382***	0.334***	0.277*	0.340***	0.356**
	(3.63)	(3.64)	(3.76)	(3.74)	(3.62)	(3.64)	(1.95)	(3.67)	(2.12)
NOL	0.003***	0.002***	0.002***	0.002***	0.002**	0.002***	0.003**	0.002***	0.002
	(3.11)	(3.01)	(2.96)	(2.65)	(2.42)	(3.05)	(2.27)	(2.72)	(1.37)
ΔNOL	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001	-0.003	-0.001	-0.003
	(-0.68)	(-0.71)	(-0.41)	(-0.85)	(-0.51)	(-0.65)	(-1.09)	(-0.66)	(-0.77)
Leverage	-0.005*	-0.005**	-0.006**	-0.007**	-0.004	-0.004	-0.001	-0.005*	-0.003
	(-1.95)	(-2.03)	(-2.40)	(-2.50)	(-1.20)	(-1.62)	(-0.32)	(-1.79)	(-0.53)
PP&E	0.004**	0.004**	0.005**	0.004**	0.003	0.004**	0.003	0.003*	0.002
	(2.25)	(2.22)	(2.57)	(2.28)	(1.63)	(2.36)	(0.83)	(1.80)	(0.53)
Foreign income	0.069***	0.069***	0.068***	0.076***	0.073***	0.069***	0.046**	0.075***	0.052***
	(4.48)	(4.47)	(4.46)	(4.75)	(4.72)	(4.50)	(2.45)	(4.84)	(2.58)
Constant	0.013***	0.011*	0.006	0.013***	0.018***	0.018***	0.010	0.015***	0.012
	(3.41)	(1.74)	(1.44)	(3.31)	(4.27)	(2.80)	(1.43)	(3.85)	(1.31)
Industry FE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm

R-squared	0.035	0.034	0.036	0.035	0.035	0.034	0.047	0.034	0.045
N	55,209	55,172	54,743	51,877	49,202	55,209	31,656	52,062	26,380

This table shows regression results from estimating Equation (2). The dependent variable is temporary book-tax differences (TBTD). TPO is the residual from estimating Equation (1) with TBTD as the dependent variable. Each column presents a different financial constraint measure. PCA is the first principal component of all eight financial constraint measures. Financial constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 6 Tax Risk Test - UTB Additions

	Dependent variable: UTB_ADDS	
	(1)	(2)
TPO	-0.001**	-0.001
	(-1.98)	(-1.39)
Constraint	-0.000	-0.000
	(-0.29)	(-0.70)
TPO×Constraint	0.001***	0.000
	(2.61)	(0.48)
Size	0.000***	0.000
	(5.69)	(1.40)
ROA	0.003***	0.002***
	(4.51)	(3.12)
MTB	0.000	-0.000
	(1.06)	(-0.48)
R&D	0.010***	0.005
	(6.62)	(1.17)
Intangible	-0.001*	0.000
	(-1.91)	(0.30)
Equity income	0.001	0.033***
	(0.10)	(2.96)
NOL	-0.000	0.000
	(-0.45)	(0.72)
ΔNOL	0.002**	0.002*
	(1.98)	(1.95)
Leverage	0.000	-0.000
	(0.15)	(-0.92)
PP&E	-0.001***	0.001**
	(-3.51)	(2.44)
Foreign income	0.009***	-0.000
	(5.76)	(-0.05)
Industry FE	Yes	N/A
Year FE	Yes	Yes
Firm FE	No	Yes
Cluster	Firm	Firm
R-squared	0.193	0.046
N	6,566	6,566

This table shows the regression results from estimating Equation (3). Column (1) is a pooled OLS regression and Column (2) includes firm fixed-effects. The constraint measure is distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 7 Tax Risk Test – Uncertain Ratio

High TPO High Constraint (N=905)					
Variable	Conventional	Uncertain	Settle	CashTaxPaid	
PotentialTax	0.231	0.027	-0.013	0.729	10.3%
	(7.09)	(1.49)	(-1.29)	(24.78)	
Controls	Yes	Yes	Yes	Yes	
r-squared	0.258	0.063	0.027	0.755	
Industry FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Low TPO High Constraint (N=1,193)					
Variable	Conventional	Uncertain	Settle	CashTaxPaid	
PotentialTax	0.426	0.009	-0.003	0.563	2.0%
	(13.06)	(0.76)	(-0.43)	(16.50)	
Controls	Yes	Yes	Yes	Yes	
r-squared	0.426	0.089	0.041	0.564	
Industry FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
High TPO Low Constraint (N=1,193)					
Variable	Conventional	Uncertain	Settle	CashTaxPaid	2.6%
PotentialTax	0.245	0.007	-0.001	0.748	
	(8.37)	(2.08)	(-0.21)	(25.56)	
Controls	Yes	Yes	Yes	Yes	
r-squared	0.389	0.176	0.052	0.801	
Industry FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	
Low TPO Low Constraint (N=905)					
Variable	Conventional	Uncertain	Settle	CashTaxPaid	1.3%
PotentialTax	0.450	0.006	0.107	0.651	
	(3.60)	(1.09)	(0.95)	(16.07)	
Controls	Yes	Yes	Yes	Yes	
r-squared	0.098	0.186	0.063	0.629	
Industry FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	

This table shows the results from estimating equation (4a), (4b), (4c) and (4d). The dependent variables are Conventional, Uncertain, Settle and CashTaxPaid in their respective equations. The independent variable is PotentialTax. All variables are defined in Appendix A. T-statistics are in the parentheses. The last column shows the percentage of tax avoidance done via uncertain tax strategies. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 8 Tax Risk Test – Future Cash ETR Volatility

Dependent variable: SD_CETR1 t+1~t+5

	(1)	(2)
TPO	0.218*	-0.466**
	(1.73)	(-2.25)
Constraint	0.006	-0.026
	(0.33)	(-1.29)
TPO×Constraint	0.069	-0.037
	(1.51)	(-0.50)
Size	-0.012	0.242**
	(-0.95)	(2.12)
PROA	-0.648	0.060
	(-3.01)	(0.39)
Leverage	-0.254*	-0.042
	(-1.84)	(-0.20)
Vol_PROA	0.125	-0.056
	(0.20)	(-0.06)
BTM	0.122*	0.031
	(1.95)	(0.87)
Discaccrual	-0.006	-0.001
	(-1.45)	(-0.29)
Vol_Special Item	1.821**	-0.601
	(2.08)	(-0.46)
Vol_OCF	2.061**	3.118**
	(2.40)	(2.49)
Vol_ETBSO	-17.823***	-5.990
	(-3.09)	(-1.01)
ETBSO	0.632	-2.722
	(0.16)	(-1.17)
Chg_TLCF	0.262	-0.154
	(1.01)	(-0.96)
TLCF	-0.222*	0.240
	(-1.76)	(1.08)
Constant	Yes	Yes
Industry FE	Yes	N/A
Year FE	Yes	Yes
Cluster	Yes	Yes
Firm FE	No	Yes
R-square	0.075	0.050
N	5,475	5,475

This table shows the results from estimating equation (5). The dependent variable is the standard deviation of one-year cash ETR from year t+1 to year t+5. Column (1) is a pooled OLS regression and Column (2) includes firm fixed-effects. Constraint measures are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively.

Table 9 Non-incentive Falsification Tests

	Dependent variable: CETR1			
	(1) IIQ1 (earnings announcement speed)	(2) IIQ2 (managerial forecast error)	(3) IIQ3 (internal control weakness)	(4) PCM
TPO	-0.051***	-0.060	-0.088***	-0.052***
	(-4.48)	(-1.35)	(-5.09)	(-4.71)
IIQ/PCM	-0.023	-0.015***	-0.014	-0.216***
	(-0.70)	(-2.74)	(-1.44)	(-5.35)
IIQ/PCM × TPO	0.518***	-0.074*	0.035	0.461***
	(3.45)	(-1.49)	(0.50)	(4.38)
Size	0.015***	-0.003	0.026***	0.019***
	(4.19)	(-0.24)	(3.50)	(5.17)
ROA	-0.185***	-0.267**	-0.232***	-0.095***
	(-8.09)	(-2.48)	(-5.86)	(-3.40)
MTB	-0.002***	0.000	-0.001	-0.002***
	(-3.22)	(0.13)	(-1.53)	(-3.01)
R&D	0.075	0.184	0.232	-0.012
	(0.86)	(0.66)	(1.25)	(-0.14)
Intangible	-0.008	0.028	-0.026	-0.010
	(-0.73)	(1.03)	(-1.47)	(-0.87)
Equity earnings	-1.981***	-3.628**	-2.720***	-2.004***
	(-4.95)	(-1.97)	(-3.64)	(-5.18)
NOL	-0.027***	0.014	-0.009*	-0.027***
	(-6.78)	(1.32)	(-1.67)	(-6.82)
ΔNOL	0.174***	0.203**	0.128***	0.173***
	(5.00)	(2.27)	(3.50)	(4.99)
Leverage	-0.034**	-0.007	-0.011	-0.031**
	(-2.36)	(-0.13)	(-0.53)	(-2.17)
PP&E	-0.003	-0.031	-0.024	-0.012
	(-0.38)	(-0.88)	(-1.52)	(-1.33)
Foreign income	-0.435***	-0.459***	-0.537***	-0.416***
	(-7.50)	(-2.98)	(-6.81)	(-7.23)
Constant	0.300***	0.274***	0.078	0.269***
	(13.82)	(2.86)	(1.45)	(12.18)
Industry FE	N/A	N/A	N/A	N/A
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
R-square	0.045	0.067	0.046	0.048
N	40,100	3,720	15,754	41,268

This table shows the regression results from estimating Equation (2), except that financial constraint measures are replaced with internal information quality (IIQ) measures and price-cost margin (PCM) measure. Each column represents a different IIQ/PCM measure. IIQ and PCM are distance from mean. All variables are defined in Appendix A. T-statistics are in the parentheses. *, **, and *** represent statistical significance at 10%, 5% and 1%, respectively. The significance level for the variable of interest (IIQ/PCM × TPO) is determined by one-tailed test.

REFERENCES CITED

Altman, E. 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance* 23 (4): 589-609.

Armstrong, C., J. Blouin and D. Larcker. 2012. The incentives for tax planning. *Journal of Accounting and Economics* 53 (1): 391-411.

Armstrong, C., J. Blouin, A. Jagolinzer and D. Larcker. 2015. Corporate governance, incentives, and tax avoidance. *Journal of Accounting and Economics* 60: 1-17.

Armstrong, C., S. Glaeser and J. Kepler. 2016. Strategic reactions in corporate tax avoidance. *Working paper*, Wharton School, University of Pennsylvania.

Badertscher, B., S. Katz and S. Rego. 2013. The separation of ownership and control and corporate tax avoidance. *Journal of Accounting and Economics* 56: 228-250.

Balakrishnan, K., J. Blouin, and W. Guay. 2012. Does tax aggressiveness reduce corporate transparency? *Working paper*, Wharton School, University of Pennsylvania.

Barth, M., W. Beaver, and W. Landsman. 1998. Relative valuation roles of equity book value and net income as a function of financial health. *Journal of Accounting and Economics* 25: 1-34.

Bonner, S. J. Davis, and B. Jackson. 1992. Expertise in corporate tax planning: the issue identification stage. *Journal of Accounting Research* 30, supplement.

Campbell, J., D. Dhaliwal, and W. Schwartz, JR. 2010. Equity valuation effects of the Pension Protection Act of 2006. *Contemporary Accounting Research* 27 (2): 469-536.

Campbell, J., N. Goldman, and B. Li. 2017. Do internal financial constraints lead to more tax planning? Evidence from the Pension Protection Act of 2006. *Working paper*, University of Georgia and University of Texas at Dallas.

Chang, X., S. Dasgupta, G. Wong, and J.Yao. 2014. Cash-flow sensitivities and the allocation of internal cash flow. *Review of Financial Studies* 27: 3628-3657.

Chen, S., X. Chen, Q. Cheng, and T. Shevlin. 2010. Are family firms more tax aggressive than non-family firms? *Journal of Financial Economic* 95: 41-61.

Chen, C. and S. Lai. 2012. Financial constraint and tax aggressiveness. *Working paper*, University of Auckland and Chinese University of Hong Kong.

Chen, K. and C.Y. Chu. 2005. Internal control versus external manipulation: a model of corporate income tax evasion. *RAND Journal of Economics* 36 (1): 151-164.

Cheng, C. S., H. Huang, Y. Li, and J. Stanfield. 2012. The effect of hedge fund activism on corporate tax avoidance. *The Accounting Review* 87 (5):1493-1526.

Christensen, D., D. Dhaliwal, S. Boivie, and S. Graffin. 2015. Top management conservatism and corporate risk strategies: evidence from managers' personal political orientation and corporate tax avoidance. *Strategic Management Journal* 36 (12): 1918-1938.

Chyz, J. 2013. Personally tax aggressive executives and corporate tax sheltering. *Journal of Accounting and Economics* 56: 311-328.

Ciconte, W., M. Donohoe, P. Lisowsky, and M. Mayberry. 2016. Predictable uncertainty: the relation between unrecognized tax benefits and future income tax cash outflows. *Working paper*, University of Illinois at Urbana-Champaign and University of Florida.

Cohn, J. and M. Wardlaw. 2016. Financing Constraints and Workplace Safety. *Journal of Finance* 71(5): 2017-2058.

Cook, K., W. Moser and T. Omer. 2016. Tax avoidance and ex ante cost of capital. *Working paper*, Texas Tech University, Miami University, and University of Nebraska, Lincoln.

Coles, J., N. Daniel and L. Naveen. 2006. Managerial incentives and risk-taking. *Journal of Financial Economics* 79: 431-468.

Desai, M. and D. Dharmapala. 2006. Corporate tax avoidance and high-powered incentives. *Journal of Financial Economics* 79: 145-179.

Dyreng, S., M. Hanlon, and E. Maydew. 2008. Long-run corporate tax avoidance. *The Accounting Review 83* (1): 61-82.

Dyreng, S., M. Hanlon, and E. Maydew 2010. The effects of executives on corporate tax avoidance. *The Accounting Review* 85 (4): 1163-1189.

Dyreng, S., M. Hanlon, and E. Maydew. 2017. When does tax avoidance result in tax uncertainty? *Working paper*, Duke University, MIT and University of North Carolina.

Dyreng, S., M. Hanlon, E. Maydew, and J. Thornock. 2017. Changes in corporate effective tax rates over the past 25 years. *Journal of Financial Economics* 124: 441-463.

Dyreng, S. and K. Markle. 2016. The effect of financial constraints on income shifting by U.S. multinationals. *The Accounting Review* 91 (6): 1601-1627.

Edwards, A., C. Schwab, and T. Shevlin. 2016. Financial constraints and cash tax savings. *The Accounting Review* 91 (3): 859-881.

Gallemore J. and E. Labro. 2015. The importance of the internal information environment for tax avoidance. *Journal of Accounting and Economics* 60: 149-167.

Gallemore, J., E. Maydew and J. Thornock. 2014. The reputational costs of tax avoidance. *Contemporary Accounting Research* 31(4): 1103-1133.

Graham, J., M. Hanlon, T. Shevlin and N. Shroff. 2014. Incentives for tax planning and avoidance: evidence from the field. *The Accounting Review* 89 (3): 991-1023.

Grubert, H. 2003. Intangible income, intercompany transactions, income shifting, and the choice of location. *National Tax Journal* 56 (1): 221-242.

Guenther, D. 2014. Measuring corporate tax avoidance: effective tax rates and book-tax differences. *Working paper,* University of Oregon.

Guenther, D., L. Krull, and B. Williams. 2014. Are "tax aggressive" firms just inflating earnings? *Working paper*, University of Oregon.

Guenther, D., S. Matsunaga, and B. Williams. 2017. Is tax avoidance related to firm risk? *The Accounting Review* 92 (1): 115-136.

Guenther, D., R. Wilson and K. Wu. 2017. Tax uncertainty and incremental tax avoidance. *Working paper*, University of Oregon.

Gupta, S. and K. Newberry. 1997. Determinants of the variability in corporate effective tax rates: evidence from longitudinal data. *Journal of Accounting and Public Policy* (16): 1-34.

Hadlock, C. and J. Pierce. 2010. New evidence on measuring financial constraints: moving beyond the KZ index. *The Review of Financial Studies* 23 (5): 1910-1940.

Hanlon, M. and S. Heitzman. 2010. A review of tax research. *Journal of Accounting and Economics* 50: 127-178.

Hanlon, M. and J. Slemrod. 2009. What does tax aggressiveness signal? Evidence from stock price reactions to news about tax shelter involvement. *Journal of Public Economics* 93: 126-141.

Kaplan, S. N. and L. Zingales. 1997. Do investment-cash flow sensitivities provide useful measures of financial constraints? *Quarterly Journal of Economics* 109: 309-340.

Kim, J., S. McGuire, S. Savoy and R. Wilson. 2017. How quickly do firms adjust to target levels of tax avoidance? *Working paper*, University of Rochester, Texas A&M University, University of Iowa, and University of Oregon.

Kim, J., P. Quinn, and R. Wilson. 2017. Managerial ownership and tax planning: evidence from stock ownership plans. *Working paper*, University of Rochester, University of Washington and University of Oregon.

Kubick, T., D. Lynch, M. Mayberry and T. Omer. 2015. Product market power and tax avoidance: market leaders, mimicking strategies, and stock returns. *The Accounting Review* 90 (2): 675-702.

Lamont, O., C. Polk, and J. Saá-Requejo. 2001. Financial constraints and Stock returns. *The Review of Financial Studies* 14 (2): 529-554.

Law, K. and L. Mills. 2015. Taxes and financial constraints: evidence from linguistic cues. *Journal of Accounting Research* 53 (4): 777-818.

Law, K. and L. Mills. 2017. Military experience and corporate tax avoidance. *Review of Accounting Studies* 21 (1): 141-184.

Lisowsky, P., L. Robinson, and A, Schmidt. 2013. Do publicly disclosed tax reserves tell us about privately disclosed tax shelter activity? *Journal of Accounting Research* 51 (3): 583-629.

McGuire, S., D. Wang, and R. Wilson. 2014. Dual class ownership and tax avoidance. *The Accounting Review 89* (4): 1487-1516.

McGuire, S., T. Omer, and D. Wang. 2012. Tax avoidance: does tax-specific industry expertise make a difference? *The Accounting Review* 87 (3): 975-1003.

Olsen, K. and J. Stekelberg. 2016. CEO narcissism and corporate tax sheltering. *Journal of American Taxation Association* 38 (1): 1-22.

Phillips, J. 2003. Corporate tax-planning effectiveness: the role of compensation-based incentives. *The Accounting Review* 78 (3): 847-874.

Rajgopal, S. and T. Shevlin. 2002. Empirical evidence on the relation between stock option compensation and risk taking. *Journal of Accounting and Economics* 33: 145-171.

Rauh, J. 2006. Investment and financing constraints: evidence from the funding of corporate pension plans. *Journal of Finance* 61 (1): 33-71.

Rego, S. 2003. Tax-avoidance activities of U.S. multinational corporations. *Contemporary Accounting Research* 20 (4): 805-833.

Rego, S. and R. Wilson. 2012. Equity risk incentives and corporate tax aggressiveness. *Journal of Accounting Research* 50 (3): 776-810.

Robinson, J., S. Sikes, and C. Weaver. 2010. Performance measurement of corporate tax departments. *The Accounting Review* 85 (3): 1035-1064.

Slemrod, J. 1990. The economic impact of the Tax Reform Act of 1986. MIT Press: 1-12.
Saavedra, D. 2015. Tax spike firms. *Working paper*, UCLA.

Shackelford, D. and T. Shevlin. 2001. Empirical tax research in accounting. *Journal of Accounting and Economics* 31: 321-387.

Skaife, H., L. Swenson, and D. Wangerin. 2013. Classification shifting of R&D expense. *Working paper*, University of Wisconsin-Madison, Georgia State University, and Michigan State University.

Weisbach, D. 2002. Ten truths about tax shelters. *Tax Law Review* 55: 215-253.

Whited, T. and G. Wu. 2006. Financial constraints risk. *Review of Financial Studies* 19: 531-559.

Wilson, R. 2009. An examination of corporate tax shelter participants. *The Accounting Review* 84 (3): 969-999.

Zimmerman, J. 1983. Taxes and firm size. *Journal of Accounting and Economics* 5 (1): 119-149.