NOVA School of Business & Economics and
Norwegian School of Economics

A Work Project, presented as part of the requirements for the Award of two Master's Degrees in International Finance from both the Nova School of Business and Economics and the Norwegian School of Business and Economics.

The economic significance of financial derivatives-based corporate tax avoidance

Sabrina Maria Erlacher

Workproject carried out under the supervision of:

Prof. Fernando António Nunes Dionísio Rodrigues dos Anjos

21-05-2021

The economic significance of financial derivatives-based corporate tax avoidance

Abstract

This working project provides evidence that a significant part of the burgeon population of derivative-using firms effectively avoids corporate tax and that specific tones in 10-K filings can reveal crucial information about firms' tax preferences. Findings show no evidence that firms hold financial derivative instruments exclusively for risk management purposes (e.g. reduction of earnings volatility), indicating a frequent exploitation of the legislative grey zone of derivatives taxation. Aggressive tone or the use of weak modals and complex words in firms' 10-K filings increase firms' amount of tax avoidance. In case of aggressiveness, the effect of tone is significantly more negative for derivative-using firms.

Keywords: Financial Derivatives, Corporate Tax Avoidance, Henry Sansing, Textual Analysis

Acknowledgements

First and foremost, I would like to thank my supervisor, Mr. Fernando Anjos, for his continuous constructive support and the enriching and inspiring discussions that ultimately shaped my research to a large extent. I learned a lot from our interactions and am grateful for his attitude of constantly challenging me to think "a little bit beyond". Next, I want to thank Mr. Michael Donohoe, who has provided me with an essential hint during the data gathering process in the initial stage of my research. His previous research has captured my interest in a way that I decided to study the field of corporate tax avoidance and derivatives more in depth and to finally write this paper. In addition, I would like to express my honest appreciation to Mr. Robin Qvarfordt, whose fantastic programming skills have not only helped me overcoming certain issues during the development of this report but more importantly, have inspired me to dive deeper into the world of programming. He also taught me that perseverance, innovative thinking and the strong will to find a solution are

among the most important characteristics of a programmer. Furthermore, I am grateful for my family, in particular my mother, Ms. Bernadette Erlacher, my grandparents, Elisabeth and Wilfried Erlacher and Ms. Olga Pavan, who have been supporting and motivating me until I wrote the last word of this working paper.

Contents

1 Chapter: Introduction

At the turn of the millennium, the introduction of SFAS No. 133 and 138 (FASB 1998, 2000) not only brought fundamental changes to the financial reporting of derivatives but, simultaneously, also countless incentives for firms to start using financial derivative instruments. While the focus of the empirical literature on derivatives has long been on the corporate risk management (e.g. CRM literature and Corporate Hedging such as Tufano 1996; Smith and Stulz 1985), over the last years many researchers have started to investigate other derivative-related benefits, in particular the avoidance of corporate tax. A significant portion of researchers and legislators regard derivatives as instruments capable of enduringly reducing global tax revenue and the Organization for Economic Cooperation and Development (OECD) declares derivatives as a principal "source of corporate tax non compliance" (Donohoe 2015b; Monsenego 2011). One of the salient papers in this field is Donohoe's study from 2015, in which he examines the economic significance of corporations' tax savings stemming from derivatives usage, filling a gap in the outstanding research literature (Donohoe 2015b). He considers a time frame between 2000 and 2008 and finds an overall reduction in corporate current and cash effective tax rates. In this report I extend Donohoe (2015b) in two main ways: First, I consider a more recent time period, which allows me to investigate whether the effect of derivatives usage on effective tax rates remains negative after the financial crisis, which introduced considerable changes to the financial macro environment.[1] Second, I carry out a deeper cross-sectional analysis, by interacting derivatives usage not only with several key firm characteristics (i.a. volatility of taxable income and cash flows), which allows me to better tease out which firms seem to be using derivatives for risk management purposes rather than tax avoidance but also with qualitative measures from a tone analysis to further examine the relation between prevailing expressions in public financial reports and tax avoidance.[2] In addition to this,

1. For instance, the enduring period of historically low interest rates provided firms with a cheap and easy access to leverage. As can be seen in Figure 2 in the appendix, the amount of global non-financial bonds and loans amounted to approximately 66 trillion USD in 2017 (BIS Monetary Economic Department, Basel, Switzerland 2016; McKinsey Global Institute 2018). This is almost as high as the additional government debt that has been taken on over the same period to overcome both the drastic drop in tax revenues and the growth in social welfare payments.

2. Note that also Donohoe makes use of interaction terms in his research, however, while his derivatives user variables are binary (old user, new user or non user) mine is continuous, meaning that I attempt to proxy derivatives

I carry out a second analysis, substituting the traditional ETRs (Effective Tax Rates) by the Henry Sansing Measure to avoid the data truncation bias. I find reductions in cash (current) rates. For instance, one-standard-deviation increase in Total_Hits (0.0016) causes a reduction of 0.7% (0.6%) in the cash rate (current rate), accounting for approximately 3% (2.4%) of the rate's unconditional mean. Also for the HS sample, I observe a negative and significant correlation between derivatives intensity and the HS measure (Table 32), supporting the findings in the ETR sample. The findings are consistent with prior research in this field (Donohoe 2015b; Lee 2017). The sentiment analysis shows that firms with an aggressive tone in 10-K filings are highly likely to avoid more taxes than their less aggressive peers when derivatives usage is kept constant. The same is true for firms using weak modals or complex words.[3] I also find that the effect of derivatives usage on cash ETRs is intensified for firms that use a highly aggressive tone in their 10-Ks.

1.1 Research approach overview

As mentioned above, this research paper aims at broadening the knowledge about financial derivatives users in the context of tax avoidance by carrying out a detailed cross-sectional analysis. Based on Donohoe (2015b), I first inspect the post-financial crisis period between 2009 and 2020, to verify whether the intensity of firm's derivative usage (Total_Hits) continues to play a significant role in the amount of tax avoidance by using the number of total derivative-related keyword hits as proxy for derivatives usage (normalized by total words in the 10-K filing to guarantee comparability across firms).[4] Subsequently, after having looked at the single effect of derivatives usage on tax avoidance, I interact Total_Hits with taxable income volatility, cash flow volatility as well as total corporate debt. Taxable income volatility and cash flow volatility can both be reduced through hedging, which often leads not only to a smoother income but also to a reduction in tax rates. For this reason, firms with high volatility in earnings and or cash flows are not likely to use

intensity instead of classifying firms in the three categories.

3. For instance, for cash rates I find reductions of 0.52%,accounting for approximately 2.4%of the cash rate's unconditional mean.

4. I run the cross-sectional analysis with a modified Total_Hits variable to consider the issue of potential double counting when computing Total_Hits. To illustrate, "swap" and "swap agreement" will be double counted as the former is part of the latter. However, differences are subtle and therefore I do not report them here.

derivatives explicitly for tax avoidance purposes. Moreover, firms with high levels of leverage have more exposure to interest rate risk, the most hedged type of risk on the OTC derivatives market according to the Monetary Economic Department, Basel, Switzerland 2020, and can reduce the risk through, for instance, derivatives hedging. Even if such firms decide to hedge their exposures through derivatives, they are likely to experience a reduction in tax rates because of the high amount of tax deductible payments rather than the use of financial instruments.

In the second part of the analysis I test whether the prevalent tone in the 10-K filing conveys information about derivatives users. For instance, users with a more aggressive tone might engage more in non-conforming tax planning strategies than users with a less aggressive tone. These analyses should foster a better understanding of whether the gap between statutory and effective tax rate for corporations enlarges as the use of derivatives increases and whether derivative users are characterized by a certain tone that prevails their financial statements. I first look at the individual effects of aggressive tone, weak modals and complex words as firms with a more litigious tone may pursue more aggressive tax planning strategies, while firms that use many complex terms or weak modals may want to mask or hide their actions. Subsequently, I interact Total_Hits with aggressiveness, complexity and weak modals to test whether the effect of tone is significantly more negative (positive) for derivative-using firms.

Furthermore, in this research paper I do not only include conventional tax avoidance measures, in particular the "Long Run Effective Tax Rate Measure" (developed by Dyreng, Hanlon, and Maydew 2008), but also the "Henry and Sansing HS Measure" (Henry and Sansing 2018), which helps avoiding the data truncation bias and compared to ETRs this measure is not exclusively driven by pre-tax profitability.[5] Even though firms that report a negative income represent an economically relevant and increasing part of the overall number of publicly traded companies, they are generally

5. When calculating ETR measures, researchers usually include exclusively non-negative pre-tax income observations, due to the difficult interpretation of negative ETRs (Henry and Sansing 2018; Limberg and Wilkie 2008). Several studies already include the HS measure as a proxy for corporate tax avoidance: (Koester, Shevlin, and Wangerin 2016; Bonsall, Koharki, and Watson 2016; Cen et al. 2017). Longrun ETRs include loss firms to a certain extent, as only firms whose n-year sum of pre-tax income (less special items) is positive are considered in the sample.
As profitable and non-profitable years are treated asymmetrically when computing long run ETRs, they might cause a distortion of results.

excluded from research samples in the field of tax avoidance. Hence, knowledge about negative income firms' tax positions is still comparatively scarce. Another non-neglectable feature of the HS measure is that it captures both non-conforming as well as conforming corporate tax avoidance, while ETRs are known to capture exclusively the non-conforming part (Badertscher et al. 2015). HS should therefore be considered as an even more reliable estimator of tax avoidance as it includes all observations, regardless of whether firms report gains or losses and gives insights about corporations' tax advantage/disadvantage. All main regressions are run using both ETRs (Effective Tax Rate Measures) and the HS Measure as the dependent variable.

1.2 Literature review

For the first half of 2020, the Bank for International Settlements reports a total market size of OTC derivatives of 606.8 trillion USD (Monetary Economic Department, Basel, Switzerland 2020).[6] Overall, businesses most frequently use derivatives as risk management strategies to protect themselves from shifts in interest rates, foreign currency exchange rate movements as well as changes in commodity prices (Stulz 2004). However, down to the present day, after several proposals to reform derivatives taxation (Rosenthal 2016; Accounting Today 2013), the legal tax framework of derivatives remains ambiguous (Lee 2017; Weidmann 2015) and leaves space for corporations to adopt sophisticated strategies to avoid tax with derivatives (Donohoe 2015b). As has been discussed extensively in the outstanding Corporate Risk Management (CRM) theory over the last decades, hedging reduces taxes by flattening the volatility of taxable earnings (hence the expected tax liabilities) in case the corporation depicts a convex tax function (Tufano 1996; Graham and Smith 1999; Smith and Stulz 1985).[7] However, an additional type of tax avoidance stems from the legislative grey zone through which firms navigate by choosing the amounts and types of derivative instruments that yield the most favourable tax outcome (Congressional Budget Office CBO 2018).

6. A table showing the amounts of notional value of the OTC derivatives market over the last 20 years can be found as Figure 1 in the appendix.

7. Generally, 75 % of all firms show a convex tax function. In particular, businesses that experience tax progressivity (the effective marginal tax rate increases with the amount of taxable income) have more hedging incentives as the tax increase in years of low income is by far outweighted by the tax reduction in years of high income.

Guter-Sandu et.al claim the current derivative tax regulatory system to have three types of shortcomings, namely "inconsistency, indeterminacy and asymmetry", which enable users of derivatives to "tinker with transactional forms" and consequently provide them with opportunities for a more beneficial taxation of their derivative positions (Guter-Sandu et al. 2018; Kleinbard 1991). In order to properly understand companys' tax planning strategies and how they exploit cubbyholes in the legal system to choose the financial instrument that ultimately minimizes tax payments, it is necessary to first look at the firm from an accounting perspective. Firms of a certain size are required to adhere to financial reporting standards, which require them i.a. to present both a balance sheet and an income statement. Derivatives may be used in a way to let specific items on the balance sheet either disappear completely or change their appearance on the income statement, hence reducing the overall effective tax of the firm. To illustrate this phenomenon, one can imagine a company that wants to acquire an equity stake in another company. The most straightforward way would be acquiring the shares directly from the selling party, but there are multiple financial transactions that lead to approximately the same outcome. The potential buyer can, for instance, make use of the put-call parity by buying a call and selling a put, carry out an equity swap, enter a forward contract or purchase an up-front forward on the seller's shares.[8] Even though all forms of transactions yield almost identical outcomes, each of them is taxed differently. In essence, this suggests that taxpayers can select the alternative that, according to their individual tax preferences, optimizes their tax payments. For this reason, "cubbyholes" in the legislative derivative taxation system leave plenty of space for creative use of even simple financial instruments, reinforcing a company's incentive to engage in tax manipulation and exploit the opacity of the legal system.

The second relevant part of this paper is the textual or sentiment analysis. Even though this examination is qualitative and might therefore be subject to higher imprecision than purely quan-

8. The concept of put-call parity originally stems from Hans Stoll (Stoll 1969) and affirms that, in perfect capital markets, the following equation must hold: Call - Put = Stock - PV(X). Note that this is true only for European options and for non-dividend paying shares. Stock refers to the share price, X is the spot price, Call and Put are defined as the respective call and put option prices with spot price X and equivalent dates of expiration. PV refers to the present value of the spot price, discounted from the expiration date (Cremers and Weinbaum 2010).

titative investigation methods, it is still recognized as a valuable tool by researchers to explore the tone dominating a certain text, or, in this case, the 10-K filing.[9] This paper focuses on the so-called "Bag-of-Words" technique in which the researcher first extracts single words from a collection of characters and then attempts to understand their meaning, which for the single word is unambiguous. The word lists used in the analysis stem from Loughran and McDonald (LM) (Loughran and McDonald 2015, 2016), whose dictionaries have been proven to be the most reliable in business context compared to other existing dictionaries.[10]

However, there is still a certain extent of imprecision that derives from the fact that words always appear in a specific context and reflect the style of a specific author, leading to a more challenging interpretation of the qualitative results. For instance, it has been scientifically proven that embedding negative information in positive words is frequently utilized by managers by simply negating positive words.[11] This is consistent with the findings of Loughran and McDonald (Loughran and McDonald 2011), who affirm that the positive sentiment analysis is often subject to flaws due to the negation of positive expressions. The same is not true for negative tones, which are considered to be generally more reliable, as it is not common for management to negate a negative word to convey positive information. In this paper, the analysis focuses on negative, complex, uncertain and litigious words as well as strong and weak modal verbs.[12]

This research paper adds to the outstanding literature about corporate derivatives and tax avoid-

9. The "tone" is, for instance, defined as the number of complex, negative, positive, uncertainty or litigious word occurrences in a text, here normalized by the total word count in the filing to make the measure comparable across firms. Even though the scaling by the total word count may lead to some misclassifications of results according to Zipf's Law (Cancho1 and Solé 2001), it is a widely-used scalar in the outstanding literature due to its rather easy computation (Loughran and McDonald 2016).

10. LM considered the most likely contextual appearance of words in business texts when creating the lists. Moreover, their dictionaries are easy to comprehend, do not miss any common negative or positive terms and, most importantly, have been established with the typical financial communication used by managers in 10-K filings.

11. To illustrate, look at the following sentence, taken from Abbott Laboratories' 10-K statement: "Abbott's research and development efforts may not succeed in developing commercially successful products and technologies" (ABBOTT LABORATORIES 2017, 10-K filing). Even though the sentence indicates a potential failure, the examination will lead to a positive tone, as the phrase contains "succeed" and "successful", which are both ranked in the positive word dictionary for this analysis. In addition to this, other companies that have a positive (or negative) word in their name, will be misclassified as overly positive (negative). An example herefore is the "Alliance Data Systems Corp", as "alliance" is also contained in the positive word list for the analysis.

12. Strong modals show confidence while uncertain words and weak models reflect insecurity and may attempt to hide bad news.

ance (Donohoe 2015b; Lee 2017; Bendi and Subagio 2018). Academic research has looked at tax incentives to hedge risk and tax benefits deriving from derivatives use (Graham and Smith 1999; DeMarzo and Duffie 1995). In particular, this report analyzes a more recent time period than existing research papers on derivatives' effects on corporate tax avoidance do (Donohoe 2015b) and includes a more comprehensive proxy for tax avoidance, the HS measure. As an increasing number of firms started using derivatives, looking at a more recent time period may give valuable insights whether the effect of tax avoidance continues to be a prevalent feature of derivatives. As mentioned above, the HS measure is a relatively new tool in the current corporate finance literature to proxy tax avoidance and should deliver an overall broader picture because loss-firms are not simply excluded from the analysis, ultimately increasing the sample size.

Furthermore, this report also adds to the burgeon research in the context of sentiment or textual analysis, which inspects the information contained in, for instance, financial accounting reports, such as 10-K filings. A few studies have already looked specifically at text analysis with respect to taxes. Luo et. al implemented a disclosure score to rate the qualitative information of income tax related footnotes (Luo et al. 2017). The authors observed that the more information about corporate tax planning strategies is contained in firms' reports' income tax related footnotes, the higher the firms' market values of tax avoidance. Allen et. al create several tax-related dictionaries (together with tax experts) and subsequently implement a keyword search in specific text sections concerning corporate tax (Allen et al. 2020). They found that certain "bags of words" provide information about current as well as future ETRs. Hutchens examines how certain aspects of tax footnote disclosure, such as less complex words and jargon or more quantitative information, can lead to more accuracy in analysts' forecasts of companies' effective tax rates (ETRs) (Hutchens 2017). Law and Mills find that more financially constrained firms (defined as companies which integrate more negative wording in their financial reports) engage in more aggressive strategies to avoid tax (Law and Mills 2015). For such companies they observe more elevated current and future unrecognized tax benefits, lower ETRs, more frequent requests for audit adjustments as well as higher activity in tax havens for their material operations. Even though the abovementioned

papers have looked at the relationship between textual tone and tax avoidance, prior research has not closely investigated which role derivatives usage plays in that relationship.

Chapter 2 of this paper briefly discusses the concept of corporate tax avoidance based on derivatives use as well as the hypothesis development. While Chapter 3 provides an overview of the data and sample used for the analyses, the subsequent part explains the research instruments and design implemented. Chapter 5 contains the discussion of results and the last chapter provides some concluding remarks as well as research limitations and suggestions for future research. The entirety of regression tables, other relevant additional information as well as a detailed list of all input variables and their respective computations are outlined in the appendix in chronological order. A list of figures and tables is outlined at the beginning of the appendix.

2 Chapter: Overview & Hypothesis Development

2.1 Financial derivatives as tools to elude corporate taxation

Derivatives are financial instruments, in particular contracts or securities, whose values are derived from an underlying, which mainly pertains to one of the following groups: physical commodities, financial assets, indices, interest rates, currencies or other derivatives (Companies and Securities Advisory Committee 1995; Stulz 2004). Derivatives are mainly subdivided in the following four clusters: futures, forwards, swaps and options (Chisholm 2010).[13] Even though many corporations use financial derivatives for hedging purposes, hence to reduce risk, there is evidence for an increasing number of enterprises that use them to avoid corporate tax (reduce their tax liabilities) (Graham and Rogers 2002).[14] In the past, this phenomenon has not only drawn attention from researchers,

13. Forward contracts are stipulated between two private parties. While one party agrees to purchase the underlying on a pre-specified date in the future at a fixed price, the other agrees to sell the underlying at the same conditions. Future contracts are in-essence very similar to forwards, with the only difference that the contract has an organized and regulated exchange acting as an intermediary between parties. Swaps are agreements to exchange payments over several pre-specified dates in the future. Options generally provide the holder with the right to buy (call) or sell (put) the underlying at a fixed price and date in the future.

14. In this paper corporate tax avoidance is defined as the diminution of so-called ”explicit taxes”, which are the real taxes paid to tax authorities (Wright 2001).

but preeminently from regulators and lawmakers, who have expressed their serious concerns in this regard (United States Government Accountability Office 2011). Donohoe identifies two sources of tax avoidance, namely tax avoidance as a byproduct from corporate risk management (hedging) and as transactional, which is defined as tax avoidance stemming from the ambiguous nexus of derivative based taxation (Donohoe 2015a). For the latter, he raises three considerations: inconsistency in derivatives taxation, failed timely tax law adaptions as consequence of financial innovation and the disproportionate tax treatment of the parties involved in the transaction.[15]

2.2 Hypothesis development

Prior research has shown that corporations use financial derivatives to reduce mainly three types of risk exposure: interest rate risk, commodity price risk and foreign exchange rate risk (Bartram, Brown, and Conrad 2011). In particular, derivative-based hedging can reduce pre-tax income volatility, which might ultimately result in lower tax payments (Graham and Smith 1999). In addition, research has proven that tax savings stemming from derivatives are economically significant (Donohoe 2015b) and past government reports express concerns about the potentially abusive side of financial derivatives, considering them as a "threat to global tax revenue" (United States Government Accountability Office 2011). In fact, derivatives are regarded to be in the most intricate field of financial reporting and tax regulation (Chang, Donohoe, and Sougiannis 2016). Another more recent study (Lee 2017) has found that non-financial corporations use both hedging and non-hedging derivative instruments and tend to "aggressively avoid taxes rather than benignly defer taxation" by exploiting the ambiguous non-hedging derivative tax regulation. The same paper suggests that enterprises' main focus is not on controlling their income through tax payments by using derivative instruments. In this report, I first test whether a corporation's cumulative tax savings enlarge as the

15. 1. Inconsistency in derivatives taxation: derivative instruments that are comparable in size and nature are not taxed equivalently in all circumstances.
2. Failed timely tax law adaptions: Financial derivative instruments have grown in complexity over time and still today there is confusion about the applicable taxation for numerous derivatives (especially if they are more sophisticated than simple "plain-vanilla" instruments), which leaves room for "creative" tax planning strategies.
3. Disproportionate tax treatment: Also characteristics of the taxed party, such as the intention (risk reduction vs speculation), the type or entity or the applicable judicature (national or international/foreign) do ultimately influence the amount of taxation.

firm enlarges its number of derivative instruments. For the hypothesis to be true, I expect a negative association between the derivative intensity variable (Total_Hits) and the dependent variable (either ETRs or Henry Sansing).

H1: Tax avoidance (the amount of tax savings) increases as a firm's derivative usage increases.

As literature suggests that a significant part of the overall population of firms mainly uses derivatives to hedge the abovementioned risks (interest rate, foreign exchange, commodity price) rather than to avoid corporate tax (Bartram, Brown, and Conrad 2011), I include interaction terms to better understand which firms are the least likely users of derivatives for tax avoidance purposes only.

The most straightforward interaction to investigate is volatility because volatile firms can hedge their risks through derivatives and hence reduce their taxes by smoothing their income (Smith and Stulz 1985).[16] Both the volatility of estimated pre-tax income and the volatility of cash flows are considered in the analysis. To test the hypothesis, I first divide firms into quintiles based on volatility in both categories and then include an indicator variable that equals 1 for the firms in the highest volatility quintile and consequently let this variable interact with derivatives usage. I expect the interaction term between volatility and derivative usage to be negative for firms in the highest volatility quintile.

H2: High income (cash flow) volatility firms are on average less likely users of derivatives exclusively for tax avoidance purposes.

Consequently, derivatives usage is interacted with the firm's level of leverage. Holding large amounts of debt implies a greater exposure to interest rate risk, which, as mentioned, can be mitigated through hedging with derivatives. This implies that highly levered firms are not likely to use derivatives only to avoid corporate tax. To test the hypothesis, I first divide firms into quintiles based on their leverage and then include an indicator variable that equals 1 for the firms in the highest leverage quintile and consequently let this variable interact with derivatives usage. I expect

16. Mitigating significant fluctuations in y-o-y cash flows contributes to an overall more stable pre-tax income.

the interaction term between leverage and derivative usage to be negative for firms in the highest leverage quintile.

H3: Highly levered firms are on average less likely users of derivatives exclusively for tax avoidance purposes.

The second part of my analysis focuses on how certain facets of "tone" in the 10-K statement, such as negative or uncertainty words, are related to the company's effective tax rate. As mentioned before, an elevated use of certain words indicates specific types of behavior (e.g. a firm that uses a large number of weak modals might want to mask certain negative aspects or dubious activities of the business, such as using financial derivatives to reduce the amount of tax payments). The analysis is carried out to understand whether an extensive use of either more aggressive expressions, complex words and weak modal verbs in the 10-K filing indicates a higher tax avoidance of firms. In this section I also introduce interaction terms to the regression, to test whether derivative-using firms with a particularly aggressive tone or a high complexity and weak modals usage avoid more tax than firms that do not have such tones. As before, I first divide firms into quintiles based on their word frequency in the specific category (aggressive, complex, weak modals) and then include an indicator variable that equals 1 for the firms in the highest quintile in that specific category and consequently let this variable interact with derivatives usage. According to what has been said above, hypotheses 4 and 5 assume that inferences about the firm's tax preferences can be drawn from an extensive use of a certain tone.

H4: Firms, whose 10-K filings show a particularly aggressive tone avoid more tax than firms with less aggressive tones.

H5: Firms, whose 10-K filings show a high number of complex words or weak modals avoid more tax than firms with lower numbers of these words.

3 Chapter: Data & Sample

Firm specific data is obtained from the Compustat database for annual accounting periods from 2009 to 2020. I exclude companies that do not meet the following criteria: publicly held, legally incorporated in the US territory, at least 3 years of observations and all industries except financial and utility sector.[17] The intensity of derivative usage by firms is identified by implementing a derivative-related keyword search in the entire 10-K Form.[18]. All firms without necessary observations to estimate the models are dropped from the sample, resulting in a final sample of 8,665 (10,465) observations for the ETR sample (HS sample) .

To determine the"tone" prevailing the 10-K filing (e.g. aggressive, uncertain, etc.), I carry out a sentiment analysis based on the Loughran-McDonald Sentiment Word List (Loughran and McDonald 2016), by extracting information from and computing sentiment measures for EDGAR's 10-K filings for each company. Firms, whose reports show a total word count of less than 2,000 words are excluded from the sample, because such files most likely contain only firms' justifications for exemptions from filing the 10-K.

4 Chapter: Research Instruments & Design

To test hypothesis 1 outlined in chapter 2, I run the subsequent model by using first traditional ETRs and then the HS Measure as a dependent variable: [19]

17. Those sectors are more prone upfront to hold derivatives for speculation rather than hedging purposes compared to other industries (Lee 2017). Moreover, firms operating in the financial and utility industry (GIC codes starting with 40 and 55, respectively) are often subject to different tax reporting schemes.

18. List of keywords used: derivative, derivative instrument, hedging instrument, swap agreement, swap, forward contract, currency exchange contract, foreign exchange contract, futures contract, option, option contract, hedging instrument, hedge instrument. Those words are then normalized with the total number of words in the filing to make them comparable across firms.
Most public US companies must submit an annual 10-K form. This report usually includes more granular information than the annual financial report to shareholders and is saved in the SEC (U.S. Securities and Exchange Commision) EDGAR database (SEC Office of Investor Education and Advocacy 2011).

19. A detailed overview of all the variables and their respective calculations can be found in the appendix. I also run the same model by replacing the Total_Hits variable with Derivative_Instrument, where this variable is used as a proxy for the firm's derivative intensity of a certain instrument (obtained from the derivative related keyword search and made comparable across firms by normalization). In this paper I test for Options, Futures, Forwards, Swap Agreements, Currency (or Foreign) Exchange related hedging. However, focusing on specific instruments does not seem to matter

$$\begin{aligned}\mathrm{ETR(HS)}_{it} = \beta_0 &+ \beta_1 \mathrm{Total\_Hits}_{it} \\ &+ \sum_a \beta_a \mathrm{RiskManagementIncentives}^a_{it} \\ &+ \sum_b \beta_b \mathrm{TaxAvoidanceIncentives}^b_{it} \\ &+ \sum_c \beta_c \mathrm{Controls}^c_{it} + \epsilon_{it} \end{aligned} \tag{1}$$

where Total_Hits is used as a proxy for the firm's overall derivative intensity (obtained from the derivative related keyword search and made comparable across firms by normalization). According to the hypothesis that the tax advantage increases with derivatives usage, the Total_Hits variable is expected to be negatively associated with both ETRs and HS ($\beta_1 < 0$). Risk Management Incentives, Tax Avoidance Incentives and Control Variables are based on Donohoe's study in 2015 (Donohoe 2015b).

The group of Risk Management Incentives includes several variables that affect corporate use of derivatives. First, I include the original AltmanZ score (AltmanZ_Score), an empirical model to predict bankruptcy, as past scientific research has proven that derivatives can help overcoming financial difficulties (Abdulkareem 2015; DeMarzo and Duffie 1982). Literature also suggests that derivatives are a way to align funds management and investment goals (Amuthan 2014), therefore the underinvestment score (Underinv_Score), indicator of a firm's failure to invest sufficient resources, is included.[20] In certain circumstances, preference shares (Pref_Shares) as well as convertible debt (Debt_Conv) are preferred over traditional derivatives, hence can disincentivize derivative-related corporate risk management (CRM).[21] Another fundamental hedging incentive in the CRM literature

as I do not obtain significant results in any of those tests.

20. Derivatives are also known to be capable of reducing the principle-agent issues (Smith and Stulz 1985). Following Bergstresser and Philippon (Bergstresser and Philippon 2006), it would have been appropriate to include their executive incentive ratio as a regressor, namely the sensitivity of CEO compensation on enterprise value. However, this regressor has been excluded due to insufficient data for the sample observations, but its computation can still be found in the variables calculation section in the appendix.

21. For instance, convertible debt implicitly stands for an option on the company's assets that lowers the sensitivity of equity value to shifts in firm value. Dorion et. al observed a drop in asset volatility after convertible debt had been issued (Dorion et al. 2014).

originates from volatility in both income (Inc_Vola) and cash flows (CF_Vola) and can be mitigated by earnings smoothing (Titman and Trueman 1988). Down to the present day, interest rate risk (IntRate_Risk), commodity price risk (ComPr_Risk) and foreign exchange rate risk (FX_Risk) are still considered to be the most frequent motives for using derivative instruments and are therefore included in this group (Stulz 2004) of variables.

The next group of regressors reflect Tax Avoidance Incentives. Volatility of taxable income (Tax_Inc_Vola) is included because according to Smith and Stulz, marginal tax rates are lower for firms which engage in income smoothing (Smith and Stulz 1985). This regression also controls for tax-loss carryforwards (TLCF_Dummy, TLCF_Change) to approximate the firm's urge to reduce its income tax. As loss firms can smooth their losses, they tend to have wider ranges of tax convexity (Lee 2017), meaning that such firms presumably have higher derivative-related tax savings because of their convex tax functions and lower volatility of taxable earnings. Tax-loss carryforwards can be used by those firms in future profitable years to reduce taxable income. Cash and cash equivalents are included as well, defined as businesses' cash needs, which in certain cases may induce them to engage in tax planning (McGuire, Omer, and Wang 2012).[22] As research suggests, economies of scale and the complexity of a business are related to tax avoidance (Chen et al. 2010). Therefore, equity income from unconsolidated subsidiaries (Eq_Inc), property, plant and equipment (PPE), depreciation and amortization (Dep_Am), long term debt and book-to-market ratio (BTM) are included as well.[23]

The last group comprises a set of other Control Variables, which might have both an impact on the intensity of derivatives usage as well as the engagement in tax planning strategies. I account for firm size (Firm_Size) as larger firms are more prone to use derivatives (Bodnar, Hayt, and Marston 1998), Return on Assets (ROA, ROA_Change) for firm profitability, income generated from operations abroad (ForInc, ForInc_Change), whether the auditor is among the top 4 auditing firms (AuditBig_Dummy) as well as the cash flow stemming from Mergers and Acquisitions

22. An example could be tax deferral strategies.

23. Research and development expense should be included as well, but I exclude it in almost all cases due to limited observations, which drastically reduce the panel size.

(M&A_Dummy).[24] Futhermore, abnormal accruals (Anbnorm_Acc) are included because of the positive relation between "financial reporting aggression and tax avoidance" (Frank, Lynch, and Rego 2009). Industry and/or time fixed effects are included to control for variation in how intensely corporations use derivative instruments across industries and time periods.

Instead of using annual effective tax rates (ETRs), I use long-run ETR measures developed by Dyreng et.al to overcome some of the limitations of annual rates (Dyreng, Hanlon, and Maydew 2008).[25] I use different types of 3 year forward looking ETRs, namely Cash ETR (Cash_Rate), Current ETR (Current_Rate) as well as total ETR (Total_Rate). Cash ETR is defined as the firm's cash tax expense divided by pre-tax income less special items and captures strategies that lead to a reduction in the actual tax payments. Current ETR is defined as the firm's current tax expense (total tax expense excluding deferred taxes) divided by pre-tax income less special items and is likely to capture non-conforming tax avoidance as well as tax deferral strategies. The last, total ETR (total tax expense including deferred taxes), is the firm's total tax expense divided by pre-tax income less special items and this measure captures tax planning strategies that most likely result in a lasting reduction of taxes as well as it accounts for tax-related accruals in earnings management (Lee 2017). As mentioned in the beginning, I run the same analysis with a different dependent variable, the Henry Sansing Measure (HS_Measure). This is to fully overcome the data truncation bias caused by loss firms, as both researchers, Henry and Sansing, argue that even though long-run ETRs are more resilient to the truncation bias, they still substantially suffer from it (Henry and Sansing 2018).[26] The HS measure is computed by dividing cash tax expense less statutory rate times pre-tax income scaled by the market value of assets and captures the tax preferences of the individual firm. To compare, for firms that successfully avoid tax, the HS measure will be negative

24. The top four auditors are Ernst& Young, Deloitte &Touche, KPMG and PricewaterhouseCoopers.

25. By looking at a longer time horizon, in our case 3 years, the potential mismatch of periods is reduced, namely summing up three years of tax expense makes it less likely that the denominator does not capture a substantial part of the time period that the numerator refers to (Gebhart 2017). From year-to-year annual rates often suffer from high volatility, which can be reduced by measuring corporate tax avoidance over a multiple time period. Also, the data truncation bias can be reduced (but not fully eliminated as in the HS measure) as firms are not excluded a priori if their history shows, for instance, a single loss year.

26. To illustrate, in a study from 2008, Dyreng (Dyreng, Hanlon, and Maydew 2008) drop 15 percent of the total observations in the sample due to this phenomenon.

(as their tax preferences are negative) and the cash ETR will be lower than the statutory rate.[27] Firms without any tax preferences will have a cash ETR that is exactly equal to the statutory rate and a HS measure of zero. Compared to ETRs, HS captures both non-conforming as well as conforming tax avoidance, while ETRs only capture the non-conforming part of tax avoidance.

Hereunder are some modifications to the previous model, which help testing the hypotheses outlined in chapter 2:

$$\begin{aligned}\mathrm{ETR(HS)}_{it} = \beta_0 &+ \sum_a \beta_a \mathrm{SentimentMeasures}^a_{it} \\ &+ \sum_b \beta_b \mathrm{RiskManagementIncentives}^b_{it} \\ &+ \sum_c \beta_c \mathrm{TaxAvoidanceIncentives}^c_{it} \\ &+ \sum_d \beta_d \mathrm{Controls}^d_{it} + \epsilon_{it} \end{aligned} \tag{2}$$

where Sentiment_Measures are used to analyze the tones prevailing the individual 10-K filings by looking at how frequently certain words of a specific category appear in the financial reports (obtained from EDGAR sentiment analysis and made comparable across firms by normalization). In this paper I examine the following categories, based on the Loughran-McDonald dictionaries: complexity, negativity, positivity, modals, uncertainty, and aggressiveness/litigious nature (Loughran and McDonald 2016).[28] I expect a negative sign for variables proxying complexity, aggressiveness and weak modals, because according to hypotheses 4 and 5 (explained above) they are negatively associated with tax avoidance.

27. positive HS: firms are said to have a tax disadvantage or positive tax preferences. The opposite is true for firms with negative HS.

28. I also compute a pessimism measure, which is obtained by subtracting the appearances of positive words from negative ones. However, no significant results are obtained in this regard.

5 Chapter: Discussion of Results

This chapter starts by briefly explaining the most relevant information obtained from the top and bottom quintile analyses that are outlined and extensively commented in section A.2 of the appendix. It continues by illustrating descriptive statistics for both samples (ETR and HS) and by providing scientific evidence in form of regression tables to test the hypotheses of this paper. For readability reasons, the entirety of relevant tables is outlined in the appendix.[29]

5.1 Top and bottom quintile analyses

By investigating more carefully the high and low end of observations with respect to a specific variable, it is possible to draw initial inferences that either support or oppose the hypotheses established a priori as well as currently outstanding literature. First, I inspect the differences in ETRs between the top and bottom quintile of derivative users, finding that the intense users have generally lower rates than lighter users. Tests with the HS sample also show a higher tax advantage for intense derivative users. Therefore, both initial tests are consistent with previous research and support hypothesis 1. Second, I only consider firms in the highest pre-tax income (cash flow) volatility quintile, finding generally lower ETRs compared to the first analysis for both groups, and even lower rates for the intense derivative users (average gap of approximately 1%). When running the same analysis for the firms in the lowest pre-tax income (cash flow) volatility quintile, ETRs are generally much higher for both groups compared to the first analysis, but here the gap between intense and low use of derivatives is even larger, reaching from 1% to over 4%). The findings are again consistent with hypothesis 1. Third, I exclusively look at firms in the highest derivative intensity quintile, finding significantly lower ETRs for firms in the highest aggressiveness quintile than for firms in the lowest. This supports hypothesis 4. When doing the same analysis by substituting aggressiveness by complex words and weak modals, similar outcomes are found, supporting hypothesis 5.[30]

29. All tables in this paper are created with stargazer (Hlavac 2018).

30. I run all tests also with the HS sample and do not obtain contradictory results, except once. Please refer to comments in section A.2.1. in the appendix.

5.2 Descriptive statistics

In essence, both samples are very similar to each other, as can be seen from Tables 19 and 20 in section A.3 in the appendix. This is because they mainly contain the same observations, but HS contains a few more, due to the fact that all loss firms are included. Most variables are in line with previous studies on similar topics (Lee 2017; Donohoe 2015b). However, I generally find lower ETRs than previous research did, but this may be explained by the sample period, which includes years between 2018 and 2020, the years with a lower statutory tax rate (21% compared to 35% before).[31] A non-neglectable part of observations falls in this time period. Hereafter, I provide a few differences between the ETR and HS sample. The ETR sample includes slightly larger firms, higher ROAs, more negative abnormal accruals, lower volatility of cash flows and income as well as slightly less exposure to interest rate foreign exchange rate and commodity price risk and larger capital intensity (PPE). The median of the HS Measure is negative, meaning that more than half of the firms in the second sample are considered to have a tax advantage. After comparing both samples, differences seem to be almost negligible, meaning that the inclusion of loss firms might not have an enormous impact on the overall characteristics of the data.

5.3 Cross-sectional analysis

This section reports and comments the results of the cross-sectional analyses. I run most analyses with both a restricted set of controls (firm size, ROA, taxable income/income volatility, cash flow volatility, debt, property plant and equipment, cash and cash equivalents) and with the full set of controls outlined in equations 1-3, to better understand how the restricted model reacts when adding the whole range of control variables. All reported standard errors are robust to correct for heteroskedasticity and clustered by firm and year.[32]

31. If only the period before 2018 is considered in the sample, I find the median rates for total, current and cash rates as follows: 26.27%, 25.52% and 22.38%, which are closer to the findings in previous research (Lee 2017).

32. In case of heteroskedastic data, standard error of OLS coefficients are biased and need therefore be corrected. This is generally done by using heteroskedasticity-consistent or robust standard errors.

5.3.1 ETR Sample - Regression development hypothesis 1

Tables 21 to 26 show the regression development to test whether tax avoidance increases with derivative usage (Hypothesis 1). The variable of interest, Total_Hits, is statistically significant and negatively associated with cash and current ETRs (Table 21) and continues to behave in this manner when adding more control variables, industry and year fixed effects.[33] For instance, Table 23 suggests that an increase of one standard deviation in Total_Hits (˜0.0016) leads to a reduction of 0.7% (-4.089*0.0016) in the cash rate. This is approximately 3% of the cash rate's unconditional mean (21.9%). The current rate experiences a reduction of 0.6%, being approximately 2.4% of the current rate's unconditional mean.

Table 26 reports the regression results when all control variables are added and industry fixed effects included. Here, the Total_Hits variable loses its statistical significance in case of the cash rate, and suggests approximately the same reduction in the current rate as Table 23 does. Overall, the results provide evidence for hypothesis 1 being true. Moreover, they are consistent with prior research in this field (Donohoe 2015b; Lee 2017).

5.3.2 ETR Sample - Sentiment analysis

The regressions in section A.4.2 in the appendix (Tables 27 to 31) examine first the effect of an aggressive tone and then of complex words and weak modals in the 10-K filing on ETRs. Highly significant results are obtained when running the analysis with the restricted (the full set of controls) and both industry and time fixed effects (industry fixed effects only). For instance, the slightly more elevated regression coefficients in Table 28 illustrate that the impact of derivatives intensity on ETRs is even slightly stronger when keeping the aggressive tone constant (in case of the cash and current rate), compared to the analysis without the LM_Litigous variable. Also, the impact of aggressive tone alone when keeping derivatives usage constant is considerable: For the cash rate, one standard deviation increase in aggressiveness (˜0.0044) causes a reduction of 0.52%, being approximately 2.4% of the cash rate's unconditional mean. When adding the full set of controls

33. Except in one case (Table 26), where the entirety of control variables is added.

and two additional sentiment controls (strong modals and negative expressions) the effect of only aggressive tone on ETRs gets even stronger (Table 29).[34] Further, the analysis regarding complex tone and weak modals shows highly significant negative correlations between complex words (weak modals) and the three dependent variables (only the cash rate) with the restricted and non-restricted set of controls. To summarize, the two tones described above seem to reduce the effective tax rates when keeping derivatives usage constant. How those measures interact with the derivatives usage is investigated in the section of interaction terms below.

5.3.3 HS Sample - Regression development hypothesis 1

Compared to the ETR Sample, here I obtain statistically significant results only with the restricted set of controls. A negative correlation between the HS variable and derivatives intensity is observed and this finding is in line with the previous research on ETRs (Lee 2017). The negative coefficient in Table 32 column (3) highlights again the tax advantage for firms using derivatives, which supports, as the findings from the ETR sample, hypothesis 1.[35]

5.3.4 ETR Sample - Interaction terms

In Tables 33 to 38 the interactions between high income/cash flow volatility, high leverage and the sentiment measures with derivatives usage are tested. I obtain mostly interaction terms that are indistinguishable from zero. These findings are not consistent with hypotheses 2-3, implying that there is little evidence for firms with high volatility in income/cash flows or high debt levels to be the least likely users of derivatives only for tax avoidance purposes. The sentiment analysis with interaction terms yields similar results, namely no statistical significance in interaction terms, except for the one in Table 36: The interaction term between derivatives intensity and the indicator variable LM_Litigous_Q5 (1 for firms in the highest aggressiveness quintile and 0 otherwise) of

34. Negative tone and strong modals are held constant, with the reasoning that firms with a more aggressive tone are expected to transmit negativity (e.g. because they are not satisfied with the business activities company) or to use strong modal verbs to embed their information in pride and confidence (e.g. to not arouse doubt from external parties about their actions).

35. Note that I do not run separate analyses with sentiment measures or interaction terms with the HS sample. In those analyses I exclusively focus on ETRs.

the cash rate column (1). The coefficient is negative and statistically significant, implying that the effect of derivatives usage on the cash ETR is stronger for firms using a highly aggressive tone in their 10-K filings. This finding is consistent with hypothesis 4, stating that more aggressive firms avoid more tax than less aggressive ones.

6 Chapter: Concluding Remarks

Down to the present day, the taxation of corporate derivatives leaves room for creative tax planning strategies, incentivizing firms to adjust their effective tax rates according to their preferences. As mentioned before, this is accomplished, for instance, through "tinkering with transactional forms". This is consistent with the finding that derivatives instruments are not exclusively held to manage corporate risk. I find that tax avoidance increases as derivatives usage increases, one-standard-deviation increase in derivatives usage causes the current (cash) rate to drop by approximately 0.7% (0.6%).[36] The reductions account for approximately 3% (2.4%) of the cash rate's (current rate's) unconditional mean of 21.9% (23.3%). The findings suggest that derivative-using firms continue to have considerable tax advantages and successful tax planning strategies after the financial crisis.[37] For the HS sample, I also find a negative and significant correlation between derivatives usage and the HS measure (Table 32), supporting the findings in the ETR sample and indicating a higher tax advantage for more intense derivative users. Furthermore, firms that show an aggressive tone or have weak modals and complex words in their 10-K filings also experience considerable reductions in ETRs. In particular, weak modals have the most noticeable negative impact on cash

36. These results have been computed from Table 23. However, regression coefficients do not assume any extreme values in any of the specifications with more or less control variables and without / with industry and year fixed effects. Therefore, on average, I find those reductions.

37. Following Donohoe (2015b), I carry out an in-depth investigation of the initial data set, dividing firms into users and non-users of derivatives. I set the constraint of zero keyword hits to define non-derivative-using firms in both the ETR and the HS sample and find a number between 2 and 5. As this zero-count approach is subject to limitations, as for instance, the word "option" can also be used in other contexts different from derivative instruments, I set a limit of 20 occurrences on "option" to define a non-user, keeping occurrences to zero for all other keywords. The number of users is still extremely limited (less than 1%), compared to the overall population in both samples. Donohoe (2015b) identifies considerably higher numbers of non-derivative users throughout his sample period from 2000 to 2008. This suggests that a much larger amount of the whole population of firms engages in derivatives usage after the financial crisis. This is consistent with Figure 1, showing the OTC derivatives notional amount from 2000 to 2020.

rates (Tables 30-31). Moreover, derivative users in the highest aggressiveness quintile experienced higher cash ETR reductions than their less aggressive derivative-using peers. As this paper provides evidence that tone analysis matters in the context of derivatives-based corporate tax avoidance, it should be considered as an anchoring point for further future research in this field. The proxy for derivatives intensity used in this paper is subject to limitations. To illustrate the problem, firm ABC may hold 10,000 derivative instruments but only have two or three word occurrences in the 10-K filing, because those instruments do not play a fundamental role in the business. Company XYZ may hold the same amount of derivatives but mention them more often in the 10-K filing, because they motivate, for instance, their hedging strategies. The problem is partially mitigated by normalizing the variable by the total number of words in the document, but again, this is also subject to limitations.[38] To mitigate, future research can adopt the approach of directly counting the number of derivatives outlined in the quantitative section of the 10-K filing. Even though this approach might be more time intense in the data gathering process, it would convey more precise information about companys' tax planning strategies that involve derivatives. Moreover, the Henry Sansing measure should be more commonly used to analyze the whole population of firms without dropping many loss years observations (as commonly done with ETRs), even though the measure's interpretation might not be as straightforward as the interpretation of ETRs.[39]

As has been found in this paper, sentiment analysis with respect to derivatives usage and tax avoidance allows researchers to better understand how the prevalent tone in a text reveals information about the author. For the sentiment analysis I used the "bag-of-words-technique", in which words from different categories are looked up in a specific text. However, future research could adopt strategies to analyze not only single words but, for instance, whole expressions. This would enable researchers to find out more about the specific context in which certain words are used and could therefore limit misleading results.[40]

38. In the example, the normalization would only have a real effect in case the filing of company XYZ is much more wordy than the one of company ABC. If both reports have the same length, the issue remains.

39. The HS measure expresses a tax advantage or disadvantage for firms, but it is not as easily quantifiable as, for instance, a percentage drop in ETRs.

40. For instance, as mentioned in the literature review, positive words are often negated in order to convey negative information. By adopting the suggested technique, such text excerpts would be less prone to misclassification.

References

Abdulkareem, H. 2015. "The revised Altman Z'-score Model Verifying its Validity as a Predictor of Corporate Failure in the Case of UK Private Companies." *Conference Paper,* 1–61.

Accounting Today. 2013. "House Republicans Propose Tax Reforms for Financial Products." Last access: March 19, 2021. https://www.accountingtoday.com/news/house-republicans-propose-tax-reforms-for-financial-products.

Allen, E. J., D. E. O'Leary, H. Qu, and C. W. Swenson. 2020. "Tax Specific Versus Generic Accounting-Based Textual Analysis and the Relationship with Effective Tax Rates: Building Context." *Journal of Information Systems, Forthcoming,* 58.

Amuthan, R. 2014. "Taxation of Derivatives." In *Taxation of Derivatives,* 245–249. Navakkarsi, Coimbatore: Himalaya Publishing House. ISBN: 9351425142.

Baber, W. R., S. N. Janakiraman, and S.-H. Kang. 1996. "Investment opportunities and the structure of executive compensation." *Journal of Accounting and Economics* 21:297–318.

Badertscher, B., S. Katz, S. Rego, and R.J.Wilson. 2015. "Conforming Tax Avoidance and Capital Market Pressure." *The Accounting Review* 94(6):1–30.

Bartram, S. M., G. W. Brown, and J. Conrad. 2011. "The Effects of Derivatives on Firm Risk and Value." *The Journal of Financial and Quantitative Analysis. Cambridge University Press* 46(4):967–999.

Bendi, D., and E. Subagio. 2018. "Financial Derivatives in Corporate Tax Aggressiveness." *THE INDONESIAN JOURNAL OF ACCOUNTING RESEARCH* 21):251–268.

Bergstresser, D., and T. Philippon. 2006. "CEO incentives and earnings management." *Journal of Financial Economics* 80:511–529.

BIS Monetary Economic Department, Basel, Switzerland. 2016. *International capital flows and financial vulnerabilities in emerging market economies: Analysis and data gaps and Economic resilience: A financial perspective.* Research report. Bank for International Settlements.

Bodnar, G., G. S. Hayt, and R. C. Marston. 1998. "1998 Survey of financial risk management by U.S. non-financial firms." *Financial Management* 27:70–91.

Bonsall, S. B., K. Koharki, and L. Watson. 2016. "Deciphering tax avoidance: Evidence from credit rating disagreements." The Accounting Review. Last access: March 19, 2021. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2511454.

Cahan, S. F., J. M. Godfrey, J. Hamilton, and D. C. Jeter. 2008. "Auditor Specialization, Auditor Dominance, and Audit Fees: The Role of Investment Opportunities." *The Accounting Review* 83:1393–1423.

Cancho1, R. F., and R. V. Solé. 2001. "Two Regimes in the Frequency of Words and the Origins of Complex Lexicons Zipf's Law Revisited." *Journal of Quantitative Linguistics* 8 (3):165–173.

Cen, L., E. L.Maydew, L. Zhang, and L.Zuo. 2017. "Customer-supplier relationships and corporate tax avoidance." Journal of Financial Economics. Last access: March 19, 2021. https://doi.org/10.1016/j.jfineco.2016.09.009.

Chang, H. S., M. P. Donohoe, and T. Sougiannis. 2016. "Do Analysts Understand the Economic and Reporting Complexities of Derivatives?" *Journal of Accounting and Economics. Research Collection School Of Accountancy* 61(2-3):584–604.

Chen, S. X. Chen, Q. Cheng, and T. Shevlin. 2010. "Are family firms more tax aggressive than firms?" *Journal of Financial Economics* 95(1):41–61.

Chisholm, A. M. 2010. "Derivatives demystified : a step-by-step guide to forwards, futures, swaps and options." In *2nd Edition,* 1–3. West Sussex: John Wiley / Sons, Ltd., Publication. ISBN: 978-0-470-74937-1.

Companies and Securities Advisory Committee. 1995. "Law and Derivatives: An International Comparison." *CASAC,* 1.

Congressional Budget Office CBO. 2018. "Tax Gains from Derivatives as Ordinary Income on a Mark-to-Market Basis." Last access: March 19, 2021. https://www.cbo.gov/budget-options/2018/54824.

Cremers, M., and D. Weinbaum. 2010. "Deviations from Put-Call Parity and Stock Return Predictability." *The Journal of Financial and Quantitative Analysis* 45 (2):335–367.

DeMarzo, P. M., and D. Duffie. 1982. "On the corporate demand for insurance." *Journal of Business* 55:281–296.

———. 1995. "Corporate Incentives for Hedging and Hedge Accounting." *The Review of Financial Studies* 8(3):741–771.

Donohoe, M. P. 2015a. "Financial Derivatives in Corporate Tax Avoidance: A Conceptual Perspective." *Journal of the American Taxation Association* 37(1):37–68.

———. 2015b. "The economic effects of financial derivatives on corporate tax avoidance." *Journal of Accounting and Economics* 59:1–24.

Dorion, C., P. Francois, G. Grass, and A. Jeanneret. 2014. "Convertible Debt and Shareholder Incentives." *Journal of Corporate Finance* 24:38–56.

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

FASB. 1998. *Accounting for Derivative Instruments and Hedging Activities. Statement of Financial Accounting Standard No. 133.* Research report. Financial Accounting Standards Board, Norwalk, CT.

———. 2000. *Accounting for Certain Derivative Instruments and Certain Hedging Activities. Statement of Financial Accounting Standard No. 138.* Research report. Financial Accounting Standards Board, Norwalk, CT.

Frank, M. M., L. J. Lynch, and S. O. Rego. 2009. "Tax Reporting Aggressiveness and Its Relation to Aggressive Financial Reporting." *The Accounting Review* 84 (2):467–496.

Gebhart, M. S. 2017. "Measuring Corporate Tax Avoidance – An Analysis of Different Measures." *Junior Management Science* 3:43–60.

Graham, J. R., and D. A. Rogers. 2002. "Do Firms Hedge in Response to Tax Incentives?" *Journal of Finance* 57(2):815–839.

Graham, J. R., and C. W. Smith. 1999. "Tax Incentives to Hedge." *The Journal of Finance* 54 (6):2241–2262.

Guter-Sandu, A., Y. Millo, A. Nesvetailova, and R. Palan. 2018. "Tax Evasion and Avoidance through Financial Engineering, The State of Play in Europe." *Coffers EU Horizon 2020 Project.*

Henry, E., and R. C. Sansing. 2018. "Corporate Tax Avoidance: Data Truncation and Loss Firms." *Review of Accounting Studies.*

Hlavac, M. 2018. "stargazer: Well-Formatted Regression and Summary Statistics Tables. R package version 5.2.2." Last access: May 19, 2021. https://CRAN.R-project.org/package=stargazer.

Hutchens, M. 2017. "Can Disclosure Characteristics Improve Analyst Forecast Accuracy?" Last access: April 21, 2021. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3042836.

Kiaupaite-Grushniene, V. 2016. "Altman Z-Score model for bankruptcy forecasting of the listed Lithuanian agricltural companies." *5th International Conference on Accounting, Auditing, and Taxation (ICAAT),* 1–13.

Kleinbard, E. 1991. "Equity Derivative Products: Financial Innovation's Newest Challenge to the Tax System." *Texas Law Review* 69:1319–1368.

Koester, A., T. J. Shevlin, and D. Wangerin. 2016. "The role of managerial ability in corporate tax avoidance." Management Science. Last access: March 19, 2021. https://ssrn.com/abstract=2753152.

Kothari, S., A. J. Leone, and C. E. Wasley. 2005. "Performance matched discretionary accrual measures." *Journal of Accounting and Economics* 39 (1):163–97.

Law, K. K., and L. F. Mills. 2015. "Taxes and Financial Constraints: Evidence from Linguistic Cues." *Journal of Accounting Research* 53(4):777–819.

Lee, Y. 2017. "The Impact of Hedging and Non-Hedging Derivatives on Tax Avoidance." *Dissertation at University of California, Irvine.*

Limberg, S. T., and P. J. Wilkie. 2008. "Measuring explicit tax (dis)advantage for corporate taxpayers: An alternative to average effective tax rates." *Journal of the American Taxation Association* 15(1):46–71.

Loughran, T., and B. McDonald. 2011. "When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks." *Journal of Finance* 66 (1):35–65.

———. 2015. "The Use of Word Lists in Textual Analysis." *Journal of Behavioural Finance* 16:1–11.

———. 2016. "Textual Analysis in Accounting and Finance A Survey." *Journal of Accounting Research* 40:1–44.

Luo, L., M. Ma, T. Omer, and H. Xie. 2017. "Corporate tax avoidance and firm value: does the income tax footnote matter?" *Working paper.*

McGuire, S. T., T. C. Omer, and D. Wang. 2012. "Tax Avoidance: Does Tax-Specific Industry Expertise Make a Difference?" *The Accounting Review* 87(3):975–1003.

McKinsey Global Institute. 2018. "A decade after the global financial crisis: what has (and hasn't changed)?" *McKinsey Briefing Note,* 1–16.

Monetary Economic Department, Basel, Switzerland. 2020. "Bank for International Settlements. OTC Derivatives Market Activity in the First Half of 2020." Last access: March 19, 2021. https://stats.bis.org/statx/srs/table/d5.1?p=20201&c=.

Monsenego, J. 2011. "Corporate Loss Utilization Through Aggressive Tax Planning." *International Transfer Pricing Journal* 19 (5):357–361.

Rosenthal, S. M. 2016. "Wyden Pursues Tax Reform for Derivatives, which is Long Overdue." Last access: March 19, 2021. https://www.taxpolicycenter.org/taxvox/wyden-pursues-tax-reform-derivatives-which-long-overdue.

SEC Office of Investor Education and Advocacy. 2011. *Investor Bulletin: How to Read a 10-K.* Research report. U.S. Securities and Exchange Commission.

Smith, C. W., and R. Stulz. 1985. "The determinants of firms' hedging policies." *Journal of Financial and Quantitative Analysis* 20:391–405.

Stoll, H. R. 1969. "The relationship between put and call option prices." *Journal of Finance* 24 (5):801–824.

Stulz, R. 2004. "Should we fear derivatives?" *Journal of Economic Perspectives* 18(3):173–192.

Titman, S., and B. Trueman. 1988. "An Explanation for Accounting Income Smoothing." *Journal of Accounting Research* 26:127–139.

Tufano, P. 1996. "Who Manages Risk? An Empirical Examination of Risk Management Practices in the GoldMining Industry." *The Journal of Finance* 51(4):1097–1137.

United States Government Accountability Office. 2011. *Financial derivative: Disparate tax treatment and information gaps create uncertainty and potential abuse.* Research report. GAO-11-750.

Weidmann, O. 2015. "Taxation of Derivatives." In *Series on International Taxation,* 21–35. Alphen aan den rijn,Netherlands: Kluwer Law International. ISBN: 978-90-411-5983-0.

Wright, B. 2001. "An Application of the Scholes and Wolfson Model to Examine the Relation between Implicit and Explicit Taxes and Firm Market." *Journal of the American Taxation Association* 23(2):59–67.

Zhang, H. 2009. "Effect of derivative accounting rules on corporate risk-management behavior." *Journal of Accounting and Economics* 47(3):244–264.

Appendix

List of Figures

List of Tables

A.1 Other informational graphs

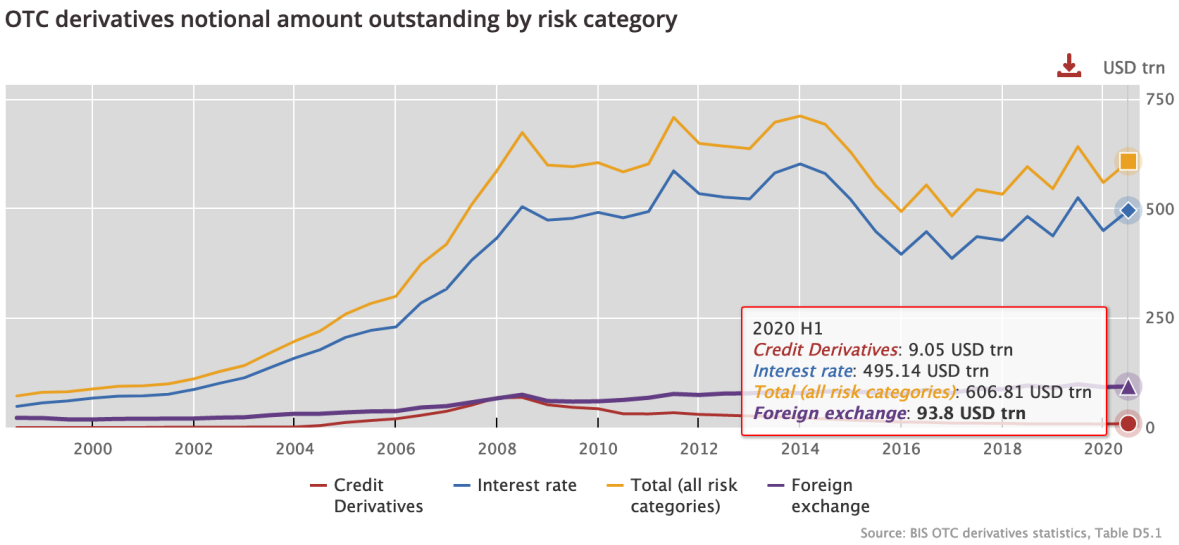

Figure 1: OTC derivatives notional amount between 2000 and 2020 (Source: Monetary Economic Department, Basel, Switzerland 2020). As can be seen from Figure 1, interest rate risk is the most hedged type of risk with derivatives.

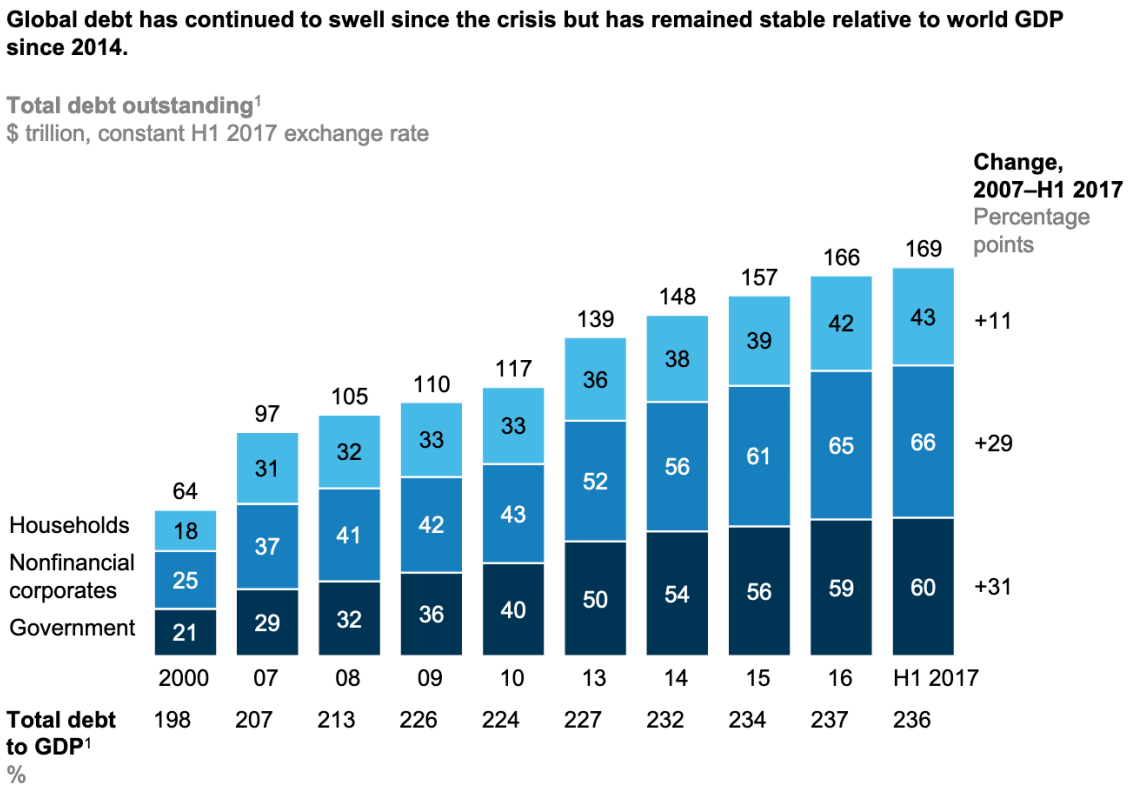

Figure 2: Total amount of global debt outstanding between 2000 and H1 2017 (Source: BIS Monetary Economic Department, Basel, Switzerland 2016; McKinsey Global Institute 2018). As can be seen from the graph, the global debt of non-financial corporate leverage has grown by more than 50 % from 2008 to the first half of 2017 and the public debt has almost doubled in size in the same period.

Table 1: Observation distribution by industry ETR

Industry	All years
Communications Equipment	199
Paper & Forest Products	50
Life Sciences Tools & Services	88
Professional Services	253
Media	204
Energy Equipment & Services	140
Personal Products	109
Construction & Engineering	100
Semiconductors & Semiconductor Equipment	429
Machinery	444
Metals & Mining	152
Software	458
Health Care Equipment & Supplies	377
Trading Companies & Distributors	136
Hotels, Restaurants & Leisure	360
Health Care Providers & Services	361
Oil, Gas & Consumable Fuels	240
Food Products	261
Airlines	44
Pharmaceuticals	97
Diversified Telecommunication Services	91
IT Services	262
Textiles, Apparel & Luxury Goods	17 2
Health Care Technology	74
Household Durables	124
Biotechnology	149
Road & Rail	118
Leisure Products	84
Internet & Direct Marketing Retail	80
Multiline Retail	49
Commercial Services & Supplies	287
Containers & Packaging	77
Diversified Consumer Services	101
Specialty Retail	360
Electronic Equipment, Instruments & Components	443
Internet Software & Services (discontinued 2018)	40
Food & Staples Retailing	126
Aerospace & Defense	216
Interactive Media & Services	52
Electrical Equipment	126
Chemicals	293
Auto Components	131
Wireless Telecommunication Services	25
Real Estate Management & Development	58
Air Freight & Logistics	61
Household Products	48
Entertainment	42
Distributors	35
Building Products	109
Construction Materials	30
Media (discontinued 2018)	46
Tobacco	26
Beverages	49
Transportation Infrastructure	6
Automobiles	16
Marine	6
Industrial Conglomerates	19

Table 2: Observation distribution by industry HS

Industry	All years
Communications Equipment	265
Paper & Forest Products	53
Life Sciences Tools & Services	114
Professional Services	268
Media	222
Energy Equipment & Services	181
Personal Products	117
Construction & Engineering	109
Semiconductors & Semiconductor Equipment	501
Machinery	461
Metals & Mining	190
Aerospace & Defense	238
Software	673
Health Care Equipment & Supplies	498
Trading Companies & Distributors	144
Hotels, Restaurants & Leisure	389
Health Care Providers & Services	407
Oil, Gas & Consumable Fuels	328
Food Products	273
Airlines	44
Pharmaceuticals	155
Diversified Telecommunication Services	109
IT Services	324
Household Products	58
Textiles, Apparel & Luxury Goods	190
Health Care Technology	91
Household Durables	146
Biotechnology	359
Road & Rail	122
Electrical Equipment	178
Leisure Products	91
Internet & Direct Marketing Retail	104
Multiline Retail	50
Commercial Services & Supplies	305
Containers & Packaging	77
Diversified Consumer Services	114
Specialty Retail	372
Electronic Equipment, Instruments & Components	518
Wireless Telecommunication Services	33
Internet Software & Services (discontinued 2018)	59
Food & Staples Retailing	130
Interactive Media & Services	65
Chemicals	323
Auto Components	145
Real Estate Management & Development	61
Air Freight & Logistics	61
Entertainment	60
Distributors	35
Media (discontinued 2018)	52
Building Products	114
Industrial Conglomerates	21
Construction Materials	33
Beverages	74
Tobacco	31
Automobiles	25
Transportation Infrastructure	7
Marine	6

A.1.1 Distribution of derivative instruments

Table 3: Distribution by derivative instrument ETR

	Option	Swap	Forward	Futures
2009	787	367	259	52
2010	865	421	288	49
2011	873	410	303	50
2012	995	459	339	57
2013	901	411	321	56
2014	86	28	23	3
2015	963	439	359	64
2016	604	241	217	29
2017	969	456	356	59
2018	696	381	290	44
2019	734	434	308	40
2020	141	75	53	6
Total	8614	4122	3116	509

Note: This table shows the distribution of derivative instruments among firms in the ETR sample by type and year.

Table 4: Distribution by derivative instrument HS

	Option	Swap	Forward	Futures
2009	860	381	270	52
2010	939	434	304	52
2011	958	432	318	56
2012	1116	480	357	62
2013	1019	439	335	62
2014	99	32	24	4
2015	1109	461	376	70
2016	720	258	230	32
2017	1180	486	386	64
2018	1053	487	351	62
2019	1058	529	358	50
2020	175	80	60	6
Total	10286	4499	3369	572

Note: This table shows the distribution of derivative instruments among firms in the HS sample by type and year.

A.2 Basic overview tables

This section outlines several tables with relevant information sustaining the results of the paper. As they are only briefly commented and summarized in Chapter 5, a more detailed description is provided below.

A.2.1 Top and bottom quintile analyses

Table 5: ETRs derivatives intensity quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.2060	0.2053	0.2263	0.2180	0.2336	0.2321
Bottom Quintile	0.2209	0.2256	0.2356	0.2320	0.2425	0.2390
Difference (abs)	0.0149	0.0203	0.0093	0.0140	0.0088	0.0069

Table 5 depicts the mean and median values for all three ETRs (cash rate, current rate and total rate), comparing the top and bottom quintile of total hits. As can be seen, for the top quintile of derivatives intensity both values are lower in all cases with no exceptions. This supports hypothesis 1: Firms with the highest derivatives usage seem to avoid more tax than lighter users of derivatives.

Table 6: HS derivatives intensity quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0023	0.0059
Bottom Quintile	-0.0012	0.0043
Difference (abs)	0.0011	0.0017

Table 6 shows the top and bottom quintile of derivatives intensity with respect to the Henry Sansing measure. While median values are in line with hypothesis 1, suggesting a higher tax advantage for firms with more derivatives, mean values show the opposite. This can be explained by the uneven distribution of the HS measure: When inspecting its normal distribution, the right tail is much longer than the left one (see below), meaning that even if the top quintile contains very few extreme values, the overall picture is distorted.

The top quintile in Table 7 illustrates the firms with the highest derivatives usage and the highest pre-tax income volatility, while the bottom quintile shows the firms with the highest pre-tax income volatility but the lowest derivatives usage. Compared to the first graph in this section

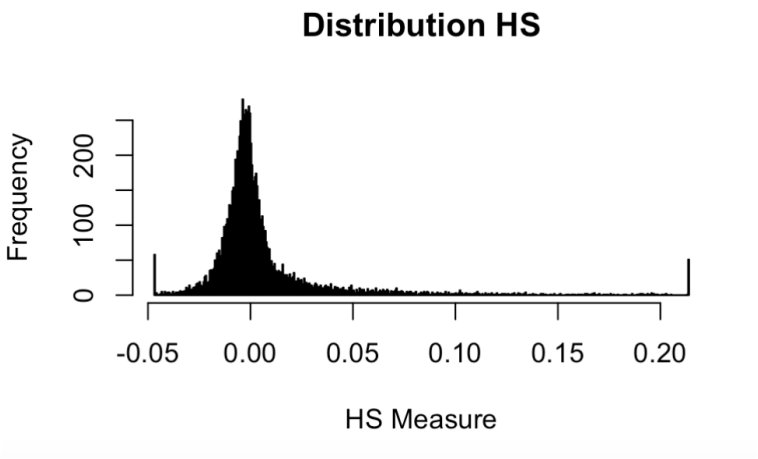

Figure 3: Henry Sansing Normal Distribution. Values are winsorized at 1 and 99% level.

Table 7: ETRs derivatives intensity and high income volatility quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.1388	0.1753	0.1273	0.1582	0.1926	0.2077
Bottom Quintile	0.1255	0.1624	0.1335	0.1771	0.1963	0.2110
Difference (abs)	0.0133	0.0129	0.0062	0.0189	0.0037	0.0033

(which includes the whole population of firms in the sample), the median and mean values are lower, suggesting generally lower effective tax rates for highly volatile firms. The results still support hypothesis 1 because the firms using most derivatives still have lower tax rates than the ones with few derivatives, except for cash rates. However, derivative users may also lower their pre-tax income volatility (income smoothing). Therefore, the next table shows the high and low derivative users, both being in the quintile of the lowest pre-tax income volatility.

Table 8: ETRs derivatives intensity and low income volatility quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.2666	0.2628	0.2778	0.2772	0.2760	0.2510
Bottom Quintile	0.2956	0.2785	0.3142	0.2859	0.3188	0.2875
Difference (abs)	0.0290	0.0157	0.0364	0.0087	0.0428	0.0365

Table 8 clearly shows that low volatility pre-tax income firms pay higher tax rates, which are much closer to statutory tax rates. However, here the gap between high and low derivatives users is much larger, spanning from approximately one to four percent.

Tables 9 and 10 yield lower medians in the top quantile in both cases, but in case of low volatil-

Table 9: HS derivatives intensity and high income volatility quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0014	0.0091
Bottom Quintile	-0.0011	0.0080
Difference (abs)	0.0003	0.0011

Table 10: HS derivatives intensity and low income volatility quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0029	-0.0000
Bottom Quintile	-0.0012	-0.0003
Difference (abs)	0.0017	0.0003

ity the effect seems to be even stronger. The results indicate that firms with low volatility and high derivative usage have the highest tax advantage, while firms with low derivatives usage and high volatility have the smallest.

With the same logic as before, I construct the following four tables with cash flow volatility instead of pre-tax income volatility. While for firms with lower cash flow volatility, median and mean rates are considerably lower for intense derivative users in all cases (Table 12), the firms with higher cash flow volatility depict mixed results (Table 11). Even though all mean values are lower for intense derivative users, median values are slightly higher for those firms in the cash and median rates.

Table 11: ETRs derivatives intensity and high cash flow volatility quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.1740	0.2015	0.1722	0.1926	0.2329	0.2246
Bottom Quintile	0.1427	0.2052	0.1982	0.2076	0.2212	0.2350
Difference (abs)	0.0313	0.0038	0.0261	0.0149	0.0117	0.0105

Table 12: ETRs derivatives intensity and low cash flow volatility quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.2194	0.2118	0.2448	0.2305	0.2330	0.2351
Bottom Quintile	0.2558	0.2437	0.2563	0.2629	0.2788	0.2616
Difference (abs)	0.0364	0.0318	0.0115	0.0325	0.0459	0.0265

For the HS sample (Tables 13 and 14), intense derivative users with low cash flow volatility

seem to have a slight tax advantage while those with the least derivatives have a tax disadvantage. For the firms with lower cash flow volatility, both the intense and the least intense derivative users have a tax advantage, but the former has a considerably larger advantage.

Table 13: HS derivatives intensity and high cash flow volatility quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0003	0.0103
Bottom Quintile	0.0041	0.0121
Difference (abs)	0.0043	0.0018

Table 14: HS derivatives intensity and low cash flow volatility quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0043	-0.0001
Bottom Quintile	-0.0020	0.0006
Difference (abs)	0.0023	0.0008

A.2.2 Top and bottom quintile analyses for sentimental analyses

Table 15: ETRs high derivatives intensity and aggressiveness quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.1511	0.1656	0.1828	0.1852	0.2243	0.2190
Bottom Quintile	0.2150	0.2173	0.2326	0.2300	0.2288	0.2218
Difference (abs)	0.0639	0.0518	0.0499	0.0447	0.0045	0.0027

Table 15 illustrates the firms that are in the highest derivatives usage quintile, splitting them in least and most aggressive ones (top and bottom quintile). This suggests that among the most intense derivative users, those with a more aggressive tone avoid more tax. This finding is consistent with hypothesis 4. Table 16 does not show any contradictory findings in this regard.

Table 16: HS high derivatives intensity and aggressiveness quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0020	0.0090
Bottom Quintile	-0.0012	0.0035
Difference (abs)	0.0008	0.0055

Tables 17 and 18 replicate the previous analysis, with the difference of analyzing the top and bottom quintile of complex words and weak modals. Both tables report similar findings to before, showing consistency with hypothesis 5.

Table 17: ETRs high derivatives intensity and complexity and weak modals quintiles

	Cash Rate		Current Rate		Total Rate	
	Median	Mean	Median	Mean	Median	Mean
Top Quintile	0.1476	0.1613	0.2063	0.2085	0.2303	0.2828
Bottom Quintile	0.2124	0.2212	0.2743	0.2311	0.2507	0.2435
Difference (abs)	0.0648	0.0599	0.0679	0.0226	0.0204	0.0393

Table 18: HS high derivatives intensity and complexity and weak modals quintiles

	HS Measure	
	Median	Mean
Top Quintile	-0.0041	-0.0028
Bottom Quintile	-0.0003	0.0131
Difference (abs)	0.0038	0.0159

A.3 Summary statistics

Table 19: Summary statistics ETR

Statistic	N	Mean	St. Dev.	Median
Firm_Size	8,665	6.808	1.873	6.878
ROA	8,665	0.061	0.124	0.064
ROA_Change	8,665	0.0002	0.119	−0.0004
Abnorm_Acc	8,665	−0.002	0.146	−0.006
ForInc	5,610	0.032	0.053	0.018
ForInc_Change	4,955	−0.001	0.038	0.000
AuditBig_Dummy	8,665	0.751	0.433	1.000
M&A_Dummy	8,665	0.486	0.500	0.000
Underinv_Score	8,665	1.053	0.236	1.067
AltmanZ_Score	8,665	6.905	3.437	7.060
(Exec_FV	5,239	0.260	0.235	0.184)
Debt_Conv	8,665	0.014	0.058	0.000
Pref_Shares	8,665	0.002	0.016	0.000
CF_Vola	8,665	1.013	3.334	0.319
Inc_Vola	8,665	2.173	5.971	0.583
IntRate_Risk	8,665	0.093	0.153	0.057
FX_Risk	8,665	0.969	1.153	0.688
ComPr_Risk	8,665	1.288	1.708	0.844
Eq_Inc	7,827	0.001	0.004	0.000
(Res_Dvlp	5,555	0.055	0.077	0.024)
Cash_CE	8,665	0.192	0.204	0.124
Debt	8,665	0.226	0.252	0.167
Debt_Change	8,665	0.031	0.143	0.000
BTM	8,665	0.509	0.504	0.421
PPE	8,665	0.252	0.237	0.171
Dep_Am	8,665	0.045	0.029	0.038
TLCF_Dummy	8,665	0.826	0.379	1.000
TLCF_Change	8,665	0.009	0.131	0.000
Tax_Inc_Vola	8,665	2.739	9.503	0.692
Current_Rate	8,665	0.233	0.162	0.233
Cash_Rate	8,665	0.219	0.155	0.212
Total_Rate	8,665	0.234	0.174	0.235

Note: This table reports the summary statistics for the ETR sample. All continuous variables are winsorized at 1st and 99th percentiles, except for the three ETR rates (Cash_Rate, Current_Rate and Total_Rate), whose extreme values above 1 and below 0 have been reset to those boundaries.

Table 20: Summary statistics HS

Statistic	N	Mean	St. Dev.	Median
Firm_Size	10,465	6.499	2.033	6.602
ROA	10,465	−0.005	0.284	0.049
ROA_Change	10,465	0.002	0.206	−0.001
Abnorm_Acc	10,465	0.008	0.229	−0.004
ForInc	6,533	0.024	0.059	0.014
ForInc_Change	5,766	−0.001	0.043	0.000
AuditBig_Dummy	10,465	0.711	0.453	1.000
M&A_Dummy	10,465	0.450	0.498	0.000
Underinv_Score	10,465	1.051	0.240	1.033
AltmanZ_Score	10,465	6.932	3.477	7.060
(Exec_FV	5,588	0.258	0.237	0.182)
Debt_Conv	10,465	0.020	0.083	0.000
Pref_Shares	10,465	0.004	0.028	0.000
CF_Vola	10,465	1.357	5.007	0.356
Inc_Vola	10,465	2.094	5.765	0.587
IntRate_Risk	10,465	0.116	0.231	0.061
FX_Risk	10,465	1.132	1.667	0.731
ComPr_Risk	10,465	1.622	3.148	0.906
Eq_Inc	9,546	0.001	0.004	0.000
(Res_Dvlp	6,913	0.086	0.141	0.035)
Cash_CE	10,465	0.230	0.279	0.139
Debt	10,465	0.223	0.270	0.154
Debt_Change	10,465	0.034	0.158	0.000
BTM	10,465	0.499	0.592	0.413
PPE	10,465	0.245	0.243	0.157
Dep_Am	10,465	0.046	0.033	0.039
TLCF_Dummy	10,465	0.851	0.356	1.000
TLCF_Change	10,465	0.058	0.373	0.000
Tax_Inc_Vola	10,465	2.792	9.330	0.762
HS_Measure	10,465	0.005	0.030	−0.002

Note: This table reports the summary statistics for the HS sample. All continuous variables are winsorized at 1st and 99th percentiles.

A.4 Main regression tables

A.4.1 ETR analysis

Table 21: ETR Regression - Main Variable

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.929^{***} (1.864)	-4.274^{**} (1.947)	-0.514 (1.913)
Observations	8,649	8,649	8,649
R^2	0.002	0.002	0.00002
Adjusted R^2	0.002	0.002	-0.0001
F Statistic (df = 1; 8647)	21.443^{***}	14.799^{***}	0.184
Industry Fixed Effects	–	–	–
Year Fixed Effects	–	–	–

Note: Table 21 reports the results of regressing only the main variable of interest, namely Total_Hits, on all three ETRs, excluding industry and year fixed effects. Derivatives usage is statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 22: ETR Regression - Main Variable, Firm Size and Industry FE

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.109^{**} (1.891)	-3.989^{**} (1.918)	-0.560 (1.915)
Firm_Size	0.002 (0.002)	0.003^{*} (0.002)	-0.006^{***} (0.002)
Observations	8,649	8,649	8,649
R^2	0.079	0.072	0.057
Adjusted R^2	0.073	0.066	0.051
F Statistic (df = 59; 8589)	12.490^{***}	11.349^{***}	8.867^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 22 extends Table 21 by controlling for firm size, the most basic control, and by adding industry fixed effects. Derivatives usage is statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 23: ETR Regression - Main Variable, Industry FE and some Controls

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.089^{**} (1.823)	-3.613^{**} (1.840)	-0.197 (1.895)
Firm_Size	0.003 (0.002)	0.006^{***} (0.002)	-0.004^{*} (0.002)
ROA	0.122^{***} (0.020)	0.126^{***} (0.023)	0.152^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0002 (0.001)	0.0002 (0.001)
Inc_Vola	0.0001 (0.001)	-0.0004 (0.001)	-0.0004 (0.001)
Debt	-0.054^{***} (0.012)	-0.076^{***} (0.012)	-0.082^{***} (0.016)
PPE	-0.066^{***} (0.018)	-0.087^{***} (0.017)	-0.021 (0.020)
Cash_CE	-0.017 (0.018)	0.015 (0.021)	-0.015 (0.019)
Observations	8,649	8,649	8,649
R^2	0.106	0.114	0.083
Adjusted R^2	0.100	0.107	0.076
F Statistic (df = 66; 8582)	15.481^{***}	16.740^{***}	11.835^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 23 extends Table 22 by adding the restricted set of control variables. Derivatives usage remains statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 24: ETR Regression - Main Variable, Industry FE , Year FE and some Controls

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.911^{***} (1.857)	-4.279^{**} (1.870)	-0.735 (1.933)
Firm_Size	0.004^{**} (0.002)	0.008^{***} (0.002)	-0.002 (0.002)
ROA	0.130^{***} (0.020)	0.139^{***} (0.023)	0.162^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0005 (0.001)	0.00000 (0.001)
Inc_Vola	0.0002 (0.001)	-0.0004 (0.001)	-0.0003 (0.001)
Debt	-0.047^{***} (0.012)	-0.066^{***} (0.012)	-0.072^{***} (0.016)
PPE	-0.064^{***} (0.018)	-0.081^{***} (0.018)	-0.016 (0.020)
Cash_CE	-0.018 (0.018)	0.014 (0.020)	-0.016 (0.018)
Observations	8,649	8,649	8,649
R^2	0.117	0.141	0.105
Adjusted R^2	0.109	0.134	0.097
F Statistic (df = 78; 8570)	14.522^{***}	18.090^{***}	12.876^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	✓	✓	✓

Note: Table 24 extends Table 23 by adding year fixed effects. Derivatives usage remains statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 25: ETR Regression - Main Variable and all Controls

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.224^{*} (2.477)	-4.992^{**} (2.403)	-2.036 (2.748)
TLCF_Dummy	-0.031^{***} (0.010)	-0.041^{***} (0.010)	-0.016 (0.012)
TLCF_Change	-0.010 (0.022)	-0.009 (0.023)	0.018 (0.028)
Eq_Inc	0.404 (0.826)	-0.312 (0.670)	0.357 (0.957)
Cash_CE	-0.121^{***} (0.023)	-0.061^{**} (0.029)	-0.097^{***} (0.026)
PPE	-0.122^{***} (0.027)	-0.162^{***} (0.028)	-0.056^{*} (0.030)
Dep_Am	0.398^{*} (0.210)	0.674^{***} (0.228)	0.724^{***} (0.242)
Debt	-0.049^{*} (0.025)	-0.100^{***} (0.027)	-0.085^{**} (0.035)
Debt_Change	0.058^{**} (0.029)	0.094^{***} (0.031)	0.063^{*} (0.035)
BTM	0.004 (0.015)	-0.008 (0.013)	-0.014 (0.014)
Firm_Size	-0.001 (0.004)	0.005 (0.004)	-0.007^{*} (0.004)
ROA	0.142^{***} (0.042)	0.102^{**} (0.049)	0.190^{***} (0.054)
ROA_Change	-0.037 (0.030)	-0.031 (0.038)	-0.095^{**} (0.046)
Abnorm_Acc	0.013 (0.019)	0.010 (0.023)	-0.028 (0.026)
ForInc_Change	-0.166^{**} (0.072)	-0.188^{**} (0.086)	-0.152 (0.099)
ForInc	0.065 (0.081)	0.161^{*} (0.089)	0.125 (0.107)
AuditBig_Dummy	0.002 (0.015)	-0.011 (0.016)	-0.006 (0.016)
M.A_Dummy	0.002 (0.007)	0.008 (0.007)	-0.009 (0.008)
AltmanZ_Score	-0.001 (0.0005)	-0.001^{***} (0.0005)	-0.002^{***} (0.001)
Underinv_Score	-0.018 (0.024)	-0.004 (0.024)	-0.034 (0.025)
Debt_Conv	-0.025 (0.060)	-0.026 (0.063)	-0.127^{*} (0.067)
Pref_Shares	0.029 (0.279)	0.044 (0.319)	-0.601^{***} (0.224)
CF_Vola	-0.0002 (0.001)	-0.001 (0.001)	0.0005 (0.001)
Inc_Vola	0.001 (0.001)	0.001 (0.001)	0.0001 (0.001)
Tax_Inc_Vola	-0.001^{*} (0.0004)	-0.001 (0.001)	0.001 (0.001)
IntRate_Risk	-0.022 (0.045)	-0.005 (0.048)	-0.017 (0.045)
FX_Risk	0.001 (0.006)	-0.002 (0.007)	-0.006 (0.007)
ComPr_Risk	-0.0001 (0.003)	0.0001 (0.004)	0.003 (0.004)
Observations	4,400	4,400	4,400
R^2	0.053	0.068	0.055
Adjusted R^2	0.047	0.062	0.049
F Statistic (df = 28; 4371)	8.672^{***}	11.366^{***}	9.122^{***}
Industry Fixed Effects	–	–	–
Year Fixed Effects	–	–	–

Note: Table 25 reports the regression results for the ETR sample with the full set of controls based on equation [1]. Derivatives usage remains statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 26: ETR Regression - Main Variable, all Controls and Industry FE

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	−3.523 (2.455)	−4.066* (2.387)	−0.763 (2.642)
TLCF_Dummy	−0.028*** (0.010)	−0.037*** (0.010)	−0.010 (0.011)
TLCF_Change	−0.013 (0.020)	−0.012 (0.023)	0.019 (0.028)
Eq_Inc	0.429 (0.781)	−0.285 (0.664)	−0.457 (0.992)
Cash_CE	−0.064** (0.026)	−0.009 (0.034)	−0.041 (0.027)
PPE	−0.112*** (0.031)	−0.152*** (0.031)	−0.092** (0.038)
Dep_Am	0.492** (0.208)	0.761*** (0.227)	0.691*** (0.249)
Debt	−0.040 (0.027)	−0.095*** (0.027)	−0.083** (0.033)
Debt_Change	0.044 (0.029)	0.082*** (0.030)	0.054* (0.032)
BTM	0.007 (0.015)	−0.007 (0.013)	−0.016 (0.014)
Firm_Size	0.001 (0.004)	0.007* (0.004)	−0.009** (0.004)
ROA	0.106** (0.043)	0.078 (0.050)	0.161*** (0.054)
ROA_Change	−0.036 (0.028)	−0.038 (0.037)	−0.088** (0.042)
Abnorm_Acc	0.008 (0.019)	0.005 (0.023)	−0.015 (0.026)
ForInc_Change	−0.145** (0.070)	−0.161* (0.085)	−0.155* (0.093)
ForInc	0.067 (0.084)	0.153 (0.095)	0.175 (0.108)
AuditBig_Dummy	−0.0002 (0.014)	−0.010 (0.016)	−0.002 (0.016)
M.A_Dummy	−0.002 (0.007)	0.005 (0.007)	−0.003 (0.007)
AltmanZ_Score	−0.001 (0.0005)	−0.001*** (0.0005)	−0.001*** (0.001)
Underinv_Score	−0.011 (0.024)	0.003 (0.023)	−0.033 (0.024)
Debt_Conv	−0.020 (0.057)	−0.004 (0.062)	−0.114* (0.066)
Pref_Shares	−0.056 (0.263)	−0.030 (0.321)	−0.633*** (0.200)
CF_Vola	−0.0002 (0.001)	−0.001 (0.001)	0.001 (0.002)
Inc_Vola	0.001 (0.001)	0.001 (0.001)	−0.0002 (0.001)
Tax_Inc_Vola	−0.0003 (0.0004)	−0.0002 (0.001)	0.001 (0.001)
IntRate_Risk	−0.003 (0.044)	0.008 (0.048)	−0.016 (0.046)
FX_Risk	0.002 (0.006)	−0.002 (0.007)	−0.005 (0.007)
ComPr_Risk	−0.002 (0.004)	−0.002 (0.004)	0.001 (0.004)
Observations	4,400	4,400	4,400
R^2	0.117	0.118	0.115
Adjusted R^2	0.100	0.101	0.099
F Statistic (df = 82; 4317)	6.944***	7.034***	6.867***
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 26 reports the regression results for the ETR sample with the full set of controls based on equation [1]. This is an extension of Table 25, to control also for industry fixed effects. Derivatives usage remains statistically significant for the cash and current rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

A.4.2 Sentiment analysis ETR

Table 27: ETR - Analysis Aggressiveness 1

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.251^{**} (1.836)	-3.735^{**} (1.853)	0.167 (1.905)
LM_Litigious	-0.629 (0.716)	-0.472 (0.727)	1.412^{*} (0.817)
Firm_Size	0.003 (0.002)	0.006^{***} (0.002)	-0.004^{**} (0.002)
ROA	0.121^{***} (0.020)	0.126^{***} (0.023)	0.154^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0005 (0.001)	-0.0002 (0.001)	0.0002 (0.001)
Inc_Vola	0.0001 (0.001)	-0.0004 (0.001)	-0.0004 (0.001)
Debt	-0.055^{***} (0.012)	-0.077^{***} (0.012)	-0.081^{***} (0.016)
PPE	-0.067^{***} (0.018)	-0.087^{***} (0.017)	-0.020 (0.020)
Cash_CE	-0.016 (0.018)	0.016 (0.021)	-0.016 (0.019)
Observations	8,649	8,649	8,649
R^2	0.107	0.114	0.084
Adjusted R^2	0.100	0.107	0.077
F Statistic (df = 67; 8581)	15.286^{***}	16.508^{***}	11.800^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 27 reports the regression results for the ETR sample with the restricted set of controls and industry fixed effects, based on equation [2]. While derivatives usage remains statistically significant for the cash and current rate, the aggressiveness variable LM_Litigious shows a positive correlation with the total rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 28: ETR Regression - Analysis Aggressiveness 2

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-5.266^{***} (1.871)	-4.753^{**} (1.883)	-0.663 (1.956)
LM_Litigious	-1.312^{*} (0.763)	-1.747^{**} (0.771)	0.265 (0.872)
Firm_Size	0.005^{**} (0.002)	0.009^{***} (0.002)	-0.002 (0.002)
ROA	0.128^{***} (0.020)	0.137^{***} (0.023)	0.163^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0004 (0.001)	-0.00000 (0.001)
Inc_Vola	0.0002 (0.001)	-0.0004 (0.001)	-0.0003 (0.001)
Debt	-0.047^{***} (0.012)	-0.066^{***} (0.012)	-0.071^{***} (0.016)
PPE	-0.065^{***} (0.018)	-0.082^{***} (0.018)	-0.016 (0.020)
Cash_CE	-0.017 (0.018)	0.015 (0.021)	-0.016 (0.019)
Observations	8,649	8,649	8,649
R^2	0.118	0.143	0.105
Adjusted R^2	0.110	0.135	0.097
F Statistic (df = 79; 8569)	14.468^{***}	18.085^{***}	12.716^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	✓	✓	✓

Note: Table 28 extends Table 27 by adding year fixed effects. While derivatives usage remains statistically significant for the cash and current rate, the aggressiveness variable now shows a negative correlation those two rates. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 29: ETR Regression- Analysis Aggressiveness 3

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.329^{*} (2.485)	-4.946^{**} (2.415)	-0.860 (2.710)
LM_Litigious	-2.811^{**} (1.244)	-3.392^{***} (1.249)	-0.791 (1.453)
LM_StrongModal	3.841 (5.582)	7.356 (6.275)	4.086 (6.238)
HV_negative	1.037^{**} (0.437)	1.442^{***} (0.460)	1.642^{***} (0.557)
TLCF_Dummy	-0.029^{***} (0.010)	-0.040^{***} (0.010)	-0.014 (0.011)
TLCF_Change	-0.014 (0.020)	-0.014 (0.022)	0.016 (0.028)
Eq_Inc	0.514 (0.790)	-0.181 (0.679)	-0.499 (0.951)
Cash_CE	-0.067^{***} (0.026)	-0.015 (0.035)	-0.047^{*} (0.027)
PPE	-0.111^{***} (0.031)	-0.151^{***} (0.030)	-0.088^{**} (0.038)
Dep_Am	0.468^{**} (0.207)	0.724^{***} (0.225)	0.645^{**} (0.251)
Debt	-0.038 (0.027)	-0.092^{***} (0.027)	-0.080^{**} (0.032)
Debt_Change	0.044 (0.029)	0.083^{***} (0.030)	0.057^{*} (0.032)
BTM	0.007 (0.015)	-0.007 (0.013)	-0.016 (0.014)
Firm_Size	0.003 (0.004)	0.009^{**} (0.004)	-0.007^{*} (0.004)
ROA	0.114^{***} (0.042)	0.089^{*} (0.050)	0.176^{***} (0.054)
ROA_Change	-0.038 (0.028)	-0.042 (0.037)	-0.095^{**} (0.042)
Abnorm_Acc	0.013 (0.019)	0.012 (0.023)	-0.008 (0.026)
ForInc_Change	-0.155^{**} (0.070)	-0.173^{**} (0.084)	-0.161^{*} (0.093)
ForInc	0.068 (0.084)	0.152 (0.094)	0.161 (0.108)
AuditBig_Dummy	-0.001 (0.014)	-0.012 (0.016)	-0.005 (0.016)
M.A_Dummy	-0.003 (0.007)	0.005 (0.007)	-0.003 (0.007)
AltmanZ_Score	-0.0004 (0.0005)	-0.001^{*} (0.001)	-0.001 (0.001)
Underinv_Score	-0.010 (0.024)	0.004 (0.023)	-0.031 (0.024)
Debt_Conv	-0.018 (0.058)	-0.003 (0.062)	-0.111^{*} (0.067)
Pref_Shares	-0.017 (0.265)	0.014 (0.318)	-0.616^{***} (0.200)
CF_Vola	-0.0001 (0.001)	-0.001 (0.001)	0.001 (0.002)
Inc_Vola	0.001 (0.001)	0.001 (0.001)	-0.0001 (0.001)
Tax_Inc_Vola	-0.0003 (0.0004)	-0.0002 (0.001)	0.001 (0.001)
IntRate_Risk	-0.004 (0.043)	0.008 (0.047)	-0.014 (0.045)
FX_Risk	0.002 (0.006)	-0.001 (0.006)	-0.004 (0.007)
ComPr_Risk	-0.003 (0.004)	-0.002 (0.004)	0.001 (0.004)
Observations	4,400	4,400	4,400
R^2	0.121	0.126	0.123
Adjusted R^2	0.104	0.109	0.106
F Statistic (df = 85; 4314)	6.991^{***}	7.316^{***}	7.109^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 29 extends Table 28 by including the full set of control variables and industry fixed effects. Two additional qualitative control variables, namely LM_StrongModal and HV_negative are added. Both derivatives usage and the aggressiveness variable are highly statistically significant for the cash and current rate, showing negative coefficients. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 30: ETR - Analysis Complexity and Weak Modals 1

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.873^{***} (1.841)	-3.682^{**} (1.851)	-0.148 (1.955)
Complex_Words	-0.227^{***} (0.045)	-0.281^{***} (0.044)	-0.171^{**} (0.080)
LM_WeakModal	-4.395^{***} (1.344)	-2.119 (1.374)	-1.197 (1.593)
HV_negative			0.891^{*} (0.536)
Firm_Size	0.004^{*} (0.002)	0.007^{***} (0.002)	-0.003 (0.002)
ROA	0.118^{***} (0.020)	0.124^{***} (0.023)	0.158^{***} (0.026)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0005 (0.001)	-0.0003 (0.001)	0.0002 (0.001)
Inc_Vola	0.0001 (0.001)	-0.0004 (0.001)	-0.0004 (0.001)
Debt	-0.050^{***} (0.012)	-0.072^{***} (0.012)	-0.077^{***} (0.016)
PPE	-0.066^{***} (0.018)	-0.086^{***} (0.017)	-0.019 (0.020)
Cash_CE	-0.010 (0.017)	0.017 (0.020)	-0.016 (0.019)
Observations	8,649	8,649	8,649
R^2	0.112	0.120	0.090
Adjusted R^2	0.105	0.113	0.083
F Statistic	15.902^{***} (df = 68; 8580)	17.193^{***} (df = 68; 8580)	12.284^{***} (df = 69; 8579)
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 30 reports the results of the sentiment analysis for complex words and weak modals for the ETR sample. The regression is run with the restricted set of controls and industry fixed effects. Complexity is highly statistically significant for all three ETRs, while weak modals are only significant for cash rates. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 31: ETR Regression - Analysis Complexity and Weak Modals 2

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.776^{*} (2.473)	-3.915 (2.382)	0.222 (2.671)
Complex_Words	-0.214^{***} (0.056)	-0.239^{***} (0.057)	-0.233^{***} (0.068)
LM_WeakModal	-6.252^{***} (1.629)	-1.780 (1.774)	1.071 (1.878)
TLCF_Dummy	-0.024^{**} (0.010)	-0.037^{***} (0.010)	-0.011 (0.011)
TLCF_Change	-0.015 (0.020)	-0.015 (0.023)	0.015 (0.028)
Eq_Inc	0.474 (0.766)	-0.293 (0.669)	-0.496 (0.987)
Cash_CE	-0.050^{*} (0.026)	-0.006 (0.035)	-0.045^{*} (0.027)
PPE	-0.112^{***} (0.031)	-0.151^{***} (0.031)	-0.090^{**} (0.038)
Dep_Am	0.519^{**} (0.209)	0.756^{***} (0.228)	0.668^{***} (0.250)
Debt	-0.035 (0.027)	-0.091^{***} (0.027)	-0.081^{**} (0.032)
Debt_Change	0.042 (0.029)	0.083^{***} (0.030)	0.056^{*} (0.032)
BTM	0.006 (0.015)	-0.008 (0.013)	-0.017 (0.014)
Firm_Size	0.002 (0.004)	0.008^{**} (0.004)	-0.007^{*} (0.004)
ROA	0.099^{**} (0.043)	0.073 (0.050)	0.159^{***} (0.053)
ROA_Change	-0.039 (0.028)	-0.040 (0.037)	-0.090^{**} (0.042)
Abnorm_Acc	0.008 (0.019)	0.009 (0.023)	-0.009 (0.026)
ForInc_Change	-0.151^{**} (0.070)	-0.164^{*} (0.085)	-0.154^{*} (0.093)
ForInc	0.061 (0.084)	0.143 (0.094)	0.164 (0.108)
AuditBig_Dummy	-0.0005 (0.014)	-0.011 (0.016)	-0.003 (0.016)
M.A_Dummy	-0.003 (0.007)	0.005 (0.007)	-0.003 (0.007)
AltmanZ_Score	-0.001 (0.0005)	-0.001 (0.001)	-0.001 (0.001)
Underinv_Score	-0.009 (0.024)	0.003 (0.023)	-0.034 (0.024)
Debt_Conv	-0.022 (0.057)	-0.005 (0.062)	-0.115^{*} (0.067)
Pref_Shares	-0.090 (0.265)	-0.057 (0.316)	-0.653^{***} (0.200)
CF_Vola	-0.00001 (0.001)	-0.001 (0.001)	0.001 (0.002)
Inc_Vola	0.001 (0.001)	0.001 (0.001)	-0.0001 (0.001)
Tax_Inc_Vola	-0.0003 (0.0004)	-0.0002 (0.001)	0.001 (0.001)
IntRate_Risk	-0.002 (0.044)	0.011 (0.048)	-0.013 (0.046)
FX_Risk	0.001 (0.006)	-0.001 (0.006)	-0.004 (0.007)
ComPr_Risk	-0.002 (0.004)	-0.002 (0.004)	0.001 (0.004)
Observations	4,400	4,400	4,400
R^2	0.124	0.122	0.121
Adjusted R^2	0.107	0.105	0.104
F Statistic (df = 84; 4315)	7.265^{***}	7.168^{***}	7.072^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 31 reports the results of the sentiment analysis for complex words and weak modals for the ETR sample. The regression is run with the full set of controls and industry fixed effects. Complexity is highly statistically significant for all three ETRs, while weak modals are only significant for cash rates. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

A.4.3 HS analysis

Table 32: HS Regression

	Dependent variable:			
	HS_Measure			
	(1)	(2)	(3)	(4)
Total_Hits	0.434 (0.285)	0.195 (0.260)	−0.512** (0.205)	0.036 (0.242)
TLCF_Dummy				−0.0005 (0.001)
TLCF_Change				0.003 (0.002)
Eq_Inc				−0.101 (0.067)
Firm_Size		−0.005*** (0.0003)	−0.002*** (0.0002)	−0.001*** (0.0003)
ROA			−0.065*** (0.004)	−0.073*** (0.006)
ROA_Change				−0.004 (0.005)
Abnorm_Acc				−0.0003 (0.004)
ForInc_Change				−0.006 (0.012)
ForInc				−0.015 (0.012)
AuditBig_Dummy				−0.001 (0.001)
M.A_Dummy				−0.002*** (0.001)
AltmanZ_Score				0.0001** (0.0001)
Underinv_Score				−0.002 (0.002)
Debt_Conv				−0.007* (0.004)
Pref_Shares				0.012 (0.015)
Tax_Inc_Vola			−0.00004 (0.00002)	0.00001 (0.00004)
IntRate_Risk				−0.005 (0.004)
FX_Risk				0.001 (0.0004)
ComPr_Risk				0.00001 (0.0002)
CF_Vola			0.0002** (0.0001)	0.0001 (0.0001)
Inc_Vola			−0.0001** (0.00005)	−0.0002*** (0.0001)
Debt			−0.006*** (0.001)	−0.002 (0.002)
Debt_Change				0.0004 (0.003)
BTM				0.003*** (0.001)
PPE			−0.006*** (0.002)	−0.008*** (0.003)
Dep_Am				0.048** (0.019)
Cash_CE			−0.002 (0.002)	0.001 (0.002)
Observations	10,321	10,321	10,321	5,130
R^2	0.001	0.185	0.479	0.519
Adjusted R^2	0.0004	0.181	0.476	0.511
F Statistic	5.462** (df = 1; 10319)	39.541*** (df = 59; 10261)	142.903*** (df = 66; 10254)	66.355*** (df = 82; 5047)
Industry Fixed Effects	✓	✓	✓	✓
Year Fixed Effects	–	–	–	–

Note: Table 32 reports the results of the regressions, which were previously run on the ETR sample and are now run on the HS sample. Column (1) shows only the regression of derivatives usage on the HS measure without controls but with industry fixed effects. No statistically significant results are found. Column (2) additional controls for firm size, still yielding no statistically significant coefficient for the derivatives usage variable. Columns (3) and (4) extend (2) by adding first the restricted and then the full set of control variables. The derivatives usage variable turns out to be statistically significant only with the restricted set of controls, suggesting a negative correlation with the HS measure.Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

A.4.4 ETR analysis with interaction terms (incl. sentiment)

Table 33: ETR Regression - Income Volatility Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-5.603^{***} (1.883)	-3.611^{*} (1.927)	0.447 (1.958)
Tax_Inc_Vola_Q5	-0.051^{***} (0.019)	-0.036^{*} (0.020)	-0.007 (0.021)
Firm_Size	0.003 (0.002)	0.006^{***} (0.002)	-0.004^{*} (0.002)
ROA	0.116^{***} (0.020)	0.119^{***} (0.023)	0.147^{***} (0.027)
CF_Vola	0.001 (0.001)	-0.0001 (0.001)	0.0003 (0.001)
Inc_Vola	0.0003 (0.001)	-0.0002 (0.001)	-0.0003 (0.001)
Debt	-0.054^{***} (0.012)	-0.077^{***} (0.012)	-0.082^{***} (0.016)
PPE	-0.066^{***} (0.018)	-0.085^{***} (0.017)	-0.020 (0.020)
Cash_CE	-0.020 (0.018)	0.011 (0.021)	-0.016 (0.019)
Total_Hits:Tax_Inc_Vola_Q5	8.139 (5.045)	0.057 (5.218)	-3.524 (5.576)
Observations	8,649	8,649	8,649
R^2	0.109	0.118	0.085
Adjusted R^2	0.102	0.111	0.078
F Statistic (df = 67; 8581)	15.630^{***}	17.151^{***}	11.889^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 33 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Industry fixed effects are included. The indicator variable is 1 for firms in the highest pretax income volatility quintile, 0 otherwise. While the negative coefficient for the individual indicator variable is highly significant for the cash and current rate, the interaction term remains indistinguishable from 0 in all three cases. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 34: ETR Regression - Cash Flow Volatility Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.278^{**} (1.973)	-3.747^{*} (2.019)	0.055 (2.148)
CF_Vola_Q5	-0.005 (0.020)	-0.037^{**} (0.019)	-0.006 (0.020)
Firm_Size	0.003 (0.002)	0.005^{**} (0.002)	-0.004^{*} (0.002)
ROA	0.121^{***} (0.020)	0.113^{***} (0.023)	0.149^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Inc_Vola	0.0001 (0.001)	-0.0003 (0.001)	-0.0004 (0.001)
Debt	-0.054^{***} (0.012)	-0.078^{***} (0.012)	-0.082^{***} (0.016)
PPE	-0.066^{***} (0.018)	-0.090^{***} (0.017)	-0.022 (0.020)
Cash_CE	-0.017 (0.018)	0.015 (0.021)	-0.015 (0.019)
Total_Hits:CF_Vola_Q5	0.843 (4.599)	2.010 (4.552)	-0.604 (4.520)
Observations	8,649	8,649	8,649
R^2	0.106	0.118	0.084
Adjusted R^2	0.099	0.111	0.076
F Statistic (df = 68; 8580)	15.029^{***}	16.922^{***}	11.518^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 34 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Industry fixed effects are included. The indicator variable is 1 for firms in the highest cash flow volatility quintile, 0 otherwise. While the negative coefficient for the individual indicator variable is highly significant for the current rate, the interaction term remains indistinguishable from 0 in all three cases. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 35: ETR Regression - Debt Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-4.158^{**} (2.003)	-4.038^{**} (2.037)	0.412 (2.050)
Debt_Q5	-0.031^{**} (0.013)	-0.042^{***} (0.013)	-0.027 (0.017)
Firm_Size	0.002 (0.002)	0.005^{**} (0.002)	-0.006^{***} (0.002)
ROA	0.124^{***} (0.020)	0.131^{***} (0.023)	0.158^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0003 (0.001)	0.0002 (0.001)
Inc_Vola	0.0001 (0.001)	-0.0005 (0.001)	-0.0004 (0.001)
PPE	-0.068^{***} (0.018)	-0.091^{***} (0.017)	-0.026 (0.019)
Cash_CE	-0.014 (0.018)	0.020 (0.021)	-0.009 (0.019)
Total_Hits:Debt_Q5	-0.910 (3.357)	0.308 (3.375)	-5.260 (4.134)
Observations	8,649	8,649	8,649
R^2	0.107	0.112	0.082
Adjusted R^2	0.100	0.105	0.074
F Statistic (df = 67; 8581)	15.370^{***}	16.194^{***}	11.379^{***}
Industry Fixed Effects	✓	✓	✓
Year Fixed Effects	–	–	–

Note: Table 35 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Industry fixed effects are included. The indicator variable is 1 for firms in the highest leverage quintile, 0 otherwise. While the negative coefficient for the individual indicator variable is highly significant for the cash and current rate, the interaction term remains indistinguishable from 0 in all three cases. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 36: ETR Regression - Aggressiveness Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-5.160^{***} (1.972)	-3.984^{**} (2.024)	-0.159 (2.099)
LM_Litigious_Q5	0.003 (0.014)	-0.0004 (0.014)	0.012 (0.016)
Firm_Size	0.003^{*} (0.002)	0.007^{***} (0.002)	-0.002 (0.002)
ROA	0.173^{***} (0.020)	0.171^{***} (0.023)	0.181^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{***} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0003 (0.001)	-0.0004 (0.001)	0.0001 (0.001)
Inc_Vola	-0.0001 (0.001)	-0.001 (0.001)	-0.0004 (0.001)
Debt	-0.049^{***} (0.012)	-0.070^{***} (0.012)	-0.069^{***} (0.017)
PPE	-0.077^{***} (0.015)	-0.104^{***} (0.015)	-0.007 (0.016)
Cash_CE	-0.072^{***} (0.016)	-0.025 (0.019)	-0.058^{***} (0.017)
Total_Hits:LM_Litigious_Q5	-6.306^{*} (3.832)	-5.826 (3.922)	-2.826 (4.494)
Observations	8,649	8,649	8,649
R^2	0.064	0.099	0.057
Adjusted R^2	0.061	0.097	0.054
F Statistic (df = 23; 8625)	25.576^{***}	41.375^{***}	22.551^{***}
Industry Fixed Effects	–	–	–
Year Fixed Effects	✓	✓	✓

Note: Table 36 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Year fixed effects are included. The indicator variable is 1 for firms in the highest aggressiveness quintile, 0 otherwise. The interaction term is negative and statistically significant for the cash rate. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 37: ETR Regression - Complexity Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-6.265^{***} (2.033)	-5.269^{**} (2.109)	-0.328 (2.206)
Complex_Words_Q5	-0.010 (0.013)	-0.015 (0.013)	0.011 (0.015)
Firm_Size	0.003 (0.002)	0.007^{***} (0.002)	-0.002 (0.002)
ROA	0.175^{***} (0.020)	0.173^{***} (0.023)	0.181^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0004 (0.001)	0.00004 (0.001)
Inc_Vola	-0.0001 (0.001)	-0.001 (0.001)	-0.0004 (0.001)
Debt	-0.049^{***} (0.012)	-0.070^{***} (0.012)	-0.070^{***} (0.017)
PPE	-0.078^{***} (0.015)	-0.104^{***} (0.015)	-0.007 (0.016)
Cash_CE	-0.074^{***} (0.016)	-0.026 (0.019)	-0.057^{***} (0.017)
Total_Hits:Complex_Words_Q5	2.167 (3.096)	3.688 (3.168)	-1.943 (3.583)
Observations	8,649	8,649	8,649
R^2	0.062	0.098	0.057
Adjusted R^2	0.060	0.095	0.054
F Statistic (df = 23; 8625)	24.863^{***}	40.562^{***}	22.557^{***}
Industry Fixed Effects	–	–	–
Year Fixed Effects	✓	✓	✓

Note: Table 37 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Year fixed effects are included. The indicator variable is 1 for firms in the quintile with most complex words, 0 otherwise. Neither the interaction term nor the individual indicator variable are statistically significant. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 38: ETR Regression - Weak Modal Interaction

	Dependent variable:		
	Cash_Rate	Current_Rate	Total_Rate
	(1)	(2)	(3)
Total_Hits	-7.095^{***} (1.927)	-4.896^{**} (1.937)	-0.708 (1.979)
LM_WeakModal_Q5	-0.038^{***} (0.013)	-0.013 (0.014)	-0.002 (0.017)
Firm_Size	0.003 (0.002)	0.006^{***} (0.002)	-0.002 (0.002)
ROA	0.169^{***} (0.020)	0.171^{***} (0.023)	0.179^{***} (0.027)
Tax_Inc_Vola	-0.001^{***} (0.0003)	-0.001^{**} (0.0004)	-0.0002 (0.001)
CF_Vola	0.0004 (0.001)	-0.0004 (0.001)	0.0001 (0.001)
Inc_Vola	-0.0002 (0.001)	-0.001 (0.001)	-0.0004 (0.001)
Debt	-0.050^{***} (0.012)	-0.071^{***} (0.012)	-0.069^{***} (0.017)
PPE	-0.076^{***} (0.015)	-0.104^{***} (0.015)	-0.008 (0.016)
Cash_CE	-0.060^{***} (0.017)	-0.021 (0.019)	-0.055^{***} (0.017)
Total_Hits:LM_WeakModal_Q5	4.051 (4.034)	1.218 (4.348)	-1.374 (5.486)
Observations	8,649	8,649	8,649
R^2	0.067	0.098	0.057
Adjusted R^2	0.064	0.095	0.054
F Statistic (df = 23; 8625)	26.788^{***}	40.693^{***}	22.554^{***}
Industry Fixed Effects	–	–	–
Year Fixed Effects	✓	✓	✓

Note: Table 38 illustrates the regression results for the regression with restricted controls with the ETR sample, including an interaction term between derivatives usage and an indicator variable. Year fixed effects are included. The indicator variable is 1 for firms in the quintile with most weak modals, 0 otherwise. While the negative coefficient for the individual indicator variable is highly significant for the cash rate, the interaction term remains indistinguishable from 0 in all three cases. Statistically significant coefficients have one of the following levels: *p<0.1; **p<0.05; ***p<0.01

Table 39: Definition of variables used in the analysis - Part 1

Variable	Description
ETRs and HS	Measures Tax Avoidance
Current_Rate	Current effective tax rate, defined as the firm's current tax expense (total tax expense less deferred taxes) divided by the book value of pretax-income less special items. Nominator and denominator are computed as the three year sum (or two year if n.a.: sometimes only 2 observations due to the division of the sample period in before and after 2018) to make the rate a more reliable estimate. All negative denominators are dropped and rates are set to 1 and 0 if values exceed those boundaries (Dyreng, Hanlon, and Maydew 2008).
Cash_Rate	Cash effective tax rate, defined as the firm's cash tax expense divided by the book value of pretax-income less special items. Nominator and denominator are computed as the three year sum (or two year if n.a.) to make the rate a more reliable estimate. All negative denominators are dropped and rates are set to 1 and 0 if values exceed those boundaries (Dyreng, Hanlon, and Maydew 2008).
Total_Rate	Book effective tax rate, defined as the firm's total tax expense divided by the book value of pretax-income less special items. Nominator and denominator are computed as the three year sum (or two year if n.a.) to make the rate a more reliable estimate. All negative denominators are dropped and rates are set to 1 and 0 if values exceed those boundaries (Dyreng, Hanlon, and Maydew 2008).
HS_Measure	Tax preferences (Δ), defined as cash taxes paid less statutory tax rate times pre-tax income, scaled by the market value of assets. As reported in Henry and Sansing 2018; Gebhart 2017.
IAV	Tax Avoidance Incentives
Tax_Inc_Vola	Volatility of taxable income, defined as the standard deviation of estimated taxable income over a minimum period of 3 years, divided by the absolute mean of the same figure throughout the same time period. Estimated taxable income, as reported by (Donohoe 2015b), is the quotient of total tax expense less deferred tax and the statutory tax rate, minus the change in tax-loss carryforwards.
TLCF_Dummy	Dummy variable that is set to 1 if the amount of tax-loss carryforwards is different from zero. Assumes the value 0 otherwise.
TLCF_ Change	Yearly change in tax-loss carryforwards, scaled by lagged total assets (lagged assets are calculated using one lag corresponding to one fiscal year).
Eq_Inc	Income generated from equity in earnings from unconsolidated subsidiaries, scaled by lagged total assets.
Cash _CE	Cash and cash equivalents, scaled by lagged total assets.
PPE	Property, plant and equipment net, scaled by lagged total assets.
Dep_ Am	Total book value of depreciation and amortization , scaled by lagged total assets.
Debt	Total long-term debt, scaled by lagged total assets.
Debt_Change	Yearly change in total long-term debt, scaled by lagged total assets.
BTM	Book to Market ratio, computed as the equity book value divided by the equity market value, whereas the equity market value is defined as the company's share price at fiscal year end multiplicated by the common shareholder's equity.
(Res_Dvlp	Research and development expense, scaled by lagged total assets.)
Controls	Control Variables
Firm_Size	Firm size, computed as the logarithm of total assets.
ROA	Return on Assets, defined as earnings before tax divided by total assets.
ROA_Change	Yearly change in Return on Assets (ROA as defined above).
Abnorm_Acc	Abnormal Accruals, computed using the ROA-modified Jones model. According to (Kothari, Leone, and Wasley 2005) companies' accruals that have undergone an atypical performance are presumed to be systematically different from zero, hence there should be a correlation between firm performance and accruals. Total accruals are estimated according to the model, whose residuals are then used as a proxy for abnormal accruals.
ForInc	Foreign income before taxes, scaled by lagged total assets.
ForInc_Change	Yearly change in foreign income before taxes, scaled by lagged total assets.
AuditBig_Dummy	Dummy variable that is set to 1 if the auditor is one of the big four auditors, namely Ernst&Young, Deloitte&Touche, KPMG or PricewaterhouseCoopers. Assumes the value 0 otherwise.
M&A_Dummy	Dummy variable that is set to 1 if the cash flow stemming from mergers and acquisitions is nonzero. Assumes the value 0 otherwise.

Table 40: Definition of variables used in the analysis - Part 2

Variable	Description
IRM	Risk Management Incentives
AltmanZ_Score	The Altman-Z score is an empirical model to predict bankruptcy. The original weights are used, as the revised scores are concern specific industry types while the sample includes a wide range of sectors (Abdulkareem 2015; Kiaupaite-Grushniene 2016).
Underinv_Score	The underinvestment score, defined as the likelihood of underinvestment and calculated as defined in (Donohoe 2015b). First, the 4 growth opportunity measures, originally developed by Baber et. al are computed as described in their paper: investment intensity, geometric mean annual growth rate of the asset's market value, market to book value of assets, R&D expenditure to total assets). Second, those 4 factors, the net operating cash flow as well as the debt to assets ratio are classified in deciles within each sector. Third, the inverse of the decile rank for net operating cash flow is computed and then added to the ranks of the remaining variables and finally divided by 30 (which constitutes the maximium amount of points) (Cahan et al. 2008; Baber, Janakiraman, and Kang 1996).
(Exec_FV	The effect of executive pay on firm value, computed in a two step procedure. First, the monetary unit change (dollar) in the CEO's performance-based compensation (comprised of total stock and options granted) that would be generated by a one percentage point increase in the firm's stock price. One_percent =0.01 times share price at fiscal year end times (number of CEO's shares and option holdings). One percent is then used to calculate the incentive ratio, the part of CEO's estimated total pay that would stem from on ppt increase of the firm's equity value. This is obtained by dividing the one percent by the estimated total pay (one percent, salary and bonus) (Bergstresser and Philippon 2006).)
Debt_Conv	The firm's entire portion of long-term debt that is convertible to its common or preference stock and is not subordinated to any other long-term debt holdings, scaled by lagged total assets.
Pref_Shares	The amount of preference stock holdings multiplied by the share price at the end of the fiscal year, scaled by lagged total assets.
CF_Vola	The volatility of net cash flow of operating activities, defined as the standard deviation of net operating cash flows over a minimum period of 3 years, divided by the absolute mean of the same figure throughout the same time period.
Inc_Vola	The volatility of income, defined as the standard deviation of income before extraordinary items (comprising special items, income tax as well as minority interest), over a minimum period of 3 years, divided by the absolute mean of the same figure throughout the same time period.
IntRate_Risk	The level of interest rate risk exposure, computed as the absolute value of the estimated macro factor coefficient from the regression described as follows. The firm's monthly holding period return (over a time span of at least 12 months) is regressed on the value-weighted monthly market portfolio return as well as the monthly percentage change in the macro factor (interest rate, here the London Interbank Offered Rate or LIBOR) (Zhang 2009).
FX_Risk	The level of foreign exchange rate risk exposure, computed as the absolute value of the estimated macro factor coefficient (here: Federal Reserve Board trade-weighted U.S.Dollar index) from the regression described in IntRate_Risk (Zhang 2009).
ComPr_Risk	The level of commodity price risk exposure computed as the absolute value of the estimated macro factor coefficient (here:Producer Price Index or PPI) from the regression described in IntRate_Risk (Zhang 2009).
User	Derivative Intensity
Total_Hits	Derivative usage intensity, defined as the total derivative-related keyword count from the 10-K report, scaled by the total words in the filing to guarantee comparability across firms. The variable serves as an indicator of how intensely firms use financial derivative instruments.