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FINANCIAL DERIVATIVES IN CORPORATE TAX AVOIDANCE: AN EMPIRICAL EXAMINATION OF NEW USERS

"Job Market Paper"

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FINANCIAL DERIVATIVES IN CORPORATE TAX AVOIDANCE: AN EMPIRICAL EXAMINATION OF NEW USERS

Abstract

The inclusion of financial derivatives in numerous tax shelters suggests tax avoidance is an economically significant, yet previously unexplored, aspect of their use. Accordingly, I investigate the extent to which derivatives facilitate tax avoidance and whether this aspect is detectable from recently enhanced financial statement disclosures. I find that new users experience reductions in tax burden following the implementation of a derivatives program. These benefits increase with the magnitude of derivatives employed and do not depend on effective hedging of economic risks. Further analyses reveal firms' *ex ante* preferences for aggressive tax strategies have a positive relation with the underlying implementation decision. This evidence collectively suggests tax avoidance is both a determinant and outcome of derivative use. However, similar to the opacity of corporate tax shelters, I find no indication of either aspect in footnote disclosures explaining why and how firms use derivatives.

JEL Classification: G32; H25; M41; M48

Keywords: financial instruments; derivatives; tax burden; tax avoidance; tax aggressiveness; hedge; speculate.

Data Availability: Data used in this study are available from public sources identified in the paper.

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"The 900-pound gorilla in all the corporate tax shelter discussion – that practitioners do not want to talk about and the Treasury report mentions only obliquely – is derivatives… Derivatives turbo charge tax shelters." – Sheppard (1999)

I. INTRODUCTION

The last three decades are witness to massive growth in the market for derivatives, with some estimates of market size currently exceeding $500 trillion and other reports suggesting derivative use by 64 percent of non-financial companies (Bartram, Brown, and Fehle 2009). Apart from their widespread role in managing firm-level risks (e.g., Aretz and Bartram 2010), derivatives facilitate the development of sophisticated and potentially lucrative tax avoidance strategies (JCT 2008).[1] Regulatory initiatives addressing ambiguities in derivative taxation (JCT 2008) and the inclusion of derivatives in numerous tax shelters (Wilson 2009) suggests tax avoidance is an economically significant, yet previously unexplored, aspect of their use. Consequently, I investigate the extent to which derivatives facilitate tax avoidance and whether this aspect is detectable from recently enhanced financial statement disclosures.

Through clever and nearly indecipherable financial arrangements, derivatives can produce precise and predictable financial results with known levels of risk and a seemingly low probability of detection by tax authorities (Donohoe 2011; Sheppard 1991). While some studies investigate tax incentives for derivative use, including tax rate progressivity (e.g., Graham and Smith 1999) and debt tax shields (e.g., Myers 1993; 1984), this literature omits the link between derivatives and tax avoidance. To a large extent, this oversight explains numerous calls for research examining whether and how financial instruments are used to avoid taxes (Hanlon and Heitzman 2010; Shevlin 2007, 1999; Shackelford and Shevlin 2001). Consequently, a large-sample investigation of these questions is necessary, especially given recent surges in tax shelter activity (e.g., Drucker 2006), regulatory

[1] Tax avoidance is defined as reducing the present value of tax payments and increasing the after-tax rate of return to investors (e.g., Hanlon and Heitzman 2010; Rego 2003).

initiatives targeting ambiguities in derivative taxation (JCT 2008), and the role derivatives are alleged to have played in the ongoing global financial crisis (Ryan 2008).

Examining the first question, the degree to which derivatives promote tax avoidance, provides an opportunity to investigate the firm characteristics through which derivatives influence tax burdens and the choice behavior motivating this process. Because derivatives can reduce tax burden and the desire to avoid taxes may lead firms to use derivatives, reducing the present value of taxes may be an impetus for, and/or consequence of, derivative use. Following Demski (2004), I exploit this potential endogeneity by exploring both the outcomes and determinants of firms' underlying choices. Specifically, I perform direct tests of the relation between tax burden and derivatives implementation, and then complement the findings with indirect tests investigating why firms make such choices. The benefit of this approach is that it not only alleviates concerns about alternative hypotheses and inferences based on endogenous relationships (Guay 1999), but also offers insight into firm-level choices. Each test, along with the relevant findings, is discussed in turn.

First, using a sample of new derivative users and a matched-pair control group, I directly test the time-series relation between changes in derivative use and changes in three measures of tax burden. By focusing the analysis on changes, I mitigate the effects of simultaneity between incentives to avoid taxes and *ex ante* tax burden.[2] Relative to the control group, I find that firms experience a 1.7 and 4.0 percent reduction in current taxes and cash taxes paid, respectively, in the four years subsequent to derivatives implementation. I do not, however, find a significant change in total tax expense, which suggests derivatives primarily provide tax deferral strategies rather than generate permanent book-tax differences that result in lower book effective tax rates.

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[2] Firms with *ex ante* large tax burdens have an incentive to engage in tax avoidance. However, if firms respond to an exogenous tax increase (e.g., statutory adjustment) by employing derivatives, it is possible to observe no change in tax burden even if derivatives are solely used to avoid taxes. A similar result may occur if firms begin using derivatives and simultaneously substitute away from other tax planning strategies (e.g., Guay 1999; Skinner 1996).

Second, because derivatives are commonly used to manage risks, I consider whether post-implementation tax burden reductions result from effective hedging rather than tax avoidance. Under both financial and tax reporting regulations, speculative and ineffective hedge positions induce income volatility (Zhang 2009; Graham and Smith 1999) and reduce debt capacity (Stulz 1996), which theory suggests leads to higher expected taxes (Stulz 1996; Smith and Stulz 1985). As such, effective hedging may induce tax burden reductions unrelated to tax avoidance. However, using unexpected changes in risk to capture hedge effectiveness (Zhang 2009), I find that tax burden reductions from effective hedging are substantially less than those from speculative and ineffective hedging. Other tests reveal no changes in the variability of income and reductions in debt usage following derivatives implementation. Thus, effective hedging, income volatility, and greater debt capacity are not alternative explanations for the post-implementation tax burden reductions.

Third, as an indirect test of tax avoidance and derivative use, I examine the cross-sectional variation in tax burden changes for new derivative users. Because derivative-based tax strategies likely require additional positions and encourage the operation of more than one derivatives program (Ensminger 2001), I test whether firms experience greater tax burden reductions as the size of initial positions increase. Further, to the extent previous inferences are spurious, observed changes in tax burden will not be correlated with the magnitude of positions or other incentives to avoid taxes (e.g., sales growth). As expected, I find that total notional principal and fair value of initial derivative positions are inversely related to changes in current tax expense and cash taxes paid.

Fourth, if derivatives are used to mitigate tax burden, then the underlying implementation decision should be a function of incentives to reduce taxes and preferences for more contentious tax planning techniques. Given that tax aggressive firms are those that move well beyond conventional approaches to avoiding taxes, I predict they are more likely than other firms to begin using derivatives.[3] Additionally, tax aggressive firms may also require larger derivative positions to accomplish their tax avoidance objectives. Using two continuous measures of tax aggressiveness, discretionary book-tax differences (Frank, Lynch, and Rego 2009) and likelihood of tax shelter participation (Wilson 2009), as well as controls for five categories of non-tax incentives to use derivatives, I find firms' preferences for less conservative tax planning techniques (i.e., *ex ante* tax aggressive behavior) increase the likelihood of derivatives implementation. These preferences, however, have no relation with the magnitude of derivatives employed. Tests separating the implementation decision from the quantity decision reveal each choice has different determinants.

Overall, the evidence suggests tax avoidance is both an incentive for, and outcome of, derivative use. Although deciphering tax avoidance from financial statement disclosures is incredibly difficult (e.g., McGill and Outslay 2002, 2004), after 2008, SFAS No. 161, *Disclosures about Derivative Instruments and Hedging Activities*, requires firms to explicitly indicate why and how derivatives are used (FASB 2008). As such, the final step is to determine whether derivative-based tax avoidance is detectable from these recently enhanced disclosures. Despite a comprehensive evaluation of derivative footnotes, I identify no firms indicating they use derivatives for tax avoidance purposes. While this finding is not at all surprising given the opacity of tax avoidance and tax shelters (Lisowsky 2010; Wilson 2009; Graham and Tucker 2006), it suggests detecting derivative-based tax avoidance from the financial statements will remain a challenge for tax authorities.

This study makes several contributions to the extant literature. First, it contributes to an extensive body of derivatives-related research (see Aretz and Bartram (2010) for a recent review) by providing large-sample evidence of a previously underexplored incentive for derivative use. Although tax avoidance may not be as strong of an incentive as risk management, this paper helps

[3] For purposes of this study, I view *tax aggressiveness* as claiming a tax benefit with relatively weak facts to sustain the benefits if the company were audited by tax authorities (Mills, Robinson, and Sansing 2010). This definition includes illegal and contentious tax positions as well as some tax avoidance. Section III provides a detailed discussion of this definition, and Section IV describes the proxies used to capture this construct.

identify in which decisions taxes represent a first-order effect and in which decisions taxes have an n^{th}-order effect (Maydew 2001). In addition, evidence that effective hedging has little influence on tax burden also relates to studies investigating the tax consequences of hedging (e.g., Graham and Rogers 2002) as well as research on the economic effects of derivative accounting and disclosure (e.g., Zhang 2009). Second, the paper responds to calls for research on the role of financial instruments in corporate tax avoidance (e.g., Hanlon and Heitzman 2010; Shevlin 2007, 1999; Shackelford and Shevlin 2001). Although derivatives comprise only one category of financial instruments, the analysis complements studies examining the tax implications of other instruments (e.g., Mills and Newberry 2005). Third, the study contributes to a growing literature on corporate tax avoidance and tax aggressiveness (e.g., Hanlon and Heitzman 2010) by investigating the determinants and consequences of derivative-based tax planning. Rather than rely on reduced-form techniques, I explore the behaviors involved by broadening the analysis to include firms' underlying choices (e.g., Demski 2004). Finally, I compare prior studies to develop a more complete empirical model for investigating the derivatives implementation decision. This model (Equation [2]) includes five categories of incentives and can be used to examine similar questions in subsequent research.

The remainder of the paper is organized as follows. Section II provides a brief background on tax avoidance with derivatives and develops the hypotheses, while Section III describes the sample and measurement of derivative use. The research design and empirical results, along with an examination of derivative disclosures are discussed in Sections IV and V, respectively. Finally, Section VI offers concluding remarks.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Derivatives and Tax Avoidance

A derivative is as a financial contract or security deriving its value based on its relationship to something else, typically referred to as the *underlying* (e.g., Stulz 2004). The underlying is often another financial instrument or economic good, but can be almost anything. For instance, derivatives exist where the value is based on the *Dow Jones Industrial Average*, the price of cattle and butter, the heat index in Florida, and even other derivatives. Derivatives generally fall into one of three broad categories: (1) options; (2) futures and forwards; and (3) swaps (Ryan 2007; Strong 2005). In short, options involve the right, but not the obligation, to buy or sell the underlying at a set price within a specified period of time. A futures or forward contract involves an obligatory promise to exchange the underlying at future date for a specific price, while swaps are agreements to exchange a periodic stream of benefits or payments based on some underlying over a predefined period.[4] Although these derivatives are individually common in practice, oftentimes they are combined with other financial instruments (or one another) to develop more sophisticated instruments. As a result, derivatives can be relatively simple to understand and execute (e.g. options) or they can be extraordinarily complicated, such as Enron's over-the-counter energy derivatives.

Corporate use of derivatives is frequently motivated by risk management concerns, including those associated with changes in interest rates, foreign exchange rates, and commodity prices (e.g., Bartram et al. 2009; Bodnar and Wong 2003; Tufano 1996). Although empirical evidence generally supports these motives (Bartram, Brown, and Conrad 2010; Guay 1999), other research suggests the effects are economically insignificant (Hentschel and Kothari 2001) and that other explanations may be more prevalent. For example, derivative use may be motivated by income smoothing (Pincus and Rajgopal 2002; Barton 2001), industry competition (Tufano 1996), and the consequences of financial distress (e.g., Smith and Stulz 1985; Mayers and Smith 1982), underinvestment problems (e.g., Froot, Scharfstein, and Stein 1993), and principal-agent conflicts (e.g., Mayers and Smith 1987).

[4] More specifically, futures are standardized exchange-traded contracts settling in cash daily and guaranteed by an exchange clearinghouse. These contracts commonly trade on both familiar products (e.g., wheat) and more abstract items such as weather (Strong 2005). Forward contracts are analogous to futures in that exchange is obligatory, but because they are customized contracts, forwards are generally not marketable to third parties.

Although overlooked by prior research, tax avoidance is another motive for derivative use. In a related study, Donohoe (2011) argues that taxpayers can use derivatives to strategically modify the timing, character, and source of gains and losses with little scrutiny from tax authorities. More specifically, he develops a framework describing *why* the fundamental, transactional, tax reporting and cognitive aspects of derivatives are useful for avoiding taxes, and then demonstrates *how* by using the framework to dissect two derivative-based tax shelters. The innermost layer of his framework (see Figure 1), fundamental aspects, includes tax function convexity and the debt tax shield as basic tax incentives for derivative use. Because progressive tax rates imply expected tax liabilities are a convex function of taxable income (i.e., pre-tax value), volatile income may lead to higher expected taxes (Smith and Stulz 1985). Therefore, reducing income volatility with derivatives (i.e., through effective hedging) can have the opposite effect (e.g., Graham and Smith 1999). Likewise, by reducing the volatility of income and/or the probability of financial distress, hedging with derivatives increases debt capacity which, in turn, may reduce taxes by increasing deductible interest payments (Stulz 1996). However, mixed empirical support for these incentives (e.g., Graham and Rogers 2002) suggests more practical explanations also play a role. Therefore, the other layers of the framework extend or indirectly encompass these fundamental theories of hedging.

<INSERT FIGURE 1 ABOUT HERE>

In the second layer, transactional aspects, Donohoe (2011) discusses why and how derivative-based transactions can be strategically engineered to achieve the basic tenets of tax planning. Specifically, through numerous examples, he demonstrates the use of one or more derivatives to facilitate the realization of gains and losses at a specific time, of a specific character (i.e., ordinary versus capital), or from a specific source (i.e., foreign versus domestic).[5] Then, building

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[5] For instance, when taxpayers are not required to apply mark-to-market rules, and where the occurrence of property disposition is of major importance, the interaction of derivatives with cash market transactions (e.g., cash settled forward contracts) may obscure any indication of whether or not a true property disposition has occurred

on these transactional features, the third layer, tax reporting aspects, considers why the reactive and particularized response of tax law to financial innovation creates inconsistency, asymmetry, and indeterminacy in derivative taxation (Weisbach 2005; Warren 2004). This discussion suggests that, in the case of derivatives, the tax reporting system is fragmented, largely incomplete, treats similar instruments and opposing sides to the same transaction differently, and offers few provisions for determining the tax treatment of new or compound transactions. Thus, the efficacy of derivatives as tax planning mechanisms is greatly enhanced by such ambiguities in the tax code.

More specifically, the generic piecemeal approach to taxing sophisticated transactions has led to a "cubbyhole" system that permits similar (and sometimes identical) economic positions to be taxed differently depending on transactional form (Kleinbard 1991). For example, using the concept of put-call parity (Merton 1973; Stoll 1969), a firm can acquire equity interests in another firm through at least five different transactions: (1) directly purchasing shares; (2) engaging in an equity swap; (3) executing an equity-linked note; (4) purchasing a call, selling a put (or entering a forward contract); and (5) buying a prepaid forward on equity. All five of these roughly equivalent transactions achieve similar ownership objectives, yet all are subject to disparate tax treatments (Donohoe 2011). Hence, the tax law distinction between different derivatives is generally untenable as financial equivalences allow one cubbyhole to replicate another. In doing so, taxpayers are essentially free to choose the alternative that provides an optimal tax outcome.[6]

Finally, derivatives are routinely considered to be one of the most complex areas of financial and tax reporting (e.g., PwC 2009; JCT 2008; IASB 2008; SEC 1997). If practitioners and investors struggle to understand derivatives (e.g., Koonce, Lipe, and McAnally 2005), then considering the intricacies of the Internal Revenue Code, tax authorities will likely encounter similar problems. In

(e.g., Ferguson 1991). In such cases, taxpayers can exploit favorable timing opportunities by choosing one derivative type over another. See Donohoe (2011) and Ferguson (1994) for examples.

[6] See Donohoe (2011) for more complete examples of how derivatives facilitate tax avoidance, including a detailed discussion of two derivative-based tax shelters.

fact, the IRS normally forms teams of highly specialized tax return examiners and financial experts to police aggressive tax strategies involving derivatives (e.g., McConnell 2007; Raghavan 2007).[7] Thus, the final layer of the framework, cognitive aspects, considers the difficulties faced by tax authorities in understanding, detecting, and enforcing derivative-based tax avoidance. Altogether, Donohoe (2011) concludes that derivatives can be employed as sophisticated tax planning tools that work in isolation or concomitantly with firms' other planning strategies. In doing so, his study raises empirical questions concerning the extent to which derivatives reduce tax burden and whether tax avoidance is a determinant or consequence of their use.

Derivative Use and Changes in Tax Burden

Derivative use may result in lower expected taxes (Smith and Stulz 1985), increased deductible expenditures (Stulz 1996; Ross 1997; Leland 1998), and in some circumstances, allow firms to alter the timing, character, and source of gains and losses (Donohoe 2011). The inherent complexity of derivatives also offers opportunities to exploit ambiguity in the tax code with a seemingly low probability of detection by tax authorities (Donohoe 2011). Given these attractive features, it seems straightforward that derivatives should facilitate tax avoidance, and therefore be associated with smaller tax burdens. However, to the extent tax avoidance motivates derivative use, this relation is more complex because firms with *ex ante* large tax burdens have an incentive to employ derivative-based tax strategies. As a result, even when derivatives are primarily used to avoid taxes, *ex post* tax burdens may be larger, smaller, or indistinguishable from those of non-users. Additionally, because they provide numerous non-tax benefits (e.g., risk management), the presence of derivatives does not necessarily imply these instruments are used to avoid taxes. Consequently, to the extent firms use derivatives for tax avoidance, reductions in tax burden should occur after the implementation a derivatives program. This leads to the first hypothesis:

[7] These teams, however, are generally small and specialized (e.g., less than 10 individuals) requiring they focus on the most egregious forms of tax avoidance. See Donohoe (2011) for further details.

H_1: *Tax burdens decrease subsequent to the implementation of a derivatives program.*

Depending on the possibility of imperfect correlations with the underlying, derivatives can be used to completely offset (perfectly hedge) or partially offset inherent business risks. However, because few hedges are perfect, failure to hold effective hedge instruments (ineffective hedging) or intentionally speculating in the derivatives market can also increase exposures to risk (e.g., Zhang 2009). Under SFAS 133, *Accounting for Derivative Instruments and Hedging Activities*, derivatives are reported as either assets or liabilities on the balance sheet at fair value with any unrealized gains and losses due to changes in fair value reported on the income statement (FASB 1998). Under certain conditions, however, the standard also permits hedge accounting whereby a derivative may be designated as a hedge of the exposure to (1) changes in fair value of a recognized asset or liability; (2) variability in cash flows of a recognized asset or liability or forecasted transaction, or (3) foreign currency risk associated with foreign operations or other foreign-currency denominated transactions. With hedge accounting, changes in fair value of an effective hedge instrument and the changes in fair value of the underlying item are included in net income in the same accounting period (i.e., they offset one another). Alternatively, unrealized gains and losses on derivatives not qualifying for hedge accounting or that result from most types of hedge ineffectiveness are recorded in net income as they occur (i.e., no offset).[8] Therefore, only speculative positions and the ineffective portion of hedges directly affect reported (book) earnings.

Similarly, a special set of rules apply when a transaction qualifies as a hedge for tax purposes (e.g., Donohoe 2011). Although the tax code takes a narrow view of risk management (e.g., Yanchisin and Ricks 2006), gains and losses on hedging transactions are generally matched with gains and losses on the underlying such that both are included in taxable income simultaneously.

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[8] Ryan (2007) outlines several sources of hedge ineffectiveness: (1) managers inability to perfectly understand or model their aggregate exposures; (2) aggregation of small imperfections that add up to large imperfections in hedging aggregate exposures, in part, because SFAS 133 only allows hedges of specific exposures; (3) unattainable or excessively costly perfect hedges; and (4) credit and other counterparty risks.

Consequently, speculative and ineffective hedge positions induce short-term volatility in both book (e.g., Zhang 2009) and taxable income (e.g., Graham and Smith 1999), which is not only less preferable to shareholders and managers (e.g., Beatty and Weber 2003; Graham, Harvey, and Rajgopal 2005), but also has important tax implications.

As mentioned, *less* volatile income results in lower expected taxes for at least two reasons. First, reductions in volatility increase debt capacity (e.g., Stulz 1996), and to the extent increased debt capacity motivates greater debt usage, it also leads to reduced taxes through the deductibility of interest payments (e.g., Graham and Rogers 2002). Second, under the present progressive corporate tax system, a firm's tax liability is generally a convex function of its taxable income (Graham 2003). Based on this theory, a firm facing an increasing marginal tax rate can reduce its expected tax liability by reducing the variability of its income (Smith and Stulz 1985). Thus, tax burden reductions following derivatives implementation may result from effective hedging, not tax avoidance.

However, to the extent derivatives are used to avoid taxes, firms may enter into positions that have little or no relation to risk management (Ensminger 2001), potentially increasing exposures to risk. In this case, firms increasing or failing to reduce exposures to economic risks will experience larger reductions in tax burdens than firms effectively hedging their risks. Additionally, the effects of income volatility, and thus effective hedging, on tax burden may be modest. For instance, firms must actually exploit increased debt capacity to garner tax benefits from additional interest deductions. Despite contentions by Ross (1997) and Leland (1998), some firms may instead choose to reduce expected bankruptcy costs and refrain from using additional debt. Further, Graham and Rogers (2002) find no relation between derivative holdings and the shape of the tax function, while other evidence suggests firms holding speculative or ineffective hedge positions use more prudent risk management strategies after the promulgation of SFAS 133 in 1998 (Zhang 2009). Taken together, reductions in tax burden following derivatives implementation are likely associated with speculative and ineffective hedge positions, leading to the second hypothesis:

> **H_2:** *Following the implementation of a derivatives program, tax burden reductions from effective hedging are smaller than tax burden reductions from speculative or ineffective hedging.*

Cross-Sectional Variation in Tax Burden Changes

Despite similarities in accounting for hedged items, rules governing the financial and tax reporting of derivatives are otherwise diverse. The financial reporting rules follow a fair value approach (i.e., mark to market) whereby the specific accounting treatment depends on whether the derivative qualifies as a hedging instrument, and if so, the reason for holding the instrument (FASB 1998). For federal tax purposes, the timing, character, and source of derivative-related gains and losses varies depending on four attributes: (1) type of instrument; (2) motive for use, (3) status of taxpayer, and (4) organizational form or jurisdiction of taxpayer (Donohoe 2010). For at least two reasons, the disparity between reporting outcomes suggests firms realize greater reductions in tax burden as the size of their positions increase. First, the divergent rules provide an incentive for firms to separate and independently maintain two derivatives programs (Ensminger 2001). Operating a program for economic (i.e., risk management) purposes and another for tax planning allows each management team to focus exclusively on identifying and exploiting value-enhancing opportunities. Because many of the "tax inspired" derivatives will be in addition to those initiated for economic purposes, firms with a tax-based derivatives program will use more derivatives overall and, to the extent the strategies are successful, have smaller tax burdens. Second, even if derivatives programs are not separately maintained, transactions entered into for economic purposes do not necessarily provide optimal tax outcomes. For example, derivatives hedging future purchase commitments or locking in prices denominated in foreign currencies generally produce *ordinary* gains and losses and serve to offset gains and losses on the underlying. If, however, a firm wishes to release suspended *capital* losses, then derivatives producing capital character outcomes can be beneficial.

Alternatively, firms may optimally choose position size after considering incremental tradeoffs. If so, it is possible for two firms holding different sized positions to experience similar tax burden reductions. Thus, a monotonic relation between position size and changes in tax burden may not be prevalent. However, the disparities in reporting outcomes suggest, on average, firms require additional positions to accomplish tax reduction objectives, leading to the third hypothesis:

H_3: *Firms experience greater reductions in tax burden subsequent to the initiation of a derivatives program as the size of derivative positions increase.*

Determinants of Derivative Program Initiation and Magnitude of Initiation

In general, the previous hypotheses predict that derivatives, when used for tax planning, reduce firms' tax burdens. Yet, the question remains as to whether reducing the present value of taxes is an impetus for, and/or a consequence of, derivative use. If firms deliberately use derivatives to reduce tax burdens, then the decision to initiate a derivatives program should be a function of incentives to avoid taxes and preferences for less conservative techniques. While prior literature (e.g., Rego 2003) identifies tax planning incentives (e.g., profitability, foreign operations), many of these also relate to risk management motives (Bartram et al. 2009). Therefore, firms' *ex ante* aggressive tax behavior likely has a more direct link to derivatives initiation.

Tax aggressiveness can be viewed as claiming a tax benefit with relatively weak facts to sustain the benefit if the company were audited by tax authorities (Mills et al. 2010). This definition includes illegal and contentious positions as well as some tax avoidance. More generally, it includes the upper range of the tax avoidance continuum.[9] Therefore, tax aggressive firms are those that

[9] *Tax avoidance* is the steps taken to reduce explicit taxes per dollar of pre-tax earnings or cash flows. With such a broad view, tax avoidance represents a continuum of tax planning strategies where indisputable ("perfectly legal") strategies lie at one end and extremely contentious or illegal strategies (i.e., some tax shelters) lie at the opposing end. A firm can fall anywhere along the continuum depending on how much avoidance the firm has or how much tax risk is assumed (Hanlon and Heitzman 2010). Although a precise meaning of *tax aggressiveness* is a matter of opinion, the general notion is that aggressiveness determines where along the continuum a firm lies. For example, relatively indisputable tax reduction strategies entail little avoidance and almost no tax risk, while other positions have sufficient avoidance or tax risk to be aggressive. Thus, involvement with illegal or extremely contentious tax positions (i.e., "abusive tax shelters") is a sufficient, but not a necessary, condition for tax aggressiveness.

move well beyond conservative approaches to tax planning (e.g., tax credits) by including more sophisticated and potentially riskier techniques in their portfolio of tax planning strategies. Because derivatives are complex financial instruments capable of providing sophisticated and oftentimes unconventional tax avoidance opportunities (Donohoe 2011), tax aggressive firms are more likely than other firms to begin using them.

In contrast, tax aggressive firms may be reluctant to employ derivatives given that the associated tax benefits are not necessarily easy to obtain. For instance, character and timing mismatches between a derivative and the underlying can arise if a transaction does not qualify as a hedge for tax purposes. That is, firms may be unable to offset gains and losses because of character differences (i.e., ordinary versus capital), or because special timing rules apply to defer losses (e.g., Donohoe 2011). These differences can destroy the tax advantages of many transactions by introducing substantial tax reporting costs (Keyes 2008). Consequently, tax aggressive firms may find that other tax planning strategies provide similar benefits with less difficulty.

Additionally, derivatives are seldom easy to understand (e.g., Koonce, Lipe, and McAnally 2005), especially in a tax planning context (Donohoe 2011). Thus, managers of tax aggressive firms may not extensively employ techniques that they themselves do not fully comprehend. Although support with tax avoidance is readily available from specialists (e.g., McGuire, Omer, and Wang 2010), these services are often costly (e.g., Donohoe and Knechel 2011) and may mitigate potential tax savings. Further, regulators' recent laser-like focus on curbing tax avoidance (e.g., Donohoe and McGill 2011) suggests derivative-based tax planning may eventually attract considerable scrutiny. In fact, the Joint Committee on Taxation (2008) is already addressing ambiguities in derivative taxation, while the IRS has hired specialists to assist with enforcement efforts (Raghavan 2008, 2007;

McConnell 2007). As a result, tax aggressive firms may limit (or avoid) involvement with derivatives so as not to attract the attention of tax authorities to these and other tax positions.[10]

Despite potential costs, tax aggressive firms, by nature, are unlikely to forgo viable tax planning opportunities, especially as tax departments become increasingly evaluated as profit centers (i.e., ability to reduce taxes) (Robinson, Sikes, and Weaver 2010; Crocker and Slemrod 2005). Additionally, during tax audit negotiations, the existence of multiple aggressive tax positions may provide flexibility to compromise in one area and retain tax benefits in another (e.g., Javor 2002). Thus, a positive relation between *ex ante* tax aggressiveness and the choice to implement a derivatives program is expected. Although firms can add derivatives over time, larger positions are likely necessary to fulfill immediate tax avoidance objectives (see H_3). Thus, *ex ante* tax aggressiveness is also expected to have a positive relation with the size of derivative positions at initiation.

H_{4A}: *Tax aggressive firms are more likely to initiate a derivatives program than other firms.*

H_{4B}: *Tax aggressive firms initiate derivatives programs with larger derivative positions than other firms.*

III. SAMPLE SELECTION AND DERIVATIVE MEASUREMENT

Data for this study begins with the universe of firms in the Compustat database for the years 2000-2008. Fiscal year 2000 is the first financial reporting year following the implementation of SFAS 133, which became effective after June 15, 2000. I require firms to meet the following criteria: (1) publicly traded; (2) domestically incorporated; (3) non-financial; (4) non-subsidiary; (5) at least three years of consecutive data; and (6) non-missing data necessary to calculate basic descriptive variables.[11] These screens result in 3,858 firms comprising 25,468 firm-year observations.

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[10] This suggests less tax aggressive (high tax burden) firms may be more likely to implement a derivatives program. However, the ease of obtaining tax benefits, complexity, and potential future scrutiny from tax authorities also mitigate the likelihood these firms begin using derivatives. Given that additional tax avoidance may be beneficial until firms reach tax exhaustion, and because tax aggressive firms are generally predisposed to implement less conventional tax planning techniques (Lisowsky 2010; Wilson 2009), the hypothesis focuses on these firms.

[11] To remove non-corporate firms, I follow Dyreng, Hanlon, and Maydew (2008) and eliminate (1) real estate investment trusts; (2) firm names ending in "-LP" or containing "Trust"; and (3) firms with six-digit CUSIPs ending in "Y" or "Z". Financial firms are classified in SIC Codes 60-69.

Following Guay (1999), I identify a subsample of *new* derivative users by manually verifying the implementation of a derivatives program for each firm. Specifically, I obtain information about fiscal year-end derivatives ownership from 10-K forms filed in the SEC's EDGAR database by searching the financial footnotes for a comprehensive listing of keywords relating to derivative use (See Appendix A).[12] A firm is considered a *New User* if it did *not* report a derivatives position as of June 2000, but *did* report a position at a fiscal year-end between June 2001 and December 2008.[13] Firms enter the *New User* sample only when derivative use is first observed such that no firm comprises more than one *New User* observation. The resulting sample of *New Users* consists of 526 firms. See Appendix B for examples of *New User*s' derivative disclosures.

For each *New User*, I construct a variable, *NTNL*, reflecting the total notional principal of derivatives held for non-trading purposes. Although notional amounts are generally larger than fair values, they capture the amount exposed to changes in fair value of the underlying and are the basis for determining the amounts exchanged by parties to the derivative (Barton 2001; Allayannis and Ofek 2000; Haushalter 2000; Guay 1999). However, SFAS 133 does not require disclosure of notional amounts (until 2009) and other regulations (e.g., Regulation S-K) hint at disclosure in only limited circumstances.[14] Therefore, I also construct a variable, *FVAL*, reflecting the fair value of derivatives held for non-trading purposes. Prior research finds fair values are highly correlated with notional amounts (i.e., greater than 0.60) indicating they are a coarse, yet reasonable, proxy for the extent of derivative use (e.g., Barton 2001).[15]

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[12] If Item 8 is "incorporated by reference", I search the incorporated document (where available) or subsequent disclosures to determine derivative use. For 93 observations I am unable to locate the appropriate document or otherwise determine derivative use. I code these observations as *Non-Users*; however, the primary analyses are not sensitive to the omission of these observations.

[13] For instance, a firm reporting a derivatives position at fiscal year-end December 2003, but not at fiscal year-end December 2002 or 2001, is classified as a *New User* in 2003.

[14] For instance, paragraph 305(a)(1)(i) of Regulation S-K lists "contract" and "principal" amounts as examples of contract terms sufficient to determine future cash flows from market risk sensitive instruments.

[15] To mitigate the possibility of sample misclassification, I re-verify each *New User* while collecting notional and fair value information. Therefore, each *New User* observation has been coded as such no less than twice.

By classifying firms as *New Users*, I also identify two additional samples consisting of derivative users and non-users. A firm is considered a *User* if it reports an outstanding position in derivatives at the end of both fiscal year *t* and *t*-1, while firms reporting no derivative positions are classified as *Non-Users*. Firms may enter either of these samples more than once.[16] Additionally, a *New User* can be a *Non-User* in an earlier time period if it did not employ derivatives for at least two consecutive years, and can also enter the *User* sample after using derivatives for at least two consecutive years. These samples consist of 12,437 *User* and 12,505 *Non-User* firm-year observations.

<INSERT TABLE 1 ABOUT HERE>

Table 1 presents characteristics of the *Non-User*, *User*, and *New User* samples. Panel A illustrates the temporal distribution of observations, while Panel B presents the type of derivative instruments held by *New Users* in each year. Although both panels reveal stable distributions over time for *Non-Users* and *Users*, the largest amount of *New Users* occurs in 2001. This high level of derivative activity likely results from the promulgation of SFAS 133, which made favorable financial reporting changes for derivatives in the previous year.[17] In addition, consistent with prior studies (e.g., Aretz and Bartram 2010), swaps and futures/forwards account for 53 and 36 percent of the instruments held by *New Users*, respectively. Panel C reports the aggregate amount of notional values disclosed by *New Users* for each sample year as well as the percentage of firms disclosing this information. On average, 84 percent of *New Users* disclose total notional value of nearly $47 billion. Finally, Panel D reports the industry distribution for each sample. Overall, firms from the manufacturing and service industries comprise the largest portion of the sample observations.

<INSERT TABLE 2 ABOUT HERE>

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[16] For example, a firm using derivatives between 2003 and 2005 enters the *User* sample twice with each consecutive two-year period constituting a separate observation.

[17] It is also possible the largest amount of *New Users* occur in 2001 because SFAS 133 makes derivative use more transparent. However, repeating the primary analyses after excluding these observations reveals similar results.

Panel A of Table 2 presents mean and median values of variables used in subsequent analyses along with *t*-statistics for mean test of differences between *New Users* and that of *Non-Users*, *Users*, and a matched-control sample described below. These statistics indicate *Non-Users* and *Users* differ from *New Users* across several dimensions, including profitability (*ROA*) and firm size (*SIZE*). Panel B presents the univariate Pearson correlations between descriptive variables for all observations. Although many correlations are significant, the panel does not suggest a problem with multicollinearity as most are less than 0.40.[18] However, some exceptions include the relation between firm size (*SIZE*), analyst following (*ANF*), and institutional ownership (*INST*). Specific details regarding each variable, including calculations and data availability are provided in Appendix C.

IV. RESEARCH DESIGN AND EMPIRICAL RESULTS

Derivative Use and Changes in Tax Burden

Research Design

To test whether firms' tax burdens decrease after implementing a derivatives program (H_1), I examine changes in effective tax rates (ETRs) across multi-year windows surrounding program initiation. An ETR (tax liability over pre-tax profit) offers a direct assessment of tax burden (Callihan 1994). However, because estimates of tax liability are subject to numerous limitations, I employ a portfolio of measures: (1) current ETR (current tax expense per dollar of book income) (*CURR*); (2) cash ETR (cash taxes paid per dollar of book income) developed by Dyreng et al. (2008) (*CASH*); and (3) the financial statement ETR (total tax expense per dollar of book income) (*GAAP*).[19] *CURR* reflects deferral strategies and non-conforming avoidance (Hanlon and Heitzman 2010) such that larger ratios imply a greater need for tax planning (Lasilla, Omer, Shelly and Smith 2010). *CASH* captures deferrals and provides a direct measure of firms' cash tax payments (Dyreng et al. 2008),

[18] Variance Inflation Factors (VIFs) indicate multicollinearity is not an issue in any of the tests that follow.
[19] Following prior research (e.g., Robinson et al. 2010; Rego 2003), I constrain each metric to lie between 0 and 100 percent to avoid estimation problems and unreasonable values due to small denominators.

while *GAAP* ignores deferrals but captures the tax rate affecting accounting earnings. Despite relative advantages (and disadvantages), all three ratios capture tax burden with error.[20]

Following Guay (1999), values for *New Users* in Panel A of Table 2 are measured *prior* to derivative use and are therefore less likely to be determined simultaneously with the implementation decision. However, the large between-sample variation in numerous characteristics suggests a direct comparison of tax burdens would be misleading. Further, short time windows raise concerns that tax burden changes may result from sample selection procedures and period-specific economic conditions. To mitigate these possibilities, I create a matched-pair control sample of *Non-Users*, and examine changes in *New Users'* tax burdens relative to changes experienced by control firms. For each *New User*, potential control firms are first limited to those holding no derivatives during the corresponding years *t*-1 and *t*, where *t* refers to the year of initiation. This approach ensures tax burden changes for *New Users* and control firms are calculated over equivalent periods. Because risk management is an important motive for derivative use, I also limit potential control firms to those facing *ex ante* interest rate, currency, or commodity price risks. By focusing only on these firms, the absence of derivatives reflects a choice not to use them, rather than lack of exposure to transferable risks.[21] I then match eligible control firms based on similar incentives to avoid taxes, which results in a matched-pair portfolio of 526 observations.[22] Finally, control-sample adjusted changes are computed by subtracting each *New Users*' change in tax burden from the change experienced by its control sample counterpart.

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20 Although sample attrition precludes the use of long-run metrics for *New Users*, tax burden changes are computed across multiple years. See Hanlon and Heitzman (2010) for a discussion of these and other ETRs.
21 See Graham and Rogers (2002) and Tufano (1998) for details. In short, firms are deemed to have *ex ante* foreign currency exposure if they disclose *foreign* assets, sales, income, currency adjustments, exchange rate effects, income taxes, or deferred taxes in Compustat. *Ex ante* interest rate (commodity) risk is based on the sensitivity of operating income to interest rates (commodity price indices).
22 Specifically, firms are matched according to capital asset intensity (*CAP*), foreign operations (*FRGN*), research and development intensity (*RD*), profitability (*ROA*), firm size (*SIZE*), and industry (2-digit SIC codes). If more than one *Non-User* matches on all parameters, then mean values for these firms are used as the control values.

To examine whether speculative and ineffective hedgers (hereafter, *SPIN*) experience larger reductions in tax burden (relative to effective hedgers) following the implementation of a derivatives program (H_2), I follow a procedure developed by Zhang (2009) to identify these firms. In short, this two-step approach classifies *New Users* as *SPIN* based on the change in a given risk exposure after program initiation.[23] The first step estimates the exposure to interest rate, foreign exchange rate, and commodity price risks before and after initiation. Following prior research (Zhang 2009; Wong 2000; Guay 1999), these risks are defined as follows:

> *Interest rate exposure* – the absolute value of the estimated coefficient from a regression of firms' monthly stock returns on the monthly percentage change in LIBOR.
>
> *Foreign currency exchange rate risk exposure* – the absolute value of the estimated coefficient from a regression of firms' monthly stock returns on the monthly percentage change in the Federal Reserve Board trade-weighted US dollar index.
>
> *Commodity price risk exposure* – the absolute value of the estimated coefficient from a regression of firms' monthly stock returns on the monthly percentage change in a given commodity price.

Using data from the pre-initiation period, I estimate three regressions quantifying how firms' risk exposures are affected by industry and firm characteristics before derivative use. I then calculate the expected risk exposures for each firm in the post-initiation period using estimated coefficients from the pre-initiation period and explanatory variables measured after initiation. Using these results, firms are designated as *SPIN* (*EH*) if a risk exposure in the post-initiation period is larger (smaller) than expected. Overall, 179 *New Users* are classified as *SPIN* with the remaining 347 as *EH*.[24]

Empirical Results

Table 3 reports results for tests of H_1 and H_2. Panel A presents percentage means of each tax burden metric for *New Users* and the matched control sample for the seven-year window (*t*-3 to *t*+3)

[23] See Zhang (2009) for complete details regarding this procedure.
[24] The primary results are not sensitive to *SPIN* designations based upon firms having more than one risk exposure larger than expected in the post-initiation period or to classifications based a 1 percent *de minimis* threshold.

relative to the year (*t*) of derivative implementation.[25] Although decreases in ETRs occur for *New Users* in the immediate pre/post initiation window (*t*-1 to *t*), these trends do not persist for *CASH* and *GAAP* in subsequent periods. This result is not surprising, however, given that tax planning strategies may result in both immediate and delayed realizations of tax benefits (e.g., Scholes et al. 2009).[26] As such, the tests that follow consider post-initiation periods longer than one year.

Panel B reports results for tests of mean changes in tax burden for *New Users* and *New Users* adjusted for mean changes in the matched control sample, where changes are measured across the indicated periods.[27] The first set of tests compare tax burdens immediately preceding derivatives initiation (*t*-1) to those at initiation and three years thereafter (*t* to *t*+3). The results indicate *New Users* experience significant reductions in tax burden following derivatives implementation. Specifically, changes in current taxes (*CURR*), cash taxes paid (*CASH*), and total income tax expense (*GAAP*) are negative. With the exception of *GAAP*, control sample adjusted tax burdens reveal similar results. Because derivatives implementation may be costly or generate benefits with a lag (e.g., Artez and Bartram 2010), the second set of tests consider year *t* as a transition period and evaluate changes between pre-initiation (*t*-1) and the three years subsequent to initiation (*t*+1 to *t*+3). These results indicate negative changes in *CURR* and *CASH* for *New Users* and *New Users* adjusted for changes in the control sample, but reveal no reduction in *GAAP*. Finding no change in *GAAP* suggests derivatives primarily provide tax deferrals rather than create permanent book-tax differences that result in lower book effective tax rates. Overall, consistent with H_1, the negative changes in Panel B indicate tax burdens decrease after derivatives implementation. As a percentage

[25] Widening this window to include other years requires adequate *New User* observations. Relative years beyond those reported result in sample sizes of less than 100 and substantially larger (and widely varying) standard deviations. The results that follow are not affected by the choice to report a seven-year window.

[26] For example, deferral strategies can immediately reduce cash taxes paid, while *New Users* may experience a learning curve associated with derivatives, especially if they are employed to maximize after-tax rate of returns.

[27] The reliability of the *t*-statistics associated with *New User* changes is questionable given the potential bias in the standard errors. Because the measured changes are likely correlated across firms, the standard errors used to calculate the *t*-statistics are likely to be too small. However, bias in the control-sample adjusted standard errors is likely to be less severe (Guay 1999). Additionally, tests of median changes in tax burdens reveal similar results.

of *New Users'* previous tax burdens (adjusted for control sample changes), these reductions represent a 1.7 and 4.0 percent decrease in current tax expense and cash taxes paid, respectively.

<INSERT TABLE 3 ABOUT HERE>

Panel C presents percentage means of *New Users*' tax burdens, where *New Users* are classified as either speculative/ineffective (*SPIN*) or effective hedgers (*EH*). Similar to Panel A, tax burdens for both *SPIN* and *EH* decrease immediately following derivatives implementation, but later revert in *CASH* and *GAAP*. Thus, to examine whether *SPIN* experience larger reductions in tax burden relative to *EH* (H_2), changes are measured across the same periods as those above. Panel D reports results for tests of mean changes in tax burden among *SPIN* and *EH* classifications.[28] For both periods the results indicate tax burden reductions for *SPIN* are significantly larger than those for *EH*. Specifically, differences between mean changes in tax burden for each group are negative and significant for all three ETRs. Consistent with H_2, these results suggest effective hedging is not alternative explanation for the results in Panel B.

Another possibility is the tax burden reductions in Panel B (H_1) are the result of lower income volatility (Graham 1999) and/or increased debt capacity (Stulz 1996) due to derivative use. To consider these explanations, I examine changes in volatility and debt usage across the same periods as those in Panels B and D. For the period *t*-1 versus *t* to *t*+3, I find no significant change in return on assets, incidences of losses, pretax income, or the standard deviation of pretax income.[29] Additionally, I find a *decrease* in long-term debt (*dltt*) (-0.02; p<0.02) and long-term debt issuances (*dltis*) (-0.04; p<0.04), and no significant change in total, current, or convertible debt usage.[30] Finding

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[28] Tests of median changes in tax burdens reveal similar results.

[29] Changes in return on assets (0.01; p<0.21), pretax income (*pi*) to total assets (*at*) (0.01; p<0.14), standard deviation of pretax income (0.09; p<0.29), and the percentage of loss observations (-0.02; p<0.23) are insignificant. All tests are one-tailed assuming unequal variances. Results are similar for the period *t*-1 versus *t*+1 to *t*+3.

[30] Changes in total (*tl/at*) (-0.02; p<0.29), current (*lct/at*) (-0.01; p<0.30), and convertible debt (*dcvt/at*) (0.01; p<0.15) are insignificant. All tests are one-tailed assuming unequal variances. Results are similar for the period *t*-1 versus *t*+1 to *t*+3.

no change in the variability of income and only reductions in long-term debt strongly mitigates the likelihood that post-implementation tax burden reductions (H_1) are explained by these alternative theories. However, it is still possible that tax burdens decrease because firms increase their use of (unobservable) off-balance-sheet financing following the implementation of derivatives.

Cross-Sectional Variation in Tax Burden Changes

Research Design

To examine whether *New Users* experience larger reductions in tax burden as the size of derivative positions increase (H_3), I estimate the following model using ordinary least squares for *New Users* disclosing the magnitude (*MAG*) of their positions – i.e., notional principal (*NTNL*) or fair value (*FVAL*):[31]

$$\Delta ETR_{it} = \varphi_0 + \varphi_1(\Delta RD_{it}) + \varphi_2(CAP_{it}) + \varphi_3(INTG_{it}) + \varphi_4(\Delta INV_{it}) + \varphi_5(\Delta LEV_{it}) + \varphi_6(FRGN_{it}) + \varphi_7(GROW_{it}) + \varphi_8(\Delta ROA_{it}) + \varphi_9(LOSS_{it}) + \varphi_{10}(SIZE_{it}) + \varphi_{11}(MAG_{it}) + \sum \omega_k(IND) + \varepsilon_{it}. \quad [1]$$

The dependent variable, *⊿ETR*, is the change in *New Users'* tax burden (*⊿CURR*, *⊿CASH*, and *⊿GAAP*) relative to the year (*t*) of initiation across the period *t*-1 versus *t* to *t*+3.[32] Other than *MAG*, variables in Equation [1] capture incentives to avoid taxes and thus relate to changes in tax burden. For instance, divergent financial and tax reporting rules governing the deductibility of research and development expenses (*⊿RD*), depreciation (*CAP*), and intangibles (*INTG*) are associated with tax avoidance (Donohoe and McGill 2011; Mills, Erickson, and Maydew 1998). Firms may also substitute inventory for capital expenditures (*⊿INV*) and take advantage of the debt tax shield (*⊿LEV*), while those with foreign operations (*FRGN*) typically have more opportunities to avoid taxes than firms operating only domestically (Rego 2003). Additionally, sales growth

[31] Due to variation in individual derivative instruments, notional principal and fair value capture the effects of derivative use on firms' tax burdens with error (e.g., Smith 1995). If this error component is correlated with other variables, then inferences from these tests may be spurious. However, Guay (1999) notes that without a model specifying how firms choose features of individual securities it is difficult control for this potential problem.

[32] Considering year *t* as a transition period and calculating tax burden changes between pre-initiation (*t*-1) and the three years after initiation (*t*+1 to *t*+3) reveals similar results.

(*GROW*), profitability (*ΔROA* and *LOSS*), and firm size (*SIZE*) reflect other general characteristics associated with changes in tax burden (Robinson et al. 2010). Consistent with H_3, I expect a negative coefficient for *MAG* as it implies decreasing tax burdens as the magnitude of derivatives increase.

Empirical Results

Table 4 presents results for tests of cross-sectional variation in *New Users*' tax burden changes. Specifically, Panels A and B report the results of estimating Equation [1] on *New Users* disclosing notional principal (*NTNL*) and fair value (*FVAL*) of initial derivative positions, respectively. For changes in *CURR*, the coefficients for *NTNL* and *FVAL* are negative and significant implying the larger the initial magnitude of positions, the greater the decline in current tax expense. Additionally, coefficients for control variables are consistent with tax avoidance. For example, greater capital asset intensity (*CAP*) is indicative of greater depreciation expense – a deferred item. Likewise, positive sales growth (*GROW*) may result in a higher tax burden by increasing taxable income, while a negative relation with changes in *LEV* suggests the associated interest expense reduces current taxes. *NTNL* and *FVAL* are also negatively related with changes in *CASH* ($p<0.10$), but have no association with changes in book effective tax rates (*GAAP*).[33]

<INSERT TABLE 4 ABOUT HERE>

Overall, consistent with H_3, the evidence in Table 4 indicates the magnitude of *New Users*' initial derivative positions are inversely related to changes in current tax expense and cash taxes paid. As before, these results imply derivative-based tax planning offers substantial tax deferral opportunities. Further, if the inferences drawn for H_1 and H_2 are spurious, then neither the magnitude of derivative positions nor proxies for tax planning incentives would be correlated with observed changes in tax burdens. Therefore, the results of H_3 not only add credibility to the

[33] I also estimate Equation [1] using probit regression, where the dependent variable is an indicator equal to 1 for negative tax burden changes. The results of these analyses are similar to those reported above. That is, the larger the magnitude of initial derivative positions, the higher the probability of a negative change in *CURR* and *CASH*.

previous conclusions, but also mitigate concerns about the potential correlation between incentives to use derivatives and the amount firms choose to employ (e.g., Guay 1999).

Determinants of Derivative Program Initiation and Magnitude of Initiation

Research Design

To test whether tax aggressive firms are more likely to initiate a derivatives program (H_{4A}), I estimate the following logistic regression model on a pooled sample of *New Users* and *Non-Users*:

$$\ln\left(\frac{P_{\text{initiation}}}{1-P_{\text{initiation}}}\right) = \beta_0 + \beta X + \mu, \qquad [2]$$

where $\ln\left(\frac{P_{\text{initiation}}}{1-P_{\text{initiation}}}\right)$ is the probability a firm initiates a derivatives program (i.e., a *New User*), and

$$\begin{aligned}\beta X = {} & \beta_1(CONV_{it}) + \beta_2(LEV_{it}) + \beta_3(ROA_{it}) + \beta_4(NOL_{it}) + \beta_5(NBM_{it}) + \beta_6(MB_{it}) + \beta_7(RD_{it}) + \\ & \beta_8(PPEX_{it}) + \beta_9(DELTA_{it}) + \beta_{10}(ANF_{it}) + \beta_{11}(ABDAC_{it}) + \beta_{12}(CYC_{it}) + \beta_{13}(STD_{it}) + \\ & \beta_{14}(INST_{it}) + \beta_{15}(FRGN_{it}) + \beta_{16}(OCF_{it}) + \beta_{17}(SIZE_{it}) + \beta_{18}(TA_{it}^{D,S}) + \sum \omega_k(IND) + \sum \tau_t(YR).\end{aligned}$$

I use two continuous measures to proxy for firm-level tax aggressiveness ($TA^{D,S}$): (1) *DTAX*, an estimate of discretionary permanent book-tax differences developed by Frank et al. (2009);[34] and (2) *SHLTR*, an estimate of the probability a firm is engaged in tax shelter activity developed by Wilson (2009).[35] Consistent with H_{4A}, I expect a positive association between $TA^{D,S}$ and the choice to initiate. The remaining variables capture diverse incentives for derivatives implementation, including: (1) tax function convexity; (2) financial distress; (3) conflicts of interest; (4) managerial risk aversion; and (5) income smoothing. Each variable is described in turn.

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34 Permanent book-tax differences arise from fundamental differences in the scope of activities considered to be income or expense items under the financial and tax reporting systems (Mills and Plesko 2003). Building on the discretionary accruals literature, Frank et al. (2009) develop an estimate of discretionary permanent differences by regressing permanent differences on nondiscretionary items unrelated to tax planning, but known to cause permanent differences. As such, their metric reflects permanent differences likely resulting from tax planning transactions under management control. See Appendix C for more details.

35 Firms' tax shelter scores are based on the model of tax sheltering in Wilson (2009). He estimates the parameters for his model based on a sample of identified tax shelter participants, where the model includes variables predicted to be associated with tax shelter activity. The metric attempts to identify active tax shelter participants and, as a result, likely captures the most tax aggressive firms. See Appendix C for more details.

If the function mapping taxable income into tax liabilities is convex, then reducing income volatility by hedging may result in lower expected taxes (Smith and Stulz 1985). As such, the difference between firms' marginal and average tax rates (*CONV*) is expected to have a positive association with derivatives initiation (e.g., Barton 2001). Similarly, by reducing the variance of firm value, derivatives may mitigate expected costs of financial distress (Smith and Stulz 1985). Thus, I include leverage (*LEV*) to measure expected costs of distress (e.g., Haushalter 2000; Dolde 1995), return on assets (*ROA*) to capture firm profitability where less profitable firms have a higher probability of entering distress, net operating loss carry forwards (*NOL*) to indicate past distress, and an indicator of negative book-to-market ratios (*NBM*) to capture extreme financial distress. Because incentives to use derivatives are greater for firms facing higher costs of distress, a negative relation with implementation is expected for *ROA* and a positive association for these other variables.[36]

Conflicts of interest between fixed and residual claimholders are related to firms' investment opportunity set. By using derivatives, firms can redistribute cash flow from states in which it exceeds obligations to states with insufficient cash flow. In doing so, derivatives can reduce the incentive to underinvest by increasing the number of future states in which equity holders are the residual claimholders (Berkman and Bradbury 1996; Bessembinder 1991). Therefore, firms with valuable growth options are more likely to begin using derivatives as they are more apt to be affected by underinvestment problems. Alternatively, Froot et al. (1993) demonstrate it is not the existence of growth options per se that is a determinant of derivative use, but the risk of not being able to convert growth options into assets in place. As such, I include proxies for both the value of a firm's growth options (*MB* and *RD*) and the ability to convert growth options into assets in place (*PPEX*).

Income volatility can be costly for managers if their compensation is tied to corporate income or cash flows (e.g., Smith and Stulz 1985; Stulz 1984). Thus, if management wealth is a

[36] It is important to note that derivatives may also increase debt capacity. For example, Graham and Rogers (2002) find that firms use derivatives to mitigate expected distress costs and that derivative use leads to greater leverage.

concave function of firm value, then it is optimal for managers to hedge firm value. However, managers are better off without hedging if options and bonus plans make compensation a convex function of firm value. *DELTA* considers managerial incentives to alter firm risk as it reflects the partial derivative of the dividend-adjusted Black-Scholes value of the CEO's stock and option portfolio with respect to firms' stock price, multiplied by one percent (Core and Guay 1999). This variable is expected to have a positive relation with derivatives implementation because it captures whether managers have exposures to idiosyncratic risks that can be reduced with derivatives.

Managers are under increasing pressure to report smooth earnings (Barton 2001). For example, firms with heavy analyst following may avoid reporting earnings surprises (e.g., Johnson 1999), while less volatile earnings and cash flows can prevent underinvestment by reducing financing costs (e.g., Minton and Schrand 1999; Géczy, Minton, and Schrand 1997). Additionally, Barton (2001) finds managers use derivatives and discretionary accruals simultaneously to smooth earnings. Thus, I include number of analysts (*ANF*) and discretionary accruals (*ABDAC*) to control for these smoothing incentives and expect positive associations with derivatives program implementation.

Other firm characteristics may also explain the implementation decision. For instance, firms with long cash conversion cycles (*CYC*) may benefit from derivatives because their cash flows are exposed to price fluctuations for extended periods (Barton 2001). Likewise, firms with short debt maturities (*STD*) may benefit from interest rate swaps (Visvanathan 1998). Additionally, managers have an incentive to hedge away performance uncertainty so the market can more precisely infer their talent (Breeden and Viswanathan 1998; Demarzo and Duffie 1991). As such, if firms owned primarily by institutional investors (*INST*) face less information asymmetry, then they should rely less on derivatives (Barton 2001). Finally, characteristics such as foreign operations (*FRGN*), liquidity constraints (*OCF*), and firm size (*SIZE*) are also known to influence a firm's choice to use derivatives (e.g., Aretz and Bartram 2010).

To examine whether tax aggressive firms have larger derivative positions at initiation (H_{4B}), I use two methods of analysis. First, I replace the dependent variable in Equation [2] with *MAG* and estimate the model using Tobit regression on the pooled sample of *New Users* and *Non-Users*.[37] Second, I use a variant of the Tobit model proposed by Cragg (1971) to accommodate the possibility the initiation of a derivatives program depends on two decisions, each with different determinants. The Cragg model applies when the *probability* of a nonlimit outcome (e.g., the decision to begin using derivatives) is determined separately from the *level* of the nonlimit outcome (e.g., the amount of derivatives to employ). This approach combines a binomial probit (the decision equation) with a conditional (truncated) regression model (the equation for *nonzero* outcomes). Specifically, in the first stage, using the pooled sample of *New Users* and *Non-Users*, I estimate Equation [2] using binomial probit regression. Then, in the second stage, using only *New Users*, I estimate a truncated model (*MAG*>0) that includes a selectivity correction variable (*IMR*) from the first stage. Overall, a positive coefficient for $TA^{D,S}$ is expected in both the Tobit and Cragg specifications.

Empirical Results

Table 5 reports the results of estimating Equation [2] on a pooled sample of 526 *New User* and 10,843 *Non-User* observations with available data, where the dependent variable (*INIT*) is an indicator set equal to 1 if the firm is a *New User* and 0 if a *Non-User*.[38] Following Guay (1999), I measure *New Users'* incentives (independent variables) prior to derivative use in order to mitigate concerns about simultaneous decisions. Specifically, Panel A presents results where *New Users* incentives are measured in the year prior to initiation (*t*-1), whereas Panel B reports results where incentives are averaged over the three years preceding initiation (*t*-3 to *t*-1). In both panels,

[37] *MAG* is left-censored as it has a value of zero for *Non-Users*.

[38] I use the Hausman test in each regression that follows to examine whether the extra orthogonality conditions imposed by a random effects estimator is more appropriate than a fixed effects estimator. The null hypothesis that the random effects estimator is consistent is rejected in all cases suggesting the fixed effects estimator is preferred. Additionally, VIFs (all <4) for each regression indicate multicollinearity is not a major concern (Kutner et al. 2004).

coefficients for *DTAX* and *SHLTR* are positive and significant, while coefficients for the other independent variables are consistent with prior research. Overall, consistent with H_{4A}, these results strongly suggest the decision to implement a derivatives program is a function of firms' *ex ante* preferences for less conservative tax planning techniques.

<INSERT TABLE 5 ABOUT HERE>

Table 6 reports the results of estimating Equation [2] using Tobit regression and *MAG* as the dependent variable. Specifically, Panel A (B) reports coefficient estimates for the pooled sample of 440 (456) *New Users* disclosing *NTNL* (*FVAL*) and 10,843 *Non-User* firm-year observations holding no derivatives. As before, *New Users'* incentives are measured prior to derivative use (*t*-1).[39] Although many of the independent variables are consistent with previous tests, coefficients for *DTAX* and *SHLTR* are insignificant in both panels. This finding implies that while *ex ante* aggressive tax behavior influences the decision to initiate a derivatives program (H_{4A}), it does not affect the magnitude of the positions (i.e., inconsistent with H_{4B}).[40]

<INSERT TABLE 6 ABOUT HERE>

Finally, Table 7 presents results for determinants of the magnitude of derivatives implementation by *New Users* (H_{4B}) after separating the initiation decision from the quantity decision. Specifically, Panels A and B report coefficient estimates and *z*-statistics for the Cragg (1971) specification of Equation [2] described above, where the truncated models include total notional principal (*NTNL*) and fair value (*FVAL*) of derivatives at initiation, respectively. Consistent with

[39] Averaging incentives over the three years preceding initiation (*t*-3 to *t*-1) reveals similar results.

[40] Derivatives considerable financial and tax reporting implications suggests the presence of auditor-provided tax services may influence the implementation and/or magnitude decisions, especially in the case of aggressive tax behavior (e.g., Donohoe and Knechel 2011). To investigate this possibility, I include an indicator variable (*APTS*) in Equation [2] to capture observations where the firm's auditor provides tax services (e.g., compliance, consulting, etc.) during the fiscal year. *APTS* is set equal to 1 if fees paid for tax services are greater than zero (0 otherwise). Because disclosure of tax fees paid to external auditors was voluntary prior to 2003, I estimate Equation [2] using a subset of observations from 2003 to 2008. The coefficients for *APTS* are insignificant in both cases (p<0.13, 0.18) suggesting auditor-provided tax services influences neither the initiation nor magnitude decision. Results are similar using a $10,000 tax fee *de minimus* expenditure threshold.

the previous analyses, both panels reveal positive and significant coefficients for *DTAX* and *SHLTR* in the first stage (i.e., initiation), but insignificant coefficients in the second stage (i.e., magnitude). Further, comparing coefficients for control variables among the first and second stage results suggests different determinants influence each decision. For example, tax function convexity (*CONV*) and the market-to-book ratio (*MB*) are only positive and significant in the second stage implying that once firms make the decision to employ derivatives, higher expected taxes and the level of growth options help explain the extent of use. Conversely, an incentive to smooth reported earnings (*ABDAC*) is important in making both decisions. Nevertheless, separating derivatives implementation into two separate decisions allows for inferences consistent with the earlier analyses (i.e., Tables 5 and 6). In summary, the analyses reported in this section collectively suggest tax avoidance is an incentive to employ derivatives and an outcome of their use.

<INSERT TABLE 7 ABOUT HERE>

V. DETECTING DERIVATIVE-BASED TAX PLANNING FROM FINANCIAL DISCLOSURES

It is well-known that deciphering tax avoidance from the financial statements is incredibly difficult. Problems commonly arise due to lack of available information about taxable income and taxes paid on current earnings (McGill and Outslay 2002, 2004; Hanlon 2003), as well as from the discretion and aggregation with which tax positions can be disclosed (e.g., Blouin et al. 2010). Although similar criticisms apply to derivative disclosures (e.g., Ryan 2007), recent changes by SFAS 161 (FASB 2008) require a description of (1) how and why firms use derivatives; (2) how derivatives and related hedged items are accounted for under SFAS 133 and its related interpretations; and (3) how derivatives and related items affect financial position, performance, and cash flows.[41] These improvements, along with the evidence in Section IV, raise the question of whether a link between tax avoidance and derivatives is detectable from the enhanced disclosures.

[41] These disclosure requirements are applicable to all entities that issue or hold derivative instruments.

To address this question I collect 2,501 derivative disclosures from the financial footnotes (Item 8) of 1,334 known users' 10-K forms for fiscal-years ending after November 15, 2008, the effective date of SFAS 161.[42] Using text string matching software, I search these disclosures for a general, but comprehensive, set of keywords relating to tax avoidance.[43] In addition, I manually review 125 (5 percent) randomly selected disclosures for evidence of tax avoidance activities. Consistent with the general concealment of tax planning strategies, I find no mention of tax avoidance in firms' explanations of why and how they employ derivatives. Instead, nearly all disclosures indicate derivatives are used to offset exposures to foreign exchange and interest rate risks. Consequently, these new disclosures offer little assistance to tax authorities should they attempt to detect derivative-based tax avoidance from the financial statements.

VII. CONCLUSION

Although corporate use of derivatives is frequently motivated by risk management, regulatory initiatives addressing ambiguities in derivative taxation (JCT 2008) and the inclusion of derivatives in numerous tax shelters (e.g., Donohoe 2011; Wilson 2009) suggests tax avoidance is an economically significant aspect of their use. Accordingly, this paper examines the extent to which derivatives facilitate tax avoidance and whether this aspect is detectable from recently enhanced financial statement disclosures. Using a sample of new users, I find direct and indirect evidence suggesting tax avoidance is both an incentive for, and outcome of, derivative use. Specifically, firms experience reductions in current taxes and cash taxes paid in the four years subsequent to derivatives implementation. These benefits increase with the magnitude of derivatives employed, result primarily from tax deferral opportunities, and are not driven by effective hedging of economic risks.

[42] Known derivative users are those firms in the *User* and *New User* samples as of fiscal year 2008. Based on availability, the sample window includes derivative disclosures filed before August 1, 2010.

[43] Keywords include variants of the following: *after-tax*, *compliance*, *defer*, *delay*, *effective tax*, *foreign tax*, *haven*, *internal revenue*, *shelter*, *tax*, *tax burden*, *tax payment*, *tax plan*, *tax liability*, *tax-exempt*, *tax expense*.

Notwithstanding recent attempts to increase the transparency surrounding derivative use, I find no indication of tax avoidance in footnote disclosures explaining why and how firms use derivatives.

Overall, I provide large-sample empirical evidence concerning the extent to which derivatives facilitate corporate tax avoidance. Consistent with Donohoe (2011), the results suggest derivatives offer unique opportunities to reduce tax burden with a seemingly low probability of detection by tax authorities. Accordingly, this study has two important implications for future policy decisions. First, as the tax-writing communities attempt to repair the inconsistency, asymmetry, and indeterminacy in the current tax reporting system for derivatives (Weisbach 2005), it is important they remain cognizant of how a piecemeal response to financial innovation leads to further discretion and flexibility. As shown, tax aggressive firms have a penchant for using derivatives and are likely to use such shortcomings to their full advantage. Second, finding no evidence of derivative-based tax planning in financial statement disclosures raises the question of whether tax authorities have adequate information to detect such behavior. Although the Schedule M-3 (e.g., Donohoe and McGill 2011) includes a line-item for "hedging transactions", this category is likely too broad to be useful for detecting tax positions that involve sophisticated derivatives and complicated ownership structures. Thus, regulators might consider more detailed disclosure requirements within the Schedule M-3 or the new Schedule UTP.

Despite attempts to ensure the robustness of the results, this study is not without limitations. Despite carefully reviewing firms' financial reports and cross-validating samples, problems may arise with the identification of new derivative users. Moreover, the confidential nature of tax return filings requires the use of imperfect tax burden and aggressiveness proxies estimated from financial statement data. Although my approach is generally accepted in the extant literature, some research suggests financial statements do not convey sufficient information to adequately estimate key aspects of firms' tax attributes (e.g., Plesko 2007). As a result, further refinements in this area would enhance the validity of the results. For example, researchers with access to corporate tax return data might consider whether tax filings (e.g., Schedule M-3 or UTP) offer insight into tax avoidance with various financial instruments, including derivatives.

APPENDIX A
Derivative Keywords

"call option"	"forward" with "contract*"
"call*"	"forward" with "treasury" with "lock*"
"cash flow hedge"	"futures"
"collar*"	"futures" with "contract*"
"commodity"	"hedge*"
"currency" with "exchange" with "contract*"	"hedging"
"currency" with "exchange" with "forward*"	"hedging*"
"currency" with "exchange" with "future*"	"ineffective portion"
"currency" with "exchange" with "option*"	"interest" with "rate" with "cap*"
"derivative*"	"interest" with "rate" with "option*"
"effective portion"	"interest" with "rate" with collar*"
"fair value hedge"	"notional amount"
"fixed" with "rate" with "lock*"	"notional*"
"foreign" with "currency" with "forward*"	"option contract"
"foreign" with "currency" with "future*"	"option*"
"foreign" with "currency" with "option*"	"put option"
"foreign" with "exchange" with "contract*"	"put*"
"foreign" with "exchange" with "forward*"	"rate" with "swap*"
"foreign" with "exchange" with "option*"	"risk management"
"forward"	"swap*"

This appendix provides a comprehensive listing of keywords (largely adapted from prior research) related to derivative use. Information about each firms's fiscal year-end derivative ownership is obtained by searching the full text of the financial footnotes within 10-K forms filed electronically in the SEC's EDGAR databse. An asterik (*) denotes a wildcard search option.

APPENDIX B
Examples of Derivative Disclosures from Form 10-K

New Users

Abbot Laboratories, Inc. [*ABT*]

FY 2000

"Abbot does not currently use derivative financial instruments, such as interest rate swaps, to manage its exposure to changes in interest rates for its debt instruments and investment securities."

FY 2001

"In 2001, Abbot entered into interest rate hedge contracts totaling $2.450 billion to manage its exposure to changes in the fair value of $2.450 billion of fixed-rate debt due in July 2004 and 2006."

American Biltrite, Inc. [*ABL*]

FY 2005

"Under its current policies, the Company does not use derivative financial instruments, derivative commodity instruments or other financial instruments to manage its exposure to changes in interest rates, foreign currency exchange rates, commodity prices or equity prices and does not hold any instruments for trading purposes."

FY 2006

"During 2006, the Company entered into two interest rate swap agreements to manage the Company's exposure to fluctuations in interest rates on its term loan and portions of its revolver borrowings."

Kaydon Corporation [*KDN*]

FY 2001

"As of December 31, 2001, the Company had not established a foreign-currency hedging program."

FY 2002

"During 2002, the Company entered into derivatives in the form of foreign exchange contracts to reduce the effect of fluctuations in foreign exchange rates on short-term, foreign currency denominated intercompany transactions."

MGM Mirage [*MGM*]

FY 2000

"To date, we have not invested in derivative or foreign currency based financial instruments."

FY 2001

"During June 2001, we entered into interest rate swap agreements designated as fair value hedges of our $500 million principal amount of fixed rate debt due in 2005."

RadioShack Corporation [*RSH*]

FY 2000

"RadioShack does not have any derivative instruments that materially increase the Company's exposure to market risks for interest rates, foreign currency rates, commodity prices or other market price risks. RadioShack does not use derivatives for speculative purposes."

FY 2001

"During the third quarter of 2001, we entered into several interest rate swap agreements, with maturities ranging from 2004 to 2007, to manage our exposure to interest rate movements by effectively converting a portion of our long-term debt from fixed to variable rates."

Non-Users

Dress Barn, Inc. [*DBRN*]

"The Company holds no options or other derivative instruments."

Servidyne, Inc. [*SERV*]

"At April 30, 2002, and 2001, the Company had no derivative instruments."

This appendix presents examples of derivative disclosures from financial footnotes of 10-K forms filed in the SEC's EDGAR database. Firm stock tickers are in brackets. See Appendix A for a listing of keywords used in the search process.

APPENDIX C

Variable Definitions & Calculations

Variable	Description	Calculation
ABDAC	Absolute value of discretionary accruals.	Absolute value of residuals from modified-Jones model (Equation [8] in Dechow et al. 1995).
ANF	Number of analysts following the firm.	Log[No. of Analysts] (IBES)
CAP	Capital asset intensity.	Gross Property, Plant, and Equipment (ppegt) / Total Assets (at)
CASH	Cash effective tax rate.	Cash Tax Paid (txpd) / [Pretax Income (pi) - Special Items (spi)]
CONV	Tax function convexity.	Marginal Tax Rate (Graham and Mills 2008) - Tax Expense (txt) / Pretax Income (pi)
CYC	Cash conversion cycle.	No. of days inventory [360 / (Cost of Goods (cogs) / Avg. Inventory (invt))] + No. of days receivables [360 / (Cost of Goods (cogs) / Avg. Receivables (rect))] - No. of days payables [Accounts Payable (ap) / Cost of Goods (cogs)] * 360.
CURR	Current effective tax rate.	Current Tax Expense (txfed) / [Pretax Income (pi) - Special Items (spi)] if txfed is missing, Current Tax Expense = txt-txfo-txs-txdi-txo.
DELTA	Dollar change in value of CEO stock and option portfolio from 1% increase in stock price.	See Core and Guay (2002).
DTAX	Estimated discretionary permanent book-tax differences.‡	Residuals (ε) from Equation [1] in Frank et al. (2009): $PERMDIFF_{it} = \alpha_0 + \alpha_1 INTANG_{it} + \alpha_2 UNCON_{it} + \alpha_3 MI_{it} + \alpha_4 CSTE_{it} + \alpha_5 \Delta NOL_{it} + \alpha_6 LAGPERM_{it} + \varepsilon_{it}$
ΔETR	Change in tax burden.	Change in either *CASH*, *CURR* or *GAAP*.
FRGN	Indicator of foreign operations.	Indicator = 1 if foreign income/loss (pifo) ≠ 0; 0 otherwise.
FVAL	Fair value of derivative positions.	Reported fair value of all derivative positions (hand collected) / Total Assets (at)
GAAP	GAAP effective tax rate.	Total Tax Expense (txt) / [Pretax Income (pi) - Special Items (spi)]
GROW	One-year percentage growth in sales.	Sales (sale) - Lagged sales (sale) / Sales (sale)
IMR	Inverse mills ratio.	Calculated from first-stage of Cragg (1971) model.
INST	Institutional ownership.	Portion of shares held by institutions from 13-f filings.
INTG	Intangible asset intensity.	Intangible Assets (intan) / Total Assets (at)
INV	Inventory intensity.	Total Inventory (invt) / Total Assets (at)
LEV	Leverage ratio.	Total Liabilities (lt) / Total Assets (at)
LOSS	Indicator of current-year loss.	Indicator =1 if income before extraordinary items (ib) <0; 0 otherwise.

APPENDIX C (cont.)

MAG	Magnitude of derivative positions.	Either *NTNL* or *FVAL*.
MB	Market to book ratio.	Price (prcc_c) * Common Shares (csho) / Stockholders' Equity (seq)
NBM	Indicator of negative book to market ratio.	Indicator =1 if [Stockholders' Eq. (seq) / Price (prcc-c) * Cmn. Shares (csho)] < 0; 0 otherwise.
NOL	Indicator of net operating loss carry forward.	Indicator = 1 if net operating loss carry forward (tlcf) ≠ 0; 0 otherwise.
NTNL	Notional principal of derivative positions.	Reported notional principal of all derivative positions (hand collected) / Total Assets (at)
OCF	Operating cash flow.	Operating Cash Flow (oancf) / Total Assets (at)
PPEX	Conversion of growth options to assets in place.	Cash Expenditures on PP&E (capx) / Total Assets (at)
RD	Research and development intensity.	R&D Expense (xrd) / Total Sales (sale)
ROA	Return on assets.	Net Income (ib) / Total Assets (at)
SHLTR	Tax shelter prediction score.	Score using estimated coefficients for Equation [1] in Wilson (2009): $SHLTR = -4.86 + (5.20 \times BTD_{it}) + (4.08 \times DAP_{it}) + (-1.41 \times LEV_{it}) + (0.76 \times SIZE_{it}) + (3.51 \times ROA_{it}) + (1.72 \times FOR\_INCOME_{it}) + (2.42 \times R\&D_{it})$
SIZE	Natural logarithm of total assets.	Log[Total Assets (at)]
STD	Short-term debt ratio.	[Total Liabilities (tl) - Long-Term Debt(dltt)] / Total Liabilities (tl)
$TA^{D,S}$	Tax aggressiveness metric.	Either *DTAX* or *SHLTR*.
VEGA	Dollar change in value of CEO option portfolio from a 1% increase in standard deviation of firm returns.	See Core and Guay (2002).

This appendix presents the calculations for each variable in the analyses. Compustat data items are in parentheses. ‡Frank et al. (2009) define the regression variables as follows: *PERDIFF* equals total book-tax differences less temporary book-tax differences [Pre-Tax Income (pi) - ((Current Tax Expense (txfed) + Current Foreign Tax Expense (cfor) / Statutory Tax Rate)] - (Deferred. Tax Expense (txdi) / Statutory Tax Rate); *INTANG* equals goodwill and other intangible assets (intan); *UNCON* equals income or loss reported under the equity method (esub); *MI* equals income or loss attributable to minority interest (mi); *CSTE* equals current state income tax expense (txs); ΔNOL equals the change in net operating loss carry forwards (tlcf); *LAGPERM* equals the one-year lagged *PERMDIFF*; and the residual term (ε) is the estimate of discretionary permanent book-tax difference (*DTAX*). As in Frank et al. (2009), I estimate this model by two-digit SIC code and fiscal year, where all variables (including the intercept) are scaled by beginning-of-year total assets (at).

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TABLE 1
Sample Characteristics

Panel A: Temporal Distribution of Sample Observations

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Non-Users	1,662	1,647	1,650	1,591	1,492	1,380	1,257	1,058	768	12,505
Users	1,242	1,275	1,425	1,476	1,509	1,477	1,433	1,349	1,251	12,437
New Users	-	117	68	93	67	54	54	47	26	526
Total	2,904	3,039	3,143	3,160	3,068	2,911	2,744	2,454	2,045	25,468

Panel B: New Derivative Users by Type of Instrument and Year

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Options	-	1	3	2	4	1	2	3	2	18
Swaps	-	84	33	52	26	22	34	34	17	302
Futures/Forwards	-	36	31	41	34	29	17	11	8	207
Other	-	5	6	10	9	5	4	7	1	47
Total	-	126	73	105	73	57	57	55	28	574

Panel C: New Derivative Users Disclosing Notional Values

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Agg. Amount (M)	-	10,274	3,749	10,723	3,432	2,841	4,514	9,677	1,700	46,910
No. of Disclosers	-	101	53	78	56	45	44	38	25	440
% Disclosing	-	86	78	84	84	83	81	81	96	84

Panel D: Industry Distribution of Sample Observations

		Non-Users		Users		New Users	
Description / SIC Code		**Obs.**	**%**	**Obs.**	**%**	**Obs.**	**%**
Agriculture, Forestry & Mining	1 - 1499	257	2	771	6	12	2
Construction	1500 - 1999	170	1	149	1	16	3
Manufacturing	2000 - 3999	6,154	49	6,449	52	246	47
Transport. & Communication	4000 - 4999	742	6	1,808	15	43	8
Wholesale	5000 - 5999	1,791	14	1,297	10	71	13
Business & Personal Services	7000 - 7999	2,434	19	1,515	12	93	18
Services	8000 - 8999	957	8	448	4	45	9
Total		12,505		12,437		526	

This table summarizes the characteristics of the *Non-User*, *User*, and *New User* samples. Panel A provides the temporal distribution of observations for each sample. Panel B presents the type of derivative instruments employed by *New Users* for each sample year. Panel C reports the aggregate amount of notional values disclosed by *New Users* for each sample year as well as the number and percentage of firms disclosing this information. Panel D reports the industry distribution for each sample.

TABLE 2
Descriptive Statistics

Panel A: Sample Statistics and Comparison Tests

	Non-Users			**Users**			**Matched Control**			**New Users**[‡]	
Variable	Mean	Median	*t*-stat	Mean	Median	*t*-stat	Mean	Median	*t*-stat	Mean	Median
ABDAC	0.08	0.05	**1.68**	0.06	0.04	**-3.60**	0.07	0.05	0.05	0.08	0.04
ANF	4.65	3.00	-1.04	6.48	5.00	**5.86**	5.28	3.00	0.89	4.92	3.50
CAP	0.45	0.34	**-1.73**	0.58	0.49	**6.37**	0.48	0.37	0.17	0.47	0.41
CASH	0.16	0.05	**-1.66**	0.21	0.18	**3.41**	0.18	0.14	1.28	0.18	0.12
CONV	-0.11	-0.02	**3.16**	-0.14	-0.07	-0.09	-0.12	-0.03	1.24	-0.14	-0.04
CYC	214.76	107.05	1.39	132.28	95.78	**-1.72**	219.51	97.13	0.63	171.93	109.25
CURR	0.15	0.05	**-3.58**	0.16	0.12	**-2.36**	0.18	0.18	-0.36	0.19	0.13
DELTA	-1.75	0.55	**-2.76**	-0.30	0.55	0.35	-0.66	0.55	-0.58	-0.46	0.55
DTAX	-0.02	0.01	**-3.88**	0.02	0.02	0.74	0.01	0.02	-0.47	0.01	0.02
FRGN	0.41	N/A	**-5.20**	0.64	N/A	**5.30**	0.55	1.00	0.99	0.52	N/A
GAAP	0.22	0.28	**-6.01**	0.29	0.33	0.78	0.27	0.34	-1.13	0.28	0.34
GROW	0.01	0.07	**-6.64**	0.02	0.07	**-5.07**	0.04	0.08	**-1.67**	0.09	0.09
INST	0.45	0.43	**-8.98**	0.62	0.68	**-8.98**	0.53	0.69	1.07	0.57	0.63
INTG	0.12	0.05	**-0.85**	0.17	0.10	**-3.09**	0.18	0.09	-1.23	0.20	0.14
INV	0.12	0.06	-0.40	0.12	0.08	-0.89	0.13	0.08	0.44	0.12	0.08
LEV	0.42	0.37	**-5.06**	0.56	0.56	**8.62**	0.50	0.49	1.61	0.47	0.45
LOSS	0.39	N/A	**5.11**	0.22	N/A	**-3.21**	0.25	N/A	-1.37	0.29	N/A
MB	3.90	2.05	1.42	3.30	1.90	0.60	2.38	1.96	-0.64	2.92	2.15
NBM	0.03	N/A	-0.17	0.03	N/A	0.97	0.04	0.00	1.51	0.03	N/A
NOL	0.39	N/A	1.13	0.41	N/A	**1.85**	0.33	0.00	-1.16	0.37	N/A
OCF	0.03	0.07	**-5.85**	0.09	0.09	**2.69**	0.08	0.09	0.86	0.07	0.08
PPEX	0.05	0.03	**-2.78**	0.06	0.04	-0.33	0.05	0.04	-0.94	0.06	0.04
RD	0.40	0.01	**8.11**	0.06	0.00	**-2.39**	0.09	0.00	-0.74	0.10	0.00
ROA	-0.05	0.03	**-4.02**	0.02	0.04	**2.36**	0.01	0.04	1.01	-0.01	0.04
SHLTR	5.97	8.01	**-7.39**	9.20	9.67	**7.18**	7.38	8.44	-0.88	7.66	8.78
SIZE	5.09	4.96	**-11.75**	7.03	6.95	**17.86**	6.00	5.87	1.59	5.86	5.81
STD	0.66	0.72	**8.93**	0.45	0.41	**-7.56**	0.57	0.55	1.51	0.55	0.53

TABLE 2 (cont.)
Descriptive Statistics

Panel B: Univariate Correlations (Full Sample)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	*ABDAC*	1.00																								
2	*ANF*	**-0.04**	1.00																							
3	*CAP*	**-0.07**	-0.01	1.00																						
4	*CASH*	**-0.09**	0.00	**0.03**	1.00																					
5	*CONV*	**0.09**	**-0.03**	**-0.01**	**-0.14**	1.00																				
6	*CYC*	0.01	0.01	**-0.03**	0.01	0.01	1.00																			
7	*CURR*	**-0.10**	**0.02**	0.01	**0.40**	**-0.26**	0.01	1.00																		
8	*DELTA*	**-0.05**	**0.04**	**0.02**	**0.05**	**-0.03**	0.00	**0.05**	1.00																	
9	*DTAX*	**-0.19**	**0.04**	**0.03**	**0.06**	**-0.03**	0.00	**0.07**	**0.06**	1.00																
10	*FRGN*	**-0.07**	**0.20**	**-0.15**	**0.09**	**-0.08**	0.00	**-0.03**	**0.03**	**0.07**	1.00															
11	*GAAP*	**-0.17**	**0.04**	**0.10**	**0.34**	**-0.73**	0.00	**0.49**	**0.08**	**0.12**	**0.07**	1.00														
12	*GROW*	**-0.02**	**0.03**	0.01	**0.02**	-0.01	0.00	**0.01**	**0.04**	**0.06**	**0.03**	**0.04**	1.00													
13	*INST*	**-0.10**	**0.37**	**-0.15**	**0.10**	**-0.07**	-0.01	**0.13**	**0.07**	**0.04**	**0.24**	**0.16**	**0.05**	1.00												
14	*INTG*	**-0.06**	**0.10**	**-0.32**	**0.03**	**-0.08**	**-0.01**	0.00	**0.01**	**0.04**	**0.14**	**0.06**	**0.04**	**0.20**	1.00											
15	*LEV*	**0.04**	**0.02**	**0.21**	**-0.01**	**-0.02**	**-0.02**	**-0.07**	-0.01	**-0.06**	-0.01	0.00	**-0.03**	**-0.04**	**0.04**	1.00										
16	*LOSS*	**0.16**	**-0.11**	**-0.10**	**-0.28**	**0.11**	0.00	**-0.28**	**-0.12**	**-0.33**	**-0.07**	**-0.42**	**-0.11**	**-0.18**	**-0.03**	**0.05**	1.00									
17	*MB*	0.00	0.00	0.00	-0.01	0.01	0.00	-0.01	**-0.01**	-0.01	-0.01	-0.02	0.00	0.02	0.00	**0.01**	**0.01**	1.00								
18	*NBM*	**0.08**	0.01	**0.07**	**-0.07**	**0.04**	0.00	**-0.08**	-0.01	**-0.08**	**-0.03**	**-0.12**	**-0.04**	**-0.05**	0.01	**0.49**	**0.14**	**-0.05**	1.00							
19	*NOL*	**0.04**	**0.04**	**-0.10**	**-0.12**	**-0.29**	0.00	**-0.17**	-0.01	0.00	**0.13**	0.00	-0.01	0.02	**0.10**	**0.03**	**0.16**	0.01	**0.04**	1.00						
20	*OCF*	**-0.11**	**0.17**	**0.19**	**0.20**	**-0.11**	**-0.02**	**0.22**	**0.15**	**0.35**	**0.12**	**0.38**	**0.09**	**0.18**	**0.05**	**-0.09**	**-0.47**	0.00	**-0.11**	**-0.12**	1.00					
21	*PPEX*	**0.03**	**0.07**	**0.53**	-0.01	**-0.02**	**-0.02**	0.00	**0.02**	**-0.02**	**-0.13**	**0.08**	**0.04**	**0.02**	**-0.22**	**0.05**	**-0.08**	0.00	0.01	**-0.06**	**0.17**	1.00				
22	*RD*	**0.04**	-0.02	**-0.06**	**-0.06**	**0.04**	0.00	**-0.06**	**-0.02**	**-0.16**	**-0.05**	**-0.09**	**-0.16**	0.00	**-0.03**	**-0.03**	**0.11**	0.00	**0.02**	**0.02**	**-0.16**	**-0.03**	1.00			
23	*ROA*	**-0.29**	**0.07**	**0.06**	**0.18**	**-0.10**	0.00	**0.19**	**0.15**	**0.53**	**0.08**	**0.27**	**0.11**	**0.12**	**0.02**	**-0.30**	**-0.46**	0.00	**-0.14**	**-0.10**	**0.55**	**0.03**	**-0.14**	1.00		
24	*SHLTR*	**-0.28**	**0.21**	**0.07**	**0.20**	**-0.10**	0.00	**0.19**	**0.10**	**0.25**	**0.15**	**0.30**	**0.05**	**0.27**	**0.06**	**-0.10**	**-0.37**	0.00	**-0.17**	**-0.23**	**0.48**	**0.05**	**-0.12**	**0.50**	1.00	
25	*SIZE*	**-0.15**	**0.49**	**0.11**	**0.15**	**-0.09**	**-0.02**	**0.11**	**0.07**	**0.10**	**0.26**	**0.23**	**0.04**	**0.59**	**0.20**	**0.24**	**-0.25**	0.00	0.00	**-0.02**	**0.26**	**0.06**	**-0.05**	**0.18**	**0.43**	1.00
26	*STD*	**0.06**	**-0.08**	**-0.35**	**-0.05**	**0.06**	0.00	-0.01	**-0.04**	**-0.01**	**0.06**	0.00	0.01	**-0.13**	**-0.16**	**-0.45**	**0.09**	-0.01	**0.15**	**0.04**	**-0.08**	**-0.16**	0.01	**-0.05**	**-0.16**	**-0.45**

This table presents descriptive statistics for all derivative user and non-user samples. Panel A provides mean and median values of various financial characteristics along with *t*-statistics for mean test of differences between the *New User* sample and all others. Bold *t*-statistics denote significance at $p<0.10$ (two-tailed). The matched-pair *Non-User* control sample is formed by first limiting potential control firms to *Non-Users* holding no derivative positions during year *t*-1 and *t*, where *t* refers to *New User* year of initiation. Control firms are also limited to those facing *ex ante* interest rate, currency, or commodity price risks (see Graham and Rogers (2002) and Tufano (1998) for details). Firms are then matched on incentives to avoid taxes *(CAP, FRGN*, *RD, ROA*, *SIZE*, and 2-digit SIC industry membership). ‡Values for *New Users* are measured prior to derivative use (*t*-1). Panel B presents correlations between financial characteristics for the full sample where bold correlations denote significance at $p<0.05$ (two-tailed). See Appendix C for details regarding each variable, including calculations and data availability.

TABLE 3
Derivative Use and Changes in Tax Burden

Panel A: Mean Tax Burden (%) Relative to Derivative Program Initiation - New Users vs. Matched-Pair Control

	CURR		***CASH***		***GAAP***		
t	*New Users*	Control	*New Users*	Control	*New Users*	Control	**N**
-3	16.54	17.39	23.65	26.18	27.49	25.21	318
-2	16.68	15.81	25.30	27.55	28.25	25.09	399
-1	18.66	18.81	27.47	25.07	28.98	27.92	526
0	18.16	18.78	24.99	28.78	27.19	23.99	526
1	16.54	18.25	24.50	27.43	27.68	27.16	480
2	15.94	18.42	26.00	26.77	27.99	27.71	402
3	14.92	18.24	27.57	28.89	27.30	25.89	331

Panel B: Mean Changes in Tax Burden (%) Surrounding Derivative Program Initiation

	Period *t*-1 vs. *t* to *t*+3				**Period *t*-1 vs. *t*+1 to *t*+3**			
	Unadjusted		**Control Adjusted**		**Unadjusted**		**Control Adjusted**	
	Mean	*t*-stat	Mean	*t*-stat	Mean	*t*-stat	Mean	*t*-stat
CURR	-2.08	-2.11**	-1.72	-1.97**	-2.76	-2.79***	-2.26	-2.60***
CASH	-1.80	-1.39*	-3.99	-4.58***	-1.60	-1.28*	-3.32	-3.81***
GAAP	-1.42	-1.44*	0.25	0.03	-1.30	-1.21	-0.38	-0.04

Panel C: Mean Tax Burden (%) Relative to Derivative Program Initiation - Speculative/Ineffective vs. Effective Hedgers

	CURR		***CASH***		***GAAP***		**N**	**N**
t	*SPIN*	*EH*	*SPIN*	*EH*	*SPIN*	*EH*	*SPIN*	*EH*
-3	15.58	18.23	23.15	24.14	29.93	26.11	121	197
-2	15.88	17.94	25.14	25.38	28.46	28.12	150	249
-1	18.18	19.41	28.91	26.65	31.31	27.78	179	347
0	17.50	19.42	23.67	26.00	28.25	26.64	179	347
1	16.26	17.15	24.41	24.54	28.61	27.37	159	321
2	15.32	17.13	24.11	26.96	27.92	28.10	126	276
3	13.28	18.76	27.39	27.67	28.87	26.63	99	232

Panel D: Mean Changes in Tax Burden (%) Around Derivative Initiation - Speculative/Ineffective vs. Effective Hedgers

	Period *t*-1 vs. *t* to *t*+3				**Period *t*-1 vs. *t*+1 to *t*+3**			
	SPIN	*EH*	Diff.	*t*-stat	*SPIN*	*EH*	Diff.	*t*-stat
CURR	-2.36	-1.26	-1.10	-1.28*	-3.07	-1.91	-1.16	-1.39*
CASH	-4.28	-0.49	-3.78	-4.33***	-3.83	-0.43	-3.40	-3.89***
GAAP	-2.92	-0.60	-2.32	-2.66***	-2.86	-0.37	-2.49	-2.86***

This table reports tax burdens and tests of changes in tax burdens for *New Users*. Panel A provides percentage means of three tax burden metrics for *New Users* and a matched control sample relative to the year (*t*) of derivative program initiation. Panel B presents tests of mean changes in tax burden for *New Users* and *New Users* adjusted for mean changes in the control sample, where changes are measured across the indicated periods. Control adjusted changes are derived by subtracting changes experienced by the control sample from changes in *New Users'* tax burdens. Panel C provides tax burden means for *New Users* classified as either speculative/ineffective hedgers (*SPIN*) or effective hedgers (*EH*) following the Zhang (2009) procedure. Panel D presents tests of mean changes in tax burdens between *SPIN* and *EH* classifications for each metric. *, **, and *** denote significance at the 10%, 5%, 1% levels, respectively (one-tailed), assuming unequal variances. See Appendix C for details regarding each variable, including calculations and data availability.

TABLE 4

Cross-Sectional Variation in Tax Burden Changes

$$\Delta ETR_{it} = \varphi_0 + \varphi_1(\Delta RD_{it}) + \varphi_2(CAP_{it}) + \varphi_3(INTG_{it}) + \varphi_4(\Delta INV_{it}) + \varphi_5(\Delta LEV_{it}) + \varphi_6(FRGN_{it}) + \varphi_7(GROW_{it}) + \varphi_8(\Delta ROA_{it}) + \varphi_9(LOSS_{it}) + \varphi_{10}(SIZE_{it}) + \varphi_{11}(MAG_{it}) + \sum \omega_j(IND) + \varepsilon_{it}$$

Panel A: New Users Disclosing Notional Principal (NTNL) of Initial Derivative Positions

		ΔCURR		**ΔCASH**		**ΔGAAP**	
	Exp.	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat
Constant	+/-	-0.08 *	-1.64	-0.02	-0.33	0.03	0.65
ΔRD	-	0.02	0.69	0.02	0.07	0.02	0.58
CAP	-	-0.06 **	2.06	-0.08 *	-1.63	0.00	0.05
INTG	-	0.02	0.29	-0.01	-0.17	-0.05	-0.96
ΔINV	-	-0.16	-0.62	0.26	0.70	0.00	0.00
ΔLEV	-	-0.09 **	-2.18	0.07	1.09	-0.11 ***	-2.51
FRGN	-	0.34	0.85	-0.45	-0.81	-0.38	-0.93
GROW	+	0.10 ***	2.97	0.00	-0.02	0.12 ***	3.36
ΔROA	+/-	0.03	0.78	-0.33 *	-1.91	0.05	1.26
LOSS	-	-0.02	-1.08	-0.05	-1.22	-0.04 *	-1.75
SIZE	+/-	0.01	0.69	0.02	1.37	0.00	-0.58
NTNL	[H_3]	-0.10 **	-2.22	-0.09 *	-1.69	0.02	0.33
Industry		Yes		Yes		Yes	
Obs.		440		440		440	
Adj. R^2		0.07		0.06		0.07	
Overall F		2.91 ***		1.77 **		2.70 ***	

Panel B: New Users Disclosing Fair Value (FVAL) of Initial Derivative Positions

		ΔCURR		**ΔCASH**		**ΔGAAP**	
	Exp.	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat
Constant	+/-	-0.06	-1.33	0.00	-0.07	0.04	0.78
ΔRD	-	0.02	0.67	0.06	0.18	0.02	0.56
CAP	-	-0.06 **	2.14	-0.08 *	-1.80	0.01	0.19
INTG	-	0.01	0.12	-0.02	-0.25	-0.05	-0.91
ΔINV	-	-0.11	-0.43	0.31	0.85	0.01	0.05
ΔLEV	-	-0.07 *	-1.75	0.08	1.24	-0.10 **	-2.32
FRGN	-	0.36	0.90	-0.42	-0.78	-0.38	-0.95
GROW	+	0.10 ***	3.01	0.00	0.05	0.11 ***	3.35
ΔROA	+/-	0.03	0.77	-0.35 **	-2.02	0.05	1.19
LOSS	-	-0.02	-1.06	-0.05	-1.25	-0.04 *	-1.76
SIZE	+/-	0.00	0.25	0.01	1.18	-0.01	-0.82
FVAL	[H_3]	-0.16 ***	-3.24	-0.10 *	-1.66	0.03	0.49
Industry		Yes		Yes		Yes	
Obs.		456		456		456	
Adj. R^2		0.07		0.06		0.06	
Overall F		3.16 ***		1.66 *		2.61 ***	

This table presents results for tests of the cross-sectional variation in *New Users'* tax burden changes. Panels A and B report the results of estimating Equation [1] on *New Users* disclosing the magnitude (*MAG*) of initial derivatives positions, notional principal (*NTNL*) or fair value (*FVAL*), respectively. The dependent variable is the change in tax burden indicated in the column heading. Changes are measured relative to the year (t) of derivative initiation across the period t-1 versus t to t+3. Industry fixed-effects are based on 2-digit SIC codes, and reported t-statistics are based on robust standard errors (White 1980). *, **, and *** denote significance at the 10%, 5%, 1% levels, respectively (two-tailed). See Appendix C for details regarding each variable, including calculations and data availability.

TABLE 5
Determinants of Derivative Program Initiation

$$\ln \frac{P_{\text{initiation}}}{1 - P_{\text{initiation}}} = \beta_0 + \beta X + \mu, \text{ where}$$

$$\beta X = \beta_1(CONV_{it}) + \beta_2(LEV_{it}) + \beta_3(ROA_{it}) + \beta_4(NOL_{it}) + \beta_5(NBM_{it}) + \beta_6(MB_{it}) + \beta_7(RD_{it}) + \beta_8(PPEX_{it}) + \beta_9(DELTA_{it}) + \beta_{10}(ANF_{it}) + \beta_{11}(ABDAC_{it}) + \beta_{12}(CYC_{it}) + \beta_{13}(STD_{it}) + \beta_{14}(INST_{it}) + \beta_{15}(FRGN_{it}) + \beta_{16}(OCF_{it}) + \beta_{17}(SIZE_{it}) + \beta_{18}(TA_{it}^{D,S}) + \sum \varpi_k(IND) + \sum \tau_t(YR)$$

		Panel A				Panel B			
		***New User* Incentives (t-1)**				***New User* Incentives (t-3 to t-1)**			
		DTAX		***SHLTR***		***DTAX***		***SHLTR***	
	Exp.	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat	Coeff.	z-stat
CONV	+	0.29	1.39	0.35 *	1.66	0.38 *	1.79	0.48 **	2.29
LEV	+	0.19	0.91	-0.07	-0.34	0.24	1.11	-0.03	-0.17
ROA	-	-0.18	-0.79	0.06	0.20	-0.21	-0.79	0.18	0.62
NOL	+	0.09	0.90	0.03	0.28	0.07	0.73	-0.01	-0.10
NBM	+	0.18	0.58	0.21	0.66	0.21	0.67	0.17	0.56
MB	+	0.00	-0.32	0.00	-0.25	0.00	0.55	0.00	0.69
RD	+	0.27 **	2.16	0.28 **	2.17	0.00	0.09	0.00	0.02
PPEX	+	2.44 ***	3.16	2.19 ***	2.82	2.34 ***	2.99	2.14 ***	2.77
DELTA	+	0.02	1.47	0.02	1.36	0.00	0.05	0.00	-0.01
ANF	+	0.02 *	1.77	0.03 *	1.94	0.02	1.48	0.02 *	1.68
ABDAC	+	1.71 ***	2.83	1.73 ***	2.84	1.83 ***	3.04	1.31 ***	2.48
CYC	+	0.00	-0.48	0.00	-0.50	0.00	-0.86	0.00	-0.92
STD	+	0.85 ***	4.45	0.95 ***	4.98	0.69 ***	3.57	0.80 ***	4.20
INST	-	0.26	1.49	0.26	1.46	-0.16	-0.88	-0.08	-0.43
FRGN	+	0.36 ***	3.47	0.38 ***	3.64	0.40 ***	3.90	0.43 ***	4.14
OCF	+	0.01	0.01	0.57	1.33	0.56	1.32	0.94 **	2.24
SIZE	+	0.19 ***	5.25	0.23 ***	6.23	0.18 ***	4.91	0.23 ***	6.37
DTAX	[H_{4A}]	0.55 **	1.97	-	-	0.62 **	2.42	-	-
SHLTR	[H_{4A}]	-	-	0.03 ***	5.81	-	-	0.03 ***	6.03
Industry		Yes		Yes		Yes		Yes	
Year		Yes		Yes		Yes		Yes	
Obs.		11,369		11,369		11,369		11,369	
Pseudo R^2		0.06		0.06		0.05		0.05	
LR χ^2		236.9 ***		258.1 ***		193.1 ***		217.9 ***	

This table presents results for tests of the determinants of derivative program initiation by *New Users*. Panel A reports the results of estimating Equation [2] using logistic regression on a pooled sample of 526 *New User* and 10,843 *Non User* observations, where the dependent variable (*INIT*) is an indicator variable set equal to 1 if the firm is a *New User* and 0 if a *Non User*. In each panel, two separate proxies (*DTAX* and *SHLTR*) are used to test the relation between tax aggressiveness and program initiation (H_{4A}). *New Users'* incentives to initiate a derivatives program (independent variables) are measured prior to derivative use (t-1). Panel B reports the results of estimating Equation [2] where *New Users'* incentives to initiate a derivatives program are averaged over three years prior to derivative use (t-3 to t-1). Industry fixed-effects are based on 2-digit SIC codes, and reported z-statistics are based on robust standard errors. *, **, and *** denote significance at the 10%, 5%, 1% levels, respectively (two-tailed). See Appendix C for details regarding each variable, including calculations and data availability.

TABLE 6

Determinants of the Magnitude of Derivative Program Initiation

$$MAG_{it} = \beta_0 + \beta_1(CONV_{it}) + \beta_2(LEV_{it}) + \beta_3(ROA_{it}) + \beta_4(NOL_{it}) + \beta_5(NBM_{it}) + \beta_6(MB_{it}) + \beta_7(RD_{it}) + \beta_8(PPEX_{it}) + \beta_9(DELTA_{it}) + \beta_{10}(ANF_{it}) + \beta_{11}(ABDAC_{it}) + \beta_{12}(CYC_{it}) + \beta_{13}(STD_{it}) + \beta_{14}(INST_{it}) + \beta_{15}(FRGN_{it}) + \beta_{16}(OCF_{it}) + \beta_{17}(SIZE_{it}) + \beta_{18}(TA_{it}^{D,S}) + \sum \tau_k(IND) + \sum \omega_t(YR) + \varepsilon$$

		Panel A				Panel B			
		New User **Incentives (*t*-1)** **Magnitude: *NTNL***				***New User*** **Incentives (*t*-1)** **Magnitude: *FVAL***			
	Exp.	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat
Constant	+/-	-1.77 ***	-11.96	-1.75 ***	-11.72	-1.51 ***	-12.41	-1.49 ***	-12.17
CONV	+	0.04	0.53	0.16	0.19	0.03	0.48	0.01	0.15
LEV	+	0.11	1.39	0.14 *	1.68	0.11 *	1.82	0.14 **	2.14
ROA	-	-0.06	-0.62	-0.04	-0.40	0.03	0.36	0.06	0.58
NOL	+	0.06	1.51	0.08 **	1.98	0.05	1.44	0.06 *	1.88
NBM	+	0.00	0.00	0.03	0.23	0.00	-0.04	0.02	0.16
MB	+	0.00	0.27	0.00	-0.28	0.00	-0.26	0.00	-0.25
RD	+	0.09 **	2.13	0.09 **	2.15	0.07 **	2.07	0.07 **	2.03
PPEX	+	0.96 ***	3.29	0.95 ***	3.22	0.84 ***	3.54	0.84 ***	3.53
DELTA	+	0.02 *	1.93	0.02 **	1.98	0.00	1.34	0.00	1.32
ANF	+	0.01 *	1.70	0.01 *	1.61	0.01 *	1.61	0.01	1.51
ABDAC	+	0.39 **	2.03	0.41 **	2.14	0.28 *	1.78	0.32 **	2.02
CYC	+	-0.01	-0.43	-0.01	-0.43	0.00	-0.43	0.00	0.43
STD	+	0.30 ***	4.14	0.29 ***	3.97	0.23 ***	3.76	0.22 ***	3.58
INST	-	0.05	0.71	0.02	0.31	0.04	0.75	0.02	0.35
FRGN	+	0.13 ***	3.46	0.13 ***	3.36	0.10 ***	3.11	0.09 ***	3.02
OCF	+	0.00	-0.01	-0.03	-0.16	-0.02	-0.14	-0.05	-0.35
SIZE	+	0.05 ***	3.72	0.04 ***	2.89	0.04 ***	3.76	0.04 ***	2.98
DTAX	[H_{4B}]	0.15	1.65	-	-	0.09	1.06	-	-
SHLTR	[H_{4B}]	-	-	0.01	0.24	-	-	0.00	1.02
Industry		Yes		Yes		Yes		Yes	
Year		Yes		Yes		Yes		Yes	
Obs.		11,283		11,283		11,299		11,299	
Pseudo R^2		0.05		0.05		0.05		0.05	
LR χ^2		179.7 ***		174.1 ***		168.8 ***		164.6 ***	

This table presents results for tests of the determinants of the magnitude (*MAG*) of derivative program initiation by *New Users*. Panel A reports the results of estimating Equation [2] using tobit regression on a pooled sample of 440 *New Users* disclosing the notional principal (*NTNL*) of derivatives at initiation and 10,843 *Non User* firm-year observations holding no derivatives. Panel B reports the results of estimating Equation [2] on a pooled sample of 459 *New Users* disclosing the fair value (*FVAL*) of derivatives at initiation and 10,843 *Non User* firm-year observations holding no derivatives. In each panel, two separate proxies (*DTAX* and *SHLTR*) are used to test the relation between tax aggressiveness and the magnitude of program initiation (H_{4B}). *New Users'* incentives to initiate a derivatives program (independent variables) are measured prior to derivative use (*t*-1). Industry fixed-effects are based on 2-digit SIC codes, and reported *t*-statistics are based on robust standard errors. *, **, and *** denote significance at the 10%, 5%, 1% levels, respectively (two-tailed). See Appendix C for details regarding each variable, including calculations and data availability.

TABLE 7

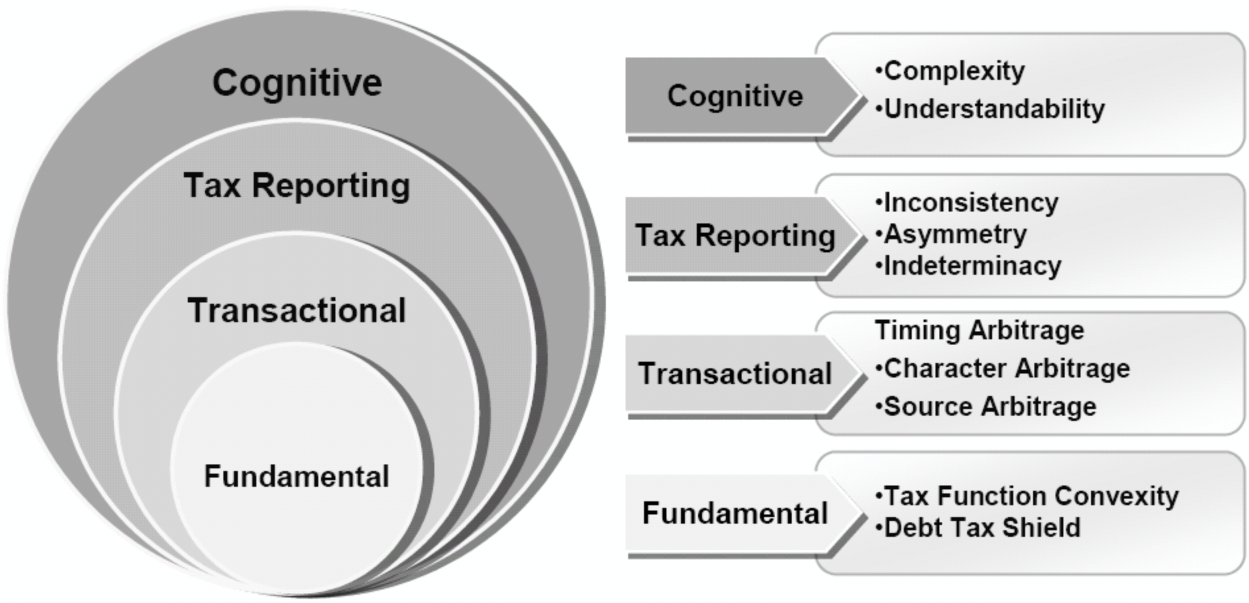
Determinants of the Magnitude of Derivative Program Initiation - Separating the Decision to Initiate from the Extent of Initiation

		Panel A								Panel B							
		Probit *INIT*		Truncated *NTNL*>0		Probit *INIT*		Truncated *NTNL*>0		Probit *INIT*		Truncated *FVAL*>0		Probit *INIT*		Truncated *FVAL*>0	
	Exp.	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat	Coeff.	*z*-stat
Constant	+/-	-2.323***	-14.47	-2.22	-0.99	-2.27***	-14.15	44.99	0.67	-2.32***	-14.47	-62.10	-0.74	-2.27***	-14.15	18.17	0.70
CONV	+	0.12	1.26	2.76	0.51	0.15	1.48	6.78**	2.22	0.12	1.26	5.53**	2.21	0.15	1.48	3.48***	3.36
LEV	+	0.05	0.52	6.10	1.27	-0.05	-0.52	10.65***	3.76	0.05	0.52	9.32***	4.29	-0.05	-0.52	4.78***	4.81
ROA	-	-0.07	-0.62	7.65	0.77	0.06	0.47	8.87*	1.77	-0.07	-0.62	5.96	1.03	0.06	0.47	0.99	0.63
NOL	+	0.05	1.18	2.45	1.08	0.02	0.48	0.54	0.45	0.05	1.18	2.57**	2.36	0.02	0.48	0.80*	1.77
NBM	+	0.15	1.03	16.58*	1.64	0.16	1.13	3.72	1.34	0.15	1.03	4.57*	1.86	0.16	1.13	1.00	0.92
MB	+	0.00	-0.30	0.41**	2.18	0.00	-0.22	0.21***	3.11	0.00	-0.30	0.17***	3.85	0.00	-0.22	0.08***	4.04
RD	+	0.12**	2.46	4.29	1.41	0.13***	2.55	0.80	0.69	0.12**	2.46	2.15	1.26	0.13***	2.55	0.46	0.71
PPEX	+	1.14***	3.19	23.29	0.99	1.05***	2.92	3.12	0.30	1.14***	3.19	5.81	0.55	1.05***	2.92	-0.72	-0.19
DELTA	+	0.01*	1.63	0.87	0.47	0.01	1.54	-0.56	-0.82	0.01*	1.63	0.37**	2.00	0.01	1.54	0.22	1.33
ANF	+	0.01*	1.68	0.60	1.13	0.01*	1.80	0.06	0.27	0.01*	1.68	0.03	0.15	0.01*	1.80	0.11	1.36
ABDAC	+	0.60***	2.48	25.73*	1.84	0.55***	2.50	23.24**	2.49	0.60***	2.48	15.87***	2.83	0.55***	2.50	9.11***	3.45
CYC	+	-0.01	-0.49	0.01	0.00	0.01	-0.49	0.00	1.35	0.01	-0.49	-0.01	0.59	-0.01	-0.49	-0.01	-0.90
STD	+	0.41***	4.66	11.50	1.00	0.44***	5.02	4.43	1.17	0.41***	4.66	2.38	0.66	0.44***	5.02	2.91**	2.13
INST	-	0.09	1.14	5.16	1.18	0.10	1.17	2.37	1.01	0.09	1.14	2.01	0.83	0.10	1.17	0.36	-0.40
FRGN	+	0.20***	4.48	3.57	0.80	0.21***	4.72	2.06	1.22	0.20***	4.48	2.86*	1.78	0.21***	4.72	1.97***	3.19
OCF	+	-0.03	-0.18	-10.38	-1.23	0.16	0.82	-7.03	-1.44	-0.03	-0.18	-1.79	-0.35	0.16	0.82	0.99	0.59
SIZE	+	0.09***	5.29	2.73*	1.62	0.11***	6.12	2.67***	2.83	0.09***	5.29	2.08***	2.44	0.11***	6.12	0.95***	2.79
IMR	+/-	-	-	27.37	0.97	-	-	-68.47	-0.82	-	-	62.37	0.60	-	-	-31.35	-0.97
DTAX	[H_4]	0.23**	2.01	-2.06	-0.25	-	-	-	-	0.23**	2.01	-1.84	-0.49	-	-	-	-
SHLTR	[H_4]	-	-	-	-	0.01***	4.99	0.08	0.40	-	-	-	-	0.01***	4.99	-0.01	-0.15
Industry		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Year		Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Obs.		11,369		440		11,369		440		11,369		456		11,369		456	
Pseudo R^2		0.06		N/A		0.06		N/A		0.06		N/A		0.06		N/A	
LR χ^2		246.1***		39.54***		262.5***		65.61***		246.1***		129.1***		262.5***		255.2***	

This table presents results for tests of the magnitude of derivative program initiation by *New Users* after separating the decision to initiate from the extent of initiation. Panels A and B report the results of estimating a variant of the Tobit model (Cragg 1971), where the truncated model includes the total notional and fair value of derivatives initiation, respectively. Two separate proxies (*DTAX* and *SHLTR*) are used to test the relation between tax aggressiveness and derivatives initiation (H_4). *New Users'* incentives to initiate are measured prior to derivative use (*t*-1). Industry fixed-effects are based on 2-digit SIC codes, and reported *z*-statistics are based on robust standard errors. *, **, and *** denote significance at the 10%, 5%, 1% levels, respectively (two-tailed). See Appendix C for details regarding each variable, including calculations and data availability.

FIGURE 1

Broad Aspects of Derivative Instruments



This figure depicts four broad aspects of derivative instruments that, when combined, provide a simple framework for describing how derivatives can be used for tax planning purposes. Each layer of the framework is high integrative and therefore, to some extent, encompasses the other three layers.

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2004 to 2006	Gunn & Company, PA, Jacksonville, Florida / Senior Tax Associate
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RESEARCH ACTIVITY

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"The Effects of Increased Book-Tax Difference Tax Return Disclosures on Firm Valuation and Behavior," (with Gary A. McGill). *Journal of the American Taxation Association* (forthcoming).

Working Papers in the Review Process

"The Effect of Tax Aggressiveness, Auditor-Provided Tax Services, and Industry-Specialization on Audit Fees" (with Robert Knechel). 2nd Round: *The Accounting Review.*
- Selected as "*Best Paper in the Audit Stream*" at the 2010 AFAANZ Annual Meeting, Christchurch, NZ.

"Clandestine Accounting: Variable Interest Entity Consolidation, Financial Leverage and Tax Shelter Participation" (with Victoria Dickinson and Gary A. McGill). Revise & Resubmit: *The Accounting Review.*

"Of Bandits and Bounty Hunters: Informant Mechanisms and Taxpayer Compliance" (with Sukyoon Jung, Gary A. McGill, and Jeff Yost). Under Review: *Journal of the American Taxation Association.*

Working Papers

"Financial Derivatives in Corporate Tax Avoidance: An Empirical Examination of New Users" (Ph.D. Dissertation).

"Financial Derivatives in Corporate Tax Avoidance: A Conceptual Analysis" (Ph.D. Dissertation).

"The Effect of Economic Conditions on Valuation Allowances for U.S. Homebuilders" (with Gary A. McGill and Ed Outslay).

Presentations

"Financial Derivatives in Corporate Tax Avoidance: An Empirical Examination of New Users." *Accounting Ph.D. Rookie Recruiting and Research Camp*, Miami, FL. December 7, 2010.

Discussant, "Pricing of Book-Tax Differences: Evidence from Short Arbitrage" by S. Chi, M. Pincus, and S. Teoh. *American Accounting Association Annual Meeting*, San Francisco, CA. August 3, 2010.

"The Effects of Increased Book-Tax Difference Tax Return Disclosures on Firm Valuation and Behavior." *Journal of the American Taxation Association* Conference, Denver, CO. February 19, 2010 (with Gary A. McGill).

"Muddying the Water: The Effect of Tax Aggressiveness, Auditor-Provided Tax Services, and Industry-Specialization on Auditor Remuneration." *International Symposium on Audit Research*, Maastricht, The Netherlands. June 26, 2009 (with W. Robert Knechel).

"Muddying the Water: The Effect of Tax Aggressiveness, Auditor-Provided Tax Services, and Industry-Specialization on Auditor Remuneration." *International Conference on Assurance and Governance*, Gainesville, FL. January 14, 2009 (with W. Robert Knechel).

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2010	Federal Income Tax I – *University of Florida*
2009	Financial Instruments and Institutions – *University of Florida* (TA)
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