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## Tax Strategy Disclosure: A Greenwashing Mandate

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# Tax Strategy Disclosure: A Greenwashing Mandate?

## Abstract

Firms constantly face new and more stringent tax disclosure requirements and, increasingly, paying a fair share of tax is seen as part of corporate social responsibility. In this paper, we investigate whether mandating *qualitative* tax disclosure leads to intended outcomes, using, as an exogenous shock, the 2016 UK reform that required the disclosure of tax strategy for firms above a certain size threshold. The goal of the mandate was to increase the availability of tax information to the general public and to decrease tax avoidance. We find that treated firms — those that are required to publish a tax strategy report — significantly increase the volume, but not the quality, of tax strategy disclosure in the annual reports. We show an 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 a qualitative tax disclosure requirement has incentivized firms to portray themselves as “*good tax citizen*”, resulting in lengthier but unsubstantiated disclosures in the annual reports without affecting their tax avoidance practices.

JEL-Codes: G380, M410, M480, H260, H200.

Keywords: disclosure regulation, nonfinancial disclosure, corporate social responsibility, tax transparency, corporate avoidance.

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## I. INTRODUCTION

Ensuring adequate information accessibility is fundamental to achieving efficient resource allocation and, thus, economic growth. In areas such as product quality, environmental policy, and taxation, mandating information disclosure is also increasingly used to promote desirable behavior, complementing the regulations that explicitly prohibit undesirable behavior (see Leuz and Wysocki, 2016; Grewal and Serafeim, 2020). In this paper, we analyze the intended and unintended consequences of a disclosure mandate which required firms to provide purely *qualitative information*. While there is a growing literature on the effects of *quantitative* tax disclosures, we know little about the effects of *qualitative* tax disclosures, despite their increasing popularity. Since the characteristics of qualitative disclosures differ fundamentally from the quantitative ones, it is crucial to understand their effectiveness as an additional tool available to regulators.

We focus on the introduction of mandatory tax strategy reporting in 2016 in the UK, which has two central goals: (1) to curb tax avoidance and (2) to increase the availability of tax information to the general public.<sup>1</sup> This regulatory change required a group of firms with operations in the UK to publish a report discussing their tax strategy concerning 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 HMRC guidelines explicitly state the possibility to avoid any numerical disclosure, making this regulatory change the perfect setting to analyze the effect of mandating a qualitative tax disclosure.

While the mandated tax strategy report must be easily accessible, it can either be a standalone report or be integrated into another report, for example, the annual report. Nearly all the UK headquartered firms we analyze publish a separate tax strategy report. Further, most firms *also* include a discussion of their tax strategy in the annual report before the mandate, and nearly all do after the mandate (PwC 2016). This feature allows us to investigate the *causal* effects of the mandate on changes in tax strategy disclosure in the annual reports. 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' previous pre-reform behavior. As such, we focus our analysis on tax strategy disclosure in the annual reports to understand the effects of the reform on the availability of tax information. In the descriptive part of the paper, we provide evidence on the existing complementarities between the tax strategy information disclosed in both outlets and discuss how firms make choices about what to disclose and where. We show that tax strategy disclosure in annual reports is similar to that in the mandated reports and that both the length and specificity between the two are positively correlated.

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<sup>1</sup> For more details, see Schedule 19 of the Finance Act 2016, <https://www.gov.uk/guidance/large-businessespublish-your-tax-strategy>.

The focus of the paper is to analyze whether the mandate fulfilled its two central goals. First, we consider 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 build a novel text-based measure of qualitative tax strategy disclosure in two steps. We manually classify sentences describing firms' tax strategy from a representative sub-sample of annual reports. We then use a Naïve Bayes machine learning approach to classify sentences in all annual reports in our sample as those about tax strategy. From a methodological perspective, this machine learning approach is a refinement of 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 methodologies to capture qualitative disclosures (e.g., Donovan et al. 2021). 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 the *quality* with the number of specific words and numbers included in those sentences.<sup>2</sup> Second, we consider the effect of the mandate on tax avoidance. We proxy for firms' tax avoidance by cash ETRs.<sup>3</sup>

To provide causal evidence, we use the difference-in-difference methodology and compare the UK headquartered firms affected by the mandate, i.e., those with turnover exceeding GBP 200m and/or a balance sheet total exceeding GBP 2bn, and those unaffected, before and after the reform. To focus exclusively on the effects of the *qualitative* tax disclosure, we exclude the very large firms that fall under the *quantitative* Country by Country (CbC) reporting requirements, which were introduced around the same time. Hence, our treated sample includes only firms above the mandatory *qualitative* threshold and below the CbC reporting threshold. Our control group includes firms below the *qualitative* threshold, which are most comparable to the treatment group. For this purpose, we exclude small and medium-sized firms (SMEs).<sup>4</sup> 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 MNEs. 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 in our sample tend to go beyond what is required by the law by providing both a separate tax strategy report *and* increasing tax strategy disclosure in their annual reports. The number of sentences and words used to describe tax strategies increased significantly. However, the quality of tax strategy information provided does not change. Additionally, we find no evidence that firms reduce their tax avoidance as a

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<sup>2</sup> See Section IV for details on how we operationalize these concepts.

<sup>3</sup> We test the robustness of our results using alternative proxies for tax avoidance. Unless the reform affects tax avoidance, we do not expect it to affect firm behavior further.

<sup>4</sup> Following the EU and UK definition, SMEs 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.

result of this mandate. We use an event study design to show that the parallel trends assumption holds in the pre-reform period and firms do not anticipate the reform both in terms of disclosure and tax avoidance outcomes.

In the second part of the paper, we focus on understanding a potential mechanism that could be driving our results. The UK policymakers introduced this new disclosure regime to require large firms to provide insights into their tax-related practices. The aim was to discourage aggressive tax planning via increased public attention to the tax practices of corporations (HMRC (2015), Point 1.18.). In the UK, the public has already demonstrated a strong interest in firms' tax affairs and anecdotal and empirical evidence shows that public attention has been successful in inducing changes in firm tax disclosure and tax avoidance behavior in response to *quantitative* mandates (Campbell, 2014; Dyreng et al., 2016). In this paper, we propose that public pressure is an important channel to ensure compliance with the regulation in case of qualitative disclosure, too.

For public pressure to influence firm behavior, disclosure needs to impose additional costs for the firm. It is not clear ex-ante, whether the UK mandate does so. From prior studies we know that new, or more disseminated, quantitative information on foreign operations or tax contributions allows activists and consumers to shame firms to change their behavior (e.g., Christensen et al., 2017; Dyreng et al., 2016; Rauter, 2020; Hoopes et al., 2018; Christensen et al., 2021). This can be the case, even in a context where firms already disclose their quantitative information voluntarily before the reform, as shown by Grewal (2019a) in the context of greenhouse gas emissions. Behavioral change may occur in this setting for two reasons: first, mandated disclosure reduces information processing costs for stakeholders by providing a benchmark (Grewal, 2019a; Healy and Palepu, 2001; Maines and McDaniel, 2000). The regulation we analyze provides four clearly defined categories of disclosure to facilitate that benchmarking. Regulation could, therefore, increase stakeholders' use of and attention to disclosures, resulting in additional pressure on firms to change behavior after mandated reporting. Second, the introduction of new disclosure regulations may increase managers' fears of further regulatory actions (Grewal, 2019a).

On the other hand, the type of qualitative disclosure we study risks being boilerplate and may be harder to verify compared to the quantitative one (e.g., Christensen et al. 2021; She, 2021). In addition, the type of disclosure that we study is geared toward a broad range of stakeholders. In fact, the Global Sustainability Standards Board has recently adopted a tax standard that incorporates a discussion of a firm's tax strategy in corporate social responsibility (CSR) disclosures.<sup>5</sup> As such, the tax strategy disclosure that we study is part of the CSR and firms may choose to increase the discussion of their tax strategy to communicate that their actions are in line with broad societal interests across all corporate

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<sup>5</sup> For more details, see <https://www.globalreporting.org/information/news-and-press-center/Pages/First-global-standard-fortax-transparency.aspx>

disclosure channels (O'Donovan, 2002). Because the information disclosed is qualitative in nature, this may result in unsubstantiated symbolic claims. This practice is commonly referred to as “greenwashing” in the CSR literature (Siano et al. 2017; Christensen et al. 2021). Consequently, stakeholders may not be able to exert any concrete pressure on companies to change real activity.

We empirically investigate whether public pressure plays a role in driving 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 sub-sample. Firms subject to high public attention already had high levels of tax strategy disclosure before the reform, and the new disclosure requirement does not change their behavior significantly relative to the control group. We find no effects on the quality of disclosure or tax avoidance in either of those two sub-samples. Our results demonstrate that mandating the publication of a tax strategy report may not generate the kind of actionable disclosure that allows stakeholders to pressure firms into changing their tax avoidance behavior. Instead, our analysis suggests that firms use the tax strategy disclosure in annual reports to portray themselves as “good tax citizens” without providing any actionable detailed information.

Our study contributes to two streams of literature that analyze the effects of mandated disclosure on firm activities, (1) the effects of tax transparency initiatives and (2) the effects of CSR-type narrative disclosures. First, we discuss our contributions to the literature on tax transparency initiatives. Mandating the disclosure of *quantitative* tax information can affect firm behavior (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 MNEs (De Simone and Olbert, 2021). At the same time, making tax payments data available to the general public leads to consumer backlash and negative market reactions for tax aggressive firms (Hoopes et al., 2018) that respond by voluntarily enhancing the transparency around their tax affairs (Kays, 2021). We contribute by providing novel evidence on the effects of *qualitative* tax information disclosure on firm disclosure choices and tax avoidance behavior.

Two concurrent papers employ our setting, Xia (2020) and Belnap (2019b). Xia (2020) focuses on the effect of mandating *qualitative* tax information in the UK on tax avoidance and the quality of the mandated tax strategy reports. Her results support our conclusion of no change in tax avoidance behavior, which was one of the key goals of this reform. While both of our papers causally analyze the effects of the mandate on tax avoidance, Xia (2020) only focuses on the post-reform quality of tax strategy reports. This means that she is unable to causally evaluate the effects of the reform on the availability of tax information. In this paper, we provide causal evidence on this second key goal of the analyzed reform. As such, the results in this paper complement Xia (2020) by investigating the



consequences of the UK mandate on the *quantity* and *quality* of tax disclosures in the annual reports. Additionally, we document that firms disclose tax strategy information not only in separate reports but also in annual reports.

Belnap (2019b) conducts a field experiment on US-headquartered firms subject to the UK mandatory tax disclosure, exposing a random sub-sample of them to increased public pressure on the mandated disclosure in 2019. Our paper is different in two dimensions. First, our sample consists of UK headquartered firms. Since the disclosure mandate was more binding for them and they had fewer options to not comply with the mandate, focusing on UK firms represents a more suitable setting to study the effect of this reform on tax avoidance and availability of tax information. Specifically, we do not have issues with non-compliance, as seen in Belnap (2019b)'s setting. Second, our results focus on tax strategy disclosure in the annual report and interactions with the separate tax strategy reports, while Belnap (2019b), similar to Xia (2020), focuses on the mandated reports only.

Second, we contribute to the literature on CSR by analyzing the effects of a CSR-like narrative disclosures mandate, which are still comparatively understudied (Christensen et al., 2021). Not only is paying “responsible taxes” increasingly viewed as a CSR topic (e.g., Grewal and Serafeim, 2020), but like tax strategy disclosure, a key feature that characterizes CSR reporting and sets it apart from financial reporting includes the diversity of *users and uses* (Christensen et al., 2021). Users of CSR disclosures tend to be relatively unsophisticated when it comes to reading financial reports, e.g., workers, consumers, NGOs, and the general public. Since these stakeholders have mostly a passive relationship with firms, CSR standards might have the largest value for this group. In terms of uses, stakeholders learn from CSR disclosures how firms contribute to society and adhere to specific norms and ethical values (Christensen et al., 2021). In our context, tax strategy disclosure represents an important tool to effectively convey the story behind complex tax numbers and reveal how tax decisions support the overall organizational goals of the firm (Deloitte, 2013).

Our findings show that a mandated qualitative tax disclosure resulted in lengthier annual reports, but the quality did not improve. Since qualitative information is harder to verify (She, 2021), firms may provide unsubstantiated disclosure in line with what stakeholders want to hear (Cho and Patten, 2007; Christensen et al. 2021). As such, we extend the findings of Dyer et al. (2017) by documenting that, in addition to accounting standards and financial regulators initiatives, mandating non-financial disclosure can affect the information volume and content of financial disclosure. Finally, our results indicate that the reform was not effective in changing tax avoidance behavior. Hence, for CSR-type mandated disclosures to affect firm behavior in desirable ways, they may need to be more verifiable. Otherwise, firms can comply with the disclosure standard by providing the required information without reconciling it with the underlying real activity, for example, tax payments.

## II. INSTITUTIONAL SETTING

Domestic and international regulations are increasingly mandating multinational enterprises 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,<sup>6</sup> more recent proposals, and regulations centered on promoting or demanding *qualitative* tax disclosure.<sup>7</sup> In this paper, we focus on the UK tax strategy disclosure regulation, which was passed in Parliament on September 15, 2016. This new disclosure requirement applies to firms with a UK presence having a turnover exceeding GBP 200m and/or their balance sheet total assets exceeding GBP 2bn in the last year.<sup>8</sup> Those firms have to publish either a separate tax strategy report on their website or integrate the discussion on their tax strategy in an existing report, e.g., the annual report, and the board is responsible for approving it.<sup>9</sup> All, but 3, treated firms in our sample have a separate tax strategy report.<sup>10</sup>

The information required covers four topics. First, firms need to discuss how UK tax risk is managed, resulting in statements like *“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.”*<sup>11</sup>

Second, firms should describe their attitude to tax planning resulting in sentences such 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.”*<sup>12</sup>

Third, firms should offer insights on their tax risk appetite, which led to disclosures like *“It is the aim of RM to minimize the level of risk taken in relation to both UK and overseas taxation matters wherever possible. Given the size and diversity of the business, taken with the complexities of taxation*

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<sup>6</sup> Examples include the Dodd-Frank Financial Reform and Consumer Protection Act, the FIN48 and Schedule UTP, 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.

<sup>7</sup> Such initiatives include for example the Tax Transparency Package Proposal by the European Commission in 2015, the Global Sustainability Standards Board proposal for a Tax Strategy Section in CSR reports, and the Australian voluntary Tax Transparency Code.

<sup>8</sup> For more details, see HMRC (2016). UK subsidiaries of an MNE group with global turnover exceeding EUR 750m 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>.

<sup>9</sup> 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>.

<sup>10</sup> The 3 firms that do not have a separate tax strategy report, all included discussion of their tax strategy in their annual report before the mandate was enacted already. Hence, we keep them in the sample.

<sup>11</sup> The sentences are taken from SEGRO’s Tax Strategy.

<sup>12</sup> The sentences are taken from Cairn’s Tax Strategy.

*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.”<sup>13</sup>*

Fourth, firms should explain their relationship with HMRC, which was done in sentences like *“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.”<sup>14</sup>*

Besides the existence of moderate monetary penalties<sup>15</sup> compliance was expected to be achieved mainly via public pressure. In 2010, UK firms were subject to public scrutiny from ActionAid International, a global non-profit 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 (Dyrenge et al., 2016). There was a similarly successful public shaming campaign aimed at inducing non-compliant US-headquartered firms to publish their tax strategy reports (Belnap, 2019b).

In our setting, UK firms’ awareness of societal interest in corporate tax affairs resulted in the disclosure of tax strategy information for the UK MNEs long *before* the tax strategy report was mandated (PwC, 2016). For example, in the UK 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 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 potentially affect these two margins.

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<sup>13</sup> The sentences are taken from RM’s Tax Strategy.

<sup>14</sup> The sentences are taken from Clipper Logistics’ Tax Strategy.

<sup>15</sup> There is a penalty for not publishing a tax strategy report: a non-compliant 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.

## The Availability of Tax Information

We study the effects of mandating tax strategy disclosure on the disclosure of tax strategy information in annual reports. Specifically, we are interested in understanding the changes in the *quantity* and the *quality* of the tax strategy information included in the annual reports. We focus on annual reports as most firms in our sample were already providing some tax strategy disclosure in the pre-reform period. Hence, we can causally identify the effects of the reform on changes in their tax strategy disclosure.

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.<sup>16</sup> As such, we would expect firms to react to the mandate by conveying that their actions are in line with broader societal interests across all corporate communication channels, i.e., not only by issuing a standalone tax strategy report but also by incorporating such 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 of corporate disclosure relative to other reports (Grewal 2019b). 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.

In this paper, we view the quality of disclosure as a more accurate proxy for tax transparency than the volume of disclosure. As such, on the one hand, tax transparency 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 (Grewal, 2019a; 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). 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.*

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<sup>16</sup> See for example, PwC - Tax is a crucial part of the ESG conversation, available at <https://www.pwc.com/gx/en/services/tax/publications/tax-is-a-crucial-part-of-esg-reporting.html>

## 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 enables the detection of tax avoidance (Lisowsky et al., 2013) and helps to estimate current and future tax figures (Ciconte et al., 2016). 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 public scrutiny over firms' tax affairs. For example, in the UK, intensive media coverage of tax scandals has proved successful in increasing the transparency of firms' tax affairs and reducing their tax avoidance (Dyreng et al., 2016). Further, increase 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 has the potential to reduce corporate tax avoidance.<sup>17</sup> Some of those 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 the data generating function of the numerical financial data and helps in understanding corporate decisions (Li, 2010). As such, *qualitative* disclosure can help information processing by less sophisticated users of disclosures (e.g., the general public, 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 can be disregarded by NGOs because it is harder to verify (She, 2021) and can be drafted using boilerplate and non-specific terms (Hope et al., 2016; Christensen et al. 2021). 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.*

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<sup>17</sup> Following the literature, we focus on tax avoidance as a first order outcome. Note that 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.

## IV. SAMPLE SELECTION AND VARIABLE MEASUREMENT

### Sample Construction

Our initial sample consists of 1,895 listed firms that have headquarters in the UK 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, i.e., all written under international financial reporting standards (IFRS) rather than local generally accepted accounting principles (GAAP) standards. Second, listed firms are potentially subject to more public scrutiny (Dyreng et al., 2016). Thus, we expect that those firms would face the highest compliance burden and the highest reputational costs. The reason we focus on UK MNEs is two-fold. First, MNEs face similar tax avoidance opportunities, which are different from those of domestic firms (Bilicka, 2019). Second, all UK MNEs face similar compliance burdens concerning the 2016 reform. These are higher compared to non-UK headquartered, foreign MNEs, 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 CbC reporting and are not small-to-medium-sized.<sup>18</sup>

In the UK, the CbC Reporting requirement was also introduced in 2016 but at a different size threshold, for MNEs having 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 MNEs that are required to publish tax strategy reports from 2016 onward but do not have to disclose a CbC Reporting: i.e., 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 CbC report, and are not SMEs. 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

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<sup>18</sup> To identify SMEs, we use the definition provided under the UK R&D tax credit regulation. SMEs 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 SMEs under this specific definition 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 SME versus non-SMEs.

thresholds at the unconsolidated level, but firms in the UK are not required to disclose their unconsolidated profit and loss account when having a consolidated one (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 for the final sample selection. Our final sample consists of 120 unique firms: 56 firms belong to the treated group and 64 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 sub-sample of annual reports and manually collect sentences in which firms discuss their tax strategy. Our classification is based on a PwC analysis studying the voluntary tax disclosure in annual reports of firms listed in the FTSE100 (PwC, 2016). The analysis conducted by PwC 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.<sup>19</sup> 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 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 construct two proxies for the *quality* of the information provided: the specificity and the inclusion of quantitative information. To measure the degree of specificity, we follow Dyer et al. (2017) and Hope et al. (2016): we use the Stanford Named Entity Recognition (NER) tool to capture how often the text refers to specific people, places, organizations, times, or numbers. We proxy for the provision of

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<sup>19</sup>For a detailed description of the technique and robustness analysis of the machine learning approach used in this paper see Appendix

quantitative information by computing the number of numbers in the text. We consider both of those proxies in levels and scaled by the number of tax strategy words in the annual report.

In untabulated analysis, we consider firm characteristics that determine which firms discuss their tax strategy before the 2016 reform and the extent of such disclosure. We show that media attention incentivizes 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 such disclosure is board composition. Firms with a higher degree of tax and accounting expertise by the board members 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 by the board members.

### **Measure of Tax Avoidance**

Following Hanlon and Heitzman (2010), we employ a commonly used tax avoidance proxy available when analyzing non-US settings, Cash ETRs. In untabulated analyses, we test the robustness of our results to using Book ETRs as an alternative proxy. Note that both proxies capture non-conforming 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). Further, Cash ETR captures tax deferral strategies, which are not included in the Book ETR measure. Following the related literature, we set ETR observations in loss years to missing, since losses distort ETR-based tax measures and make them hard to interpret (e.g., Dyreng et al., 2017, Chyz et al., 2019, Robinson et al., 2010).

Note that 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

### Tax Strategy Reports Characteristics

In Table 2, we summarize the characteristics of the tax strategy reports of our treated firms. First, the length of documents in our treated sample varies substantially between 63 words and 3,166 words.<sup>20</sup> Second, on average, a report contains 53 specific words, and the degree of specificity is 7 percent, but the reports exhibit a large variation in terms of specificity, 2-19 percent.<sup>21</sup> Third, we account for whether the report provides additional quantitative information by counting the number of numbers in each document. We find that most firms in our sample do not provide numbers in their tax strategy reports but the few ones that do, include a very detailed overview of their tax contribution.

### 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 are given the option to 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.<sup>22</sup> Our results are reported in Table 3 and Figure 1. First, we find that 95% of treated firms in our sample issue a standalone report.

In Table 3, 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 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 between the two. We also find a negative correlation between the number of numbers reported in the two outlets. Firms do not disclose numbers in the tax strategy reports at all, but some do so in the annual reports. This suggests that perhaps firms combine the qualitative and quantitative tax disclosure in the annual reports.

In Figure 1, Panel A we plot the distribution of the similarity between the annual report tax strategy disclosure and the tax strategy report.<sup>23</sup> The similarity score ranges between 20 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 and less specific

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<sup>20</sup> In Online Appendix B, we present examples of two extreme cases. RPS, a UK MNE offering professional services, provides a one-page long 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 eleven pages long tax strategy report where, besides the mandatory topics, an overview of the firm's total tax contribution and geographical distribution of tax payments is offered.

<sup>21</sup> In Online Appendix B, we present an example of a disclosure with a high degree of specificity. Macfarlane, a UK packaging and label MNE, scores 19 percent on our specificity index. For example, it states the exact period of time 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.

<sup>22</sup> For the comparison we use the 2017 fiscal year annual report.

<sup>23</sup> We capture the similarity of the tax strategy disclosures in the two outlets by computing the cosine similarity.

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 copy-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 in the next section.

In Panel B of Table 3, we examine whether a firm's Cash ETR is correlated with the disclosure patterns in both the tax strategy and the annual report. We split firms according to high or low disclosure across all disclosure outcomes and look at 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 provide fewer numbers. This provides first evidence for “greenwashing”, i.e., longer unsubstantiated reports.

### **Control and Treated Groups Characteristics**

In Table 4, we show the pre-2016 descriptive statistics for the variables used in our analysis, which we break down into treatment and control groups.<sup>24</sup> Treated firms in our sample devoted a larger portion of their annual report disclosure to the 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 and control groups. Firms in our sample have mean Cash ETRs of 24.6%. This, again, is not statistically significantly different between treated and control group firms. However, treated firms are significantly larger, they have more leverage, they are older, less likely to incur losses, 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.

Note that the level differences in firm characteristics do not invalidate our causal identification strategy, especially since we control for them in all specifications. Specifically, in Figure 2, we show that the evolution of the key outcome variables does not differ between treated and control groups before the reform. Further, 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.

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<sup>24</sup> In Table A1 in the Online Appendix, we provide descriptive statistics for the complete sample period.

## VI. CAUSAL EFFECTS OF THE UK DISCLOSURE MANDATE

### Difference-in-Difference 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 UK in 2016 as an exogenous shock to tax information disclosure and employ a difference-in-difference strategy. This legislation requires groups over a certain size to disclose additional qualitative tax information. Thus, we consider firms that are required to publish a tax strategy report as treated firms. As a control group, we use firms that are below the size threshold and are not required to publish a tax strategy report. Our difference-in-difference specification takes the following form:

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

where  $i$  is firm, and  $t$  is year.  $Post_t$  is a dummy, which denotes years after 2016.<sup>25</sup>  $TaxStrategyReport_i$  is a dummy equal to one for those firms that are required to publish a tax strategy report. As 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 ( $\gamma_i$ ) and year ( $\delta_t$ ) 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 these sentences consist of ( $Tax Strategy Words_{it}$ ). We then consider the *quality* of the tax strategy disclosures as proxied by the number of specific words included ( $Tax Strategy Specific Words_{it}$ ), the specificity level ( $Tax Strategy Specificity Level_{it}$ ), and the number of numbers ( $Tax Strategy Numbers_{it}$ ) also scaled by the number of words ( $Tax Strategy Numbers Level_{it}$ ). Second, we test whether mandating a tax strategy report has an impact on firm tax avoidance, measured by Cash ETR ( $Cash ETR_{it}$ ). 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  $\beta_1$  to be positive and significant in regressions with  $Tax Strategy Sentences_{it}$  and  $Tax Strategy Words_{it}$  as dependent variables. Hypothesis 2 suggests no effect on tax avoidance. Hence, we expect the coefficient on  $\beta_1$  to have a small magnitude and to be insignificant in specifications with  $Cash ETR_{it}$  as an outcome variable.

We present the results in Table 5. 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

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<sup>25</sup> 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.

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 their annual report before the reform (Table 4), this suggests an increase of almost 52 percent. Results from Columns (3)-(6) indicate that the mandate does not significantly and systematically affect the quality of the information disclosed. In Column (7) we report the effect of the reform on Cash ETR. We find no significant effect on tax avoidance for our treated firms after the reform.

### 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 this assumption using an event study methodology. We also use this method to evaluate the speed with which the reform affects our outcome variables. We estimate Equation 2 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:

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

The variables of interest are the dummies  $D_t^k$  that 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 ( $\gamma_i$ ) 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 tax strategy disclosure for treated and control groups evolved 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). However, Panels (c) - (f) show that the quality of that disclosure did not change following the reform for either of those groups. Overall, our results suggest that the reform was not effective in increasing tax transparency, as proxied by the quality of disclosure.

In Panel (g), we show that there was no significant difference in the evolution of ETRs between treated and control firms before the reform in any of the pre-treatment periods, as well as in any post-treatment periods. 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 (2019b) shows that media scrutiny was used effectively to induce compliance in publishing tax strategy reports for US MNEs. To test whether public pressure also plays such an important role in the case of UK MNEs, 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 firms in the low media attention category have below-median news coverage. 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 firms 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.<sup>26</sup> 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 sub-sample.

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 both treated and control group firms subject to high media attention increase the volume of their tax strategy disclosure, which explains why we find no effect in the difference-in-difference 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 following the tax strategy report mandate, even for firms that are not subject to the mandate themselves. This is consistent with the public exerting pressure on 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

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<sup>26</sup> Note that we do not find these coefficients to be statistically significantly different from each other, but that can be due to the small sample size.

media attention before the reform increase their disclosure significantly when compared to the control group firms with equally low media attention.

In Columns (3)-(6), we find no effect of the reform mandate on the quality of tax strategy disclosure across both sub-samples. The event study evidence from Panels (c) - (f) in Figure 3, suggests no significant differences pre and post reform between treated and control sub-groups across all quality proxies. In Column (7), 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 that are 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. ROBUSTNESS CHECKS**

In this section, we discuss several tests we conduct to check the robustness of our causal findings. First, we examine how our results are affected by the choice of an alternative identification strategy. Second, we show that our results are robust to matching on firms' observables. Third, we consider how a different classification of tax strategy sentences in the annual reports influences our conclusions. Fourth, we use alternative measures of tax avoidance as outcomes. 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.

### **Regression Discontinuity Design**

We chose a difference-in-difference design as our preferred identification strategy. However, a regression discontinuity design (RDD) would, in principle, also be suitable. Note that 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. However, the benefit of RDD is that firms in treated and control groups will have similar sizes. Given that evidence from Table 4 suggests that treated and control groups differ in terms of their sizes, this identification strategy would attenuate potential bias coming from those differences.

We demonstrate the existence of a positive discontinuity in the quality and volume of tax strategy disclosures in the annual report around the reporting threshold, and a negative discontinuity for Cash and Book ETR. We use these discontinuities to estimate the effect of the mandate on our outcome variables. We find the increases in volume and quality at the discontinuity threshold to be broadly similar to our baseline in terms of coefficient size.

### **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 4), 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 are unable to eliminate it.

We find that the results using the matched sample regression are similar to 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 unscaled number of Specific Tax Strategy Words and the Tax Strategy Numbers, yet the Tax Strategy Specificity and Numbers Level do not change significantly, which supports the conclusion that the quality of disclosure is not systematically changed by the reform. The effect of the reform on Cash ETRs is not systematically statistically significant but the sign remains negative.

### **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 not related 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 non-tax 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 under-estimates 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 the magnitude of the effect is smaller.

### **Alternative Tax Avoidance Measures**

Our benchmark results use Cash ETRs as a main tax avoidance measure. As an alternative, we use Book ETRs and the tax aggressiveness measure developed by Balakrishnan et al. (2019), which is the

difference between the average industry and size adjusted Cash/Book ETR and firm-level Cash/Book ETR. A positive value indicates an increase in tax avoidance. Our results suggest no significant change in tax avoidance using these alternative measures.

## **IX. CONCLUSION**

Currently, governments around the world are taking action to reduce corporate tax avoidance and increase tax transparency. In this study, we focus on one of such measures, mandating the disclosure of a qualitative tax strategy report, and investigate its effects on firm behavior. We find that affected firms increase the volume of discussion of their tax strategy in their annual reports, but we find no effect on the quality of that disclosure or tax avoidance behavior. As such, we demonstrate the difficulty of generating a standard that avoids low-quality disclosures when the disclosure mandate is asking for qualitative information only. The results of our study contribute to a better understanding of the differences between demanding *qualitative* and *quantitative* tax disclosures on firm activities. In contrast to mandates for quantitative tax 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.

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. Our findings suggest that firms may choose to show an image of exceptional “tax citizenship” by including lengthy discussions with unsubstantiated symbolic claims. Consequently, they largely provide “greenwashing” tax strategy information that does not change their real behavior. 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 thinking about introducing these types of purely qualitative CSR-like disclosure mandates.



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## Tables and Figures

Table 1: Sample Selection Steps.

	Unique	Firm-Year
	Firms	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-check)	(38)	(367)
Dropping missing and singleton observations	(67)	(898)
Final Sample	120	839

Table 2: Descriptive Statistics on Tax Strategy Reports.

<b>Tax Strategy Disclosure</b>	Obs	Mean	St. Dev.	Min	P25	Median	P75	Max
Words TSR	56	788.250	510.511	63	553	697.500	940	3,166
Sentences TSR	56	28.982	17.019	2	20	26.500	33.500	103
Specific Words TSR	56	52.982	42.003	7	27.500	44.500	61	231
Numbers TSR	56	0.661	3.772	0	0	0	0	28
Specificity Level TSR	56	0.069	0.030	0.019	0.051	0.068	0.086	0.189
Numbers Level TSR	56	0	0.002	0	0	0	0	0.010

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 56 are in the final sample. All variables are defined in Appendix A.

Table 3: Disclosure Outlet Comparison (Post-Treatment Statistics).

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

Tax Strategy in Standalone TR/AR	(1)	(2)	(3)		(4)	(6)	(7)
	Words	Sentences	Specific Words	Numbers		Specificity Level	Numbers Level
(1) Words	0.003						
(2) Sentences		0.155**					
(3) Specific Words			-0.021				
(4) Numbers				-0.057			
(5) Specificity Level					0.264***		
(6) Numbers Level							-0.028

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

<i>Splitting variable</i>	<b>Low Disclosure</b>	<b>High Disclosure</b>	Diff.	SE	T- Val.	P-Val.
<b><i>Tax Strategy Report</i></b>						
<i>Words TSR</i>	0.238	0.225	0.013	0.026	0.50	0.607
<i>Sentences TSR</i>	0.251	0.209	0.042	0.026	1.65	0.104
<i>Spec. Words TSR</i>	0.225	0.240	-0.016	0.026	-0.60	0.545
<i>Numbers TSR</i>	0.236	0.187	0.049	0.031	1.60	0.126
<i>Spec. Level TSR</i>	0.229	0.235	-0.007	0.026	-0.25	0.801
<i>Num. Level TSR</i>	0.236	0.187	0.049	0.031	1.60	0.126

Table 3 (continued)

<i>Splitting variable</i>	<b>Low Disclosure</b>	<b>High Disclosure</b>	Diff.	SE	T- Val.	P-Val.
<b><i>Annual Report</i></b>						
<i>Tax Strategy Words</i>	0.259	0.223	0.037	0.022	1.65	0.098
<i>Tax Strategy Sentences</i>	0.272	0.212	0.060	0.022	2.65	0.008
<i>Tax Strategy Specific Words</i>	0.250	0.232	0.018	0.022	0.80	0.416
<i>Tax Strategy Numbers</i>	0.230	0.253	-0.023	0.022	-1.05	0.304
<i>Tax Strategy Specificity Level</i>	0.240	0.242	-0.003	0.022	-0.10	0.907
<i>Tax Strategy Numbers Level</i>	0.213	0.267	-0.053	0.022	-2.45	0.016

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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. \*\*\* 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. Tax Strategy Specificity Level and Tax Strategy Numbers Level are calculated by scaling by the total tax strategy words in the respective document. All variables are defined in Appendix A.



Table 4: Test for the Difference in Means for Control and Treated Firms Pre-treatment.

Variable	Control		Treated		Difference in means			
	Obs	Mean	Obs	Mean	Diff	St Err	t-value	p-value
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
Tax Strategy Spec. Words	217	0.751	226	0.969	-0.218	0.163	-1.35	0.181
Tax Strategy Numbers	217	0.419	226	0.513	-0.094	0.093	-1.00	0.317
Tax Strat. Spec. Level	217	0.005	226	0.005	0	0.002	-0.05	0.957
Tax Strat. Numbers Level	217	0.005	226	0.003	0.002	0.001	1.95	0.053
Cash ETR	177	0.240	201	0.261	-.0190	.022	-0.85	0.386
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
Media Attention	204	0.505	209	0.713	-0.208	0.047	-4.40	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 1<sup>st</sup> and 99<sup>th</sup> percentiles besides Cash ETRs which are censored to be between 0 and 1. All variables are defined in Appendix A.

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	Tax Strategy Words	Tax Strategy Sentences	Tax Strategy Specific Words	Tax Strategy Numbers	Tax Strategy Specificity Level	Tax Strategy Numbers Level	Cash ETR
Treated × Post	81.50** (34.05)	2.783*** (0.921)	0.416 (0.371)	0.427 (0.300)	0.003 (0.003)	0.004* (0.002)	-0.058 (0.037)
Observations	839	839	839	839	839	839	707
Firms	120	120	120	120	120	120	113
R-squared	0.784	0.799	0.575	0.389	0.382	0.441	0.436
Firm FE	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Clustering	firm	firm	firm	firm	firm	firm	firm

Note: This Table summarizes the results on the effect of the reform on volume and quality of tax strategy disclosure (Columns 1-6) and on Cash ETR (Column 7). The dependent variable is displayed at the top of each column, respectively. The level variables are scaled by the number of tax strategy words. 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, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

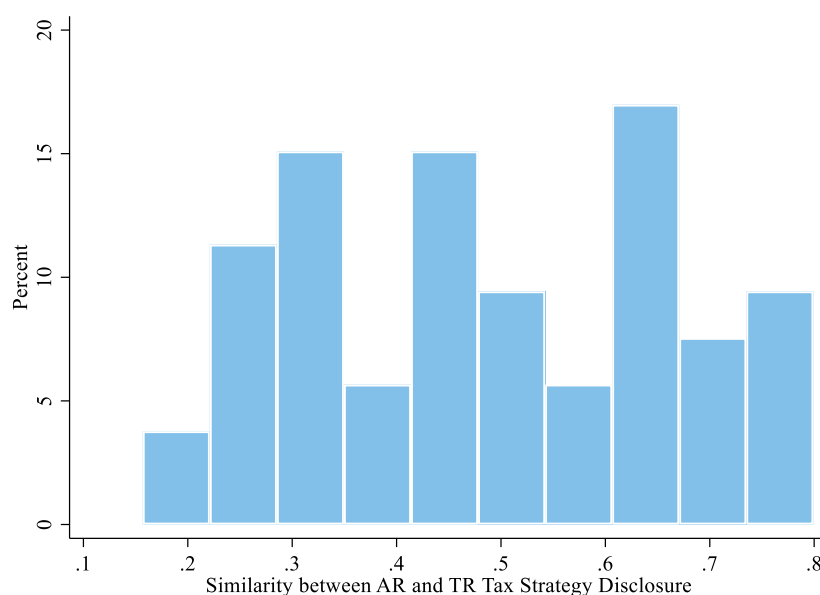
Table 6: The Effect of Mandatory Qualitative Tax Disclosure Regulation by Pre-Media Attention.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Var.	Tax	Tax	Tax	Tax	Tax	Tax	Cash
	Strategy	Strategy	Strategy	Strategy	Strategy	Strategy	ETR
	Words	Sentences	Specific Words	Numbers	Specificity Level	Numbers Level	
<b><i>Panel A: Pre-Reform High Media Attention</i></b>							
Treated × Post	22.40	1.311	0.127	0.060	0.006	0.005	-0.086
	(55.60)	(1.469)	(0.609)	(0.452)	(0.005)	(0.004)	(0.055)
R-squared	0.792	0.804	0.621	0.386	0.408	0.417	0.443
Observations	443	443	443	443	443	443	368
N. of Firms	57	57	57	57	57	57	54
Pre-Reform Mean	188.2	4.940	1.031	0.567	0.006	0.004	0.259
<b><i>Panel B: Pre-Reform Low Media Attention</i></b>							
Treated × Post	102.8**	2.981*	0.659	0.670	0.002	0.003*	-0.038
	(50.53)	(1.480)	(0.456)	(0.430)	(0.001)	(0.0013)	(0.057)
R-squared	0.750	0.776	0.521	0.523	0.493	0.611	0.625
Observations	312	312	312	312	312	312	310
N. of Firms	46	46	46	46	46	46	46
Pre-Reform Mean	125.7	3.689	0.634	0.385	0.003	0.003	0.242
Firm FE	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Clustering	firm	firm	firm	firm	firm	firm	firm
<i>Equiv. P-Value</i>	<i>0.217</i>	<i>0.316</i>	<i>0.533</i>	<i>0.289</i>	<i>0.218</i>	<i>0.569</i>	<i>0.537</i>

Note: This Table summarizes the results on the effect of the reform on volume and quality of tax disclosure (Columns 1-6) and on Cash ETR (Column 7). In panel A (B) the sample is restricted to firms with above (below) pre-treatment median media attention. The dependent variable is displayed at the top of each column, respectively, the level variables are scaled by the number of tax strategy words. 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

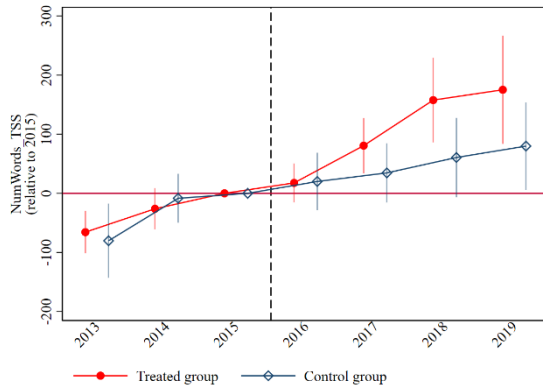


Panel B: Annual Report Characteristics by Similarity.

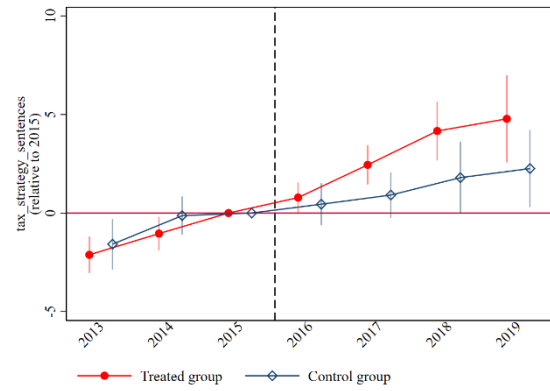
<i>Annual Report Tax Strategy Disclosure</i>	<b>Low Similarity</b>	<b>High Similarity</b>				
	Mean	Mean	Diff.	SE	T- Val.	P-Val.
Words	178.837	530.25	-351.413	60.401	-5.8	<b>0</b>
Specificity Level	0.007	.004	.004	.002	2.45	<b>.021</b>
Numbers	0.750	1.324	-0.574	.366	-1.55	<b>.126</b>

Note: This Table provides descriptive statistics on the similarity between the annual report and the separate tax strategy report. 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. Words are Tax Strategy Words, Specificity Level is Tax Strategy Specificity Level and Numbers is Tax Strategy Numbers all in 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. All variables are defined in Appendix A.

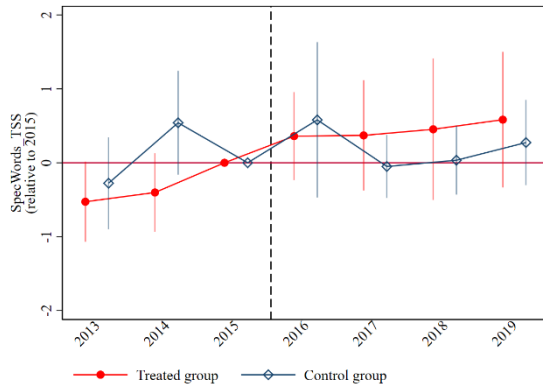
Figure 2: Dynamic Effects of the Reform on Qualitative Tax Disclosure - Event Studies.



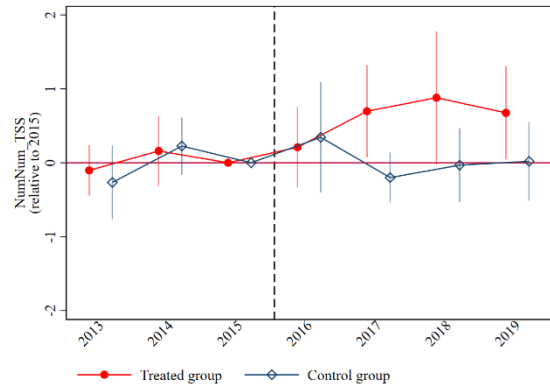
(a) Tax Strategy Words



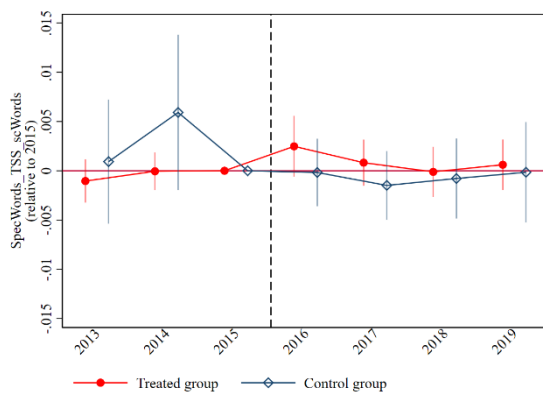
(b) Tax Strategy Sentences



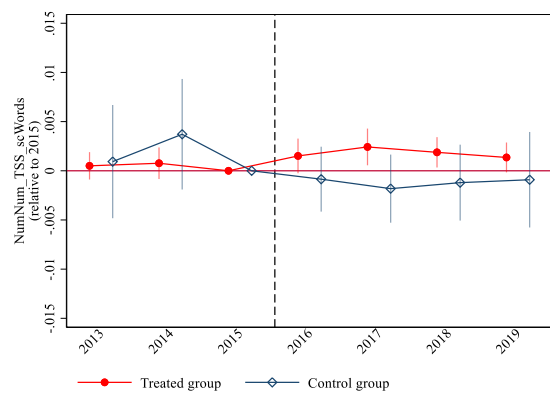
(c) Tax Strategy Specific Words



(d) Tax Strategy Numbers

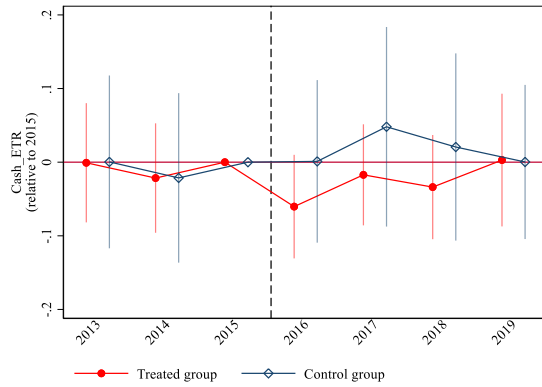


(e) Tax Strategy Specificity Level



(f) Tax Strategy Numbers Level

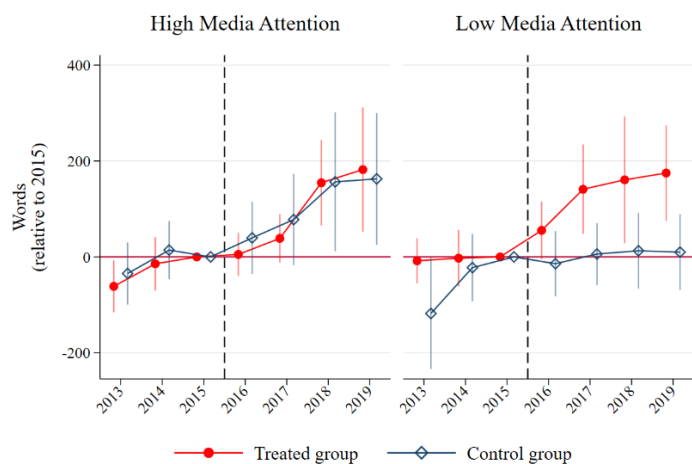
Figure 2 (continued)



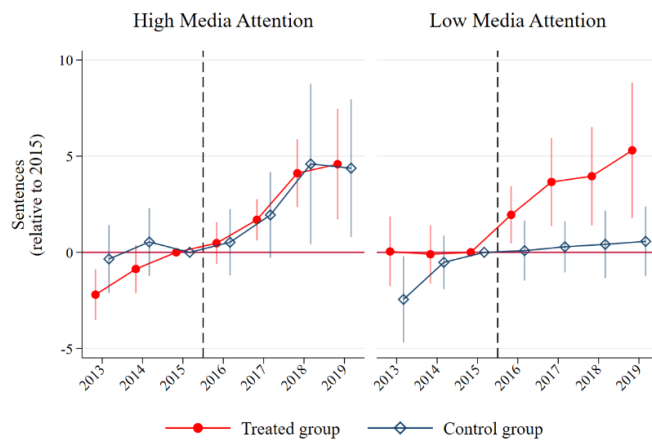
(g) Cash ETR

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.

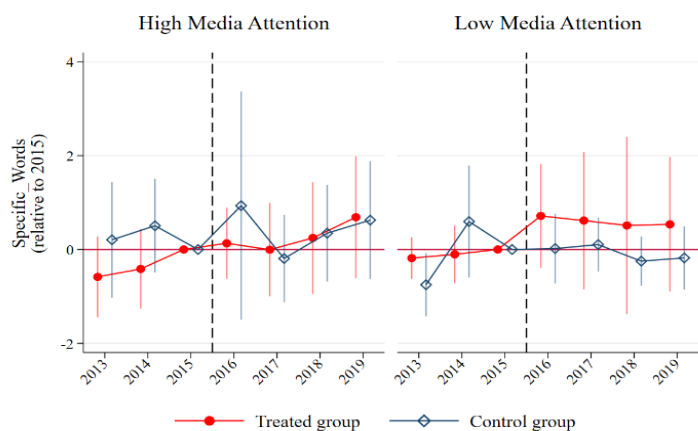
Figure 3: Dynamics Public Attention Split by Treated and Control Firms.



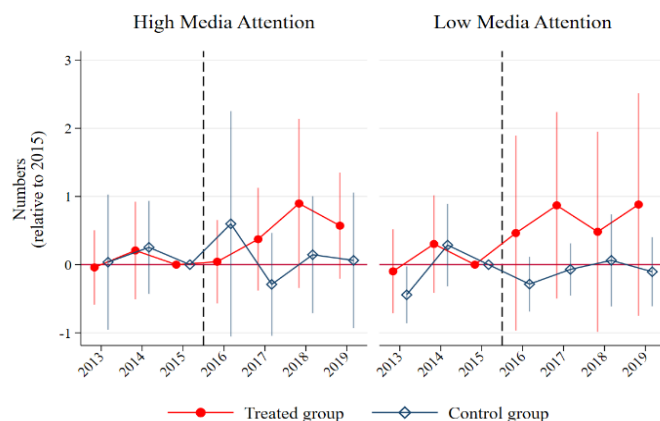
(a) Tax Strategy Words



(b) Tax Strategy Sentences



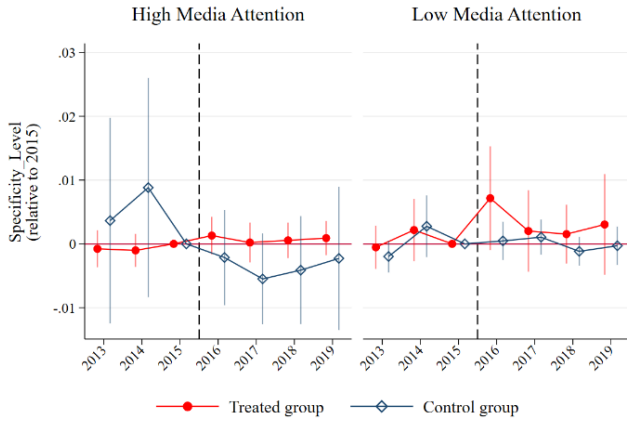
(c) Tax Strategy Specific Words



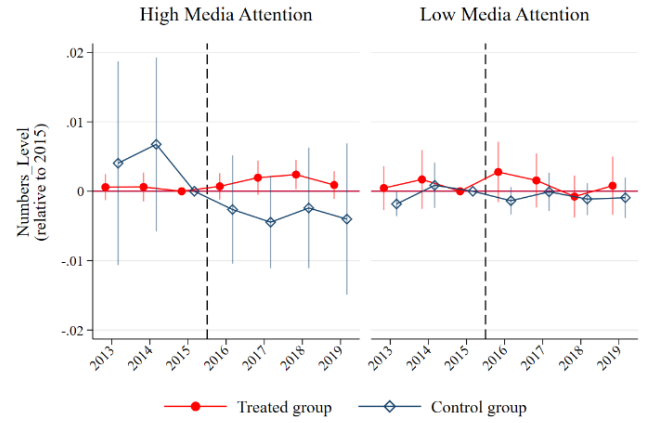
(d) Tax Strategy Numbers



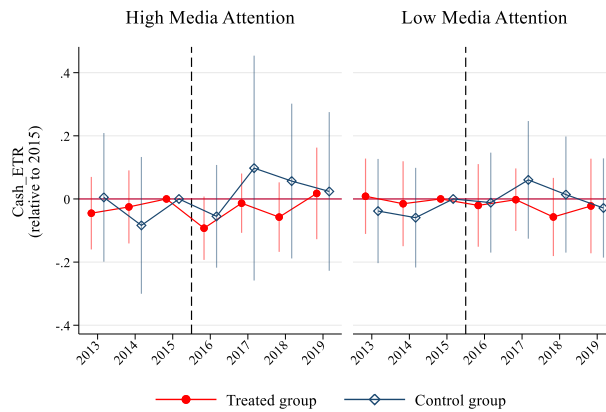
Figure 3 (continued)



(e) Tax Strategy Specificity Level



(f) Tax Strategy Numbers Level



(g) 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.
Tax Strategy Specific Words	The number of specific words in the annual report that appear in sentences which describe the tax strategy. 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.
Tax Strategy Numbers	The number of numbers in the annual report that appear in sentences which describe the tax strategy. Tax strategy disclosure in the annual report is identified by the Naïve Bayes algorithm at the sentence level.
Tax Strategy Specificity Level	The tax strategy specific words scaled by the total number of words that are used to describe the tax strategy in the annual report.
Tax Strategy Numbers Level	The tax strategy numbers scaled by the total number of words that are used to describe the tax strategy in the annual report.
Words TSR	The number of words in the dedicated tax strategy report. 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. 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.
Specific Words TSR	The number of specific words in the dedicated tax strategy report. 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. 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.
Numbers TSR	The number of numbers in the dedicated tax strategy report. 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.
Specificity Level TSR	The number of specific words in the dedicated tax strategy report scaled by the total number of words in this report.
Numbers Level TSR	The number of specific words in the dedicated tax strategy report scaled by the total number of words in this report.
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.
High (Low) Media Attention	A dummy equal to one (zero) if a firm has above (below) median coverage computed considering the counts of distinct news events about a firm in the last 91 days as stated in Ravenpack
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
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## 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.<sup>27</sup> 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.

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.<sup>28</sup> 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”.<sup>29</sup> 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

<sup>27</sup> 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”.

<sup>28</sup> For the cosine similarity exercise, we use tf-idf (term frequency-inverse document frequency) as weighting scheme.

<sup>29</sup> Also, for the Naïve Bayes, we use tf-idf (term frequency-inverse document frequency) as weighting scheme.

large corpus and avoids possible biases induced by the researcher’s subjectivity.<sup>30</sup>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 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).<sup>31</sup>

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%.

Table A1: Confusion Matrix

<sup>30</sup> For the formal derivation of Naïve Bayes, see Antweiler and Frank (2004).

<sup>31</sup> 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.

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

<b>Examples of Tax Strategy Sentences</b>
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.

<b>Examples of Non-Tax Strategy Sentences</b>
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.