Essays on the Measurement of Corporate Tax Avoidance and the Effects of Tax Transparency

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Vorwort

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Köln, im Dezember 2019 Hubertus Wolff

Content

Chapter 1

Introduction

Chapter 1

1.1 Motivation and Object of Research

Two independent studies by the European Parliamentary Research Service (EPRS) estimate that EU member states lose between EUR 50 and 190 billion of annual revenues due to corporate tax avoidance (EPRS, 2015a, 2015b). There are two potential conclusions that could be drawn from this: Firstly, there is a problem related to the taxation of corporations and European policymakers should feel urged to respond adequately to it. Secondly, the bandwidth of the estimates suggests that there is a great deal of uncertainty about the extent and the severity of the problem.

However, understanding the scope of aggressive corporate tax planning and its determinants and mechanisms should be of utmost priority for policymakers around the world. If companies pay little or no taxes on a systematical basis, the collection of public revenue and, consequently, the funding of worthwhile investments and public goods is at risk (For a global assessment, see Crivelli, De Mooij and Keen, 2016). Moreover, corporate tax avoidance has attracted increasing attention over the past decades and became a topic of major public and political interest. If companies do not contribute their fair share, why should citizens feel obliged to do so? Or put differently, why should civilians elect politicians or trust in authorities that tolerate such circumstances? In fact, several European parties, including the Greens and the Party of the European Socialists, address the public resentment when they stress the need for stricter corporate tax rules in their campaigns for the 2019 European parliament election.[1]

Anecdotal evidence of multinational enterprises (MNEs) strongly affects the public perception of corporate tax aggressiveness as a whole (Lee, 2015). In particular, large U.S. MNEs have made the headlines due to their low tax burdens: For instance, Amazon.com Inc. did not pay a single cent of U.S. federal income taxes despite its accumulated profit of $16.8

[1] *Press Release by the Greens* (22/01/2019); available at: https://www.greens-efa.eu/en/article/press/vast-differences-in-corporate-tax-rates-across-eu-shows-urgent-need-for-transparency-new-report/ and *Press Release by PES* (21/03/2018); available at https://www.pes.eu/en/news-events/news/detail/PES-welcomes-Commissions-legislative-proposal-to-tax-digital-companies/.

billion in the fiscal years of 2017 and 2018.[2] Other firms, like Google Inc. and Starbucks, exploited artificial international structures in order to relocate taxable profits from high- to low-tax countries and paid less than 5 percent of taxes on their profits abroad.[3] Moreover, the recent revelation of numerous tax scandals through confidential tax documents fueled the public debate: The Luxembourg Leaks in 2014, the Swiss Leaks in 2015 and the Panama Papers in 2016 provided the public with sensible data regarding tax fraud and/ or reprehensible tax planning activities of individuals, companies and authorities (Huesecken and Overesch, 2015; Rettig, 2016).

The good news is that public policymakers worldwide undertook coordinative efforts and have been developing reforms that aim at a more successful taxation of MNEs. The Base Erosion and Profit Shifting (BEPS) Project by the Organization for Economic Co-operation and Development (OECD) is intended to establish an international framework to combat tax avoidance of MNEs. The main ambition of the project is fixing tax law inconsistencies between countries that enabled corporations to shift profits from high to low-tax jurisdictions. The BEPS action plan comprises in total 15 action points, ranging from specific anti-avoidance rules, as the limitation of intra-group interest deduction or controlled-foreign-company (CFC) rules, to broader initiatives, as stricter disclosure regulation (OECD, 2015). In particular, increasing tax transparency (Action Plan 13) carries substantial hope in the combat against international tax avoidance. Contrary to many traditional anti-avoidance rules, mandated tax transparency, e.g. in form of a Country-by-Country-Reporting (CbCR) scheme, cannot be circumvented by corporations through alternative tax planning techniques. Tax transparency rules require the disclosure of key financial data – in particular actual tax expenses – and are intended to indirectly exert pressure on CEOs and CFOs of MNEs. Already in 2013, the European

[2] *Institute on Taxation and Economic Policy* (13/02/2019); available at: https://itep.org/amazon-in-its-prime-doubles-profits-pays-0-in-federal-income-taxes/.
[3] *Bloomberg* (11/12/2012); available at https://www.gadgetsnow.com/it-services/How-Google-saved-2-billion-in-income-tax/articleshow/17567959.cms and *The Guardian* (15/12/2015); available at: https://www.theguardian.com/business/2015/dec/15/starbucks-pays-uk-corporation-tax-8-millionpounds.

Commission mandated an independent, pioneering tax transparency initiative for the European financial sector, including CbCR (European Commission, 2013). Moreover, the European Commission presented its proposal for an Anti-Tax Avoidance Directive (ATAD), which is scheduled to enter into force for all EU member states form January 2019 onwards (European Commission, 2016). But not only international organizations tackled the issue of corporate tax avoidance. Several governments, like the U.S. administration under Donald Trump, also reacted, partly in uncoordinated solo-efforts, with new anti-avoidance regulations over the last years.

Whereas the taxpayers' sentiment pressured the political action, the input for reforms must be based on sound knowledge regarding the systematic incentives, mechanisms and determinants of aggressive corporate tax planning. Tax researchers have been delivering such input: A large strand of literature examines how international company structures facilitate tax avoidance (e.g. Collins and Sheckleford, 2003; Huizinga and Laeven, 2008; Markle, 2016). In particular, the key role of affiliates in tax havens was analyzed in this context (e.g. Desai, Foley and Hines, 2006; Dyreng and Lindsey, 2009). Moreover, specific firm attributes have been identified as particular suitable for saving taxes: Grubert (2003) and Dischinger and Riedel (2011) show how firms systematically exploit intangibility in assets and higher Research and Development (R&D) expenditures for the reduction of their tax expense. De Simone, Mills and Stomberg (2014) emphasize the crucial factor of mobility in income for successful tax planning. Moreover, tax aggressive firms can be linked to higher debt financing (Graham and Tucker, 2006), specific ownership structures (Chen, Chen, Cheng, and Shevlin, 2010) and managers' compensation (Armstrong, Blouin, and Larcker, 2012), among others. All this helps policymakers to design precisely targeted tax reforms and certain input is already embedded in the current regulations.

Nonetheless, the secrecy of fiscal data and the complex interconnection between corporate tax and operational, accounting, financial and other strategical decision processes

complicates the identification of tax planning determinants. Even nine years after the call for more research on tax avoidance in the renowned literature review by Hanlon and Heitzman (2010), there remains uncertainty regarding several aspects of the phenomenon. In particular, the question why only a limited number of corporations takes advantage of tax planning opportunities – the so called "undersheltering puzzle" (Weisbach, 2002) – still represents a pressing challenge for tax researchers. This shows that researchers most likely have not yet identified all related costs (or overestimated the benefits) of aggressive tax planning for corporations (Kim, McGuire, Savoy and Wilson, 2016).[4]

This thesis aims at a better understanding of corporate tax avoidance, its empirical measurement and the evaluation of tools for policymakers in the global combat against it. The three independent essays address two challenging areas of tax research that have not been sufficiently examined yet.

The first challenge lies in the measurement of corporate tax avoidance. Until today, there exists neither a uniform definition of corporate tax aggressiveness nor an academic consensus on how to measure it (Blouin, 2014). Instead, tax researchers apply numerous empirical proxies when examining the aggressiveness of corporate tax planning. However, Hanlon and Heitzman (2010, p. 146) express that their "overarching concerns" are with the divergent proxies, their difficult validation and, most importantly, with the strength of the inference that can be made given the chosen proxies. So far, the literature has mostly neglected the effect of conceptual differences between distinct measures on the measurement outcome. Thus, investigating to what extent methodological choices affect the tax avoidance outcome is justified and helpful for future tax research. Moreover, the existing literature has not sufficiently stressed the risk of misinterpreting low tax expenses as necessary consequences of aggressive tax planning (Henry and Sansing, 2018; Drake, Hamilton and Lusch, 2018). As a matter of fact, corporations

[4] Potential costs of tax avoidance could be reputational losses (Gallemore, Maydew and Thornock, 2014) or anticipated litigation through tax authorities (Wilson, 2009), among others.

occasionally have low tax expenses for justified reasons that are unrelated to intentional tax planning. Financial years before and after net operating losses (NOLs) represent such periods.[5] Thus, putting the measurement outcome into the perspective of NOLs is necessary for the correct documentation of tax planning activities. Lastly, tax avoidance researchers (and the public mind) sometimes tend to ignore firm-specific circumstances for the interpretation and extrapolation of their findings. Thus, drawing conclusions beyond distinct industries, tax-jurisdictions and even firm characteristics is to be seen critically. In particular, MNEs that are headquartered and represented in different countries over the world cannot be compared with respect to their global tax burden without making further assumptions. Thus, information on the geographical distribution of firm activities should be incorporated in the measurement of international tax aggressiveness. This, however, was often not feasible due to data limitations.

The second challenge for tax avoidance researchers is to give policymakers feedback on the effectiveness of their actions. The number of ongoing reforms bespeaks how seriously policymakers have come to take the issue of corporate tax avoidance. Nevertheless, whether the new legislations achieve their goals is still to be determined. Recent evidence suggests that prior regulation attempts have not effectively curbed corporate tax avoidance over the past 30 years (Dyreng, Hanlon, Maydew and Thornock, 2017). Corporations turn out to be quite flexible when confronted with new anti-avoidance rules (see e.g. Buettner, Overesch, Schreiber and Wamser, 2012; Nicolay, Nusser and Pfeiffer; 2017). Moreover, path-breaking reforms as the BEPS program have been, if at all, only a few years in place and, consequently, not been extensively examined yet. Thus, it is necessary to analyze how corporations respond to the new regulatory attempts in order to provide further guidance for effective policy-making (Dharmapala, 2014; OECD, 2014; Wilde and Wilson, 2018).

[5] Corporations can take advantage of their accumulated tax loss carryforwards or carrybacks in several years before and after a net operating loss (Cooper and Knittel, 2006).

The three essays of this thesis aim to address existing knowledge gaps in the described areas of tax avoidance research. The first essay "*The Measurement of Corporate Tax Avoidance in the Presence of Net Operating Losses*" investigates how loss-observations in archival database research affect the measurement of corporate tax avoidance and how tax researchers can deal with it. I show that NOLs can meaningfully be included in the analysis by the use of certain tax avoidance proxies but only under given restrictions. Moreover, I document that the conventional removal of loss-years from tax researchers' samples can have profound effects on the measurement outcome. In view of this, I revise trends in U.S. corporate tax avoidance documented by Dyreng, et al. (2017). The paper is single-authored and thus my sole responsibility. It was presented at the *Doctoral Research Seminar in Cologne in February 2019*.

The second essay "*Measuring the Aggressive Part of International Tax Avoidance*" is co-authored by Michael Overesch, Chair of Business Taxation at the University of Cologne and Tanja Krapat, former doctoral research assistant at the Chair of Business Taxation at the University of Cologne. We propose a new measure that isolates the additional or even aggressive part in international tax avoidance and analyze the determinants of aggressive tax avoidance of MNEs. Additionally, we show that our new measure can be used to condense the information provided by a tax transparency scheme. Based on a prior joint working paper, I was responsible for the collection and analysis of CbCR data and substantial revisions with regard to structural and empirical aspects. A previous version of the paper was presented at the *Doctoral Research Seminar in Vienna 2014*, the *37th European Accounting Association Annual Congress in Tallinn 2014*, and the *4th EIASM Workshop on Current Research in Taxation in Muenster 2014*.

The thesis concludes with the essay "*Tax Transparency to the Rescue: Effects of Country-by Country Reporting in the EU Banking Sector on Tax Avoidance*", co-authored by Michael Overesch, Chair of Business Taxation at the University of Cologne. The paper analyzes the effect of mandatory tax transparency on corporate tax avoidance in the European banking

sector. We find that particularly multinational banks with activities in tax havens increased their tax expense relative to other banks unaffected by the CbCR mandate. Our results suggest that CbCR can serve as an additional instrument for policy makers to curb corporate tax avoidance. During the project, I was responsible for data collection, the execution of all empirical analyses and structural revisions. The paper was presented at the *Doctoral Research Seminar in Cologne 2016,* the *40th European Accounting Association Annual Congress in Valencia 2017,* the *Research School of International Taxation in Tuebingen 2017,* the *VHB Annual Conference in Magdeburg 2018,* the *IIPF Annual Congress in Tampere 2018,* the *Annual Meeting of the National Tax Association in New Orleans 2018,* the *Internal Research Seminar in Iowa City 2018* and the *CPB Tax Haven Workshop in The Hague 2018.*

1.2 The Measurement of Corporate Tax Avoidance in the Presence of Net Operating Losses

1.2.1 Research Question and Design

This article addresses the question whether loss-observations can be implemented in the measurement of corporate tax avoidance and analyzes how the handling of losses affects the measurement outcome. Tax avoidance researchers have two choices regarding the treatment of loss-observations: They either remove losses from the sample or include them by using specific, asset-scaled measures of corporate tax avoidance.[6] One goal of this article is to inspect what new information is carried by studies that include losses and to which extent the enlarged sample coverage or conceptual differences between the applied measures determine the different outcomes. For this purpose, I compare the different measurement concepts of tax avoidance and discuss how the methodological choice affects the outcome. More precisely, I

[6] Asset-scaled measures (e.g. Book-Tax-Differences) have the advantage over conventional profit-scaled measures (e.g. Effective Tax Rates) that the scalar is independent of pretax income, such that loss-observations can remain in the analysis.

measure U.S. industry tax avoidance and lay particular focus on the conceptual differences between profit- and asset-scaled measures of tax avoidance and the associated sample selection.

Furthermore, this article highlights that the removal of loss-observations from tax researchers' samples can have profound effects on the conceptual measurement of corporate tax avoidance. I document that one single financial loss does not only yield a non-meaningful effective tax rate (ETR) for the loss-year itself, but is also accompanied by misleading annual tax expenses before and after loss-years that are unlikely to signal tax planning. Consequently, even studies that remove loss-observations from the sample deal with abnormal tax expenses that could erroneously be interpreted as tax avoidance. In view of this, I revise the declining trend in CASH ETR for U.S. domestic firms detected by Dyreng et al. (2017) with respect to loss-observations. I replicate the original analysis but interact the main variable of interest, the time trend, with a variable that captures the firm-specific loss-intensity in the sample prior to data cleaning. This way, I differentiate the time trend between profitable and non-profitable firms.

1.2.2 Results and Contribution to the Literature

I find that the systematic inclusion of loss-observations in the measurement of corporate tax avoidance is feasible but only under certain conditions. My descriptive results suggest that asset-scaled measures label less-profitable firms more tax aggressive than profit-scaled measures, which origins from a scaling induced bias, firstly discussed by Guenther (2014). Hence, NOLs can only be meaningfully included in the samples of tax researchers when the ratio of pretax income (in profitable years) to book/market value of assets is comparable among firms and over time. Moreover, the intake of loss-observations changes the samples of tax researchers substantially. The newly gained loss-observations in Compustat are concentrated within a remarkably smaller, shorter-lived and younger subset of frequently unprofitable firms. Firms that continuously report negative earnings yield little, if not any, information content in

terms of tax avoidance. Thus, tax researchers should be clear on whether they would like to include such specific firms in their analyses.

Additionally, I show that the underlying NOL structure in the data matters for the assessment of corporate tax avoidance even after the removal of loss-observations from the sample. I control for the initial loss-structure of firms in the research design of Dyreng et al. (2017) and observe that the decline in CASH ETR of domestic U.S.-firms is to some part attributable to distorted tax expenses that are linked to the loss-structure in the data. I document that profitable domestic U.S.-corporations did not engage in more aggressive tax planning activities over the years of their existence. This finding is new because so far abnormal ETR values of loss-making firms insinuated that domestic firms as a whole became more tax aggressive.

This study contributes to the tax avoidance literature in several ways. It is the first study, to my knowledge, that explores the sample selection linked to different proxies of tax avoidance and their respective measurement outcome. Second, it adds knowledge to the understanding of loss-firms and their characteristics, frequency and patterns in the Compustat database (Teoh and Zhang, 2011; Klein and Marquardt, 2006). Most importantly, this is the first study to show how the handling of NOLs affects the measurement of corporate tax avoidance: Either through a scaling-induced profitability bias when applying asset-scaled measure or the contamination of neighboring observations even after the removal of actual loss years from the sample. Lastly, this article contributes to the ongoing discussion about trends in U.S. corporate tax avoidance (Dyreng et al., 2017; Henry and Sansing, 2018).

1.3 Measuring the Aggressive Part of International Tax Avoidance

1.3.1 Research Question and Design

The second essay "Measuring the Aggressive Part of International Tax Avoidance" proposes a new measure for the aggressive part of international tax avoidance of MNEs. The

public debate about corporate tax aggressiveness has been fueled by anecdotal evidence on low ETRs of MNEs. As statutory tax rates on corporate income are significantly higher in most industrialized countries, this creates a gap between disclosed tax positions and common expectations about the tax level imposed. Nevertheless, MNEs pay their taxes in all countries of operation and consequently face a spectrum of different statutory tax rates. Thus, we propose a measure of international tax avoidance that isolates more aggressive international tax planning from the influence of moderate tax rates in host countries.

Our new measure ETRDIFF is computed as the difference between the average of the statutory tax rates imposed by all countries worldwide that host a subsidiary and the ETR. A firm is classified as more tax aggressive if the gap between its ETR and its expected benchmark tax level according to the average statutory tax rate increases. We compute the ETRDIFF measure for the S&P 500 firms over a period from 2002 to 2012 by combining information of the location of subsidiaries disclosed in Exhibit 21 of Form 10-k and Compustat data. For the manual collection of the statutory tax rates we use the worldwide corporate tax summaries of PwC, KPMG and E&Y. We also validate our measure with established proxies for international tax avoidance. In particular, we compare subsamples of firms with intense tax haven operations, firms with intense R&D activities and income mobile firms. Furthermore, we examine in multivariate regressions the impact of specific firm characteristics and international tax planning strategies, such as tax haven operations and profit-shifting opportunities, on our new measure.

In additional analyses, we collect information regarding the geographical distribution of corporate activities in order to refine our measure: First, we weight the host countries' statutory tax rates by sales of a typical U.S. foreign subsidiary (adjusted ETRDIFF). Next, we undertake a case-study approach in a specific industry where disclosure regulation provides valuable detailed data on geographical activities. In 2014 a European directive obliged financial institutions to publicly disclose key financial and tax information on a country-by-country level

for the first time in history. We exploit this - so far unique- data and compute a refined ETRDIFF measure for the largest European banks. This application shows that our measure can be used to condense the data set provided by a CbCR.

1.3.2 Results and Contribution to the Literature

For our sample of US firms from 2002 until 2012, we find an average FOREIGN ETRDIFF of approximately 5 percentage points. This suggests that U.S. firms undercut the mean of all foreign statutory tax rates clearly. Hence, U.S. MNEs in our sample appear to engage in aggressive tax planning that goes beyond the mere benefitting from moderate corporate tax rates. We also validate our measure with established proxies for international tax avoidance. Our analysis shows that larger tax haven operations or the enhanced opportunities to manipulate transfer prices are clearly associated with a higher value of our ETRDIFF measure. The results remain robust when we approximate the economic relevance of the foreign subsidiaries by sales data. Lastly, we apply our new measure to country-by-country data of European banks and revise the perception of their international tax aggressiveness. While some banks have substantial operations in countries with moderate corporate tax rates and consequently pay less taxes (e.g. Credit Agricole) other banking groups manage to pay less taxes globally despite their predominant activities in high tax countries (e.g. HSBC). Overall, the perception of EU banks' tax avoidance changes substantially when the public mind benchmarks the banks' tax payments against the expected tax liability in all countries of operation.

The findings contribute to the recent debate about base erosion and profit shifting. The OECD requests new measures to analyze the scope and the determinants of base erosion and profit shifting (OECD, 2014). The methodology proposed in this paper allows to isolate the aggressive part of international tax avoidance and to identify important determinants such as

tax haven usage and opportunities to manipulate transfer prices. Moreover, the applications in this article emphasize the value of enhanced data availability through tax transparency.

1.4 Financial Transparency to the Rescue: Effects of Country-by-Country Reporting in the EU Banking Sector on Tax Avoidance

1.4.1 Research Question and Design

The third essay "Tax Transparency to the Rescue: Effects of Country-by-Country Reporting in the EU Banking Sector on Tax Avoidance" analyzes the effect of mandatory tax transparency on corporate tax avoidance. In recent years, policy makers have been discussing comprehensive tax transparency as a key strategy for combating international tax avoidance (OECD, 2015). Corporate tax transparency rules require the disclosure of key financial data—in particular actual tax expenses—and are intended to indirectly curb tax aggressiveness by exerting pressure on CEOs and CFOs of MNEs. Until now, most tax transparency initiatives have not yet been fully implemented and the existing ones do not make the collected data available to the public. Consequently, the effectiveness of tax transparency policy is largely unknown.

The Capital Requirements Directive IV by the European Commission from 2013 forced multinational banks to publish key financial and tax data in the form of Country-by-Country Reporting for the first time in history. We use this event as an exogenous shock to the disclosure duties of European banks and examine tax expenses around the reform. More precisely, we apply several independent Difference in Differences approaches in order to quantify the impact of tax transparency on affected multinational EU banks relative to several control groups: Domestic EU banks, multinational U.S. banks, EU insurance companies and large European manufacturing corporations. For comparisons outside the EU banking sector, we apply propensity-score matching with respect to firm size and profitability to ensure comparability between the firms. Additionally we apply various robustness checks and install several placebo

treatments in order to disentangle the effect from tax transparency from other regulatory changes over time.

1.4.2 Results and Contribution to the Literature

Our results suggest that European multinational banks experienced a significant increase in their effective tax levels after the regulation, relative to unaffected banks. In particular, we find that the multinational banks, which are most exposed to the newly demanded transparency through the revelation of their activities in tax havens, reacted the strongest to the mandatory disclosure of CbCR. Banks with activities in tax havens increased their ETR by 3.6 percentage points relative to the other banks in our sample. In additional comparisons, we checked our results against trends in corporate tax avoidance, both in the financial sector and across other industries. This further analysis reveals a response only in the European banking sector. We also dismiss other regulatory influences embedded in the Basel III framework as alternative explanations. Ultimately, our results suggest that European multinational banks responded to the new transparency and did not simply follow a general trend in the financial sector or in international tax avoidance.

We contribute to prior literature, which suggests that disclosure of additional information about the international firm structure influences the scope of international tax avoidance (e.g. Hope, Ma and Thomas, 2013; Dyreng, Hoopes and Wilde, 2016). We add to this literature by analyzing the impact of the first comprehensive, supranational tax transparency initiative on tax avoidance behavior of MNEs. Our findings suggest that CbCR can be an additional effective instrument for policy makers to curb cross-border corporate tax planning.

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Chapter 2

The Measurement of Corporate Tax Avoidance in the Presence of Net Operating Losses

The Measurement of Corporate Tax Avoidance in the Presence of Net Operating Losses*

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Abstract

This article addresses the question whether net operating loss (NOL) observations can be implemented in the measurement of corporate tax avoidance and how the handling of losses affects the measurement outcome. I find that the implementation of NOLs in the measurement of tax avoidance is feasible but only under certain restrictions. If researchers control for the confounding effect of firm-profitability and heterogeneous characteristics of non-prospering firms, losses can meaningfully be included in the analysis by the use of asset-scaled proxies. When researchers decide to remove net operating losses from their sample, they should be aware of misleading tax expenses before and after loss-years that remain in the sample and do not signal tax planning. In view of this, I re-examine trends in aggregate U.S. corporate tax avoidance documented by Dyreng, Hanlon, Maydew and Thornock (2017) and find that the loss structure in the data partly conceals the true development of U.S. domestic firms' corporate tax planning.

Keywords: Tax Avoidance; Losses; Effective Tax Rates; Book-Tax-Differences

JEL Classification: H25, H26, H32, M41

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Chapter 2

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2.1 Introduction

The majority of tax researchers ignores loss-observations when measuring corporate tax avoidance. However, net operating losses (NOLs) in the Compustat database have become substantially more prevalent, persistent, and larger in magnitude since the 1970s (Denis and McKeon, 2016). In fact, 41 percent of all annual Compustat U.S. firm observations since the year 2000 represent negative earnings. Thus, it is difficult for tax researchers to further ignore losses without explaining why. The empirical measurement of corporate tax avoidance relies on multiple proxies. Effective Tax Rates (ETRs) and Book-Tax-Differences (BTDs) are the two most fundamental measurement concepts and often appear together in research designs. (e.g. Frank, Lynch and Rego, 2009; Lennox, Lisowsky and Pittman, 2013). Both measures are closely related but differ with respect to their scalars: ETRs are always scaled by firm profits whereas BTDs are most commonly scaled by book value of firm assets (Guenther, 2014). Thus, negative earnings lead to ETR realizations that are difficult to interpret.[7] Contrary, BTD can be constructed for loss-firms because its scalar is independent of the sign of reported earnings. Yet, the usage of loss-observations in BTD research is not consistent: The majority of BTD studies did not to include loss-observations in the sample due to an overall skepticism towards their information content. (e.g. Hanlon, 2005; Blaylock, Shevlin and Wilson, 2012).

Henry and Sansing (2018) have reacted to this and developed the first cash-based measure of tax avoidance which is constructed to generate meaningful values for both profitable and loss-firms.[8] When applying their measure, Henry and Sansing (2018) find contradicting results to prior literature which exclusively relied on profitable subsamples. Many industries that appear to be tax-favored in profitable samples are actually tax-disfavored when losses are included in the analysis. Moreover, the authors revise the results of Dyreng, Hanlon, Maydew

[7] A firm with a tax expense of 35 but a pretax loss of 100 would have the same ETR as a firm with a tax refund of 35 and positive pretax income of 100 (Henry and Sansing, 2018).
[8] I use *HS2018* when referring to the tax avoidance measure developed in Henry and Sansing (2018) and Henry and Sansing (2018) when referring to the published article, itself.

and Thornock (2017) who document a trend in increasing tax avoidance over time. Dyreng et al. (2017) detect a declining trend in ETR for both multinational and domestic firms between 1988 and 2012. In contrast, Henry and Sansing (2018) find that the tax avoidance of domestic U.S.-firms decreased over time when unprofitable observations remain in the sample. The documented decline in profit-scaled ETR for domestic firms has been discussed by other researchers, as well: Schwab, Stomberg and Xia (2018) assess GAAP ETR as an unsuitable measure of corporate tax avoidance for poorly performing firms. In line with Drake, Hamilton and Lusch (2018), they document that the metric of GAAP ETR frequently suffers from substantial distortions, triggered among others by the release of valuation allowances and the impairment of non-tax deductible goodwill, which are both frequent events for loss-firms. Thus, Drake et al. (2018) argue that the downward trend in domestic firms' ETRs is to a large part attributable to firm losses, their truncation from the data in ETR-research and subsequent releases of valuation allowances.

Given the amount of studies that posit a reconsideration of established results from the ETR literature, it is necessary to gain a deeper understanding of loss-observations and their information content for the measurement of tax avoidance. It is of particular interest to inspect what new information is carried by studies that include loss-observations and whether the extended sample coverage or conceptual differences between the applied proxies determine the different outcomes.

First, I compare different methods for tax researchers to include loss-firms in the measurement of corporate tax avoidance and discuss how the methodological choice affects the outcome. My descriptive results indicate that the intake of loss-observations changes the samples of tax researchers substantially: Using BTD (HS2018) instead of CURRENT ETR (CASH ETR) increases sample size up to 43.1 percent (28.1 percent) and the newly gained loss-observations in Compustat are concentrated within a remarkably smaller, shorter-lived and younger subset of continuously unprofitable firms. Therefore, I argue that tax researchers

should distinguish between infrequent loss years of usually profitable firms and losses accumulated by steadily unprofitable firms. The latter are eventually unlikely to create future tax benefits due to impending bankruptcy of the firms and thus difficult to interpret when measuring tax avoidance. Ultimately, my findings suggest that asset-scaled BTDs - and the novel HS2018 measure- label less-profitable industries more tax aggressive than ETRs, which origins from a scaling induced profitability bias, first discussed by Guenther (2014). Thus, it is possible to analyze the tax planning of both, profitable and unprofitable firms, but only if the confounding factor of firm-profitability and the heterogeneous characteristics of non-prospering firms are controlled for.

Second, I show that the removal of loss-observations from tax researchers' samples can have profound effects on the measurement of corporate tax avoidance, as well. I document that one single financial loss does not only yield a non-meaningful ETR for the loss-year itself, but is also accompanied by misleading annual tax expenses before and after loss-years that are unlikely to signal tax planning. Consequently, even studies that remove loss-observations from the sample deal with distorted ETR values that could falsely be interpreted as tax avoidance. In view of this, I revise the declining trend in CASH ETR for domestic firms detected by Dyreng et al. (2017) with respect to loss-observations. In the beginning, I show that the Compustat coverage of more recent generations of low-tax firms contributes substantially to the documented cross-sectional decline in CASH ETR. In fact, the tax planning of older U.S.-firms increased over the years, too, but at a lower rate than initially supposed. Most importantly, I observe that the decline in CASH ETR over the lifespan of domestic U.S.-firms is attributable to distorted ETR values that can be linked to the loss-structure in the data. Hence, domestic U.S.-corporations did not engage in more aggressive tax planning activities over their existence. In contrast, U.S.-multinationals truly became more tax aggressive.

This study contributes to the tax avoidance literature in several ways. It is the first study, to my knowledge, that explores the sample selection linked to different proxies of tax avoidance

and their respective measurement outcome. Second, it adds knowledge to the understanding of loss-firms and their characteristics, frequency and patterns in the Compustat database. Most importantly, this is the first study to show how the handling of NOLs affects the measurement of corporate tax avoidance: Either through a scaling-induced profitability bias when applying BTD/HS2018 or the contamination of neighboring ETR values even after the removal of actual loss years from the sample. Thus, NOLs always affect the measurement of corporate tax avoidance. Lastly, this article contributes to the ongoing discussion about trends in U.S. corporate tax avoidance. I link the underlying loss-structure in the data to measured trends in tax avoidance and find that domestic and multinational U.S.-corporations evolved differently with respect to successful tax planning. This finding is new because so far abnormal ETR values of loss-making firms insinuated that domestic firms became more tax aggressive over their existence, too.

The remainder of the article is structured as follows: Section 2 delivers an overview over the tax literature dealing with NOLs. Section 3 compares different methods for tax researchers to include NOLs in the measurement of corporate tax avoidance and the respective consequences for the measurement outcome. Section 4 analyzes how the omission of loss-observations affects the measurement of tax avoidance and revises long run trends in U.S. corporate tax avoidance. Section 5 concludes.

2.2 Related Literature

Hanlon and Heitzman (2010, p.129) point out: "[…] we do not have a very good understanding of loss-firms, the utilization and value of tax-loss carryforwards, and how the existence of losses affects the behavior […] of any of the involved parties". This incentivized tax researchers to closely explore loss-firms, their attributes and the informative content of accounting information related to losses.

A substantial body of research stresses the informative value of tax loss carry-forwards (TLCFs) for future firm performance. Dhaliwal, Kaplan, Laux and Weisbrod (2013) suggest that the recognition of a deferred tax asset valuation allowance – a discretionary accounting judgment that increases net income based on estimated future tax benefit realizations – provides incremental information about the persistence of future losses. Thus, investors should pay attention to such an event. McGuire, Neuman, Olson and Omer (2016) analyze the investors' valuation of new TLCFs and find that it varies with firms' prior tax avoidance behavior. This is because former tax avoidance signals firms' abilities to generate taxable income to offset TLCF through tax planning. Finley and Ribal (2018) confirm the informative value of the valuation allowance release decision but suggest that investors are not timely responding to it. Besides future performance, Edwards (2017) and Watson (2018) link the existence of deferred tax valuation allowances to firms' creditworthiness. Moreover, Flagmeier (2017) finds that the predictive ability of deferred tax valuation allowances persists even when it is not recognized (as under US GAAP) but instead solely mentioned in the footnote (as under IFRS). However, the complexity of the accounting for deferred taxes and respective costs have been criticized (Laux, 2013) and some researchers find that the implementation of deferred taxes into common forecasting approaches even worsens the prediction performance (Dreher, Eichfelder and Noth, 2017).

At the same time, data quality appears to be a major issue when analyzing TLCF. Several scholars emphasize that the readily-available proxies for NOLs, in databases as Compustat, suffer from considerable measurement error (e.g. Mills, Newberry and Novack, 2003). Heitzman and Lester (2017) develop a measure on basis of hand-collected data, which is superior to the traditional proxy in predicting cash tax shields on future earnings. Rechbauer (2016) confirms that database-driven methods do not perform well in predicting the availability of TLCFs for Italian firms. Lastly, given the great deal of uncertainty about the future gains from TLCF, Sarkar (2014) proposes a novel contingent-claim model to value this asset. Recent

work by Leung and Veenman (2018) analyzes the informative value of non-GAAP earnings disclosures (in press releases) for loss-firms and finds that they are significantly more predictive and less strategic than for profit firms. This suggests that loss-firms can help their investors to disaggregate GAAP losses into components that have differential implications for the firm by distributing information outside financial reporting.

Second, there exist studies that analyze how firms take actions in order to maximize their tax loss benefits. Maydew (1997) finds that firms appear to report larger losses when the relative tax benefit of the carryback, measured by the tax rate differential before and after the 1986 tax reform, is larger. Albring, Dhaliwal, Khurana and Pereira (2011) observe that a reduction in the NOL carryback period in the Taxpayer Relief Act 1997 incentivized firms to shift income to accelerate loss recognition in the tax year 1997. Erickson, Heitzman and Zhang (2013) document that firms manage their loss reporting in order to claim a cash refund of recent tax payments before the option to do so expires. Furthermore, they show that analysts do not incorporate tax-motivated loss shifting which leads to higher forecasting error. A large share of firms is known for exercising certain rights plans (so called "poison pills") as a tool to preserve net TLCF (Erickson and Heitzman, 2010). Interestingly, Sikes, Tian and Wilson (2014) document a broadly negative market response to the announcement of such right plans and argue that investors do not believe that pills are usually adopted to preserve a valuable tax asset but instead to entrench management.

Lastly, there exists a growing number of studies that re-evaluate and newly interpret established findings from the tax avoidance literature by explicitly including (and focusing on) loss-observations in the analyses. As Denis and McKeon (2016) indicate, operating losses in the Compustat database have become substantially more prevalent, persistent and larger in magnitude since the 1970s. The extent of loss-firms ranges between 30 and 50 percent of all available yearly observations, which makes it understandable why scholars argue that it might not be reasonable to exclude such a large share of firms. This holds in particular when

examining the variation in average corporate tax planning across the total population of firms. As mentioned before, Henry and Sansing (2018) develop their own measure of cash tax avoidance that produces meaningful values for losses, and re-evaluate the findings of Dyreng et al. (2017) on changes in corporate effective tax rates over the past 25 years. Henry and Sansing (2018) conclude that domestic firms have – contrary to the original analysis – become more tax-disfavored over time. This re-examination builds on the argument of Teoh and Zhang (2011) that the trimming of loss-observations in accounting studies might cause a downward truncation bias in estimated mean returns that is stronger in ex ante subsamples with more loss-firms.

Cooper and Knittel (2006, 2010) analyze U.S. tax return data and find that firms can incur significant penalties from the US corporate loss regime due to the lag between the generation of a tax loss and its utilization. They estimate the time delay in loss-utilization up to ten financial years after the actual loss. This underlines that low tax expenses several years after the event of a loss can origin from delayed TLCFs and, thus, do not necessarily signal aggressive tax planning. Guenther (2011) analyzes in detail 113 "unusual observations" from the research setup of Hanlon (2005) and indicates that despite Hanlon's diligent attempt to eliminate observations with TLCF, one third of those unusual observations report deferred tax assets related to TLCF. Thus, Guenther (2011) concludes that the utilization of TLCFs should not be interpreted as an actual BTD, supposedly triggered by earnings management and/or tax avoidance. Kohlhase (2016) investigates this link in detail by disaggregating the positive association between TLCFs and BTDs and finds that only so-called "double picture firms" with positive pretax income but negative taxable income explain the association between temporary BTDs and TLCFs.

Schwab et al. (2018) more generally evaluate GAAP ETR as a measure of corporate tax avoidance for poorly performing firms. In line with Drake et al. (2018), they document that the metric of GAAP ETR frequently suffers from substantial distortions and could be misleading

when it is used to proxy tax avoidance. Two events triggering such distorted GAAP ETRs are the release of valuation allowance and the impairment of non-tax deductible goodwill, which are both frequent events for loss-firms. Drake et al. (2018) argue that the documented downward trend in domestic firms' ETRs is to a large part attributable to decreases in the valuation allowance account of domestic firms and hence should not be interpreted as tax avoidance.[9]

2.3 Including NOLs in the Measurement of Corporate Tax Avoidance

In the following, I discuss different methods for tax researchers to include loss-observations for the assessment of tax aggressiveness. It is of particular interest to inspect what new information is carried by studies that include losses and to what extent the enlarged sample coverage or conceptual differences between the applied measures determine the different outcomes. For this purpose, I elaborate the differences between profit- and asset-scaled measures of tax avoidance. Next, I show how the choice of tax avoidance measure affects the composition of tax researchers' Compustat samples. Then, I examine how the perception of U.S. industry tax avoidance changes when using asset-scaled BTD/ HS2018 instead of profit-scaled ETR on an identical sample. Lastly, I discuss the information content of loss-observations and when it is useful to incorporate them in the analysis of corporate tax avoidance.

2.3.1 Conceptual Comparison of Tax Avoidance Measures

ETRs and BTDs represent probably the two most frequently used measurement concepts for tax avoidance and often appear together in research designs (e.g. Chen, Chen, Cheng and Shevlin, 2010; Lennox et al., 2013). Both measures are closely related but differ with respect to their scalars: ETRs are always scaled by firm profits whereas BTDs are most commonly

[9] Since the majority of decreases in the valuation allowance takes place in profitable years and the increases in valuation allowance in loss years, the exclusion of only the latter in tax studies leads to a downwards bias in *GAAP ETR* (Drake et al., 2018).

scaled by firm assets (Guenther, 2014). Thus, negative earnings lead to ETR realizations that are difficult to interpret. Contrary, BTDs can incorporate loss-firms because its scalar is independent of the sign of reported earnings.

ETR is computed as a measure of tax expense divided by pretax financial income. There exists a number of potential ways to measure tax expenses, which leads to different expressions of ETR. A widely used version of ETR is *GAAP ETR* (Graham, Hanlon, Shevlin and Shroff, 2013) with total tax expenses representing the numerator. Total tax expenses include current and deferred taxes. Thus, *GAAP ETR* provides information to stakeholders about the amounts, timing and uncertainty of current and future tax payments (Demere, Li, Lisowsky and Snyder, 2017). The *CURRENT ETR* differs from *GAAP ETR* as it relies exclusively on current tax expense and hence is unaffected by future tax payments. Lastly, *CASH ETR* describes the ratio of cash tax paid to pretax income of a given year.[10] *CASH ETR* supposedly reflects all tax planning strategies, including those missed by accrual based measures, and has therefore been used extensively by tax researchers (Dyreng et al., 2017). Given the parallel structure, all expressions of ETR describe the respective average tax rate payable/paid for one unit of financial income (Dyreng, Hanlon and Maydew, 2010; Frank et al., 2009; Gupta and Newberry, 1997).

$$ETR = \frac{Tax\ expense/paid}{Pre{-}tax\ Income} \qquad \text{(Eq.1)}$$

Per definition, ETR measures indicate which firms manage to have a low tax burden in relation to their profits. Thus, ETRs do not capture conforming tax avoidance strategies which lower both, the tax expense and the book income (Badertscher, Katz, Rego and Wilson, 2015).

[10] Therefore *CASH ETR* does not reflect taxes accrued in the current period but tax payments accrued in prior periods or advance tax payments (Lee, Dobiyanski, and Minton, 2015; Lennox et al., 2013).

By way of contrast, BTD is computed as the total difference between financial and approximated taxable income and scaled by a firm's pretax total assets (Manzon Jr and Plesko, 2002). Due to the fiscal secrecy, the true taxable income stated on a firm's tax return is not publicly available and thus commonly approximated by dividing the firm's current tax expense by the statutory tax rate (τ).[11]

$$BTD = \frac{Pre{-}tax\ Income - (Current\ tax\ \ expense)/\tau}{Total\ Assets} \quad \text{(Eq.2)}$$

Large BTDs describe situations where the approximated taxable income is lower than the book income, suggesting that taxes are successfully avoided and/or earnings are managed upwards without generating additional tax liability. Importantly, the choice of assets as a scalar for BTDs allows to retrieve potentially meaningful tax avoidance values for firms with negative pretax income. Thus BTDs, traditionally scaled by assets, have the advantage over ETRs that loss-firms can remain in the sample. Yet, the usage of loss-observations in BTD research is not consistent: The majority of BTD studies decided not to include loss-observations in the sample due to an overall skepticism towards their information content (e.g. Hanlon, 2005; Blaylock et al., 2012). Contrary, other studies included them without explicitly elaborating why (e.g. Lisowsky, 2010; Seidman, 2010; Lennox et al., 2013).

The novel *HS2018* measure represents a special type of BTD that is supposed to provide meaningful measurement of tax avoidance regardless of a firm's pretax profitability. For this purpose, it relies on a firm's cash tax payments and its market value of total assets as a scalar:

$$HS2018 = \frac{\Delta}{Market\ Value\ of\ Total\ Assets} = \frac{Adj.\ \ Cash\ Tax\ paid - \tau * Pre{-}tax\ Income}{Market\ Value\ of\ Total\ Assets} \quad \text{(Eq.3)}$$

[11] This procedure, however, has been subject to criticism due to systematically different consolidation rules and handling of tax credits between the book and tax account. (Hanlon, 2003; Gaertner, Laplante and Lynch, 2016). I set τ to 34% for fiscal years before 1992 and to 35% for fiscal years after 1993 in the analysis.

Henry and Sansing (2018) measure corporate tax avoidance by Δ, an indicator for being tax favored scaled by market value of assets. Δ describes the difference between adjusted cash taxes paid[12] and the statutory tax burden (τ * pretax income). If a firm has a Δ of zero, its *CASH ETR* equals the statutory tax rate. The less taxes a firm pays, the lower is Δ and the more tax favored is a firm. Interestingly, Δ can also become negative and consequently indicate that a firm is tax-favored in relation to the statutory tax rate. Scaling by market value of total assets brings the advantage that it is always positive and thus avoids the truncation of negative profit firms, just as the conventional asset-scaled BTD. Indeed, the *HS2018* measure combines the advantages of BTD and *CASH ETR*: It does rely on real cash tax paid (and thus is not distorted by accounting concepts as valuation allowances) and supposedly provides meaningful information for loss-firms. However, the measure is still novel and is required to be used more frequently by other researchers.

Lisowsky, Robinson and Schmidt (2013) discuss potential differences between ETR and BTD and argue that the latter captures more aggressive tax avoidance behavior than ETR does. This argument predominantly evolved from the tax shelter literature where researchers were able to link actual shelter activity, a strongly aggressive tax planning behavior, to BTDs but less to ETRs. However, Guenther (2014) clarifies that ETRs and BTDs are statistically equivalent measures unless they are scaled by different proxies. This matters as it is common practice in accounting research to scale ETRs by firm profit and BTDs by firm assets. Thus, Guenther (2014) argues that the BTD measure is equivalent to the ETR multiplied by the firm's pretax return on assets. In the same manner, Guenther (2014) highlights that the *HS2018* measure (earlier version) is statistically equivalent to the ETR multiplied by a measure that reflects several different firm characteristics, including risk, growth and leverage.

[12] Henry and Saning (2018) adjust cash taxes paid by deducting changes in a firm's tax refund receivable (*txr*) variable from it. This way, the usage of TLCF shall be reflected in the measure.

$$CURRENT\ ETR = f(Profit, Current\ Taxes) \iff BTD = f(Profit,\ Current\ Taxes, \tau, TA)$$

$$BTD = f(Current\ ETR\ x\ ROA)$$

(Eq. 4)

$$CASH\ ETR = f(Profit, Taxes\ Paid) \iff HS2018 = f(Profit,\ Taxes\ Paid, \tau, MVTA)$$

$$HS2018 = f(CASH\ ETR\ x\ ROMVA)$$

(Eq. 5)

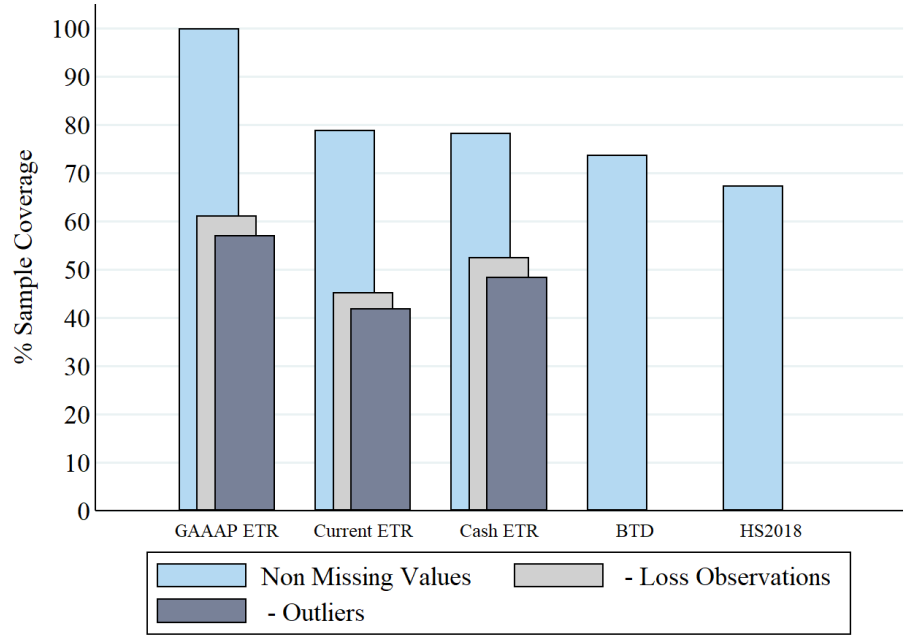
He underlines his theoretical argument with numerical simulations and shows that controlling for the additional factor influence from ROA by ROA itself is insufficient in order to correct the scalar induced bias. Ultimately, Guenther (2014) concluded that the information content on tax avoidance is equal between *CURRENT ETR* (*CASH ETR*) and conventional *BTD* (*HS2018*) and that any conflicting results between those measures result from the choice of scalar.

2.3.2 Sample Selection of Different Tax Avoidance Measures

Researchers can expand the size of their sample by choosing asset-scaled over profit-scaled measures for tax avoidance. However, the occurrence of financial losses is most unlikely random between firms and time-periods. Therefore, I will explore the characteristics of loss-observations in Compustat and how their inclusion through asset-scaled proxies affects the samples of tax researchers.

First, I show the extent of additional tax avoidance observations when applying asset-scaled proxies. Figure 1 illustrates the available values for asset- and profit-scaled measures of tax avoidance in the Compustat Database from 1990 to 2017:

Figure 1: Availability of Tax Avoidance Measures in Compustat



Note: Full Sample covers 200,096 observations from 1990 to 2017 with non-missing values for income. ETR Outliers are defined as ETRs above 100% or below 0%.

The total number of observations with non-missing pretax income is 200,096 for 27 years of data and it is possible to construct *GAAP ETR* for 99.9 percent of it. This is less often the case for *CURRENT ETR* and *CASH ETR*, as the variables of interest (*txc*, *txpd*) are only available for 78 percent of the sample. Then, researchers are required to drop loss-observations form their ETR sample and end up with substantially less information: The share of usable *GAAP ETR* values shrinks to 61 percent while *CURRENT ETR* decreases to 45 percent and *CASH ETR* only delivers 52 percent of interpretable values. However, ETR sometimes happens to range at extreme values (above 100 percent and below 0 percent), even for positive pretax-income[13], which again does not result in meaningful values and consequently is usually subject to further trimming.[14] This last step eliminates on average approximately further 3 percent of observations such that ultimately only 56.9 percent meaningful values remain for *GAAP ETR*, while only 41.8 percent for *CURRENT ETR* and 48 percent for *CASH ETR*. On the other hand,

[13] The reception of a tax refund while reporting positive earnings would be one scenario for a negative ETR.
[14] Henry and Sansing (2018, p. 1047) reviewed 23 studies from top accounting journals and found that 20 of those studies removed extreme ETR values (above 100 percent or below 0 percent) and eliminated negative-profits.

asset-scaled proxies provide more information: The construction of *BTD* is possible for 73.6 percent of all observations. This is due to the fact that *BTD* relies (like *CURRENT ETR*) on the availability of current tax expense (*txc*) and total assets (*at*) but does not require the trimming of negative profits or extreme values.[15] Likewise, *HS2018* produces meaningful values for 67.2 percent of all observations. The construction of the *HS2018* measure is more demanding than *BTD* as it relies on adjusted cash taxes paid (*txpd, txr*) and market value of total assets, which is computed as book value of assets (*at*) plus the difference between market value of equity (*prcc, f, csho*) and book value of equity (*bkvlps, csho).*

When comparing the corresponding concepts *CURRENT ETR* and *BTD* (*CASH ETR* and *HS2018*), it is to conclude that the asset-scaled proxy provides approximately 43.1 percent (28.1 percent) more meaningful values and thus expands the sample size in this scenario by 64,430 (39,619) observations. This underlines the extent of data truncation in ETR research, but also shows that asset-scaled measures are not able to incorporate all observations in Compustat, neither. Interestingly, the surplus of observations for the *HS2018* measure is not as large as initially expected. This should be kept in mind when discussing data truncation because now the non-missing criteria for required variables to compute market values of total assets in Compustat determine the sample selection.

Next, sample selection issues for the intake of additional observations through asset-scaled proxies will be discussed. Table 1 shows structural attributes of additional observations which provide meaningful values when measured with *BTD* (*HS2018*) in comparison to the baseline sample that can be analyzed with both, *CURRENT ETR* and *BTD* (*CASH ETR* and *HS2018*) in terms of tax avoidance.

[15] However, BTDs have often been subject to winsorizing at the top and bottom one percent in the literature, e.g. see Hanlon (2005).

Table 1: Sample Selection Characteristics by Tax Avoidance Measure

Sample	Current ETR & BTD		Only BTD		Cash ETR & HS2018		Only HS2018	
Observations	79,901		68,245		73,023		47,654	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
AGE (Years)	18.55	14	12.42	8	17.89	13	13.64	9
LIFETIME	28.61	25	19.95	17	27.87	24	21.14	18
SALES	2661.1	316.0	637.6	22.2	2677.5	277.9	726.3	46.0
TOTAL_ASSETS	5338.8	368.4	1745.3	39.4	5301.8	318.7	1958.8	57.3
MNE	0.410	0	0.258	0	0.442	0	0.328	0
ROA	0.323	0.08	-7.45	-0.17	0.201	0.083	-8.774	-0.113
R&D	0.036	0	4.30	0	0.035	0	3.155	0
PPE	0.285	0.20	0.244	0.14	0.255	0.186	0.244	0.150
INTANG	0.121	0.03	0.118	0.01	0.129	0.045	0.124	0.024
LEVERAGE	0.327	0.21	2.211	0.23	0.283	0.182	2.044	0.242
CAPEX	0.316	0.20	0.712	0.21	0.318	0.225	0.435	0.204
ADVERT	0.012	0	0.023	0	0.013	0	0.020	0
SPECIAL_ITEMS	0.285	0	-3.400	0	0.045	0	-4.624	-0.002
NOL	0.291	0	0.535	1	0.313	0	0.526	1
MARKET_BOOK	5.83	2.00	1.40	1.33	5.29	2.03	-0.58	1.18
BTD	0.673	0.0125	-7.160	-0.1730	-	-	-	-
CURRENT ETR	0.262	0.28	-	-	-	-	-	-
HS2018	-	-	-	-	-0.008	-0.004	0.164	0.0267
CASH ETR	-	-	-	-	0.2416	0.238	-	-

Note: The baseline sample Current ETR & BTD refers to the subsample of observations which provide meaningful observations for both BTD and CURRENT ETR (53% of population). The Only BTD sample provides meaningful values exclusively for BTD (44%). The next baseline sample Cash ETR & HS2018 refers to the subsample of observations that provide meaningful values for both HS2018 and CASH ETR (57%). The only-HS2018 surplus sample provides exclusively meaningful values for HS2018 (34%). The subsamples that produce only meaningful values for CURRENT ETR (3%) or CASH ETR (9%) have been ignored for the purpose of this table.

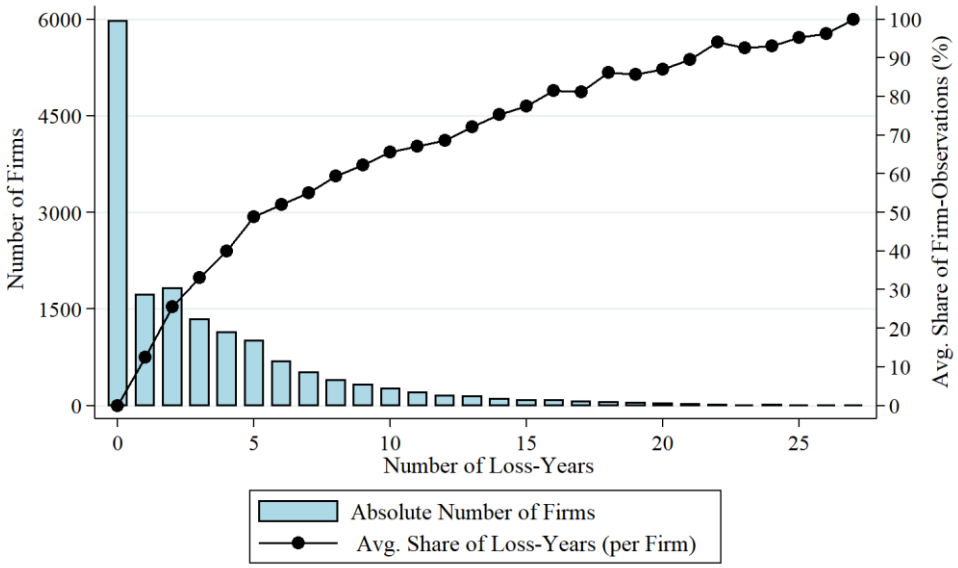
It is apparent from Table 1 that the ability of *BTD* and *HS2018* to interpret financial loss-years adds firms with very distinct attributes to the samples of tax researchers. As suggested by prior literature (Joos and Plesko, 2005; Klein and Marquardt, 2006), negative earnings firms have different characteristics than the remaining Compustat population. Those firms are significantly younger, shorter-lived and smaller than profitable ones. The difference in size is remarkable, as the median profitable firm has almost ten times more total assets/sales than the median loss firm. The shorter lifetime (years listed in the Compustat Database) of those firms suggests that a considerable amount of unprofitable firms went out of business during the sample period. Furthermore, loss-firms are substantially higher-leveraged, less international and invest more in R&D and capital relative to their assets, which is typical for smaller

corporations (Dang, Li and Yang, 2018). Nevertheless, loss-firms have also on average a lower Market-to-Book ratio, which suggests that the market anticipates their limited growth potential. Asset-scaled proxies additionally cover industries which have suffered from the crises over the sample period, namely the Dotcom-Bubble (2000-2002) and the last financial crisis (2007-2009). Thus, asset-scaled proxies add numerous firm observations from Computer and Electronics Industries to the samples of tax researchers.[16] Loss-observations do not occur randomly but highly concentrated in a distinct subpopulation of very small, non-prospering firms. This finding raises the question whether it is desired by researchers to include such a specific subpopulation of firms in their analyses.

Given the distinct characteristics of loss-firms, it is reasonable to distinguish between firms that experience losses on an occasional basis and firms that report them frequently. Figure 2 graphically illustrates the frequency of loss years for firms in the observed sample period. The histogram bars report the absolute number of firms that experience a given number of loss years (left y-axis) and the line depicts the average losses-to-lifetime ratio for firms with a given number of loss years in the sample (right y-axis). The losses-to-lifetime ratio describes the percentage share of loss years of a company's years covered in the Compustat sample.

[16] Table A3 in the Appendix shows the industry composition of the additional observations through asset scaled proxies.

Figure 2: Loss Frequency and Firm Lifetime



Note: Full Sample covers 200,096 observations from 1990 to 2017 with non-missing values for income.

First, it is to note that approximately 6,000 firms in the sample have exclusively reported profits in the 27 year lasting sample period. Second, still a noticeable amount of 4,890 firms experiences between one to three loss-years and lastly, 5,406 firms have more than three loss-years over the entire sample period. This shows that Compustat covers numerous firms with a frequent loss history. Moreover, the connected line illustrates that the average losses-to-lifetime ratio increases steeply with the number of reported loss-years. In fact, the average company that reports three loss-years between 1990 and 2017 shows a losses-to-lifetime ratio of 32.3 percent and thus has an expected lifetime of approximately nine years before it disappears from Compustat. The average Compustat lifetime for a company reporting five loss years is approximately ten years, indicated by a loss ratio of 49.8 percent. This underlines the findings from table 2 that not all loss-firms are experiencing a shorter lifetime in Compustat but particularly the rather steadily unprofitable subpopulation of small firms. While most tax researchers might agree that it would be worthwhile to incorporate infrequent loss-years of usually profitable firms into the analysis (e.g. Drake et al., 2018), it would require some clear intention why tax avoidance studies should include small non-prospering firms that accumulate

losses which eventually are unlikely to results in future tax benefits due to impending bankruptcy.[17]

2.3.3 Determining Industry Tax Avoidance with Different Measures

According to Guenther (2014), the profitability bias is responsible for different outcomes between studies that use BTDs and ETRs. In the following, I empirically investigate this finding by comparing the median tax planning between all U.S. industries subject to the different proxies for tax avoidance.[18] My sample consists of U.S. firm observations between 1990 and 2017 from Compustat Northern America. I restrict the sample to positive pretax income observations as only then both BTD and ETR can be constructed and subsequently compared. Additionally, all missing values for any necessary variable to compute *CASH ETR*, *CURRENT ETR*, *BTD* or *HS2018* were removed for the sample in order to eliminate any sample selection bias in the comparative analysis.[19] This results in a sample size of 55,232 observations from 33 industries according to the Fama and French (1997) classification.

I follow Heitzman and Ogneva (2018) and compute a three-year medium run variable for each measure of tax avoidance. This serves the smoothing of volatile one-year values and thus mitigates the effect of outliers. A three-year medium run ETR is constructed by the sum of the annual respective tax liabilities/payments over the three-year period divided by the sum of pretax income (before special items) over the same period. Analogously, the three-year medium *BTD* is the three-year difference between pretax income and the approximated taxable income, scaled by the three-year average of total assets. Lastly, the three-year medium run *HS2018* is constructed in the same manner as *BTD* but describes the averaged three-year difference between pretax income and cash-approximated taxable income. To compare the

[17] Cooper and Knittel (2010) document that in particular smaller and younger firms struggle to realize tax benefits from their TLCFs.
[18] Industry definitions rely on the Fama and French (1997) 48-industry classification. The minimum number of firms per industry was set to 50 such that 33 industries remain for the comparison.
[19] Necessary Compustat items for computation of the named variables are (in order of the named proxies): *pi, xi, txt, txpd, txc, at, bkvlps, csho, prcc, txr*.

measures, I use negative *BTD* and positive *HS2018* to specify that lower values imply higher tax avoidance, as it holds for ETRs. Ultimately, I compute the median value of the respective tax avoidance measure for each industry over the total time-period and develop a ranking of tax avoidance on this basis. Table 2 contains an excerpt of the results:[20]

Table 2: Industry Tax Avoidance Ranking by Selected Measures

Industry	**Code**	**Firms**	***CASH ETR***		***CURRENT ETR***		***BTD***		**HS 2018**	
Petroleum & Gas	30	290	**1**	(0.135)	1	(0.156)	1	(0.021)	1	(-0.006)
Real Estate	47	100	**2**	(0.14)	2	(0.182)	5	(0.008)	11	(-0.002)
Computer Software	36	671	**3**	(0.192)	9	(0.289)	23	(-0.002)	9	(-0.003)
Computers	35	206	**4**	(0.198)	11	(0.292)	28	(-0.005)	8	(-0.003)
Electronic Equipment	37	433	**5**	(0.205)	6	(0.268)	8	(0.006)	3	(-0.003)
Transportation	41	190	**6**	(0.211)	3	(0.227)	2	(0.02)	2	(-0.006)
Entertainment	7	131	**7**	(0.228)	5	(0.265)	14	(0.002)	15	(-0.002)
Medical Equipment	12	232	**8**	(0.247)	15	(0.305)	11	(0.004)	5	(-0.003)
Communication	32	225	**9**	(0.25)	4	(0.254)	9	(0.005)	19	(-0.001)
Pharmaceutical	13	240	**10**	(0.251)	14	(0.303)	7	(0.006)	10	(-0.002)
…	…	…	…	…	…	…	…	…	…	…
Construct. Materials	17	161	**24**	(0.304)	21	(0.32)	18	(0.001)	27	(-0.001)
Automobiles & Trucks	23	107	**25**	(0.307)	22	(0.321)	20	(-0.0001)	23	(-0.001)
Construction	18	107	**26**	(0.311)	31	(0.356)	31	(-0.006)	26	(-0.001)
Food Products	2	137	**27**	(0.312)	25	(0.332)	17	(0.001)	21	(-0.001)
Rubber & Plastic	15	81	**28**	(0.315)	27	(0.333)	25	(-0.003)	30	(0.0001)
Apparel	10	111	**29**	(0.322)	29	(0.352)	29	(-0.005)	25	(-0.001)
Consumer Goods	9	117	**30**	(0.324)	28	(0.348)	27	(-0.004)	31	(0.0001)
Wholesale	42	343	**31**	(0.326)	30	(0.356)	30	(-0.005)	32	(0.0001)
Retail	43	428	**32**	(0.327)	32	(0.358)	32	(-0.006)	29	(0.0001)
Printing & Publishing	8	61	**33**	(0.337)	33	(0.358)	33	(-0.008)	33	(0.001)

Note: A lower rank describes higher tax avoidance for all measures. The total sample contains 55,230 observations and spans the time-period 1990 to 2017. Industries with less than 50 firms were removed.

The most tax aggressive U.S. industries have median cash tax rates between 13.5 percent and 21.11 percent, and include among others Petroleum and Gas, Computers and Software Products, Electronic Equipment and Transportation. Typical for all those industries is that they possess a relatively high share of mobile capital, which is easier shifted to low tax jurisdictions.[21] Additionally, it is to be noted that many of the leading industries typically have

[20] The complete industry ranking is listed in Table A2 in the Appendix.

[21] The real estate sector is ranked high in tax avoidance despite its intensity in physical capital. This surprising outcome might be related to the data truncation of loss-observations, which represent almost 50 percent of all observations from the real estate industry in the sample period.

high R&D expenditures, which has constantly been subject to generous tax credits over the past decades (Belz, von Hagen and Steffens, 2017). The bottom of the tax planning ranking is occupied with physical capital intensive industries as Printing & Publishing, Consumer Goods, Rubber and Plastics. These industries are less mobile in the geographical allocation of capital and thus do not possess the above described possibilities to lower their effective tax burden.

Overall, it is to say that the measures display a similar assessment of tax planning for most industries. This holds in particular for the bottom of the ranking, where all four measures assign similar ranks to the respective physical capital-intensive industries. However, this is not the case for a couple of industries in the upper half of the ranking. Particularly Computers and Software are ranked as rather tax aggressive by profit-scaled measures while asset-scaled measures assign lower rankings to them. As already discussed before, current tax expenses and cash taxes paid differ because an accrual is affected by events which might not result in cash outflow. More important to the purpose of this study is how *CURRENT ETR* (*CASH ETR*) and *BTD* (*HS2018*) differ with respect to the median industry tax planning, as this divergence must result from the distinct scalars according to Guenther (2014). Figure 3 illustrates the divergence between tax avoidance ranks of profit- and asset-scaled measures:

Figure 3: Industry Tax Avoidance by Selected Measures

Note: A lower rank describes higher tax avoidance for all measures. The total sample contains 55,230 observations and spans the time-period 1990 to 2017. Industries with less than 50 firms are removed.

Figure 3 plots the industry rankings of asset-scaled measures (x-axis) against the rankings of profit-scaled measures (y-axis). If both types of measure resulted in identical ranking of industries, all combined rankings were on the 45° line. However, we see that a substantial amount of observations is scattered around the line. If an industry is above the 45° line, it is perceived more tax aggressive by asset-scaled measures than by profit-scaled ones. According to Guenther (2014), the divergence systematically results from differences in ROA (ROMVA) as e.g. two firms with similar tax paid and profits but different size (amount of assets) are perceived differently by the measures. The rectangular, colored dots in the graph mark the bottom half industries in terms of ROA (ROMVA). The majority of the less profitable industries falls above the 45° line and thus are more tax aggressive according to BTDs than to ETRs. The detected pattern supports the argument of Guenther (2014) that asset-scaled BTDs reflect a combination of profit-scaled ETR and firm profitability.

2.3.4 The Information Content of NOLs for Tax Avoidance Research

The intake of NOLs is only possible when tax researchers use asset-scaled measures of tax avoidance. This enlarges the sample size and associated statistical power tremendously. On the other hand, under the assumption that profit-scaled ETR is the correct theoretical measure for corporate tax avoidance – which appears reasonable in the case of income taxes – scaling tax planning activity by book value of assets needs to be seen critically.

First, Guenther (2014) and the approximation of U.S. industry tax avoidance in this article, highlight that asset-scaled measures over-estimate the tax aggressiveness of relatively less profitable firms. This is problematic because only if the ratio of pretax income (in profitable years) to book or market value of assets remains constant over time and equal between firms, BTD and HS2018 provide meaningful comparisons. Thus, Henry and Sansing (2018) only portray the actual trends in U.S. corporate tax avoidance with their new measure under the condition that the ratio between pretax income and market value of total assets remained

constant between 1988 and 2014 and does not differ on average between multinational and domestic firms.[22] Second, the use of asset-scaled tax avoidance proxies changes the samples of tax researchers substantially. Loss-observations occur highly concentrated in a distinct subpopulation of small, non-prospering firms from specific industries and researchers should be clear on the increased heterogeneity in their samples. Among those new firms are shorter-lived companies that accumulate losses which eventually are unlikely to results in future tax benefits due to impending bankruptcy (see Cooper and Knittel, 2010). Those firms are to be perceived critically as they yield limited information content for the assessment of corporate tax planning.

Despite the named restrictions, it is to acknowledge that it is feasible to investigate loss-firms' tax planning with asset-scaled proxies like *HS2018*. Infrequent corporate loss-observations yield information content in terms of tax avoidance and can be included in the samples of tax researchers, albeit only in a very controlled setup: Scholars must diligently ensure comparability among firms with regard to profitability, measured by ROA or ROMVA in years of positive earnings. Only then, loss-observations contain valid information for the assessment of corporate tax avoidance.[23] Moreover, tax researchers should generally be advised to ensure certain minimum criteria with respect to firm size, year coverage or a minimum requirement for profitability. This way, steadily unprofitable firms remain excluded and the in-sample heterogeneity is bounded. Ultimately, it is to point out that the necessity to incorporate NOL-years depends on the respective research question.

2.4 Excluding NOLs from the Measurement of Corporate Tax Avoidance

So far, the vast majority of tax researchers restricted their analyses to profitable subsamples. This holds for most studies that apply profit-scaled ETRs or asset-scaled BTDs.

[22] This appears unlikely and will be discussed more in depth in section 4.3 of this article.
[23] Interestingly, Guenther (2014) shows that one typical way of controlling for profitability, by adding a control variable to the regression, does not solve this problem. Thus, sample stratification is required.

Nevertheless, the trimming of loss-observations might cause a measurement bias that is stronger in ex ante subsamples with more loss-firms (Teoh and Zhang, 2011). Particular from a tax perspective, the truncation of single loss-years is to be seen critically because the tax expenses of other years are likely affected by the loss-event. In the following, I will analyze how the truncation of loss-years affects the measurement of corporate tax avoidance. For this purpose and the given restrictions upon asset-scaled proxies, I will solely focus on profit-scaled ETRs. First, I explore in a controlled Compustat scenario how loss-observations contaminate firms' ETRs around the event of a loss. Then, I revise the declining trend in *CASH ETR* documented by Dyreng et al. (2017) and pay particular attention to the underlying loss structure in the data.

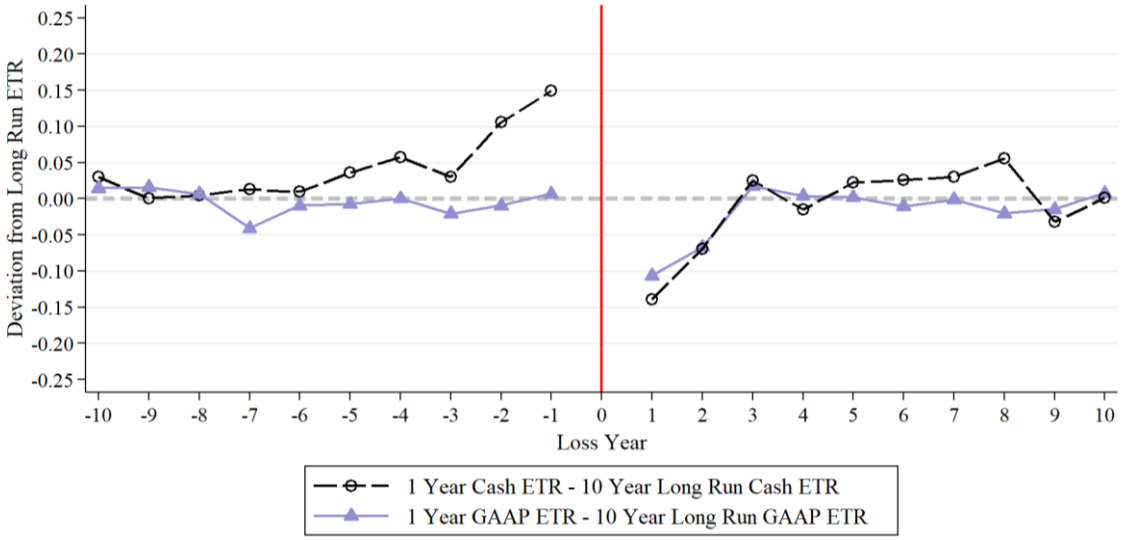
2.4.1 The Distortion of ETR values before and after Loss Years

It is useful to assess the impact of a loss year on neighboring firm-year observations because it illustrates the real extent of the data anomaly: The ETR of the loss year itself is non-meaningful and thus usually removed from the sample. However, the ETRs of the subsequent years are likely affected by the consequences of the loss (see Cooper and Knittel, 2006) and remain in the sample. Firms should be able to exercise their TLCF and consequently benefit from lower tax payments. Thus, low ETRs of periods after a loss are unlikely to mirror tax planning activity and should not be interpreted in such way.

I collected a specific sample of Compustat firms that share a common history in loss-years: All firms experienced exactly one year of negative profits with ten consecutive years of profits before and after the loss-year in the sample period 1990-2017. This implicates that firms do not have to experience the loss in the same actual year, but that all firms share a long-lasting profitable phase before and after it, such that the loss-year has been a unique event for the companies. This is important as I try to compute a firm's true, idiosyncratic benchmark ETR level by building the ten year long-run ETR before and after the loss year. In the next step, I measure the difference between annual ETR values and the long-run ETR, what I call ETR-

DEVIATION and explore how it develops around the loss year.[24] The sample consists of 189 firms with in total 3,546 observations over 21 firm-specific years.[25] In accordance with common literature, the ETR value for the loss year is eliminated from the sample, which results in 3,357 observations. Figure 4 displays the development of average *CASH ETR-DEVIATION* and *GAAP ETR-DEVIATION* from ten years prior to the financial loss year to ten years after it.

Figure 4: CASH ETR and GAAP-ETR Deviation around the Loss Year



Note: Figure 4 is based on a sample of 189 firms (3,546 observations) over 21 firm-specific years between 1990 and 2017. All firms in the sample experience exactly one loss-year over the period. Table A4 in the Appendix contains descriptive statistics of the one-loss-year-sample.

The figure illustrates that both *CASH ETR* Deviation and *GAAP ETR*-Deviation is mostly close to zero for pretty much all years before the loss and most years after the loss. This implies that the annual ETR values do not differ much from the long-run ETR in most profitable years. In contrast, the first two periods after the loss contain a *CASH ETR DEVIATION* (*GAAP ETR DEVIATION*) of approximately -14 (-11) and -7 (-6) percentage points. Thus, the graph displays that corporations are able to exercise their accumulated TLCF and correspondingly pay lower taxes. It is to note that even the second period after the loss shows a notably negative

[24] The Long Run ETR is constructed separately for the pre- and the post-loss-period. This is required as the long run ETR before the loss might not be a good benchmark for ETR values after the loss and vice versa. An alternative approach using one constant benchmark for the entire timeline is not equally suitable here, as it does not display the discontinuity around the loss-year in a likewise manner and is more likely influenced by long run time trends in ETR.

[25] Table A4 in the Appendix contains descriptive statistics of the one-loss-year-sample.

CASH ETR-DEVIATION and *GAAP ETR-DEVIATION*. This should be of interest to tax researchers who currently control with an indicator variable for the first year after a loss but not any further. The figure reveals even more data anomalies around the loss year for *CASH ETR*: Already two years before the loss (t_{-2}, t_{-1}), large positive deviations of annual *CASH ETR* from the long run *CASH ETR* stand out. This implies that the relationship between firms' cash taxes paid and reported profits is increasing before a loss. One potential explanation for this might be that firms transition towards a loss by experiencing steadily declining profits while tax payments do not decline at the same rate. This could result either from a certain structural non-linear relationship between cash taxes and profits (see Edwards, Kubata and Shevlin, 2018) or the mere fact that advance payments for tax liabilities have not been adjusted adequately.

The graph illustrates exemplarily how costly loss-observations might come in ETR research. In this selective subsample, a one-year loss results in an average of two consecutive abnormal low *GAAP ETR* and *CASH ETR* values after the loss and two abnormal high *CASH ETR* values before it. These abnormal values could falsely be misinterpreted as corporate tax aggressiveness despite the circumstance that the loss-years themselves are usually removed from the samples of tax researchers.[26] How exactly NOLs affect the measurement of tax avoidance depends on the occurrence of losses in the respective sample. Thus, it is worthwhile to re-evaluate certain findings based on ETR research with respect to the loss-structure in the initial dataset.

2.4.2 Re-examining Trends in U.S. Corporate Tax Avoidance

Dyreng et al. (2017, p.462) state that "purely domestic firms do not appear to be disadvantaged relative to multinational firms in terms of tax avoidance and [...] both types of firms are benefitting from decreased effective tax rates over time". This finding contradicts the

[26] This is particularly alarming in the context of high losses-to-lifetime ratios for steadily unprofitable firms. Tax researchers would not be able to retrieve any but abnormal *ETR* values for these firms.

conventional knowledge that the declining effective tax rates of multinationals result from increasing income shifting and cross-border reorganization tactics, which are unavailable to domestic firms. Henry and Sansing (2018) re-examine the same analysis with their asset-scaled *HS2018* measure instead of *CASH ETR* and expand the study to loss-firms. Among others, they find that domestic firms have become less tax-favored over time. Thus, the inclusion of loss-firms appears to matter for the measurement of aggregate tax avoidance. In separate work, Watrin and Weiss (2018) develop a new measure of relative corporate tax avoidance and suggest that characteristic-varying tax planning did not follow any trend over the past 30 years. Drake et al. (2018) analyze the observed decline in domestic corporations' *GAAP ETR* by investigating income tax reconciliations and argue that the aggregate phenomenon is largely attributable to the releases of TLCF valuation allowances, research credits and changes to GAAP reporting of goodwill. Schwab et al. (2018) highlight the frequent distortions of annual *GAAP ETR* through valuation allowance releases, too. Taken together, these studies suggest that the documented decline in domestic firms' ETRs originates from data truncation and/or specific aspects of GAAP but not from actual corporate tax planning.

In the following, I re-examine the study of Dyreng et al. (2017) with a special focus on loss-observations and surrounding, abnormal ETR values in order to review the alternative explanations for declining ETRs. Contrary to Henry and Sansing (2018), I will not expand the original sample to loss-observations but focus on firms that were subject to data truncation. Thus, this paper is the first to empirically link the underlying loss-structure in the data prior to data cleaning to the ex-post measured trend in tax avoidance after loss-years were removed from the sample. The authors removed loss-years from their sample. However, ETRs of profitable years subsequent to losses are expected to be downwards biased, which could affect their findings of declining ETR trends for multinational and domestic U.S.-firms. Lastly, I will discuss my findings and tools how to deal with loss-observations in ETR research.

NOLs and Trends in Cash ETR over Time

As mentioned in section 3.2, domestic firms are more likely to experience losses than international ones. Moreover, the loss coverage differs for both firm populations in Compustat over time. Table 3 describes the Dyreng et al. (2017) sample before the elimination of loss-observations:[27]

Table 3: Loss Coverage in the Dyreng et al. (2017) sample

Time Period		1988-1993	1994-1999	2000-2005	2006-2012	Total
Panel: Multinational Firms	Firms	1,427	2,410	2,670	2,493	4,294
	Obs.	5,604	8,764	10,685	12,435	37,488
	Losses	20.8%	21.8%	31.5%	27.4%	26.3%
Panel: Domestic Firms	Firms	2,614	3,849	3,058	1,932	5,766
	Obs.	9,817	13,456	10,662	8,148	42,083
	Losses	23.1%	27.6%	36.4%	35.7%	30.4%

Note: The total sample contains 79,571 observations of which 22,621 are loss-observations.

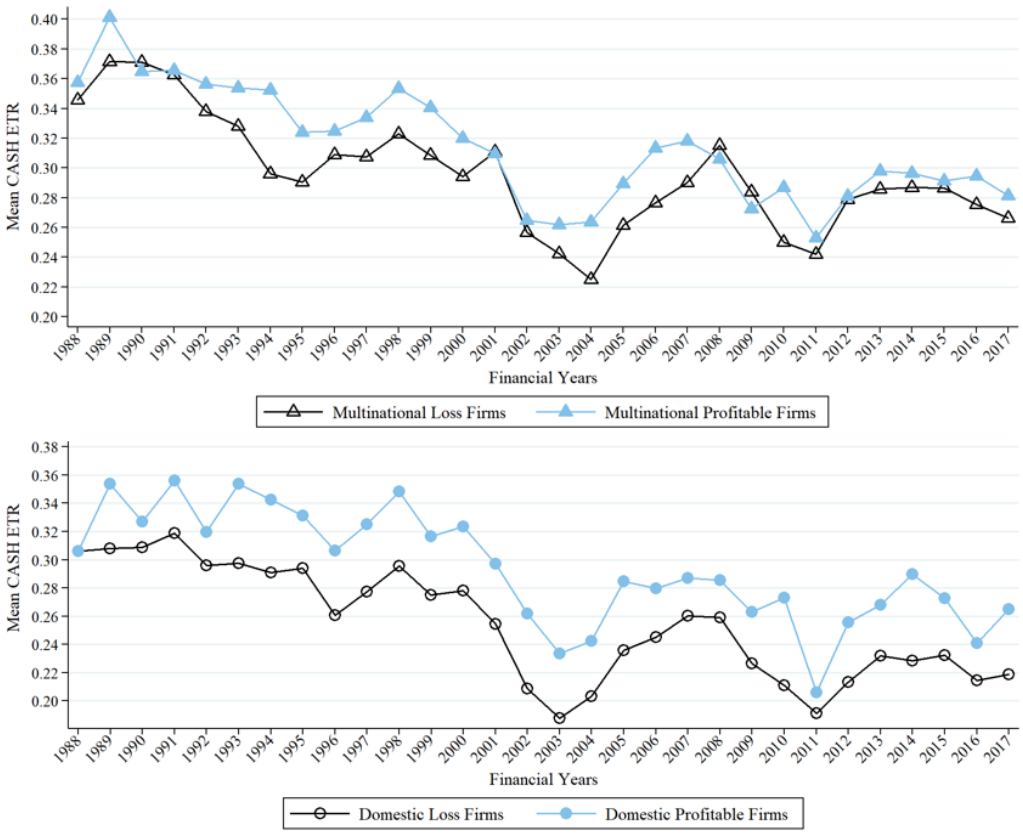
The share of domestic loss-observations in the sample increased from 23.1 percent up to 35.7 percent over the sample period and even ranged higher in the aftermath of the Dotcom-Bubble. Loss-observations of multinational firms increased over time, too, but at a lower rate, namely from 20.8 percent to 27.4 percent over the entire sample period. Thus, abnormal ETR values, originating from loss-observations, are becoming more present in the subsample of domestic firms over time than for multinational firms. Furthermore, it is to note that the number of domestic firms falls from the year 2000 onwards. This suggests that a considerable number of domestic firms in Compustat went out of business and was not covered in Compustat anymore. Given all this, the decline in domestic *CASH ETR* over time might be related to loss-induced distorted ETR values, which are not as present for multinational firms.

Figure 5 is inspired by figure 3 of Dyreng et al. (2017, p. 448) and plots the average *CASH ETR* over time for multinational and domestic firms. Contrary to the original figure, I

[27] The total number of observations in Dyreng et al. (2017) is 54,028. My sample contains 56,955 observations when losses are omitted. When loss-observations are included, the sample size is 79,571.

distinguish between loss-making and permanently profitable firms. Firms are considered permanently profitable only if they reported exclusively positive earnings in every year between 1988 and 2012. The *CASH ETR* values of loss-making firms provide abnormal values surrounding omitted loss years, while profitable firms cannot be affected by abnormal ETR values through losses. In fact, one quarter (24.7 percent) of all observations in the Dyreng et al. (2017) sample stems from permanently profitable firms.

Figure 5: Average Cash ETR over Time



Note: Figure 5 is based on a sample of 66,177 observations and ranges from 1988 to 2017. Overall, 24.7 percent of observations origin from permanently profitable corporations. The share of domestic firms is 51 percent. Loss-years are removed from the sample.

Figure 5 documents the declining trend in *CASH ETR* for both multinational and domestic firms. It is to note that loss-firms on average show lower *CASH ETR*s than profitable firms. This holds in particular for the domestic subsample where the *CASH ETR* differential between the two groups ranges between 2 and 4 percentage points. The profitability induced *CASH ETR* differential for multinational firms is smaller and less persistent over time. In

general, the level difference in *CASH ETR* between profitable and loss-making firms appears mostly constant over time. This suggests a somewhat similar time-trend in *CASH ETR* regardless of the underlying loss-structure in the data.

To analyze the effect of firm-specific losses on the aggregate time trend of ETRs, I re-estimate the original regression by Dyreng et al. (2017) and include the additional variable *LOSS*.

$$ETR_{ijt} = TIME_t + LOSS_i + TIME_t \; x \; LOSS_i + Controls_{ijt} + Industry_j + \varepsilon_{it} \quad \text{(Eq.6)}$$

As in the original analysis, the variable *TIME* is calculated as the fiscal year of a given firm-year observation less the number 1988, which is the first year in the data set. Thus, *TIME* reveals the average annual change in *CASH ETR*, ceteris paribus. The binary variable *LOSS* describes the loss-affinity of a given firm in the sample before negative profit observations are eliminated. *LOSS* equals one for all firms that experience one or more loss-years in the sample period. This way, the *LOSS* variable indicates which firms are more likely to have distorted ETR values in the final sample despite the removal of loss years.[28] Consequently, the interaction term *TIME x LOSS* describes how the average time trend in ETR varies between profitable and unprofitable firms. Then, the stand-alone *TIME* regressor captures the ETR trend of permanently profitable firms (*LOSS* = 0). In additional regression specifications, I control for the cofounding effect of loss-observations at the intensive margin: The variable *LOSS_INT* is the decile in which a firm ranks according to the ratio of reported loss-years to all firm-years in the Dyreng et al. (2017) sample. The more operating loss years a firm experienced over the sample period, the more distorted CASH ETR values are to expect. Table 4 contains the results of the regression outcomes for multinational and domestic firms, separately:[29]

[28] Dyreng et al. (2017) winsorize outlier ETR values at 100 percent and 0 percent. Therefore, the distorted ETRs remain meaningful for the outcome.
[29] The original regression estimation is to be found in table 6 in Dyreng et al. (2017, p.453).

Table 4: Corporate Tax Avoidance and Losses over Time

Dependent Variable	CASH ETR					
Panel	Multinational Firms			Domestic Firms		
Specification	(1) Dyreng et al. (2017) Replication	(2) Controlling for LOSS	(3) Controlling for LOSS_INT	(4) Dyreng et al. (2017) Replication	(5) Controlling for LOSS	(6) Controlling for LOSS_INT
TIME	-0.434***	-0.473***	-0.462***	-0.415***	-0.410***	-0.339***
	(0.0232)	(0.0393)	(0.0397)	(0.0221)	(0.0406)	(0.0405)
LOSS	-	-2.549***	-	-	-3.293***	-
		(0.671)			(0.579)	
TIME x LOSS	-	0.0570	-	-	-0.00518	-
		(0.0444)			(0.0464)	
LOSS_INT	-	-	-0.683***	-	-	-0.606***
			(0.0980)			(0.0799)
TIME x LOSS_INT	-	-	0.00730	-	-	-0.0150**
			(0.00646)			(0.00639)
CONSTANT	34.40***	36.33***	38.70***	31.50***	34.61***	36.07***
	(2.349)	(2.387)	(2.395)	(1.877)	(1.932)	(1.928)
Dyreng et al. (2017) Controls	✓	✓	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓	✓	✓
Loss-Obs. Omitted	✓	✓	✓	✓	✓	✓
Observations	27,647	27,647	27,647	29,308	29,308	29,308
Adj. R-squared	0.044	0.045	0.056	0.083	0.087	0.101

Note: The dependent variable is *CASH ETR*. *TIME* is calculated as the fiscal year of a given firm-year observation less the number 1988, which is the first year in the data set. *LOSS* is binary and equals one for all firms that (relative to their lifetime in Compustat) experience at least one loss-year in the sample period. *LOSS_INT* is the decile in which a firm ranks according to the ratio of reported loss-years to all firm years. Control variables are: *LOG_ASSETS, R&D, PPE, INTANG, LEVERAGE, CAPEX, ADVERT, SPECIAL_ITEMS, NOL* and *ΔNOL*. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at the 1%, 5%, 10% level, respectively.

Specification (1) and (4) refer to the replication of the original Dyreng et al. (2017, p. 453) regression. Specifications (2), (3), (5) and (6) refer to the estimation strategy from equation (5) with either *LOSS* or *LOSS_INT* as additional interactive regressors. My coefficient of *TIME* in specification (1) is almost identical with the coefficient in the original study (-0.439), suggesting a decrease in multinationals' *CASH ETR* of approximately 0.4 percentage points per year. The coefficient of the *LOSS* variable in specifications (2) and (5) is negative and statistically significant, demonstrating that firms which have been subject to loss-data truncation in the sample selection process show on average lower *CASH ETR*s, ceteris paribus. The *LOSS_INT* variable in specification (3) and (6) shows likewise that an increase in the firm-specific loss intensity during the sample period is associated with lower *CASH ETR*. This goes in line with the documented pattern of abnormally low ETR values immediately following loss-

years, discussed in section 4.1.[30] However, introducing the *LOSS* variable and the *TIME x LOSS* interaction term does not alter the coefficient of the independent *TIME* variable noticeably, neither for multinational (2) nor for domestic firms (5). In fact, the negative stand-alone TIME coefficient in the multinational firm panel even increases slightly in magnitude to -0.473 percentage points. The insignificant interaction terms in both specifications suggest that the time-trend is unaffected by the firm-specific loss-history at the extensive margin. Thus, permanently profitable firms experienced the same steady decline in both *CASH ETR* and as loss-firms over the 25 years. The interaction of TIME and *LOSS_INT* is insignificant for multinational firms (3) but not for domestic firms. In the domestic subsample, an increase in firm-specific loss intensity leads to a more declining time trend in *CASH ETR* (6). The stand-alone TIME coefficient ranges at -0.339 and is less negative than before. However, this still implies that the *CASH ETR* of firms in the lowest decile of loss intensity decreased substantially over time. The contribution of loss-induced data truncation to the aggregate decline of *CASH ETR* over time appears negligible.

NOLs and Trends in Cash ETR over Firm Age

Given the robustness of the findings by Dyreng et al. (2017), I would like to add further understanding to the development of domestic firms' *CASH ETR* over time. Thus, I replicate the analysis of Dyreng et al. (2017) again but control for the dynamic sample composition over time. Instead of examining the cross-sectional change in *CASH ETR* between financial years from 1988 to 2012, I elaborate how *CASH ETR* changes over the lifespan of multinational and domestic U.S.-firms. To be more precise, I regress *CASH ETR* not over a time trend variable (*TIME*) as before, but instead over the firm-specific age in the sample: *FIRM_AGE* is computed as the difference between the current financial year of the firm-year observation and the first

[30] The negative coefficient of LOSS does not support the idea of abnormally high *CASH ETR* values before a loss. However, the abnormal low ETRs after the loss could be dominating the overall effect.

year in which the company appeared in the Dyreng et al. (2017) sample. Thus, the variable *FIRM_AGE* does not describe the average cross-sectional yearly change of *CASH ETR* over time but the average yearly change of *CASH ETR* over the lifespan of U.S.-companies. In fact, the results by Dyreng et al. (2017) suppose that existing firms (both multinational and domestic) engaged in more aggressive tax planning over the years. However, it is also possible that the sample composition in Compustat changed over time unequally for both groups. New firms from more-tax aggressive industries might be added to the sample belatedly and determine the trending *CASH ETR*. Thus, I focus on the lifespan of each firm and examine *FIRM_AGE* as dimension of time.[31]

Figure 6 plots the average *CASH ETR* of multinational and domestic firms over *FIRM_AGE*:

[31] Whereas the TIME variable per definition is identical for all firms in the same financial year, the variable *FIRM_AGE* is not. In case of a fully balanced panel, however, TIME and *FIRM_AGE* would be identical. Figure A1 in the appendix illustrates the difference between the variables *TIME* and *FIRM-AGE* in the Dyreng et al. (2017) sample.

Figure 6: Average Cash ETR over Firm Age

Note: Figure 6 is based on a sample of 66,177 observations and ranges from 1988 to 2017. Overall, 24.7 percent of observations origin from permanently profitable corporations. The share of domestic firms is 51 percent. Loss-years are removed from the sample.

Figure 6 makes apparent that *CASH ETR* of multinational U.S. firms declines steadily over the age of a firm, regardless of the profitability. Again, the *CASH ETR* of multinational loss-firms ranges below the *CASH ETR* of profitable multinational firms and the trend appears comparable over time, albeit slightly less declining for profitable multinationals. Thus, the figure suggests that U.S.-multinationals truly became more tax aggressive over the years of their existence and that this trend is not due to loss-induced data anomalies. This does not hold for the subsample of domestic firms. While domestic loss-making firms appear to have decreasing *CASH ETR* over their lifespan, the *CASH ETR* of profitable firms ranges at a somewhat steady level over most parts of their existence. Besides the drop in average *CASH ETR* around the firm age of 23 years[32], the average *CASH ETR* lies between 28 and 34

[32] Firms that were already listed in Compustat in 1988 witnessed the Dotcom Bubble Crisis in the 23rd year of the sample.

percentage points. The divergence between profitable and loss-making domestic firms suggests that the distribution of abnormal ETR values, induced by omitted loss years, evidently affects the trend of *CASH ETR* over firm age.

Table 5 contains the results of regressing *CASH ETR* over *FIRM_AGE* instead of *TIME*, analogous to the regressions before:

Table 5: Corporate Tax Avoidance and Losses over Firm Age

Dependent Variable	CASH ETR					
Panel	Multinational Firms			Domestic Firms		
Specification	(1)	(2)	(3)	(4)	(5)	(6)
	Dyreng et al. (2017) Replication	Controlling for LOSS	Controlling for LOSS_INT	Dyreng et al. (2017) Replication	Controlling for LOSS	Controlling for LOSS_INT
FIRM_AGE	-0.283***	-0.306***	-0.258***	-0.236***	-0.0394	0.0501
	(0.0241)	(0.0412)	(0.0414)	(0.0257)	(0.0522)	(0.0499)
FIRM_AGE x LOSS	-	0.0398	-	-	-0.220***	-
		(0.0467)			(0.0575)	
LOSS	-	-6.272***	-	-	-1.462***	-
		(1.255)			(0.544)	
LOSS_INT	-	-	-0.568***	-	-	-0.422***
			(0.0816)			(0.0676)
FIRM_AGE x LOSS_INT	-	-	-0.00571	-	-	-0.0503***
			(0.00699)			(0.00785)
CONSTANT	32.57***	34.28***	36.23***	29.73***	31.53***	33.34***
	(2.355)	(2.388)	(2.385)	(1.884)	(1.922)	(1.911)
Dyreng et al. (2017) Controls	✓	✓	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓	✓	✓
Loss-Obs. Omitted	✓	✓	✓	✓	✓	✓
Observations	27,647	27,647	27,647	29,308	29,308	29,308
Adj. R-squared	0.051	0.052	0.049	0.092	0.095	0.093

Note: The dependent variable is *CASH ETR*. *FIRM_AGE* is the difference between the fiscal year of a given firm-year observation and the first year in the sample in which the firm was listed. *LOSS* is binary and equals one for all firms that (relative to their lifetime in Compustat) experience at least one loss-year in the sample period. *LOSS_INT* is the decile in which a firm ranks according to the ratio of reported loss-years to all firm years. Control variables are: *LOG_ASSETS, R&D, PPE, INTANG, LEVERAGE, CAPEX, ADVERT, SPECIAL_ITEMS*, *NOL* and *ΔNOL*. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at the 1%, 5%, 10% level, respectively.

Specifications (1) and (4) replicate the original regression by Dyreng et al. (2017) with *FIRM_AGE* instead of *TIME* and the remaining specifications introduce the *LOSS* or *LOSS_INT* control and interactions with *FIRM_AGE*. There are two major take-aways from table 5: First, specifications (1) and (4) show that one additional year of *FIRM_AGE* is associated with a decrease of *CASH ETR* by -0.283 and -0.236 percentage points for multinational and domestic firms. This complements the findings of Dyreng et al. (2017) that *CASH ETR* also decreased

over firm-specific age and not just in the cross-sectional yearly aggregate. The coefficient of *FIRM_AGE* is smaller than the *TIME* coefficient in specification (1) and (4) of table 4, which suggests that a substantial part of the documented aggregate trend in cross-sectional *CASH ETR* by Dyreng et al. (2017) results from the coverage of additional, new firms in more recent years of Compustat data. The new generations of firms in the sample benefit from lower *CASH ETR*s than the firms that were already longer in the sample.[33] Regression specifications (5) and (6) deliver the second key insight from table 9: The insignificant coefficient of *FIRM_AGE* indicates that the declining trend in *CASH ETR* over the life cycle of domestic firms is not robust when controlling for the loss-structure in the data. Both interaction terms are negative and statistically significant. The *CASH ETR* of domestic firms that were subject to loss-related data truncation declines sharper, by 2.2 percentage points, than the *CASH ETR* of permanently profitable domestic firms. The same holds on the intensive margin: The more loss-years a firm initially had in the sample, the more negative is the firm-specific trend in *CASH ETR*. Thus, permanently (and mostly) profitable domestic U.S.-firms did not benefit from decreasing *CASH ETR*s over the years of their existence. On the other hand, multinational U.S.-firms, as a whole, did.

Ultimately, I run regressions on the permanently profitable sample of both multinational and domestic firms together in table 6.

[33] Figure A2 in the appendix provides graphical evidence on the dynamic coverage of tax aggressive industries between multinational and domestic U.S.-firms.

Table 6: Corporate Tax Avoidance of Permanently Profitable Firms

Panel	Permanently Profitable Firms			
Dependent Variable	CASH ETR	HS2018	CASH ETR	HS2018
Specification	(1)	(2)	(3)	(4)
TIME	-0.404***	-0.0003***	-	-
	(0.0336)	(0.00003)		
TIME x MNE	-0.0251	0.0000	-	-
	(0.0449)	(0.0001)		
FIRM AGE	-	-	0.0899**	0.00001
			(0.0439)	(0.00004)
FIRM AGE x MNE	-	-	-0.309***	-0.0001***
			(0.0525)	(0.00004)
MNE	2.522***	0.0013**	4.644***	0.0026***
	(0.652)	(0.0005)	(0.563)	(0.0005)
CONSTANT	42.90***	0.0004	39.56***	-0.0021
	(2.333)	(0.0018)	(2.331)	(0.0018)
Dyreng et al. (2017) Controls	✓	✓	✓	✓
Industry Fixed Effects	✓	✓	✓	✓
Loss-Obs. Omitted	✓	✓	✓	✓
Observations	14,875	14,875	14,875	14,875
Adj. R-squared	0.091	0.076	0.091	0.076

Note: The dependent variable is *CASH ETR*. *TIME* is calculated as the fiscal year of a given firm-year observation less the number 1988, which is the first year in the data set. *FIRM_AGE* is the difference between the fiscal year of a given firm-year observation and the first year in the sample in which the firm was listed. *LOSS* is binary and equals one for all firms that (relative to their lifetime in Compustat) experience at least one loss-year in the sample period. Control variables are: *LOG_ASSETS*, *R&D*, *PPE*, *INTANG*, *LEVERAGE*, *CAPEX*, *ADVERT*, *SPECIAL_ITEMS*, *NOL* and *ΔNOL*. Robust standard errors are reported in parentheses. ***, **, * represent statistical significance at the 1%, 5%, 10% level, respectively.

Over the 25-year lasting time-period, there are 1,493 firms that are permanently profitable (14,875 observations). As suggested by the graphical evidence in figure 5 and the split sample regressions before, the interaction term TIME x MNE is never significant: Neither in specification (1) with *CASH ETR* as dependent variable nor in specification (2) with the *HS2018* measure of tax avoidance. Thus, the trend in corporate tax aggressiveness is not significantly different between profitable multinational and profitable domestic firms when measured at the cross-sectional year level over the 25-year lasting period. Contrary, the interaction term *FIRM_AGE* x MNE is negative and statistically significant for both dependent variables. Thus, the average decline in *CASH ETR* per firm year is 0.3 percentage points stronger for profitable U.S.-multinationals than for profitable U.S. domestic corporations. In fact, the *CASH ETR* of profitable domestic U.S.-corporations increased slightly by 0.09 percentage points p.a.. When applying *HS2018*, the general outcome is similar. The last two

specifications underline that U.S.-multinationals became more tax aggressive on the firm level over the 25-year period while domestic U.S.-firms did not. The tax aggressiveness of profitable domestic firms did neither change over time when using *HS2018*.

2.4.3 Discussion of Results

My analysis reveals that the Compustat coverage of new tax aggressive firms in more recent years contributes substantially to the documented declining trend in cross-sectional/aggregate *CASH ETR* over the years 1988 to 2012. The firm-lifetime *CASH ETR* trend is significantly declining, too, but at a lower rate than supposed by the results of Dyreng et al. (2017). Most interestingly, the decline in firm-specific *CASH ETR* of domestic firms is attributable to loss-observations and surrounding abnormal *CASH ETR* values. Given this, it is to adhere that domestic U.S.-corporations did not engage in more aggressive tax planning over the period 1988 to 2012. Instead, incremental Compustat coverage of additional domestic firms from tax aggressive industries determine the documented increasing yearly trend in aggregate domestic tax avoidance.

It is to emphasize that this study neither criticizes the findings of prior research on the subject nor desires to correct them in any way. In fact, my results suggest that the findings of Dyreng et al. (2017) are robust and no empirical artefact of the loss structure in the data. The observed decline in cross-sectional *CASH ETR* for multinational and domestic firms over the financial years 1988 to 2012 remains statistically significant after controlling for the firm-specific loss structure. However, I recommend a more careful extrapolation of the outcome based on yearly aggregate corporate tax avoidance. Inferences from time trends over cross-sectional levels of an unbalanced panel might not only result from variation within firms over time, but also from the dynamic sample composition. When focusing solely on within firm variation it becomes clear that multinational and domestic firms evolved differently over time.

This, however, has been concealed in the data by abnormal *CASH ETR* values of loss-making firms.[34]

Moreover, the findings in this article need to be distinguished from the contribution of Henry and Sansing (2018). In fact, my results indicate that loss-observations do not alter the time-trend of U.S. corporate tax avoidance when measured by annual aggregations (*TIME*), neither for multinational, nor for domestic firms. Contrary, Henry and Sansing (2018, p. 1065) conclude that the inclusion of loss-observations alters the trend in tax avoidance over the years (*TIME*) significantly: They find that multinational firms remained on the same level of tax favoritism over their 27-year-period and that domestic firms actually became less tax-favored. My results on the permanently profitable subsample (table 6) contradict this finding. I see two possible explanations for this: First, as described in section 3.2, loss-firms differ considerably from the remaining Compustat population. Henry and Sansing (2018) are likely to include numerous shorter-lived and smaller firms[35] into the unbalanced panel. This possibly intensifies the cross-sectional change with respect to sample characteristics (i.e. industry tax avoidance) over time. Another potential reason for their different documentation of tax avoidance over time could be the conceptually induced profitability bias in the *HS2018* measure, highlighted by Guenther (2014). The sharp growth in market capitalization of multinational Compustat firms over the sample period might hint towards an inflation of the *HS2018* scalar in more recent years. Average domestic firms did not experience a likewise increase in market capitalization over time. This asymmetry possibly influences the documented divergence in the *HS2018* measure for multinational and domestic firms on the aggregate level.[36]

[34] The approach of Dyreng et al. (2017) to control for firm-years with existing TCLFs (NOL, ΔNOL) does not solve this problem. This is due to the poor quality of the available TLCF proxies in Compustat (Heitzman and Lester, 2018a) and the fact that not only ETRs one year after a loss, but several surrounding year ETRs are likely distorted (see Figure 4).

[35] Henry and Sansing (2018) leave unclear whether they apply a minimum size requirement for firms (e.g. book value of assets).

[36] Figure A1 in the Appendix illustrates the average market capitalization for multinational and domestic firms over time.

Considering the extent of loss-firms and their distinct characteristics in the Compustat database, the robustness of the detected time trend (*TIME*) in Dyreng et al. (2017) might appear surprising on first sight. But it is to note that Dyreng et al. (2017) apply minimum criteria for size (more than ten million USD in total assets) and Compustat coverage (more than 5 year observations) in the sample selection process. In view of the average small size and short lifetime of persistently loss-making firms, this way Dyreng et al. (2017) already ensure that a substantial amount of loss-firms is not included in the analysis and, consequently, was not included in my replication of the study. Therefore, for the sake of robustness to loss-observations, tax researchers should generally be advised to ensure certain minimum criteria with respect to firm size, year coverage and/or a minimum requirement for profitability.

2.5 Conclusion

This article addresses the question whether loss-observations can be implemented in the measurement of corporate tax avoidance and analyzes how the handling of losses affects the measurement outcome. Tax avoidance researchers have two choices regarding the treatment of NOLs: They either remove losses from the sample or include them by using specific, asset-scaled, measures of corporate tax avoidance. Asset-scaled measures, like *BTDs*, have the advantage over profit-scaled measures, like *ETRs*, that the scalar is independent of pretax income, such that loss-observations can be included in the analysis. However, this advantage comes at the cost of a scaling bias, highlighted by Guenther (2014), as such measures differ between firms of equal tax avoidance but varying profitability.

My descriptive results confirm that *BTD* and the novel *HS2018* measure label less-profitable industries more tax aggressive than *ETRs* do. Moreover, I find that the intake of loss-observations changes the samples of tax researchers substantially: Using *BTD* (*HS2018*) instead of *CURRENT ETR* (*CASH ETR*) increases sample size up to 43 percent (28 percent) while the newly gained loss-observations in Compustat are concentrated within a remarkably smaller,

shorter-lived and younger subset of steadily unprofitable firms. This underlines that financial losses do not occur randomly between corporations and time-periods. Therefore, tax researchers should be clear on whether they would like to include such specific firms in their analyses.

Moreover, I show that the removal of loss-observations from tax researchers' samples can have profound effects on the measurement of corporate tax avoidance. I document that one single financial loss does not only yield a non-meaningful *ETR* for the loss-year itself, but also distorted *ETRs* for several succeeding and preceding financial years of such firms. Thus, even studies that remove loss-observations from the sample deal with distorted *ETR* values, which could erroneously be interpreted as tax avoidance. In view of this, I revise the declining trend in *CASH ETR* for domestic firms detected by Dyreng et al. (2017). I control for the initial loss-structure of firms in the original study and observe that the decline in *CASH ETR* of domestic U.S.-firms is to some part attributable to distorted ETR values that are linked to the loss-structure in the data. Hence, contrary to multinationals, profitable domestic U.S.-corporations did not engage in more aggressive tax planning over the years of their existence. This finding is new because so far abnormal ETR values of loss-making firms insinuated that domestic firms as a whole became more tax aggressive. My results contribute to the tax literature by showing the lingering effect of loss-observations on the measurement of tax avoidance. Only when losses are taken into account, it becomes clear that U.S. domestic firms evolved differently with respect to successful tax planning than U.S.-multinationals.

From a practical point of view, the measurement of corporate tax avoidance in the presence of NOLs is essentially more complicated than in their absence. Tax researchers can include loss-observations in their samples by applying asset-scaled proxies as *BTD* or *HS2018*. However, they should pay attention to the heterogeneous characteristics of non-prospering firms and the confounding effect of firm profitability (in years of positive earnings) on the measured outcome. Only then, NOLs can meaningfully be included in the measurement of corporate tax avoidance. Nevertheless, firms that steadily report negative earnings yield little,

if not any, information content in terms of tax avoidance. If researchers decide to remove loss-observations from their samples, they should implement (manually constructed) NOL indicators before and after loss-years and, still, remain aware of the initial loss-structure in their data.

Appendix

Table A1: Variable Definitions

ADVERT	The ratio of advertising expense (*xad*; if missing set to zero) to sales (*sale*).
AGE	The difference between the financial year of the firm-year observation and the first financial year in which the firm was listed in Compustat.
BTD	The difference between pretax income (*pi*) and approximated taxable income (txc/τ), scaled by total assets (*at*).
CAPEX	The amount spent on capital assets (*capx*) scaled by net property, plant and equipment (*ppent*).
CASH ETR	The ratio of cash taxes paid (*txpd*) to pretax income (*pi*).
CASH ETR-Deviation	The difference between the annual *CASH ETR* and the firm's LONG RUN *CASH ETR* for the ten year-period before or after the loss year (in section 4.1).
CURRENT ETR	The ratio of current income taxes (*txc*) to pretax income (*pi*); the latter adjusted for special items (*xi*).
FIRM_AGE	The difference between the fiscal year for a given firm-year observation less the first fiscal year in which the company was listed in the Dyreng et al. (2017) data set.
GAAP ETR	The ratio of total income taxes (*txt*) to pretax income (*pi*); the latter adjusted for special items (*xi*).
GAAP ETR-Deviation	The difference between the annual *GAAP ETR* and the firm's LONG RUN *GAAP ETR* for the ten year-period before or after the loss year (in section 4.1).
HS2018	The difference between adjusted cash taxes paid ($txpd-\Delta txr$) and expected statutory tax liability ($\tau * pi$), scaled by market value of total assets ($at + mkvalt - ceq$).
INTANG	The amount of Intangible Assets (*intan*) scaled by total assets (*at*).
MNE	Indicator for multinational firm-years and is equal to one if the absolute value of pretax foreign income (*pifo*) is greater than zero or if the absolute value of foreign tax expense (*txfo*) is greater than zero.
LEVERAGE	The total debt ($dltt + dlc$) scaled by total assets (*at*).
LIFETIME	The difference between the most recently recorded financial year of a firm and the first financial year in which the firm is listed in Compustat.
LOG_ASSETS	The natural log of total assets (*at*).
LOSS	Firm-level Indicator variable that equals one if a firm experienced at least one negative pretax income (*pi*) in the sample period before data processing.
LOSS_INT	The decile in which a firm ranks in the sample according to its number of loss-years ($pi < 0$) relative to its covered firm years in the sample period.
MARKET_BOOK	The ratio of market value of a firm's equity (mkvalt; if missing replaced by share price (*prcc_f*) multiplied by the number of shares outstanding (*csho*)).
NOL	Indicator variable equal to one if Compustat reports a tax-loss carryforward (*tlcf*) at the end of the previous year.
ΔNOL	The change in net operating losses and is the difference between the current and lagged tax-loss carryforward (*tlcf*), scaled by lagged total assets (*at*).
PPE	The ratio of net property, plant and equipment (*ppent*) to total assets (*at*).
R&D	The amount of research and development expense (*xrd*; if missing set to zero) scaled by the sales (*sale*).
ROA	The ratio of pretax income (*pi*) to total assets (*at*).
ROMVA	The ratio of pretax income (*pi*) to market value of total assets ($at + mkvalt - ceq$)
SALES	The absolute USD amount of sales (*sale*).
SPECIAL_ITEMS	The ratio of special items (*spi*; if missing set to zero) to average total assets (*at*).
TIME	The difference between the fiscal year for a given firm-year observation less the number 1988, which is the first year in the Dyreng et al. (2017) data set.
TOTAL_ASSETS	The absolute USD amount of total assets (*at*) in millions.

Table A2: Complete Industry Tax Avoidance Ranking by Selected Measures

Industry	Code	Firms	Cash ETR		Current ETR		BTD		HS 2018	
Petroleum and Gas	30	290	**1**	(0.135)	1	(0.156)	1	(0.021)	1	(-0.006)
Real Estate	47	100	**2**	(0.14)	2	(0.182)	5	(0.008)	11	(-0.002)
Computer Software	36	671	**3**	(0.192)	9	(0.289)	23	(-0.002)	9	(-0.003)
Computers	35	206	**4**	(0.198)	11	(0.292)	28	(-0.005)	8	(-0.003)
Electronic Equipment	37	433	**5**	(0.205)	6	(0.268)	8	(0.006)	3	(-0.003)
Transportation	41	190	**6**	(0.211)	3	(0.227)	2	(0.02)	2	(-0.006)
Entertainment	7	131	**7**	(0.228)	5	(0.265)	14	(0.002)	15	(-0.002)
Medical Equipment	12	232	**8**	(0.247)	15	(0.305)	11	(0.004)	5	(-0.003)
Communication	32	225	**9**	(0.25)	4	(0.254)	9	(0.005)	19	(-0.001)
Pharmaceutical	13	240	**10**	(0.251)	14	(0.303)	7	(0.006)	10	(-0.002)
Restaurants, Hotels, etc.	44	166	**11**	(0.256)	10	(0.29)	4	(0.009)	4	(-0.003)
Measuring. Eq.	38	159	**12**	(0.257)	17	(0.312)	15	(0.002)	12	(-0.002)
Healthcare	11	207	**13**	(0.257)	18	(0.314)	24	(-0.002)	16	(-0.002)
Insurance	46	228	**14**	(0.262)	7	(0.279)	10	(0.005)	13	(-0.002)
Steel Works Etc	19	102	**15**	(0.266)	12	(0.293)	6	(0.007)	7	(-0.003)
Banking	45	128	**16**	(0.267)	13	(0.294)	16	(0.002)	22	(-0.001)
Chemicals	14	132	**17**	(0.274)	8	(0.287)	3	(0.012)	6	(-0.003)
Recreation	6	65	**18**	(0.282)	19	(0.316)	21	(-0.000)	28	(0.0001)
Machinery	21	236	**19**	(0.286)	20	(0.316)	12	(0.004)	14	(-0.002)
Personal Services	33	99	**20**	(0.291)	23	(0.326)	19	(0.001)	17	(-0.002)
Electrical Equipment	22	100	**21**	(0.292)	24	(0.327)	22	(-0.000)	18	(-0.001)
Business Services	34	457	**22**	(0.294)	26	(0.332)	26	(-0.003)	24	(-0.001)
Business Supplies	39	93	**23**	(0.3)	16	(0.311)	13	(0.003)	20	(-0.001)
Construction Materials	17	161	**24**	(0.304)	21	(0.32)	18	(0.001)	27	(-0.001)
Automobiles and Trucks	23	107	**25**	(0.307)	22	(0.321)	20	(-0.000)	23	(-0.001)
Construction	18	107	**26**	(0.311)	31	(0.356)	31	(-0.006)	26	(-0.001)
Food Products	2	137	**27**	(0.312)	25	(0.332)	17	(0.001)	21	(-0.001)
Rubber and Plastic	15	81	**28**	(0.315)	27	(0.333)	25	(-0.003)	30	(0.0001)
Apparel	10	111	**29**	(0.322)	29	(0.352)	29	(-0.005)	25	(-0.001)
Consumer Goods	9	117	**30**	(0.324)	28	(0.348)	27	(-0.004)	31	(0.0001)
Wholesale	42	343	**31**	(0.326)	30	(0.356)	30	(-0.005)	32	(0.0001)
Retail	43	428	**32**	(0.327)	32	(0.358)	32	(-0.006)	29	(0.0001)
Printing and Publishing	8	61	**33**	(0.337)	33	(0.358)	33	(-0.008)	33	(0.001)

Note: A lower rank describes higher tax avoidance for all measures. Profitability The total sample contains 55,230 observations and spans the time-period 1990 to 2017.

Table A3: Industry Sample Selection by Tax Avoidance Measure

Sample	Current ETR& BTD	Only BTD	CASH ETR & HS2018	Only HS2018
Observations	79,901	68,245	73,023	47,654
Computer Software	6.5%	11.7%	5.7%	11.5%
Pharmaceutical Products	2.6%	11.4%	2.3%	6.7%
Electronic Equipment	4.9%	5.8%	4.5%	6.6%
Business Services	5.4%	4.9%	5.0%	5.2%
Other	2.3%	4.8%	1.9%	4.7%
Petroleum and Natural Gas	3.3%	4.6%	3.1%	5.0%
Medical Equipment	2.6%	4.4%	2.4%	3.5%
Fin. Trading	8.2%	4.1%	6.9%	4.6%

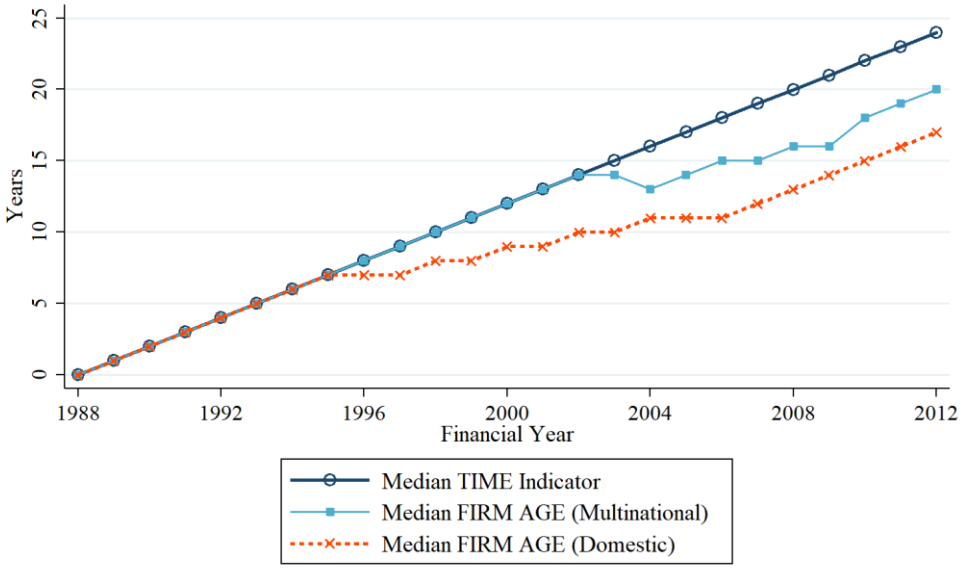
Note: The Baseline Sample 1 refers to the subsample of observations which provide meaningful observations for both *BTD* and *CURRENT ETR* (53% of population). The BTD Surplus Sample only provides meaningful values for *BTD* (44%). The Baseline Sample 2 refers to the subsample of observations that provide meaningful values for both *HS2018* and *CASH ETR* (57%). The HS2018 Surplus Sample only provides meaningful values for HS2018 (34%). The subsamples that produce only meaningful values for *CURRENT ETR* (3%) or *CASH ETR* (9%) have been ignored for the purpose of this table.

Table A4: Sample Characteristics of One-Loss-Year Sample

Variable	N	Mean	P25	P50	P75	SD	Min	Max
AGE (Years)	3,566	23.41	11.00	19.00	35.00	15.63	0.00	66.00
LIFETIME	3,566	35.93	23.00	32.00	48.00	15.47	15.00	68.00
SALES	3,549	3294.1	140.2	607.3	2711.1	6937.6	-3.2	81186.0
TOTAL_ASSETS	3,554	10673.7	318.9	1211.4	5352.3	31388.1	1.7	393780.0
MNE	3,566	0.355	0	0	1	0.479	0.000	1.000
ROA	3,549	0.067	0.015	0.050	0.103	0.081	-0.937	0.761
R&D	3,549	0.014	0.00	0.00	0.01	0.041	0.000	0.744
PPE	3,423	0.231	0.022	0.142	0.352	0.244	0.000	0.948
INTANG	3,299	0.098	0.000	0.023	0.137	0.149	0.000	0.829
LEVERAGE	3,548	0.210	0.053	0.162	0.310	0.198	0.000	1.937
CAPEX	3,129	0.203	0.092	0.159	0.271	0.165	-0.009	2.192
ADVERT	3,554	0.010	0.00	0.00	0.00	0.038	0.000	0.476
SPECIAL_ITEMS	3,554	-0.006	-0.002	0.000	0.000	0.039	-1.014	0.532
NOL	3,566	0.186	0	0	0	0.390	0.000	1.000
MARKET_BOOK	3,172	2.62	1.17	1.72	2.79	9.36	-12.44	482.90
GAAP ETR	3,546	0.27	0.25	0.33	0.38	0.55	-10.69	4.54
CASH ETR	3,236	0.19	0.10	0.25	0.36	1.25	-23.10	11.43

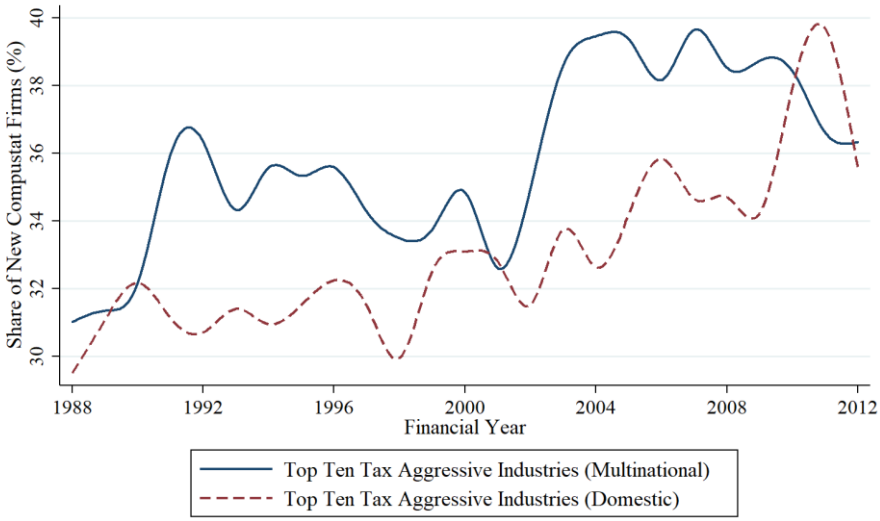
Note: Table A4 is based on a sample of 189 firms (3,546 observations) over 21 firm-specific years between 1990 and 2017. All firms in the sample experience exactly one loss-year over the period.

Figure A1: The Difference between Firm Age and Time



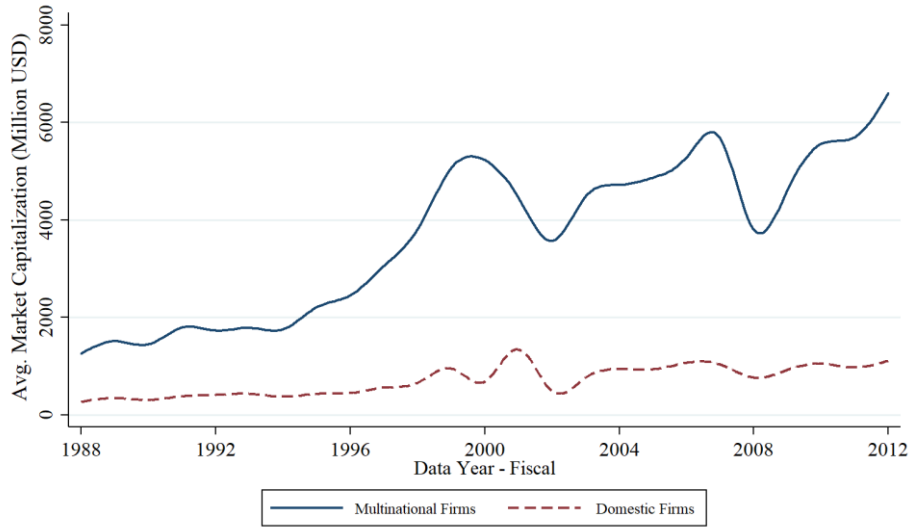
Note: Figure A1 shows the median values of TIME and *FIRM_AGE* of multinational and domestic firms over the financial years in the Dyreng et al. (2017) sample. The further the median *FIRM_AGE* falls below the TIME median in the graph, the more new firms have entered (and the more formerly covered firms dropped out of) the Compustat population in the given year. Until the year 1995, the upper 50 percent of all firms were already existent in 1988 in the data. This holds for multinationals until the year 2002. However, the coverage of new domestic firms in Compustat was much more comprehensive. Already in 1996, more than 50 percent of all existing domestic firms were added belatedly, after 1988, to the Dyreng et al. (2017) sample. Multinational firms have been added to the sample, too, but not in a similar scope and later in time. This highlights that the TIME coefficient of Dyreng et al. (2017) does not measure the change in *CASH ETR* of given firms over time but the cross-sectional aggregate change in *CASH ETR*, which is affected by dynamic sample composition.

Figure A2: Compustat Coverage of Tax Aggressive Industries over Time



Note: Figure A2 shows the Compustat coverage of tax aggressive industries separately for multinational and domestic U.S. firms in the Dyreng et al. (2017) sample between 1988 and 2012. The top ten tax aggressive industries are Petroleum and Natural Gas, Real Estate, Computer Software, Computers, Electronic Equipment, Transportation, Entertainment, Medical Equipment, Communication and Pharmaceutical Products. The sample contains 56,955 observations after the removal of NOLs.

Figure A3: Market Capitalization over Time



Note: Figure A3 shows the development of average market capitalization (in Million USD) of public multinational and domestic U.S. firms in the Dyreng et al. (2017) sample. The sample contains 56,955 observations after the removal of NOLs.

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Chapter 3

Measuring the Aggressive Part of International Tax Avoidance

Measuring the Aggressive Part of International Tax Avoidance*

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Abstract

We propose a new measure that isolates the additional or even aggressive part in international tax avoidance. Our new measure is computed as the difference between a firm's individual benchmark tax level and its effective tax rate. We apply our new measure to multinational enterprises from the U.S. and show that our measure is correlated with well-known tax avoidance proxies. In additional analyses, we show that our new measure can be used to condense the information provided by a country-by-country reporting scheme. For this purpose, we apply our new measure to country-by-country data of European banks and revise the perception of their international tax aggressiveness.

Keywords: Effective Tax Rate, Tax Accounting, Tax Aggressiveness, International Tax Planning

JEL Codes: M41, H25, H26

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Chapter 3

Tables

Figures

3.1 Introduction

It is well known that multinational enterprises (MNEs) can avoid taxes. However, there is no broad agreement about the definition of "aggressive" tax avoidance. We propose a new measure for the aggressive part of international tax avoidance of MNEs and apply it to U.S. MNEs. Moreover, we show how the additional information provided by a country-by-country reporting scheme (CbCR) fits perfectly the purpose of our new measure and apply it to CbCR data in the European banking sector.

Aggressive tax avoidance of MNEs has received much attention recently. The debate has been stimulated by very low effective tax rates (ETRs) disclosed in consolidated financial statements and low tax payments in certain countries of some well-known firms. For example, Google Inc. paid only $ 0.36 billion foreign taxes on $ 8.1 billion of non-U.S. profits in 2012, which leads to a foreign ETR lower than 5 percent.[37] As statutory tax rates on corporate income are significantly higher in most industrialized countries, this creates a gap between disclosed tax position and common expectations about the tax level imposed. Many citizens argue that MNEs should pay their fair share of taxes in every country where they operate. Recently, a study by Janský (2019) shows that affiliates of MNEs in all EU member states have lower ETRs than the respective nominal statutory tax rates. We, however, argue that the home country statutory tax rate is no adequate benchmark. MNEs pay their taxes in all countries of operation and consequently face different statutory tax rates.

Therefore, we propose a new measure of international tax avoidance based on the gap between worldwide expected and actually paid tax payments. Our new measure *ETRDIFF* is computed as the difference between a benchmark tax level that would be expected if a firm paid its fair share of taxes and its ETR disclosed in consolidated financial accounts. As the benchmark tax level, we consider an average of the statutory tax rates imposed by all countries

[37] Google U.K. paid £ 11.2m in corporate tax, The Financial Times, 30/09/2013.

worldwide that host at least one subsidiary of the respective MNE. The ETR is defined as worldwide tax expenses divided by worldwide pre-tax income of a MNE. Thus, the ETR represents a well-established ex-post measure for the effectively realized taxes of a firm. Considering the difference between the two measures, our new *ETRDIFF* measure isolates the additional or even aggressive part of international tax avoidance from the simple influence of differences in host country tax levels.

Our measure does not categorize a MNE as tax aggressive if its low ETR is caused by low statutory tax rates of its host countries, e.g. in certain Eastern European countries. On the other hand, a firm is classified as tax aggressive if the gap between its expected benchmark tax rate and the actually realized ETR increases, for instance due to income shifting techniques. While the ETR can be taken from the financial accounts of public firms, the collection of information about the location of economic activities is more challenging. However, disclosure rules already oblige public firms to publish a list of their significant subsidiaries (e.g. Exhibit 21 of SEC Form 10-k). We use this information about the worldwide distribution of a firm's economic activities and compute our new *ETRDIFF* measure for U.S. firms. We consider different versions of our *ETRDIFF* measure referring to the *GAAP ETR*, the *CASH ETR* and the *FOREIGN ETR*.

For a sample of U.S. firms from 2002 until 2012, we find an average *FOREIGN ETRDIFF* of approximately 5 percentage points. This suggests that U.S. firms clearly undercut the mean of all foreign statutory tax rates. Hence, U.S. MNEs in our sample appear to engage in aggressive tax planning that goes beyond the mere benefitting from moderate corporate tax rates. We also validate our measure with established proxies for international tax avoidance. Our analysis shows that larger tax haven operations or the enhanced opportunities to manipulate transfer prices are clearly associated with a higher value of our *ETRDIFF* measure.

A concern with the data disclosed by MNEs is the lack of detailed information regarding the structures of their worldwide activities. Thus, in subsequent case-studies, we focus on a

specific industry where such valuable data exist. Since 2014, a European directive obliged financial institutions headquartered in the European Economic Area (EEA) to publicly disclose key financial and tax information on a country-by-country level. We show that the data provided by a CbCR can be implemented in the construction of a more refined version of our new measure. We exploit this – so far unique – data and compute our *ETRDIFF* measure for the largest European banks. This application shows that our measure can be used to condense the data set provided by a CbCR. Consequently, applying our *ETRDIFF* measure to CbCR data allows a proper distinction between the aggressive part of tax avoidance and tax differences that are associated with different statutory tax rate imposed by different host countries.

The previous literature has already investigated tax avoidance of MNEs (for an overview cf. Dharmapala, 2014; Hanlon and Heitzman, 2010). Most of the literature considers financial accounting data and refers to different types of ETRs (Collins and Shackelford, 1995, 2003; Rego, 2003; Plesko, 2003; Dyreng, Hanlon and Maydew, 2008). A few studies analyze abnormal or permanent differences between book and tax income (Desai and Dharmapala, 2006, 2009; Frank, Lynch and Rego, 2009).

The idea of using a differential between effective taxes and statutory tax rate as tax avoidance measure is also known in the tax literature (Hanlon and Heitzman, 2010, p. 140). As subsidiaries of MNEs are subject to different tax levels in their host countries, we argue that a reduction in the ETR resulting from foreign economic activities should not be denoted as "aggressive" tax avoidance. Only an additional tax reduction should be attributed to aggressive tax avoidance. Considering the influence of international tax rate variation, we replace the statutory tax rate of the home country by the average of all statutory tax rates imposed by all host countries of a MNE.

Our approach also relates to a measure proposed by Balakrishnan, Blouin and Guay (2019) that benchmarks a firm's tax level with its industry mean. Using the industry mean as a benchmark, however, might lead to some underestimation of the scope of tax avoidance if the

majority of industry-peers avoid taxes as well. Accordingly, previous evidence has not disentangled the elementary effect of tax rate variation across host countries from additional or even aggressive tax avoidance like transfer pricing, royalties or 'check-the-box' techniques. To the best of our knowledge, we are the first to propose a measure of tax avoidance that isolates the effect of more aggressive international tax planning strategies from the simple influence of differences in host country tax rates. This way, we provide a more refined assessment of corporate tax avoidance and expand the discussion of fair tax payments beyond already mentioned firms with strikingly low ETRs by any standards.

We contribute to the current discussion about base erosion and profit shifting (BEPS) of MNEs (OECD, 2014). In particular, the OECD requests new measures to analyze the scope and the determinants of base erosion and profit shifting. We believe that it is important to distinguish between MNEs with justified low tax expenses and MNEs that are truly tax aggressive. Only then, targeted policy actions can be designed effectively in the combat against global tax avoidance. Moreover, we show that the additional information provided by a CbCR can be used to identify more aggressive forms of tax avoidance. The OECD base erosion and profit shifting (BEPS) project suggests only a confidential CbCR available for tax authorities (OECD, 2015). This paper, however, demonstrates how such data could be used outside tax authorities. Consequently, we hope to stimulate the ongoing debate about public CbCR.

The remainder of the paper is organized as follows. In Section 2, we propose our new measure for the aggressive part of tax avoidance. In Section 3, we apply our measure to U.S. MNEs and in section 4 to large European banks. Section 5 concludes.

3.2 Measuring International Tax Avoidance

3.2.1 The Aggressive Part of International Tax Avoidance

Until now, there does neither exist a uniform definition of corporate tax aggressiveness nor an academic consensus on how to measure it (Blouin, 2014). Instead, tax researchers apply

numerous empirical proxies when examining tax aggressiveness. A broad literature has analyzed subsidiary level data and provides evidence for international tax avoidance, e.g. due to income shifting (cf. Hines Jr and Rice, 1994; Huizinga and Laeven, 2008; Blouin, Robinson and Seidman, 2012; Klassen and LaPlante, 2012a, 2012b). However, insights into the scale of the global tax avoidance of MNEs requires an analysis based on data from the consolidated financial statements of MNEs. ETRs and Book Tax Differences (BTDs) represent probably the two most widely used measurement concepts for tax avoidance and often appear together in research designs (e.g. Frank, Lynch and Rego, 2009; Lennox, Lisowsky and Pittman, 2013). Both measures relate tax expense and pre-tax financial income. The ETR describes the respective average tax rate paid for one unit of financial income (Gupta and Newberry, 1997). BTDs portray the gap between a company's financial and (approximated) taxable income (Manzon Jr and Plesko, 2002). Thus, lower (higher) ETRs (BTDs) signal tax aggressiveness.

However, BTDs are constructed via grossing up taxable income by dividing the tax expense through the statutory tax rate of the firm's country of incorporation. Hence, the concept of BTD automatically benchmarks a company's tax expense to the expected statutory tax expense in its home country.[38] The metric of the ETR does not involve an automatic benchmark such that researchers often resort to individual comparisons. While many scholars follow the most obvious choice to compare ETR to the company's home country statutory tax rate (e.g. Dyreng, Hoopes and Wild, 2016), others choose differently. For example, Balakrishnan et al. (2019) decide to capture relative tax avoidance by measuring the differential between firm-specific ETR and the average ETR of similar sized industry-peers. However, the industry benchmarking can only identify tax avoidance that is not typical for the industry.

Regarding international tax avoidance, a few studies have investigated the impact of foreign activities on the ETR. Rego (2003), Collins and Shackelford (1995, 2003) as well as

[38] BTDs are usually scaled by book value of total assets to be comparable between firms of different size. See Guenther (2014) for a conceptual comparison of BTD and ETR.

Markle and Shackelford (2012a) compare ETRs of MNEs with those of domestic firms. Expectations for the impact of international activities on the ETR are ambiguous. On the one hand, investments in high tax countries like the U.S., Canada, Germany or Japan are associated with increasing ETRs. On the other hand, MNEs invest in low tax countries or even tax havens. Dyreng and Lindsey (2009) and Markle and Shackelford (2012a, 2012b) consider tax haven operations and proxies for profit-shifting channels as determinants of ETR measures.

Recently, a study by Janský (2019) on MNEs' worldwide ETRs fueled the ongoing debate about whether corporations pay their fair share. The study shows that affiliates of MNEs in all EU member states have lower ETRs than the respective nominal statutory tax rates. On the basis of these results, the Greens, a German based political party in the European parliament who commissioned the study, posit the introduction of minimum effective tax rates in the EU to stop the tax competition in the European Union (Janský, 2019, p. 4).

We believe that low ETRs of MNEs' unconsolidated affiliates should be interpreted with caution. First, a low ETR of an unconsolidated affiliate cannot be linked to MNEs' cross-border profit-shifting activities because income shifting also affects by definition pre-tax income, as the denominator of the ETR. Moreover, low ETRs of certain firms, in particular holding firms, are to a certain degree expected from the design of national tax systems. Dividends received from other subsidiaries are (almost) tax-exempt because they reflect income that was already subject to tax at the level of the other subsidiary. Second, even when discussing the ETR of consolidated group accounts, we argue that the home country statutory tax rate is no adequate benchmark. Under territorial tax regimes, MNEs pay their taxes in all countries of operation and consequently face different statutory tax rates.[39] Thus, the worldwide tax liability of a MNE should not be benchmarked solely against the statutory tax rate of a single country.

[39] The effect is similar under quasi-territorial tax systems like the U.S. system prior to the Tax Cuts and Jobs Act if permanently re-invested earnings are not subject to tax in the home country.

In fact, we argue that a substantial part of MNEs (headquartered in high-tax countries) is wrongly perceived as too tax aggressive while other MNEs (headquartered in low-tax countries) are not recognized sufficiently critical when following the described logic above. Our argument can be illustrated by the example of a hypothetical manufacturing firm headquartered in France. Suppose the company has outsourced substantial parts of its production to subsidiaries in Eastern European countries due to lower wages than in France. Hence, the firm will produce, for example, in Hungary, a country with a statutory tax rate of 9% in 2015. The after-tax profit of the Hungarian subsidiary is distributed to the French parent company where intercompany dividends are almost tax exempt. Most likely, the company also has a production line in France and pays the French corporate income tax rate (33.3%) on profits generated there. In absence of any income shifting strategies, the total tax liability of the group should equal something between the French and the Hungarian statutory tax rates, depending on the distribution of geographical activity.

As international differences in corporate tax rates are significant in magnitude and subsidiaries are subject to taxation in their host countries, we argue that a reduction in the ETR resulting from the incorporation of an additional foreign subsidiary in a host country with a moderate tax level should not be denoted as "aggressive" tax avoidance.[40] Only an additional reduction of tax expenses should be attributed to additional or even aggressive tax avoidance. Therefore, we suggest to reconsider existing benchmarks for "fair amount of taxes paid" and propose a more differentiated measure to distill the aggressive part of international tax avoidance from MNEs' worldwide tax payments.

[40] Here, it is to emphasize that we clearly distinguish between countries with moderate tax rates and tax havens. We design our new measure such that the benchmark is not watered-down by tax rates of tax havens.

3.2.2 A New Measure for Aggressive International Tax Avoidance

We denote our new measure as *ETRDIFF* because it is computed as the difference between a firm's individual benchmark tax level and an ETR. The ETR is taken from the consolidated financial accounts of a firm and a commonly used proxy for tax avoidance in previous literature (Hanlon and Heitzman, 2010). A lower ETR suggests that a firm has realized less tax expenses than other firms with higher ETRs. We benchmark the ETR against the expected tax level that would occur if the MNE pays taxes at the statutory tax level. Therefore, we compute the following measures for each multinational firm *i* in fiscal year *t*:

$$ETRDIFF_{i,t} = \overline{STR}_{i,t} - ETR_{i,t} \qquad \text{(Eq.1)}$$

where:

$\overline{STR}$:	Worldwide average of the statutory corporate tax rates of all host countries of firm i where at least one subsidiary is located (no consideration of tax haven countries).[41]
ETR:	Effective tax rate measure like the *GAAP ETR*, *CASH ETR* or *FOREIGN ETR.*

The *ETRDIFF* measure identifies abnormally low ETRs that cannot be explained by a benchmark tax level. Accordingly, we categorize a MNE as tax aggressive if its *ETRDIFF* is positive. This means that its *ETR* is abnormally low compared to a benchmark tax level that would be expected in the absence of any profit shifting strategies and shell corporations in tax haven countries. We use different versions of our *ETRDIFF*, considering established versions of ETR like, for example, the *GAAP ETR*, *CASH ETR* or the *FOREIGN ETR*.

Our benchmark $\overline{STR}$ is the average of the statutory corporate income tax rates of all countries worldwide that host a subsidiary of the respective firm. Since $\overline{STR}$ is used as a proxy for the expected tax level according to the distribution of real economic activities, we do not

[41] We classify countries as tax havens according to the established tax haven list of Dyreng and Lindsey (2009).

consider typical tax haven countries for the computation.[42] Our benchmark tax level is determined by a firm's individual business model, i.e. by location choices, but is not affected by particular aggressive tax planning strategies.

We argue that the statutory corporate tax rate of a host country is a convincing benchmark for the proper tax level of a MNE's subsidiary in the absence of any additional tax planning activities. The incorporation of an additional subsidiary in a host country with a moderate corporate tax rate affects both the *ETR* as well as the $\overline{STR}$. If a MNE benefits from additional tax savings due to profit shifting or other aggressive international tax planning, the *ETR* decreases while the $\overline{STR}$ remains constant. The more extensively a MNE uses tax planning strategies to decouple the locations of its business activities from those of taxable income, the wider fall $\overline{STR}$ and *ETR* apart. Our approach allows to isolate the aggressive part of international tax avoidance and to identify the impact of certain tax planning strategies. The *ETRDIFF* reflects the scope of additional tax planning that cannot be explained by the distribution of a firm's real activities, i.e. the subsidiary locations.

The main challenge associated with the computation of the benchmark tax level $\overline{STR}$ is data availability. Information on the international structure of a MNE is required but only rudimentary disclosed. However, SEC rules (Exhibit 21 of form 10-k) and IFRS 10 specify the disclosure of a list of all subsidiaries considered. Such data allow the construction of $\overline{STR}$ as an arithmetic mean of statutory tax rate across all host countries of a firm.

This benchmark might be already a good heuristic for the idea that a MNE should pay its fair share of taxes. A more refined benchmark $\overline{STR}$ could also consider a weighting scheme in accordance with the scale of real economic activities of a MNE at each of its locations. Proxies for economic activity or value creation are, for example, sales or the number of employees.

[42] In further analysis we also modify the *ETRDIFF* measure and include tax haven locations but consider a weighting scheme that refers to host country sales as a proxy for size of real economic activities at each location of a MNE.

Unfortunately, complete subsidiary-level data on sales or employees is not available for most MNEs. Well-known databases like Amadeus or Orbis include only an incomplete number of subsidiaries and detailed financial data is missing for more than 50 percent of them. However, the data provided by a CbCR perfectly fit and can be directly used to compute a weighted average benchmark tax level $\overline{STR}$. In Section 4, we will therefore exploit actual CbCR data from the European banking sector.

3.3 Measuring Aggressive Tax Avoidance of U.S. MNEs

In this section, we apply our *ETRDIFF* measure to U.S. MNEs listed in the S&P 500 index. We use the S&P 500 index for two reasons: First, U.S. corporations have been at the center of the public debate about aggressive base erosion and international tax planning activities. Second, U.S. listed firms are obliged by SEC regulation to disclose a list of their significant subsidiaries in Exhibit 21 of form 10-k. We use this information about the structure of the worldwide activities of MNEs and compute our new measure.

3.3.1 Sample Selection

We consider a panel of U.S. firms listed in the S&P 500 over the period from 2002 to 2012. We use financial data from Compustat North America (5,907 firm-year observations). The construction of our *ETRDIFF* measure requires information about foreign subsidiary locations. Exhibit 21 of Form 10-k contains information about significant subsidiaries (Item 601 of SEC Regulation S-K).[43] Similar to Dyreng and Lindsey (2009), we use the subsidiary information disclosed in Exhibit 21 and available at the SEC's database EDGAR.[44] Companies

[43] According to SEC Regulation (17 CFR 210.1-02(w)), a subsidiary can be deemed not to be a significant subsidiary if all of the following three conditions are met: (1) the parent company's and its other subsidiaries' investments in the subsidiary do not exceed 10 % of the parent company's total assets; (2) the parent company's and its other subsidiaries' investments proportionate share of the assets of the subsidiary do not exceed 10 % of the consolidated firm's total assets; and (3) the parent company's and its other subsidiaries' investments proportionate share of the subsidiary's pre-tax income from continuing operations does not exceed 10 % of the consolidated income from continuing operations.

[44] https://www.sec.gov/edgar/searchedgar/companysearch.html.

which do not provide an Exhibit 21 in EDGAR are not included in our data sample. We refer to the group structure disclosed in the Exhibit 21 from the year 2007 because subsequently, U.S. companies removed hundreds of offshore subsidiaries from their publicly disclosed financial filings in the successive years.[45] Moreover, we limit our sample to multinational U.S.-based firms and thus delete all firms which are not headquartered in the U.S. and have only domestic subsidiaries. Imposing these prerequisites on the dataset results in a sample of 4,345 firm-year observations. On average, one U.S. firm in our sample has 132 foreign subsidiaries.

Furthermore, we limit the sample to companies that have a positive pre-tax income (pi) as it is difficult to analyze tax planning activities of loss firms (cf. Stickney and McGee, 1982; Zimmermann, 1983; Gupta and Newberry, 1997; Rego, 2003).[46] We exclude observations with ETRs < 0 and ETRs > 1 to limit the influence of outliers.

3.3.2 Measurement of Aggressive Tax Avoidance of U.S. MNEs

We apply the methodology described in Section 2.1 to compute our *ETRDIFF* measures for each firm included in our sample. We consider different ETR definitions[47] like the *GAAP ETR* as well as the *CASH ETR* and the *FOREIGN ETR* to compute the *GAAP ETRDIFF*, the *CASH ETRDIFF* and the *FOREIGN ETRDIFF*. Table 1 depicts mean values for the *GAAP ETRDIFF*, the *CASH ETRDIFF* and the *FOREIGN ETRDIFF* of U.S. MNEs.

As benchmark tax level, we consider the mean of the statutory corporate tax rates of all host countries of a firm ($\overline{STR}$). Tax haven countries are neglected because setting up a tax haven subsidiary might be already interpreted as an aggressive form of tax avoidance. The mean value for the $\overline{STR}$ is 0.32 which is smaller than the U.S. tax level due to smaller corporate tax rates

[45] Cf. The Incredible Vanishing Subsidiary – From Google to FedEx, Wall Street Journal, 5/22/2013.
[46] In case of the *FOREIGN ETR* measures, we require a positive pre-tax foreign income (*pifo*).
[47] *GAAP ETR* is defined as total taxes divided by pre-tax profit less extraordinary items. The numerator of the *CASH ETR* is computed by using cash taxes paid (Dyreng, Hanlon and Maydew, 2008). *FOREIGN ETR* is the sum of foreign current taxes and foreign deferred income taxes divided by foreign pre-tax income.

imposed by several host countries. The standard deviation of the benchmark $\overline{STR}$ is 0.037 suggesting very different tax levels in the host countries of MNEs.

Before the Tax Cuts and Jobs Act in 2017, the U.S. tax system was worldwide. Foreign income of U.S. MNEs was subject to U.S. corporate income taxes at repatriation. However, U.S. taxes could be deferred if foreign income was retained. Many U.S. firms avoid redistribution and prefer to reinvest or hold just cash in their foreign subsidiaries (Foley, Hartzell, Titman and Twite, 2007). Moreover, ASC 740-30-25-3 provides an exception to deferred tax accounting for permanently reinvested foreign earnings.[48] We therefore neglect repatriation taxes when computing our benchmark $\overline{STR}$.

Considering the U.S. firms in our sample, the mean *GAAP ETRDIFF* is 0.018 (Panel A). The value of 0.018 indicates that the difference between the *GAAP ETR* (sample mean: 30.2 percent) and the mean of the statutory corporate tax rates of all host countries of a firm (sample mean: 32 percent) is 1.8 percentage points. The mean values for the *CASH ETRDIFF* and *FOREIGN ETRDIFF* are larger and amount to 0.062 and 0.050, respectively. The positive *ETRDIFF* shows additional tax avoidance beyond the benchmark tax level associated with the international tax rate distribution across host countries.

Table 1: Summary Statistics Subsamples – ETRDIFF

	GAAP ETRDIFF		***CASH ETRDIFF***		***FOREIGN ETRDIFF***	
	N	Mean	N	Mean	N	Mean
(1) TOTAL	2,422	0.0179	2,351	0.0623	1,760	0.0502
(2) HAVEN	626	0.0298	600	0.1013	497	0.0787
(3) R&D	606	0.0570	588	0.0938	440	0.1274
(4) INCOME MOBILE = 1	528	0.0556	522	0.0901	481	0.1189

Notes: Table 1 shows descriptive results for the dependent variables *GAAP ETRDIFF*, *CASH ETRDIFF* and *FOREIGN ETRDIFF* for different (sub)samples: (1) Total number of observations; (2) *HAVEN* in top-75% percentile; (3) *R&D* intensity in top-75% percentile; (4) *INCOME MOBILE* = 1.

[48] ASC 740-30-25-3 (formerly APB 23) allows an U.S. multinational to assert that its investment (outside basis) in a foreign subsidiary is permanent and those foreign earnings will be indefinitely reinvested, so there is no current or deferred incremental U.S. tax liability.

Moreover, we employ the data to provide some validation of the *ETRDIFF* measure. Table 1 reports sample means of the *ETRDIFF* for subsamples that might be particularly tax aggressive: (i) firms with tax haven operations in the top-75% percentile, (ii) firms with a R&D intensity in the top-75% percentile, and (iii) income mobile firms.[49] The additional data clearly illustrate that, compared to the total sample, *ETRDIFF* measures increase if we only consider firms with intense tax haven operations, firms with intense R&D activities or income mobile firms. The mean *GAAP ETRDIFF* of U.S. MNEs doubles for firms with intense tax haven usage or when firms from income mobile industries are considered. The differences become even more apparent for the *CASH ETRDIFF* and *FOREIGN ETRDIFF*. For example, the mean value of the *FOREIGN ETRDIFF* computed for firms in income mobile industries is 0.12. The *FOREIGN ETRDIFF* of 0.12 translates into a difference between a firm's benchmark tax level and its *FOREIGN ETR* of 12 percentage points. The explorative analysis suggests that proxies for certain international tax avoidance schemes are associated with higher values of the *ETRDIFF* measure.

3.3.3 Adjusted Benchmark Tax Levels

As benchmark tax level for our *ETRDIFF* measures, we consider the mean of the statutory corporate tax rates of all host countries of a firm ($\overline{STR}$). A concern with the arithmetic mean of the corporate tax rates across all locations of a MNE is the asymmetric economic relevance of locations. Unfortunately, no additional financial information is included in Exhibit 21. As a robustness check, we however try to approximate the economic weights of MNEs' foreign subsidiaries. We do so by using statistics on the outward activities of U.S. MNEs provided by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). These statistics provide information about the sales of U.S. controlled foreign subsidiaries for each host country

[49] According to De Simone, Mills and Stomberg (2014), we classify the following three-digit SIC codes as income mobile industries: 283 (Pharmaceutical), 357, 367, 737 (Computers) and 738 (Services).

and the number of U.S. subsidiaries located in the respective country.[50] We use this data and construct a new weighting scheme for the host countries of each individual firm. $\overline{STR}$ is now an average of the host counties' statutory tax rates weighted by the sales of a typical controlled foreign subsidiary as reported in the BEA data.[51]

Table 2: Summary Statistics Subsamples – ETRDIFF adjusted

	GAAP ETRDIFF Adjusted		***CASH ETRDIFF Adjusted***		***FOREIGN ETRDIFF Adjusted***	
	N	Mean	N	Mean	N	Mean
(1) TOTAL	2,422	0.0330	2,351	0.0776	1,760	0.0644
(2) HAVEN	626	0.0460	600	0.1179	497	0.0949
(3) R&D	606	0.0710	588	0.1078	440	0.1403
(4) INCOME MOBILE = 1	528	0.0701	522	0.1045	481	0.1322

Notes: Table 2 shows descriptive results for the dependent variables *GAAP ETRDIFF adjusted*, *CASH ETRDIFF adjusted* and *FOREIGN ETRDIFF adjusted* for different (sub)samples: (1) Total number of observations; (2) *HAVEN* in top-75% percentile; (3) *R&D* intensity in top-75% percentile; (4) *INCOME MOBILE* = 1.

Table 2 depicts the measures using this alternative weighting scheme for $\overline{STR}$ when computing adjusted *ETRDIFF* measures. For the U.S. firms, the mean values for the adjusted *ETRDIFF* measures are slightly larger compared to the values computed without any adjustment. We conclude that the MNEs in our samples tend to have larger economic activities (measured by sales) in high tax countries. Therefore, the arithmetic mean of statutory tax rates across all host countries underestimates the benchmark tax level. Accordingly, the values reported for the standard definition of the *ETRDIFF* might still underestimate the aggressive part of international tax avoidance to some extent.

Although the differences between adjusted and unadjusted *ETRDIFF* measures are small, this exercise suggests that more refined data about the relevance of economic activities of foreign subsidiaries for the individual firm would be helpful to better infer the amount of aggressive international tax avoidance. In Section 4, we therefore also apply the *ETRDIFF*

[50]Available for download at http://www.bea.gov/international/di1usdop.htm.
[51]Average domestic sales of a typical U.S. subsidiary is assumed to be 55 % of total sales. cf. http://us.spindices.com/documents/research/research-sp-500-2014-global-sales.pdf?force_download=true

measure to the European banking sector, where publicly available CbCR data provide the possibility to adjust the benchmark tax rate with respect to the exact geographical operations of large European headquartered banks.

3.3.4 Determinants of Aggressive Tax Avoidance

In an additional analysis, we use multivariate regressions to further validate the *ETRDIFF* as a measure for the aggressive part of tax avoidance. We evaluate how some established proxies for international tax planning strategies affect the *ETRDIFF* measure of firm *i* in year *t*. More precisely, we estimate the following OLS regression:

$$ETRDIFF_{i,j,t} = \beta_0 + \beta_1 SIZE_{i,j,t} + \beta_2 PROFITABILITY_{i,j,t} + \beta_3 CAPINT_{i,j,t} + \beta_4 LEVERAGE_{i,j,t} + \beta_5 HAVEN_{i,j,t} + \beta_6 INCOME\ MOBILE_{i,j} + \beta_7 R\&D_{i,j,t} + Year_t + Industry_j + \varepsilon_{i,j,t} \quad \text{(Eq. 2)}$$

As dependent variable, we evaluate different versions of our *ETRDIFF*. As control variables, we consider firm-specific determinants of tax avoidance that have been widely used in previous literature. In particular, we consider *SIZE*, which is total assets (in logs). The variable capital intensity (*CAPINT*) is the quotient between property, plant and equipment (ppeveb) and total assets (at). Additionally, we include the variable *LEVERAGE* in our analysis, which is defined as short-term liabilities (dlc) divided by total assets (at). A description of all variables and descriptive statistics are shown in the Appendix. As tax avoidance opportunities differ across industries due to different business models (Balakrishnan et al., 2019), we control for industry-fixed effects in accordance with the Fama and French classification of 17 different industry groups.[52]

[52] Updated industry-classification can be downloaded from http://mba.tuck.dartmouth.edu/pages /faculty/ken.french/ Data_Library/changes_ind.html.

Our main focus, however, is on established proxies for international tax planning via the use of tax havens and profit shifting. We expect positive effects for the proxies for international tax planning activities on the *ETRDIFF* measures. First, we construct a variable *HAVEN*, which is the number of tax haven countries in which the group has subsidiaries scaled by the total number of countries in which the company operates.[53] In addition, we include a variable *R&D*, which is defined as R&D expenses scaled by total assets in our analysis[54] because firms with a large amount of R&D have enhanced opportunities to reallocate profits in low-tax countries (Grubert, 2003). Firms in high-tech and pharmaceutical industries ("income mobile industries") have significant intellectual property and products which allow them to implement tax avoidance strategies by shifting profits to low-tax jurisdictions via transfer-pricing. We compute a dummy variable *INCOME MOBILE* which equals one if the respective industry of the parent is supposedly mobile in income. According to De Simone, Mills and Stomberg (2014), we classify the following three-digit SIC codes as income mobile industries: 283 (Pharmaceutical), 357, 367, 737 (Computers) and 738 (Services).

Table 3 depicts the regression results using the *GAAP ETRDIFF*, *CASH ETRDIFF* and *FOREIGN ETRDIFF* as dependent variables. Columns (1), (3) and (5) contain variables concerning firm characteristics and general tax planning activities. The other columns also consider the additional proxy variables for international tax planning activities.

[53] The definition of tax haven countries follows Dyreng and Lindsey (2009). Note that tax haven subsidiaries are not considered when computing the benchmark tax level used for the *ETRDIFF*.

[54] We require companies to have non-missing values for all components of the dependent and independent variables. However, visual inspection of several Form 10-K filings reveals that many of the missing values in Compustat, especially for R&D expenses, should be coded as zero. Therefore, we set missing *R&D* to zero.

Table 3: Determinants of Aggressive Tax Avoidance

	GAAP ETRDIFF		*CASH ETRDIFF*		*FOREIGN ETRDIFF*	
	1	**2**	**3**	**4**	**5**	**6**
SIZE	0.0076**	0.0082**	0.0078	0.0078	0.0088	0.0122**
	(0.0038)	(0.0036)	(0.0053)	(0.0053)	(0.0062)	(0.0058)
PROFITABILITY	-0.0583	-0.0997**	0.1290	0.1160	0.2770***	0.2730***
	(0.0505)	(0.0505)	(0.0846)	(0.0834)	(0.0830)	(0.0795)
CAPINT	-0.0275	-0.0155	-0.0128	-0.0044	-0.1000***	-0.0736***
	(0.0170)	(0.0167)	(0.0220)	(0.0213)	(0.0265)	(0.0246)
LEVERAGE	-0.0682*	-0.0592	-0.0505	-0.0637	-0.1700**	-0.1390**
	(0.0406)	(0.0412)	(0.0498)	(0.0524)	(0.0804)	(0.0705)
NOL	0.0537***	0.0529***	0.0841***	0.0876***	-0.0166	-0.0120
	(0.00962)	(0.0095)	(0.0136)	(0.0134)	(0.0193)	(0.0191)
HAVEN		0.0851**		0.1680***		0.2680***
		(0.0365)		(0.0496)		(0.0635)
INCOME MOBILE		0.0218*		0.0318**		0.0428**
		(0.0118)		(0.0157)		(0.0193)
R&D		0.3960***		0.1600		0.4320***
		(0.1170)		(0.1470)		(0.1330)
Industry-FE	✓	✓	✓	✓	✓	✓
Year-FE	✓	✓	✓	✓	✓	✓
N	2,422	2,422	2,351	2,351	1,760	1,760
R^2	0.141	0.185	0.124	0.153	0.176	0.250

Notes: Table 3 presents results of OLS regressions with the *GAAP ETRDIFF* in columns (1) – (2), the *CASH ETRDIFF* in columns (3) – (4) and the *FOREIGN ETRDIFF* in columns (5) – (6) as dependent variables. Robust standard errors clustered by firms are shown in parentheses. All specifications include a constant. Variables are defined in the Appendix. *, ** and *** show significance at the level of 10 %, 5 % and 1 %, respectively.

First, we take into account the *GAAP ETRDIFF* in specifications (1) and (2). Across both specifications, our analysis shows a positive effect of *SIZE* on the *GAAP ETRDIFF*. This result refers to the political power theory (Siegfried, 1972). Larger firms have greater resources to influence political processes in a tax-efficient manner. Moreover, tax planning activities might be associated with economies of scale which leads to a more aggressive tax avoidance behavior. Additionally, the dummy variable *NOL* has a high positive impact on the *GAAP ETRDIFF*. The use of prior operating tax loss carry-forwards reduces firms' tax payments (Cooper and Knittel, 2010) while the benchmark tax rate remains constant. The variables *PROFITABILITY* and *LEVERAGE* only exert a weak and less robust negative influence on the *GAAP ETRDIFF*, whereas *CAPINT* is not significant at any conventional level.

The variables for international tax planning activities are associated with significantly higher values of *GAAP ETRDIFF*. Our results in column (2) of table 3 support the expectation that the *ETRDIFF* is significantly higher if a MNE operates in tax haven countries. Compared with a firm not having any tax haven activities, our prediction for *GAAP ETRDIFF* is about 1.9 percentage points higher for a firm with the sample mean of *HAVEN* activities (0.2208).

Recent evidence suggests that multinationals can particularly shift some types of taxable profits that are more mobile. Indeed, we find a positive and significant effect of proxy variables for income shifting opportunities on the *GAAP ETRDIFF*. Considering the coefficient 0.396 of the variable *R&D* in column (2), we find that, evaluated at sample mean, R&D intense firms have a higher *GAAP ETRDIFF* of approximately 1.1 percentage points. In columns (3) and (4) of Table 3, we also provide additional regressions using the *CASH ETRDIFF* as dependent variable. Again, almost all proxies for international tax planning opportunities have a significant positive impact on our measure.

In specifications (5) and (6) of Table 3, we examine the *FOREIGN ETRDIFF* as dependent variable to focus more on international tax avoidance. Across all specifications, *PROFITABILITY* exerts a strong positive effect on the *FOREIGN ETRDIFF*. This positive

relationship is very reasonable because more profitable firms have more opportunities and incentives to reduce tax expenses by engaging in tax avoidance. For instance, widely used transfer pricing methods such as the cost plus method, the resale pricing method or the transactional net margin method are associated with particular profit-shifting opportunities if profitability is abnormally high. *CAPINT* exerts a negative and significant influence on *FOREIGN ETRDIFF* in all specifications. The negative effect suggests less aggressive tax avoidance if a firm has a high level of property, plant and equipment, which is in line with the expectation that profit-shifting is more associated with intangibility in assets.

Moreover, results depicted in column (6) also confirm that the *FOREIGN ETRFIFF* measure is larger in the case of income mobile industries, the use of tax havens and profit-shifting opportunities associated with R&D. Evaluated at sample means (0.2152), tax havens are responsible for an increase in *FOREIGN ETRDIFF* of 5.8 percentage points. Moreover, *INCOME MOBILE* firms have a *FOREIGN ETRDIFF* that is 4 percentage points higher than firms from other industries. Taking the coefficient of 0.432 for the variable *R&D* into consideration, we receive an additional effect of approximately 2 percentage points on the *FOREIGN ETRDIFF* for a firm with a R&D intensity that is one standard deviation higher.

Coefficients and inferences for the international tax planning determinants are higher if we consider *FOREIGN ETRDIFF* compared to the *GAAP ETRDIFF* and *CASH ETRDIFF*. We conclude that in particular the *FOREIGN ETRDIFF* allows a detailed analysis of the effects of enhanced international tax planning activities.

3.4 Measuring Aggressive Tax Avoidance Using Country-by-Country Reporting Data

So far, we have considered the mean of the statutory corporate tax rates of all host countries of a MNE as the relevant benchmark tax level. However, this is only an approximation of the benchmark tax level that is perceived as fair according to the distribution of the firm's real economic activities. It only represents the worldwide tax obligations of a MNE if all its

activities are equally distributed across the host countries. In fact, it would be necessary to incorporate the scope of real economic activities in all host countries of a MNE in order to compute the fair statutory tax liability on a worldwide basis. This way, a firm's individual worldwide benchmark tax level could be constructed as the mean of all statutory tax rates weighted by local economic activity. Potential weights for real economic activity could be the employment of full-time workers or generated revenues in the respective country. Therefore, the information content of a comprehensive CbCR scheme, as demanded by the OECD, perfectly complements our *ETRDIFF* measure.

3.4.1 Availability of Country-by-Country Reporting Data

Action point 13 of the BEPS initiative by the OECD leads to the implementation of a CbCR obligation for MNEs in the majority of all OECD member states. MNEs with a sufficiently high revenue are obliged to disclose key financial information, among others revenue, number of employees, profit and income taxes paid, for each jurisdiction in which the MNE operates (OECD, 2015). However, this tax transparency initiative is only addressed towards tax authorities as the actual reports are not required to be disclosed publicly. This regulatory aspect led to substantial criticism (Tax Justice Network, 2014; U.S. Congress Members, 2017).

Contrariwise, the European Commission mandated an independent publicly available CbCR for European headquartered multinational banks in order to fight financial opacity in the financial sector (European Commission, 2013). Thus, European Banks currently represent the only MNEs for which accurate information regarding their geographic economic activity is publicly available. In the following, we refine the benchmark tax rate of our measure for large multinational European banks where sufficient data exist. Subsequently, we re-examine *ETRDIFF* for these banks.

3.4.2 Aggressive International Tax Planning: The Case of HSBC

HSCB, Europe's largest bank by assets, is headquartered in London and operates in 57 countries worldwide (HSBC, 2016). For the years 2013-2017, the firm's medium run *GAAP ETR* shows that the HSBC group had an annual tax expense of 21.2% of its worldwide income.[55] The corporate tax rate in the UK was 20% in 2015, suggesting that HSBC paid more taxes than required by UK standards. However, since 2009, the UK tax system is territorial (as most other EU countries) and exempts foreign income from taxation in the UK. Consequently, HSBC's generated profits abroad underlie foreign tax regimes. The average statutory tax rate of all 57 tax-regimes listed in the official Country-by-Country Report 2015 of HSCB is 24.8%, suggesting that HSBC paid less than its worldwide fair share of taxes.

In view of the simplifying assumptions of this approximate benchmark, we further extract information regarding HSBC employees in all its countries of operation. We eventually use the local number of employees of HSBC in a given country as weight for the country's tax rate when constructing the benchmark tax rate. Only 17.2% of HSBC's total employees are located in the UK and generate 25.2% of the group's total revenue. Following our logic, the fair tax share of HSBC's worldwide profits should only depend to less than one fifth on the UK corporate tax rate when we assume that taxes should be paid where the economic activity – here measured by full-time employment – takes place. In total, we find that HSBC's fair worldwide benchmark tax rate should be 28.8% when corporate tax rates are weighted with local employee numbers.

This exercise illustrates that HSBC is actually not paying its fair share of taxes on a worldwide level as its *GAAP ETR* ranges 7.6 percentage points below the average statutory tax rate that it faces in different parts of the world – weighted by economic activity. Accordingly,

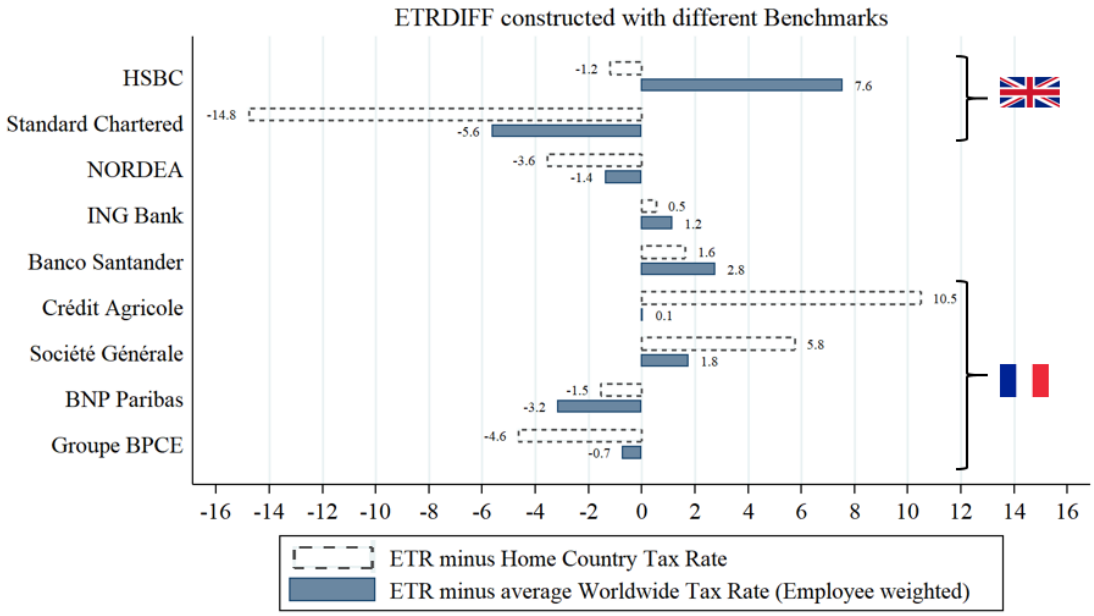
[55] The medium run GAAP ETR equals the amount of total taxes paid for the years 2013-2017 divided by the amount of pre-tax income (adjusted for special items) over the five-year period. We chose medium run ETR over annual ETR in this section as it produces less volatile values via smoothing.

the *ETRDIFF* of HSBC amounts to 0.076 if we consider an employee weighted statutory tax rate as the benchmark. If we would consider the home country tax rate as the benchmark, the difference would be only 0.002.

3.4.3 Aggressive International Tax Planning in the European Banking Sector

We similarly construct different tax rate benchmarks for the remaining European headquartered Global Systematically Important Banks (G-Sibs). Then, we compute their *ETRDIFF* for the year 2015. Figure 1 illustrates the *ETRDIFF* of nine G-Sibs[56] headquartered in the EU:

Figure 1: Aggressive International Tax Planning of European Banks



When using the benchmark adjusted for international economic activity some banks, including HSBC, ING Bank and Banco Santander, appear as tax avoiders because their worldwide *GAAP ETR* is lower than the weighted average international tax rates that the banks face. Other banks, including Crédit Agricole, BNP Paribas and Groupe BPCE, do not appear as tax avoiders when incorporating their economic activity abroad. These banks have subsidiaries

[56] In total, 13 EU-headquartered banks were listed as G-Sibs in the year 2015 (Financial Stability Board, 2015). However, Barclays, Deutsche Bank, Royal Bank of Scotland and Unicredit Group accumulated losses in the respective years such that no meaningful ETR could be constructed. Thus, they are not included in Figure 1.

in numerous countries with lower statutory tax rates than in France and thus for a reason pay less taxes relative to their profits than purely domestic French firms do. Moreover, this finding is not apparent when comparing those banks' *GAAP ETR* to their home country's statutory tax rate. Generally, banks from low-tax countries, such as the UK, appear more tax aggressive and banks from high tax countries, such as France, are perceived less tax aggressive when using the adjusted benchmark. Nevertheless, there exists variation within the headquarter countries, too: While foreign activities explain a substantial share of Crédit Agricole's and Société Générale's allegedly low tax burden, this is less the case for BNP Paribas and Groupe BPCE.

Overall, we conclude that the perception of EU banks' tax avoidance changes substantially when the public mind benchmarks the banks' tax payments against the expected tax liability in all countries of operation. Particularly French banks turn out less aggressive and UK headquartered banks more aggressive than expected beforehand. According to the *ETRDIFF* measure, HSBC engages by far the most in aggressive international tax planning among all examined G-Sibs. Unfortunately, public CbCR data are only available for the European banking sector. The assessment of other MNE's international tax avoidance would likely benefit from the access to CbCR data, too.

3.5 Conclusion

We have proposed a new measure for the aggressive part of international tax avoidance. The *ETRDIFF* measure describes the differential between the worldwide ETR of a MNE and the average of all statutory tax rates imposed on the global subsidiaries of the MNE. Accordingly, we characterize a MNE as tax aggressive if its ETR is abnormally low compared to a firm's individual benchmark that would be expected in the absence of any profit shifting strategies and additional subsidiaries in tax haven countries. The *ETRDIFF* measure considers that tax levels of MNEs vary in accordance with the variation in statutory tax rates of their host countries and isolates only the additional or even aggressive part of international tax avoidance.

We have applied our new measure to a sample of U.S. firms listed in the S&P 500 Index. We exploit a SEC regulation that requires public U.S. companies to publish a list of their significant subsidiaries. This data allows to compute for each firm in the S&P 500 Index the average of all statutory corporate tax rates imposed by foreign host countries on the subsidiaries of the firm. This way, we construct a firm-specific benchmark tax rate and compare it to the ETR of U.S. MNEs. We find significant positive values for the *FOREIGN ETRDIFF* suggesting additional tax avoidance beyond the benchmark tax level of the firms. In an additional analysis, we have evaluated whether proxies for tax planning opportunities affect the scope of international tax avoidance. Our regression analysis reveals that proxies for tax haven operations and opportunities to manipulate transfer prices are associated with significantly higher values of *ETRDIFF*.

Our findings contribute to the recent debate about base erosion and profit shifting. The OECD requests new measures to analyze the scope and the determinants of base erosion and profit shifting (OECD, 2014). The methodology proposed in this paper allows to isolate the aggressive part of international tax avoidance and to identify important determinants such as tax haven usage and opportunities to manipulate transfer prices.

In additional computations, we have approximated the economic relevance of the foreign subsidiaries by sales data taken from FDI statistics and provide adjusted values for our *ETRDIFF* measures. Although the differences between adjusted and unadjusted *ETRDIFF* measures are small, more refined data about the relevance of economic activities of foreign subsidiaries for the individual firm is helpful to further improve estimations of the amount of aggressive international tax avoidance. Therefore, we exploited the CbCR reports of large European headquartered banking groups for the construction of an adequate benchmark tax rate, weighted by true economic activity in host countries. While some banks have substantial operations in countries with moderate corporate tax rates and consequently pay less taxes (e.g. Crédit Agricole), other banking groups manage to pay less taxes globally despite their

predominant activities in high tax countries (e.g. HSBC). This exercise shows that our new measure can help to understand tax avoidance of MNEs.

If comprehensive data from a detailed CbCR scheme as discussed by the OECD (2015) became publicly available for all industries, the identification of aggressive corporate tax planning would be facilitated at large. Consequently, our study also demonstrates how CbCR data could be analysed.

Appendix

Table A1: Variable Definitions

GAAP ETR	The ratio of total income taxes (*txt*) to pretax income (*pi*); the latter adjusted for special items (*xi*).
GAAP ETRDIFF	$\overline{STR}$ – GAAP ETR
CASH ETR	The ratio of cash taxes paid (*txpd*) to pretax income (*pi*).
CASH ETRDIFF	$\overline{STR}$ – CASH ETR
FOREIGN ETR	The ratio of total and deferred foreign income taxes (*txfo* + *txdfo*) to pretax foreign income (*pifo).*
FOREIGN ETRDIFF	$\overline{STR}$ – *FOREIGN ETR*
$\overline{\text{STR}}$	Worldwide average of the statutory corporate income tax rates of all countries where subsidiaries are located.
SIZE	The natural log of total assets (*at*).
PROFITABILITY	The ratio of pretax income (*pi*) to total assets (*at*).
CAPINT	The ratio of property, plant and equipment (*ppeveb*) to total assets (*at*).
LEV	The total debt (*dltt* + *dlc*) scaled by total assets (*at*).
HAVEN	Number of tax havens in which the group has subsidiaries scaled by total number of countries the company operates in.
INCOME MOBILE	Dummy which is one if the SIC Codes of the parent is: 283, 357, 367, 737 or 738.
R&D	The amount of research and development expense (*xrd*; if missing set to zero) scaled by the book value of assets (*at*).

Table A2: Summary Statistics

Panel A1: U.S. Sample – GAAP ETRDIFF

U.S. Sample	Obs.	Mean	Std. Dev.	Min	Max
GAAP ETR	2,422	.302812	.1001742	.0005053	.9817883
$\overline{STR}$	2,422	.3206857	.0366824	.20585	.4159
GAAP ETRDIFF	2,422	.0178737	.1042004	-.6974849	.3855493
SIZE	2,422	9,351229	1,327573	6,448.386	13,92941
PROFITABILITY	2,422	.1133787	.0708528	.0012223	.5242996
CAPINT	2,422	.4771289	.3539383	.0029962	1,769818
LEV	2,422	.0427874	.0757203	0	.7142423
INCOME MOBILE	2,422	.2180017	.4129738	0	1
R&D	2,422	.0283963	.0425736	0	.2830379
HAVENS	2,422	.2208277	.1376736	0	.75

Notes: The table shows descriptive statistics for all variables included in our main regression analysis regarding the *GAAP ETRDIFF*. Variables are defined in Table A1.

Panel A2: U.S. Sample – Foreign ETRDIFF

U.S. Sample	Obs.	Mean	Std. Dev.	Min	Max
FOREIGN ETR	1,760	.2615714	.1494751	.0014045	.9837399
$\overline{STR}$	1,760	.3117356	.0321824	.2400317	.4118
FOREIGN ETRDIFF	1,760	.0501642	.1529443	-.6899928	.405124
SIZE	1,760	9.323.095	1.322.681	6.448.386	1.392.866
PROFITABILITY	1,760	.1046511	.0842599	-.4670951	.4675889
CAPINT	1,760	.4759077	.3418687	.0044364	1.769.818
LEV	1,760	.0425033	.0702686	0	.6285961
INCOME MOBILE	1,760	.2732955	.4457779	0	1
R&D	1,760	.0366518	.0499038	0	.6798642
HAVENS	1,760	.2151871	.1186979	0	.75

Notes: The table shows descriptive statistics for all variables included in our main regression analysis regarding the *Foreign ETRDIFF*. Variables are defined in Table A1.

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Chapter 4

Tax Transparency to the Rescue: Effects of Country-by Country Reporting in the EU Banking Sector on Tax Avoidance

Tax Transparency to the Rescue: Effects of Country-by-Country Reporting in the EU Banking Sector on Tax Avoidance*

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Abstract

We analyze the effect of mandatory financial transparency on corporate tax avoidance. Capital Requirements Directive IV by the European Commission forced multinational banks to publish key financial and tax data in the form of Country-by-Country Reporting for the first time in history. We use this event as an exogenous shock to the disclosure duties of European banks and examine tax expenses around the reform. We find that multinational banks increased their tax expense relative to other banks unaffected by the Country-by-Country Reporting mandate. Moreover, we find a stronger response of those banks that were particularly exposed to the new transparency due to significant activities in tax havens. In additional tests we compare our sample of multinational banks to several different control groups from the financial sector and other industries. Our results suggest that Country-by-Country Reporting can serve as an additional instrument for policy makers to curb corporate tax avoidance.

JEL Classification: F23, G18, G21, H26

Keywords: Tax Transparency, Country-by-Country Reporting, Banks, Tax Avoidance

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Chapter 4

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Figures

4.1 Introduction

Policy makers have struggled to curb tax avoidance of multinational enterprises (MNEs) in the last couple decades. Recently, the OECD base erosion and profit shifting (BEPS) project presented additional proposals for novel anti-tax avoidance regulation (OECD, 2015a). Traditional anti-avoidance rules commonly subject certain transactions or entities to additional taxes or fines under the rationale that punitive damages will prevent firms from egregious forms of tax avoidance. However, the effectiveness of regulations like controlled foreign company and thin-capitalization rules is questionable because firms can react by using alternative tax planning that is not subject to specific legislation. Thus, in recent years, comprehensive tax transparency has been discussed as an alternative strategy for combating avoidance. Corporate tax transparency rules require the disclosure of key financial data—in particular actual tax expenses—and are intended to indirectly curb tax aggressiveness by exerting pressure on CEOs and CFOs of MNEs.

Until now, most tax transparency initiatives have not yet been fully implemented and the existing ones don't make the collected data available to the public. Consequently, the effectiveness of tax transparency policy is largely unknown. However, from the reporting period of 2014 onwards, a European directive mandated that financial institutions headquartered in the European Economic Area (EEA)[57] publicly disclose key financial and tax information on a country-by-country level. This introduction of mandatory Country-by-Country Reporting (CbCR) provides a rare opportunity to evaluate the effectiveness of transparency as an anti-tax avoidance instrument. Accordingly, we use the implementation of CbCR as an exogenous shock to disclosure requirements and investigate its effect on the worldwide tax expenses of MNEs.[58] Several studies show that banks engage in international

[57] The EEA comprises all 28 member states of the European Union (EU) and Norway, Liechtenstein and Iceland.
[58] Art. 89 of CRD IV, which refers to CbCR, was a last-minute amendment to the directive and thus is unlikely to have been anticipated by the affected companies (E&Y, 2014).

profit shifting and other strategies with the intention of saving taxes (Huizinga, Voget and Wagner, 2012; Merz and Overesch, 2016; Bouvatier, Capelle-Blancard and Delatte, 2017). We compare tax expenses of European multinational banks with tax expenses of other banks and firms that were unaffected by the new CbCR-legislation. Overall, our results suggest a significant influence of CbCR on the worldwide tax expenses of banks, and thus on their corporate tax avoidance behavior.

The new European CbCR regulation is part of the EU Capital Requirement Directive IV (CRD IV) and was one of the first international policy actions involving a CbCR for MNEs at that time.[59] The implementation of CbCR for multinational banks in Europe stimulated the ongoing debate about tax avoidance tremendously as key figures such as effective tax payments per country had been under the guise of fiscal secrecy thus far. This newly available information has garnered much attention in the media. Headlines of large European newspapers have addressed these issues, for example, "*French banks rely heavily on tax havens*"[60] or "*Barclays in Luxembourg: £593m profits, £4m tax, report reveals*".[61] Hence, the introduction of CbCR induced a new era in terms of financial transparency to the affected banking institutions (Oxfam France, 2014; Tax Justice Network, 2014).

The focus of our analysis is on the behavioral response of managers to increasing tax transparency associated with CbCR-obligations. In particular, we evaluate the effect of one of the pioneering CbCR-legislations on corporate tax avoidance of MNEs. We exploit financial data from the consolidated accounts of European headquartered banking groups (and other control groups) through the *Compustat Global* database. As dependent variable we deploy effective tax rates (ETRs) as measure of worldwide tax expenses divided by worldwide pre-tax

[59] The European Commission imposed new disclosure rules for extractive industries in a separate EU directive in 2013. To our knowledge, this has been the only other supranational legislation at the time, which obliged firms to fulfill CbCR duties.

[60] CNBC (16/05/2016), available at: http://www.cnbc.com/2016/03/16/report-french-banks-rely-heavily-on-tax-havens.html.

[61] The Guardian (30/03/2015), available at https://www.theguardian.com/business/2015/mar/03/barclays-luxembourg-profits-tax-report.

income of a MNE. ETR represents a well-established measure for worldwide tax payments of a firm. A lower ETR indicates reduced corporate tax payments. Thus, we expect the ETRs of tax aggressive European banks, which have been obliged to disclose CbCR, to increase relative to unaffected banks after CRD IV.

We start by comparing the ETRs of international European banks and European domestic banks to determine the impact of CbCR-obligations, which were exclusively established for multinational banks from the 2014 reporting period onwards. We subsequently differentiate between banks by activity in European tax havens. This way we measure the impact of CbCR on presumably more exposed banks (to the new regulation) in comparison to their multinational peers without reprehensible activities in tax havens. Our results suggest that European-headquartered multinational banks increased their effective tax levels significantly relative to their domestic peers after CbCR entered into force. We find that banks with activities in tax havens react the strongest to the reform due to their particular exposure to tax transparency. The ETR of those exposed banks increases by 3.6 percentage points relative to other banks without presence in European tax havens. Moreover, comparisons with other control groups are undertaken in order to eliminate trends in tax avoidance either in the financial sector or commonly for multinational enterprises. Additional analyses reveal that neither U.S. multinational banks nor financial sector firms nor manufacturing firms – all unaffected by the CbCR regulations - did exhibit a likewise effect.

Our findings support the view that enforced transparency via CbCR curbed tax avoidance of European multinational banks. We contribute to prior literature, which suggests that disclosure of additional information about the international firm structure influences the scope of international tax avoidance. Hope, Ma and Thomas (2013) find significantly lower ETRs for firms that abstain from the disclosure of geographic earnings in their financial reports after the adoption of the Statement of Financial Accounting Standards No. 131 in 1998. Dyreng, Hoopes and Wilde (2016) analyzed public pressure on MNEs in the United Kingdom (UK) to

carefully report a complete list of all foreign subsidiaries. The study reveals increasing ETRs for UK firms after they were required to reveal additional information. We add to this literature by analyzing the impact of the first comprehensive, supranational tax transparency initiative on tax avoidance behavior of MNEs. In particular, we investigate whether the exposed content of the newly demanded CbCR is powerful enough to reduce incentives for aggressive tax planning. In concurrent work Joshi, Outslay and Persson (2018) document changes in profit shifting activities of banks over the implementation of CRD IV. However, we remain uncertain on the availability of sufficient subsidiary level data and discuss their findings alongside ours in the results section. Our analysis suggests that European banks in fact responded to the transparency shock.

Our results have policy implications. So far, most MNEs are not obliged to disclose a CbCR. The OECD decided only to enhance tax transparency towards the tax authorities instead of the general public (OECD, 2015b). However, supporters clamor for a publicly disclosed CbCR in Europe and the U.S. (Tax Justice Network, 2014; U.S. Congress Members, 2017) or for public disclosure of tax returns (Lenter, Shackelford and Slemrod, 2003; Hoopes, Robinson and Slemrod, 2018). Currently, European international banks are among the few firms that have to provide tax information through public CbCR. Our results suggest that publicly available CbCR is associated with less tax avoidance in the European financial sector. Accordingly, our results confirm a relationship between publicly available information on international firm structures and the scope of international tax avoidance. Consequently, our results support the view that tax transparency can be an effective instrument to limit tax avoidance of MNEs.

The remainder of this paper is structured as follows: Section 2 provides institutional details on CbCR requirements and develops hypotheses. Section 3 describes the data and the applied research design. Section 4 contains the results of our analysis. We show the robustness of our results and dismiss other regulatory changes as alternative explanations in section 5. We conclude in section 6.

4.2 Institutional Background and Hypotheses Development

4.2.1 Country-by-Country Reporting Duties within CRD IV

The Basel III regulatory framework imposes guidance on capital adequacy, market liquidity risk and stress testing of worldwide banks. Furthermore, this framework was devoted to address the deficiencies in financial regulations that were revealed during the financial crisis of 2007/08 by fortifying the capital requirements of banks (Basel Committee for Banking Supervision, 2010; Cohen and Scatigna, 2015). The European Commission nevertheless expanded the scope of the Basel III agreement on prudential requirements for credit institutions and investment firms with its capital requirements regulation.[62] The legislative package comprises Directive 2013/36/EU (CRD IV) and Regulation (EU) No. 575/2013. In CRD IV, the European Commission included specific rules for corporate governance and remuneration policy linked to risk management and, most important to our purpose, an enhanced transparency initiative regarding the international activities of banks and investment funds via mandatory CbCR. Banks, that serve as credit institutions, are now required to publish key financial and tax information about the geographical distribution of their business activities and tax payments.

All EEA countries were required to transpose CbCR into domestic law, and most member states effectively implemented the directive in the first half of 2014 at the latest (PWC, 2014). National laws require financially active banks to publish profits and effective tax payments per tax jurisdiction since the 2014 financial year (European Commission, 2013a; HM Treasury, 2013; E&Y, 2014).[63] This implies that the public is able to perform meaningful cross-country comparisons of key performance indicators using annual reports referring to the period of 2014. Consequently, bank managers have to consider the additional transparency of CbCR

[62] The Capital Requirements Regulation (CRR) accompanies CRD IV (European Commission, 2013b).
[63] CRD IV introduced a tentative version of CbCR excluding profit and tax figures, which was supposed to pave the way for the upcoming complete transparency initiative. Those reports referred to the elapsed 2013 fiscal year and did not include information regarding profit and tax payments.

for their tax planning since 2014. However, banks certainly were urged to adjust their tax structures quickly due to the short time frame between the publication of CRD IV legislation and its transposition into national law.

According to Art. 89 of CRD IV, multinational European banks must publish the following information, per country:

a) The name, activities and geographical location of any subsidiary and branch

b) Turnover

c) Average number of employees

d) Profit or loss before tax

e) Corporate taxes paid

f) Public subsidies received

Institutions of scope are defined as entities authorized to act as a credit institution or an investment firm. Specifically, European headquartered groups with at least one foreign subsidiary must disclose CbCR-Information on the highest group level. We will refer to all these institutions as multinational banks. Banks without foreign subsidiaries, which we refer to as domestic banks, are not required to publish CbCR. European headquartered financial service providers without credit lending activities, as e.g. insurers, do not have to fulfill any CbCR duties. International banks that are headquartered outside Europe must disclose CbCR solely for their subsidiaries located within Europe. This means, that U.S. multinational banks must only provide a very fragmentary CbCR that covers solely their subsidiaries in the EEA.

For European G-SIBs[64], the largest and systematically most relevant banks, Art. 89 CRD IV includes a special feature: The G-SIBs have already been required to submit profit and tax figures confidentially to the European Commission for the 2013 fiscal year. The special status of G-SIBs is examined in depth in empirical specifications of the robustness section.

[64] Worldwide 29 banks represent Global Systematically Important Banks (G-SIBs) out of which fourteen are headquartered in the European Union (Financial Stability Board, 2013).

In particular, the information on profitability in combination with measures of real economic activities (turnover and number of employees) allows to compute financial indicators by country such as operating profit margin ($\frac{d}{b}$) or profit per employee ($\frac{d}{c}$). Accordingly, this information can be used for simple cross-country comparisons. Significant deviations from the mean might be perceived as an indication for profit shifting i.e., where profits might be artificially inflated and hence shifted from other locations. Moreover, intelligence regarding surprisingly low tax payments on a per-country basis can help to identify tax avoidance in certain host countries. This information does not only facilitate the work of tax auditors, it makes disproportionate tax patterns easy to grasp and to pass on by the media, as Oxfam France (2014) did in its special report on French banks: *"Abroad French banks make one third of their profits in tax havens while they only represent one fourth of their activity, one fifth of their tax and one sixth of their employees*".

4.2.2 Development of Hypotheses

The European Commission argues that enhanced transparency is essential in order to regain the trust of citizens into the financial sector after the financial crisis (European Commission, 2013a). One crucial question on the reasoning behind CbCR is whether it solely satisfies the curiosity of citizens or additionally has a real impact on future activities of the affected firms through surging pressure from the newly given insights. So far MNEs have been required to disclose information about their tax position in their financial accounts. This information already can be used to compute measures of effective tax expenses. However, the detailed information about the distribution of economic activities, profits and tax payments provided by a CbCR allows for the first time an assessment of intra-group profit shifting activities with the goal of saving taxes.

Limited regional disclosure regulations and a lack of cross-border transparency for banking groups made financial information regarding their subsidiaries scarce before CRD IV.

Available databases as *Orbis Bankfocus* provide detailed information on the consolidated accounts but cover subsidiaries within banking groups utmost fragmentarily.[65] Thus it was neither possible for regulatory bodies nor for researchers nor the public to examine the extent of international profit shifting activities of multinational banks before. In fact, the additional information from 2014 onwards can be used to identify anomalies in profit margins as well as tax payments across host countries of an MNE. Moreover, international tax avoidance is associated with cross-border firm structures (Lewellen and Robinson, 2013). Therefore, information about subsidiaries and particularly about activities in tax havens is often perceived as evidence for an aggressive tax avoidance strategy.

The disclosure of detailed information via CbCR might impact banks' tax avoidance behavior if managers and investors anticipate public scrutiny. Additional costs cause the link between rising fiscal transparency and tax avoidance: An engagement in tax avoidance strategies is not only associated with paying less taxes but also with risks. Activities like tax sheltering carry the risk of being detected or suffering a negative reputation for the firm and its top management. As a consequence, enhanced tax transparency may increase reputational costs, litigation costs and regulatory costs associated with tax avoidance.

First, reputational damages may occur if customers believe that a bank does not pay its fair share of taxes in all of its locations of presence and/ or is engaged in significant activities in tax havens. Reputational costs crucially depend on the information available for the assessment of a firm's tax strategy by shareholders, customers or the general public. If a firm uses aggressive tax avoidance strategies and fears reputational effects, the firm should benefit from less transparency due to the decreasing risk of being detected or suffering a negative reputation. Consequently, rising fiscal transparency due to a new CbCR should increase

[65] We extracted all available subsidiaries of the HSBC group, Europe's largest bank by total assets, in *Orbis Bankfocus* for the time before 2013 and solely financial information on subsidiaries in 10 countries turned out accessible. By way of contrast HSBC officially incorporates subsidiaries in 57 countries worldwide (HSBC, 2015). Langenmayr and Reiter (2017, p.11) lament this shortcoming of the *Orbis Bankfocus* database, too.

reputational costs (Hombach and Sellhorn, 2018). A survey among tax executives of U.S. firms suggests that managers are concerned with the reputational effects associated with corporate tax planning (Graham, Hanlon, Shevlin and Shroff, 2014). Hoopes et al. (2018) support this view as they detect reactions in tax payments, consumer sentiment and stock prices after information from company income tax returns was made publicly accessible in Australia. Managers should be less tax aggressive, if they perceive significant reputational costs associated with public disclosure regulations. Second, the revealing of sensible information as generated profits and paid taxes per jurisdiction may provide tax auditors with additional information for a more effective prosecution of international profit shifting. Fiscal authorities have access to additional information on the worldwide distribution of profits and might intensify their investigations leading to additional tax litigations. Tax audits are often characterized by discussions about interpretation of laws and administrative instructions between taxpayer and tax-auditors. Transfer pricing disputes serve as important examples. Therefore, the bargaining position of a taxpayer in confrontations with tax authorities is likely to be deteriorated by the new CbCR. Third, additional disclosure might be associated with future regulatory cost: The salience of disproportional profit and tax patterns of certain banks between high and low tax jurisdictions could trigger new laws and regulations by governments or standard setting institutions.

Given all this, the expectation of public scrutiny should incentivize bank managers to re-allocate profits to the presumable high-tax countries of origin after CbCR became mandatory. Due to its large geographical scope of application over all 31 member states of the EEA, the new CbCR regulation for European Banks is expected to be very powerful in exerting pressure through the creation of financial transparency beyond borders. Consequently, banks might engage less in tax avoidance due to public pressure, which they possibly anticipate from information published by CbCR. Therefore, we will test the following hypothesis:

H1: Banks that have been affected by the implementation of CbCR-duties in 2014 should experience increasing effective tax levels relative to unaffected banks or firms.

From a conceptual perspective the intensity of the transparency shock introduced via CbCR depends on the intelligence, which a financial institution is forced to reveal. Tax savings from international tax planning crucially depend on tax rate differentials between host countries. The existence of significant activities in tax haven countries that impose only low or even zero taxes are associated with low ETRs (Dyreng and Lindsey, 2009; Lisowsky, 2010; Markle and Shackelford, 2012a, 2012b). Therefore, information on subsidiary location, particularly on subsidiaries in tax haven countries, is often perceived as evidence for an aggressive form of tax avoidance strategy. Thus, it is reasonable to argue that enforced transparency has a particular impact if a bank is more exposed to reputational damage or litigation effects due to its revealed activities in tax havens. We test this supposition in the second hypothesis:

H2: Banks with activities in tax havens should be more exposed to tax transparency and consequently experience a stronger surge in effective tax levels after the reform.

The expectation of such a behavioral response of managers goes in line with related work on CbCR of European resource-extracting companies. Rauter (2017) documents real effects on various government payments of European resource extracting firms to hosting governments after CbCR became mandatory.[66]

Nevertheless, the benefit of additional information to assess international tax avoidance is arguable. In particular, MNEs are already obliged to disclose information about their tax position in their financial accounts. CbCR provides only new information about the geographical distribution of activities and tax payments but does not disclose detailed

[66] CbCR in extractive industries was among others motivated by the opaqueness of negotiated contracts between corporations and local governments. However, CbCR in the banking sector exclusively serves tax transparency.

information about tax planning techniques. Previous literature finds only ambiguous evidence for the magnitude of reputational costs if firms were involved in tax shelters as a particular aggressive form of tax avoidance (Hanlon and Slemrod, 2009; Gallemore, Maydew and Thornock, 2014). Regarding the introduction of mandatory CbCR, findings for the effect on firm values are also mixed. While Johannesen and Larsen (2016) find a decrease in firm values after the announcement of European CbCR obligations for extractive industries, an event-study by Dutt, Ludwig, Nicolay, Vay and Voget (2018) for the announcement of CRD IV doesn't detect any capital market reaction.

4.3 Data and Research Design

4.3.1 Data and Sampling

In order to analyze the impact of CbCR-duties on corporate taxation we exploit consolidated financial information on banking groups from the *Compustat Global* database. In a first step, we collect financial data on all available banks headquartered in EEA countries from the year 2010 to 2016. We identify 375 such banks within the *Compustat Global* database.

Table 1: Sample Selection

Description	Observations	
	European Banks	Firm-Years
Available in Database	375	1,952
Highest Consolidated Group Level	336	1,748
Elimination of Cross-Ownership	277	1,440
Non-Missing Control Variables	207	1,202

Second, we restrict our sample to banks that represent the highest hierarchy level within their group structure. We remove all observations with missing financial control variables. We pursued a consistent elimination of outlier and non-plausible values at this stage of the sample selection.[67] We deleted all firm year observations with negative profits and erased the top and

[67] Italian-headquartered banks were removed from the sample due to apparently conceptual measurement errors in the *Compustat Global* Database. Despite a statutory tax rate of 27.5%, the average ETR of an Italian bank ranges

bottom one percentile of ETR values in the sample. Finally, there remain 207 banks in our sample, providing in total 1,202 bank-year observations.

In a third step, we classify the banks of our sample as multinational or domestic banks. The distinction between multinational banks and domestic banks matters as only multinational banks are subject to CbCR obligation according to CRD IV. We denote a European bank as a multinational (*MULTI* = 1) if it has at least one subsidiary in another country than the bank headquarter is located in.[68] Of the 207 firms, 83 are categorized as multinational banks and 124 banks count as domestic (*MULTI* = 0).[69] A bank is classified as domestic if either all of its subsidiaries are located within the same country as the banks headquarter or if the bank does not own subsidiaries at all.

While detailed financial information at the subsidiary or country-level was missing before CbCR introduction, information about the existence of subsidiaries was to a certain extent available. We gain the information from the *Orbis Bankfocus* subsidiary database. Given the aforementioned fragmentariness of the *Orbis Bankfocus* database, we augmented and validated the data by extensive manual research on the corporate structures of all banks in our sample. This additional information was taken from annual reports or other official documents disclosed on the official webpages or from trustworthy internet sources on company structures.

Furthermore, we distinguish multinational banking groups according to their activities in tax havens. We designate banks in our sample accordingly with the indicator variable *EXPOSED*, which equals 1 for all banking groups that have at the minimum one subsidiary in at least one of the following five European tax havens: Cyprus, Ireland, Liechtenstein, Luxembourg and Malta. All five countries can be found in the established tax haven list by

above 50%. The implausibly high Italian ETRs in the *Compustat Global* database have been previously lamented by other scholars. See e.g. Kohlhase and Pierk (2016).

[68] The most minimalistic case of CbCR extends to two countries, as it exemplarily can be observed for the UK headquartered Arbuthnot Banking Group, which is active in the UK and Dubai.

[69] The Bank for International Settlements (BIS) regularly publishes monitoring results of the implemented standards for worldwide banks and refers to an amount of 101 large international and 129 "other" banks within its confidential data analysis (Bank for International Settlements, 2016). The number of 83 international banks in our EU sample is smaller, but appears fairly justified in terms of selection as we only refer to European banks.

Dyreng and Lindsey (2009) and are moreover listed as tax havens by the IMF (Reuters, 2008). We focused on countries with small population numbers and relatively low GDP figures because activities in small tax haven countries are more likely to be perceived as tax motivated.[70]

We exclusively consider European tax havens because of poor data quality in the *Orbis Bankfocus* database. However, there exists recent evidence by Bouvatier et al. (2017) for European banks to have strong preferences for tax havens within geographical Europe, which suggests that we pick up a substantial share of banks' overall tax haven activity in the selected five countries. Moreover, it is unlikely that European banks have a subsidiary in overseas tax havens like the Bahamas if they are not already engaged in a European one.

We define the ETR, our dependent variable, as tax expenses divided by pretax income and adjust the latter for extraordinary items. In accordance with the accounting literature, we use ETR as an ex post measure of tax avoidance (e.g. Hanlon and Slemrod, 2009; Dyreng, Hanlon and Maydew, 2010; Markle and Shackelford, 2012a, 2012b). Information to compute the ETR is taken from the consolidated financial statements of MNEs. The ETR evaluates retrospectively the worldwide tax expenses of a firm and therewith indicates the overall level of employed tax avoidance. A lower ETR implies higher tax avoidance. A multinational bank with a low ETR appears to exercise tax planning activities more effectively compared to its peers with higher ETRs (Hanlon and Heitzman, 2010).

4.3.2 Descriptive Statistics

Our base sample of European banks covers a wide array of member states of the EEA and hence delivers an extensive picture of the European banking sector. The largest financial centers as London and Frankfurt host the most banking headquarters, which puts the UK and

[70] Whereas a country such as the Netherlands is well known for its IP box regime, a bank's decision to open a subsidiary there might be motivated by other factors than tax-related reasons such as the market potential, which countries with larger population and GDP numbers typically offer.

Germany to the top of our sample in terms of observations. Data availability of banking data in *Compustat Global* limits the representativeness of countries to some extent, but further stratification would be difficult to justify given the already small sample size. Therefore, to address imbalances among the regional compositions of our subsamples, we introduce country specific trends over time in our robustness section. Table A2 in the Appendix provides a country snapshot of the headquarters of all multinational banking groups in the sample.

In accordance with the previous literature in tax accounting we define the ETR as tax expenses divided by pretax income that is corrected for extraordinary items. As one control variable, we deploy banks' size (*SIZE*) measured by the log of total assets because banks that differ in size are likely to differ in their possibilities to pursue tax planning (Omer, Molloy and Ziebart, 1993). Second, we include bank profitability, represented by the return on equity figure (*ROE*), as more profitable institutions theoretically might encounter lower pressure to engage in aggressive tax planning strategies.[71] Lastly, we control for the equity ratio of a bank (*EQUITY*) which describes the ratio of a bank's equity to total assets. The capital structure of a bank matters for tax planning as it indirectly proxies financial leverage, which is well known for functioning as a tax shield through the deductibility of interest payments (Graham, 2000; Andries, Gallemore and Jacob, 2017). Table 2 contains summary statistics on all of our variables of interest for multinational and domestic banks.

[71] Similarly, one could argue alternatively that profitable banks could engage more easily into tax planning due to greater financial resources. For a more detailed analysis of this connection see Thomas and Zhang (2014).

Table 2: Descriptive Statistics

Variable	Multinational Banks					Domestic Banks				
	N	Mean	Std. Dev.	Min	Max	N	Mean	Std. Dev.	Min	Max
ETR	467	0.232	0.109	0.003	0.703	737	0.249	0.099	0	0.805
SIZE	467	17.280	2.904	4.888	21.52	737	14.76	2.169	6.164	19.77
ROE	467	0.151	0.208	0.008	2.652	737	0.132	0.12	0.001	1.192
EQUITY	467	0.112	0.135	0.011	0.996	737	0.128	0.111	0.010	0.991
MULTI	467	1	0	1	1	737	0	0	0	0
EXPOSED	467	0.486	0.500	0	1	737	0	0	0	0
EMPLOYEES	396	30,287	53,532	4	295,061	414	3,037	4,636	8	21,121

Notes: Summary statistics for both banking groups are based on the pooled firm-year observations from 2010 to 2016.

Certain structural attributes of multinational and domestic banks are apparent in the sample: First, internationally active banks are expectedly larger than their domestic peers. This finding is captured by differences in scaled total assets and even more emphasized by the distinct average numbers of full-time employees. Multinational banks in our sample show an ETR of approximately 23.2 percent whereas domestic firms report on average an ETR that is 1.7 percentage points higher. This finding is in accordance with the expectation that internationally orientated firms have enhanced tax planning opportunities.

Multinational banks show a slightly higher profitability than domestic banks. This pattern is familiar in financial services industries within OECD countries, where substantial profits arise from cross border activities (Shehzad, De Haan and Scholtens, 2013). We observe an equity ratio of approximately 12 percent for both groups, which accompanies the mandatory Basel III capital adequacy ratio of 8 percent.[72] Among the multinational banks, the *EXPOSED* variable indicates that every second multinational bank in our sample was to reveal tax-haven activities in its CbCR.

[72] Basel III sets a fixed threshold for the capital adequacy ratio. This ratio differs from the equity ratio as it involves risk weighted total assets. The set minimum capital adequacy ratio (Tier 1) that banks must maintain is 8 percent (Basel Committee for Banking Supervision, 2010).

4.3.3 Methodology

Our empirical analysis of tax avoidance in the banking sector consists of several independent Difference in Differences (DiD) setups with altering control groups in order to test hypothesis 1. We begin with the comparison of European multinational and domestic banks. We measure the relative change in the ETR between the two groups over time to identify the effect of mandatory CbCR. Therefore, we deploy the dummy variable *MULTI* as a quasi-treatment in our DiD regression approach:

$$ETR_{it} = \beta_0 + \beta_1\, MULTI_i\ + \beta_2\, MULTI_i\ x\ POST_{it} + \ Year_t + \ \beta_j X_{it} + u_{it} \qquad \text{(Eq. 1)}$$

The dependent variable is the ETR of bank *i* in year *t*. The variable *POST* is a time dummy, which equals 1 from the year in which the full CbCR-regulations have been in place. This is the case for the financial years from 2014 to 2016. We include year fixed effects in order to correct for annual trends in ETRs. The main coefficient of interest, β_2, measures the relative change of multinational bank-ETRs over the CRD IV implementation to the change of domestic banks over the same period. The vector X_{it} denotes additional covariates, which are introduced into the regression framework to account for other variables associated with effective tax payments of banking institutions. Finally, we perform additional regression specifications including bank-fixed effects to eliminate omitted variable bias through time-invariant factors.

We test hypothesis 2 and analyze the heterogeneity in treatment intensity across European multinational banks by extending equation (1) with an additional interaction term:

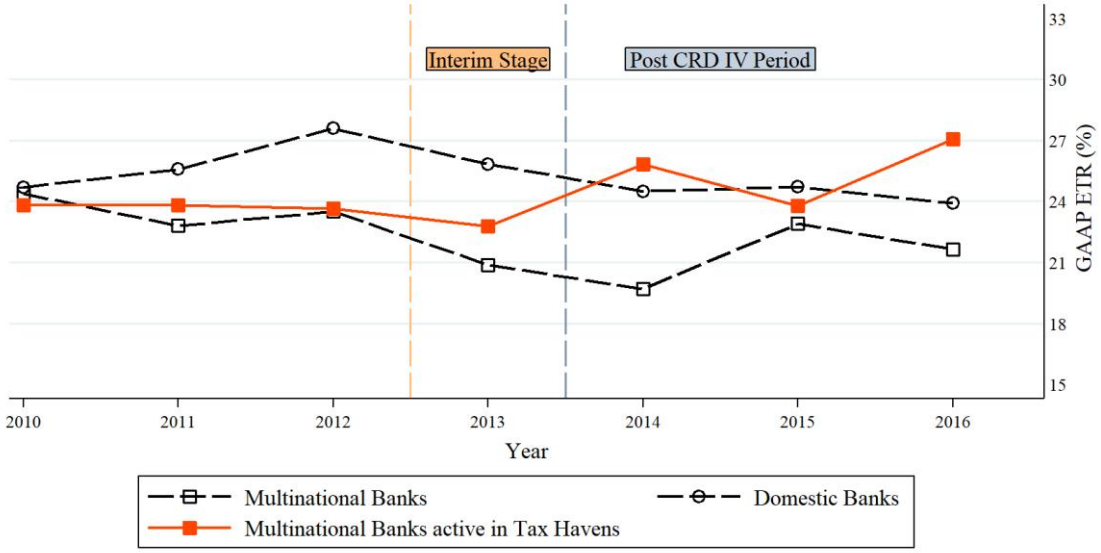
$$ETR_{it} = \beta_0 + \cdots + \ \beta_3\ \ MULTI_i x\ \ EXPOSED_i + \ \beta_4\, MULTI_i\, x\, POST_{it}\, x\, EXPOSED_i + u_{it}$$

(Eq. 2)

We thereby differentiate the treatment effect between multinational banks, which have at least one subsidiary in one of the designated tax havens (Cyprus, Ireland, Liechtenstein, Luxembourg and Malta) and other multinational banks, that do not. We expect a positive effect,

i.e. presumably more exposed international banks should react stronger to the transparency shock induced by CbCR.

Figure 1: Effective Tax Rates over Time



Note:
During the Interim Stage only Global-Systematically-Important-Banks were required to file CbCR on an extensive basis.

Figure 1 illustrates the development of ETRs over time for all banks with yearly observations in our sample. Whereas domestic (circled markers, dashed line) and multinational banks (squared markers, dashed line) without particular exposure to tax transparency follow a slight general downwards trend in their ETRs from 2010 to 2016, the graph documents an increase in effective tax payments for banks, whose activities in tax havens have been exposed to public scrutiny ex post CRD IV (squared markers, solid line). We regard the ETRs of exposed and remaining multinational banks to share a common trend before CRD IV exclusively. Moreover, unexposed multinational ones and national banks appear to follow a largely similar trend over most of the sample period.

Alternative Control Groups

Domestic and international banks generally offer similar services, face the same financial market environment and underlie the same regulatory regime, namely, the Basel Committee. However, the business model of domestic banks potentially differs from the

concept of their multinational peers. For example, domestic banks may be more focused on retail lending and/or be less involved in risky investments.[73] Therefore, in additional analyses, we consider three additional control groups, which were not subject to CbCR during the observed time-period.

First, we deploy matched large multinational U.S. banking corporations as alternative control group. Large U.S. multinational banks are likely to rely on similar business models as European ones and possess equally international firm structures. We retrieved information on the multinational activity of U.S. banks from the Federal Reserve System's list of large commercial banks (Federal Reserve System, 2017). Second, we consider matched European financial service providers outside banking as control firms to check for general trends in the financial industry with regard to tax-expenditures. Non-banking financial firms as, for instance, insurance companies have been subject to regulatory change by a reform named Solvency II, but not yet with regard to tax transparency (European Commission, 2014). Third, we consider a control group of matched European corporations from various industries, particularly manufacturing industries. This comparison is intended to test whether higher tax payments by banks after CRD IV could have also been explained by an upwards trend in the ETR across all industries in Europe, that is possibly driven by the BEPS process.

For each comparison a Propensity Score Matching (PSM) approach is applied. We identify matching partners for our international banks with regard to key financial characteristics, such that we receive other firms similar to our multinational banks in terms of size and/ or profitability. The underlying idea of applying PSM here is to account for confounding factors that partly explain structural differences between the European banking industry and the control groups.

[73] Theoretically, international banks penetrate foreign markets and crowd out domestic players of their routine business or alternatively can focus on niche services in the foreign market. Buch and Golder (2001) conclude that co-existence between domestic and international banks in most service lines is the case and hence business concepts appear comparable.

4.4 Empirical Results

4.4.1 ETR Development in the European Banking Sector

We begin our investigation by using domestic European banks as control group. Table 3 contains the corresponding outcome. We always use ETR as dependent variable. Specification (1) reports the most concise DiD estimation which solely includes the indicator variable *MULTI* and year fixed effects as control variables. Specification (2) introduces additional control variables to the regression and specification (3) adds firm-fixed-effects. The overall DiD-coefficient of interest is the interaction term *MULTI x POST*.

The coefficient is positive and statistically significant in specifications (1) – (3). Considering specification (2), the point estimate suggests that banks affected by the CbCR-regulation experienced an average increase in effective tax levels of 2.5 percentage points relative to banks, which remained unaffected by the reform, ceteris paribus. The effect size ranges at 2.3 percentage points and is significant when firm fixed effects are introduced in column (3). This finding implies, that multinational banks paid substantially more taxes than their domestic peers after the reform. Taking an average ETR of 23 percent, the magnitude of the coefficient suggests that the overall tax expenditure of an affected banking group increased by approximately one tenth in total through CbCR. In particular, the introduction of firm fixed effects bolsters our interpretation of the CbCR-reform as the driving force because this model eliminates potential bias through time-invariant unobserved factors; this way any constant level differences between EU countries regarding taxes are controlled for.

Table 3: ETR Comparisons in the European Banking Sector

VARIABLES	Testing H1			Testing H2		Placebo Test (H2)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MULTI	-0.0230*	-0.0122		-0.0109		-0.00532	
	(0.0122)	(0.0118)		(0.0136)		(0.0126)	
MULTI x POST	0.0203**	0.0245**	0.0227**	0.0082	0.0045	0.0120	0.0104
	(0.0101)	(0.0101)	(0.00998)	(0.0135)	(0.0138)	(0.0128)	(0.0132)
MULTI x EXPOSED				0.00085			
				(0.0190)			
MULTI x EXPOSED x POST				0.0332**	0.0361**		
				(0.0169)	(0.0168)		
MULTI x LARGE						-0.0169	
						(0.0184)	
MULTI x LARGE x POST						0.0246	0.0235
						(0.0170)	(0.0171)
SIZE		-0.00283	-0.0125*	-0.00339	-0.0105*	-0.0022	-0.0101
		(0.00280)	(0.00681)	(0.00291)	(0.00612)	(0.00292)	(0.00657)
ROE		-0.0466*	-0.0784*	-0.0469*	-0.0768*	-0.0485*	-0.0806**
		(0.0281)	(0.0408)	(0.0274)	(0.0398)	(0.0279)	(0.0406)
EQUITY		-0.0786*	-0.0390	-0.0805**	-0.0376	-0.0772*	-0.0376
		(0.0406)	(0.0623)	(0.0405)	(0.0612)	(0.0408)	(0.0616)
CTR		0.007***	0.005***	0.007***	0.005***	0.007***	0.005***
		-0.00067	-0.0016	-0.00067	-0.0015	-0.00066	-0.0015
NOL		-0.0426**	-0.0369	-0.0425**	-0.0363	-0.0425**	-0.0367
		(0.0209)	(0.0250)	(0.0207)	(0.0249)	(0.0208)	(0.0249)
Year Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Firm Fixed Effects			✓		✓		✓
N	1,204	1,202	1,202	1,202	1,202	1,202	1,202
Pseudo R2	0.0166	0.230	0.113	0.234	0.144	0.231	0.150

Notes: The dependent variable is ETR. Specifications (1-3) serve the testing of H1 and compare the ETRs of both banking groups over the introduction of CbCR. Specifications (4-6) serve the testing of H2, the analysis of particular exposed banks, by introducing an additional interaction term to the regressions. Analogous to (4-6) an alternative placebo interaction term is introduced in specification (6-7) to show the distinct effect of exposure to transparency. The constant is not reported. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** show significance at the level of 10 percent, 5 percent, and 1 percent, respectively.

The covariates in our model affect banks' tax payments in an anticipated manner: A one percentage point increase in the corporate income tax rate (*CTR*) of a bank's home country is associated with an average increase of roughly 0.5 percentage points in the ETR of the bank. Larger and more profitable banks tend to pay slightly less taxes (conditional on cross-border activity) than their smaller and less profitable peers. We do not find an association between equity ratio and tax payments in our sample. The *MULTI*-indicator in specification (1) reveals a significant negative ETR level difference of 2.3 percentage points for international banks. This mirrors the fact that international banks enjoy additional possibilities to reduce their tax burden.

In columns (4) – (5) of Table 3 we test our hypothesis H2. We expect that multinational banks with activities in tax havens are particularly exposed to a shock in transparency and consequently may show a stronger reaction in their adaption of tax payments. Therefore, we insert an additional interaction term *MULTI x POST x EXPOSED*. The coefficient is positive and significant in both specifications. Here - column (5)- we detect an effect of 3.6 percentage points. Hence firms with activities in tax havens increased their ETR by 3.6 percentage points relative to all other multinational banks over the period. This finding implies twofold: First, firms that declare activities in the named tax havens react in a more pronounced manner to CbCR-duties than other multinationals, which supports H2. Second, the magnitude of the interaction term and the corresponding insignificant coefficient of the *MULTI x POST* variable suggest, that the exposed banks are driving the detected overall effect of column (3). The remaining multinational banks do not provide a substantial reaction in tax payments – relative to domestic banks. This is in line with the presented concept of surging pressure through reputational cost and litigation risk: Banks that are not forced to lay bare any dubious activity, should not be urged to adjust their tax planning in the presence of enhanced transparency.

For presumable reasons, the indicator *EXPOSED* is positively correlated with the size of a bank, as larger banking groups per se possess more subsidiaries and hence are more likely

to be present in one of the designated tax haven countries. To not misinterpret the *EXPOSED* indicator as a disguised size proxy, we run a placebo test in specifications (6) - (7) of Table 3: The dummy *LARGE* equals 1 for the largest 38 multinational banks measured in total assets in the sample.[74] The coefficient of interest *MULTI x POST x LARGE* is positive but not significant and supports our interpretation that truly the fact whether a bank has been subject to critical exposure of dubious tax planning in fiscal havens by CbCR, caused the stronger adaptation in tax levels. Our results support H2: Banks with activities in tax havens experienced stronger transparency pressure through CbCR, which is expressed through higher effective tax levels ex post 2014.

4.4.2 Additional Control Groups

To strengthen our findings, we present additional comparisons with alternative control groups. We assign each European multinational bank to a certain number of alike firms from the respective control group in order to compare the development of exposed banks' tax levels to tax planning trends across other industries.[75] Given the available pool of matchable firms, the PSM criteria were selected in such way, that comparability according to the attributes is guaranteed and the number of successfully matched multinational banks is maximized.[76]

The subsequent matched sample analysis follows the specification from equation (1) while different control groups are introduced in separate samples, illustrated by the panels A, B and C. Table 4 contains the corresponding outcome.

[74] The threshold of 38 is to design a proportionally alike sample split to the exposed/non-exposed differentiation among the multinational banks. Taking the median in size as threshold neither entails significant interaction terms.
[75] Only exposed multinational European banks with activities in tax havens are used for the PSM.
[76] Information on the undertaken PSM and for all control groups are shown in Table A3 in the Appendix.

Table 4: ETR Comparisons beyond the European Banking Sector

Variables	Panel A			Panel B			Panel C		
	Control Group: U.S. Multinational Banks			Control Group: EU Financial Services			Control Group: EU Manufacturing Firms		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
EU-Multi-Bank	-0.0626***	0.0051		-0.0139	-0.0285		-0.0284	-0.0835***	
	(0.0173)	(0.0226)		(0.0209)	(0.0185)		(0.0179)	(0.0260)	
EU-Multi-Bank x POST	0.0323*	0.0494*	0.0398*	0.0391**	0.0397**	0.0382**	0.0300*	0.0310*	0.0317**
	(0.0174)	(0.0259)	(0.0207)	(0.0170)	(0.0177)	(0.0176)	(0.0155)	(0.0159)	(0.0157)
SIZE		-0.0009	-0.0078		0.0029	-0.0126		0.0034	-0.0076
		(0.0031)	(0.0092)		(0.0044)	(0.0091)		(0.0054)	(0.0108)
ROE		0.0818	-0.182		-0.0472**	-0.0552**		-0.0251	-0.0261
		(0.103)	(0.165)		(0.0235)	(0.0214)		(0.0184)	(0.0273)
EQUITY		0.0267***	0.0129*		-0.0585	-0.0920		-0.146***	-0.192*
		(0.0065)	(0.0075)		(0.0564)	(0.0885)		(0.0505)	(0.100)
CTR		0.505***	0.0324		0.0041***	0.0039		0.0032***	0.0007
		(0.166)	(0.389)		(0.0015)	(0.0038)		(0.0012)	(0.0027)
Matched Control Group	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year-Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm Fixed Effects			✓			✓			✓
Number of EU Banks	15	15	15	35	35	35	34	34	34
Number of Control Firms	15	15	15	41	41	41	82	82	82
N	199	184	184	442	439	439	715	713	713
Adj. R^2	0.111	0.230	0.3069	0.035	0.160	0.538	0.004	0.085	0.4417

Notes: The dependent variable is ETR. OLS Regressions are based on three separate sample-panels (A, B and C) with observations ranging from 2010 to 2016. In each panel a specific number of EU banks is matched to a number of respective control firms over a specific set of control variables. Panel A comprises 1:1 matched (total assets in €̶ and return on equity) U.S. Banks and EU Banks. Panel B comprises 1:2 matched (absolute profits in €̶, total equity in €̶, number of employees) EU banks an EU non-banking financial services providers. Panel C contains 1:3 matched (absolute profits in €̶, number of employees) EU banks and EU manufacturing enterprises. Information on the quality of the undertaking PSM are to be found in Table A3. The constant is not reported. Robust standard errors clustered on the firm level and are shown in parentheses. *, **, and *** show significance at the level of 10 percent, 5 percent, and 1 percent, respectively.

Panel A contains a small-scaled matched sample of equally large and profitable U.S. and European multinational banks.[77] Large U.S. multinational banks appear suitable as they undergo similar regulatory actions as their European peers and are likely to be affected by likewise business cycles. Specifications (1) - (3) show the corresponding results and deliver a similar interpretation to our main analysis: The coefficient of interest is *EU Multi Bank x POST*. The effect is positive which suggests that the observed rise in the ETR after the implementation of CbCR for European banks was not experienced in a similar manner by U.S. multinational banks. The significance of the coefficient of interest holds when including further controls and firm-fixed effects. However overall statistical significance does not exceed the 10 percent level, which is partly owed to the small number of observations. Furthermore, it is shown that European banks, on average, pay less taxes than their U.S. peers. This difference may originate from lower statutory tax rates in Europe and corresponds to findings in previous studies (PWC, 2011; Markle and Shackelford, 2012a). The sample size restrains the extensive validity of the findings; however together with the first comparison, it supports our interpretation that not explicit business cycle conditions for multinational banking groups explain the relative surge in ETRs of European multinational banks.

Columns (4) – (6) refer to a matched sample of European multinational banks and other European financial service providers. We consider the alternative control group in order to test whether the particular development of the ETR in the banking sector was due to the implementation of CbCR and did not result from a general trend in the financial services industry. The control group includes mostly insurance and non-banking investment companies. Insurers appear among others suitable for our purpose because they have undergone

[77] In case of the U.S. control group , the limited number of multinational U.S. banks origins from the list of large commercial banks from the FED (Federal Reserve System, 2017), which lists 23 U.S. headquartered banks to have subsidiaries abroad and data availability issues from the *Compustat Banks Database*. A 1:1 nearest neighbor PSM approach has been applied over the amount of total assets in € and the return on equity ratio. In total, we compare 15 European multinational banks with 15 U.S. multinational banks in Panel A.

Solvency II, an insurance regulatory regime, passed by the European Commission in June 2014 – which imposed somewhat similar capital requirements to the BASEL III, but without the obligation of CbCR.[78]

The results shown in columns (4) – (6) of Table 4 support the established results. The main coefficient of interest, *EU Multi Bank x POST*, turns out to be positive and significant at the 5 percent level and is robust to the introduction of firm fixed effects. This finding suggests that other financial service providers, which have not been subject to CbCR-duties, did not experience a comparable rise in effective tax levels ex post 2014. Moreover, no systematic difference in ETR between banks and insurance companies has been caught by the indicator variable *EU Multi Bank*.

Panel C contains European multinational banks and matched firms from various manufacturing industries, whereby all firms are headquartered in the EU.[79] Results of the matched sample analysis are shown in columns (7) - (9). The results support the preceding findings. The coefficient of interest *EU Multi Bank x POST* is positive and significant at the 5 percent level. The magnitude of the coefficients resembles the magnitude of the previous results and is robust to the introduction of firm fixed effects. Particularly specification (9) suggests that constant heterogeneity neither between industries, nor between individual firms, causes the surge of banks' ETRs relative to the ones of industrial firms.

Independent comparisons across industries may suffer from structural differences among the groups. To curb such criticism, we deployed sector-related industries (financial services) and to certain extent, statistically comparable firms (matched firms) as counterfactuals

[78] We apply 1:2 nearest neighbor matching and consider absolute profit in €, number of employees and the total amount of equity in € when computing the propensity score. The matched sample contains 35 European multinational banks and 41 other European financial firms.

[79] A 1:3 nearest neighbor matching was applied over the number of employees and absolute profit in € made in order to construct a group of firms that is similar to banks in terms of size and absolute profitability before the implementation of CbCR. The matching procedure results in 34 multinational banks and 82 industry firms in Panel C.

for multinational banks from Europe. We do not observe any likewise increase in effective tax levels for non-banking institutions post CRD IV. The concurrence of our comparisons within and beyond the European banking sector suggests that the increase in the effective tax levels of multinational banks since 2014 is associated with the implementation of the CbCR obligation.

4.4.3 Insights from the Disclosed Reports

While our findings suggest an increase in ETRs of European banks after CbCR introduction, additional analysis of certain tax avoidance schemes at the subsidiary level could further support the view that banks have reduced their tax avoidance behavior. Prior CRD IV, no comprehensive financial data on banks' subsidiaries exist on a representative basis. Thus we argue that the introduction of CbCR provides new information that was not available to the public beforehand.

As a consequence, the difficulty remains to closely observe changes in reported profits or certain tax avoidance structures on a host country basis before and after the reform due to the lack of data before 2014. Joshi et al. (2018) inspect the impact of the CRD IV reform on the profit shifting activities of banks and find a substantial decrease in the profit shifting activities of financial subsidiaries after the reform. However, the authors claim that the amount of profits shifted through non-banking subsidiaries could have increased at the same time, which supposedly keeps overall tax avoidance high.[80] We are skeptical on the availability of sufficient data on the subsidiary level in existing databases to perform representative analyses on profit shifting channels of banks. As mentioned before, the *Orbis Bankfocus* database offers the most comprehensive data on bank subsidiaries worldwide but – from our and others' experience

[80] Potential reasons for the different documentation of aggregate tax avoidance in the banking sector might origin from variations in the applied research design and likely from distinct coverage of financial firms between the *Compustat Global* and the *Orbis Bankfocus* database.

(Langenmayr and Reiter (2017, p.11) - is far from full coverage of entire groups nor suitable for aggregations on the country level (see our discussion in section 2.2).

In order to shed light on the underlying mechanisms behind the increase in worldwide tax payments of exposed banks, we extract information from the actual Country-by-Country-Reports: We collected the publicly available reports of all available EEA-headquartered G-SIBs[81] for the years 2014, 2015 and 2016 and analyzed patterns of local profitability over time. Figure 2 describes the average profit per worker in the G-SIB's respective headquarter-country alongside with Ireland and Luxembourg:

Figure 2: G-SIBs' Profitability in Selected Countries over Time

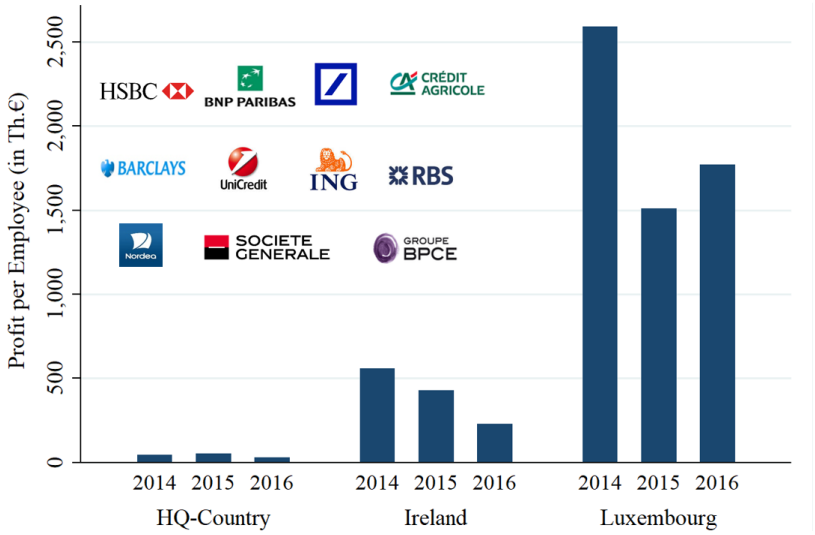


Figure 2 displays a strikingly diverse image of per-worker-productivity between both Ireland and Luxembourg and other countries: In the respective banks' country of incorporation one worker can be assigned to an average corporate profit of 44 K € in 2014, while at the same time the average G-SIB employee in Ireland is linked to 560 K €, which still appears moderate in contrast to a stunning average 2.6 m. € of pre-tax-profit per employee in Luxembourg. These obvious distortions in local profit accumulation found their way into European newspaper

[81] BBVA and Standard One Bank were dismissed from the subsample due to permanent losses in their country of incorporation. All but one of the eleven banks possess subsidiaries in both Luxembourg and Ireland.

headlines and quickly reached the public mind. Moreover, the CbCR data show a trend in tax haven profitability over time since the implementation of CRD IV: The per-worker-profitability in Ireland and Luxembourg diminished over the succeeding years by a substantial amount. This might suggest an underlying intention by banks' managers to paint a less conspicuous picture of their geographical profit allocation over time. It could indicate that reallocations of profits from tax havens to high-tax-countries might have resulted in higher overall ETRs of the observed banks. For the named eleven banks we document an average ETR increase of 3.1 percentage points in our sample over a three-year window around the reform.

4.5 Robustness Checks

4.5.1 Variations in Sample Design

In additional analyses standard placebo and other robustness checks of the applied statistics are undertaken. For each model specification we present only the coefficient of interest *MULTI x POST*. Table 5 contains the corresponding outcomes.

We implement altering timings of the treatment before and after the actual implementation of the regulation in 2014 in order to examine the exact timing of the observed effect (specifications (A1) - (A3) of Table 5). We find no significant coefficient for a placebo-early treatment in the interim period of 2013 (specifications (A2)). However, the treatment effect remains significant if we remove this year (specification (A1)) or start belated treatment in 2015 (specifications (A3)).[82] This implies threefold: First, the disclosure duty of CbCR for annual reports of 2014 affected the effective tax levels of consolidated banking groups positively, which could not be observed in a likewise manner before the reform. Second, the fact that the exclusion of the interim treatment years 2013/14 does not alter our findings, suggests that banks did not only adapt their tax payments in the short run, but experienced

[82] The alternative removal of the treatment year 2014 does not alter our finding, too.

longer lasting pressure through CbCR. Last, belated treatment from the year 2015 onwards yields a significant treatment effect. One possible reasoning behind this could be that – analogous to the second point - the banks' response to the transparency shock required some time (corresponding to the development of local profitability displayed in Figure 2). The observed adaptation in tax planning appears to be a gradual process over the post-CRD IV years.

Table 5: Alternative Sample Designs

Sample: EU Multinational and EU Domestic Banks		
Description of Robustness Specification		MULTI x POST
(A1)	Elimination of Interim Stage (2013)	0.0228* (0.0116)
(A2)	Early Treatment in 2013	0.0172 (0.0109)
(A3)	Late Treatment in 2015	0.0275** (0.0103)
(A4)	Large Sample including Financial Crisis (2007 - 2016)	0.0223** (0.00984)
(A5)	Further ETR Outlier Elimination (top & bottom 5% in ETR)	0.0249** (0.00872)
(A6)	Reduced - perfectly balanced - Subsample	0.0321*** (0.0101)
(A7)	Negative Profit Observations remain in the sample	0.00193* (0.0124)
(A8)	G-SIBs Interim Treatment in 2013	0.0226** (0.00966)
(A9)	Including Country-Year Fixed Effects	0.0269* (0.0138)
Year Fixed Effects		✓
Controls		✓
Firm Fixed Effects		✓

Notes: The dependent variable is ETR. OLS Regressions are based on the sample of EU multinational and EU domestic banks from 2010 to 2016, as used in table 3. Exceptionally the specification A4 extends the sample to the time-period from 2007 to 2016. The regression model resembles specification (3) of table 3, including control variables and firm-fixed effects. The interaction terms refer to the DiD coefficient of interest in the respective regression captured by the interaction term of treatment and post-treatment period. The coefficients of other control variables and the constant are not reported. Robust standard errors clustered on the firm level and are shown in parentheses. *, **, and *** show significance at the level of 10 percent, 5 percent, and 1 percent, respectively.

Moreover, we run several robustness tests on different samples altering in size (specifications (A4) - (A7)). First, we include the years 2007 – 2009 and thus ingest the financial crisis time-period. Second, we run our initial setup on the sample excluding outlier banks with regard to ETR values.[83] Third, we use a reduced, fully balanced panel sample for the original estimation.[84] Fourth, we repeat the analysis on the baseline sample including negative profit observations (specification (A7)), which have been eliminated in the original sample selection process. The tests on modified sample sizes indicate that the detected results are robust to changes in the sample composition and the estimation strategy. Including the years of the financial crisis in the sample does not affect the estimates in a notable manner. The same is true for the application of smaller subsamples: Neither using a perfectly balanced sample nor the exclusion of outliers in the ETR triggers changes in the coefficient of interest.

Subsequently we examine the role of G-SIBs that have been obliged to report their tax data confidentially to the European Commission one year before CbCR became mandatory. We respect their early CbCR duty in 2013 in specification (A8). The early treatment of G-SIBs in 2013 does not turn out to be a major driving force, either.

Lastly, we introduce country-year fixed effects into our original regressions in order to account for potential national trends and/ or legislative changes and/or imbalances in country coverage in our sample (specification (A9). Introducing country-specific-trends over time even increases the magnitude of the DiD-coefficient.

Given all the above, the detected surge in effective tax levels of multinational banks over their domestic peers in the European banking industry appears robust to several variations in our research design.

[83] Outlier banks are defined as the bottom and top fifth percentile in ETR values. Hence in total 10% of banks in the sample are – additionally to the original elimination of outliers- truncated for this specification.
[84] The reduced fully balanced sample contains 692 observations over the 2010 to 2016 period.

4.5.2 Disentangling the effect of CbCR from CRD IV

Subsequently, we address concerns regarding the interfering influences of other regulatory changes that accompanied CbCR (Art. 89) within CRD IV: The new standard minimum capital adequacy rate (Art. 129), new liquidity requirements (Art. 105) and revised corporate governance rules (Art. 90 – 96) for banking groups represent the most pertinent ones. In order to avoid a misinterpretation of our identified effect, we analyze whether ETRs of discernibly different banks with regard to size, profitability and equity equipment developed differently over the implementation of CRD IV.

For this purpose, we again install placebo-treatments: we categorize banks as placebo-treated according to their above/below-median attribute in the respective characteristic in the year before the reform. In specification (B1) of Table 6, we compare the change in effective tax payments of large relative to small European banks over the enactment of CRD IV. Likewise, we compare more profitable to less profitable banks in specification (B2) and stronger financially leveraged to less leveraged banks in specification (B3). Despite a certain correlation among the applied criteria, the presented setups provide widely diverging treatment group constellations of banks, containing both multinational and domestic ones. If our interpretation holds, we should not observe an effect from the placebo treatments on the ETR. Table 6 contains the coefficients of interest to the designated placebo-identification strategies, analogous to the empirical models from our main analysis:

Table 6: CRD IV Placebo Treatment Groups

Sample: EU Multinational and EU Domestic Banks			
Description of Robustness Specification		Coefficient of Interest	DiD Interaction Term
(B1)	Placebo: Critical Size as Treatment Classification	0.0120 (0.010)	LARGE x POST
(B2)	Placebo: Critical Profitability as Treatment Classification	0.0110 (0.0099)	PROFITABLE x POST
(B3)	Placebo: Critical Equity Share as Treatment Classification	-0.0147 (0.0094)	STRONG EQUITY x POST
	Year Fixed Effects	✓	
	Controls	✓	
	Firm Fixed Effects	✓	

Notes: The dependent variable is ETR. OLS Regressions are based on the sample of EU multinational and EU domestic banks from 2010 to 2016. The regression model resembles specification (3) of Table 3, including control variables and firm-fixed effects. The interaction terms refer to the DiD coefficient of interest in the respective regression captured by the interaction term of treatment and post-treatment period. The coefficients of other control variables and the constant are not reported. Robust standard errors clustered on the firm level and are shown in parentheses. *, **, and *** show significance at the level of 10 percent, 5 percent, and 1 percent, respectively.

No placebo-treatment delivers a statistically significant coefficient of interest. This means, that we only observe – in relative terms - higher post-reform effective tax payments for international banks, but not for larger, more profitable or less leveraged ones. Given this, we are confident that exclusively CbCR-duty explains this surge in tax payments, whereas other regulatory implementations over the course of Basel III doesn't.

4.6 Conclusion

The European Commission implemented a pioneering CbCR regulation in 2014 with the goal of fighting financial opacity and restoring the trust of society and stakeholders in the European banking sector (European Commission, 2014b). While it is hard to answer the question of whether trust was restored, we investigate whether the new regulation exercised sufficient pressure on CEOs and CFOs such that it curbed international tax planning. We analyzed the impact of the tax transparency shock on banks' tax avoidance behavior by evaluating their effective tax rates both before and after the mandatory disclosure of CbCR.

Our results suggest that European multinational banks experienced a significant increase in their effective tax levels after the regulation, relative to unaffected banks. In particular, we find that the multinational banks, which are most exposed to the newly demanded transparency through the revelation of their activities in tax havens, reacted the strongest to the mandatory disclosure of CbCR. Banks with activities in tax havens increased their ETR by 3.6 percentage points relative to the other banks in our sample. In additional comparisons, we checked our results against trends in corporate tax avoidance, both in the financial sector and across other industries. This further analysis reveals a response only in the European banking sector. We also dismiss other regulatory influences embedded in the Basel III framework as alternative explanations. Ultimately, our results suggest that European multinational banks responded to the new transparency and did not simply follow a general trend in the financial sector or in international tax avoidance.

This study contributes to the recent debate about financial transparency as a potential means to limit the tax avoidance of MNEs. From our analysis, we conclude that tax avoidance behavior of managers and the scope of public disclosure are related. Our findings suggest that CbCR can be an additional effective instrument for policy makers to curb cross-border corporate tax planning.

However, one limitation of our study is that we are unable to clearly establish how transparency affects tax planning behavior. We discuss three potential channels for the observed effect. While we suspect the impending litigation-costs imposed by better-informed tax auditors to deliver the most incentives for company executives to react, the outcome could also result from increased reputational or regulatory cost of corporate tax planning. The examination of the distinct mechanisms remains a challenge for future research.

Appendix

Table A1: Variable Definitions

CTR	Corporate Income Tax Rate of a firm's home country
EMPLOYEES	Number of a firm's full-time employees
EQUITY	Ratio of a firm's equity over total assets
ETR	GAAP Effective Tax Rate of a firm, i.e. income taxes divided by pretax income, which was corrected for extraordinary items
EXPOSED	Indicator variable, which equals one for all exposed banks that possess subsidiaries in at least one of the following five EEA Tax Havens: Cyprus, Ireland, Liechtenstein, Luxembourg, Malta
LARGE	Indicator variable, which equals one for firms that rank above the median value of Size in the respective sample
MULTI/ EU MULTI BANK	Indicator variable, which equals one for EEA-headquartered banks that possess at least one subsidiary in another country
NOL	An indicator variable equal to one if the firm reported negative earnings in the prior financial year
POST	Indicator variable, which equals one for the year of treatment and following years
PROFIT	A firms annual profit in millions of €
PROFITABLE	Indicator variable, which equals one for firms that rank above the median value of ROE in the respective sample
ROE	Return on Equity i.e. pretax income divided by total assets
SIZE	Size of a Firm, i.e. logarithm of total assets
STRONG EQUITY	Indicator variable, which equals one for firms that rank above the median value of Equity Ratio in the respective sample
TOTAL ASSETS	Total Assets of a firm in billions of €
TOTAL EQUITY	A firms equity in billions of €

Table A2: Multinational Bank-Headquarter Locations by Country

	EU Multinational Banks	
	# of Banks	% of Banks
Austria	6	7.2%
Belgium	2	2.4%
Bulgaria	2	2.4%
Croatia	1	1.2%
Cyprus	2	2.4%
Denmark	5	6.0%
Finland	2	2.4%
France	6	7.2%
Germany	13	15.7%
Hungary	1	1.2%
Iceland	1	1.2%
Latvia	1	1.2%
Liechtenstein	2	2.4%
Netherlands	3	3.6%
Norway	2	2.4%
Poland	2	2.4%
Portugal	1	1.2%
Slovenia	1	1.2%
Spain	4	4.8%
Sweden	7	8.4%
United Kingdom	19	22.9%
Total	83	100.0%

The baseline sample contains 83 multinational banks with their headquarters in the EEA. In total, the sample covers 21 of all 31 EEA countries.

Table A3: Propensity Score Matching Quality

Panel A: Matching EU Multinational Banks & US Multinational Banks

Nearest Neighbor 1:1	Mean			Bias	t-test	
	N	EU Multi Banks	US Multi Banks	(in %)	t	p>t
Total Assets (bn. €)	199	289.21	271.36	3.7	0.10	0.92
ROE	199	0.1513	0.1682	-13.5	-0.63	0.53

Panel B: Matching EU Multinational Banks & EU Financial Service Providers

Nearest Neighbor 1:2	Mean			Bias	t-test	
	N	EU Multi Banks	EU Fin. Services	(in %)	t	p>t
Profit (m. €)	442	2,387	2,033	14.5	0.50	0.62
Total Equity (bn. €)	442	21.470	18.321	16.2	0.53	0.60
Employees	402	48,313	33,251	32.9	1.10	0.28

Panel C: Matching EU Multinational Banks & EU Manufacturing Ind.

Nearest Neighbor 1:3	Mean			Bias	t-test	
	N	EU Multi Banks	EU Manufacturing	(in %)	t	p>t
Profit (m. €)	715	1.595	2.005	0.3	0.02	0.98
Employees	692	40,732	73,187	-56.8	-1.60	0.11

Notes on the performed PSM-Methodology:
Table A3 shows the matched samples A, B and C, used in Table 4, and their respective attributes after PSM was applied. For each panel we show the number of nearest neighbor matched firms, the variables of interest, the number of observations and most importantly the attribute-means for both groups, which should not provide a statistically significant difference (t-tests). The bias in mean values is expressed in percentage of the EU multinational banks' mean. In Panel A we apply 1:1 nearest neighbor PSM approach over the amount of total assets in € and the return on equity ratio. In total, Panel A contains 15 European multinational banks with 15 U.S. multinational banks. Observations are from the period 2010-2016. In Panel B we apply a 1:2 nearest neighbor matching over the criteria absolute profit in €, number of employees and the total amount of equity in € in order to compute the propensity score. Panel B contains 35 European multinational banks and 41 other European financial firms. Observations are from the period 2010-2016. In Panel C we apply a 1:3 nearest neighbor matching approach over the number of employees and absolute profit in €. The matching procedure leads to 34 multinational banks and 82 industry firms in Panel C. Observations are from the period 2010-2016. Standard caliper values are set to 0.03 for all matching procedures, which is in accordance with existing literature on the methodology (Austin, 2011; Lunt, 2014; Rosenbaum and Rubin, 1983). Matching procedures in Panel B and C allowed for replacement in the pool of firms. Replacement in Panel A was not feasible due to the low number of available multinational U.S. banks.

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Chapter 5

Concluding Remarks

5 Concluding Remarks

This thesis aims at a better understanding of corporate tax avoidance, its empirical measurement and the evaluation of tools for policymakers in the global combat against it. The reliable detection and measurement of corporate tax planning strategies is indispensable for the design of targeted regulatory actions. Thus, the insights from this thesis hopefully contribute to the ongoing debate on the measurement of corporate tax avoidance and potential means to curb it.

Chapter 2 addresses the question whether net operating loss (NOL) observations can be implemented in the measurement of corporate tax avoidance and how the handling of losses affects the measurement outcome. It is demonstrated that NOLs can systematically be included in the analysis but only under certain restrictions. Only, if researchers control for the confounding effect of firm-profitability and heterogeneous characteristics of non-prospering firms, losses can meaningfully be implemented in the analysis. When researchers decide to remove NOLs from their sample, they should be aware of misleading tax expenses before and after loss-years that remain in the sample and do not signal tax planning. Eventually, it is shown that the loss-structure in the data partly conceals the true development of U.S. domestic firms' corporate tax planning. Thus, tax researchers must pay close attention to NOLs regardless of whether they include them in the analysis or not.

Chapter 3 proposes a new measure for the aggressive part of international tax avoidance of multinational enterprises (MNEs). MNEs pay their taxes in all countries of operation and consequently face a spectrum of different statutory tax rates. Thus, we propose a measure of international tax avoidance that isolates more aggressive international tax planning from the influence of moderate tax rates in host countries. When applying the new measure it turns out that multinational U.S. firms systematically engage in aggressive tax planning that goes beyond the mere benefitting from moderate corporate tax rates. Furthermore, aggressive international

tax avoidance is strongly associated with tax haven operations and enhanced opportunities to manipulate transfer prices. Lastly, we exploit data from a pioneering Country-by-Country Reporting (CbCR) initiative in the European financial sector and refine our measure with details on geographical corporate activities. This way we revise the perception of multinational banks' tax aggressiveness and demonstrate how useful tax transparency data can be, if made available to the public.

Chapter 4 analyzes the effectives of tax transparency as a policy tool against international corporate tax avoidance. For this purpose, we examine how the aforementioned tax transparency initiative in the European banking sector affected the scope of banks' aggressive tax planning. The Capital Requirements Directive IV from 2013 by the European Commission forced multinational banks to publish key financial and tax data in the form of CbCR for the first time in history. Our results suggest that European multinational banks experienced a significant increase in their effective tax levels after the regulation, relative to unaffected banks. In particular, we find that the multinational banks, which are most exposed to the newly demanded transparency through the revelation of their activities in tax havens, reacted the strongest to the mandatory disclosure of CbCR. Thus, CbCR appears to be an additional effective instrument for policy makers to curb cross-border corporate tax planning.

In conclusion, the precise empirical measurement of tax avoidance is intricate but possible and necessary. Tax researchers must pay attention to the underlying loss-structure in the data and incorporate information on international operations to correctly assess the extent of aggressive tax planning. Only on basis of reliable information policy makers can make effective decisions and, consequently, ensure the collection of public revenues. Among several other current initiatives, enhanced tax transparency appears to be one promising anti-avoidance legislation.

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