# Do Financing Constraints Lead to Incremental Tax Planning? Evidence from the Pension Protection Act of 2006*

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# Do Financing Constraints Lead to Incremental Tax Planning? Evidence from the Pension Protection Act of 2006

**Abstract:**

Over the last three decades, academic research has sought to understand how cash shortfalls impact a firm's ability to take all available value-increasing investment projects. We investigate whether firms facing greater financing constraints turn to tax strategies that generate lower cash effective tax rates (ETRs) to mitigate the adverse effect of these financing constraints. We use the Pension Protection Act of 2006 (PPA 2006) as an exogenous shock to financing constraints for pension firms, but not for other firms. Using a difference-in-differences research design, we predict and find that pension firms experience a decrease in their cash ETRs by 1.8 to 2.4 percentage points after the PPA 2006, relative to other firms. These cash tax savings mitigate the investment shortfall brought about by financing constraints by 19%. We also predict and find that the decline in cash ETRs is greater among firms more adversely affected by the PPA 2006. Our paper sheds light on the direction, causality, and economic magnitude of the association between financing constraints and tax planning activities. We also provide insight into the role of tax planning activities within firms' broader corporate business strategies in responding to financing constraints.

**Keywords:** financing constraints, tax planning, Pension Protection Act of 2006, off-balance sheet financing, investment

## 1. Introduction

Whether financing constraints prevent firms from fully investing in positive net present value (NPV) projects available to them is a central and unsettled question in economics, finance, and accounting. Prior studies provide evidence that financing constraints raise firms' cost of capital, thereby causing firms to forego valuable investment opportunities (e.g., Fazzari et al. 1988, 2000; Rauh 2006; Almeida and Campello 2007; Campbell et al. 2012). Meanwhile, other studies argue that this evidence may suffer from endogeneity concerns (e.g., Poterba 1988; Kaplan and Zingales 1997, 2000; Bakke and Whited 2012). More recently, researchers have examined the link between financing constraints and the extent to which tax planning activities might help to alleviate these constraints (e.g., Albring et al. 2011; Law and Mills 2015; Dyreng and Markle 2016; Edwards et al. 2016).

In this paper, we more carefully consider the causal effect of firm-level financing constraints on corporate tax planning activities. The purpose of our study is twofold. First, we use the Pension Protection Act of 2006 (PPA 2006) as a plausibly exogenous event that increased pension firms' financing constraints to better establish the direction and causal relation between financing constraints and tax planning. A closer step towards establishing causality is important because otherwise, we cannot exclude the possibility that the association is driven by inefficient tax planning, leading to more financing constraints (i.e., reverse causality) or other omitted firm attributes. Second, the Scholes-Wolfson (1992) framework suggests that corporate tax planning does not stand alone; instead, it is integrated into firms' investment and financing decisions. Thus, we quantify the extent to which tax planning allows firms to recoup a portion of the investments that financing constraints would otherwise force them to forego. In so doing, we document the benefits and limitations of using tax planning to mitigate financing constraints within firms' broader corporate strategy decisions.

The PPA 2006 is an ideal setting as an exogenous increase to pension firms' financing constraints for several reasons. Prior to the PPA 2006, firms were allowed 30 years to fund 90% of their defined benefit plan funding obligation. After the enactment of the PPA 2006, firms are required to fully fund their plans within seven years. In other words, this legislation immediately increases firms' required pension contributions by over 400%. Furthermore, the PPA 2006 imposes financing constraints only on firms having defined benefit plans and leaves other firms unaffected, so we can employ a difference-in-differences (DID) research design to more carefully consider causality. Finally, the impact of the PPA 2006 depends on the funded status of pension plans, allowing us to examine cross-sectional variations within firms with defined benefit plans. In sum, the PPA 2006 imposes an immediate and significant shock to firms' demand for additional funding, and this shock is systematic and uncorrelated with firms' tax activities.[1]

Figure 1 illustrates that corporate tax strategy is an equilibrium outcome where firms trade off tax benefits and costs (e.g., Goh et al. 2016; Cook et al. 2017; Scholes et al. 2020).[2] The benefits of tax planning are an increase in internally generated cash flows. The costs of tax planning are penalties and fines if the IRS disallows a claimed position. The PPA 2006 increases the benefits related to tax planning because it increases firms' financing constraints, making internally generated cash flows more valuable (Fazarri et al. 1988; Kaplan and Zingales 1997). However, the PPA 2006 should not affect tax planning costs, such as IRS detection risk and penalties, because it is not a tax regulation and thus should not affect IRS scrutiny. Therefore, we hypothesize that

[1] While traditional proxies for financing constraints, such as credit ratings, paying dividends, or self-constructed indices, are largely descriptive and often subject to measurement problems (Farre-Mensa and Ljunqvist 2016), mandatory pension contributions are not only economically significant and measurable but also vary across firms (e.g., Rauh 2006; Franzoni 2009; Campbell et al. 2010, 2012).

[2] Prior literature suggests that firms do not choose all available tax planning activities (Weisbach 2002). Cook et al. (2017) provide evidence that one possible reason why firms forego certain tax planning activities is that the extant tax planning is at an equilibrium. Specifically, following the pecking order theory (Myers and Majluf 1984), the costs of choosing some tax planning activities is greater than the costs of accessing other internal or external cash flows. As internal financing becomes less available and external financing becomes more expensive, firms are more likely to choose these available, albeit expensive, tax planning activities to avoid foregoing positive NPV projects.

the PPA 2006 increases the benefits of tax planning but does not impose a significant change on the cost of tax planning, and, as a result, the equilibrium level of tax planning increases. Said another way, we expect that firms affected by the PPA 2006 have tax positions that they were unwilling to take before the PPA 2006 due to their equilibrium level of tax planning, but now they are willing to take after the PPA 2006 because of the change in the cost-benefit tradeoff.

[Insert Figure 1 here]

Figure 2 demonstrates the cost-benefit tradeoffs of tax planning within a broader context of corporate strategies related to investments and financing decisions (Scholes et al. 2020), which are particularly salient in our setting because financing constraints cause external financing to become more costly, leading to underinvestment. Prior research argues that tax planning can be viewed as a form of off-balance sheet financing in that it provides the firm with cash inflows (Shevlin 1987). Therefore, within the context of this interplay between tax planning, financing, and investment decisions, tax planning could become a preferred source for cash flows because the benefits are internally generated and thus not affected by the increase in external financing costs (Myers and Majluf 1984).

[Insert Figure 2 here]

We first document the causal effect of the PPA 2006 on firm-level financing constraints. Specifically, we show that, after the PPA 2006, pension firms' increases in the cost of equity and cost of debt around the PPA 2006 are significantly greater than those of non-pension firms. We also show that, relative to unaffected firms, pension firms' experience greater increases in investment-to-cash-flow sensitivity, which serves as a proxy for the effect of financing constraints on capital expenditures increases in the post-PPA period. These results indicate that the PPA 2006

increases financing constraints for pension firms but not for non-pension firms, confirming the validity of using the PPA 2006 setting for our analyses.

To test our research questions, we use a DID design to account for aggregated trends in corporate tax rates. Because cash tax savings can be viewed as a source of internal funding, our primary dependent variable is cash effective tax rates (ETRs) adjusted to remove pension contributions to avoid capturing a mechanical relation between increased tax-deductible pension contributions and lower cash tax rates (see Appendix 1).[3] We find that pension firms experience a decrease in their adjusted (i.e., non-pension related) cash ETR after adopting the PPA 2006, relative to non-pension firms. The adjusted cash ETR decreases by 1.8–2.4 percentage points more for pension firms than non-pension firms after the regulation change, and the result persists in the entire post-PPA 2006 period except for 2008. Given that the average value of adjusted cash ETR is 22.9%, the result suggests that pension firms' tax planning increases by 7.9%–10.5% of the average tax rate.[4] In terms of how this fits into the broader corporate strategy, our results imply that incremental tax planning activities mitigate pension firms' investment shortfall by about 19%.[5] While significant, the result suggests that tax planning activities have their own limitations in that, absent any other nontax methods of recouping the lost cash flows precipitated by the PPA 2006, the financing constraints induced by the Act still have an overall negative impact on pension firms' cost of capital and investment levels.

[3] In untabulated robustness tests, our results are qualitatively and quantitatively similar when using raw cash ETRs without adjusting for pension contributions.

[4] While the post-PPA 2006 period does include the financial crisis, it is worth noting that our primary results are concentrated in years other than the financial crisis and that the inferences remain unchanged when including year fixed effects, suggesting that our findings are not driven by macroeconomic conditions that hold across all firms. In addition, our results are robust to including firm and year fixed effects (e.g., Bertrand and Mullainathan 2003). Lastly, in untabulated analysis, we re-examine our analysis after removing years 2008 and 2009 from the sample. Our inferences remain unchanged.

[5] We determine the percentage that tax planning activities mitigate pension firm's investment shortfall using a five-step process: (i) determine the increase in pension obligations, (ii) estimate the percentage change in capital expenditures due to PPA 2006, (iii) estimate the effect of the increase in pension obligations on capital expenditures, (iv) calculate the cash flow increase from tax avoidance following the PPA 2006, and (v) calculate the percentage of cash flow from tax avoidance as a percentage of estimated decrease in investments. See Appendix 2 for the detail calculation for all pension firms, as well as separately for low and high underfunded pension firms.

Our second analysis examines whether the effect of the PPA 2006 on adjusted cash ETRs varies with firms' pre-Act financial condition. Pension firms with relatively more underfunded pension plans should face a more significant shock to their cash outflows under the PPA 2006 than those with less underfunded pension plans. Accordingly, we categorize pension firms into those with *low* underfunded pension plans and those with *high* underfunded pension plans based on their plans' funded status prior to the legislation.[6] We find that the shock mainly affects firms in the high underfunded category and that tax planning activities are more economically significant for high underfunded firms relative to low underfunded firms. These findings suggest that the impact of the PPA 2006 on corporate tax planning is associated with firms' financial condition prior to the legislation.

Next, we consider how corporate tax planning fits into a firm's overall corporate strategy by investigating alternative nontax avenues that firms may use to generate cash flows after the PPA 2006. We find that, relative to non-pension firms, pension firms become less likely to pay out dividends and buy back stock after the PPA 2006, consistent with these firms having a higher propensity to conserve internally generated cash through payout cuts due to their increased financial constraints. Meanwhile, we find that pension firms do not raise more debt or equity after the PPA 2006, consistent with our expectation that these firms' cost of external capital increases with their financing constraints. Furthermore, we find that pension firms do *not* cut discretionary expenditures such as advertising, R&D, and SG&A after the PPA 2006. This finding suggests that, unlike tax planning, firms consider generating cash by cutting these essential expenditures to have negative long-term profitability and firm value implications (Roychowdhury 2006; Gunny 2010; Bonsall et al. 2020). Overall, our results are consistent with the Scholes-Wolfson framework by

[6] The definition is based upon the percentage of the projected benefit obligation (PBO) that is funded with plan assets. The ratio equals the fair value of plan assets (FVPA) divided by projected benefit obligation (PBO) (see Appendix 1).

showing that tax planning is one of the prominent avenues in conjunction with payout policy through which firms can generate cash flows in response to financing constraints.

We also explore what types of tax planning activities might be used by pension firms via keyword searches in firms' 10-Ks. We find suggestive evidence that pension firms do not only rely on temporary tax planning—that is, they may also use permanent tax planning in response to financing constraints. We also find that (i) our primary results are more concentrated among domestic firms, and (ii) multinational firms affected by the PPA 2006 are more likely to increase inbound income shifting. These findings suggest that multinational corporations may have exhausted their tax planning opportunities before the PPA 2006, or that the nontax costs of additional tax planning outweigh the tax benefits of such planning, or both.[7]

Finally, we perform several procedures to substantiate the validity of our findings. To validate the parallel trends assumption underlying the DID design, we show that pension and non-pension firms' tax rates are not statistically different from each other in the pre-PPA 2006 period (see Figure 3). We also conduct a battery of auxiliary tests to check the sensitivity of our results to alternative measures, model specifications, and sample selection criteria.

Our study makes several contributions. First, we provide direct evidence of a positive relation between financing constraints and corporate tax planning. Prior studies focus on the general association between proxies for financing constraints and ETRs (Law and Mills 2015; Edwards et al. 2016), and a concurrent study indicates that this association could be moderated by firms' tax planning opportunities (Wu 2018). Our identification strategy allows us to draw more causal evidence on the relation between the two, which is necessary given potential endogeneity

[7] Our findings above are consistent with Dyreng and Markle's (2016) explanations as to whether and under what circumstances their results can be reconciled with those in Law and Mills (2015) and Edwards et al. (2016) (see pages 1606–1607 in Dyreng and Markle 2016).

concerns when examining financing constraints and investments (Fazzari et al. 1988; Kaplan and Zingales 1997). Second, our study considers how tax planning fits within the broader context of a corporate strategic response to financing constraints. We find that firms use taxes in conjunction with payout policy to mitigate the adverse impact of financing constraints on firm investments. Third, our study extends our understanding of the relation between taxation and off-balance sheet financing (Shevlin 1987; Mills and Newberry 2005; Han et al. 2015). As Hanlon and Heitzman (2010) indicate, off-balance sheet financing is often tied to financial reporting incentives, which cloud the inferences when trying to understand off-balance sheet finances and tax decisions. Our study examines a particular type of off-balance sheet financing in cash flows from tax planning with little financial statement effects, which provides a unique opportunity to show empirical evidence on whether firms use off-balance sheet financing from tax planning to address financing constraints.

## 2. Background and predictions

### *The PPA 2006*

The US Congress has regulated pension funding since the enactment of the Employee Retirement Income Security Act (ERISA) of 1974. Being managed by the US Department of Labor (DOL), the ERISA created the Pension Benefit Guarantee Corporation (PBGC) to protect the pensions of American workers and retirees. One way that ERISA protects these pensions is that it requires firms to fund 90% of the underfunded portion of their pension liabilities over a 30-year period. When a company fails to meet pension funding requirements, the PBGC is empowered to recover the pension deficit by filing a claim against the company's assets. In this scenario, the

PBGC's claim has the most senior status in bankruptcy proceedings. Moreover, the PBGC must assume the responsibility for the defined benefit pension plan if the firm decides to terminate it.[8]

In 2005, two key developments led the US Congress to revise their pension funding rules. First, United Airlines defaulted on their pension plan, which represented the largest corporate pension default in US history (Peltz 2005). Second, many firms were facing significant pension underfunding and could potentially be faced with similar circumstances as United. In response to the impending pension crisis, on August 17, 2006, the US President signed the PPA 2006 into law. The PPA 2006 creates a quasi-natural experiment to further our understanding of how financing constraints affect corporate tax planning because this legislation substantially affects mandatory pension contributions for firms with defined benefit pension plans in the following ways.[9] First, the legislation significantly increased the amount of required cash outflows for pension funding in the current and upcoming years. Specifically, firms were required to fund 100% of their underfunded pension obligation over seven years as opposed to funding only 90% of their underfunded pension obligation over a much longer 30-year period.[10,11] Second, a firm's ability to meet the increase in required contributions is related to the pension plan's funded status. The PPA 2006 required firms with severely underfunded plans to make the largest increase in contributions.

[8] The PBGC is largely funded by insurance premiums paid by US firms with defined benefit plans. The director of the PBGC reports directly to the US Secretary of Labor.

[9] Wu (2018, 25) uses the same setting to examine whether corporate tax savings are more pronounced for firms with higher levels of tax planning opportunities (TPO). Notably, there are considerable differences between the two papers—our focus is on the main effect of PPA 2006 on tax planning against the backdrop of the Scholes-Wolfson (1992) framework, whereas Wu's (2018) paper focuses on the cross-sectional differences in the effect of PPA 2006 conditional on high TPO versus low TPO. We believe the fact that two independent studies find consistent evidence, despite their different focuses, is as a testament to the strength of our underlying results.

[10] In addition to this key change, the PPA 2006 increased the level of deductibility to 150% of the projected pension obligations (Campbell et al. 2010). This change was an incentive for firms to fund their pension plans beyond 100% of their pension plans and did not affect the dollar deducted for each dollar contributed among underfunded pension firms.

[11] Both before and after the PPA 2006, firms undergo changes to pension funding obligations. For example, if the market performed well (poorly) in one year, then the underfunding gap will decrease (increase), and pension funding obligations for each subsequent year will be lower (higher). Because these annual changes are systematic across the entire market and relatively small compared to the increase in required pension funding contributions introduced by the PPA 2006, we only focus on the changes introduced by the PPA 2006. Furthermore, in our H2 analysis, we provide evidence of cross-sectional variation based on the firm's funded status. If the market-wide fluctuations significantly biased our results, then we would only expect it to bias us against our findings.

In particular, this legislation divided pension plans into risk categories based upon the percentage of the projected pension obligations (PBO) that are funded with plan assets (i.e., FVPA/PBO). As a result, there are significant cross-sectional variations in the extent to which the PPA 2006 affected firms' financing constraints.

Furthermore, different from traditional proxies for financing constraints that are largely descriptive (e.g., the Kaplan-Zingales, Whited-Wu, and Hadlock-Pierce indices), the economic magnitude of mandatory pension contribution can be directly measured. On average, firms with defined benefit pension plans must raise their required pension contributions from 3% to 14% of the funded status per annum after the onset of the PPA 2006.[12] The measurability of pension contributions could alleviate concerns about measurement error embedded in traditional financing constraint proxies (e.g., Kaplan and Zingales 1997, 2000; Farre-Mensa and Ljungqvist 2016). Relatedly, pension contributions can be expressed in dollar amounts and thus, avoid the problem of some traditional proxies having a nonlinear relation with financial constraints. For instance, a decrease in Altman's (1968) Z-score from three to one is not directly comparable to a decrease in Z-score from five to three.

Finally, prior studies confirm the validity of using pension contributions to capture exogenous variation in financing constraints. For example, Rauh (2006) uses mandatory pension contributions as an exogenous shock to internal financial resources and finds a negative association between these pension contributions and capital expenditures. Franzoni (2009) adopts Rauh's (2006) identification strategy to estimate the market's assessment of internal financial resources' value and finds consistent evidence. Campbell et al. (2010) document that investors react

[12] We calculate the required incremental pension contributions using the pension funding rules in place during each year. Specifically, before the PPA 2006, firms must fund 90% of the underfunded pension obligation over 30 years, or 3% per year. After the PPA 2006, firms must fund 100% of their underfunded pension obligation over 7 years, or 14% per year.

negatively to key events in the passage of the PPA 2006, and that the negative reaction is greater when the Act is anticipated to result in higher future pension contributions. Campbell et al. (2012) show that an increase in mandatory pension contributions raises the firms' cost of external capital. The abundant evidence in prior research provides support for the identification strategy used in our study.

***Empirical predictions***

Tax planning activities are a popular source of internally generated cash flows due to their discretionary nature and profitability (Mills et al. 1998). Prior literature establishes that these cash flows are a form of off-balance sheet financing since the positions do not appear as liabilities on the balance sheet (Shevlin 1987; Engel et al. 1999; Han et al. 2015; Scholes et al. 2020). To simplify, in the case of a temporary tax position, the firm receives cash tax benefits similar to an interest-free loan from the US government. In the case of a permanent tax position, this "loan" does not need to be repaid. While tax planning activities may incur some additional costs such as public scrutiny, information asymmetry between managers and shareholders, and the possibility that the position is overturned and has to be repaid (Gallemore et al. 2014; Chen et al. 2019; Balakrishnan et al. 2019; Dyreng et al. 2019), the costs of raising funds via tax planning are not dissimilar to those related to raising external funds from the debt or equity market (Goh et al. 2016; Cook et al. 2017; Shevlin et al. 2020). When the costs of obtaining cash flows via tax planning are smaller than those arising from external or internal financing, based on the pecking order theory of corporate finance (Myers and Majluf 1984), firms will turn to tax planning activities to address their financing constraints.

Figure 1 illustrates our prediction by showing the benefit and cost curves for firm *i*'s tax planning strategy. We assume that $Y_1$ is the intersection of the benefit and cost curves in the pre-

PPA period, that is, the equilibrium outcome of tax planning for firm *i* in year 2006. Said another way, we assume that firms in 2006 have selected tax planning activities to maximize firm value based on their financing and investment needs and that firms will not simply take every tax position available and introduce unnecessary tax risk. Important to our setting is the accepted notion that tax planning does not stand alone (Scholes and Wolfson 1992; Scholes et al. 2020). Instead, it is embedded in the firm's investment and financing decisions. As shown in Figure 2, firms do not perform tax planning in a vacuum. Conditional on their investment opportunities, firms must consider the possibility of generating cash flows from tax planning in conjunction with alternative sources of financing.

Based on this framework, we expect that when the PPA 2006 induces an exogenous shock to firm *i*'s mandatory pension contributions, the benefit curve is shifted to the upper right corner (see the dotted line in Figure 1). This shift occurs because a marginal dollar from tax savings becomes more valuable to the firm after this legislation. Meanwhile, the cost curve stays the same due to the sudden change in a short time period. As a result, firm *i* achieves a new equilibrium outcome of its tax planning ($Y_2$), thus saving more cash tax outflows in the post-PPA period. Consequently, tax planning activities that were available but passed on in 2006 because of the risk-reward tradeoff will now be chosen by the firm because the passage of the PPA increases the firm's demand for cash flows to a greater extent.[13,14] Following the passage of the PPA 2006, the

[13] Firms can choose tax positions that they previously were not choosing. For example, a firm may have R&D activities for which it previously had not applied for the research and experimentation tax credit. Following the PPA 2006, this firm may want to reclassify more of those expenses as qualifying for the tax credit to lower its tax liability. A firm could also be more drastic and change its operations to manufacture more in the United States, thereby receiving more tax benefits from the Domestic Productions Activity Deduction (DPAD). See Edwards et al. (2016) for more examples of tax planning activities firms can choose to address financing constraints.

[14] This prediction is also consistent with prior literature documenting tax planning can be used as a profit center (Robinson et al. 2010) and that tax planning is an integral part of firms' enterprise risk management framework (Beasley et al. 2020).

marginal benefits of tax planning for pension firms increase, so these firms should be willing to incur higher risks to execute these otherwise forgone tax planning strategies. H1 follows:

> HYPOTHESIS 1 (H1). *After the adoption of the PPA 2006, firms with defined benefit pension plans experience larger decreases in cash ETRs relative to other firms.*

Our second hypothesis predicts that the PPA 2006 has a more prominent effect on cash ETR savings for pension firms whose defined benefit plans are more underfunded. This prediction is motivated by Campbell et al.'s (2010) finding that significantly underfunded firms experience the most negative market reactions during the legislative process of the PPA 2006 because the Act has a substantial impact on those firms' mandatory pension contributions. Thus, this leads to H2:

> HYPOTHESIS 2 (H2). *After the adoption of the PPA 2006, pension firms experience larger decreases in cash ETRs when their defined benefit pension plans are more underfunded before the legislation.*

## 3. Research design

### *Model specification for the tests of H1*

To test H1, we estimate the following OLS model:

$$\begin{aligned} AdjCashETR_{i,t} = {} & \alpha + \beta_1 Pension_{i,t} + \beta_2 PPA_t + \beta_3 Pension \times PPA_{i,t} + \beta_4 ROA_{i,t} \\ & + \beta_5 Leverage_{i,t} + \beta_6 ForeignAssets_{i,t} + \beta_7 NewInvestments_{i,t} + \beta_8 PPE_{i,t} \\ & + \beta_9 Intangibles_{i,t} + \beta_{10} EqInc_{i,t} + \beta_{11} Size_{i,t} + \beta_{12} BTM_{i,t} + \beta_{13} DA_{i,t} + \beta_{14} Cash_{i,t} \\ & + \beta_{15} Delaware_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

Our tax planning measure is based on the cash ETR (Hanlon and Heitzman 2010; Dyreng et al. 2008), adjusted to remove the mechanical nature of employer contributions to defined benefit pension plans. Specifically, we create the measure, *AdjCashETR*, by adjusting the numerator by cash pension contributions and the denominator by pension expense (see Appendix 1).[15] Cash pension contributions are publicly available for 93% of pension firms in our sample. For the remaining observations, we estimate cash pension contributions by subtracting the difference in

[15] Pension contributions are a deductible expense under I.R.C. § 404.

the current year and prior year funded status and adding pension expenses.[16] These adjustments remove the effect of pension contributions on corporate tax rates and thus, provide a measure of tax planning net of any mechanical pension effects.

To provide causal evidence on the effect of financing constraints, we employ a DID research design around the PPA 2006 (Campbell et al. 2010, 2012). Our first difference is the change to internal liquidity itself. We create an indicator variable that equals one for years after implementing the Pension Protection Act of 2006 (*PPA)*, and zero otherwise. Our second difference is whether the PPA 2006 affects the firm or not. We create an indicator variable that equals one if the observation has a defined benefit pension plan in the current year (*Pension*), and zero otherwise.[17] Lastly, we interact these two indicator variables (*Pension*×*PPA*) to assess pension firms' incremental effect versus non-pension firms in the post-PPA period relative to the pre-PPA period. We also control for a battery of firm characteristics following Cen et al. (2017), and use various fixed-effect structures, such as no fixed effects, industry fixed effects (Fama-French 48 classification), and firm fixed effects.[18] We include firm-clustered standard errors throughout all tests in our manuscript.[19] All variables used in the paper are defined in Appendix 1.

[16] In untabulated analysis, we estimate pension contributions for all firm-year observations, and, among those observations that disclose their cash paid for pension contributions, we document a 74% correlation ($p < 0.01$) between the actual and estimated contributions. As a result, the estimated pension contributions appear to be a reasonable estimate of pension contributions among firms that do not disclose this information. While this statistic represents a high correlation, we also mitigate any concerns of using an estimated value by running two additional analyses: (i) we only examine equation (1) using firm-year observations with actual pension contributions available, and (ii) we examine equation (1) using estimated values for all firm-year observations, even those with actual values available. In untabulated analysis, in both alternative specifications, our inferences remain unchanged.

[17] Because *Pension* can vary, it does not become collinear when including firm fixed effects. In untabulated analysis, our inferences remain unchanged when we define *Pension* as an indicator variable equal to one if the firm has a defined benefit pension plan in 2006, and zero otherwise. Given the small number of firms that change having a pension plan (64 total firms out of 2,637 in our sample, or 2.5%), we do not remove these firms from our sample.

[18] We use firm fixed effects to control for any unobserved and time-invariant firm characteristics. For example, some unobserved characteristics might be fundamentally different between pension and non-pension firms. Adding firm fixed effects can help control for time-invariant differences between pension and non-pension firms and analyze how within firm variation in financial constraints affect tax planning. Consequently, with the inclusion of firm fixed effects, the coefficient on the interaction term (*Pension*×*Post*) reflects the average effect of the PPA 2006 within pension firms, while the coefficient on *Post* indicates the average effect of the PPA 2006 within non-pension firms. However, as deHaan (2020) indicates, controlling for firm fixed effects inevitably restricts our analyses to within-firm variations and sometimes, may exacerbate the effects of measurement errors or outliers. We thus present our results with industry-fixed effects as well as firm-fixed effects to be as complete as possible.

[19] As highlighted by Petersen (2009) and deHaan (2020), we include firm-clustered standard errors throughout our manuscript to correct for a lack of independence within a given firm. We acknowledge that Cameron and Miller (2015) suggest clustering standard

Importantly, the DID design, together with all controls and fixed effects, helps us draw causal inferences (e.g., Bertrand et al. 2004: Leuz and Wysocki 2016). Given that early evidence on the effects of financing constraints on firm investments has often been questioned by subsequent studies with respect to endogeneity, construct validity, and identification (e.g., Poterba 1988; Kaplan and Zingales 1997; Bakke and Whited 2012), our research design serves as a first step in the process of understanding the causal link between financing constraints and corporate tax planning.

To provide more insights for temporal variations in the PPA effects, we disaggregate the *PPA* indicator to yearly indicators and then interact them with the *Pension* indicator for the post-PPA period:

$$\begin{aligned} AdjCashETR_{i,t} = {} & \alpha + \beta_1 Pension_{i,t} + \beta_2 F2008_t + \beta_3 F2009_t + \beta_4 F2010_t + \beta_5 F2011_t \\ & + \beta_6 F2012_t + \beta_7 Pension{\times}F2008_{i,t} + \beta_8 Pension{\times}F2009_{i,t} + \beta_9 Pension{\times}F2010_{i,t} \\ & + \beta_{10} Pension{\times}F2011_{i,t} + \beta_{11} Pension{\times}F2012_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} Leeragev_{i,t} \\ & + \beta_{14} ForeignAssets_{i,t} + \beta_{15} NewInvestments_{i,t} + \beta_{16} PPE_{i,t} + \beta_{17} Intangibles_{i,t} \\ & + \beta_{18} EqInc_{i,t} + \beta_{19} Size_{i,t} + \beta_{20} BTM_{i,t} + \beta_{21} DA_{i,t} + \beta_{22} Cash_{i,t} + \beta_{23} Delaware_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

In particular, we define all variables in equation (2) consistent with equation (1) except for replacing *PPA* with *F20XX* variables, which are indicators for fiscal year 20XX in the post-PPA period.[20] A negative $\beta_3$ in equation (1) and negative $\beta_7$–$\beta_{11}$ in equation (2) would be consistent with our first hypothesis (H1), suggesting that firms respond to incremental financing constraints by increasing their tax planning activities.

errors by firm may not always be appropriate when including firm-fixed effects because the wrong degrees of freedom would be used in estimating the standard errors. In untabulated analysis, we re-estimate our analysis with firm-fixed effects and industry-clustered standard errors as well as firm-fixed effects and no clustering, and our inferences remain unchanged.

[20] We do not include an indicator variable for 2007, which is excluded from our primary analyses because the PPA was passed into law in 2006 but did not take effect until 2008. However, firms were encouraged (but not required) to fund their plans during 2007. Thus, 2007 is a hybrid year where firm behavior is unclear. Furthermore, given Albring et al. (2011) and Dyreng and Markle's (2016) results that firms sacrifice short-run tax planning for more immediate cash flows, it is incrementally important to exclude the year immediately after the shock from our testing sample. See the additional discussion of our sample selection in section 3. In our robustness tests, we include 2007 as a post-year and our inferences remain unchanged. See section 5 for additional discussion.

***Model specification for the tests of H2***

To test H2, we estimate the following OLS model:

$$\begin{aligned} AdjCashETR_{i,t} = {} & \alpha + \beta_1 LowUnderfunded_{i,t} + \beta_2 HighUnderFunded_{i,t} + \beta_3 PPA_{i,t} \\ & + \beta_4 LowUnderfunded \times PPA_{i,t} + \beta_5 HighUnderFunded \times PPA_{i,t} + \beta_6 ROA_{i,t} \\ & + \beta_7 Leverage_{i,t} + \beta_8 ForeignAssets_{i,t} + \beta_9 NewInvestments_{i,t} + \beta_{10} PPE_{i,t} \\ & + \beta_{11} Intangibles_{i,t} + \beta_{12} EqInc_{i,t} + \beta_{13} Size_{i,t} + \beta_{14} BTM_{i,t} + \beta_{15} DA_{i,t} \\ & + \beta_{16} Cash_{i,t} + \beta_{17} Delaware_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

In equation (3), we use two indicators to measure the relative funded status of the defined benefit pension obligation. The PPA 2006 divides pension plans into three categories: "well-funded", 80% or more funded; "underfunded", between 65% and 80% funded; and "at-risk", less than 65% funded. Following Campbell et al. (2010, 2012), we use these designations to categorize pension firms into whether their funded status is deemed to be *HighUnderfunded,* which equals one for "at-risk" pension firms, and zero otherwise, and *LowUnderFunded*, which equals one for "well-funded" and "underfunded" pension firms, and zero otherwise. Firms without defined benefit pension plans have zero values for both *HighUnderfunded* and *LowUnderfunded*. All other variables in equation (3) are the same as those in equation (1). The data for determining funded status originates from the Compustat annual pension database. We calculate the fair value of the plan assets as the sum of pension plan assets (PPLAO) and underfunded pension plan assets (PPLAU). We calculate the projected benefit obligation as the sum of the projected benefit obligation (PBPRO) and the underfunded projected benefit obligation (PBPRU). [21] The percentage-funded status is the result of scaling the fair value of plan assets by the projected benefit obligation. We determine a firm's funded status as of 2006 and keep that funded status constant throughout our sample.[22] Firms without defined benefit pension plans take the value of zero for

[21] We include the corresponding Compustat – Pension Annual database mnemonics in parentheses.
[22] Our inferences remain unchanged if we relax this assumption and allow funded status to change each year.

their funded status. In equation (3), our main variables of interest are *HighUnderfunded*×*PPA* and *LowUnderfunded*×*PPA*. We also include industry (Fama-French 48) fixed effects or firm fixed effects in the regression. Our second hypothesis (H2) predicts $\beta_4$ is significantly greater than $\beta_5$ in equation (3).

Additionally, we examine the annual effects of *LowUnderfund* versus *HighUnderfund* in the post-PPA period by separating the *PPA* indicator into yearly indicators in the post-PPA period:

$$\begin{aligned} AdjCashETR_{i,t} = {} & \alpha + \beta_1 LowUnderfunded_{i,t} + \beta_2 HighUnderFunded_{i,t} + \beta_3 F2008_t \\ & + \beta_4 F2009_t + \beta_5 F2010_t + \beta_6 F2011_t + \beta_7 F2012_t + \beta_8 LowUnderfunded \times F2008_{i,t} \\ & + \beta_9 LowUnderfunded \times F2009_{i,t} + \beta_{10} LowUnderfunded \times F2010_{i,t} \\ & + \beta_{11} LowUnderfunded \times F2011_{i,t} + \beta_{12} LowUnderfunded \times F2012_{i,t} \\ & + \beta_{13} HighUnderfunded \times F2008_{i,t} + \beta_{14} HighUnderfunded \times F2009_{i,t} \\ & + \beta_{15} HighUnderfunded \times F2010_{i,t} + \beta_{16} HighUnderfunded \times F2011_{i,t} \\ & + \beta_{17} HighUnderfunded \times F2012_{i,t} + \beta_{18} ROA_{i,t} + \beta_{19} Leverage_{i,t} \\ & + \beta_{20} ForeignAssets_{i,t} + \beta_{21} NewInvestments_{i,t} + \beta_{22} PPE_{i,t} + \beta_{23} Intangibles_{i,t} \\ & + \beta_{24} EqInc_{i,t} + \beta_{25} Size_{i,t} + \beta_{26} BTM_{i,t} + \beta_{27} DA_{i,t} + \beta_{28} Cash_{i,t} + \beta_{29} Delaware_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

***Sample selection***

The initial sample consists of all Compustat firms between fiscal years 2002 and 2012 except for fiscal year 2007. We eliminate 2007 because it is a "hybrid" year—that is, the law was passed in 2006 but did not go into effect until 2008. While firms were encouraged to increase the funding for their pension plans in 2007, they were not required to do so. Thus, our sample has five years before and five years after the PPA.[23] Because firms with negative earnings or negative cash taxes paid may have different tax planning incentives than other firms (Scholes et al. 2020), we eliminate loss firms from our sample. For similar reasons, we also exclude financial services and utility firms. We require all firms to have at least one observation in the pre- and post-PPA periods. We also exclude firms with greater than 100% funded pension plans in 2006 since they are not

[23] Our inferences are robust to minimizing the window to three years before and after the PPA 2006, as well as expanding our sample from 1992 to 2015.

affected by the PPA's funding requirements.[24] Lastly, we eliminate firms with missing variables for the analyses. This sample selection leaves 18,540 observations for our tests. Table 1, panel A, describes our sample selection procedure, and panels B and C present our sample by year and by industry, respectively.

[Insert Table 1 here]

## 4. Main analyses

### *Summary statistics*

Table 2 presents descriptive statistics for our primary testing sample. Panel A presents the descriptive statistics. The mean value of adjusted cash ETR (*AdjCashETR*) is 22.9%, which is consistent with prior literature on cash ETRs (Dyreng et al. 2008; Dyreng et al. 2017). The mean value of *Pension* is 0.360, suggesting that 36% of our sample has a defined benefit pension plan. When examining these pension plans' funding status, we document that 28.1% of the sample is in the low-underfunding category, and 7.9% is in the high-underfunding category. By design, about half of the sample falls in the pre-event period (2002–2006), and the other half falls in the post-event period (2008–2012). The remaining statistics are consistent with prior research (e.g., Cen et al. 2017).

[Insert Table 2 here]

### *Validation of the parallel trend assumption*

Our identification strategy primarily involves a DID design surrounding the PPA 2006 as a plausibly exogenous shock to financing constraints. Bertrand et al. (2004) and Leuz and Wysocki (2016) caution about using this identification strategy without demonstrating a parallel trend between the treatment and control group during the pre-shock years. Figure 3 tests this assumption

[24] In untabulated analysis, we further exclude firms that have greater than 95%, 90%, or 80% pension funding as of 2006, as well as including all defined benefit pension firms and our inferences remain unchanged.

by plotting the treatment effects of our pension firms relative to corresponding non-pension firms over our sample period with a 90% two-tailed confidence interval (see Christensen et al. 2017). Notably, the treatment effects are not statistically different from zero across the pre-PPA period. Figures 4 and 5 provide additional univariate evidence on tax planning activities in pension firms and non-pension firms. Figure 4 plots the *AdjCashETR* levels for pension and non-pension firms each year. From 2002 to 2006, the average levels of *AdjCashETR* for these two groups of firms move in virtual unison and are 75% correlated (untabulated, $p < 0.01$). Figure 5 separates pension firms into two subgroups: *LowUnderfund* and *HighUnderfund.* We continue to document that the two subgroups of pension firms move in unison with non-pension firms in the pre-period. Thus, these figures support the parallel trend assumption underlying our research design.[25]

[Insert Figure 3 here]

[Insert Figure 4 here]

[Insert Figure 5 here]

Moreover, Figures 3–5 provide univariate evidence to support our main predictions. Figure 3 shows that the treatment effects become significant in the post-PPA period, consistent with H1. In Figure 4, we document that, on average, pension firms have lower *AdjCashETR* beginning in 2007, while the non-pension firms incur a slight increase in *AdjCashETR* during this period. When dissecting this trend in Figure 5, we note that the decrease in *AdjCashETR* is primarily driven by pension firms designated as *HighUnderfund*. In contrast, firms designated as *LowUnderfund* do not appear to have significant changes in *AdjCashETR* following the onset of the PPA 2006. This evidence corroborates H2 and the notion that the changes in *AdjCashETR* are driven by the

[25] In untabulated analysis, we re-estimate our primary specification by year and include indicator variables for years 2003, 2004, 2005, and 2006, as well as the interaction of those variables with *Pension.* We note an insignificant coefficient on each interaction term. This analysis complements our graphical findings in Figures 3, 4, and 5 of a parallel-trend between pension and non-pension firms in the pre-PPA 2006 period.

treatment sample rather than the control sample. Collectively, Figures 3–5 confirm the parallel trend assumption in the pre-PPA period and provide evidence consistent with our two hypotheses.

***Validation of the identification strategy***

While the PPA 2006 increases the demand for cash flows, the event may not necessarily lead to changes in financing constraints. Thus, before testing our hypotheses, we validate that the legislation does lead to meaningful increases in financing constraints for the treatment sample (i.e., pension firms), as manifested in their higher cost of capital and stronger investment-cash flow sensitivities. To do so, we first examine whether pension firms experience an increase in their cost of equity capital (*COEC*) after the PPA 2006 relative to non-pension firms by estimating the equation below:

$$\begin{aligned} COEC_{i,t} = {} & \alpha + \beta_1 Pension_{i,t} + \beta_2 PPA_{i,t} + \beta_3 Pension \times PPA_{i,t} + \beta_4 FS_{i,t} + \beta_5 LTG_{i,t} + \beta_6 Disp_{i,t} \\ & + \beta_7 Beta_{i,t} + \beta_8 Size_{i,t} + \beta_9 BTM_{i,t} + \beta_{10} Leverage_{i,t} + \beta_{11} IndAvgCOC_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

The dependent variable is the cost of equity capital, calculated per Gebhardt et al. (2001).[26] Our main variable of interest is the interaction term *Pension×PPA*. We also include a vector of control variables following prior research (e.g., Campbell et al. 2012). We estimate this regression with no fixed effects, industry fixed effects, or firm fixed effects.[27]

Next, we test whether PPA 2006 significantly and adversely affects the firms' cost of debt capital. To proxy for the cost of debt, we examine the likelihood of a credit rating downgrade as credit ratings significantly impact the firms' borrowing cost (e.g., Fischer 1959; Merton 1974; Ericsson and Renault 2006). We estimate the following probit equation following Ayers et al. (2010):

$$\begin{aligned} Dec\ in\ Credit\ Rating_{i,t} = {} & \alpha + \beta_1 Pension_{i,t} + \beta_2 PPA_{i,t} + \beta_3 Pension \times PPA_{i,t} \\ & + \beta_4 ChangeSize_{i,t} + \beta_5 ChangePPE_{i,t} + \beta_6 ChangeLeverage_{i,t} + \beta_7 ChangeROA_{i,t} + \\ & \beta_8 ChangeIntCov_{i,t} + \beta_9 ChangeSales_{i,t} + \beta_{10} ChangeFCF_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (6)$$

[26] We define all variables used in this test and subsequent tests in Appendix 1.
[27] Note that the calculation of *COEC* causes sample attrition.

The dependent variable is an indicator variable equal to one when a firm incurs a credit rating downgrade, and zero otherwise. Our main variable of interest is *Pension×PPA*. We also include a vector of control variables following Ayers et al. (2010). We estimate this probit model with no fixed effects, industry fixed effects, or firm fixed effects.[28]

Lastly, we test whether a firm's investment-cash flow sensitivity increases more after the PPA 2006 for pension firms than non-pension firms using the following equation:

$$\begin{aligned} Capex_{i,t} = {} & \alpha + \beta_1 Pension_{i,t} + \beta_2 PPA_{i,t} + \beta_3 CFO_{i,t} + \beta_4 Q_{i,t-1} + \beta_5 Pension \times PPA + \\ & \beta_6 Pension \times CFO_{i,t} + \beta_7 Pension \times Q_{i,t} + \beta_8 PPA \times CFO_{i,t} + \beta_9 PPA \times Q_{i,t} + \\ & \beta_{10} Pension \times PPA \times CFO_{i,t} + \beta_{11} Pension \times PPA \times Q_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (7)$$

Following prior literature, we define *Capex* as the total capital expenditures scaled by prior year total assets, *CFO* as operating cash flows scaled by prior year total assets, and *Q* as Tobin's Q (Fazzari et al. 1988; Kaplan and Zingales 1997; Rauh 2006; Almeida and Campello 2007). The main variable of interest is *Pension×PPA*. Prior research suggests that corporate investments depend on both cash flows and investment opportunities, and firms are viewed as more financially constrained when relying more on cash flows rather than investment opportunities to fund investments. As a result, the relation between *Capex* and *CFO* is indicative of financing constraints.

Panel A of Table 3 presents the descriptive statistics for the variables used in the validation tests. We document an average value for *COEC* of 0.106, which suggests a 10.6% average cost of equity capital, and *Dec in Credit Rating* has a mean value of 0.099, which indicates that about one out of ten firm-year observations incurs a credit rating decline. In addition, *CapEx, Q,* and *CFO* have mean values of 0.079, 1.947, and 1.294, respectively.

[Insert Table 3 here]

[28] Note that the calculation of *Dec in Credit Rating* causes sample attrition. We do not estimate the firm fixed effects specification using a probit model due to the significant loss of sample when including firm-fixed effects in a probit model. In untabulated analysis, when we estimate equation (6) using a probit model and firm fixed effects, the inferences remain unchanged.

Panel B of Table 3 presents our estimation of equation (7). Consistent with our expectation, the coefficient on *Pension*×*PPA* ($\beta_3$) is significantly positive across all specifications. The coefficient ranges from 0.003 to 0.005 (30 to 50 basis points). Given an average *COEC* of 0.106, the result suggests that, on average, pension firms have a 2.8 to 4.7 percentage point increase in the cost of equity capital following the PPA 2006 relative to non-pension firms. Panel C of Table 3 presents our estimation of equation (8), where the coefficient on *Pension*×*PPA* ($\beta_3$) is significantly positive across all specifications. Using the OLS regression coefficient in column (3), we estimate that pension firms incur a credit rating decline at a rate of 4.1% more than non-pension firms following the PPA 2006. Given a mean value of *Dec in Credit Rating* of 0.099, this result suggests that pension firms have a 41% higher likelihood of a credit rating decline after the PPA 2006. Finally, panel D of Table 3 presents our estimation of equation (9). The coefficient on the three-way interaction, *Pension*×*PPA*×*CFO* ($\beta_{10}$), is reliably positive, suggesting that, following the PPA 2006, pension firms have significantly higher investment-cash flow sensitivity than non-pension firms. In other words, pension firms experience greater declines in investments relative to non-pension firms.

Taken together, Table 3 establishes two important results. First, these results provide causal evidence that higher financing constraints lead to increases in the cost of capital and decreases in firm investment, consistent with prior studies (e.g., Fazzari et al. 1988; Rauh 2006; Campbell et al. 2012). Second, these results provide a baseline from which we can quantify the extent to which firms use the additional cash generated from tax planning activities to mitigate the adverse effects of financing constraints on the cost of capital and firm investment.

***Empirical tests of H1***

H1 examines whether firms with defined benefit plans are more likely to raise cash through tax planning activities after the PPA 2006 relative to non-pension firms. We test this hypothesis using equations (1) and (2) and present the results in Table 4. We document consistent results across all the columns that the PPA 2006 increases pension firms' tax planning activities. The results remain statistically and economically significant even after controlling for firm fixed effects. In columns (1), (2), and (4), we note that the $\beta_3$ coefficients range from –0.018 (*t*-statistic = –2.33) to –0.024 (*t*-statistic = –3.25), suggesting that pension firms experience a 1.8 to 2.4 percentage point decrease in cash ETR relative to non-pension firms following the PPA 2006. Given an average *AdjCashETR* of 22.9%, our evidence implies that pension firms respond to incremental financial constraints from the PPA 2006 by increasing tax planning between 7.9% and 10.5%.

[Insert Table 4 here]

Apart from examining pre-PPA 2006 versus post-PPA 2006, we also examine each year following this regulation's onset. Columns (3) and (5) present the estimates of equation (2). In column (3), our findings persist following the onset of the PPA 2006, except for 2008. When we include firm fixed effects in column (5), we continue to note similar results, although the significance levels for 2010 and 2011 decline as the model eliminates all but within-firm variations. These results are important for two reasons. First, we show that the impact of the PPA 2006 on tax planning is both economically significant and long-lasting. Second, these findings mitigate the possibility that the 2008 financial crisis predominantly drives our results.[29] The aggregate of these

[29] In addition to this test, we provide robust evidence mitigating the possibility that the financial crisis is strictly responsible for our results. First, our DID research design is based on a single event—the PPA 2006—so our treatment and control groups are subject to the same macroeconomic factors. Second, in a separate robustness test (not tabulated), we perform entropy balancing to ensure the similarity between our treatment and control samples. As a result, we would not expect our treatment sample to react differently to the financial crisis than our control sample, and our inferences remain unchanged. Third, our test of H2 examines cross-sectional variations among pension firms, which arguably have more similar characteristics. Lastly, we validate our setting and document in

empirical specifications provides consistent and robust evidence that pension firms increase tax planning activities in response to more financial constraints resulting from the PPA 2006, supporting our first hypothesis (H1).

***Empirical tests of H2***

H2 examines whether the funded status (*LowUnderfund* or *HighUnderfund*) of a firm's defined benefit plans affects the relation between the PPA 2006 and tax planning activities. We test H2 by estimating equation (3) and report the results in Table 5. Across all the specifications, we find reliably negative coefficients on our two variables of interest.[30] Specifically, the coefficient on *LowUnderfund*×*PPA* ranges from –0.012 (*t*-statistic = –1.49) to –0.018 (*t*-statistic = –2.33), suggesting an increase in tax planning and a reduction in cash ETRs of 5.2% to 7.8%. Meanwhile, the coefficient on *HighUnderfund*×*PPA* ranges from –0.047 (*t*-statistic = –3.59) to –0.049 (*t*-statistic = –3.54), suggesting an increase in tax planning and a reduction in cash ETRs of 20.5% to 21.3%. We also compare the two coefficients on these variables of interest. Consistent with our expectation, the coefficient on *HighUnderfund*×*PPA* is significantly more negative than *LowUnderfund*×*PPA* across all the specifications (at the 0.05 level). Consistent with H2, the evidence suggests that corporate tax planning increases with the firm's degree of financing constraints. Lastly, the estimates of equation (4) reported in columns (3) and (5) present the yearly effect of financial constraints on tax planning. *HighUnderfund* firms statistically differ from non-pension firms in most years. These findings also support our H2.

[Insert Table 5 here]

Table 3 that the PPA 2006, in fact, elicits significant financing constraints on the treatment firms relative to the control firms. Collectively, we posit that our main findings are driven by the PPA 2006 rather than the financial crisis.

[30] One exception to this is that the coefficient on *LowUnderfund*×*PPA* in column (4) is directionally consistent, but loses two-tailed significance with a t-stat of -1.49.

***Using tax savings to recoup investment***

Our results in Table 4 suggest that pension firms increase their tax savings by 7.9% and 10.5% in response to the PPA 2006. However, these results do not inform us of the economic significance in terms of the extent to which those tax savings can be used to recoup the investment that would be otherwise lost. Given that (i) a firm's investment depends on both investment opportunities and cash flows (Fazzari et al. 1988; Kaplan and Zingales 1997) and (ii) the PPA 2006 causes significant cash outflows but does not necessarily affect investment opportunities, we examine the economic significance of the tax savings related to the PPA 2006 in the context of firm's investment-cash flow sensitivity.[31]

To illustrate this economic consequence, Appendix 2 provides a detailed calculation of the estimation in five steps: (1) we determine the PPA 2006-induced increase in pension obligations, (2) we estimate the associated percentage change in capital expenditures, (3) we estimate the effect of the pension obligation increase on capital expenditures, (4) we calculate the cash flow increase from tax planning following the PPA 2006, and (5) we calculate the percentage of cash flow from tax planning as a percentage of the estimated decrease in investments. Using this approach, we estimate that, on average, firms generate $17 million more cash from tax planning following the PPA 2006 than previously, while facing a decrease in capital expenditures of $92 million due to the new pension funding requirements. In other words, pension firms' tax planning mitigates about 19% of the investment that would be otherwise forgone following the PPA 2006. The estimates also suggest that tax savings could reduce underinvestment by 15% for less underfunded firms and by 33% for more underfunded firms (see Appendix 2 for details).

[31] Our calculation is based on the average changes to investment cash-flow sensitivity for the affected firms relative to the unaffected firms. In the absence of proprietary forecasted and budgeted capital expenditure reports provided by the firms, we cannot know the exact amount of investment firms intended for the post-PPA years. However, our calculation serves as an estimate of the effect.

## 5. Supplemental analyses

### *The role of tax planning in corporate strategy*

In this section, we explore the role of tax planning in the context of firms' overall business strategy in response to financing constraints. Investment theory indicates that firms choose all positive NPV projects and pass on negative NPV projects (Modigliani and Miller 1958). When financing constraints are introduced, firms must take action to generate cash flows to finance their positive NPV projects. While our analyses above provide evidence consistent with firms turning to tax planning to address financing constraints arising from the PPA 2006, it is still a question as to where tax planning falls within a firm's overall business strategy.

We attempt to shed light on this question by examining other avenues that firms may use to generate cash flows after the PPA 2006. We structure the tests along the following lines. First, we consider whether pension firms attempt to raise new capital via debt or equity financing in response to the PPA 2006's new funding requirements. Second, we consider whether pension firms alter their payout policy (i.e., dividends and stock buybacks) following the onset of the PPA 2006. Third, we examine whether pension firms reduce other discretionary expenditures such as R&D, SG&A, and advertising expenses to address financing constraints. It is noteworthy that we may not find that pensions firms use more external financing due to increases in their cost of capital (see Table 3). Similarly, we may not find pension firms cutting payouts to shareholders because they may have sticky distribution policies that cannot be easily changed (e.g., Brav et al. 2005). Finally, we may not find pension firms cutting discretionary expenditures because doing so may have a long-term negative impact on future performance and firm value (e.g., Roychowdhury 2006; Gunny 2010; Bonsall et al. 2020).

Table 6 presents the results.[32] Columns (1) and (2) present our analysis examining debt and equity issuances. Consistent with the increased demand for external financing being offset by the increased cost of capital due to the financing constraints, we do find that pension firms raise more new capital through debt or equity in response to financing constraints. Column (3) reports our stock buyback and dividends analysis, suggesting that pension firms become less likely to repurchase stock and issue dividends following the PPA 2006. These findings support our primary analysis because, similar to tax planning, changing payout policy is a relatively affordable way of saving cash flows without significantly affecting operations. Finally, column (4) presents our discretionary expenditures analysis. We find that pension firms do not appear to sacrifice activities that may diminish future profitability, such as advertising, R&D, and SG&A, in response to financing constraints. Overall, tax planning appears to be one of the avenues in which firms can generate cash flows in response to financing constraints.

[Insert Table 6 here]

***Different types of tax planning activities***

Edwards et al. (2016) provide a range estimate for temporary tax planning activities as a percentage of total tax planning activities in financially constrained firms. They claim that about 20%–95% of these firms' tax planning activities derive from temporary tax positions. Edwards et al. (2016, p. 859) conclude that "constrained firms achieve a substantial portion of their current tax savings via deferral-based tax planning strategies." From another perspective, their findings also imply that between 5% and 80% of tax planning activities derive from permanent tax planning activities. Despite the wide range of Edwards et al.'s (2016) estimates, they provide suggestive

[32] For presentation purposes, we only present the explanatory variables of interest, and we model external financing (Hovakimian et al. 2004; Brav 2009), payouts (Kahle 2002), and discretionary expenditures (Roychowdhury 2006) separately following prior literature.

evidence on specific tax planning activities that might be used by constrained firms. Based on their analysis, we further explore different types of tax planning activities in our setting.[33]

We specifically examine three tax planning activities that can generate immediate cash benefits via permanent tax positions, including the Domestic Production Activities Deduction (DPAD), the R&D tax credit, and the medical portion of worker's compensation. We focus on these activities because (i) firms may become more aggressive in defining qualified activities for the DPAD, which would allow them to obtain more tax credits; (ii) firms may become more aggressive in assigning what qualifies as eligible R&D activities for more tax credits; and (iii) self-insurance firm may reclassify the medical portion of workers compensation for more tax credits (see Edwards et al. 2016). Using textual analysis, we bifurcate our sample into firms that mention the keywords associated with these tax planning activities and those that do not and re-estimate equation (1).[34] We expect to find cross-sectional variations among firms that explicitly discuss matters related to these permanent tax positions in their financial statements.[35] In Table 7, columns (1) and (2) present the results based on DPAD, columns (3) and (4) present the results based on R&D tax credits, and columns (5) and (6) present the results based on the medical portion of worker's compensation. We find evidence consistent with our expectations across all three

[33] In untabulated analysis, we estimate our analysis using an adjusted *GAAPETR* as well as *AdjCashETR* orthogonalized on the adjusted *GAAPETR*. In both specifications, we continue to find a negative and significant coefficient on our interaction term. Given that *GAAPETR* only captures permanent tax planning activities and the orthogonalized terms should measure the temporary tax planning activities, these findings provide evidence consistent with Edwards et al. (2016) that firms use permanent and temporary tax planning activities to address financing constraints.

[34] See Appendix 3 for a complete list of the keywords used to identify firms that likely choose these tax planning activities. Consistent with the majority of the tax literature, we cannot truly know what tax positions firms are, or are not taking. We explicitly assume that a reference to the tax planning activity in the firm's audited financial statements suggests that the firm (i) engages in this activity, and (ii) the engagement is significant enough to be materially disclosed. Furthermore, we assume that failure to discuss the tax planning activity suggests, on average, firms choose these activities less or the positions represent a less material portion of the firm's financials relative to those firms that do explicitly discuss these activities. Nonetheless, we caveat this analysis since financial statement disclosures may not perfectly translate to the firm's confidential tax returns.

[35] We do not perform these textual analysis tests for temporary book-tax differences because these positions do not affect earnings, and thus firms are less likely to consistently reference them in their financial statements. In untabulated analysis, we investigate whether our findings differ among firms that reference the foreign tax credit or foreign tax rate differentials, both of which would be indicative of permanent book-tax differences that do not yield immediate cash benefits. We fail to document differences among the two groups of firms.

categories. For example, the estimates of $\beta_3$ are both reliably negative in columns (1) and (2), while the *F*-test suggests that firms making a reference to DPAD have a significantly lower cash ETR than firms that do not use DPAD following the PPA 2006 (at the 0.05 level). We note similar inferences for firms that use the R&D tax credit *vs.* those that do not (at the 0.10 level) and self-insurance firms versus non-self-insurance firms (at the 0.10 level).[36] Overall, our results are more concentrated in firms that are suspects for more aggressive permanent tax positions, suggesting that pension firms respond to financing constraints by using permanent tax positions to generate cash.

[Insert Table 7 here]

***Domestic versus multinational firms***

Prior literature suggests that the relation between financing constraints and tax planning is not ubiquitous for domestic and multinational firms. Notably, Dyreng and Markle (2016) find that financially constrained firms increase inbound income shifting to free up available cash despite paying higher taxes on the shifted income. At the same time, Law and Mills (2015) and Edwards et al. (2016) find evidence that, on average, constrained firms lower their ETRs. Dyreng and Markle (2016) reconcile their findings by arguing that the need for capital supersedes a multinational firm's need for a lower ETR. So, multinational firms may not see a reduction in taxes paid in response to financing constraints because any tax planning strategies they implement to reduce taxes paid could be more than offset by higher taxes paid on inbound income shifting.

We conduct two tests to provide supporting evidence to Dyreng and Markle's (2016) explanation that domestic and multinational firm's ETRs respond to the PPA 2006 differently. We

[36] Because we control for R&D expenses, this analysis is not capturing new R&D activities, and instead likely captures the reallocation of R&D expenses as qualifying for the R&D tax credit.

first split the sample into multinational firms and purely domestic firms and estimate equation (1) for these two groups of firms separately. We report the results in panel A of Table 8.[37] We find no statistically significant changes in multinational firms' ETRs following the onset of the PPA 2006, while there is a significant decline in domestic firms' ETRs in the same period. In the second test, we extend Dyreng and Markle (2016) by focusing on multinational firms and examining whether and how the PPA 2006 affects those firms' income shifting activities.[38] See panel B of Table 8 for these findings. Consistent with Dyreng and Markle (2016), we find that, following the PPA 2006, multinational firms significantly increase inbound income shifting and decrease outbound income shifting. As a result, those actions would *increase* rather than *decrease* the firm's ETRs. The findings collectively suggest that multinational corporations may have exhausted their tax planning opportunities before the PPA 2006, or that the nontax costs of additional tax planning outweigh the tax benefits of such planning, or both.

[Insert Table 8 here]

***Robustness tests***

To further ensure the validity of our results, we conduct numerous robustness tests. First, we examine two alternative measures that proxy for ETRs: (i) the unadjusted cash ETR (Hanlon and Heitzman 2010), and (ii) the Henry and Sansing (2018) cash ETR. Second, we adjust our sample years by (i) including the year 2007 as part of the pre-years or part of the post-years in our sample, (ii) limiting our sample to just the three years before and after the PPA 2006 (2004–2006 vs. 2008–2010), (iii) expanding our sample to all available post-SFAS 109 years (1992–2015), and (iv) limiting our sample to just the non-financial-crisis years (2002–2006 vs. 2009–2012). Third,

[37] For presentation purposes, we only present the analysis with firm fixed effects, and we suppress control variables. Our inferences remain unchanged using the other specifications.
[38] See equations (4a) and (4b) in Dyreng and Markle (2016, 1609).

we use the entropy balancing method following Hainmueller (2012). Fourth, we employ an alternative tax planning model from Lisowsky et al. (2013). This model is generally the same as Cen et al. (2017) but differs in the set of control variables employed as well as the Lisowsky et al. (2013) specification being a model of the uncertain tax benefit reserve rather than cash ETR. Finally, we adjust our sample selection in two additional ways: (i) we limit our sample to only firms that exist in every year of our sample period, and (ii) we include loss firms in the sample.[39] Throughout each of these robustness tests, our main inferences of the results are unchanged. We tabulate each of these results in the online Appendix.[40]

## 6. Conclusion

In this study, we examine whether financing constraints lead firms to implement additional tax planning activities, as well as quantify the extent to which firms use tax planning to address their financing needs. Using the PPA 2006 as a plausible exogenous shock to financing constraints, we find that pension firms significantly decrease their cash ETRs by 1.8 to 2.4 percentage points relative to non-pension firms. The cash tax savings mitigates the investment shortfall brought about by financing constraints by 19%. We find that the decline in ETRs is significantly greater for firms that are more constrained relative to less constrained ones. Our DID research design allows us to extend the finance, economics, and accounting literatures by providing stronger causal inferences about the important relation between financing constraints and tax planning as well as shedding light on the economic magnitude of the relation.

[39] When we limit the firms that exist in every year of our sample, we are left with 568 unique firms and 5,680 total observations. When we expand our sample to include loss firms, our sample size increases to 34,849 firm-year observations, and we adjust the equations to include an indicator variable for whether the firm is in a loss position.
[40] Please see supporting information as an addition to the online article.

In supplemental analyses, we explore avenues other than tax planning that firms might pursue to generate cash flows in response to financing constraints. Specifically, we find that, in addition to incremental tax planning, firms reduce their dividend payments and stock repurchases to save internal cash flows. We find little evidence that firms alter their discretionary spending on advertising, R&D, and SG&A, likely because these investments are more directly linked to long-term performance and firm value. In addition, our study complements the existing literature by providing further evidence on the differential impact of financing constraints on tax planning for multinational versus domestic firms. Overall, our results suggest that tax planning is one of the prominent avenues, in conjunction with payout policy, through which firms generate cash flows in response to financing constraints.

While our evidence is suggestive of a causal relation between financing constraints and tax planning, we offer the following caveats to our findings. First, the PPA 2006 became effective in 2008, which corresponds with the timing of the 2008 financial crisis. While it is not clear why the financial crisis would differentially impact pension firms precisely the same way that the PPA 2006 does, we designed several tests to mitigate the likelihood that the financial crisis explains our results. That said, as with any DID research design, it is impossible to rule out that our results result from an unknown omitted variable that affects tax planning around the PPA 2006 in the exact same way that the PPA 2006 affects pension contributions. Second, the PPA 2006 only applies to firms with defined benefit pension plans. It is possible that financial constraints arising from non-pension sources may not have the same relation with tax planning. Finally, because firm disclosures surrounding their tax planning activities are not complete, we cannot precisely identify the exact tax planning activities to which firms turn. Despite these caveats, we exercise due diligence and follow prior literature in our research design to mitigate these concerns and diminish

the possibility of incorrect inferences. We, thereby, instill confidence that our findings can be interpreted as documenting a positive, causal relation between financing constraints and corporate tax planning.

**APPENDIX 1**

***Variable definitions***

| Variable | Description |
|---|---|
| **Dependent variables of interest** | |
| *AdjCashETR* | *CashETR* adjusted for the pension activity. We calculate *CashETR* as taxes paid (TXPD) scaled by pre-tax income (PI) less special items (SPI). We winsorize *CashETR* at 0 and 1. To adjust for pension activity, we increase the numerator by the pension contributions and decrease the denominator by pension expense. All variables are obtained through Compustat through the "Fundamentals" and "Pension" data sets. The result of these adjustments generates a cash ETR independent of pension activity. $AdjCashETR = \frac{Taxes\ Paid\ (TXPD) + Pension\ Contributions(PBEC)}{Pre{-}Tax\ Income\ (PI) - Special\ Items(SPI) + Pension\ Expense(XPR)}$ |
| **Independent variables of interest** | |
| *Pension* | Indicator variable equal to one when the firm-year observation has a defined benefit pension plan (PBO), and zero otherwise |
| *HighUnderfund* | Indicator variable equal to one when the firm-year observation has a defined benefit pension plan is considered to be "at-risk" (PBO×0.65 < FVPA), and zero otherwise |
| *LowUnderfund* | Indicator variable equal to one when the firm-year observation has a defined benefit pension plan considered to be "well-funded" or "underfunded" (PBO×0.65 ≥ FVPA), and zero otherwise. |
| *PPA* | Indicator variable equal to one when the firm-year observation has a fiscal year on or after 2007, and zero otherwise |
| *F2008* | Indicator variable equal to one when the firm-year observation has a 2008 fiscal year, and zero otherwise |
| *F2009* | Indicator variable equal to one when the firm-year observation has a 2009 fiscal year, and zero otherwise |
| *F2010* | Indicator variable equal to one when the firm-year observation has a 2010 fiscal year, and zero otherwise |
| *F2011* | Indicator variable equal to one when the firm-year observation has a 2011 fiscal year, and zero otherwise |
| *F2012* | Indicator variable equal to one when the firm-year observation has a 2012 fiscal year, and zero otherwise |
| **Control variables** | |
| *ROA* | Pre-tax income (PI) scaled by prior year total assets (AT) |
| *Leverage* | Long-term debt (DLTT), scaled by prior year total assets (AT) |
| *ForeignAssets* | The sum of the observation's total amount of foreign assets obtained via Compustat Segments database, scaled by prior year total assets (AT) |

| | |
|---|---|
| *NewInvestments* | The sum of new investments (XRD + CAPX + AQC – SPPE – DPC) scaled by prior year total assets (AT) |
| *PPE* | Net property plant and equipment (PPENT) scaled by prior year total assets (AT) |
| *Intangibles* | Intangible assets (INTAN) scaled by prior year total assets (AT) |
| *EqInc* | Equity in earnings from unconsolidated subsidiaries (ESUB) scaled by prior year total assets (AT) |
| *Size* | The natural log of the market value of equity (PRCC_F×CSHO) |
| *BTM* | The book value of assets (CEQ) scaled by the market value of assets (PRCC_F×CSHO) |
| *DA* | The discretionary accruals calculated in accordance with the performance-matched discretionary accruals model (Kothari et al. 2005) |
| *Cash* | Cash and cash equivalents (CHE) scaled by prior year total assets (AT) |
| *Delaware* | Indicator variable equal to one when the observation is incorporated in Delaware, and zero otherwise |
| **Validation test testing variables** | |
| *COEC* | The implied cost of equity capital, as defined by Gebhardt et al. (2001) |
| *Dec in Credit Rating* | Indicator variable equal to one when the observation incurs a decline in credit rating (SPLTICRM), and zero otherwise |
| *Capex* | Capital expenditures (CAPX) scaled by prior year total assets (AT) |
| *CFO* | Operating cash flows (OANCF) plus depreciation expense (DP), scaled by prior year total assets |
| *Q* | The market value of assets (PRCC_F×CSHO) scaled by the book value of assets (CEQ) |
| *FS* | Pension funded-status (FUND_STATUS) scaled by the market value of equity (PRCC_F×CSHO) |
| *LTG* | Mean analyst long-term growth forecast, as obtained from I/B/E/S |
| *Disp* | The natural logarithm of the standard deviation of analyst estimates for the next period's earnings divided by the consensus forecast for the next period's earnings, as obtained from I/B/E/S |
| *Beta* | Capital market beta estimated with the market model with a minimum of twenty-four monthly returns over the sixty prior months, using a value-weighted market index return |
| *IndAvgCOC* | The industry average cost of equity capital for year t |
| *ChangeSize* | *Size* in year *t* minus *Size* in year *t*-1 |
| *ChangePPE* | *PPE* in year *t* minus *PPE* in year *t*-1 |
| *ChangeLeverage* | *Leverage* in year t minus *Leverage* in year t-1 |
| *ChangeROA* | *ROA* in year *t* minus *ROA* in year *t*-1 |
| *ChangeIntCov* | *IntCov* in year *t* minus *IntCov* in year *t*-1. We define *IntCov* as operating income before depreciation (OIBDP) scaled by interest expense (XINT) |

| | |
|---|---|
| *ChangeSales* | *Sales* in year *t* minus *Sales* in year *t*-1. We define *Sales* as revenues (SALES) scaled by prior year total assets (AT) |
| *ChangeFCF* | *FCF* in year *t* minus *FCF* in year *t*-1. We define *FCF* as free cash flows (OANCF) scaled by prior year total assets (AT) |

**Corporate finance test variables**

| | |
|---|---|
| *Debt Issuance* | Indicator variable equal to one when the observation has a debt issuance in year *t*, and zero otherwise. We define a debt issuance if the observation has an increase in *Leverage* from year *t*-1 to year *t* |
| *Equity Issuance* | Indicator variable equal to one when the observation has an equity issuance in year *t*, and zero otherwise. We define an equity issuance if the observation has an increase in equity, as defined by the net of the sale of stock (SSTK) less the purchase of stock (PRSTKC), from year *t*-1 to year *t* |
| *Equity Buyback* | Indicator variable equal to one when the observation has an equity buyback in year *t*, and zero otherwise. We define an equity buyback if the observation has either a purchase of stock (PRSTKC) or a dividend (DVC) in year *t* |
| *Dec. Disc Exp.* | Indicator variable equal to one when the observation incurs a decline in discretionary expenditures in year *t*, and zero otherwise. We define discretionary expenditures as the sum of R&D (XRD), advertising (XAD), and SG&A (XSGA) expenses all scaled by prior year total assets (AT) |

## APPENDIX 2
### *Calculating economic significance*

An important aspect of our study is to estimate the percentage of investment that is "recouped" by additional tax planning following the PPA 2006. We present this evidence below for all pension firms, as well as separately for each group based upon their funding status. We restrict our economic significance calculations to the specifications with controls and industry fixed effects. Our estimates remain consistent when we examine other specifications. We formulate our calculations using the following five steps:

1. Determine the increase in pension obligations.

We begin with a series of calculations to estimate the amount of investments that are "forgone" due to PPA 2006. First, we use descriptive evidence (untabulated in the paper) to determine the increase in pension obligations. Specifically, we calculate the change in the mean pension obligations (in millions) from before PPA 2006 to after PPA 2006:

| | **All Pension Firms** | **Low Underfunded** | **High Underfunded** |
|---|---|---|---|
| Pre-PPA 2006 | \$1,560 | \$1,910 | \$623 |
| Post-PPA 2006 | \$1,944 | \$2,297 | \$994 |
| | | | |
| Difference in Pension Obligations | \$384 | \$388 | \$372 |

2. Estimate the percentage change in capital expenditures due to PPA 2006.

Next, we estimate the change in capital expenditures based on the firms' investment-cash flow sensitivity. For all firms, we begin with the information from Table 3, panel D, column (2), by summing $\beta_3$, $\beta_6$, and $\beta_{10}$. These coefficients are untabulated for our Low Underfunded and High Underfunded firms. We then de-scale these coefficients by the mean values of property, plant, and equipment to generate the unscaled change in capital expenditures from PPA 2006:

| | **All Pension Firms** | **Low Underfunded** | **High Underfunded** |
|---|---|---|---|
| ICFS Coefficients | 0.072 | 0.071 | 0.075 |
| Mean PPE | 0.301 | 0.291 | 0.321 |
| | | | |
| Decrease in Capital Expenditures | 23.92% | 24.40% | 23.36% |

3. Estimate the effect of the increase in pension obligations on capital expenditures.

We then multiply the difference in pension obligation by the change in capital expenditures due to investment-cash flow sensitivities to generate our estimate of the change in capital expenditures due to the lower cash flows resulting from PPA 2006:

| | **All Pension Firms** | **Low Underfunded** | **High Underfunded** |
|---|---|---|---|
| Difference in Pension Obligations | \$384 | \$388 | \$372 |
| Decrease in Capital Expenditures | 23.92% | 24.40% | 23.36% |
| | | | |
| PPA 2006 Decrease in CapEx | \$92 | \$95 | \$87 |

4. Calculate the cash flow increase from tax avoidance following the PPA 2006.

Next, we calculate the incremental cash generated from tax avoidance following the PPA 2006. Using the coefficients from Table 4, column (2) (All Firms), and Table 5, column (2) (Low Underfunded and High Underfunded), we obtain the percentage change in tax avoidance due to the PPA 2006. We de-scale this number by multiplying the coefficient by average pre-tax income less special items obtained via Compustat to generate the dollars (in millions) generated from tax avoidance.

| | **All Pension Firms** | **Low Underfunded** | **High Underfunded** |
|---|---|---|---|
| *Pension ×PPA* | 0.021 | 0.016 | 0.047 |
| Pre-Tax Income less special items | $811 | $890 | $602 |
| | | | |
| Cash Generated from Tax Avoidance | $17 | $14 | $28 |

5. Calculate the percentage of cash flow from tax avoidance as a percentage of estimated decrease in investments.

Finally, we determine the percentage of lost investments mitigated via tax avoidance by scaling the tax avoidance dollars (in millions) by the decrease in capital expenditures.

| | **All Pension Firms** | **Low Underfunded** | **High Underfunded** |
|---|---|---|---|
| Cash Generated from Tax Avoidance | $17 | $14 | $28 |
| PPA 2006 Decrease in CapEx | $92 | $95 | $87 |
| | | | |
| % Recoup from Tax Avoidance | 19% | 15% | 33% |

**Summary:**

Our calculations suggest that pension firms lowered investments by $92 million ($87 to 95 million depending on funding status) due to PPA 2006. Among these lost investments, we estimate that pension firms recovered $17 million ($14 to 28 million depending on funding status), which equates to a 19% (15% to 33% depending on funded status) recovery rate of lost investment from financing constraints via tax avoidance.

**APPENDIX 3**
***Keywords used for textual analysis***

| Search topic | Keywords used |
|---|---|
| *Domestic Production Activities Deduction* | "DPAD" "Domestic Production Activities Deduction" "Domestic Manufacturing Deduction" |
| *R&D Tax Credit* | "R&D Tax Credit" "Research and Development Tax Credit" "R&E Tax Credit" "Research and Experimentation Tax Credit" |
| *Medical Portion of Worker's Compensation* | "Self-insurance Claims" "Accrued Insurance" "Medical Portion of Worker's Compensation" |

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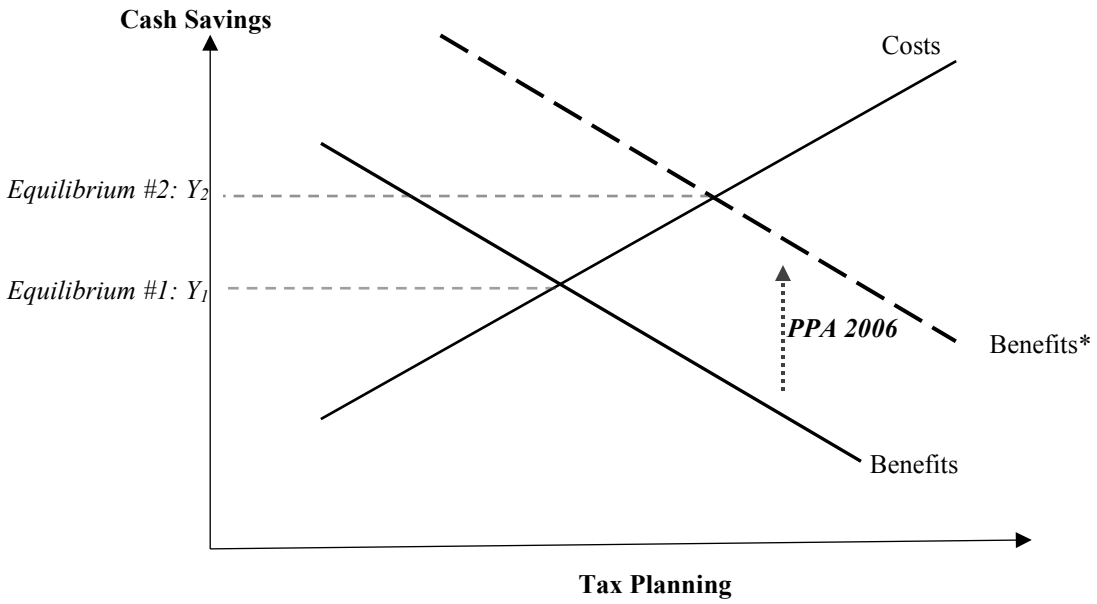
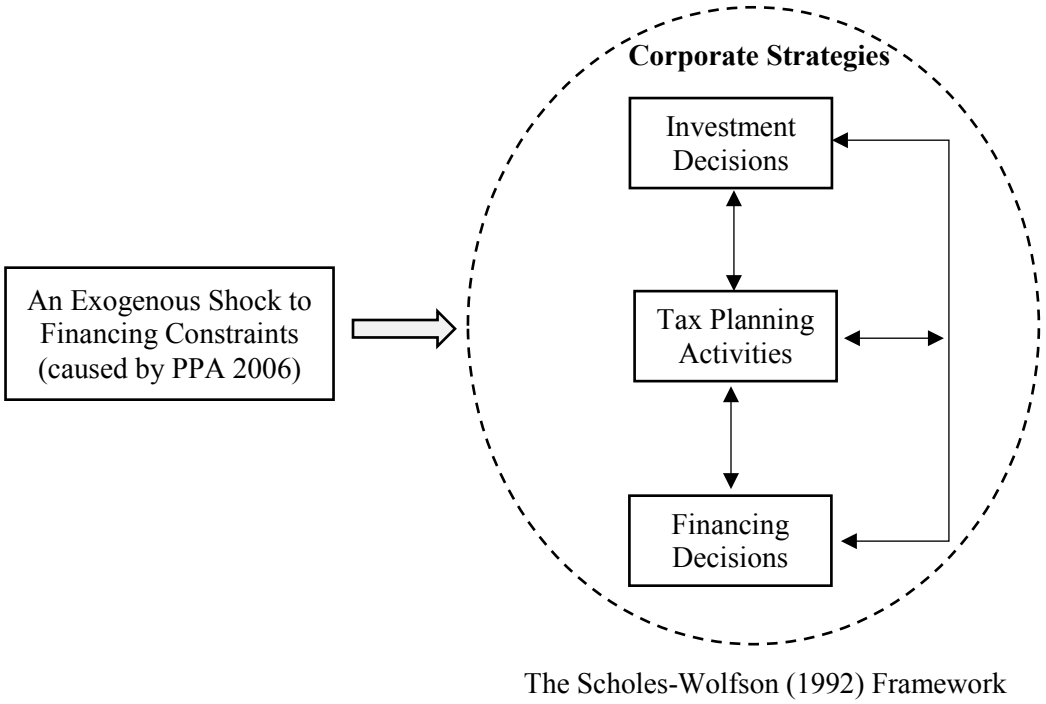
**Figure 1.** Benefits and Costs of Tax Avoidance



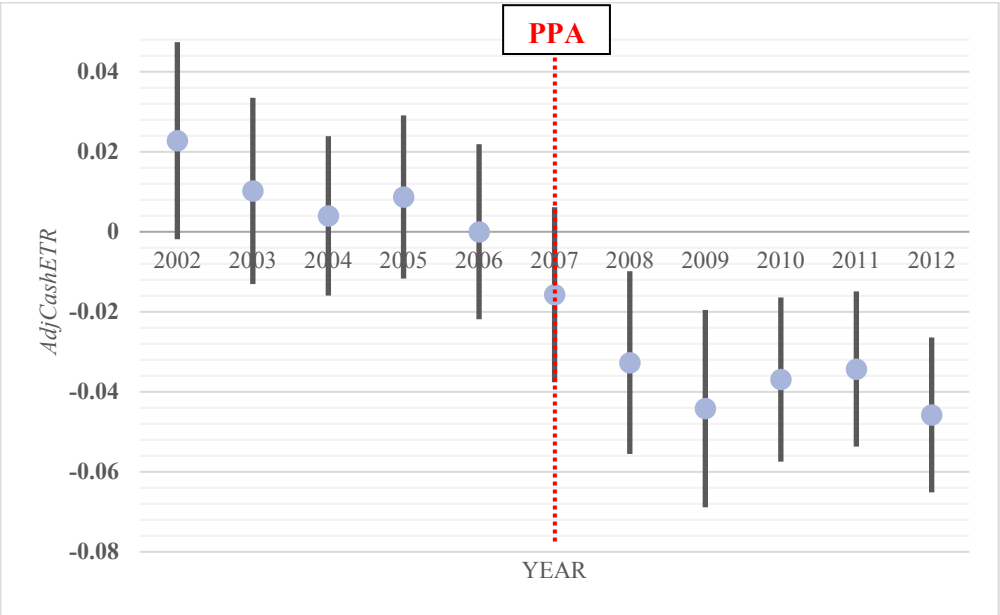

*Notes*: This figure depicts how a firm's tax planning levels reach an equilibrium that balances the costs and benefits of tax planning decisions ($Y_1$), and how the PPA 2006 increases the benefits of tax planning and results in a new equilibrium ($Y_2$) among affected firms. The Y-axis represents the marginal cash savings effect from tax planning. The X-axis represents tax planning activities. The curves represent the declining (increasing) marginal benefits (costs) of tax planning. The PPA 2006 increases the marginal value of cash savings from tax planning, as represented by the upwards arrow.

**Figure 2.** Conceptual Framework of Our Study



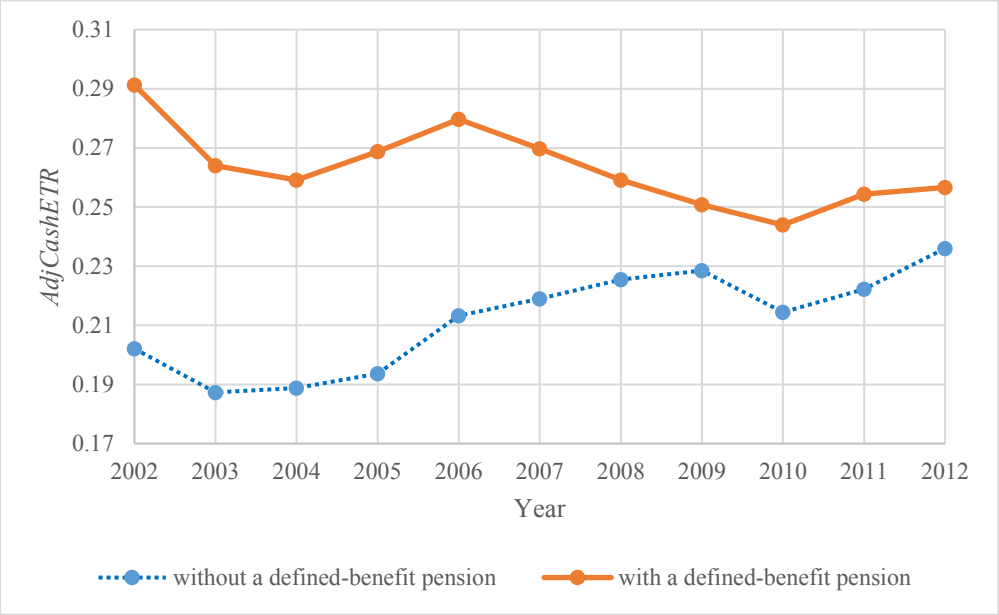

*Notes*: This figure presents the conceptual framework for how financing constraints interact with the Scholes-Wolfson (1992) corporate strategies framework.

**Figure 3.** Tax Rate Changes for Firms with and without Defined Benefit Plans —Treatment Effects



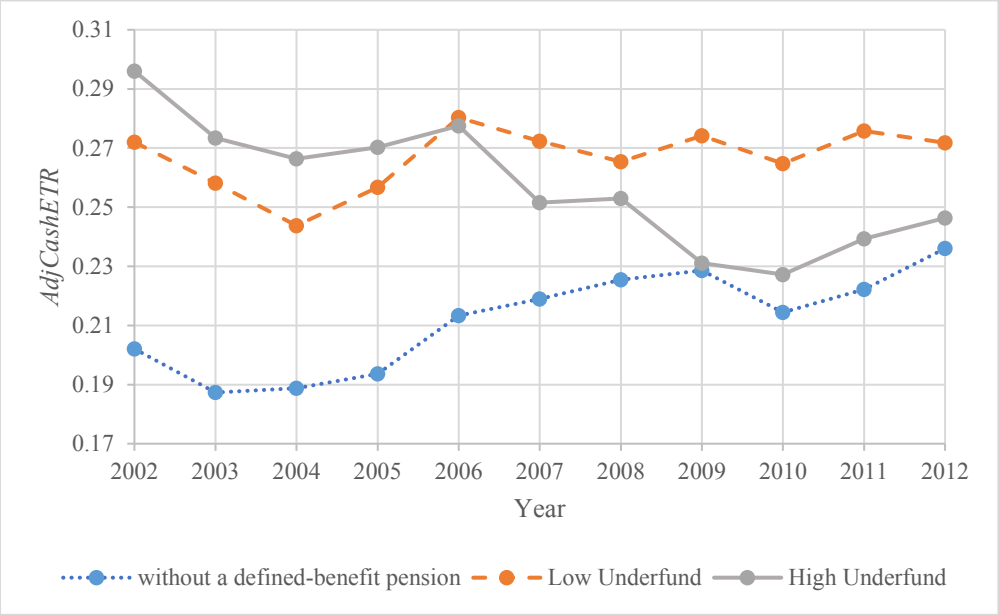

*Notes*: This figure presents the trends in our outcome variable (*AdjCashETR*) across pension and non-pension firms by mapping out treatment effects over our sample period. See Appendix 1 for variable definitions. We present the means and two-tailed 90% confidence intervals.

**Figure 4.** Tax Rate Changes for Firms with and without Defined Benefit Plans — Univariate Trend




*Notes*: This figure presents the univariate trend of *AdjCashETR* over time separately for firms with and without a defined benefit pension. See Appendix 1 for variable definitions. We present the trend for all years in our sample as well as the year 2007.

**Figure 5.** Tax Rate Changes for Firms with and without Defined Benefit Plans by Funded Status — Univariate Trend




*Notes*: This figure presents the univariate trend of *AdjCashETR* over time separately for firms with and without a defined benefit pension. For firms that have pension funds, we separately examine those with low underfunding versus those with high underfunding. See Appendix 1 for variable definitions. We present the trend for all years in our sample as well as the year 2007.

**TABLE 1**

**Panel A:** Sample Selection

| **Criteria:** | |
|---|---|
| Compustat Firms 2002–2012 | 122,333 |
| Less: Fiscal Year 2007 Firms | –11,044 |
| Less: Firms with negative earnings or cash taxes paid | –57,311 |
| Less: Firms in regulated industries | –15,777 |
| Less: Firms without at least one observation in the pre and post–periods | –10,195 |
| Less: Firms with fully funded pension plans | –1,228 |
| Less: Observations without enough data to calculate control variables | –8,238 |
| **Total Sample Size:** | **18,540** |

**Panel B:** Sample by Year

| **Fiscal Year** | ***N*** | **% of Sample** |
|---|---|---|
| 2002 | 1,739 | 9.38% |
| 2003 | 1,758 | 9.48% |
| 2004 | 1,783 | 9.62% |
| 2005 | 1,914 | 10.32% |
| 2006 | 1,962 | 10.58% |
| 2008 | 1,833 | 9.89% |
| 2009 | 1,819 | 9.81% |
| 2010 | 1,947 | 10.50% |
| 2011 | 1,939 | 10.46% |
| 2012 | 1,846 | 9.96% |

**Panel C:** Sample by Industry

| **Industry (FF48)** | ***N*** | **% of Sample** |
|---|---|---|
| 1 - Agriculture | 77 | 0.42% |
| 2 - Food Products | 477 | 2.57% |
| 3 - Candy and Soda | 116 | 0.63% |
| 4 - Beer and Liquor | 127 | 0.69% |
| 5 - Tobacco Products | 42 | 0.23% |
| 6 - Toys | 140 | 0.76% |
| 7 - Entertainment | 297 | 1.60% |
| 8 - Printing and Publishing | 146 | 0.79% |
| 9 - Consumer Goods | 331 | 1.79% |
| 10 - Clothing Apparel | 323 | 1.74% |
| 11 - Healthcare | 429 | 2.31% |
| 12 - Medical Equipment | 556 | 3.00% |
| 13 - Pharmaceutical Products | 648 | 3.50% |
| 14 - Chemicals | 553 | 2.98% |
| 15 - Rubber and Plastic | 135 | 0.73% |
| 16 - Textiles | 55 | 0.30% |
| 17 - Construction Materials | 417 | 2.25% |
| 18 - Construction | 195 | 1.05% |
| 19 - Steel | 332 | 1.79% |
| 20 - Fabricated Products | 76 | 0.41% |
| 21 - Machinery | 850 | 4.58% |
| 22 - Electrical Equipment | 361 | 1.95% |
| 23 - Automobiles and Trucks | 400 | 2.16% |
| 24 - Aircraft | 147 | 0.79% |
| 25 - Shipbuilding | 53 | 0.29% |
| 26 - Defense | 66 | 0.36% |
| 27 - Precious Metals | 129 | 0.70% |
| 28 - Non-Metallic Mining | 147 | 0.79% |
| 29 - Coal | 62 | 0.33% |
| 30 - Petroleum and Natural Gas | 1,214 | 6.55% |
| 32 - Telecommunication | 864 | 4.66% |
| 33 - Personal Services | 302 | 1.63% |
| 34 - Business Services | 2,363 | 12.75% |
| 35 - Computers | 626 | 3.38% |
| 36 - Electronic Equipment | 1,394 | 7.52% |
| 37 - Laboratory Equipment | 522 | 2.82% |
| 38 - Business Supplies | 261 | 1.41% |
| 39 - Shipping Containers | 66 | 0.36% |
| 40 - Transportation | 877 | 4.73% |
| 41 - Wholesale | 836 | 4.51% |
| 42 - Retail | 1,169 | 6.31% |
| 43 - Restaurants and Hotels | 359 | 1.94% |

**TABLE 2**
Descriptive Statistics for Primary Testing Sample

| Variable | *N* | Mean | Std Dev | Min | 25th Pctl | 50th Pctl | 75th Pctl | Max |
|---|---|---|---|---|---|---|---|---|
| *AdjCashETR* | 18,540 | 0.229 | 0.208 | 0.000 | 0.034 | 0.216 | 0.345 | 1 |
| *Pension* | 18,540 | 0.360 | 0.474 | 0 | 0 | 0 | 1 | 1 |
| *LowUnderfund* | 18,540 | 0.281 | 0.442 | 0 | 0 | 0 | 1 | 1 |
| *HighUnderfund* | 18,540 | 0.079 | 0.270 | 0 | 0 | 0 | 0 | 1 |
| *PPA* | 18,540 | 0.506 | 0.500 | 0 | 0 | 1 | 1 | 1 |
| *ROA* | 18,540 | 0.123 | 0.109 | 0.002 | 0.050 | 0.094 | 0.162 | 0.646 |
| *Leverage* | 18,540 | 0.183 | 0.211 | 0.000 | 0.001 | 0.131 | 0.282 | 1.077 |
| *ForeignAssets* | 18,540 | 0.035 | 0.086 | 0.000 | 0.000 | 0.000 | 0.014 | 0.467 |
| *NewInvestments* | 18,540 | 0.059 | 0.085 | 0.000 | 0.002 | 0.035 | 0.092 | 0.395 |
| *PPE* | 18,540 | 0.320 | 0.294 | 0.008 | 0.102 | 0.221 | 0.448 | 0.988 |
| *Intangibles* | 18,540 | 0.169 | 0.188 | 0.000 | 0.010 | 0.096 | 0.277 | 0.726 |
| *EqInc* | 18,540 | 0.025 | 0.118 | –0.190 | 0.000 | 0.000 | 0.000 | 0.857 |
| *Size* | 18,540 | 6.509 | 2.344 | 0.000 | 5.065 | 6.627 | 8.093 | 11.552 |
| *BTM* | 18,540 | 0.571 | 0.463 | 0.010 | 0.286 | 0.469 | 0.734 | 3.774 |
| *DA* | 18,540 | 0.009 | 0.098 | –0.327 | 0.000 | 0.000 | 0.013 | 0.455 |
| *Cash* | 18,540 | 0.198 | 0.219 | 0.000 | 0.040 | 0.117 | 0.280 | 0.997 |
| *Delaware* | 18,540 | 0.492 | 0.500 | 0 | 0 | 0 | 1 | 1 |

*Notes:* This table presents the descriptive statistics for the sample population for our primary analysis. See Appendix 1 for a full description of all variables. We winsorize all continuous variables at the 1st and 99th percentiles.

**TABLE 3**

**Panel A:** Descriptive Statistics for Validation Tests

| Variable | *N* | Mean | Std Dev | Min | 25th Pctl | 50th Pctl | 75th Pctl | Max |
|---|---|---|---|---|---|---|---|---|
| *COEC* | 9,770 | 0.106 | 0.038 | 0.011 | 0.083 | 0.097 | 0.119 | 0.470 |
| *FS* | 9,770 | –0.014 | 0.028 | –0.317 | –0.015 | 0.000 | 0.000 | 0.012 |
| *LTG* | 9,770 | 0.014 | 0.011 | –0.595 | 0.006 | 0.011 | 0.019 | 92.500 |
| *Disp* | 9,770 | 0.026 | 0.033 | –2.996 | 0.007 | 0.014 | 0.031 | 2.639 |
| *Beta* | 9,770 | 1.050 | 0.557 | –7.434 | 0.644 | 0.997 | 1.398 | 8.918 |
| *Size* | 9,770 | 7.362 | 1.385 | 2.379 | 6.319 | 7.244 | 8.300 | 11.536 |
| *BTM* | 9,770 | 0.453 | 0.240 | 0.090 | 0.270 | 0.408 | 0.595 | 3.632 |
| *Leverage* | 9,770 | 0.174 | 0.169 | 0.000 | 0.002 | 0.143 | 0.284 | 4.088 |
| *IndAvgCOC* | 9,770 | 0.090 | 0.011 | 0.049 | 0.081 | 0.090 | 0.099 | 0.177 |
| *Dec in Credit Rating* | 6,079 | 0.099 | 0.298 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *ChangeSize* | 6,079 | 0.082 | 0.101 | –0.052 | 0.004 | 0.062 | 0.142 | 0.278 |
| *ChangePPE* | 6,079 | –0.002 | 0.043 | –0.079 | –0.025 | –0.002 | 0.021 | 0.075 |
| *ChangeLeverage* | 6,079 | –0.007 | 0.072 | –0.124 | –0.052 | –0.010 | 0.034 | 0.126 |
| *ChangeROA* | 6,079 | 0.009 | 0.040 | –0.054 | –0.018 | 0.007 | 0.034 | 0.082 |
| *ChangeIntCov* | 6,079 | 0.823 | 3.517 | –5.000 | –0.070 | 0.000 | 1.971 | 8.029 |
| *ChangeSales* | 6,079 | 0.007 | 0.130 | –0.222 | –0.074 | 0.013 | 0.095 | 0.217 |
| *ChangeFCF* | 6,079 | 0.002 | 0.040 | –0.069 | –0.023 | 0.000 | 0.025 | 0.073 |
| *CapEx* | 18,540 | 0.079 | 0.703 | 0.013 | 0.026 | 0.031 | 0.076 | 16.921 |
| *Q* | 18,540 | 1.947 | 2.929 | 0.625 | 1.168 | 1.529 | 2.164 | 7.530 |
| *CFO* | 18,540 | 1.294 | 2.703 | –1.973 | 0.241 | 0.508 | 1.172 | 19.515 |

**Panel B:** The Effect of the PPA 2006 on COEC

| D.V. = *COEC* | (1)<br>Coef.<br>(*t*-stat) | (2)<br>Coef.<br>(*t*-stat) | (3)<br>Coef.<br>(*t*-stat) |
|---|---|---|---|
| *Intercept* | 0.103*** | 0.033* | 0.052*** |
| | (129.66) | (1.72) | (4.75) |
| *Pension* | –0.005*** | –0.006*** | –0.005** |
| | (–3.71) | (–3.89) | (–1.97) |
| *PPA* | 0.007*** | –0.000 | 0.002 |
| | (6.16) | (–0.15) | (1.61) |
| ***Pension×PPA*** | **0.005*** ** | **0.004** ** | **0.003*** |
| | **(2.65)** | **(2.44)** | **(1.65)** |
| *FS* | | –0.072*** | –0.098*** |
| | | (–2.58) | (–2.94) |
| *LTG* | | –0.156*** | –0.073 |
| | | (–2.64) | (–1.04) |
| *Disp* | | 0.139*** | 0.042*** |
| | | (8.45) | (3.11) |
| *Beta* | | 0.008*** | 0.001 |
| | | (7.50) | (0.98) |
| *Size* | | –0.005*** | –0.004*** |
| | | (–9.16) | (–3.21) |
| *BTM* | | 0.029*** | 0.017*** |
| | | (10.26) | (5.59) |
| *Leverage* | | 0.017*** | 0.013*** |
| | | (5.24) | (3.34) |
| *IndAvgCOC* | | 0.852*** | 0.758*** |
| | | (12.24) | (12.04) |
| *N* | 9,770 | 9,770 | 9,770 |
| Adjusted $R^2$ | 0.014 | 0.267 | 0.517 |
| Fixed effects | None | FF 48 | Firm |
| Cluster std. errors | Firm | Firm | Firm |

**Panel C:** The Effect of the PPA 2006 on COD

| D.V. = *Dec in Credit Rating* | (1)<br>Coef.<br>(*z*-stat) | (2)<br>Coef.<br>(*z*-stat) | (3)<br>Coef.<br>(*t*-stat) |
|---|---|---|---|
| *Intercept* | –1.155*** | –1.329*** | 0.141*** |
| | (–24.59) | (–2.95) | (6.88) |
| *Pension* | –0.110* | –0.104 | –0.033 |
| | (–1.73) | (–1.54) | (–1.04) |
| *PPA* | –0.224*** | –0.256*** | –0.055*** |
| | (–2.96) | (–3.27) | (–3.19) |
| ***Pension×PPA*** | **0.139*** | **0.130*** | **0.041**** |
| | **(1.84)** | **(1.70)** | **(1.96)** |
| *ChangeSize* | | –0.384 | 0.007 |
| | | (–1.30) | (0.11) |
| *ChangePPE* | | –1.063 | –0.186 |
| | | (–1.46) | (–1.29) |
| *ChangeLeverage* | | 3.732*** | 0.622*** |
| | | (8.10) | (6.66) |
| *ChangeROA* | | –0.571 | –0.059 |
| | | (–0.73) | (–0.39) |
| *ChangeIntCov* | | –0.029*** | –0.004*** |
| | | (–3.97) | (–2.82) |
| *ChangeSales* | | –0.349 | –0.057 |
| | | (–1.33) | (–1.12) |
| *ChangeFCF* | | 0.403 | 0.056 |
| | | (0.60) | (0.44) |
| *N* | 6,079 | 6,079 | 6,079 |
| Adjusted $R^2$ | 0.0036 | 0.0534 | 0.059 |
| Fixed effects | None | FF 48 | Firm |
| Cluster std. errors | Firm | Firm | Firm |

**Panel D:** The Effect the of PPA 2006 on ICFS

| D.V. - *CapEx* | (1)<br>Coef.<br>(*t*-stat) | (2)<br>Coef.<br>(*t*-stat) | (3)<br>Coef.<br>(*t*-stat) |
|---|---|---|---|
| *Intercept* | 0.191*** | 0.104*** | 0.164*** |
| | (36.79) | (5.59) | (13.28) |
| *Pension* | –0.072*** | –0.059*** | –0.046*** |
| | (–7.04) | (–4.92) | (–2.68) |
| *PPA* | –0.029*** | –0.029*** | –0.036*** |
| | (–5.45) | (–4.66) | (–4.94) |
| *CFO* | 0.071*** | 0.072*** | 0.078*** |
| | (27.42) | (13.59) | (10.70) |
| *Q* | 0.047*** | 0.045*** | 0.049*** |
| | (59.71) | (17.60) | (14.81) |
| *Pension×PPA* | 0.028* | 0.028** | 0.032** |
| | (1.95) | (2.31) | (2.38) |
| *Pension×CFO* | –0.024*** | –0.024*** | –0.027*** |
| | (–8.16) | (–3.77) | (–4.30) |
| *Pension×Q* | –0.004 | –0.006 | 0.003 |
| | (–0.82) | (–0.88) | (0.42) |
| *PPA×CFO* | –0.000*** | –0.000*** | –0.000* |
| | (–4.47) | (–6.66) | (–1.75) |
| *PPA×Q* | –0.006*** | –0.006*** | –0.004*** |
| | (–6.19) | (–7.62) | (–3.01) |
| ***Pension×PPA×CFO*** | **0.024*** ** | **0.025*** ** | **0.027*** ** |
| | **(8.36)** | **(3.87)** | **(4.39)** |
| *Pension×PPA×Q* | –0.004 | –0.004 | –0.006 |
| | (–0.56) | (–0.63) | (–0.82) |
| *N* | 18,540 | 18,540 | 18,540 |
| Adjusted $R^2$ | 0.277 | 0.297 | 0.440 |
| Fixed effects | None | FF 48 | Firm |
| Cluster std. errors | Firm | Firm | Firm |

*Notes:* This table presents our estimations of equations (5), (6), and (7). Panel A presents the descriptive statistics for these tests. Panel B examines the effect of the PPA 2006 on the cost of equity capital, panel C examines the effect of the PPA 2006 on the cost of debt, and panel D examines the effect of the PPA 2006 on investment-cash flow sensitivity (ICFS). In panel B, our dependent variable of interest is *COEC,* the cost of equity capital, calculated following Gebhardt et al. (2001). Our independent variables of interest are *Pension, PPA*, and the *Pension×PPA* interaction term. We also control for several determinants of *COEC*. In panel C, our dependent variable of interest is the probability of a decrease in credit rating. Our independent variables of interest are *Pension*, *PPA*, and the *Pension×PPA* interaction term. We also control for variables that prior literature suggests are determinants of credit ratings. In panel D, our dependent variable of interest is *Capex*. Our independent variables of interest are *CFO* and *Q*. We then interact both of those variables with *Pension* and *PPA,* forming all the respective two-way and three-way interaction terms. See Appendix 1 for a full description of all variables. Across panels B, C, and D, column (1) presents our evidence without any control variables or fixed effects, column (2) includes industry fixed effects, and column (3) includes firm fixed effects. Rows presented in bold represent variables of interest. All regressions include firm-clustered standard errors. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * signify statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed p-values.

**TABLE 4**
H1: The Effect of Financing Constraints on Tax Avoidance

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | | | DV = *AdjCashETR* | | |
| | Coef. | Coef. | Coef. | Coef. | Coef. |
| | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) |
| *Intercept* | 0.195*** | 0.213*** | 0.214*** | 0.165*** | 0.164*** |
| | (50.05) | (4.69) | (4.73) | (10.88) | (10.78) |
| *Pension* | 0.066*** | 0.055*** | 0.055*** | –0.010 | –0.010 |
| | (9.72) | (7.89) | (7.89) | (–0.88) | (–0.90) |
| *PPA* | 0.031*** | 0.025*** | | 0.019*** | |
| | (7.47) | (5.71) | | (3.96) | |
| ***Pension×PPA*** | **–0.024*** ** | **–0.021*** ** | | **–0.018** ** | |
| | **(–3.25)** | **(–2.86)** | | **(–2.33)** | |
| *F2008* | | | 0.036*** | | 0.029*** |
| | | | (5.79) | | (4.54) |
| *F2009* | | | 0.024*** | | 0.017** |
| | | | (3.69) | | (2.48) |
| *F2010* | | | 0.004 | | 0.002 |
| | | | (0.71) | | (0.36) |
| *F2011* | | | 0.021*** | | 0.015** |
| | | | (3.34) | | (2.18) |
| *F2012* | | | 0.044*** | | 0.035*** |
| | | | (6.56) | | (4.78) |
| ***Pension×F2008*** | | | **–0.009** | | **–0.004** |
| | | | **(–0.79)** | | **(–0.31)** |
| ***Pension×F2009*** | | | **–0.030*** ** | | **–0.030*** ** |
| | | | **(–2.97)** | | **(–2.79)** |
| ***Pension×F2010*** | | | **–0.015*** | | **–0.015** |
| | | | **(–1.72)** | | **(–1.41)** |
| ***Pension×F2011*** | | | **–0.021** ** | | **–0.017** |
| | | | **(–1.99)** | | **(–1.52)** |
| ***Pension×F2012*** | | | **–0.032*** ** | | **–0.025** ** |
| | | | **(–2.96)** | | **(–2.17)** |
| *ROA* | | 0.036 | 0.034 | –0.162*** | –0.163*** |
| | | (1.59) | (1.50) | (–5.98) | (–6.00) |
| *Leverage* | | –0.072*** | –0.072*** | –0.008 | –0.010 |
| | | (–6.09) | (–6.15) | (–0.57) | (–0.66) |
| *ForeignAssets* | | –0.091*** | –0.090*** | –0.116*** | –0.114*** |
| | | (–3.34) | (–3.31) | (–3.39) | (–3.35) |
| *NewInvestments* | | –0.096*** | –0.100*** | 0.021 | 0.015 |
| | | (–4.12) | (–4.26) | (0.83) | (0.60) |
| *PPE* | | –0.063*** | –0.062*** | 0.008 | 0.009 |
| | | (–4.92) | (–4.86) | (0.46) | (0.54) |
| *Intangibles* | | –0.006 | –0.006 | 0.039 | 0.040* |
| | | (–0.39) | (–0.36) | (1.63) | (1.66) |
| *EqInc* | | 0.008 | 0.009 | 0.049* | 0.050* |
| | | (0.38) | (0.40) | (1.92) | (1.96) |
| *Size* | | 0.002 | 0.002 | 0.009*** | 0.009*** |
| | | (1.22) | (1.19) | (4.15) | (4.16) |
| *BTM* | | 0.008 | 0.006 | 0.025*** | 0.023*** |
| | | (1.31) | (1.10) | (4.08) | (3.70) |
| *DA* | | –0.027 | –0.029* | 0.012 | 0.011 |
| | | (–1.61) | (–1.71) | (0.74) | (0.63) |
| *Cash* | | –0.079*** | –0.077*** | –0.037** | –0.034** |
| | | (–6.41) | (–6.25) | (–2.29) | (–2.14) |
| *Delaware* | | 0.018*** | 0.018*** | | |
| | | (3.64) | (3.63) | | |
| *N* | 18,540 | 18,540 | 18,540 | 18,540 | 18,540 |
| Adjusted $R^2$ | 0.019 | 0.071 | 0.073 | 0.344 | 0.345 |
| Fixed effects | None | FF 48 | FF 48 | Firm | Firm |
| Cluster std. errors | Firm | Firm | Firm | Firm | Firm |

*Notes*: This table presents our H1 analysis examining the effect of financing constraints on tax avoidance. Our dependent variable of interest is *AdjCashETR*. Column (1) presents our estimation of equation (1) without any control variables. Column (2) presents our estimation of equation (1) with control variables and industry fixed effects (FF48). Column (3) presents our estimation of equation (2). Columns (4) and (5) repeat our estimations of equations (1) and (2), respectively, but include firm fixed effects instead of industry fixed effects. Across columns (1), (2), and (4), our independent variables of interest are *Pension*, *PPA,* and the interaction of *Pension* and *PPA*. For the remaining columns, we replace *PPA* with *F20XX,* which is a series of indicator variables that take the value of one if the firm-year observation has a fiscal year equal to XX (where XX is equal to 08, 09, 10, etc.), and zero otherwise. All tests that include controls use the same set of control variables. We include a full description of all variables in Appendix 1. Rows presented in bold represent variables of interest. All regressions include firm-clustered standard errors. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * signify statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tail p-values.

**TABLE 5**

H2: The Effect of Financing Constraints on Tax Avoidance Partitioned by Funded Status

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | | | DV = *AdjCashETR* | | |
| | Coef. | Coef. | Coef. | Coef. | Coef. |
| | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) |
| *Intercept* | 0.195*** | 0.217*** | 0.218*** | 0.166*** | 0.166*** |
| | (49.25) | (4.94) | (4.99) | (11.09) | (10.99) |
| *LowUnderfund* | 0.063*** | 0.053*** | 0.053*** | | |
| | (8.43) | (6.76) | (6.76) | | |
| *HighUnderfund* | 0.062*** | 0.056*** | 0.056*** | | |
| | (4.82) | (4.43) | (4.43) | | |
| *PPA* | 0.033*** | 0.027*** | | 0.020*** | |
| | (8.01) | (6.21) | | (4.22) | |
| ***LowUnderfund×PPA*** | **–0.018**** | **–0.016**** | | –0.012 | |
| | **(–2.33)** | **(–2.02)** | | (–1.49) | |
| ***HighUnderfund×PPA*** | **–0.049***** | **–0.047***** | | **–0.049***** | |
| | **(–3.72)** | **(–3.59)** | | **(–3.54)** | |
| *F2008* | | | 0.039*** | | 0.032*** |
| | | | (6.35) | | (4.96) |
| *F2009* | | | 0.029*** | | 0.022*** |
| | | | (4.43) | | (3.17) |
| *F2010* | | | 0.006 | | 0.003 |
| | | | (1.03) | | (0.50) |
| *F2011* | | | 0.021*** | | 0.013* |
| | | | (3.31) | | (1.94) |
| *F2012* | | | 0.044*** | | 0.034*** |
| | | | (6.60) | | (4.67) |
| ***LowUnderfund×F2008*** | | | **–0.032** | | **–0.027** |
| | | | **(–1.52)** | | **(–1.36)** |
| ***LowUnderfund×F2009*** | | | **–0.009** | | **–0.006** |
| | | | **(–0.70)** | | **(–0.47)** |
| ***LowUnderfund×F2010*** | | | **–0.002** | | **–0.003** |
| | | | **(–0.18)** | | **(–0.29)** |
| ***LowUnderfund×F2011*** | | | **–0.007** | | **–0.001** |
| | | | **(–0.59)** | | **(–0.07)** |
| ***LowUnderfund×F2012*** | | | **–0.035***** | | **–0.031***** |
| | | | **(–3.33)** | | **(–2.72)** |
| ***HighUnderfund×F2008*** | | | **–0.042**** | | **–0.058***** |
| | | | **(–2.07)** | | **(–2.75)** |
| ***HighUnderfund×F2009*** | | | **–0.060***** | | **–0.054***** |
| | | | **(–3.01)** | | **(–2.63)** |
| ***HighUnderfund×F2010*** | | | **–0.058***** | | **–0.061***** |
| | | | **(–3.51)** | | **(–3.59)** |
| ***HighUnderfund×F2011*** | | | **–0.043**** | | **–0.043**** |
| | | | **(–2.41)** | | **(–2.27)** |
| ***HighUnderfund×F2012*** | | | **–0.028**** | | **–0.027** |
| | | | **(–2.38)** | | **(–1.21)** |
| **Test: *LowUnderfund×PPA* vs. *HighUnderfund×PPA* = 0** | **0.031**** | **0.031**** | | **0.037**** | |
| *N* | 18,540 | 18,540 | 18,540 | 18,540 | 18,540 |
| Adjusted $R^2$ | 0.018 | 0.071 | 0.072 | 0.344 | 0.346 |
| Fixed effects | None | FF 48 | FF 48 | Firm | Firm |
| Cluster std. errors | Firm | Firm | Firm | Firm | Firm |
| Controls | No | Yes | Yes | Yes | Yes |

*Notes:* This table presents our H2 analysis examining the effect of financing constraints on tax avoidance. Our dependent variable of interest is *AdjCashETR*. Column (1) presents our estimation of equation (3) without any control variables. Column (2) presents our estimation of equation (3) with control variables and industry fixed effects (FF48). Column (3) presents our estimation of equation (4). Columns (4) and (5) repeat our estimations of equations (3) and (4), respectively, but include firm fixed effects instead of industry fixed effects. Across columns (1), (2), and (4), our independent variables of interest are *LowUnderfund* and *HighUnderfund, PPA,* and the interaction of *HighUnderfund, LowUnderfund,* and *PPA.* For the remaining columns, we replace *PPA* with *F20XX*, which is a series of indicator variables that take the value of one if the firm-year observation has a fiscal year equal to XX (where XX is equal to 08, 09, 10, etc.), and zero otherwise. We also control for numerous variables, as defined in equations (3) and (4). We include a full description of all variables in Appendix 1. In addition, we present the difference in coefficients between *LowUnderfund×PPA* and *HighUnderfund×PPA,* as well as the *p*-value of the *F*-test comparing those two coefficients. Rows presented in bold represent variables of interest. All regressions include firm-clustered standard errors. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * signify statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed p-values.

**TABLE 6**
Other Corporate Strategies and the PPA 2006

| DV - | (1) *Debt Issuance* Coef. (*t*-stat) | (2) *Equity Issuance* Coef. (*t*-stat) | (3) *Equity Buyback* Coef. (*t*-stat) | (4) *Dec. Disc. Exp.* Coef. (*t*-stat) |
|---|---|---|---|---|
| *Intercept* | –0.207*** | 0.524*** | 0.645*** | 0.928*** |
| | (–4.44) | (12.21) | (20.98) | (21.30) |
| *Pension* | –0.009 | –0.002 | 0.036 | –0.015 |
| | (–0.33) | (–0.10) | (1.58) | (–0.66) |
| *PPA* | 0.012 | –0.020** | 0.125*** | 0.109*** |
| | (1.19) | (–2.43) | (11.92) | (12.49) |
| ***Pension×PPA*** | **0.012** | **0.013** | **–0.052*** ** | **0.035** |
| | **(0.70)** | **(1.08)** | **(–3.12)** | **(1.27)** |
| *Control Variables* | Yes | Yes | Yes | Yes |
| *N* | 18,540 | 18,540 | 18,540 | 18,540 |
| Adjusted $R^2$ | 0.259 | 0.448 | 0.497 | 0.156 |
| Fixed effects | Firm | Firm | Firm | Firm |
| Clustered std. errors | Firm | Firm | Firm | Firm |

*Notes:* This table presents our additional analysis examining whether firms change corporate strategies in response to PPA 2006. We estimate equation (1), but we replace *AdjCashETR* with the probability of a *Debt Issuance, Equity Issuance, Equity Buyback,* or *Dec. Disc. Exp* in columns (1), (2), (3), and (4), respectively. We include firm fixed effects in all columns. Due to the use of firm fixed effects, we examine each analysis using a regression, but our results remain similar when using a probit, but no firm fixed effects. For each test, we use tailored control variables for the different dependent variables. We include a full description of our variables in Appendix 1. Rows presented in bold represent variables of interest. All regressions include firm-clustered standard errors. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * signify statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed p-values.

**TABLE 7**

The Effect of Financing Constraints on Permanent Tax Benefits Using Textual Analysis

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | DV = *AdjCashETR* | | | | | |
| | DPAD = 1 | DPAD = 0 | R&D Credit = 1 | R&D Credit = 0 | Self Ins. = 1 | Self Ins. = 0 |
| | Coef. | Coef. | Coef. | Coef. | Coef. | Coef. |
| | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) | (*t*-stat) |
| *Intercept* | 0.114** | 0.167*** | 0.166*** | 0.170*** | 0.117* | 0.165*** |
| | (2.37) | (10.61) | (6.41) | (9.40) | (1.74) | (10.66) |
| *Pension* | 0.020 | –0.014 | 0.001 | –0.026* | –0.048 | –0.007 |
| | (0.42) | (–1.15) | (0.07) | (–1.73) | (–1.10) | (–0.57) |
| *PPA* | 0.028* | 0.017*** | 0.022*** | 0.017*** | –0.006 | 0.020*** |
| | (1.84) | (3.43) | (3.10) | (2.78) | (–0.37) | (4.09) |
| ***Pension×PPA*** | **–0.048**** | **–0.014*** | **–0.025***** | **–0.013** | **–0.038*** | **–0.016**** |
| | **(–2.53)** | **(–1.89)** | **(–2.70)** | **(–1.46)** | **(–1.78)** | **(–2.39)** |
| ***Test: Pension×PPA [1] vs. Pension×PPA [0] =0*** | **–0.033**** | | **–0.012*** | | **–0.022*** | |
| *Control Variables* | Yes | Yes | Yes | Yes | Yes | Yes |
| *N* | 2,105 | 16,435 | 3,652 | 14,888 | 1,288 | 17,252 |
| Adjusted $R^2$ | 0.225 | 0.353 | 0.306 | 0.387 | 0.297 | 0.346 |
| Fixed effects | Firm | Firm | Firm | Firm | Firm | Firm |
| Clustered std. errors | Firm | Firm | Firm | Firm | Firm | Firm |

*Notes:* This table presents our estimation of equation (1) partitioned into groups based on textual analysis. Columns (1) and (2) present analysis for firms that do and do not reference DPAD in their 10-K. Columns (3) and (4) present analysis for firms that do and do not reference R&D tax credits in their 10-K. Columns (5) and (6) present analysis for firms that do and do not reference self-insurance in their 10-K. See Appendix 3 for a full list of keywords used to identify whether the firm does or does not reference the corresponding tax position. Our dependent variable of interest is *AdjCashETR*. Our independent variables of interest are *Pension*, *PPA,* and the interaction of *Pension* and *PPA.* We include a full description of all variables in Appendix 1. Rows presented in bold represent variables of interest. All regressions include firm-clustered standard errors. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * represent statistically significant relations at the 1%, 5%, and 10% levels, respectively, using a two-tailed test. We perform an *F*-test comparing *Pension×PPA* for firms with and without reference to the respective keywords. Because this test has clear directional predictions, ***, **, and * represent statistically significant relations at the 1%, 5%, and 10% levels, respectively, using a one-tailed test.

**TABLE 8**

**Panel A:** The Effect of Financial Constraints on Tax Avoidance – Split on MNC

| D.V. = *AdjCashETR* | (1)<br>*MNC = 1*<br>Coef.<br>(t-stat) | (2)<br>*MNC = 0*<br>Coef.<br>(t-stat) |
|---|---|---|
| *Intercept* | 0.278*** | 0.106*** |
| | (9.22) | (5.33) |
| *Pension* | -0.003 | -0.000 |
| | (-0.13) | (-0.02) |
| *PPA* | 0.008 | 0.022*** |
| | (1.02) | (3.49) |
| ***Pension×PPA*** | **0.002** | **-0.036*** ** |
| | **(0.17)** | **(-2.72)** |
| *Control Variables* | Yes | Yes |
| *N* | 8,489 | 10,051 |
| Adjusted $R^2$ | 0.317 | 0.377 |
| Fixed effects | Firm | Firm |
| Cluster std. errors | Firm | Firm |

**Panel B:** Income Shifting among Pension Firms Before and After the PPA 2006

| D.V. = *DPIDOM & DPIFO* | (1)<br>*Pension = 1*<br>Coef.<br>(t-stat) | | (2)<br>*Pension = 0*<br>Coef.<br>(t-stat) |
|---|---|---|---|
| *InterceptDom* | 0.010*** | | 0.005*** |
| | (11.12) | | (7.91) |
| *InterceptFor* | 0.002*** | | 0.008*** |
| | (11.43) | | (7.13) |
| *OutboundTransfers* | 0.137*** | | 0.164*** |
| | (5.14) | | (3.61) |
| *InboundTransfers* | 0.239** | | 0.399*** |
| | (2.36) | | (7.84) |
| *ROForeignSales* | 0.093*** | | 0.123*** |
| | (6.60) | | (10.32) |
| *RODomesticSales* | 0.040*** | | 0.149*** |
| | (3.19) | | (14.97) |
| ***OutBoundTransfers×PPA*** | **-0.057** | | **0.148** |
| | **(-0.49)** | | **(1.49)** |
| ***InboundTransfers×PPA*** | **0.244**** | | **0.031** |
| | **(2.15)** | | **(0.50)** |
| *ROForeignSales×PPA* | 0.036* | | 0.026* |
| | (1.82) | | (1.71) |
| *RODomesticSales×PPA* | 0.076*** | | -0.034*** |
| | (4.26) | | (-2.53) |
| ***Test: OutboundTransfers×PPA [1] vs. OutboundTransfers×PPA [0] = 0*** | | **-0.205*** | |
| ***Test: InboundTransfers×PPA [1] vs. InboundTransfers×PPA [0] = 0*** | | **0.213**** | |
| *N* | 3,415 | | 3,099 |
| Adjusted $R^2$ - PIDOM Eq | 0.142 | | 0.099 |
| Adjusted $R^2$ - PIFO Eq | 0.102 | | 0.037 |

*Notes:* This table presents our analysis examining multinational versus domestic firms. Panel A presents our re-estimation of equation (1), but we split the sample on whether the observation is multinational (*MNC = 1* in column (1)) versus purely domestic (*MNC = 0* column (2)). We define *MNC* as an indicator variable equal to one if *ForeignAssets* is greater than 0, and zero otherwise. We include firm fixed effects and cluster standard errors by firm. Panel B presents our estimation system of equations (4a) and (4b) from Dyreng and Markle (2016). We define our variables consistent with their study. For both panels, we present a split-sample analysis to avoid the need to interpret a three-way interaction. See Appendix 1 for variable definitions. Rows presented in bold represent variables of interest. We winsorize all continuous variables at the 1st and 99th percentiles. ***, **, and * represent statistically significant relations at the 1%, 5%, and 10% levels, respectively, using a two-tailed test.