// NO.21-047 | 12/2022

DISCUSSION PAPER

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Tax Strategy Disclosure: A Greenwashing Mandate

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Tax strategy disclosure: A greenwashing mandate?*

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First Version: 23.04.2021

This Version: 02.12.2022

Abstract

We investigate the effects of a *qualitative* tax disclosure mandate aimed at improving the availability of tax information and tax compliance by imposing reputational costs for firms. We use, as an exogenous shock, the 2016 UK reform that required the disclosure of tax strategy details by large businesses. We find that treated firms—those that must publish a tax strategy report—significantly increase the volume of tax strategy disclosure in their annual reports but also provide more boilerplate statements. Disclosure volume and boilerplate increase the most for high public pressure and tax aggressive firms. We show the important role that public pressure plays in facilitating this increase in disclosure volume, even in the absence of the mandate. We document no significant effect on tax avoidance. Our findings indicate that this requirement for qualitative tax disclosure has incentivized firms to portray themselves as "*good tax citizens*" without actually changing their tax practices.

JEL: G38, M41, M48, H26, H20

Keywords: Disclosure Regulation, Nonfinancial Disclosure, Corporate Social Responsibility, Tax Transparency, Corporate Tax Avoidance

*Acknowledgements: We are especially grateful to Federico Nanni for all the helpful and fruitful discussions. We appreciate the valuable suggestions and comments from Erik Beardsley (discussant), Jennifer Blouin, Sarah Clifford, John Gallemore, Nathan Goldman, Michelle Hanlon, Jeff Hoopes, Martin Jacob, Kiridaran (Giri) Kanagaretnam, Becky Lester, Christian Leuz, Bradley P. Lindsey, Petro Lisowsky, Micheal Minnis, Jan Möhlmann, Elena Patel, Christoph Spengel, Steven Young, and Brian Wenzel, the seminar participants at the University of Mannheim, Questrom School of Business – Boston University, the University of Brescia, NHH – NoCeT, WHU Otto Beisheim School of Management, and the audience at the ZEW Public Finance Conference, the International Accounting Symposium, the Mannheim Taxation Campus Meeting, the 112th NTA Annual Congress, the Oxford Said Business School Doctoral Meeting, the Annual Mannheim Taxation Conference, the TRR Annual Conference, and the 2021 AAA Annual Meeting. We are also thankful to Antoine Heidt and Moritz Pilarski for their outstanding research assistance. We gratefully acknowledge the financial support from the German Research Foundation Project-ID 403041268 – TRR 266 Accounting for Transparency, the Graduate School of Economic and Social Sciences of the University of Mannheim and the Leibniz Science Campus Mannheim Taxation. A previous version of this paper was titled "Qualitative Information Disclosure: Is Mandating a Tax Strategy Report Useful?"

I. INTRODUCTION

In the summer of 2022, the European Commission endorsed appropriate tax risk management as one of the key criteria to assess whether an economic activity should be considered sustainable (European Commission, July 2022). In line with this, the discussion of a firm's tax strategy is increasingly viewed as an important component of corporate social responsibility disclosure (CSR).[1] The Global Sustainability Standards Board has recently adopted a tax standard that incorporates tax strategy information into firms' CSR reports.[2] Policymakers have also deemed tax strategy disclosure to be important, as the UK tax strategy mandate and the Australian voluntary Tax Transparency Code demonstrate. Like other CSR-type information, tax strategy reporting comes mostly in the form of *qualitative* disclosure and includes, for example, information on the management of tax risk, the relationship with tax authorities and attitude to tax planning. The rationale behind encouraging firms to publish their tax strategy is to increase tax transparency and reduce aggressive tax planning by imposing reputational costs on firms.

In this paper, we study the effects a UK regulation that requires large businesses to disclose tax strategy information. The UK disclosure mandate has two central goals: (1) to increase the availability of tax information to the general public and (2) to curb tax avoidance.[3] This regulatory change requires a group of firms with operations in the UK to report their tax strategies, including firm-level tax risk governance, attitude towards tax planning, their tax risk appetite, and the relationship with the local tax authority, Her Majesty's Revenue and Customs (HMRC). The mandated report can either stand alone or be integrated into another report, for example, the annual report. An interesting feature of our setting

[1] See PwC, Tax is crucial part of ESG conversation, available at https://www.internationaltaxreview.com/article/2agvpy1eska7g2qr6nls1/sponsored/the-tax-transparency-train-fuelled-by-esg.

[2] The Global Sustainability Standards Board sets the globally most used sustainability standards. See https://ec.europa.eu/environment/international_issues/pdf/g7_workshop_paris_march_2019/Session_4_P1_GRI_Krotova.pdf and https://www.globalreporting.org/news/news-center/four-in-five-largest-global-companies-report-with-gri/. For the information on the GRI tax standard, see https://www.globalreporting.org/standards/standards-development/topic-standard-project-for-tax/.

[3] For more details, see Schedule 19 of the Finance Act 2016, https://www.gov.uk/guidance/large-businessespublish-your-tax-strategy. This has been also explicitly stated by David financial former secretary of HMRC in an interview shortly after the introduction of the mandatory tax strategy report. See https://www.theguardian.com/business/2015/jul/23/big-businesses-agree-stop-aggressive-tax-planning-hmrc.

is that the HMRC is regulating the disclosure but explicitly relies on public scrutiny, such as naming and shaming, as the enforcement mechanism.[4]

For public pressure to influence firm behavior, a disclosure must impose additional costs on the firm. The regulation we study has the requisite characteristics. Mandating *qualitative* tax disclosures could be informative for stakeholders, given previous findings on the informativeness of a narrative discussion on tax risks in annual reports (Campbell et al. [2014]; Beatty et al. [2019]; Bozanic et al. [2017]). In our setting, firms were already disclosing information voluntarily before the reform (PwC, [2016]), and behavioral change may occur mainly due to a reduction in information processing costs for stakeholders. The regulation we analyze provides four clearly defined categories of disclosure that facilitate benchmarking (Robinson and Schmidt [2013]; Healy and Palepu [2001]; Maines and McDaniel, [2000]). In addition, qualitative disclosure can provide previously unavailable nuance about firms' tax affairs, for example, by offering a detailed description of which strategies are vulnerable to tax law changes. In the context of financial disclosures, textual information provides insights into the how the numerical data was generated and helps in understanding corporate decisions (Li [2010]). This regulation could therefore increase stakeholders' attention to tax strategy disclosures, resulting in additional pressure on firms to improve reporting and tax compliance.

On the other hand, research provides mixed evidence about the reputational costs of tax avoidance (Gallemore et al. [2014]; Chen et al. [2019]; Hoopes et al. [2018]; Dyreng et al. [2020]). Especially given the qualitative nature of tax strategy disclosures, firms may be tempted to communicate that their actions comport with broad societal interests without actually changing their underlying behavior. Qualitative CSR information risks being boilerplate and vague (SASB [2017]) and can be harder to verify than quantitative information (e.g., Christensen et al., 2021; She, [2021]) potentially resulting in unsubstantiated claims (O'Donovan, [2002]). This practice is commonly referred to as "greenwashing"

[4] In the consultation documents related to the regulation we read "A legislative requirement for all large businesses to publish their tax strategy, enabling shareholder, investor, and public scrutiny of their approach towards tax planning and tax compliance" (HMRC [2015]). A chief executive at the HMRC also stated "If they [large businesses] have to explain to people what their tax strategy is, it does have an effect on their behavior" (Financial Times [2016]).

in the CSR literature (Siano et al., [2017]; Christensen et al., [2021]). Thus it is unclear upfront whether imposing tax strategy reporting will lead to the intended outcomes.

We study whether the mandate fulfilled two objectives that are common among tax transparency regimes: improving disclosures and reducing avoidance. We start by considering the effects on the availability of tax information, which we proxy by the *quantity* and *quality* of tax strategy disclosures in the annual reports. We focus on changes in tax strategy disclosures in the annual report for three reasons. First, while nearly all the UK-headquartered firms we analyze publish a separate tax strategy report, most also had voluntarily discussed their tax strategy in their annual reports before the mandate (PwC [2016]). This feature allows us to investigate the causal effects of the mandate on changes in firms' quantity and quality of tax strategy disclosure, holding the disclosure outlet fixed. Simply using the newly published standalone tax strategy reports, we would not be able to do so, as we cannot compare this disclosure to firms' pre-reform behavior. Second, an annual report is more salient and easier to access than a standalone report published somewhere on a firm's website: becoming aware of the standalone report and processing the information entails significant incremental costs to stakeholders (Belnap [2022]).[5] Third, and more generally, annual reports are a critical firm disclosure outlet, and our goal is to evaluate the reform's *overall* effect on firms' tax disclosure. While we expect the mandate to increase the quantity of tax disclosure, the effect on quality is more ambiguous. An unintended consequence of the mandate could be to reduce the quality of tax disclosure in annual reports.

To quantify the availability of tax information in the annual report, we build a novel text-based measure. First, we manually classify sentences describing firms' tax strategy from a representative subsample of annual reports. We then use naïve Bayes machine learning to classify sentences in all annual reports in our sample as those about tax strategy. We measure the *quantity* of tax strategy information disclosed with the number of tax strategy sentences and the number of words in these sentences. We measure its *quality* by computing the level of boilerplate and the specificity of firms' tax

[5] In the descriptive part of the paper, we provide evidence on the complementarities between the tax strategy information disclosed in both outlets and discuss how firms chose what to disclose and where. We show that tax strategy disclosure in annual reports resembles that in the mandated reports and that both the length and specificity between the two are positively correlated.

strategy sentences following the textual analysis literature (e.g., Lang and Stice-Lawrence, [2015]; Hope et al., [2016]; Dyer et al., [2017]).[6] Next we consider the effect of the mandate on tax avoidance. We proxy for firms' tax avoidance by cash ETRs, book ETRs, and industry-adjusted cash and book ETRs (Balakrishnan et al. [2019]).[7]

To provide causal evidence, we use a difference-in-differences methodology and compare the UK-headquartered firms affected by the mandate, that is, those with turnover exceeding GBP 200 million or a balance sheet total exceeding GBP 2 billion, and those unaffected, before and after the reform. To exclusively identify the effects of *qualitative* tax disclosure, we exclude the very large firms that fall under the *quantitative* country-by-country reporting requirements, which were introduced around the same time. Hence our treated sample includes only firms above the mandatory *qualitative* threshold and below the country-by-country reporting threshold.[8] Our control group includes UK firms below the *qualitative* threshold, which are most comparable to the treatment group. For this purpose, we exclude small and medium-sized firms (SMEs).[9] We further address the concern that the treated and control firms may not be fully comparable in robustness tests using different propensity-score matched samples and a regression discontinuity analysis. We focus on the UK-headquartered firms as the compliance burden of the 2016 reform is similar and applies to the whole firm, not just a UK portion of its operations, as would be the case with foreign multinationals. Our final sample includes 120 firms with 839 observations over the period 2010–2019.

The first set of results refers to the effects of the reform on disclosure quality and quantity and tax avoidance. We show that the volume of tax strategy disclosure increased on average: treated firms intend to exceed the law's requirements by providing both a separate tax strategy report *and* increasing tax

[6] Boilerplate identifies the portion of phrases that a firm uses in its tax strategy disclosures that are common. Specificity represents the percentage of words in the tax strategy disclosures that provide specific information as captured by names of persons, locations, and organizations. The intuition behind specificity is that, when disclosures are specific, firms are providing relevant details on a subject matter in contrast to making boilerplate statements. See Section IV for details on how we operationalize these concepts with examples.
[7] Unless the reform affects tax avoidance, we do not expect it to affect firm behavior further.
[8] Firms included in our sample have median cash ETRs of 21% and book ETR of 22%, similar to the ETRs of country-by-country firms, 23% for both cash and book ETR. We do not include the latter in the analysis, but our sample appears to have similar tax avoidance opportunities.
[9] Following the EU and UK definition, SMEs are firms with less than 50 employees, less than GBP 11.4 million total assets, or less than GBP 22.8 million annual turnover.

strategy disclosure in their annual reports. The number of sentences and words used to describe tax strategies in the annual reports increased significantly. However, the quality of tax strategy information provided in annual reports decreases, as the level of boilerplate increases significantly. Additionally, we find no evidence that firms reduce their tax avoidance. We show that the parallel trends assumption holds in the pre-reform period and that firms do not anticipate the reform both in terms of disclosure and tax avoidance outcomes. One potential concern with the insignificant results on tax avoidance could be that our tests lack power, due to rather small sample size. However, in robustness tests, when we match firms on a set of observable characteristics, in some instances we even find a statistically significant increase in tax avoidance, as opposed to the policy-intended decrease.

In the second part of the paper, we focus on understanding a potential mechanism that could be driving our results. UK policymakers wanted large firms to provide insights into their tax-related practices. They aimed to discourage aggressive tax planning via increased public attention (HMRC, 2015, Point 1.18.).[10] The UK public had already demonstrated a strong interest in firms' tax affairs, and anecdotal and empirical evidence shows that public attention had induced changes in firm tax disclosure and tax avoidance in response to *quantitative* mandates (Campbell, 2014; Dyreng et al., 2016). We thus empirically investigate whether public pressure influences our results, by splitting the baseline sample into firms subject to high and low media attention measured in the pre-reform years. Our results indicate that firms subject to low public attention increase the volume of tax strategy disclosure in their annual reports, relative to control firms in that subsample. Firms subject to high public attention already had high levels of tax strategy disclosure before the reform, and the new requirement does not change their behavior significantly, relative to the control group. In contrast, the level of boilerplate for the high public attention subsample increases significantly for treated firms, and treated firms subject to low public attention provide more specific disclosures after the mandate. We find no effect on tax avoidance in either of those two subsamples.

[10] For a similar scope of public attention to firms' tax strategies in the United States see also: https://www.forbes.com/sites/taxnotes/2022/06/28/microsoft-and-cisco-face-shareholder-pressure-over-public-disclosures/?sh=4484bf595d39.

In an additional analysis, we test whether the reaction to the mandate differs for tax aggressive versus nontax-aggressive firms (defined using median pre-treatment cash ETR), since tax aggressive firms were the main policy target. We find that these firms increase the *quantity* of tax strategy disclosure significantly more than less tax-aggressive firms. At the same time, their boilerplate increases significantly with no reduction in tax avoidance. Put differently, firms appear to discuss their tax strategy more, but the quality of their disclosures is lower, and their tax planning is unaffected.

These findings are consistent with the mechanism discussed above, as the most tax-aggressive firms, that is, the target of the regulation, do not feel pressured to change and instead "greenwash" their tax strategy via increases in low-quality disclosures. On the other hand, we find a statistically significant improvement in the quality of tax strategy disclosure for the low media attention firms. The regulation could have increased the cost of lower quality disclosure for those firms, as they might have experienced the largest change in public attention.

Our study contributes to two streams of literature that analyze the effects of mandated disclosure on firm activities. Specifically, it addresses (1) the effects of tax transparency initiatives and (2) the effects of CSR-type narrative disclosures. While there is a growing literature on the effects of *quantitative* tax disclosures, researchers know little about the effects of *qualitative* tax disclosures, despite their increasing popularity. Mandating the disclosure of *quantitative* tax information can affect firm behavior (Blouin et al. [2010]; Tomohara et al. [2012]; Gupta et al. [2014]; Henry et al. [2016]; Hope et al. [2013]; Joshi [2020]; Joshi et al. [2020]; Overesch and Wolff [2021]), and it offers valuable information to tax authorities (Bozanic et al. [2017]). At the extreme, mandating the disclosure of country-level economic activity can affect the organizational structures of multinationals (De Simone and Olbert [2022]). We contribute to the literature by providing novel evidence on the effects of mandating the reporting of *qualitative* tax information on firm disclosure choices and tax avoidance. We show that a qualitative mandate can have unintended consequences on the quality of overall tax disclosure and does not lead to reductions in tax avoidance. A concurrent paper, by Xia [2020] also employs our setting. Xia [2020] studies the effect of mandating *qualitative* tax information in the United Kingdom on tax avoidance and the quality of the mandated tax strategy reports. Her results support our

conclusion of no reduction in tax avoidance. Our paper complements hers, as she does not investigate the effect of the mandate on overall tax transparency, the second policy goal, but focuses on the quality of tax strategy reports. In this paper, we provide causal evidence on the consequences of the UK mandate on the *quantity* and *quality* of tax disclosures in *annual reports*. As such, we account for the fact that many UK firms were voluntarily providing tax strategy information before the reform, and we demonstrate an unintended consequence of the reform: the deterioration of tax strategy disclosure quality in annual reports.

Second, we contribute to the literature on CSR by analyzing the effects of a CSR-like narrative disclosure mandate where firms can exploit the discretion allowed and engage in "greenwashing." Since qualitative information is harder to verify (She [2021]), firms seem to be able to provide unsubstantiated disclosures that comport with what stakeholders want to hear (Cho and Patten [2007]; Christensen et al. [2021]), as supported by our findings in the tax aggressive and high public attention subsamples. We extend the findings of Dyer et al. [2017] by documenting that, in addition to accounting standards and financial regulators initiatives, mandating nonfinancial disclosure can affect the information volume and content of financial disclosure and reduce its quality. Hence, for CSR-type mandated disclosures to desirably affect firm behavior, for example, to reduce tax avoidance, they may need to be more verifiable than the currently proposed formats for tax strategy reports in the United Kingdom and the very similar recent Global Reporting Initiative Tax Standard (GRI 207).[11] Otherwise firms can comply with the disclosure standard by providing the required information without reconciling it with their underlying real activities.

II. INSTITUTIONAL SETTING

Domestic and international regulations are increasingly mandating multinationals around the world to disclose more information on their tax strategies and the geographical distribution of tax payments. While early initiatives focused exclusively on mandating quantitative disclosure,[12] more recent

[11] See https://www.globalreporting.org/standards/media/2482/gri-207-tax-2019.pdf.
[12] Examples include the Dodd-Frank Financial Reform and Consumer Protection Act, the FIN48, the EU CRD IV and the Capital Requirements Regulation, the Action 13 of the BEPS project, which has now been introduced in most countries around the world.

proposals and regulations have centered on promoting or demanding *qualitative* disclosure.[13] In this paper, we focus on the UK tax strategy disclosure regulation, which was passed in Parliament on September 15, 2016. This new requirement applies to firms with a UK presence having a turnover exceeding GBP 200 million or their balance sheet total assets exceeding GBP 2 billion in the last year.[14] Those firms have to publish either a separate tax strategy report on their website or integrate the discussion of their tax strategy in an existing report, for example, the annual report, and the board is responsible for approving it.[15] All but three treated firms in our sample have a separate tax strategy report.[16]

The information required covers four topics. First, firms must discuss how their UK tax risk is managed, resulting in such statements as "The CFO and Head of Tax oversee tax risk management, which is undertaken by the Group's tax team. The tax team consists of the Head of Tax, who leads the team, two Tax Managers and a Tax Accountant." or "Overall responsibility for ensuring that tax risk is managed effectively across the Group lies with the Board. The Audit Committee reviews the effectiveness of the risk management process on behalf of the Board."[17]

Second, firms should describe their attitude to tax planning resulting in such sentences as "Cairn undertakes tax planning that supports our business and reflects commercial and economic activity. The Group's policy is not to enter into any artificial tax avoidance schemes" or "Cairn will base its views on the relevant tax laws in force at the time and seeks to minimize disputes."[18]

Third, firms should offer insights on their tax risk appetite, which led to such disclosures as "It is the aim of RM to minimize the level of risk taken in relation to both UK and overseas taxation matters

[13] Recent initiatives promoting the disclosure of qualitative tax information include the Tax Transparency Package Proposal by the European Commission in 2015, the Global Reporting Initiative Tax Standard (GRI 207), the UK tax strategy regulation, and the Australian voluntary Tax Transparency Code.
[14] For more details, see HMRC [2016]. UK subsidiaries of a multinational group with global turnover exceeding EUR 750 million are also required to publish a tax strategy report. See Schedule 19 "Large business: tax strategies and sanctions" of the Finance Act 2016, available at https://www.legislation.gov.uk/ukpga/2016/24/schedule/19.
[15] For the complete law, see "Schedule 19 - Large business: tax strategies and sanctions" of the Finance Act 2016, available at https://www.legislation.gov.uk/ukpga/2016/24/schedule/19.
[16] The three firms that do not have separate tax strategy reports. All included discussion of their tax strategy in their annual report before the mandate was enacted. Hence, we keep them in the sample.
[17] The sentences are taken from SEGRO's Tax Strategy.
[18] The sentences are taken from Cairn's Tax Strategy.

wherever possible. Given the size and diversity of the business, taken with the complexities of taxation legislation in multiple tax jurisdictions, it is inevitable that an element of tax risk will arise" or "Where complete mitigation of a risk is not possible, reduction to a minimum level is sought."[19]

Fourth, firms should explain their relationship with HMRC, which was done in such sentences as "The Group is committed to the principles of integrity, transparency and openness and seeks to apply these in its dealings with the UK tax authorities*"* or "Where possible we seek constructive and early discussions on any new tax matter to obtain certainty. We engage positively when discussing any differences in legal interpretation between ourselves and HMRC."[20]

Besides the existence of moderate monetary penalties,[21] compliance was expected to be achieved mainly via public pressure. In 2010, UK firms were subject to public scrutiny from ActionAid International, a global nonprofit organization, highlighting how around 50 percent of the FTSE100 were not compliant with the requirement to disclose the full list of subsidiaries and their respective locations in annual reports. The reputational threat was sufficient to induce almost all FTSE100 to become fully compliant within two years after the ActionAid International campaign (Dyreng et al. [2016]). There was a similarly successful public shaming campaign aimed at inducing noncompliant US-headquartered firms to publish their tax strategy reports (Belnap [2022]).

In our setting, UK firms' awareness of societal interest in corporate tax affairs resulted in the disclosure of tax strategy information for the UK multinationals long *before* the tax strategy report was mandated (PwC [2016]). For example, in the United Kingdom in 2016, 66% of the FTSE100 companies disclosed their approach to tax and their tax governance voluntarily. However, according to the UK survey data, tax-aggressive firms might be exactly the ones less willing to voluntarily disclose tax-related information (TNS [2015]). Thus forcing all large firms to provide insights into their tax-related

[19] The sentences are taken from RM's Tax Strategy.
[20] The sentences are taken from Clipper Logistics' Tax Strategy.
[21] There is a penalty for not publishing a tax strategy report: a noncompliant firm faces a monetary punishment of GBP 7,500 for being caught without a tax strategy report and another GBP 7,500 if the report is not published six months after it should have been, plus GBP 7,500 for each following month until the firm becomes compliant.

practices had the goal to discourage aggressive tax planning via increased public attention on the tax practices of corporations (HMRC [2015], Point 1.18.).

III. HYPOTHESIS DEVELOPMENT

In 2016, the UK government mandated the disclosure of a tax strategy report with the aim of (1) increasing the availability of tax information to the general public and (2) reducing tax avoidance. In what follows, we develop our hypotheses related to how the reform can affect these two margins.

The Availability of Tax Information

Increasingly, taxes are seen as part of a firm's corporate social responsibility (e.g., Grewal and Serafeim [2020]), and both investors and other stakeholders value firms' efforts concerning these issues. As such, we would expect firms to react to the mandate by conveying that their actions comport with broader societal interests across all corporate communication channels, that is, not only by issuing a standalone tax strategy report but also by incorporating this disclosure in the financial reports (O'Donovan [2002]). The annual report may be an especially salient disclosure outlet, as it is considered a more credible and visible medium, relative to other reports (Grewal [2019]). However, it is unclear whether an increase in the volume of disclosure would lead to an increase in the *quality* of tax information available to the public.

On the one hand, tax strategy disclosure quality could increase, as Schedule 19 of the Finance Act 2016 provides clear categories for the information to be disclosed. Clear categories imply that the mandate may function well for stakeholders as a benchmarking tool by reducing the cost of comparing the tax strategy disclosures between firms (Robinson and Schmidt, [2013]; Healy and Palepu, [2001]; Maines and McDaniel [2000]). Benchmarking works as public pressure device, as it helps stakeholders to draw conclusions on firms' *relative* compliance (Christensen et al. [2021]) and can induce firms to increase transparency around their tax affairs. On the other hand, due to the *qualitative* nature of the disclosure, firms may be able to draft the tax strategy disclosure in a vague language (Freedman and Vella [2015], [2016]), thus providing low quality disclosures. Our first set of hypotheses follows.

H1a: *The tax strategy mandate will induce firms to publish a tax strategy report and will increase the volume of their tax strategy disclosure in the annual report.*

H1b: The mandate to disclose tax strategy information will not affect the quality of tax strategy disclosure in the annual report.

Tax Avoidance

The literature has mainly focused on analyzing the effects of mandating *quantitative* tax information on tax avoidance. For example, in the context of FIN48 adoption in the United States, evidence suggests that public disclosure of additional tax figures on unrecognized tax benefits can enable the detection of tax avoidance (Lisowsky et al. [2013]) and help estimate current and future tax figures (Ciconte et al. [2016]). While at the same time the quality of FIN 48 disclosures is lower for more tax aggressive firms (Robinson and Schmidt [2013]). Further, there was a documented reduction in tax avoidance (measured in terms of changes in different types of ETRs) after the introduction of FIN48 (e.g., Hope et al. [2013]; Gupta et al. [2014]; Henry et al. [2016]).

Requiring the disclosure of *qualitative* tax information could induce similar benefits. Mandating the publication of a tax strategy report should foster shareholders', investors', and the public's scrutiny over firms' tax affairs. For example, in the United Kingdom, intensive media coverage of tax scandals has increased the transparency of firms' tax affairs and reduced their tax avoidance (Dyreng et al. [2016]). Further, increases in transparency, especially that related to CSR-type disclosure, can affect firms' strategies (Wu et al. [2020]). Therefore, we would expect that mandating a formalized written tax strategy can reduce corporate tax avoidance through public scrutiny.[22] Some benefits may also be specific to the qualitative nature of the UK disclosure mandate. This is because qualitative, as opposed to purely quantitative disclosure, can give more nuanced information on firms' tax affairs. In the context of financial disclosures, textual information provides insights into how the financial statement data was

[22] Following the literature, we focus on tax avoidance as a first order outcome. Recent evidence shows that regulations limiting tax avoidance can lead to real economic consequences for firms, e.g., changes in employment, investment, and asset holdings (Bilicka et al., 2021; Serrato, 2018). Hence, if the qualitative tax disclosure mandate affects tax avoidance, it may also alter real outcomes for these firms. Since we do not expect any changes in tax avoidance of firms, we also would not expect any other real behavioral changes to affect firms that have to disclose the qualitative tax information after the reform.

generated and helps illuminate corporate decisions (Li [2010]). As such, *qualitative* disclosure can help information processing by less sophisticated users of disclosures (e.g., the general public and employees), who are the main targets of this CSR-like disclosure.

However, mandating the disclosure of *qualitative* tax information can have drawbacks, compared to *quantitative* tax information, because of the inherent characteristics of such disclosure. Specifically, nonnumerical disclosure may be disregarded by NGOs because it is harder to verify (She [2021]) since it can be drafted using boilerplate and vague terms (Hope et al. [2016]; Christensen et al. [2021]). In line with this, anecdotal evidence indicates that stakeholders are concerned over the quality of tax strategy disclosures.[23] Hence we may see no change in firm tax planning after the mandate for a tax strategy report is introduced. Our second hypothesis follows:

H2: Following the tax strategy mandate, firms will not reduce the level of tax avoidance.

IV. SAMPLE SELECTION AND VARIABLE MEASUREMENT

Sample Construction

Our initial sample consists of 1,895 listed firms that have headquarters in the United Kingdom based on the ownership information from the Bureau Van Dijk Orbis database. We focus our analysis on listed firms for two reasons. First, to construct our measure of tax disclosure, we require firms to have easily accessible and comparable annual reports, that is, all written under international financial reporting standards (IFRS) rather than local generally accepted accounting principles (GAAP) standards. Second, listed firms may be subject to more public scrutiny (Dyreng et al. [2016]). Thus, we expect that they would face the highest compliance burden and the highest reputational costs. The reason we focus on UK multinationals is twofold. First, multinationals face similar tax avoidance opportunities, which differ from those of domestic firms (Bilicka [2019]). Second, all UK multinationals face similar

[23] Cisco's shareholders have stated in relation to the UK Tax Strategy report the company issues: "The document is not fit-for-purpose, insofar as it does not provide investors with the information to undertake an appraisal of the company's tax risk appetite" (https://www.forbes.com/sites/taxnotes/2022/06/28/microsoft-and-cisco-face-shareholder-pressure-over-public-disclosures/?sh=23a665515d39).

compliance burdens concerning the 2016 reform. These are higher, compared to non-UK headquartered foreign multinationals, for which only part of the structure is subject to the regulation.

For each of those 1,895 firms, we obtain data from three different sources. Accounting data and firm information come from Datastream and firm media exposure comes from RavenPack. We merge these datasets using ISIN numbers. We then add annual reports from the Perfect Information Filings Experts database, matching by firm name to firms in Datastream. We then remove observations for which the annual report has not been correctly converted and for which we have no financial data on relevant variables (tax paid, pre-tax income, assets, sales) two years prior and two years after the reform. Next we restrict our sample to firms that are not subject to country-by-country reporting and are not small to medium-sized.[24]

In the United Kingdom, the country-by-country reporting requirement was also introduced in 2016, but at a different size threshold, as it applies to multinationals with sales above EUR 750 million. Excluding these firms enables us to isolate the effect of mandating the disclosure of a tax strategy report from that of mandating country-by-country reporting. Our cleaned sample consists of 2,104 firm-year observations for 225 unique firms.

Using this sample, we construct treatment and control groups for our analysis. Our treated firms are multinationals that must publish tax strategy reports from 2016 onward but do not have to disclose country-by-country reporting, that is, firms that have over GBP 200 million in annual sales or GBP 2 billion of total assets but have sales below EUR 750 million. Firms in our control group are those that do not have to publish the tax strategy report, the country-by-country report, and are not small or medium-sized. Of the 225 firms in our sample, 113 are treated, and 112 belong to the control group. Given that Schedule 19 of the 2016 Finance Act set thresholds at the unconsolidated level but UK firms are not required to disclose their unconsolidated profit and loss account when having a consolidated one

[24] To identify small and medium-sized firms, we use the definition provided under the UK R&D tax credit regulation. They are firms with less than 50 employees, less than GBP 11.4 million total assets, and/or less than GBP 22.8 million annual turnover. Removing these firms alleviates the concerns that differences in ETRs are not driven by tax avoidance but by the different generosity of the R&D tax credit for small and medium-sized firms versus other firms.

(see Company Act 2006 – S408), we use consolidated data to define thresholds. We validate the definition of our treatment by hand collecting tax strategy reports for our treated firms and find tax strategy reports for 75 out of 113 firms. We manually inspect annual reports for firms for which we did not find tax strategy reports and find that their UK operations are likely too small to be subject to the mandate. To avoid incorrect assignments, we drop these 38 firms. We find no tax strategy reports for firms in the control group. Finally, we remove missing and singleton observations. Table 1 provides an overview of each step of the final sample selection. Our final sample consists of 120 unique firms: 57 firms belong to the treated group, and 63 firms belong to the control group.

Measures of Tax Strategy Disclosure

We construct a firm-level measure of tax strategy disclosure in the annual report by employing textual analysis techniques. We pick a representative subsample of annual reports from years 2010 to 2016 and manually collect sentences in which firms discuss their tax strategy. Our classification is based on a PwC analysis of the voluntary tax disclosure in annual reports of firms listed in the FTSE100 (PwC [2016]). This analysis considers five categories of information: approach to tax, tax governance, cash tax reconciliation, total tax contribution, and geographical reporting of the tax liability. We only consider the first two categories because they represent purely qualitative tax information and reflect the information required in the tax strategy reports under Schedule 19 of the Finance Act 2016.

We use our manually constructed training sample to classify the tax sentences in all annual reports using the naïve Bayes classifier. We use a test sample to evaluate the effectiveness of the classifier and find consistently high levels of *accuracy* and *recall* ranging from 0.88 to 0.95.[25] Based on the classified sentences in each annual report, we construct a measure of the volume of firm-year level qualitative disclosure, which is equal to the number of tax strategy sentences in a firm's annual report. In Appendix B, we include examples of the tax strategy sentences classified using the trained naïve

[25] For a detailed description of the technique and robustness analysis of the machine learning approach used in this paper see Appendix B.

Bayes classifier. We include the number of words as an additional proxy for the *volume* of tax strategy disclosure provided.

Having isolated the portion of the annual report in which a firm discusses its tax strategy, we follow the literature studying qualitative disclosures (e.g., Dyer et al. [2017]; Hope et al. [2016]; Lang and Stice-Lawrence [2015]) to construct two proxies for the *quality* of the information provided: the level of boilerplate and the degree of specificity. The level of boilerplate captures the amount of common phrases that a firm uses in its tax strategy sentences and is computed as the portion of trigrams in a firm's tax strategy sentences that is found in at least 5 percent of the documents in a given fiscal year. To measure the degree of specificity, we use the Stanford Named Entity Recognition (NER) tool and capture specific words that convey detailed information that is relevant to the disclosing firm. Specific words are determined on the basis of how often the text refers to people, places, organizations, times, or numbers. We scale the number of specific words by the number of tax strategy words in the annual report. We provide examples of tax strategy sentences including common phrases and specific words in Appendix C.

From a methodological perspective, the machine learning approach we use to classify tax strategy sentences refines previous methodologies, which mostly used the dictionary approach (e.g., Balakrishnan et al. [2019]; Campbell et al. [2014]; Allen et al. [2021]). As such, we contribute to the growing literature that uses machine learning to capture qualitative disclosures (e.g., Donovan et al., [2021]).

In an untabulated analysis, we consider firm characteristics that determine which firms discuss their tax strategy before the 2016 reform and the extent of their disclosures. We show that media attention encourages a firm to offer insights into its tax practices. Another important driver of a firm's willingness to discuss its tax strategy and the extent of the disclosure is board composition. Firms with a higher degree of tax and accounting expertise on the board tend to disclose their tax strategy in the annual reports, and, in such firms, this type of disclosure is, on average, longer, compared to firms with no tax and accounting expertise among board members.

Measure of Tax Avoidance

Following Hanlon and Heitzman [2010], we employ as our main measure of tax avoidance a commonly used proxy available when analyzing non-US settings, cash ETRs. We test the robustness of our results using book ETRs and industry-size adjusted tax aggressiveness (Balakrishnan et al. [2019]) as alternative proxies. The industry-size adjusted tax aggressiveness measure is the difference between the three-year cash ETR (book ETR) and the median cash ETR (book ETR) of the industry-size cohort to which the firm belongs (where the median is a within three-year median). Following the related literature, we set ETR observations in loss years to missing, since losses distort ETR-based tax measures and inhibit interpretation (e.g., Dyreng et al. [2017]; Chyz et al. [2019]; Robinson et al. [2010]).

Note that book and cash ETR proxies capture nonconforming tax avoidance only and do not capture changes in tax accounting accruals. However, our sample is exclusively composed of listed firms, which face high capital market pressure and thus are less likely to adopt conforming tax avoidance (e.g., Hanlon and Heitzman [2010]; Badertscher et al. [2019]). Cash ETR captures tax deferral strategies, which are not included in the book ETR measure. Further, since our sample consists of UK headquartered firms only, this limits the types of tax avoidance proxies available to us. The lack of foreign tax expenses prevents us from using book-tax difference proxies, and reporting of the item "unrecognized tax benefit" is not required under IFRS.

V. DESCRIPTIVE EVIDENCE

Characteristics of Control and Treated Groups

In Table 2, we show the pre-2016 descriptive statistics for the variables used in our analysis, which we break down into treatment and control groups.[26] Treated firms in our sample devoted more of their annual report disclosure to discussion of their tax strategy with 5.3 tax strategy sentences (196 tax strategy words), which corresponds to 0.4 percent of the total sentences in the annual report. Firms in the control group disclosed, on average, 3.4 sentences (128 tax strategy words). In general, we do not observe statistically significant differences in the quality of tax strategy information provided by treated

[26] In Table A1 of the online appendix, we provide descriptive statistics for the complete sample period.

and control groups. Firms in our sample have mean cash ETRs of 24.6 percent. This again is not statistically significantly different between the treated and control group firms. However, treated firms are significantly larger, have more leverage, are older, less likely to incur losses, and have higher growth opportunities, operating volatility, analyst following, and media attention. Differences in size between treated and control groups are to be expected, given that the threshold to belong to the treated group depends on size and turnover.

Tax Strategy Reports or Annual Reports Disclosure?

A unique feature of the UK Tax Strategy disclosure requirement is that, when complying with the mandate, firms can choose their disclosure outlet. Here we investigate this choice and study how tax strategy disclosure in the annual report relates to that in the tax strategy report.[27] Our results are reported in Tables 3 and 4 and Figure 1. We find that 95% of treated firms in our sample issue a standalone report.

In Table 3, we summarize the characteristics of the tax strategy reports of our treated firms. First, the length of documents in our treated sample varies substantially with an average length of 784 words and 29 sentences and a standard variation of 507.11 words.[28] Second, on average, the level of boilerplate is 24 percent, and the degree of specificity is 7 percent, but the reports exhibit a large variation in terms of specificity, 2 percent to 19 percent.[29]

In Table 4, Panel A, we show pairwise correlations between characteristics of each of the reporting outlets. We look at correlations between the volume and quality of tax strategy disclosure in

[27] For the comparison, we use the 2017 fiscal year annual report.

[28] In Online Appendix B, we present examples of two extreme cases. RPS, a UK multinational offering professional services, provides a one-page tax strategy report, where the description of its tax planning strategy and its relationship to tax authorities is limited to a few lines while the discussion of its risk management extends over three paragraphs. Jupiter, a UK fund management group, presents an 11-page report, where, besides the mandatory topics, it offers an overview of the firm's total tax contribution and geographical distribution of tax payments.

[29] In Online Appendix B, we present an example of a tax strategy report with a high degree of specificity. Macfarlane, a UK packaging and label multinational, scores 19 percent on our specificity index. For example, it states the exact period to which the described tax payment overview refers, it describes organizational details of the tax function, and it lists each subsidiary with the corresponding name and location.

the standalone report and the annual report. We find that the length and specificity between the two are positively correlated, suggesting some degree of complementarity.

In Figure 1, Panel A, we plot the distribution of the similarity between the annual report tax strategy disclosure and the tax strategy report.[30] The similarity score ranges between 20 percent and 80 percent, and it is homogeneously distributed over this interval. In Panel B, we show that firms that have similar information in the annual report and the tax strategy report tend to have lengthier, more boilerplate, and less specific disclosures. Firms that have more dissimilar information in the two outlets have shorter and more specific disclosures. These results suggest that the high similarity between the tax strategy disclosure in the separate report and the annual report may be a sign of copying and pasting information from the separate tax strategy report verbatim. This does not offer any additional specific information but lengthens the annual report and increases the volume of disclosure. We investigate this issue casually below.

In Panel B of Table 4, we examine whether a firm's cash ETR is correlated with the disclosure patterns in both the tax strategy and annual report. We split firms according to high or low disclosure across all disclosure outcomes and examine mean cash ETRs for each. We document that firms with a lower cash ETR are those that have longer tax strategy disclosures in the annual report and use more boilerplate.[31] This provides first evidence for greenwashing, that is, longer unsubstantiated reports.

VI. CAUSAL EFFECTS OF THE UK DISCLOSURE MANDATE

Difference-in-Differences Estimations and Evidence

To causally identify the effects of mandating disclosure of qualitative tax information, we use the introduction of mandatory tax strategy reporting in the United Kingdom in 2016 as an exogenous shock to tax information disclosure and employ a difference-in-differences strategy. This legislation requires groups over a certain size to disclose additional qualitative tax information. Thus we consider firms that must publish a tax strategy report as treated firms. As a control group, we use firms that are

[30] We capture the similarity of the tax strategy disclosures in the two outlets by computing the cosine similarity.
[31] We find the coefficients to be different from each other, yet the difference is not statistically significantly.

below the size threshold and are not required to publish a tax strategy report.[32] Our difference-in-differences specification takes the following form:

$$ReformOutcomes_{it} = \alpha + \beta_1 Post_t \times TaxStrategyReport_i + BX_{it} + \gamma_i + \delta_t + \varepsilon_{it}, \quad (1)$$

where i is firm and t is year. $Post_t$ is a dummy, which denotes years after 2016.[33] $TaxStrategyReport_i$ is a dummy equal to one for those firms that must publish a tax strategy report. For firm-level controls (X_{it}), we follow Balakrishnan et al. [2019] and use size, leverage, age, geographical complexity, market-to-book ratio, operating volatility, an information production quantity proxy, and performance volatility. We include firm (γ_i) and year (δ_t) fixed effects. Thus we estimate the effect of mandatory disclosure using the within-firm variation. We cluster standard errors at the firm level.

We examine the effects of the reform on the *volume* of tax strategy information as proxied by the number of tax strategy sentences (*Tax Strategy Sentences*$_{it}$) and the number of words in these sentences (*Tax Strategy Words*$_{it}$). We then consider the *quality* of the tax strategy disclosures as proxied by the level of boilerplate (*Boilerplate*$_{it}$), and the degree of specificity (*Specificity*$_{it}$). We then test whether mandating a tax strategy report has an impact on firm tax avoidance, measured by cash ETR (*Cash ETR*$_{it}$), book ETR (*Book ETR*$_{it}$), and the industry-size adjusted tax aggressiveness measure of cash and book ETR (*Ind.-Size Adj. TA Cash (Book) ETR*$_{it}$).

Hypothesis 1 indicates that the reform will increase the *volume* of tax strategy disclosure in the annual reports but not the *quality*. Thus we expect coefficient β_1 to be positive and significant in regressions with *Tax Strategy Sentences*$_{it}$ and *Tax Strategy Words*$_{it}$ as dependent variables and small and insignificant in regressions with tax strategy disclosure *quality* measures. Hypothesis 2 suggests no

[32] Our choice of control group firms is restricted to the United Kingdom because of the need of an annual report in comparable format to our treated group. The advantage of a UK control group, however, is that we can control in our research design for shocks to the UK economy that would affect firms' disclosure and ETRs in the control and treated groups equally by differencing out the common time trend within the United Kingdom.

[33] Although the first articles highlighting the proposal to introduce a mandatory tax strategy report are from May 2015, the size threshold was only announced in the summer of 2015 (HMRC [2015]). This threshold applied to turnover and assets in 2015. The reform is effective for fiscal years starting on or after September 2016.

effect on tax avoidance. Hence we expect the coefficient on β_1 to have a small magnitude and to be insignificant in specifications with measures of *tax avoidance* as outcome variables.

We present the results in Table 5, Panels A and B. Panel A, Columns (1) and (2), show the results for the quantity measures, and columns (3)–(6) for the quality ones. We find that, for affected firms, the volume of tax strategy disclosure in the annual report significantly increased, relative to the control firms, after the reform. Results from Column (2) indicate that treated firms after the reform increased the number of sentences describing their tax strategy in the annual report by 2.8 on average, compared to control firms. Given that the average treated firm had 5.3 tax strategy sentences in its annual report before the reform (Table 2), this suggests an increase of almost 52 percent. Results from Columns (3) and (4) indicate that the mandate significantly increased the level of boilerplate, without having much effect on specificity. In Panel B, we report the effects of the reform on tax avoidance. In Columns (1)–(2), we fix the sample to be the same as in our analysis of tax strategy disclosure outcomes (only setting loss years to missing), while in Columns (3)–(6), we extend the sample by retaining those observations with missing tax disclosure outcomes in the sample (missing annual reports). We find no significant effect on tax avoidance for our treated firms after the reform across all measures of tax avoidance. The coefficient sizes are small and, at best, suggest an increase in tax avoidance. Note that *Industry-Size Adjusted Tax Aggressiveness* is defined such that an increase denotes higher tax aggressiveness.

Event Study Evidence

Our identification strategy relies on the assumption that qualitative tax disclosure and the appetite for tax avoidance for the control and treated firms would have evolved in parallel in the absence of the reform. We test the plausibility of this assumption using an event study.[34] We also use this method to evaluate the speed with which the reform affects our outcome variables. We estimate Equation 2

[34] The level differences in firm characteristics in Table 2 do not invalidate our causal identification strategy, especially since we control for them in all specifications. In the robustness section, we provide two additional tests to address any remaining concerns about comparability between treated and control groups. First, we show results using a matched sample. Second, we use an alternative identification strategy, the regression discontinuity design (RDD), to take advantage of the size threshold that defines the treated group.

separately for the control and treated groups. This is a version of Equation 1, in which we replace the coefficient on the interaction between the post-2016 dummy and the treated firm indicator with seven separate indicator variables, each marking one year during the t-4 to t+3 periods, relative to the year before the treatment event date (t=-1). We omit the indicator for period t-1 to serve as a benchmark. The treatment indicators are binned at endpoints, such that t-4 indicates treatment at time t-4 and all previous ones. Hence we do not plot the estimates for t-4 (McCrary [2007]). We estimate the following equation:

$$ReformOutcomes_{it} = \sum_{k=-4}^{3} \beta_k * D_t^k + \gamma_i + BX_{it} + \varepsilon_{it}. \quad (2)$$

The variables of interest are the dummies D_t^k, which indicate a point in time k periods from the reform year (2016). The coefficient on each of those dummies estimates the difference in each dependent variable in that year, relative to year k-1 (2015). As a dependent variable, we use the reform outcome variables described above. We add firm fixed effects (γ_i) as well as controls (X_{it}) and cluster standard errors at the firm level, as specified in Equation 1.

We present the corresponding dynamic event study results in Figure 2. For each year, we plot the coefficient estimates and the 95 percent confidence intervals separately for treated and control groups. We show that the quantity of tax strategy disclosure for treated and control groups evolved similarly before the 2016 reform, with both types of firms increasing this disclosure throughout the sample period. We document that, since the reform, treated firms increased the volume of their tax strategy disclosure in the annual report at a much quicker rate than control group firms, as shown in Panels (a) and (b). Panel (c) shows that the level of boilerplate disclosure did not change before the reform for either treated or control groups but increased afterward, especially for treated firms. The degree of specificity did not change following the reform for either of those groups, as evidenced in Panel (d). Overall our results suggest that the reform was ineffective in increasing tax transparency, as proxied by the quality of disclosure.

In Panels (e) and (f), we show that there was no significant difference in the evolution of cash ETRs and book ETRs between treated and control firms before the reform in any of the pre-treatment periods

as well as in any post-treatment periods.[35] This suggests that firms did not change their ETRs in anticipation of the reform and that the disclosure mandate did not affect tax avoidance. If anything, we observe a small but insignificant decline in cash ETRs, which would suggest an increase in tax avoidance.

VII. THE ROLE OF PUBLIC PRESSURE

We identify public pressure as a potential mechanism through which tax transparency and tax avoidance may be affected by the reform. The literature offers mixed evidence on the effects of public pressure on firm behavior (e.g., Chen et al. [2019]; Dyreng et al. [2020]; Dyreng et al. [2016]). In our setting, Belnap [2022] shows that media scrutiny helped induce compliance to publish tax strategy reports for US multinationals. To test whether public pressure also plays such an important role in the case of UK multinationals, we repeat the analysis from Section VI, splitting the sample into firms subject to high and low media attention measured in pre-reform years. Firms in the high media attention category have above-median news coverage before the reform, while those in the low media attention category have below-median coverage.[36] We present the results in Table 6.

In Columns (1) and (2) in Panel A, we show that treated firms subject to high media attention do not significantly increase the volume of their tax strategy disclosure, relative to the control group, after the reform In Columns (1) and (2) in Panel B, we document that the increase in the volume of tax strategy disclosure observed in our baseline estimates is driven by firms subject to low media attention before the reform.[37] Note that the pre-reform average number of tax strategy sentences in the annual reports is 4.9 for the firms subject to high media attention, while it is 3.7 for firms in the low media attention subsample. In Figure 3, we plot the dynamic evolution of these coefficients separately for treatment and control groups. In Panels (a) and (b), we find that firms in both the treated and control groups subject to high media attention increase the volume of their tax strategy disclosure, which

[35] For brevity we focus on the main measure of tax avoidance in the event study.
[36] An alternative measure for capturing public pressure is being in a B2C business. However, since most firms in our sample are B2C, we do not have enough power to conduct such splits.
[37] We do not find the coefficients to be statistically significantly different from each other, but that could be due to the small sample size. This holds true for all cross-sectional tests on media attention.

explains why we find no effect in the difference-in-differences estimates. They also both start from higher benchmark voluntary disclosure.

This suggests that firms subject to public attention feel the need to justify their tax positions to outside stakeholders, even before the mandate, and this need increases afterward, even for firms not subject to the mandate themselves. This is consistent with the public pressuring those firms to disclose and control group firms' managers possibly expecting their firms to be subject to tax strategy reporting mandates soon as well. In turn, only treated firms with low media attention before the reform increase their disclosure significantly, when compared to the control group firms with equally low media attention.

In Columns (3) and (4), we document mixed results on the effect of the reform on the quality of tax strategy disclosures across the two subgroups. We find that treated firms subject to high media attention significantly increase the level of boilerplate in their tax strategy disclosure, relative to the control group firms, after the reform. At the same time, firms subject to low media attention do not see a similar significant increase; instead specificity increases significantly here. This suggests that the mandate might improve disclosure quality for firms for which the reform is costlier. This is because public attention on the low media attention firms' tax affairs is likely to have increased the most. The event study evidence from Panels (c) and (d) in Figure 3 shows that, while both high and low media attention treated firms increase their level of boilerplate, the low media attention control group firms increase that too. On the other hand, firms subject to high media attention do not see a significant change in the level of specificity, while firms subject to high media attention experience a significant increase in that. Evidence from Panel (d) in Figure 3 suggests that this increase is partially driven by a fall in specificity for the control group. This fall is consistent with an increase in boilerplate for these low media attention control group firms.

In Column (5), we consider the effects of the reform on cash ETR. We find no significant effect in either of the specifications, suggesting that public pressure does not affect real behavior in our setting, even for firms exposed to more public scrutiny. Again we find no significant differences pre and post reform between treated and control groups in the event study.

VIII. ADDITIONAL ANALYSIS: TAX AGGRESSIVE FIRMS

The UK reform was mostly targeted at tax aggressive firms. Hence we expect that firms that were more tax aggressive prior to the reform may react differently than those that were less aggressive. On the one hand, highly tax aggressive firms could increase the quality and quantity of tax strategy disclosure and reduce tax avoidance more. This is because they may be more exposed to broad public attention after the reform, which could result in a need to justify their tax positions. If they cannot credibly do so, they may reduce their tax avoidance. On the other hand, if firms can evade informative disclosure by providing only green-washed disclosures, highly tax aggressive firms may not change their tax avoidance while still increasing the quantity of tax disclosure to display a *commitment* to being good tax citizens. Consistent with this argument, the evidence in Towery [2017] suggests that firms facing the highest costs of disclosing will provide lower quality narrative descriptions to tax authorities in response to Schedule UTP. In Table 7, we explore whether tax aggressive firms react differently to the reform by splitting the sample into highly (low) tax aggressive firms, which we define as those firms with below (above) median cash ETR prior to treatment.

In Columns (1) and (2), we show that treated *tax aggressive* firms significantly increase the volume of their tax strategy disclosure, relative to the control group firms and relative to low tax aggressive firms, after the reform. (The difference across samples is significant at the 5% level.) However, in Column (3), we also find that the level of boilerplate in the disclosures of aggressive firms increases significantly. These results suggest that, while tax aggressive firms increase the quantity of their tax strategy disclosure, this disclosure is uninformative, given its increased level of boilerplate. In Column (5), we consider the effects of the reform on cash ETRs.[38] We find no significant effect in either of the specifications, suggesting that both tax aggressive and nontax aggressive firms do not change their tax planning. These results confirm that even the most tax aggressive firms in our sample (mean pre-treatment ETR of 12%) can increase the volume of their tax strategy disclosure without changing their tax planning significantly. If anything, we find that more tax aggressive firms further reduce their cash

[38] In untabulated robustness tests, we test all alternative outcomes and samples for tax avoidance as used in our main analysis in Table 5. We find no evidence of a change in avoidance in any of the subsamples.

ETR. This could suggest that this reform has allowed tax aggressive firms to be even more aggressive, while describing them superficially to the public and consequently green washing their tax planning.

IX. ROBUSTNESS CHECKS

In this section, we discuss several tests we conduct to check the robustness of our causal findings. First, we show that our results are robust to matching on firms' observable. Second, we examine how our results are affected by the choice of an alternative identification strategy. Third, we consider how a different classification of tax strategy sentences in the annual reports influences our conclusions. The results we discuss here are not tabulated in the main text to simplify the paper's exposition. They can be found in the online appendix.

Propensity-Score Matching

To attenuate the concern that treated and control group firms differ in terms of some of the observable characteristics in the pre-reform periods (see Table 2), we construct a matched sample. We use nearest neighbor propensity-score matching and match within industry on total assets in the two years before the reform: 2015 and 2014. Alternatively, we match on the number of employees. We set the caliper width to 0.2 of the standard deviation of the propensity score and allow for matching of up to four nearest neighbors and replacement. We test the robustness of this matching procedure by using kernel matching and changing the number of nearest neighbors to three or two. Those matching strategies reduce bias but cannot eliminate it.

We find that the results using the matched sample regression resemble our baseline. When matching on total assets (employees) using nearest neighbor matching, the reform increases the tax strategy disclosure in annual reports by 72 (92) tax strategy words and using kernel matching by 97 (99) tax strategy words. Tax strategy sentences increase by between 2.5 to 3.2. In all four matching specifications, the coefficients on the outcomes tax strategy words and sentences are significantly different from zero. When it comes to the effects on the quality of disclosure, we observe a significant increase in the Boilerplate measure by 0.027 in one specification and marginally nonsignificant effects of similar magnitude in the other specifications, which supports the conclusion that the quality of

disclosure is not improved by the reform. Further, the level of specificity does not change significantly, and the coefficient size remains small. The effect of the reform on cash ETRs is statistically significant in two out of the four specifications, but the sign remains negative. The coefficient on book ETR is insignificant and negative.

Regression Discontinuity Design

We chose a difference-in-differences design as our preferred identification strategy. A regression discontinuity design (RDD) would, in principle, also be suitable. However, in the regression discontinuity analysis, the sample is restricted to firms just around the treatment threshold. Therefore the measured effect is local, and this would reduce our relatively small sample even further. Nevertheless, the benefit of RDD is that firms in treated and control groups will have similar sizes. Given that evidence from Table 2 suggests that treated and control groups differ in terms of their sizes, this identification strategy would attenuate potential bias coming from those differences, although we interpret the regression discontinuity with caution, due to the small sample.

Despite the small sample, we can demonstrate the existence of a positive discontinuity in the volume of tax strategy disclosures in the annual report around the reporting threshold. However, no discontinuities in the quality (boilerplate and specificity) of tax strategy disclosures in the annual report and in tax planning (cash and book ETR) exist. We use these discontinuities to estimate the effect of the mandate on our outcome variables around the threshold. We find the increases in volume at the discontinuity threshold to be broadly similar to our baseline in terms of coefficient magnitude and robust to different ad hoc and optimal bandwidth selections.

Dictionary Approach

Our preferred method of identifying the volume of tax strategy disclosure in the annual reports involves using a naïve Bayesian algorithm, which could be considered a complex method. However, for the purpose of our analysis, a dictionary approach that simply counts the tax strategy sentences that include the word “tax” is not well suited. There is no set of ideal keywords that we can use to clearly identify tax strategy sentences. When a firm discusses its approach to tax or tax governance, examples

of the most frequent phrases include "group tax," "tax laws," "tax rate," and "tax position." These words can be used in several other tax contexts in the annual reports unrelated to tax strategy. Thus it is the sentence as a whole that determines whether a firm is discussing its approach to tax or tax governance.

Still, as a robustness test of our measures for the volume of tax strategy disclosure, we construct a very conservative dictionary-based count of the most frequent words used in tax strategy sentences but not used in nontax strategy sentences. We use this dictionary approach to classify sentences in the annual reports. Since we explicitly exclude words that appear in both types of sentences, the resulting classification severely underestimates the volume of the true tax strategy sentences in the annual reports. This means that we continue to find that the tax strategy mandate significantly increases the volume of disclosure in the annual reports but that the magnitude of the effect is smaller.

X. CONCLUSION

Governments around the world are striving to reduce corporate tax avoidance and increase tax transparency. We focus on one of the measures designed to achieve this—mandating the disclosure of a qualitative tax strategy report—and investigate its effects on firm behavior. We find that, while affected firms increase the volume of discussion of their tax strategy in their annual reports, they also include more boilerplate statements without changing their underlying behavior. We thus demonstrate the difficulty of generating a standard that avoids low-quality disclosures when the disclosure mandate asks for qualitative information only. The results of our study contribute to a better understanding of the differences between demanding *qualitative* and *quantitative* tax disclosures. In contrast to mandates for quantitative disclosures, our findings suggest that qualitative information may not be verifiable for outside stakeholders and firms may instead increase the volume of qualitative disclosure as a type of insurance against negative public attention, which in turn can lead to an overall reduction of the quality of tax strategy disclosures. We also show that public pressure plays an important role in incentivizing firms to increase tax strategy disclosure in their annual reports, even in the absence of the mandate. Since the UK tax strategy reports are in many respects similar to qualitative CSR disclosures, which are becoming more common, our findings are of relevance to policymakers considering introducing these types of purely qualitative disclosure mandates.

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Tables and Figures

Table 1: Sample Selection Steps.

	Unique Firms	Firm-Year Observations
Unbalanced sample: Domestic MNEs with time-series data in Datastream for the period 2010-2019	1,074	9,839
Of which:		
Domestic MNEs with available Ravenpack data for the period 2010-2015	814	3,963
Domestic MNEs with available correctly converted documents from Perfect Information for the period 2010-2019	752	4,942
Sample balanced on sales, taxes paid, total assets, and cash ETR for the period 2014-2018	699	6,600
Dropping SMEs	(270)	(2,503)
Dropping CbC reporting firms	(204)	(1,993)
Dropping Firms with uncertain control/treated assignment (hand-checked)	(38)	(367)
Dropping missing and singleton observations	(67)	(898)
Final Sample	120	839

Note: This Table presents the sample selection steps we follow to identify our final sample of firms as described in Section IV.

Table 2: Test for the Difference in Means for Control and Treated Firms Pre-treatment.

	Control		Treated		Difference in means			
Variable	Obs	Mean	Obs	Mean	Diff	St Err	t-value	p-value
Outcomes								
Tax Strategy Words	217	128.133	226	196.146	-68.013	18.242	-3.75	0
Tax Strategy Sentences	217	3.442	226	5.323	-1.881	0.478	-3.95	0
Boilerplate	217	0.073	226	0.061	0.012	0.009	1.35	0.181
Specificity	217	0.030	226	0.028	0.003	0.003	0.95	0.338
Cash ETR	177	0.240	201	0.261	-.0190	.022	-0.85	0.386
Controls								
Size	217	11.091	226	12.891	-1.800	0.100	-17.95	0
Leverage	217	0.120	226	0.160	-0.040	0.017	-2.30	0.021
Age	217	2.987	226	3.313	-0.327	0.053	-6.10	0
Geographic Com.	217	0.577	226	0.609	-0.032	0.028	-1.10	0.267
Loss	217	0.171	226	0.093	0.077	0.032	2.40	0.016
Mkt to Book Ratio	217	0.945	226	1.650	-0.705	0.140	-5.05	0
Std Dev of Sales	217	9.412	226	10.408	-0.996	0.087	-11.55	0
Analyst Following	217	1.285	226	1.913	-0.628	0.051	-12.45	0
Std Dev of Returns	217	2.393	226	2.195	0.198	0.044	4.45	0

Note: This Table presents the pre-2016 (pre-treatment) summary sample statistics on the relevant variables used in the analysis. We show the results of the t-test for the difference in means for our main outcome and control variables for treated and control firms respectively over the pre-period. All variables are winsorized at the 1st and 99th percentiles besides Cash ETRs which are censored to be between 0 and 1. All variables are defined in Appendix A.

Table 3: Descriptive Statistics on Tax Strategy Reports.

Tax Strategy Disclosure	Obs	Mean	St. Dev.	P25	Median	P75
Words TSR	57	783.67	507.11	545.00	694.00	933.00
Sentences TSR	57	28.86	16.89	20.00	26.00	33.00
Boilerplate TSR	57	0.24	0.07	0.20	0.24	0.29
Specificity TSR	57	0.07	0.03	0.05	0.07	0.09

Note: This Table presents summary sample statistics related to relevant variables used in the analysis of the tax strategy reports. For the sample of treated firms, we manually collected 75 tax strategy reports, of which 57 are in the final sample. All variables are defined in Appendix A.

Table 4: Disclosure Outlet Comparison (Post-Treatment Statistics).

Panel A: Post-Treatment Correlation between Annual Report (AR) Tax Strategy Disclosure and Standalone Tax Strategy Disclosure (TSR).

	Tax Strategy in Standalone TSR/AR	(1) Words	(2) Sentences	(3) Boilerplate	(4) Specificity
(1)	Words	0.065			
(2)	Sentences		0.161**		
(3)	Boilerplate			-0.076	
(4)	Specificity				0.146***

Panel B: Post-Treatment Means of Cash ETR by Tax Strategy Disclosure Characteristics.

	Cash ETR If Disclosure …					
	Low	***High***	Diff.	SE	T- Val.	P-Val.
Disclosure variable:						
In Tax Strategy Report						
Words TSR	0.238	0.225	0.013	0.026	0.50	0.607
Sentences TSR	**0.251**	**0.209**	**0.042**	**0.026**	**1.65**	**0.104**
Boilerplate TSR	0.241	0.224	0.018	0.026	0.70	0.486
Specificity TSR	0.229	0.235	-0.007	0.026	-0.25	0.801
In Annual Report						
Tax Strategy Words	**0.259**	**0.223**	**0.037**	**0.022**	**1.65**	**0.098**
Tax Strategy Sentences	**0.272**	**0.212**	**0.060**	**0.022**	**2.65**	**0.008**
Tax Strategy Boilerplate	0.248	0.235	0.014	0.022	0.60	0.539
Tax Strategy Specificity	0.252	0.23	0.022	0.022	0.95	0.341

Note: This Table describes the disclosure characteristics of treated firms post-2016 (post-treatment). Panel A shows correlations between the tax strategy disclosure in the tax strategy report and the annual report. The figure excludes the three treated firms with integrated tax strategy disclosure in the annual report, i.e., that do not have a standalone tax strategy report. *** p<0.01, ** p<0.05, * p<0.1. Panel B shows post-2016 means of Cash ETR by high/low levels of tax strategy disclosure. All variables are defined in Appendix A.

Table 5: The Effect of Mandatory Qualitative Tax Strategy Disclosure Regulation.

Panel A: Tax Strategy Disclosure in Annual Report

	(1)	(2)	(3)	(4)
	Disclosure Quantity		Disclosure Quality	
Dep.Var.	Tax Strategy Words	Tax Strategy Sentences	Boilerplate	Specificity
Treated × Post	81.50**	2.783***	0.0299**	0.00350
	(34.05)	(0.921)	(0.0144)	(0.00525)
Observations	839	839	839	839
N. of Firms	120	120	120	120
R-squared	0.784	0.799	0.665	0.422

Panel B: Tax Planning

Sample	*Main Sample*		*Extended Sample*			
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	Cash ETR	Book ETR	Cash ETR	Book ETR	Ind.-Size Adj. Cash TA	Ind.-Size Adj. Book TA
Treated × Post	-0.058	-0.020	-0.033	0.005	0.007	0.029
	(0.037)	(0.028)	(0.024)	(0.020)	(0.059)	(0.067)
Observations	707	714	1,232	1,243	1,007	988
N. of Firms	113	113	165	165	163	161
R-squared	0.436	0.405	0.403	0.403	0.592	0.522
Firm FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Clustering	firm	firm	firm	firm	firm	firm

Note: Panel A (B) summarizes the results on the effect of the reform on volume and quality of tax strategy disclosure (tax avoidance). The dependent variable is displayed at the top of each column, respectively. The *extended sample*, versus the *main sample*, retains those firms with missing tax strategy disclosure outcomes for the tax avoidance analysis (missing annual report), Panel B Columns 3-6. The measures in Panel B Columns 5-6 denote the difference between 3-year Cash (Book) ETR and the median Cash (Book) ETR of the industry-size cohort to which the firm belongs to (where the median is a within 3-year median), from Balakrishnan et al. (2019). These measures ***go up*** as tax aggressiveness (TA) increases. Treated denotes a dummy equal 1 for firms that are required by Schedule 2019 of the Finance Act 2016 to publish a tax strategy report. Post denotes dummy equal 1 for all periods from 2016. In all columns we control for: Size, Leverage, Age, Geographic Complexity, Loss, Market-to-Book Ratio, Standard Deviation of Sales, Analyst Following and Return Volatility. All variables are defined in Appendix A. Standard errors are clustered at firm level and are reported in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: The Effect of Mandatory Qualitative Tax Disclosure Regulation by Pre-Reform Media Attention.

	(1)	(2)	(3)	(4)	(5)
Dep.Var.	Tax Strategy Words	Tax Strategy Sentences	Boilerplate	Specificity	Cash ETR
Panel A: Pre-Reform High Media Attention					
Treated × Post	22.40	1.311	0.0480***	-0.001	-0.086
	(55.60)	(1.469)	(0.018)	(0.009)	(0.055)
R-squared	0.792	0.804	0.535	0.367	0.443
Observations	443	443	443	443	368
N. of Firms	57	57	57	57	54
Outcome Pre-Reform Mean	188.234	4.940	0.057	0.031	0.259
Panel B: Pre-Reform Low Media Attention					
Treated × Post	102.8**	2.981*	0.026	0.016**	-0.038
	(50.53)	(1.480)	(0.029)	(0.007)	(0.057)
R-squared	0.750	0.776	312	312	0.625
Observations	312	312	0.744	0.583	310
N. of Firms	46	46	46	46	46
Outcome Pre-Reform Mean	125.708	3.689	0.087	0.027	0.242
Firm FE	X	X	X	X	X
Year FE	X	X	X	X	X
Controls	X	X	X	X	X
Clustering	firm	firm	firm	firm	firm
Equiv. P-Value	*0.217*	*0.316*	*0.480*	*0.183*	*0.537*

Note: This Table summarizes the results on the effect of the reform on volume and quality of tax disclosure (Columns 1-4) and on Cash ETR (Column 5). In panel A (B) the sample is restricted to firms with above (below) median pre-treatment media attention. The dependent variable is displayed at the top of each column, respectively. Treated denotes a dummy equal 1 for firms that are required by Schedule 2019 of the Finance Act 2016 to publish a tax strategy report. Post denotes dummy equal 1 for all periods from 2016. In all columns we control for: Size, Leverage, Age, Geographic Complexity, Loss, Market-to-Book Ratio, Standard Deviation of Sales, Analyst Following and Return Volatility. All variables are defined in Appendix A. Standard errors are clustered at firm level and are reported in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

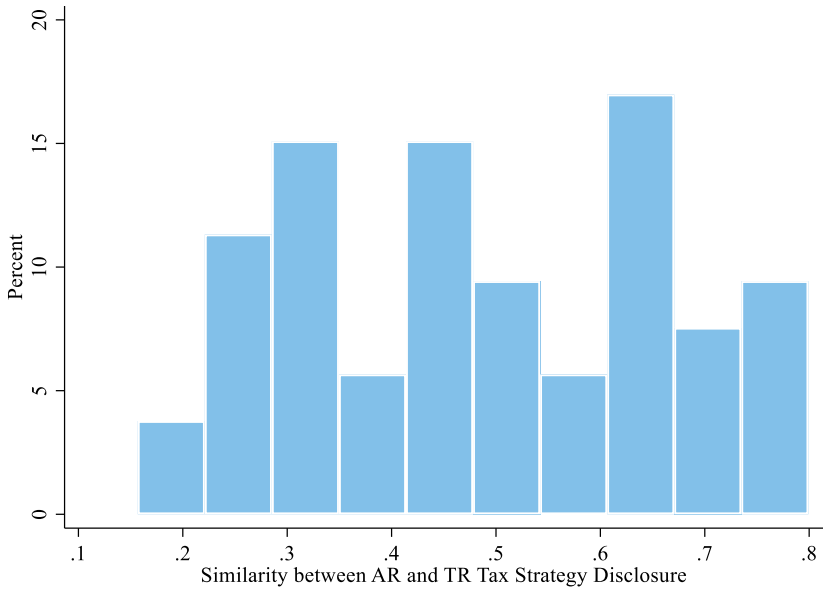
Table 7: The Effect of Mandatory Qualitative Tax Disclosure Regulation by Pre-Reform Tax Aggressiveness

	(1)	(2)	(3)	(4)	(5)
Dep.Var.	Tax Strategy Words	Tax Strategy Sentences	Boilerplate	Specificity	Cash ETR
Panel A: Pre-Reform Low Tax Aggressiveness					
Treated × Post	7.039	1.569	0.019	-0.000	0.009
	(47.777)	(1.360)	(0.021)	(0.007)	(0.053)
R-squared	0.794	0.787	0.715	0.405	0.358
Observations	453	453	453	453	372
N. of Firms	64	64	64	64	59
Outcome Pre-Reform Mean	179.133	4.920	0.080	0.027	0.353
Panel B: Pre-Reform High Tax Aggressiveness					
Treated × Post	170.21***	4.122***	0.045**	0.009	-0.072
	(51.871)	(1.282)	(0.018)	(0.007)	(0.046)
R-squared	0.802	0.829	0.543	0.447	0.387
Observations	386	386	386	386	335
N. of Firms	56	56	56	56	54
Outcome Pre-Reform Mean	142.097	3.744	0.049	0.031	0.380
Firm FE	X	X	X	X	X
Year FE	X	X	X	X	X
Controls	X	X	X	X	X
Clustering	firm	firm	firm	firm	firm
Equiv. P-Value	*0.022*	*0.173*	*0.351*	*0.373*	*0.252*

Note: This Table summarizes the results on the effect of the reform on volume and quality of tax disclosure (Columns 1-4) and on Cash ETR (Column 5). In panel A (B) the sample is restricted to firms with above (below) median pre-treatment Cash ETR as measure of tax aggressiveness. The dependent variable is displayed at the top of each column, respectively. Treated denotes a dummy equal 1 for firms that are required by Schedule 2019 of the Finance Act 2016 to publish a tax strategy report. Post denotes dummy equal 1 for all periods from 2016. In all columns we control for: Size, Leverage, Age, Geographic Complexity, Loss, Market-to-Book Ratio, Standard Deviation of Sales, Analyst Following and Return Volatility. All variables are defined in Appendix A. Standard errors are clustered at firm level and are reported in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 1: Similarity between TR and AR Tax Strategy Disclosure.

Panel A: Histogram of Similarities

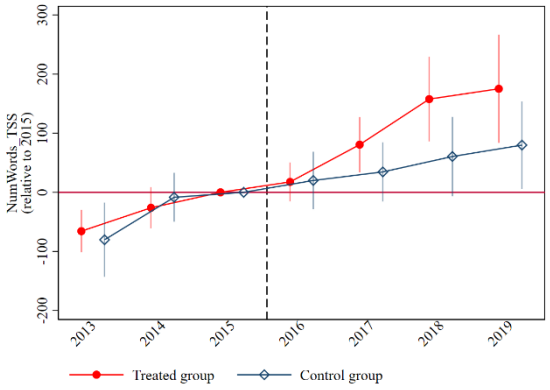


Panel B**:** Annual Report Characteristics by Similarity.

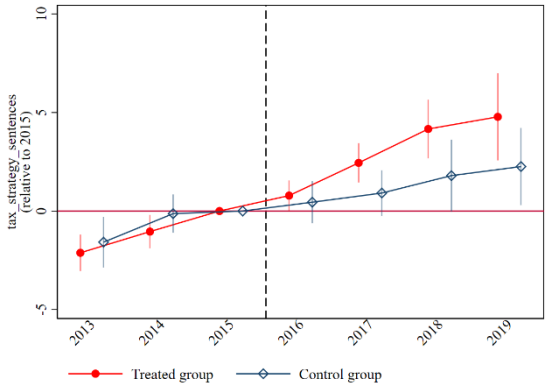
Annual Report Tax Strategy Disclosure	**Low Similarity**	**High Similarity**				
	Mean	Mean	Diff.	SE	T- Val.	P-V.
Words	178.837	530.25	-351.413	60.401	-5.80	0.0
Sentences	4.644	15.164	-10.519	1.671	-6.30	0.0
Boilerplate	0.114	0.119	-0.005	0.027	-0.15	0.8
Specificity	0.030	0.025	0.005	0.005	1.00	0.3

Note: This Figure provides descriptive statistics on the similarity between the annual report (AR) and the separate tax strategy report (TR). Panel A shows the histogram of the distribution of cosine-similarities between tax strategy disclosure in the annual report and separate tax strategy report. In Panel B, we provide descriptive characteristics on the annual report tax strategy disclosure splitting by the similarity between the annual report and the tax strategy report. The figure excludes the three treated firms with integrated tax strategy disclosure in the annual report, i.e., that do not have a standalone tax strategy report. All variables are defined in Appendix A.

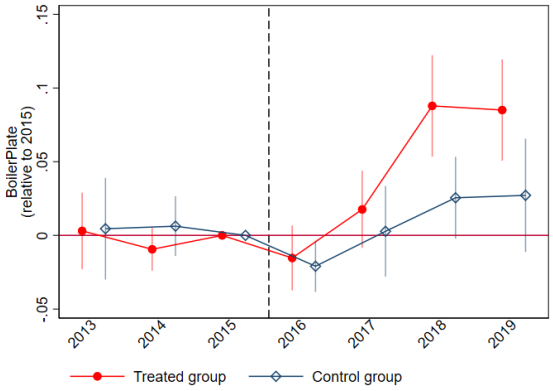
Figure 2: Dynamic Effects of the Reform on Qualitative Tax Disclosure - Event Studies.



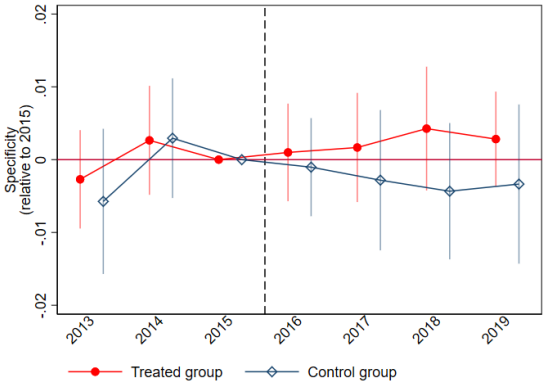
(a) Tax Strategy Words



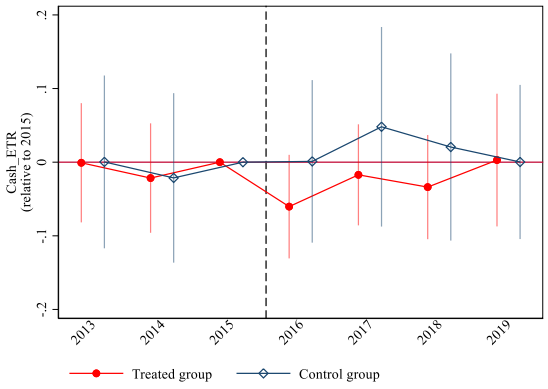
(b) Tax Strategy Sentences



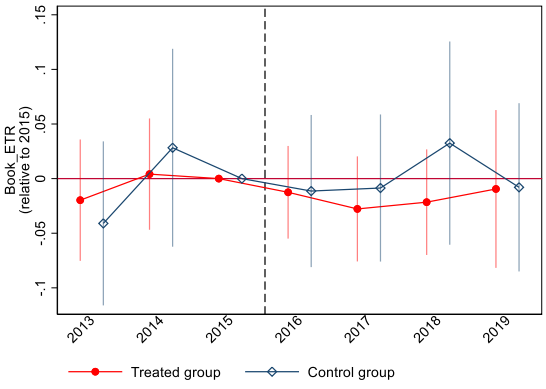
(c) Boilerplate



(d) Specificity



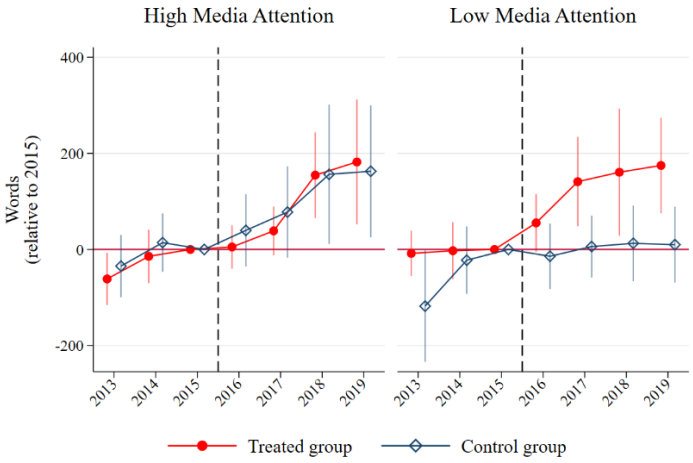
(e) Cash ETR



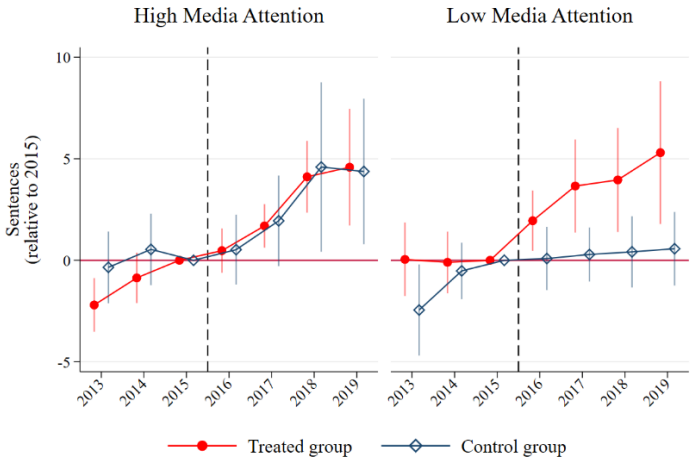
(f) Book ETR

Note: This figure plots the event study regression coefficients for treated – red full circles and control groups – hollow blue diamonds. Each dot represents the difference between the outcome variable in each year relative to the baseline year, 2015. In all specifications we include firm fixed effects and a set of firm-level controls: Size, Leverage, Age, Geographic Complexity, Loss, Market-to-Book Ratio, Standard Deviation of Sales, Analyst Following and Return Volatility. All variables are defined in Appendix A. The vertical lines represent the 95% confidence intervals.

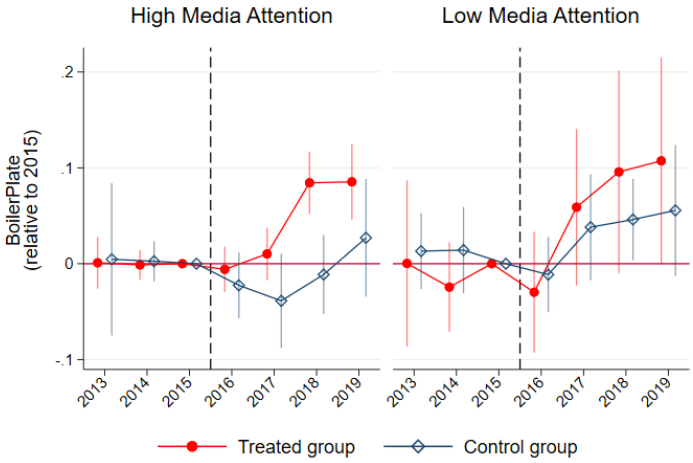
Figure 3: Dynamics Public Attention Split by Treated and Control Firms.



(a) Tax Strategy Words

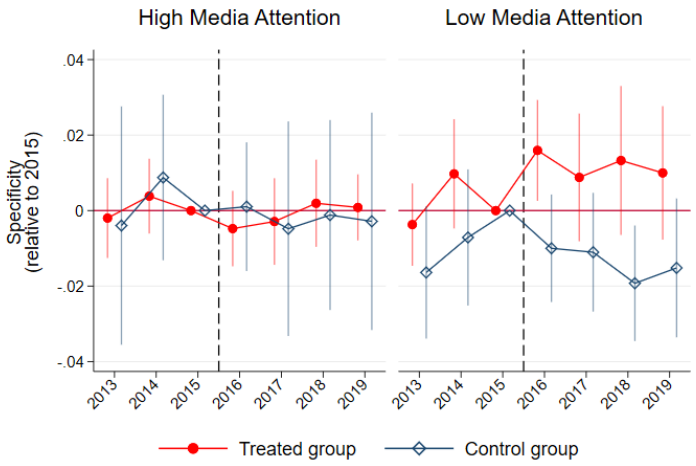


(b) Tax Strategy Sentences

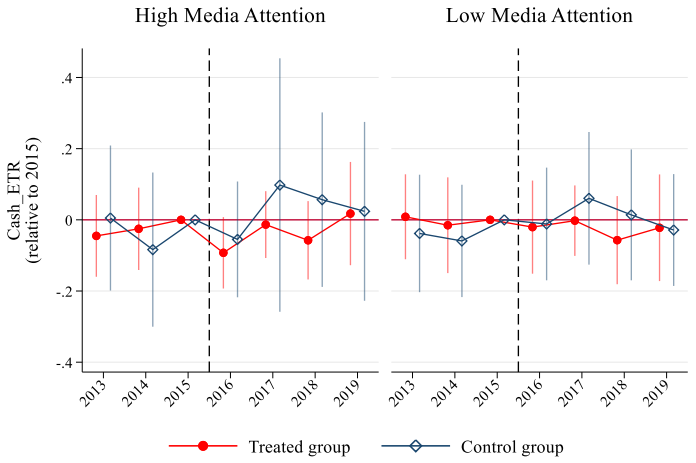


(c) Boilerplate

Figure 3 (continued)



(d) Specificity



(e) Cash ETR

Note: This figure plots the event study regression coefficients for treated – red full circles and control groups – hollow blue diamonds. In each figure we plot the coefficient estimates separately for the two groups of firms: those with high media attention in the left-hand side panels, and those with low media attention in the right-hand side panels. Media attention is measured as the mean level of attention before the reform and the sample is split at the median of that mean. Each dot represents the difference between the outcome variable in each year relative to the baseline year, 2015. In all specifications we include firm fixed effects and a set of firm-level controls: Size, Leverage, Age, Geographic Complexity, Loss, Market-to-Book Ratio, Standard Deviation of Sales, Analyst Following and Return Volatility. All variables are defined in Appendix A. The vertical lines represent the 95% confidence intervals.

APPENDIX

A. Variable Definitions

Variable	Description
Tax Strategy Words	The number of words in the annual report that describe the tax strategy. Tax strategy disclosure in the annual report is identified by the naïve Bayes algorithm at the sentence level.
Tax Strategy Sentences	The number of sentences in the annual report that describe the tax strategy. Tax strategy disclosure in the annual report is identified by the naïve Bayes algorithm at the sentence level.
Boilerplate	The portion of trigrams in a firm's tax strategy sentences that is found in at least 5% of all firms' tax strategy disclosures in a given fiscal year.
Specificity	The number of specific words in the annual report that appear in sentences which describe the tax strategy scaled by total number of tax strategy words. Tax strategy disclosure in the annual report is identified by the naïve Bayes algorithm at the sentence level. Following Hope et al. (2016) specific words are defined as: entity names, including names of persons, locations, and organizations; quantitative values in percentages; money values; times; and dates as captured by the Stanford Named Entity Recognition (NER) tool.
Words TSR	The number of words in the dedicated tax strategy report (TSR). This is usually a standalone report in our sample. In three cases the dedicated tax strategy report was integrated in the annual report and the firm did not publish a standalone report. In all other cases the standalone report is used.
Sentences TSR	The number of sentences in the dedicated tax strategy report (TSR). This is usually a standalone report in our sample. In three cases the dedicated tax strategy report was integrated in the annual report and the firm did not publish a standalone report. In all other cases the standalone report is used.
Boilerplate TSR	The portion of trigrams in a firm's tax strategy report that is found in at least 5% of all firms' tax strategy reports in a given fiscal year
Specificity TSR	The number of specific words by total number of tax strategy words in the dedicated tax strategy report (TSR). Following Hope et al. (2016) specific words are defined as: entity names, including names of persons, locations, and organizations; quantitative values in percentages; money values; times; and dates as captured by the Stanford Named Entity Recognition (NER) tool. Notes on the TSR: The TSR is usually a standalone report in our sample. In three cases the dedicated tax strategy report was integrated in the annual report and the firm did not publish a standalone report. In all other cases the standalone report is used.
Cash ETR	The ratio of tax paid over pre-tax income, set to one if above 1 or if tax paid is positive and pre-tax income negative and set to zero if tax paid is negative. Set to missing in loss years.
Book ETR	The ratio of tax expense over pre-tax income, set to one if above 1 or if tax paid is positive and pre-tax income negative and set to missing if tax paid is negative. Set to missing in loss years.
Industry-Size Adjusted Cash (Book) Tax Aggressiveness (TA)	The difference between the 3-year Cash (Book) ETR and the median Cash (Book) ETR of the industry-size cohort to which the firm belongs to (where the median is a within 3-year median), taken from Balakrishnan et al. (2019). Industry is measured based on the Fama French 48 industry classification.
Size	The natural logarithm of market value of equity.

Leverage	The ratio of long-term debt over total assets.
Loss	A dummy equal to one if the firm has negative profit/loss before taxes for the majority of the selected period.
Age	The natural logarithm of the number of years the firm has been listed on Datastream.
Geographic Complexity	The sum of squares of each geographical segment's sales as a percentage of the total firm sales.
Mkt to Book Ratio	The ratio of the market value of assets to the book value of assets.
Std Dev of Sales	The standard deviation of annual sales computed over the previous five years (or less than five years, if less than five previous years are available).
Analyst Following	The log of the number of analysts following the firm.
Std Dev of Returns/ Return Volatility	The log of the standard deviation of returns computed over three years.
High (Low) Media Attention	A dummy equal to one (zero) if a firm has an above (below) median news coverage computed considering the counts of distinct news events about a firm in the last 91 days as stated in Ravenpack pre-treatment.
High (Low) Tax Aggressiveness	A dummy equal to one (zero) if a firm's pre-treatment mean Cash ETR lies above (below) the pre-treatment median Cash ETR of all firms in the sample.

B. Naïve Bayes Classifier - Statistics and Outcomes

In this Appendix, we describe in detail how we construct the volume of tax strategy disclosure in the annual report. We start by selecting a sub-sample of 450 annual reports from firms listed in the FTSE100 for the period 2010-2016 as our training set. We explicitly select annual reports from this group of firms to maximize the volume of detected tax strategy sentences. Partitioning the annual reports into sentences leads to 1,116,411 million sentences from which we exclude all sentences not containing the three letters "tax" when appearing sequentially. This enables us to preserve sentences containing the word "tax" as well as sentences containing the word "taxation". We then eliminate sentences in which the only time the three letters "tax" appear is for the words "pre-tax", "net of tax", "before income tax", "after tax", "before tax", "tax free". We end up with 41,683 tax sentences.[39] Out of this set of sentences, we then manually select tax strategy sentences and remove duplicates to obtain a final sample of 2,534 tax strategy sentences.

[39] This enables us to minimize the risk of false positives (Type I Error), by restricting our analysis to a subset of sentences where tax strategy sentences are most likely to appear. The drawback of our filtering approach is the increase in the risk of false negative (or Type II Error) since we might not capture sentences in which a firm discusses its tax strategy without explicitly using words "tax".

Next, we chose sentences in which the firm does not discuss its tax strategy, but which have a high degree of semantic similarity to the tax strategy sentences. For this purpose, we perform a cosine similarity analysis between all sentences in the training set, which contain the word tax and the manually selected tax strategy sentences.[40] This is a crucial step to ensure that once we proceed with the machine learning approach, we can train the algorithm on non-tax strategy sentences for which the risk of misclassification is the highest. Our final sample is a balanced sample of 2,534 tax strategy sentences (sentences discussing a firm's approach to tax or tax governance) and 2,534 non-tax strategy sentences (sentences not discussing a firm's approach to tax or tax governance, but semantically similar to the sentences discussing a firm's approach to tax or tax governance).

We use this sample of sentences to train the naïve Bayes algorithm, which is a supervised machine learning methodology. We use naïve Bayes to classify all sentences in our complete sample of annual reports that contain the word "tax".[41] This approach relies on a prediction model, where the input variables are the words in the document and the predicted value is the probability of a certain category. In the context of our study, the sentence categories are sentences containing information on a firm's tax strategy and sentences not containing information on a firm's tax strategy. The conditional probabilities of a word occurrence given a sentence category are learned based on the set of manually labeled sentences on which a machine learning model is trained. Since naïve Bayes is machine-based, it facilitates the analysis of a large corpus and avoids possible biases induced by the researcher's subjectivity.[42]Overall, naïve Bayes represents a fairly straightforward approach, which delivers consistently good classification accuracy, and thus it is the single most used classifier in the finance and accounting literature (El-Haj et al. 2019).

Our complete sample is made of 9,742,293 sentences of which 279,853 contain the three letters "tax" when written sequentially after excluding those sentences in which the only time the three letters "tax" appear is for words "pre-tax", "net of tax", "before income tax", "after tax", "before tax", "tax free". We classify them into 10,946 tax strategy sentences and 268,907 non-tax strategy sentences using the

[40] For the cosine similarity exercise, we use tf-idf (term frequency-inverse document frequency) as weighting scheme.
[41] Also, for the naïve Bayes, we use tf-idf (term frequency-inverse document frequency) as weighting scheme.
[42] For the formal derivation of naïve Bayes, see Antweiler and Frank (2004).

trained naïve Bayes classifier. Our naïve Bayes approach achieves a classification accuracy of 91 percent in the in-sample validation test, which is in line with the related literature (Huang et al. 2014).[43]

Below, we present the key statistics on the performance of our naïve Bayes classifier based on the average of 50 naïve Bayes models (iterations). We first present the result of the confusion matrix, which is built using our training set (Tables A1 and A2). These tables show how many sentences are predicted to be tax strategy sentences (true) and are actually tax strategy sentences and the same for non-tax strategy sentences (false). Precision indicates the fraction of true tax strategy sentences over the total Tax Strategy Sentences classified as tax strategy sentences (that is the sum of true tax strategy sentences and false tax strategy sentences). Thus, it is the ability of our classifier to avoid classifying a sentence as a tax strategy sentence when in reality it is a non-tax strategy sentence. Recall indicates the fraction of true tax strategy sentences over the total number of correctly classified sentences. Thus, it is the ability of our classifier to find all true tax strategy sentences. F1-score is the average between precision and recall. Support is the total number of considered sentences. Our accuracy score is 91.56 percent which is the average between the F1 score of the tax strategy sentences and non-tax strategy sentences.

We also compared the accuracy of our model to the one we would obtain using alternative approaches. We use two alternative supervised machine learning classifiers, SVM and the random forest, which are also used in the finance and accounting literature. Using either, we achieve similar accuracy levels as with naïve Bayes, but slightly lower in the case of SVM (90%). Second, we offer a representative set of examples of sentences capture under the category "Tax Strategy Sentences" versus the one captured under the category "Non-Tax Strategy Sentences".

Overall, since some tax strategy sentences can be hard to identify clearly, we construct a rather conservative measure of tax strategy disclosure in annual reports to avoid false positives. Specifically, we do not count sentences as tax strategy sentences as soon as the classified probability of being a tax strategy sentence vs. a non-tax strategy sentence lies just above 50%, instead we chose a cut-off value of 99%.

[43] We manually inspected a sample of randomly selected tax-strategy and non-tax strategy sentences to check the validity of our out-of-sample results.

Table A1: Confusion Matrix

actual \predicted	FALSE	TRUE
FALSE	426.28	24.62
TRUE	47	351.1

Table A2: Naïve Bayes (10 iterations for each model)

Model	Class	Precision	Recall	F1-score	Support
4009*2	FALSE	0.9	0.95	0.92	450.9
	TRUE	0.93	0.88	0.91	398.1

Examples of Tax Strategy Sentences
tax planning is always aligned with our commercial and economic activity.
taxation: the audit committee reviewed the group tax risk policy which sets out compliance with relevant jurisdictional legislation, identifying areas of tax risk for appropriate focus and managing the overall group tax risk.
where appropriate, the group enters into consultation with tax authorities to help shape proposed legislation and future tax policy.
we also used our own tax specialists to critically assess the appropriateness of the future tax planning strategies.
our board continues to work toward being assessed as 'low risk' by hmrc and ensures that the group adheres to the revised tax policy adopted in 2014 of not undertaking tax planning or making use of tax havens.
an open dialogue is maintained with HMRC involving regular meetings to review tax issues and brief them on business issues.
the group takes a responsible approach to the management and control of its tax affairs and is cooperative in its dealings with the tax authorities.
our principal activities are UK-based and we have regular meetings with hm revenue and customs to discuss tax matters and business developments.
we will pay the right and fair amount of tax in each territory we trade from in accordance with the letter and spirit of local laws and regimes.
the board is regularly updated on tax matters, and any tax implications of commercial activities are highlighted to the board with the use of a risk matrix to assess the appropriateness of a proposal.

Examples of Non-Tax Strategy Sentences
these shares may be withdrawn at any point during years four and five, but income tax and national insurance would then be payable on any amounts withdrawn.
deferred income tax assets and liabilities are offset when there is a legally enforceable right to offset current tax assets against current tax liabilities and when the deferred income taxes and liabilities relate to income taxes levied by the same taxation authority on either the taxable entity or different taxable entities when there is an intention to settle the balance on a net basis.
these discount rates are derived from the group's post-tax weighted average cost of capital as adjusted for the specific risks relating to each geographical region.

retail sales and delivery receipts are recorded net of returns, relevant vouchers, and value added tax and recognised upon dispatch from the warehouse at which point title and risk passes to the customer.
the group provides for potential tax liabilities that may arise on the basis of the amounts expected to be paid to the tax authorities.
the carrying amount of deferred tax assets is reviewed at each statement of financial position date and reduced to the extent that it is no longer probable that sufficient taxable income will be available to allow all or part of the asset to be recovered.
this revenue growth reflected the strength of tax and accounting's product offerings and demand in the global tax and accounting market.
the discount rates used reflect the post-tax yields to maturity that can be obtained on government bonds with similar maturity dates and currencies to those of the deferred tax assets or liabilities.
there is no time restriction over the utilisation of tax losses.
impairment of assets the carrying amounts of the group's non-financial assets, other than inventories (see accounting policy 'inventories') and deferred tax balances (see accounting policy 'deferred taxation'), are reviewed at each balance sheet date to determine whether there is an indication of impairment.

C. Illustrative Examples – Quality of Tax Strategy Disclosure

Boilerplate - The bold words in the following sentences extracted from annual reports of treated firms in our sample identify common phrases that are captured by our boilerplate measure.

the group seeks to protect its reputation as **a responsible taxpayer**, and adopts a responsible attitude to arranging its tax affairs, aiming to ensure effective, sustainable and active management of tax matters in support of business performance
we aim to make a positive contribution to the societies in which we operate, and one of the most sustainable ways to achieve this is to be **a responsible taxpayer**
our vision for tax is to be a responsible corporate citizen, contributing the **right amount of tax** to society at the right time and in the right tax jurisdiction whilst maintaining our integrity and corporate reputation and continuing to deliver value for our shareholders
we use legitimate tax reliefs for the purpose for which they were intended and aim to pay the **right amount of tax** in the territories in which we operate

Specificity - The bold words in the following sentences extracted from annual reports of treated firms in our sample identify specific words that are captured by our specificity measure.

as described in note 13 to the consolidated financial statements, we are facing a number of tax investigations at subsidiary level, including a disputed tax assessment in **poland** relating to pre-ipo intellectual property restructuring and deductibility of certain management re-charges
tax and treasury committee meets twice a year - chaired by **wendy pallot**
the group operates in a complex multinational tax environment in relation to direct and indirect taxes and there are a number of open tax matters with tax authorities, especially in the **uk, us** and **canada**
deploying our us tax specialists, we evaluated the key judgements, assumptions and interpretations used by management to assess the impact of **us** tax reform

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