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Do US Firms Pay Less Tax than their European Peers? On Firm Characteristics, Profit Shifting Opportunities, and Tax Legislation as Determinants of Tax Differentials

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Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
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Do US Firms Pay Less Tax than their European Peers? On Firm Characteristics, Profit Shifting Opportunities, and Tax Legislation as Determinants of Tax Differentials

Abstract

Using pairs of similar US and European firms listed on the S&P500 or StoxxEurope600, we examine effective tax differentials between US multinational corporations (MNCs) and their European peers. We show that statutory tax rates and profit shifting opportunities are important determinants of effective tax rates. Our findings suggest substantially lower total tax payments of US MNCs after the 2017 US tax reform. Based on past reforms of Controlled Foreign Company (CFC) rules and of the principle of worldwide taxation, we confirm that international tax legislation affects effective tax expenses. We also provide evidence for heterogeneity in firm responses: MNCs with profit shifting opportunities benefit most from more-lenient CFC rules.

JEL-Codes: H260, H320, F230.

Keywords: effective tax rate, tax avoidance, tax reform, CFC rule, international taxation, pair matching, difference-in-differences analysis.

Michael Overesch
University of Cologne
Albertus-Magnus-Platz
Germany – 50923 Cologne
overesch@wiso.uni-koeln.de

Sabine Schenkelberg
University of Cologne
Albertus-Magnus-Platz
Germany – 50923 Cologne
schenkelberg@wiso.uni-koeln.de

*Georg Wamser**
University of Tuebingen
Mohlstr. 36
Germany – 72074 Tübingen
georg.wamser@uni-tuebingen.de

*corresponding author

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1 Introduction

Until the fundamental US tax reform was enacted in December 2017, the US statutory tax rate on corporate profits was one of the highest in a worldwide comparison.[1] Many agree that the high home country tax was particularly problematic in an international context, as foreign profits are taxed upon repatriation under the US system of worldwide taxation, while most European countries exempt foreign income from any home taxation. The "Tax Cuts and Jobs Act" in December 2017 has responded to these arguments. The US corporate tax rate was cut to 21% and the worldwide tax system was replaced by a territorial system.

Yet not everyone shares the concern of a potential competitive disadvantage of US MNCs. In an interview on the Irish tax ruling of *Apple Inc.* Margrethe Vestager, the European Union's commissioner for competition, said that "*it is irritating when American companies pay less in taxes than European ones*".[2] Apple Inc., with an effective foreign tax rate of below 4% in recent years, is one of quite a few examples of well-known US MNCs reporting low effective tax rates (ETRs) on their foreign incomes.[3] The statement by Mrs. Vestager highlights a common concern that US MNCs had already a competitive advantage relative to their European competitors through substantially lower tax expenses before the major US tax reform was enacted.

The objective of this study is to add to this debate by comparing and analyzing the tax expenses of US MNCs and their European peers. Our analysis focuses on large MNCs listed either on the S&P500 or StoxxEurope600 stock market indices. One main contribution of our study is that we calculate and examine effective tax expense differentials between US and European competitors. While previous evidence suggests that the headquarters location of an MNC has a

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[1] For example, Swenson and Lee (2008) emphasize that *"US companies are overtaxed relative to their international competitors"*.

[2] *Bloomberg* (19/09/2016), available at http://www.bloomberg.com/news/articles/2016-09-19/eu-s-vestager-signals-apple-just-the-start-of-u-s-tax-probes.

[3] For more examples, see *The Financial Times* (30/09/2013), available at http://www.ft.com/cms/s/0/c6ff0ebc-29c4-11e3-bbb8-00144feab7 de.html.

major effect on its worldwide tax expenses (Markle and Shackelford, 2012a), existing studies do not provide clear evidence on whether US or European MNCs pay less taxes (Avi-Yonah and Lahav, 2012; PricewaterhouseCoopers, 2011). Moreover, it is largely unexplained whether tax differentials between European and US MNCs must be attributed to differences in home country tax legislation or if they can be explained by firm characteristics. Therefore, the second aim of our analysis is to understand the determinants of tax differentials and whether these reflect differences in firm characteristics distinctive to either US or European MNCs (e.g., technology) or are rather driven by tax legislation. We investigate the impact of (i) home country statutory tax rates, (ii) tax planning opportunities, (iii) CFC legislation, and (iv) home country taxation of foreign income. Issues that were also recently addressed by the US "Tax Cuts and Jobs Acts".

We propose an empirical approach that recognizes fundamental problems of identification in this context. First, we identify pairs of similar US and European MNCs, given observable firm characteristics. Besides firm characteristics, the matching of firm-pairs imposes further restrictions, such as the exact matching on the industry a firm is operating in. For example, the European *Danone S.A.* is found to be the best match for the US headquartered *Kellogg Corp.*, and the Europe-based *SAP SE is* found to be the best match for the US-based *Oracle Corp.* Running regressions on the matched sample conditional on pair fixed effects allows us to analyze the determinants of effective tax rate differentials that arise between very similar US and European MNCs. Of particular interest, then, is determining whether differentials are the result of policy reforms or whether responses to changes in policy depend on individual tax planning opportunities. To the best of our knowledge, a thorough comparative study of US and European MNCs in terms of tax expenses has not been provided so far.

Based on our matched sample of MNCs listed either in the S&P500 or the StoxxEurope600, we start our analysis by comparing the effective tax expenses of US and European MNCs over

recent years. The findings suggest that US MNCs have paid significantly less foreign taxes (measured as a foreign effective tax rate, *Foreign ETR*) but have reported significantly higher total tax expenses (measured by *GAAP ETR*) compared to their European counterparts. To be precise, the *Foreign ETRs* of US MNCs are found to be 9.6 percentage points lower compared to European MNCs, while the *GAAP ETR* of US MNCs was approximately 2.1 percentage points higher.

We then test whether differences in tax institutions and tax planning opportunities can explain the tax rate differentials. First, our analysis suggests that the high *GAAP ETR* of US MNCs can be attributed to the high corporate tax rate in the US prior to the fundamental US tax cut in 2018. Second, while US firms usually paid less foreign taxes, we show that a significant part of the difference can be attributed to enhanced profit shifting opportunities of US MNCs. A central result of our analysis is that US MNCs, compared to European ones, were able to reduce tax expenses through profit shifting, which compensates for a higher tax rate at home.

Additional analysis is concerned with tax policy as a determinant of tax differentials between US MNCs and their European peers. Based on our matched sample of comparable US and European MNCs, we estimate our regression model with pair fixed effects (given the matched pairs) and a difference-in-differences approach to pinpoint responses to changes in policy.

With the goal of restricting tax planning activities and to prevent erosion of their corporate tax bases, most countries have implemented a vast number of tax laws and regulations. The US Controlled Foreign Company (CFC) rules are often mentioned to be ineffective and thus one of the main causes of the low foreign tax expenses of US MNCs.[4] We therefore analyze the effectiveness of US and European CFC rules as a potential explanation for the tax differentials between US and European MNCs. We exploit two tax law amendments that changed the application of CFC rules:

[4] TaxJusticeBlog (20/07/2015), available at http://www.taxjusticeblog.org/archive/2015/07/like_a_campy_horror_movie_the.php#.V-gdyclrPo0.

The introduction of the Check the Box (CTB) option, which allows US MNCs to avoid US CFC rules, is expected to increase the tax differential between US and European firms. Similarly, in 2006, European CFC rules were adjusted after the European Court of Justice's (ECJ) "Cadbury Schweppes" decision,[5] with the result that the rules today apply only to "wholly artificial arrangements". We find that European MNCs have reduced their tax expenses significantly since the ECJ judgment. To be precise, our results suggest that European firms reduced their *GAAP ETRs* by approximately 2.6 percentage points after the Cadbury Schweppes decision. The introduction of CTB in the US led to 4.6 percentage points lower ETRs of US MNCs. This means that both US and European CFC rules became more lenient and less effective over time.

Another issue raised by the fundamental US tax reform is the replacement of the worldwide tax system by a territorial tax system. We analyze whether the international tax system has implications for tax differentials between competitors. While the change in the US international tax system in 2018 cannot yet be evaluated, we exploit the 2009 UK tax reform, through which the UK switched from a worldwide system of taxation to a territorial one. Based on a matched sample, we find that the reform has reduced the *GAAP ETRs* of UK MNCs by more than 2 percentage points. However, we do not find evidence that firms with additional profit shifting opportunities have benefited more from the switch to a territorial system. Moreover, the *Foreign ETR* of UK MNCs was unaffected by the reform.

Our study contributes to the literature and to the recent public debate on the tax expenses of MNCs in several ways. In contrast to previous studies, our paper compares ETRs of US and European MNCs at the micro level, uses different measures of ETRs, allows for pairwise comparisons, conditions on firm-specific characteristics, and provides causal evidence on the

[5] Judgment from September 12, 2006, C-196/04.

consequences of tax reforms. However, our paper is related to previous studies. First, earlier contributions have analyzed the determinants of tax avoidance and effective tax expenses. For example, a broad body of literature examines the ETRs of US MNCs (Dyreng et al., 2017; Yin, 2003). Only a few studies investigate the differences in tax expenses between the US and other countries of the world (Markle and Shackelford, 2012a; Swenson and Lee, 2008). To the best of our knowledge, only two studies compare (aggregate) tax expenses between the US and Europe (Avi-Yonah and Lahav, 2012; PricewaterhouseCoopers, 2011).

Second, our analysis is closely related to studies investigating the impact of home country tax systems and tax legislation, such as CFC rules and the system of international taxation. Dunbar and Duxbury (2015) find evidence that US MNCs reported 9 percentage points lower foreign ETRs directly after the CTB introduction. Ruf and Weichenrieder (2013, 2012) investigate the consequences of the German CFC rule on the allocation of financial assets across affiliates held by German MNCs. Their findings suggest that the German CFC rule prevented German MNCs from holding financial assets in tax haven countries until 2006, while German firms started to use low-tax countries within Europe much more heavily after the ECJ Cadbury Schweppes judgment. Related to this, previous research has found that the international tax system of the home country has implications for the tax planning activities of MNCs (Atwood et al., 2012; Markle, 2016). Egger et al. (2015) exploit the UK tax reform in 2009 and find that the abolishment of the worldwide tax system has affected repatriation behavior (see also Hasegawa and Kiyota, 2017, for a study on the Japanese switch to a territorial system).

The remainder of the paper is organized as follows: In the next section, we describe the institutional background and develop testable hypotheses. The data and research design are described in Section 3. Empirical results regarding the differences in tax expenses between US and

European MNCs are shown in Section 4. The impact of tax planning opportunities and the home countries' tax rules are presented and discussed in Section 5. Section 6 concludes.

2 Institutional Background and Research Hypotheses

The question of whether US MNCs are paying their fair share of taxes has become a central public concern. The argument is often used that European firms are unable to avoid taxes to the same extent and are therefore disadvantaged relative to their US competitors. Particularly well-known US firms, such as *Google Inc.*, *Amazon.com Inc*., and *Starbucks Corp*., are mentioned in public debate and are accused of avoiding taxes to a significant degree.[6] Having said that, many tax experts argue in turn that prior to the US tax reform, US MNCs were subject to the high US statutory tax rate on corporate profits and a worldwide tax system.

While many empirical studies analyze the tax expenses (measured as ETRs) of US firms, only a few empirical studies compare the tax expenses between different countries. These studies come to opposing conclusions: Markle and Shackelford (2012a) compare the ETRs of US MNCs to those of Australian, French, German and UK firms and find a 1 percentage point *lower* average ETR of US firms compared to those of the other four countries. The study of Swenson and Lee (2008) suggests *higher* US ETRs if US MNCs are compared to MNCs headquartered in OECD member states. We know of only two studies that compare US MNCs and European MNCs. PricewaterhouseCoopers (2011) analyzes the *Forbes Global 2000* list and finds a 5.8 percentage points *higher* ETR for US MNCs for the period 2006 to 2009, whereas Avi-Yonah and Lahav (2012) find a 4.0 percentage points *lower* ETR for the largest US firms during the period 2001 to 2010. Our paper is related to these studies because we analyze tax expense differentials between comparable US and European MNCs.

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[6] *BBC News Magazine* (21/05/2013), available at http://www.bbc.com/news/magazine-20560359.

Taking into account the aforementioned debate and, in particular, the concern of the high US corporate tax rate prior to the US tax reform, we test the following hypothesis:

H1a: US MNCs report higher ETRs compared to European MNCs.

The public debate about taxation of MNCs often refers to international tax avoidance. Accordingly, the public discussion is to a large extent based on the *Foreign ETR* of those firms.[7] Particularly, very low *Foreign ETRs* of some prominent US MNCs are mentioned. Regarding the tax expenses associated with foreign operations, we therefore test the following hypothesis:

H1b: US MNCs report lower Foreign ETRs compared to European MNCs.

Earlier studies suggest that differences in ETRs are naturally related to differences in industry membership and firm characteristics (Gupta and Newberry, 1997; Plesko, 2003; Rego, 2003; Richardson and Lanis, 2007; Stickney and McGee, 1982). By using matching techniques, our analysis addresses potentially confounding effects of firm characteristics. In particular, we compare pairs of US and European MNCs[8] that belong to the same industry and have very similar firm characteristics.

While our analysis is based on novel data and techniques, which we believe are particularly suitable for making such a comparison, we primarily contribute to the literature by focusing on possible explanations for the observed tax expense differentials between US and European MNCs. In the following, we will formulate more-specific hypotheses along the determinants of effective taxes to learn about the origins of the tax differential between US and European firms. As possible determinants thereof, we suggest differences in *(i) home country statutory tax rates*, *(ii) tax planning opportunities*, *(iii) CFC legislation*, and *(iv) home country taxation of foreign income.*

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[7] E.g., *The Financial Times* (30/08/2016), available at https://www.ft.com/content/3e0172a0-6e1b-11e6-9ac1-1055824ca907.

[8] Our comparison focuses on the MNCs listed on the two leading stock market indices, S&P500 and StoxxEurope600.

(i) Home Country Statutory Tax Rates

A potential reason for differences in tax expenses between US and European MNCs might simply be the direct effect of the level of the corporate income tax rate at home. While the US statutory tax rate was among the highest in the world prior to the "Tax Cuts and Jobs Act",[9] corporate income tax rates in Europe vary across countries and were, on average, significantly lower than in the US. Home country statutory tax rates affect the ETR, as the profits of the ultimate parent company and operations in the home country are taxed at this rate. Moreover, given the worldwide tax system, the high US statutory tax would be the minimum tax rate when profits were repatriated. Many US firms urged therefore policymakers to cut the statutory tax rate in order to avoid a competitive disadvantage.[10] All this suggests that naive comparisons between US and European firms might be misleading with regard to tax avoidance, and the empirical analysis should be conditional on the home statutory tax rate. This leads to our second hypothesis:

H2: US MNCs report lower effective tax rates compared to European MNCs, conditional on the high statutory corporate tax rate in their home country.

(ii) Tax Planning Opportunities

International tax planning seems to be an important determinant of MNCs' tax expenses. Previous literature provides convincing evidence that MNCs shift taxable income to low-tax affiliates in order to minimize their overall tax expenses (Heckemeyer and Overesch, 2017; Hines and Rice, 1994; Huizinga and Laeven, 2008). The main channels through which income is shifted are transfer prices for intrafirm transactions and the strategic use of internal capital markets and

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[9] Tax Foundation (07/09/2017), available at https://taxfoundation.org/corporate-income-tax-rates-around-the-world-2017/. Note that our sample period ends in 2015. Nowadays, the US do no longer have the highest corporate tax rate worldwide due to the US tax rate cut in 2017.

[10] *The Financial Times* (02/05/2011), available at http://www.nytimes.com/2011/05/03/business/economy/03rates.html?_r=1.

internal debt financing. For example, MNCs may determine transfer prices such that high expenses accrue at affiliates located in high-tax countries, while high earnings should accrue at low-tax affiliates (Cristea and Nguyen, 2016; Davies et al., 2017). A similar strategy allows MNCs to utilize their internal capital markets: providing loans from affiliates at low-tax locations to affiliates at high-tax locations gives rise to a tax shield at the high-tax location (Buettner and Wamser, 2013; Desai et al., 2006; Huizinga et al., 2008).

The opportunities to reduce tax expenses through profit shifting depend on the specific business models of firms. For example, large amounts of intangible assets or R&D-intensive businesses facilitate the profit shifting activities of MNCs (Grubert, 2003; Harris, 1993). Hence, differences in tax expenses between US and European MNCs may relate to differences in the fundamental characteristics of firms and their businesses. But even if we compare very similar firms and align firm characteristics, US MNCs might still avoid more (or less) taxes compared to their European peers if the shifting opportunities differ between US and European firms. These differences may arise from specificities in business models, products, or production processes. Hypothesis H3 follows:

H3: Differences in tax expenses of very similar US and European MNCs are related to differences in profit shifting opportunities associated with fundamental firm characteristics.

(iii) Controlled Foreign Company Rules

The extent to which MNCs engage in tax saving activities might be determined by the taxation of foreign income in the home country of the firm. In particular, so-called Controlled Foreign Company (CFC) rules are implemented by the home countries of MNCs to restrict profit shifting activities. Thus, CFC rules should affect ETRs. While such rules are established in the US

and in many European countries, they often differ in application and scope. What they have in common, however, is that they aim at preventing MNCs from shifting passive income (such as royalty or interest income) to low-tax countries. If a foreign subsidiary meets the criteria of a controlled foreign company, foreign profits to which a CFC rule is applied to will be taxed at the (higher) tax rate of the country of the parent firm. In addition, the usual privilege of exemption upon deferral is not granted to income taxed under a CFC rule. We therefore expect that changes in the scope and application of CFC rules should be reflected in tax differentials between European and US firms.

Tax experts have considered the implementation of the so-called “Check the Box” (CTB) regulation in 1997 as a substantial change in the practical application of US CFC law. The CTB option was introduced in the US with the aim to simplify entity classification rules. However, part of the new legislation allows US MNCs to avoid Subpart F by checking the box to classify an affiliate as a “disregarded entity”.

Altshuler and Grubert (2006) suggest that using the CTB rule was associated with foreign tax savings of approximately $7.0 billion in 2002. Costa and McGrath (2010) also argue that CTB is an important tool to avoid Subpart F, as 69 percent of new foreign entities checked the box in order to be a disregarded entity for US tax purposes. Grubert (2012) finds that the Foreign ETR of US MNCs has declined by nearly 2 percentage points since the introduction of CTB. Dunbar and Duxbury (2015) provide evidence that US MNCs were able to reduce their foreign ETRs by approximately 9 percentage points compared to non-US MNCs immediately after the introduction of CTB in 1997. Furthermore, a decrease in the Cash ETR of US MNCs due to CTB is suggested by Dyreng et al. (2017).

European CFC rules were also subject to a drastic change in the way CFC legislation is applied by European countries. In 2006, the European Court of Justice (ECJ) decided that CFC

rules infringe upon the European principle of freedom of establishment, and it restricted their applicability. The so-called "Cadbury Schweppes" judgment limits the application of CFC rules within Europe to wholly artificial arrangements that do not reflect any economic activity (e.g., pure letter boxes). European countries had to adjust their CFC rules. It seems that Cadbury Schweppes rendered CFC application within Europe more or less ineffective, as wholly artificial arrangements can be easily avoided by firms (Bräutigam et al., 2017). While German MNCs appear to have held only small financial investments in European low-tax countries before the ECJ judgment, they substantially increased passive investments in the aftermath of the ECJ decision (Ruf and Weichenrieder, 2013, 2012). By and large, it seems that the literature agrees on the interpretation that the ECJ decision has facilitated tax planning within Europe for European MNCs since 2006 to a significant degree.

We examine how changes in the application of CFC rules in the US and Europe affected the tax differentials between European and US MNCs. Based on the explanations above, we state our fourth hypothesis:

H4a: Changes in the application of CFC rules in the home countries affect the effective tax expenses of MNCs.

CFC rules are anti-tax-avoidance measures applied by home countries to prevent home resident MNCs from allocating mobile income to low-tax countries. Thus, we expect that changes to CFC rules affect particularly MNCs with more profit shifting opportunities. This suggests the following:

H4b: Changes in the application of CFC rules in the home countries should particularly affect MNCs with large profit shifting opportunities.

(iv) Home Country Taxation of Foreign Income

An additional feature of a home country tax system is the general taxation of foreign income. Nearly all European countries have implemented a territorial system.[11] In the US, a worldwide tax system had been applicable until 2017 when the foreign tax credit was replaced by a territorial tax system.

Under a worldwide tax system, dividends from foreign subsidiaries are taxed upon repatriation. The overall tax burden is equal to the (possibly) high tax level of the home country, but only when profits are repatriated to the parent. In contrast, under a territorial tax system, dividends repatriated to the parent are partially or wholly exempt from tax in the home country.

Due to the additional tax on dividends repatriated to US parent firms, many argue that this was a competitive disadvantage for US MNCs relative to MNCs operating under a territorial system (e.g., Hines, 2012). In line with these arguments, earlier research has found enhanced tax planning activities for MNCs headquartered in countries with a territorial tax system compared to MNCs from countries with a worldwide tax system (Atwood et al., 2012; Dyreng and Markle, 2016; Markle, 2016). In contrast, anecdotes of US MNCs suggest that different strategies, such as using a series of short-term loans, have been used to shift money back to the US without paying repatriation tax.[12] Although the US have recently replaced their worldwide tax system, an evaluation is not possible at this point in time due to missing data. In 2009, however, the UK already switched from a system of worldwide taxation to a territorial system. We exploit the UK tax reform to learn about the impact of the international tax system on effective tax expenses. We will test the following hypothesis:

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[11] Nowadays, Ireland is the only European country with a worldwide tax system. See further worldwide corporate tax summaries of PwC, KPMG, and EY.

[12] E.g., *HP is* accused of repatriating billions of dollars each year from offshore entities to the US without paying taxes; see Forbes (20/09/2012), available at https://www.forbes.com/sites/janetnovack/2012/09/20/senate-report-hits-hp-microsoft-for-offshore-ploys-saving-billions-in-tax/#2b35c9a6229e.

H5: The switch from a system of worldwide taxation to a territorial system affects the effective tax expenses of MNCs.

3 Data and Research Design

3.1 Data and Exploratory Analysis

The main objective of our paper is to provide reliable estimates about the determinants of tax differentials between US and European MNCs. We focus on firms with US or European headquarters listed on the S&P500 or StoxxEurope600 stock market indices, and we consider their consolidated financial information taken from the *Compustat* and *Compustat Global* databases.

Many different measures have been suggested to gauge the effective tax level of a firm. Following a recent stream of literature in accounting, we base our analysis on variations in effective tax rates (ETRs) as ex post measures of tax expenses (e.g., Dyreng et al., 2010; Hanlon and Slemrod, 2009; Markle and Shackelford, 2012a, 2012b). The data to compute ETRs are taken from the consolidated financial statements of the MNCs. The ETR measures the overall tax expenses of a firm. Thus, it reflects numerous choices made by the firm, including tax avoidance or tax planning activities. In our main analysis, we focus on a firm's *GAAP ETR*. According to ASC 740, we define *GAAP ETR* as tax expenses (txt) divided by pretax income (pi). We adjust the latter for extraordinary items (xi).[13] See Appendix A.1 for detailed variable description.

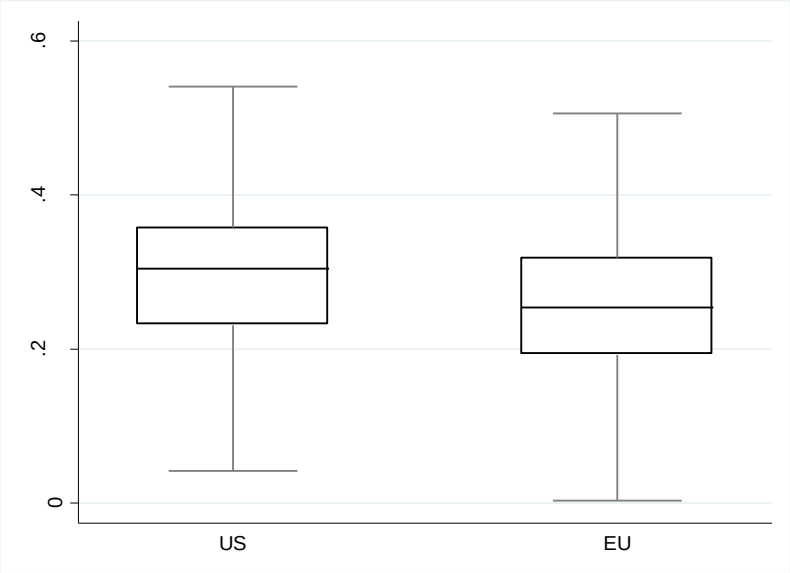
Our base sample includes MNCs that have been listed on either the S&P500 or StoxxEurope600 at least once during the period 1995 to 2015. In sum, 965 US firms and 1,015 European firms for which financial information are reported in *Compustat* or *Compustat Global*, enter our sample (see Table 1 for more detailed information).

[13] We replace missing values in the latter variable by including zeros. We delete a firm-year observation if the numerator or denominator of the ETR is negative, and we generally exclude ETRs with negative values or with values greater than one.

[Table 1]

We investigate effective tax differentials between US and European MNCs for different time periods dating back to 1995. However, the recent debate about the aggressive tax planning structures of several MNCs started around 2012.[14] Thus, to gain a first idea about the distribution of US and European *GAAP ETRs*, we have calculated ETRs for the years 2012 to 2015 and display them in Figure 1. The statistics suggest that the average *GAAP ETR* of US MNCs equals 28.9%, which is 2.0 percentage points higher than the mean of the European firms, which is 26.9%. The median values of 30.5% for the US MNCs and 25.4% for the European ones suggest that the distribution of US ETRs is also more left-skewed – implying that a few US MNCs save a lot of taxes but many others face relatively high effective tax payments – compared to the distribution of European ETRs.

Figure 1. GAAP ETR



Notes: Comparison of *GAAP ETR* between US and European MNCs. The figure is based on data for the years 2012 to 2015. A box portrays the interquartile range of the *GAAP ETR* distribution. The horizontal line in the box represents the median.

[14] For example, public hearings on aggressive tax planning in the U.S. or the United Kingdom, e.g., U.S. Senate, Permanent Subcommittee on Investigations, Hearing On Offshore Profit Shifting and the U.S. Tax Code, 9/20/2012; House of Commons, Committee of Public Accounts, 11/12/2012.

In additional tests we will also consider the *CURRENT ETR* and the *CASH ETR*, although the sample size becomes smaller due to missing data.[15] However, in our main analysis, we prefer the *GAAP ETR* because data is available for most firms, and the public debate mainly refers to the *GAAP ETR* or its counterpart, the *Foreign ETR*. The *Foreign ETR* focuses only on tax expenses associated with foreign operations. For US MNCs, the *Foreign ETR* is calculated as "foreign taxes" (txfo + txdfo) divided by "foreign income" (pifo). Unfortunately, European MNCs are not obligated to disclose foreign taxes and foreign pretax income. Therefore, we approximate the Foreign ETRs for European MNCs by subtracting domestic taxes and domestic pretax income from the overall tax expenses and pretax income. We obtain the domestic information for European MNCs by combining ownership information with financial information taken from the *Amadeus* database.[16] We provide an example of the calculation of the *Foreign ETR* of European MNCs in Table A.2.

We believe that we can calculate comparable measures reasonably well. In particular, *Compustat* reports foreign tax information for very few European firms. Thus, we are able to validate our measure with the reported tax information for a very limited number of firms. The overall good approximation is documented in Table A.3. Note, moreover, that the second part of our empirical analysis focuses on time-variation and should therefore not be too sensitive to cross-sectional inconsistencies (if there are any).

The findings, presented in Figure 2, suggest that the distinction between foreign taxes and overall taxes matters: On average, the US *Foreign ETR* (23.7%) is 6.8 percentage points lower compared to the European one (30.5%), and the whole distribution of US ETRs has substantially shifted to the left (or down, in the boxplots depicted) compared to Figure 1.

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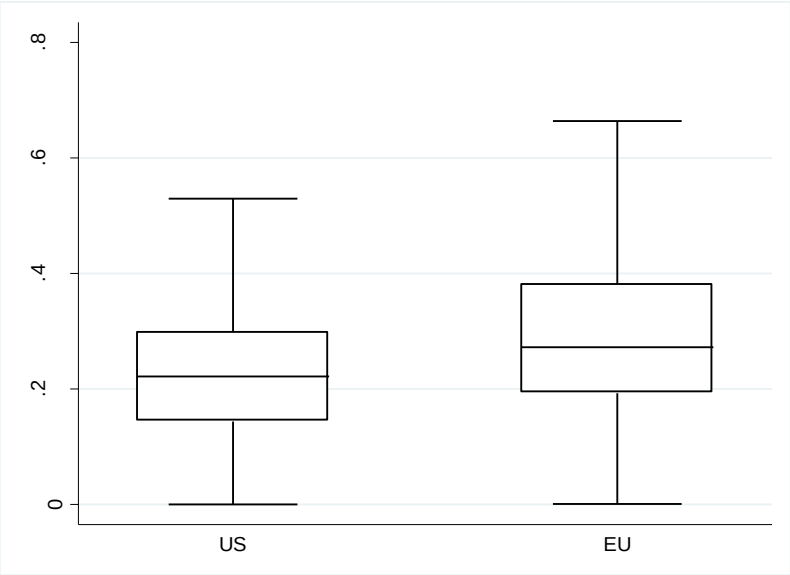
[15] Moreover, we cannot compute *CASH ETRs* of European firms for years before 2006 due to a lack of data.

[16] The ownership data from *Amadeus* are available only for the most recent years, so the group structure information we use is usually from the year 2012.

Figure 2. Foreign ETR



Notes: Comparison of *Foreign ETR* between US and European MNCs. The figure is based on data for the years 2012 to 2015. A box portrays the interquartile range of the *Foreign ETR* distribution. The horizontal line in the box represents the median.

We can conclude that descriptive statistics do not provide a clear answer to the question of whose tax expenses – US or European – are lower. This obviously depends on how we measure tax expenses. Moreover, firm characteristics, which determine ETRs as well, clearly differ between US and European firms in our sample (although we focus on large public firms). Table 2 presents summary statistics on firm variables. The time period of Panel A in Table 2 corresponds to the years 2012 to 2015. A rough comparison between the US and European MNCs suggests that the former are larger and more profitable than the latter. While European firms own more intangible assets, US MNCs face higher R&D expenses. Because previous literature has shown that firm characteristics affect ETRs, systematic differences therein may also bias estimated tax differentials between US and European MNCs.

[Table 2**]**

3.2 Empirical Approach

We proceed with a multivariate empirical analysis of the ETR-differential between US and European MNCs. Our identification strategy is based on the following steps. First, we use propensity score matching to identify similar US and European firms. Second, we run panel regressions in which we condition on fixed effects at the level of firm-pairs, which we identify in step 1. To these regressions, we add a number of time-variant variables measured at the level of firms. Third, we focus on firm heterogeneity in explanatory variables to learn about the determinants of tax differentials. Fourth, we exploit policy reforms in a difference-in-differences setting to identify the consequences of particular tax legislation on effective tax expenses.

(i) Finding Firm-Pairs

Let us first define the indicator variable US_i to indicate whether firm *i* is US based ($US_i = 1$) or European based ($US_i = 0$). Note that the variable is not indexed by time *t*. We are primarily interested in how US_i and interactions thereof (interacted with firm- and tax-law variables) affect ETR_{it}. The latter denotes the different measures of effective tax expenses.

The first step involves estimating the probability $\widehat{p_i}$ that firm *i* is US based. Thus, we specify

$$US_{i,2011} = \beta_1 X_{i,2011} + \varepsilon_{i,2011}, \tag{1}$$

to determine the linear index in a probability model.[17] Equation (1) indicates that the probability of being a US firm depends on firm-*i*-specific determinants, captured by $X_{i,2011}$, where the 2011 index denotes that all variables are measured in 2011. Note that our first regression-based analysis (see below) starts in 2012, which is why we base the estimates of the propensity scores on the year 2011.

[17] We will estimate equation (1) assuming a probit model.

The choice of regressors in (1) is based on determinants of tax expenses (e.g., Augurzky and Schmidt, 2001; Caliendo and Kopeinig, 2008). To be specific, we consider $SIZE_i$, defined as the logarithm of total assets (at) of firm i.[18] ROA_i is the return on assets as a proxy for profitability. LEV_i is the liability (dltt)-to-total-assets (at) ratio of i. RD_i captures the R&D expenses (xrd) relative to total assets (at). $INTAN_i$ are the intangible assets (intan) divided by total assets (at).[19]

Estimating (1) produces two vectors of propensity scores: one for the US firms, $\hat{p}^{US}$, and one for the European firms, $\hat{p}^{EU}$. Once we have estimated $\hat{p}^{US}$ and $\hat{p}^{EU}$, we aim at finding so-called *nearest neighbors* for each US unit, i.e., the best comparable match from the group of European firms. We may use ω_i to denote a matched European unit *m* that is identified as the best match for the US unit *i*. The best match is determined as $\omega_i = \min_{\{m\}}(|\hat{p}_i^{US} - \hat{p}_m^{EU}|)\,, i \neq m$, where we additionally ensure that only firms operating in exactly the same industry are matched.[20] Furthermore, to ensure acceptable matching quality, we require a difference in propensity scores of less than 0.02.[21] Note that our approach produces firm-pairs $\{US_i = 1; US_m = 0\}$, where units (firm-pairs) are very similar (comparable).[22]

In the following, we analyze different periods of time. Because our objective is to analyze pairs of very similar firms over time, we repeat our matching procedure whenever analyzing different time periods and treatment events.

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[18] To guarantee comparability, we have used yearly exchange rates to convert total assets to US dollars.

[19] The latter two variables are set equal to zero in case they are missing in our data.

[20] According to the Fama and French classification of 17 different industry groups.

[21] According to Austin (2011), the optimal caliper width lies at 20% of the standard deviation of the propensity score, and calipers equal to 0.02 or 0.03 show superior performance.

[22] Note that matching on the propensity score is based on two central assumptions. The first assumption is called ignorability of treatment. The second assumption is the so-called balancing property. The latter assumption is testable.

(ii) Estimating Conditional ETR Differentials

To learn about ETR differentials between US and European firms, we suggest the following regression model:

$$ETR_{it} = \alpha_1 US_i + \theta_t + \omega_i + u_{it}. \quad (2)$$

The dependent variable is an ETR measure of firm *i* in year *t*. The first tests focus on the *GAAP ETR*. Additional regressions consider the *Foreign ETR* as well. The explanatory variable of interest is the indicator variable US_i, which equals one if the MNC is located in the US and zero if the MNC is located in Europe. The coefficient α_1 measures the tax differential between US and European MNCs, conditional on the pair-(ω_i) and year-(θ_t) fixed effects. Hence, equation (2) allows us to average over all pair-specific differentials, i.e., conditional on the propensity score.

(iii) Different Tax Planning Opportunities

In additional analysis, we can augment equation (2) by firm- and country-specific time-variant regressors that could lead to bias in α_1. In particular, we control for firm characteristics associated with international tax planning opportunities. Moreover, we can analyze whether distinct tax planning opportunities between US and European MNCs exist by introducing interaction terms between firm characteristics and the indicator variable US_i.

(iv) The Effect of Home Country Tax Rules

One particular advantage of the identification approach suggested above is that it allows us to effectively combine the pair-matching with a difference-in-differences approach to analyze the differential impact of tax policy reforms. As described in Section 2, we consider US and European reforms of CFC legislations, as well as the UK's switch to a territorial tax system.

The difference-in-differences approach ensures that the estimates are not biased by time-constant differences in the treatment and control groups (Caliendo and Kopeinig, 2008; Heckman et al., 1998).[23] The approach also helps us understand and pin down where possible ETR differentials come from and how these have changed after the reforms of tax rules. Let us define the variable $TREATMENT_i$, which is equal to one if firm *i* is affected by the change in tax legislation, and zero otherwise. Since the reforms we study affect either US firms or European firms, the indicator $TREATMENT_i$ usually captures the location of the MNCs as above. We estimate the following equation:

$$ETR_{it} = \gamma_1 TREATMENT_i + \gamma_2 TREATMENT_i \times POST_t + \theta_t + \omega_i + u_{it}. \quad (3)$$

In equation (3), $POST_t$=1 denotes the periods of and after a policy reform. The coefficient γ_2 is the treatment effect we are interested in, as it measures the differential response of a treated firm *i* relative to a firm that is not affected by a reform.

4 Comparing Effective Tax Expenses: US vs. European Firms

4.1 Conditional Comparisons

We start with a comparison of ETR measures of US and European firms for the most-recent years available in our data (2012 to 2015). Before we do so, we need to estimate propensity scores and find the best matching pairs of US and European firms. The matching is based on the year before our panel analysis starts, *i.e.*, propensity scores are calculated for the year 2011.

Table 3 suggests that the matching removes most of the bias in firm characteristics between US ($US_i = 1$) and European ($US_i = 0$) firms. The nearest neighbor matching (with a 2% caliper as

[23] Note that our regressions are still based on a pair-matched sample. We thereby ensure that the common trend assumption in a difference-in-differences setting is not an issue.

suggested above) finds 352 matched pairs (see Panel B in Table 2 for descriptive statistics). The matching produces very reasonable results. For example, the European-based *SAP SE* is matched to the US-headquartered *Oracle Corp.*

[Table 3]

Based on the matched sample, we then run equation (2). The results are presented in Table 4. Columns (1) to (3) of Table 4 are regressions where the dependent variable corresponds to *GAAP ETR*. Column (1) reports a specification that includes only year and pair fixed effects. The coefficient of interest, *US*, is positive and statistically significant.

[Table 4]

We add firm characteristics in column (2). While the matching procedure has aligned firm characteristics of our firm-pairs in the benchmark year, our results show that changes in *SIZE, ROA* and *LEV* may have an impact on the effective tax expenses, even though that impact is either almost zero (*SIZE*) or insignificant (*SIZE* and *LEV*). To control for profit shifting possibilities, we further include *RD* and *INTAN*. The effect of *RD* on *GAAP ETR* is negative but (statistically) insignificant. The coefficient for the dummy *US* suggests that the *GAAP ETRs* of US firms are approximately 2 percentage points higher compared to European ones, which confirms our hypothesis *H1a* and the findings of our unconditional comparison in Section 3.2.

In specifications (4) to (6) of Table 4, we consider the *Foreign ETR* as the dependent variable. Our results confirm the findings of the descriptive analysis in Section 3.2 that US MNCs pay less foreign taxes compared to their European peers: being a US firm suggests an almost 10

percentage points lower *Foreign ETR*. This means that an unconditional comparison even underestimates the tax differential. Thus, when we focus on foreign taxes, we can confirm *H1b*.[24]

4.2 Influence of the Home Country Tax Rate

Many argue that it is mainly the high home country tax level faced by US MNCs during the considered sample period that affects US firms' competitiveness. We therefore add the statutory tax rate (*STR*) of an MNC's home country in column (3) of Table 4. The difference in statutory corporate tax rates is substantial. Whereas the mean tax rate in the home countries of European MNCs is 27.5% in our sample period, the US corporate tax rate is significantly higher.[25] Note that the European MNCs are headquartered in different countries. Within the European sample, statutory tax rates vary across home countries and over time. Rates range from approximately 12.5% (as, for example, in Ireland,) to almost 39% (as, for example, in France, where a statutory tax rate of 38.9% applies).

As expected, the home country tax rate is positively related to *GAAP ETR*. The coefficient can be interpreted. It suggests that a 1 percentage point higher STR increases the effective tax rate by about 0.5 percentage point. Given that we measure total worldwide tax payments on the left-hand side, this is quite substantial. Conditional on the statutory tax level, the sign of the *US* coefficient becomes negative. That is, controlling for the different levels of the statutory tax rate, the *GAAP ETRs* of US MNCs are approximately 3.3 percentage points lower compared to those of European MNCs.

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[24] Comparing our measurement of Foreign ETRs with the available *Compustat* Foreign ETRs for a limited number of European firms indicates that our approximation is very close to and just slightly below the reported Foreign ETR for European firms during the very recent years. Overall, this suggests that the tax differential in terms of Foreign ETRs between US and European firms may potentially be underestimated.

[25] See Panel B of Table 2. The statutory tax rates were collected from the worldwide corporate tax summaries of PwC, KPMG, and EY and from the OECD statistics website (http://stats.oecd.org/). The US statutory tax rate is the combined corporate income tax rate taken from the OECD statistics website.

A comparison of the results shown in columns (1) - (2) and (3) suggests that the relatively high US effective tax burden we find in unconditional comparisons is explained by the differences in statutory tax rates. Hence, the fact that US firms faced a high statutory tax burden at home during the sample period might be interpreted as a competitive disadvantage for US firms. Since we are interested in the tax differential that is associated with being a US firm relative to being a European firm, conditional on tax law and observable firm characteristics, our estimates suggest that the *GAAP ETR* of a US firm is approximately 3.3 percentage points below the *GAAP ETR* of a comparable European firm. At this point, we may interpret the negative *US* coefficient as an indicator capturing the tax avoidance behavior of US MNCs to compensate for the higher home country tax rate. Thus, the findings support *H2*.

In specification (6) of Table 4, we consider the *Foreign ETR* as a dependent variable. The result for the tax differential measured by the *Foreign ETR* is unaffected by the additional consideration of the home country tax level. The coefficient for the dummy *US* confirms a 7 percentage points lower *Foreign ETR* of US MNCs compared to their European peers.

4.3 Robustness Checks

Table 5 presents the results of several robustness checks. All specifications in column (1) include fixed effects only, whereas the regressions in column (2) include the full set of our control variables. We report only results for the dummy *US*, which captures the ETR differentials between US and European firms.

In rows (1) to (8), the dependent variable is the *GAAP ETR*, but the specifications differ in the use of different fixed effects and the matching procedures applied. While row (1) repeats our benchmark results, we consider only year fixed effects in row (2) and add industry fixed effects in row (3). Specification (4) considers year-pair fixed effects. The results in row (5) are based on a

similar matching as the benchmark matching, with the only difference being that we do not require an exact industry matching of firm-pairs. Rows (6) to (8) consider higher-order polynomials of explanatory variables as well as interaction terms between size and explanatory variables when computing propensity scores.

[Table 5]

All in all, the variations shown in Table 5 suggest that our approach produces quite reliable estimates. If we control for the home country tax level, such as in all specifications in column (2) of Table 5, our results always suggest that the remaining tax differential between US and European firms is negative, i.e., US firms have less tax expenses conditional on the higher US corporate tax rate.

Earlier literature has applied different definitions of ETRs, such as *CASH ETR* and *CURRENT ETR* (Dyreng et al., 2008; Hanlon and Heitzman, 2010). Rows (9) and (10) show results for the tax rate differential between US and European MNCs in terms of the *CASH ETR* and *CURRENT ETR*, respectively. Interestingly, using these alternative measures of tax expenses suggests that the effective taxes of US MNCs are slightly smaller than those of European MNCs. If we control for home country tax rates (column (2) of Table 5), the differential between US and European firms is larger in absolute terms for both *CASH ETR* and *CURRENT ETR*. The latter finding suggests that the higher *GAAP ETR* of US MNCs compared to their European peers can also be attributed to higher deferred tax expenses of US MNCs. Therefore, the disadvantage of US MNCs measured by the *GAAP ETR* must be interpreted carefully, in particular when taking into account the recent devaluation of deferred tax liabilities due to the significant US tax rate cut.

5 Explaining the Tax Differentials between US and European MNCs

In additional analyses, we attempt to explain the identified tax differentials between US and European MNCs. First, we test whether additional tax planning opportunities associated with certain firm characteristics can explain the tax differential. Second, we investigate the consequences of CFC legislation, since implementing CFC rules is discussed at the policy level as a central countermeasure against base erosion and profit shifting. Third, we analyze the impact of the home country tax system for foreign income.

5.1 Does Tax Planning Associated with Firm Characteristics Explain Tax Differentials?

We proceed with a test of *H3* and investigate whether US MNCs have enhanced tax planning and profit shifting opportunities. Using the same sample of matched firm-pairs as in Section 4, we additionally interact firm variables with the *US* dummy. Of particular interest is a potential differential response of ETRs to proxies of firm-level profit shifting opportunities. The variables *RD* and *INTAN* are often interpreted as proxies for profit shifting opportunities. MNCs with particularly high R&D expenses are able to shift more profits and taxes (which is in line with Grubert, 2003; Harris, 1993). Thus, we interact these two variables with the *US* dummy. Table 6 presents the results.

[Table 6]

Columns (2) and (5) support *H3*: high *RD* values enable US MNCs to reduce their *GAAP ETR* and *Foreign ETR* substantially more compared to European MNCs. A one standard deviation higher value of *RD* enables US MNCs to decrease their *GAAP ETR* by approximately 1.9 percentage points more than the European counterparts. The advantage is even higher if we consider the *Foreign ETR*: an increase of one standard deviation in *RD* leads to a 3.8 percentage

points lower *Foreign ETR* of US MNCs compared to their European peers. Note that *RD* does not have an effect on the *ETRs* of European MNCs (the estimated coefficient on *RD* becomes insignificant).

Because the *US* dummy becomes smaller in column (2) – or even insignificant, as in column (5), compared to our base specifications, while the interaction terms with *RD* are negative – we can say that one channel through which lower effective taxes materialize is the tax avoidance channel associated with R&D expenditures. Thus, we may conclude that a substantial part of the negative ETR differential between US and European firms can be attributed to enhanced profit shifting opportunities associated with R&D expenses. Moreover, we should mention that specifications (2) and (5) achieve the highest values in the adjusted R^2, which suggests that the variable *RD* is highly relevant in this context. All in all, the findings support *H3*, as tax differentials are particularly large if profit shifting opportunities (measured by *RD*) are large as well.

We do not find such an effect for the variable *INTAN*. However, we interpret this finding cautiously. The amount of intangible assets might be sometimes a crude proxy for a firm's profit shifting opportunities because R&D expenses are not always capitalized and self-generated intangibles are not recognized in the balance sheet.

5.2 Does Home Country CFC Legislation Explain Tax Differentials?

We further explore whether ETR differentials are related to home country tax rules. Differences in tax legislation at the location of the headquarters may explain differences in the opportunities to shift profits.

Let us first focus on CFC rules. In particular, ineffective CFC rules might explain the influence of our proxies for profit shifting on tax rate differentials. Since we do not have a measure for the effectiveness of CFC rules, we make use of two important changes in CFC rule application.

As described in Section 2, European CFC rule application has been adjusted since the 2006 ECJ "Cadbury Schweppes" judgment, and US Subpart F legislation has changed in a way that has facilitated tax avoidance since the CTB introduction in 1997.

As before, we base our analysis on samples of matched firm-pairs of US and European MNCs. To evaluate the effect of the policy changes, we will compare time periods before and after the two important tax reforms. To mitigate the problem that both events could influence tax expenses and to be better able to separate the effects, we focus on the time period 2002 to 2015 to investigate the ECJ judgment and on the years 1995 to 2003 for the CTB introduction.

(i) Evaluating "Check the Box"

In this section, we test whether the US CFC rules have become less effective in the aftermath of the CTB introduction. The $TREATMENT^{US}$ variable indicates whether an MNC is located in the US ($TREATMENT^{US}$ =1) and has been affected by the CTB introduction. Again, we use propensity score matching to generate pairs of similar US and European MNCs (see Table A.4 in the appendix for the balancing of covariates). Based on the matched samples and observations from 1995 to 2003, we estimate equation (3) as described in Section 3.2. Table 7 presents the results.

Specification (1) of Table 7 considers 1997 as the year of treatment. Propensity score estimates are based on the year 1996. However, there is plenty of anecdotal evidence, regularly coming from the exchange of arguments between IRS employees and international tax lawyers, that the widespread use of CTB for tax planning activities was delayed.[26] We therefore consider 1999 and 2002 as alternative treatment years in specifications (2) and (3); matching is then based on data from 1998 and 2001, respectively.

[26] For further information, see Dunbar and Duxbury (2015).

[Table 7]

We consider the *GAAP ETR* as the dependent variable. All specifications in the table control for the usual set of firm characteristics, pair-effects, as well as aggregate year effects. The differential impact we are interested in is the estimated coefficient on $TREATMENT^{US}$ *x POST*. Across all specifications, we find a negative treatment effect. The treatment effect increases in absolute values if we consider 1999 (column 2) or even 2002 (column 3) as treatment years. Thus, our findings support the anecdotal evidence from discussions between IRS employees and international tax lawyers arguing that there was some delay in using CTB for tax avoidance.

The point estimate of specification (3) suggests that US firms reduce their *GAAP ETR* by 4.6 percentage points after the introduction of the CTB option compared to their European counterparts. Our estimated effect of a 4.6 percentage points decline in the *GAAP ETR* in response to the CTB option is close to the finding by Dyreng et al. (2017), who suggest a decline of 3.9 percentage points in the US MNC's Cash ETRs.[27] Hence, it happened at this point in time when the change in CFC legislation allowed US MNCs to pay less taxes compared to their European peers (conditional on STR). In further untabulated tests, we repeat our regressions with *Current ETR* as the dependent variable and obtain an effect very close to our baseline effect.

We further test for specific channels or heterogeneity in treatment effects by including interaction terms between $TREATMENT^{US}$, *POST*, and firm-specific proxies for profit shifting. As argued above, as well as in previous contributions, high *RD* and *INTAN* values facilitate profit shifting to a significant extent. Columns (4) and (5) are based on the same sample as column (3), and they correspond to Panel C of Table 2. Specification (4) of Table 7 confirms a negative and

[27] Moreover, Dunbar and Duxbury (2015) suggest a decline of 9 percentage points in the US MNC's Foreign ETRs. Because *Amadeus* only provides financial data for the last ten years, we are unable to compute the *Foreign ETR* for European MNCs prior to 2003.

significant treatment effect ($TREATMENT^{US}$ x *POST*). In addition, we include the interaction term between the treatment indicator and our proxy for profit shifting opportunities, *RD*. The coefficient of the interaction between $TREATMENT^{US}$, *POST*, and *RD* is negative and statistically significant. The same pattern is found for the interaction with *INTAN* in column (5). All these results are consistent with the hypothesis that the CTB introduction affects those firms that can respond to changes in the application of CFC rules. If a firm lacks the capacity for international tax planning, a more-lenient application of CFC rules should, ceteris paribus, be less relevant.

To conclude, two findings are particularly interesting. First, the basic ETR-differential between US and European firms was positive during the considered period 1995 to 2003. Second, given the magnitude of the treatment effect, the CTB introduction makes the positive tax differential vanish or even turn negative.

(ii) Evaluating Cadbury Schweppes

To identify possible effects of the ECJ Cadbury Schweppes decision, we focus on European MNCs that have been affected by the judgment. Because not all European countries had implemented CFC rules before 2006, and therefore, MNCs from these countries have not been affected by the Cadbury Schweppes judgment, we exclude MNCs headquartered in European countries where no CFC rule was implemented in 2005. Table A.5 in the appendix provides information about the respective countries.

Note that the treatment indicator $TREATMENT^{EU}$ now refers to European firms, which we indicate by the superscript *EU*. We use the year 2005 to estimate the propensity score, i.e., one year before the 2006 ECJ judgment. Moreover, Spain and France anticipated the ECJ judgment and changed their CFC rules already in 2004 and 2005. Because anticipation effects in these two countries could potentially blur the precise identification of the Cadbury Schweppes effect, we use

the years 2003 and 2004 to estimate the propensity score for those observations. The balancing of covariates is clearly not an issue, as is documented in Table A.6 in the appendix.[28] The matching creates 324 pairs of US and European MNCs, and we consider all observations of these firms from 2002 to 2015 (see Panel D in Table 2 for descriptive statistics). The results of the pair fixed effects regressions are shown in Table 8.

[Table 8]

The negative treatment effect indicates that the ECJ decision facilitated saving taxes. Quantitatively, the treatment effect is quite substantial (-2.6 percentage points). Hence, our estimates suggest that the ECJ decision has allowed European firms to partially reduce the initial tax differential vis-á-vis US MNCs. Nevertheless, the responses of US MNCs to the CTB introduction were stronger than those of European MNCs to the Cadbury Schweppes decision.

As before, we expect a stronger effect of the ECJ decision if the activities of the MNCs facilitate profit shifting. We find a more pronounced treatment effect in columns (2) and (3) of Table 8 for those firms that have more shifting opportunities associated with R&D expenses and intangible assets. In columns (4) to (6) of Table 8, we consider the *Foreign ETR* as a dependent variable and repeat the previous regressions. The coefficient on $TREATMENT^{EU}$ x *POST* is negative and statistically significant (column (4)). It suggests that a laxer CFC practice allows European MNCs to avoid taxes, which shows in a 3.6 percentage point lower *Foreign ETR*. While the coefficients of the interactions between $TREATMENT^{EU}$, *POST*, and *RD* or *INTAN* are negative in specifications (5) to (6), the estimated coefficients are no longer significant. The reason for this may be that the sample size is approximately half that using the *GAAP ETR*.

[28] Note that the outcome equations (here, equation (3)) always condition on covariates used in the propensity score estimates. The balancing property should, in any case, never be an issue.

Additional unreported tests confirm our results. One such test excludes Spanish and French MNCs, as these countries anticipated the ECJ decision. In another test, we focus on the years around the ECJ decision (2004 to 2007), and again, we obtain similar results. In a further robustness check, we repeat the difference-in-differences approach based on the StoxxEurope600 MNCs as the treatment group and domestic firms from the same countries as the control group. The results show similar and significant coefficients for the interaction term. Moreover, we find similar results regarding *Current ETR* as the dependent variable.

In additional untabulated placebo-type tests, we consider European MNCs from European countries that had not implemented a CFC rule prior to the Cadbury Schweppes judgment. The tax planning of these firms should be unaffected by the ECJ decision. While this reduces the number of observations substantially, the results are still based on 88 matched firm-pairs of European and US MNCs, which we observe over time. Results for the relevant estimate of the $TREATMENT^{EU}$ x *POST* interaction are insignificant. Since we would expect that firms from countries where no CFC rules are implemented are unaffected by the Cadbury Schweppes decision, this finding supports the reasoning that the significant responses found before are indeed related to the ECJ's judgment.[29]

5.3 Does Home Country Taxation of Foreign Income Explain Tax Differentials?

An additional feature of a home country tax system is the taxation of foreign income. The fundamental US tax reform has replaced the worldwide tax system by a territorial system. We, however, exploit the 2009 switch from a system of worldwide taxation to a territorial system in the UK to learn about this issue. Based on the same basic approach as above, we first define MNCs headquartered in the UK as the group of treated firms ($TREATMENT^{UK}$), and US MNCs as the

[29] We confirm our results when considering a shorter time span around the Cadbury Schweppes decision (2004 to 2007), and when we exclude the years of the financial crisis (2008 and 2009).

control group. The matching is based on the year 2008 and leads to 97 pairs (see Table A.7 in the appendix for the balancing of covariates). The following regressions consider observations of these 97 pairs from 2006 to 2015 (see Panel E of Table 2 for descriptive statistics).

[Table 9]

Table 9 provides the results of our regression analysis. The main variable of interest is the interaction term between $TREATMENT^{UK}$ and *POST*, which equals one for MNCs headquartered in the UK in 2009, and all following years. The coefficient in column (1) indicates that UK MNCs reduced their GAAP ETR by 2.4 percentage points after the switch to a territorial tax system. The recent US switch to a territorial system may have even a bigger effect, as the US statutory tax rate (39%) before the reform was more than 10 percentage points higher than the UK (28%) one at the time of the reform.

The worldwide tax system affects the tax burden on repatriated foreign profit and might reduce incentives for international tax avoidance. However, the additional home country tax can be deferred if foreign profits are reinvested abroad. In columns (2) and (3), we test for specific channels or heterogeneity in treatment effects by including interaction terms between $TREATMENT^{UK}$, *POST*, and firm-specific proxies for profit shifting opportunities. We do not find any statistically significant effects, neither with *RD* nor with *INTAN* as proxies for profit shifting opportunities.

The latter finding deviates from the conclusion of Dyreng and Markle (2016), who suggest that adopting a territorial tax system would increase (outbound) income shifting activities. In contrast to Dyreng and Markle (2016), we do not use a proxy to analyze the influence of a territorial tax system but instead are able to analyze the effect of a policy change (UK tax reform). Our results

are reasonable given anecdotal evidence[30] and given our findings in Section 5.1, suggesting that US firms engaged in and benefited from profit shifting activities, although the US applied a worldwide tax system during the considered sample period.

In columns (5) – (7), we consider the *Foreign ETR* as a dependent variable and repeat the previous regressions. The result is clear: there is no differential impact of the reform with respect to the UK's switch from worldwide to territorial. This finding confirms the previous result that foreign tax avoidance is not significantly affected by the home country taxation of foreign income.

In columns (4) and (8) of Table 9, we present the results of an alternative comparison. We run regressions based on a matched sample of similar UK MNCs and MNCs headquartered in the remaining (non-UK) European countries (see Panel F in Table 2, for descriptive statistics). In line with the previous results, we find a negative treatment effect of the UK tax reform with a point estimate of -2.7 if the *GAAP ETR* is the dependent variable. Again, we do not find any effect for the *Foreign ETR*.

Overall, our results confirm a decrease in tax expenses after the home country (here, the UK) has switched from a worldwide to a territorial system of taxation. This supports *H5*. Our results also suggest that the effect should be attributed to the abolishment of additional home country taxes if foreign income is repatriated, while we find no evidence that firms with enhanced profit shifting opportunities respond more (or less) to the switch to a territorial system. Moreover, the *Foreign ETR* of UK MNCs was unaffected by the reform.

[30] See the example of *HP* in Section 2 (Footnote 11).

6 Conclusion

The objective of this paper is to produce reliable estimates on the tax expenses of US MNCs and their European peers. By applying matching techniques, we first create pairs of very similar US and European MNCs. Based on these matched pairs, we find, for the most recent years of 2012 to 2015, that the *GAAP ETRs* of US MNCs were in fact higher compared to their European peers. However, conditional on the home country tax rates, the *GAAP ETRs* of US MNCs are approximately 3.3 percentage points lower than the *GAAP ETRs* of European MNCs. Moreover, US MNCs clearly reported lower *Foreign ETRs* than their European counterparts. Our analysis suggests that these findings are mainly related to enhanced profit shifting opportunities of US MNCs associated with R&D expenditures.

We additionally examine the impact of tax legislation on effective tax differentials between US and European MNCs. First, we confirm that home country CFC legislation affects the tax expenses of MNCs. In particular, we analyze how changes in the application of CFC rules in the US and Europe have affected tax expenses. Our results suggest that the *ETRs* of US MNCs decreased significantly after the CTB introduction. We also find that the *GAAP ETRs* of European MNCs fell by approximately 2.6 percentage points after the ECJ Cadbury Schweppes judgment in 2006. Additional analyses reveal that MNCs whose activities allow for profit shifting have benefited most from a more lenient application of CFC rules. Second, we examine the switch from a worldwide tax system to a territorial tax system in the UK in 2009. Our analysis reveals that MNCs have reported significantly lower ETRs since this change in the taxation of foreign income. The switch to a territorial tax system in 2009 has reduced the *GAAP ETR* but has not influenced the *Foreign ETR* of UK-headquartered MNCs. Let us finally highlight that observables (tax law as well as firm characteristics) explain most of the difference in ETRs between US and European firms. However, a residual differential in the *GAAP ETR* has to be attributed to unobservable effects

associated with being a US firm. Such unobservables may relate to specific preferences in what has been called “tax aggressiveness” in recent policy discussions.

Let us interpret three of our results in light of the current US tax reform. First, our findings may give ex-post support to the US tax rate cut, as our study confirms a disadvantage of US MNCs due to the high tax level in the US until 2017. However, conditional comparisons imply that the magnitude of the rate cut to a tax rate of 21% will result in a competitive advantage for US MNCs compared to European ones. Additional analyses reveal that higher taxes of US MNCs were associated with higher deferred tax expenses, which are now likely to become less important after the reform. Second, the switch to a territorial system will additionally benefit US firms. Our results suggest that the *GAAP ETRs* of US MNCs will further decrease after abolishing the worldwide tax system, while the *Foreign ETRs* will be unaffected by the implementation of the territorial tax system. Third, given a relatively lax US CFC legislation allowing for the Check the Box option, stricter rules on international tax avoidance may increase foreign and home effective tax payments.

Our findings have policy implications. One of the arguments in favor of a territorial system (as opposed to a worldwide system) is that it ensures a level playing field for competing firms in host markets. We show, however, that tax planning opportunities as well as tax law (implemented in the home country) are significant determinants of effective tax payments abroad (in the host market). This suggests that the system of international taxation is inefficient and that even a territorial system will not guarantee that firms compete on equal terms with each other. Hence, our findings support the view that there is first a need for more coordination in international tax policy.

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Table 1. Sample Selection

Description	**European Firms**		**US Firms**	
	Firms	Firm-Years	Firms	Firm-Years
Index Firms	1,078	17,707	1,086	17,343
Headquarters in EU / US	1,052	17,289	977	15,452
Non-Missing GAAP ETR	1,031	14,038	966	12,636
Non-Missing Control Variables	1,015	13,136	965	12,574

Notes: The sample is based on firms that were included in the S&P500 or StoxxEurope600 stock market indices at least once during the period 1995 to 2015.

Table 2. Summary Statistics

	Panel A Years from 2012 to 2015 (unmatched Sample)						**Panel B** Years from 2012 to 2015 Matching Year: 2011 352 Matched Pairs					
	European Firms			**US Firms**			**European Firms**			**US Firms**		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.
SIZE *	2,248	2.36	1.77	2,003	2.77	1.43	1146	2.49	1.76	1168	2.74	1.44
ROA *	2,248	0.08	0.11	2,003	0.10	0.08	1146	0.08	0.07	1168	0.09	0.06
LEV *	2,248	0.25	0.17	2,003	0.27	0.19	1146	0.25	0.17	1168	0.27	0.18
RD *	2,248	0.01	0.03	2,003	0.02	0.04	1146	0.02	0.04	1168	0.01	0.03
INTAN *	2,248	0.23	0.21	2,003	0.22	0.21	1146	0.24	0.21	1168	0.25	0.22
STR	2,248	0.27	0.06	2,003	0.39	0.00	1146	0.28	0.06	1168	0.39	0.00
GAAP ETR	2,248	0.27	0.14	2,003	0.29	0.12	1146	0.27	0.13	1168	0.29	0.11
FOREIGN ETR	780	0.31	0.18	1,228	0.24	0.15	409	0.31	0.18	692	0.25	0.15

	Panel C Years from 1995 to 2003 Matching Year: 2001 302 Matched Pairs			**Panel D** Years from 2002 to 2015 Matching Year: 2005 324 Matched Pairs			**Panel E** Years from 2006 to 2015 Matching Year: 2008 97 Matched Pairs			**Panel F** Years from 2006 to 2015 Matching Year: 2008 87 Matched Pairs		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.
SIZE *	4,849	1.41	1.66	7,189	2.37	1.66	1,668	2.07	1.67	1,488	2.00	1.72
ROA *	4,849	0.09	0.08	7,189	0.09	0.09	1,668	0.11	0.08	1,488	0.09	0.07
LEV *	4,849	0.25	0.16	7,189	0.25	0.18	1,668	0.25	0.17	1,488	0.26	0.16
RD *	4,849	0.01	0.03	7,189	0.01	0.03	1,668	0.01	0.03	1,488	0.01	0.03
INTAN *	4,849	0.11	0.15	7,189	0.20	0.20	1,668	0.28	0.23	1,488	0.26	0.21
STR	4,849	0.37	0.06	7,189	0.35	0.05	1,668	0.33	0.07	1,488	0.28	0.05
GAAP ETR	4,849	0.32	0.12	7,189	0.30	0.12	1,668	0.28	0.11	1,488	0.26	0.13
FOREIGN ETR	-	-	-	3,130	0.29	0.16	916	0.29	0.17	502	0.32	0.17

Notes: Sample sizes differ usually because of data availability. All variables with "*" are used to calculate the propensity scores. Panel C includes US and European firms. Panel D includes firms from the US and firms from European countries with existing CFC rules in 2005; matching of French and Spanish MNCs is therefore based on 2004 and 2003, respectively. Panel E includes UK and US firms. Panel F includes UK and (Non-UK) European firms.

Table 3. Nearest Neighbor Matching, Balancing Property (2011)

Nearest Neighbor 1:1		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	(in %)	(in %)	t	p>t
SIZE	Unmatched	2.5143	2.2614	15.9		2.66	0.008
	Matched	2.5032	2.4437	3.7	76.5	0.49	0.627
ROA	Unmatched	0.1046	0.0846	25.8		4.35	0.000
	Matched	0.0844	0.0892	-6.2	76.1	-0.92	0.359
LEV	Unmatched	0.2421	0.2496	-4.2		-0.71	0.475
	Matched	0.2526	0.2538	-0.7	83.7	-0.09	0.928
RD	Unmatched	0.0192	0.0148	11.8		1.98	0.048
	Matched	0.0142	0.0177	-9.4	20.5	-1.29	0.197
INTAN	Unmatched	0.2177	0.2318	-6.8		-1.15	0.251
	Matched	0.2317	0.2180	6.6	2.5	0.86	0.391

Notes: Balancing property tests. The tests are based on observations from the year 2011. The matching applies one-to-one nearest neighbor matching, which requires a difference in propensity scores of less than 0.02.

Table 4. Regression Analysis, ETR Differentials

Variables	GAAP ETR			FOREIGN ETR		
	1	2	3	4	5	6
US	0.0209***	0.0221***	-0.0328**	-0.0961***	-0.0961***	-0.0696*
	(0.0059)	(0.0061)	(0.0146)	(0.0141)	(0.0144)	(0.0392)
SIZE		-0.00589	-0.0098*		0.00422	0.00697
		(0.0052)	(0.0052)		(0.0102)	(0.0103)
ROA		-0.2457***	-0.2405***		-0.1490	-0.1460
		(0.0868)	(0.0852)		(0.1890)	(0.1890)
LEV		-0.0195	-0.0196		-0.0514	-0.0478
		(0.0222)	(0.0215)		(0.0554)	(0.0547)
RD		-0.2450	-0.2810		-0.00673	0.0141
		(0.1860)	(0.1750)		(0.3360)	(0.3470)
INTAN		0.0295	0.0292		0.0376	0.0386
		(0.0202)	(0.0203)		(0.0546)	(0.0538)
STR			0.4832***			-0.2220
			(0.1150)			(0.2980)
Year FE	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓
N	2,314	2,314	2,314	1,101	1,101	1,101
Adj. R^2	0.283	0.288	0.300	0.364	0.364	0.364

Notes: Regressions are based on a matched sample, where MNCs are headquartered either in the US or in Europe; years from 2012 to 2015 (Panel B) are included. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Table 5. Additional Sensitivity Checks (Treatment: *US*)

	Coeffcient on US	
	1	2
(1) Probit:	0.0209***	-0.0328**
Exact matching by industry	(0.0059)	(0.0146)
(2) Probit:	0.0227***	-0.0439***
Only Year FE	(0.0076)	(0.0142)
(3) Probit:	0.0223***	-0.0363***
Year FE and Industry FE	(0.0073)	(0.0137)
(4) Probit:	0.0240***	-0.0357*
Year-Pair-FE	(0.0082)	(0.0199)
(5) Probit:	0.0143***	-0.0380***
No Exact Matching	(0.0053)	(0.0122)
(6) Probit:	0.0262***	-0.0263*
2nd order polynomial	(0.0062)	(0.0136)
(7) Probit:	0.0209***	-0.0268*
3rd order polynomial	(0.0064)	(0.0147)
(8) Probit:	0.0281***	-0.0328**
Size interactions	(0.0065)	(0.0142)
(9) Probit, *CASH ETR:*	-0.0367***	-0.0958***
Exact matching by industry	(0.0084)	(0.0190)
(10) Probit, *CURERRENT ETR:*	-0.0193**	-0.0648***
Exact matching by industry	(0.0075)	(0.0145)

Notes: Regressions are based on matched samples, where MNCs are headquartered either in the US or in Europe; years from 2012 to 2015 are included. Unless otherwise described, year and firm-pair fixed effects are included in all specifications. Regressions in column (2) include the control variables *SIZE, ROA, LEV, RD, INTAN* and *STR.* The dependent variable is *GAAP ETR* in specifications (1) to (8). Specification (1) repeats our basis regression (Panel B). Specifications (2) to (4) are based on Panel B and differ due to the use of different fixed effects, while in specifications (5) to (8), different matching procedures apply. The dependent variables in specifications (9) and (10) are *CASH ETR* and *CURRENT ETR*, respectively. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Table 6. Firm Characteristics

Variables	GAAP ETR			FOREIGN ETR		
	1	2	3	4	5	6
US	-0.0328**	-0.0254*	-0.0425**	-0.0696*	-0.0475	-0.0370
	(0.0146)	(0.0150)	(0.0167)	(0.0392)	(0.0381)	(0.0419)
RD	-0.2810	-0.0813	-0.2730	0.0141	0.3870	-0.0200
	(0.1750)	(0.1740)	(0.1760)	(0.3470)	(0.2740)	(0.3360)
US x RD		-0.5250**			-1.0620**	
		(0.2370)			(0.4100)	
INTAN	0.0292	0.0233	0.00755	0.0386	0.0190	0.1160
	(0.0203)	(0.0204)	(0.0251)	(0.0538)	(0.0542)	(0.0765)
US x INTAN			0.0395			-0.1230
			(0.0326)			(0.0906)
Year FE	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓
N	2,314	2,314	2,314	1,101	1,101	1,101
Adj. R^2	0.300	0.303	0.301	0.364	0.371	0.366

Notes: Regressions are based on a matched sample, where MNCs are headquartered either in the US or in Europe; years from 2012 to 2015 (Panel B) are included. Year and firm-pair fixed effects are included in all specifications. Regressions include the control variables *SIZE, ROA, LEV, RD, INTAN* and *STR*. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Table 7. Consequences of Check the Box Introduction

Variables	GAAP ETR				
	1	2	3	4	5
TREATMENT^{US} (T^{US})	0.0295***	0.0316***	0.0300***	0.0388***	0.0275***
	(0.0066)	(0.0057)	(0.0060)	(0.0065)	(0.0075)
T^{US} x POST	-0.0132**	-0.0174***	-0.0457***	-0.0422***	-0.0375***
	(0.0061)	(0.0060)	(0.0070)	(0.0072)	(0.0079)
T^{US} x RD				-0.5860***	
				(0.1480)	
T^{US} x POST x RD				-0.3580**	
				(0.1460)	
T^{US} x INTAN					0.0257
					(0.0363)
T^{US} x POST x INTAN					-0.0642**
					(0.0317)
Control Variables	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓
N	6,160	5,868	4,849	4,849	4,849
Adj. R^2	0.335	0.281	0.365	0.371	0.365

Notes: Regressions are based on matched samples, where MNCs are headquartered either in the US or in Europe. The data of column (1) refer to a matching based on the year 1996, and the year of treatment is 1997. The data of column (2) refer to a matching based on the year 1998, and the year of treatment is 1999. The data of columns (3) to (5) refer to Panel C. Control variables include *SIZE, ROA, LEV, INTAN, RD,* and *STR*. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively

Table 8. The Consequences of Cadbury Schweppes

Variables	GAAP ETR			FOREIGN ETR		
	1	2	3	4	5	6
$TREATMENT^{EU}(T^{EU})$	0.0289***	0.0218**	0.0181	0.0866***	0.0692***	0.0807***
	(0.0085)	(0.0090)	(0.0111)	(0.0197)	(0.0217)	(0.0247)
T^{EU} x POST	-0.0256***	-0.0223***	-0.0023	-0.0357**	-0.0306*	-0.0168
	(0.0068)	(0.0074)	(0.0099)	(0.0152)	(0.0163)	(0.0192)
T^{EU} x RD		0.4940***			0.8820**	
		(0.1580)			(0.3490)	
T^{EU} x POST x RD		-0.2780**			-0.2520	
		(0.1190)			(0.3530)	
T^{EU} x INTAN			0.0697			0.0550
			(0.0472)			(0.0785)
T^{EU} x POST x INTAN			-0.1250**			-0.1020
			(0.0490)			(0.0648)
Control Variables	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓
N	7,189	7,189	7,189	3,130	3,130	3,130
Adj. R^2	0.256	0.257	0.259	0.314	0.316	0.314

Notes: Regressions are based on a matched sample, where MNCs are headquartered either in the US or in Europe. The data refer to Panel D, which includes firms from the US and firms from European countries with existing CFC rules in 2005. Year and firm-pair fixed effects are included in all specifications. Regressions include the control variables *SIZE*, *ROA*, *LEV*, *RD*, *INTAN* and *STR*. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Table 9. Consequences of Abolishment of System of Worldwide Taxation

	GAAP ETR				FOREIGN ETR			
	1	2	3	4	5	6	7	8
TREATMENT^{UK} (T^{UK})	-0.0572*	-0.0687**	-0.0537*	0.00396	-0.0217	-0.0319	-0.0187	-0.0604
	(0.0300)	(0.0303)	(0.0313)	(0.0124)	(0.0758)	(0.0760)	(0.0804)	(0.0382)
T^{UK} x POST	-0.0237*	-0.0259*	-0.0313*	-0.0272*	0.0235	0.0247	0.0129	0.0313
	(0.0123)	(0.0133)	(0.0173)	(0.0150)	(0.0290)	(0.0308)	(0.0392)	(0.0381)
T^{UK} x RD		1.6330***				1.0090*		
		(0.3340)				(0.5860)		
T^{UK} x POST x RD		0.2450				0.1160		
		(0.2560)				(0.6820)		
T^{UK} x INTAN			-0.0124				-0.0100	
			(0.0533)				(0.1190)	
T^{UK} x POST x INTAN			0.0301				0.0452	
			(0.0381)				(0.1140)	
Control Variables	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓	✓	✓
N	1,668	1,668	1,668	1,488	916	916	916	502
Adj. R^2	0.227	0.247	0.226	0.240	0.335	0.336	0.334	0.180

Notes Regressions in columns (1) to (3) and (5) to (7) are based on a matched sample, where MNCs are headquartered either in the US or in Europe. The data in these columns refer to Panel E. Regressions (4) and (8) are based on a matched sample including MNCs headquartered either in the UK or in the remaining European countries (Panel F). Control variables include *SIZE, ROA, LEV, INTAN, RD,* and *STR*. Robust standard errors clustered by firms are shown in parentheses. *, **, and *** indicate significance at the level of 10%, 5%, and 1%, respectively.

APPENDIX

Table A.1 Variable Definitions

GAAP ETR	txt / (pi – xi), i.e., income taxes divided by pretax income, adjusted for extraordinary items (set to zero if missing); exclude outliers
FOREIGN ETR	txfo / pifo for US MNCs, i.e., foreign income taxes divided by foreign pretax income; exclude outliers; (txt – txdom) / (pi – pidom) for European MNCs, i.e., domestic taxes subtracted from total taxes divided by pretax income excluding domestic pretax income; exclude outliers
CASH ETR	txpd / pi, i.e., taxes paid divided by pretax income; exclude outliers
CURRENT ETR	(txt - txdi) / pi, i.e., current taxes divided by pretax income; exclude outliers
SIZE	log (at), i.e., logarithm of total assets
ROA (Return on Assets)	pi / at, i.e., pretax income divided by total assets
LEV (Leverage)	(dlc + dltt) / at, i.e,. total debt divided by total assets
RD (Research & Development)	xrd / at, i.e., research and development expense divided by total assets (set to zero if missing xrd)
INTAN (Intangibles)	intan / at, i.e., intangibles divided by total assets (set to zero if missing intan)
STR (Statutory Tax Rate)	Statutory corporate tax rate of the MNC's home country
US	Dummy, which is one for US MNCs and zero for European MNCs
TREATMENT (T)	Dummy, which is one for MNC treated, and zero otherwise; depending on the respective analysis, the indicator refers to European, US, or UK firms
POST	Dummy, which is one for the year of treatment and following years

Notes: Data are taken from *Compustat* and *Compustat Global*. Foreign taxes and pretax income for European MNCs were calculated by combining the *Compustat* and *Amadeus* databases.

Table A.2 Calculation of Foreign ETR

	Total Taxes (in Mio. USD)	**Pretax Income** (in Mio. USD)
Compustat Data (Worldwide Data)	**724.85**	**2,241.11**
Amadeus Data		
1st French Subsidiary	41.05	127.72
2nd French Subsidiary	28.02	112.88
…	…	…
14 th French Subsidiary	1.77	6.39
∑ **Domestic Data**	**93.48**	**366.66**

$$Foreign\ ETR = \frac{(Total\ Taxes - Domestic\ Taxes)}{(Pretax\ Income - Domestic\ Pretax\ Income)} = \frac{(724.85 - 93.48)}{(2{,}241.11 - 366.66)}$$

$$= \frac{631.37}{1{,}874.45} = 33.68\ \% \qquad \textit{Eq. (A.1)}$$

We calculate the Foreign ETRs for European MNCs by subtracting domestic taxes and domestic pretax income from the overall tax expenses and pretax income. We obtain the domestic figures of European MNCs by combining ownership information with financial information taken from the *Amadeus* database provided by Bureau van Dijk.
The example calculation above is given for the French-based *Danone S.A.* and is based on financial information from the year 2014.
Note that there could be a potential bias of our measure due to the subtraction of an aggregated unconsolidated figure (domestic data) from a consolidated base (worldwide data). Because double counting of subsidiaries profits would particularly occur at the parent level, we exclude the parent company from our calculation of the domestic data.

Table A.3 Validation of Foreign ETR

	Sample Period from 2002 to 2015			Sample Period from 2012 to 2015		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Foreign $ETR^{Approximation}$	92	0.2789	0.1324	21	0.2232	0.1080
Foreign $ETR^{Compustat}$	92	0.2726	0.1143	21	0.2227	0.1037

Notes: Validation Test for Foreign ETR calculation. Sample includes those European firms for which the Foreign ETR can be calculated first by using only *Compustat* data and second by combining *Compustat* and *Amadeus* data. Foreign $ETR^{Approximation}$ is calculated by combining *Compustat* and *Amadeus* data, as explained above. Foreign $ETR^{Compustat}$ is defined as *txfo / pifo*, i.e. foreign income taxes divided by foreign pretax income; data are taken from Compustat.

Table A.4 Nearest Neighbor Matching, Balancing Property (2001)

Nearest Neighbor 1:1		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	(in %)	(in %)	t	p>t
SIZE	Unmatched	1.8270	1.1770	37.4		6.02	0.000
	Matched	1.5610	1.5820	-1.2	96.8	-0.16	0.874
ROA	Unmatched	0.0948	0.0863	10.3		1.65	0.099
	Matched	0.0849	0.0880	-3.7	63.6	-0.47	0.639
LEV	Unmatched	0.2729	0.2661	3.9		0.62	0.533
	Matched	0.2693	0.2707	-0.8	79.5	-0.10	0.919
RD	Unmatched	0.0163	0.0111	15.5		2.50	0.013
	Matched	0.0127	0.0134	-2.1	86.6	-0.26	0.795
INTAN	Unmatched	0.1255	0.1303	-3.0		-0.48	0.629
	Matched	0.1203	0.1327	-7.7	-156.6	-0.94	0.345

Notes: Balancing property tests. The tests are based on observations from the year 2001. The matching applies one-to-one nearest neighbor matching, which requires a difference in propensity scores of less than 0.02.

Table A.5 CFC Countries

Countries with a CFC Rule	Countries without a CFC Rule
Denmark	Austria
Finland	Estonia
France	Belgium
Germany	Bulgaria
Greece (from 2014)	Croatia
Hungary	Cyprus
Iceland (from 2010)	Czech Republic
Italy	Ireland
Lithuania	Latvia
Norway	Liechtenstein
Poland (from 2015)	Luxembourg
Portugal	Malta
Spain	Netherlands
Sweden	Romania
United Kingdom	Slovakia
USA	Slovenia

Notes: The table is based on a list provided by Deloitte (see further: https://www2.deloitte.com/global/en/pages/tax/articles/guide-to-controlled-foreign-company-regimes.html) and the worldwide corporate tax summaries of PwC, KPMG, and EY.

Table A.6 Nearest Neighbor Matching, Balancing Property (2005)

Nearest Neighbor 1:1		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	(in %)	(in %)	t	p>t
SIZE	Unmatched	1.7204	2.0680	-20.7		-4.30	0.00
	Matched	2.1110	2.0669	2.6	87.3	0.37	0.72
ROA	Unmatched	0.0971	0.1001	-3.4		-0.72	0.47
	Matched	0.0958	0.0993	-3.9	-15.2	-0.52	0.60
LEV	Unmatched	0.2457	0.2309	8.8		1.74	0.08
	Matched	0.2386	0.2506	-7.1	18.8	-0.98	0.33
RD	Unmatched	0.0110	0.0170	-18.9		-3.64	0.00
	Matched	0.0127	0.0107	6.5	65.6	0.96	0.34
INTAN	Unmatched	0.1708	0.1678	1.7		0.33	0.74
	Matched	0.1702	0.1813	-6.1	-269.1	-0.82	0.42

Notes: Balancing property tests. The tests are based on observations from the year 2005. The matching of French and Spanish MNCs is based on 2004 and 2003, respectively. One-to-one nearest neighbor matching is applied, which requires a difference in propensity scores of less than 0.02.

Table A.7 Nearest Neighbor Matching, Balancing Property (2008)

Nearest Neighbor 1:1		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	(in %)	(in %)	t	p>t
SIZE	Unmatched	1.5969	2.2104	-40.1		-4.40	0.000
	Matched	1.8507	2.0369	-12.2	69.7	-0.79	0.430
ROA	Unmatched	0.1048	0.1195	-16.9		-1.73	0.085
	Matched	0.1061	0.1057	0.5	97.3	0.03	0.973
LEV	Unmatched	0.2625	0.2474	8.1		0.83	0.406
	Matched	0.2736	0.2499	12.7	-57.0	0.89	0.373
RD	Unmatched	0.0107	0.0216	-31.2		-2.90	0.004
	Matched	0.0141	0.0086	15.7	49.6	1.51	0.134
INTAN	Unmatched	0.2517	0.2172	16.4		1.70	0.089
	Matched	0.2507	0.2769	-12.5	24.1	-0.79	0.428

Notes: Balancing property tests. The tests are based on observations from the UK and the US in the year 2008. One-to-one nearest neighbor matching is applied, which requires a difference in propensity scores of less than 0.02.

Table A.8 Nearest Neighbor Matching, Balancing Property (2008)

Nearest Neighbor 1:1		Mean		Bias	Bias Reduction	t-test	
		Treated	Control	(in %)	(in %)	t	p>t
SIZE	Unmatched	1.5969	2.4133	-47.9		-4.75	0.000
	Matched	1.9644	1.9615	0.2	99.7	0.01	0.991
ROA	Unmatched	0.1048	0.0835	25.4		2.54	0.011
	Matched	0.0897	0.0803	11.3	55.6	0.88	0.380
LEV	Unmatched	0.2625	0.2839	-11.8		-1.17	0.241
	Matched	0.2880	0.2684	10.8	8.6	0.75	0.455
RD	Unmatched	0.0107	0.0143	-12.3		-1.16	0.245
	Matched	0.0125	0.0104	7.5	39.1	0.55	0.581
INTAN	Unmatched	0.2517	0.2173	17.0		1.72	0.085
	Matched	0.2629	0.2464	8.2	52.0	0.53	0.593

Notes: Balancing property tests. The tests are based on observations from the UK and other European countries in the year 2008. One-to-one nearest neighbor matching is applied, which requires a difference in propensity scores of less than 0.02.

Table A.9 Probability of being US or treated Firm

	Panel B	Panel C	Panel D	Panel E	Panel F
Variables	US	Treatment	Treatment	Treatment	Treatment
	1	2	3	4	5
SIZE	0.1260***	0.1960***	-0.1050***	-0.2250***	-0.1670***
	(0.0264)	(0.0263)	(0.0199)	(0.0440)	(0.0420)
ROA	2.9840***	2.7240***	-0.6810*	-2.0230**	0.7760
	(0.5440)	(0.5970)	(0.3850)	(0.7880)	(0.8190)
LEV	0.1550	0.3740	0.2150	-0.1890	-0.4120
	(0.2240)	(0.2480)	(0.1830)	(0.3430)	(0.3750)
RD	2.3150**	3.0580**	-3.6950***	-7.0780***	-6.5090***
	(1.0610)	(1.2330)	(0.9960)	(2.1400)	(2.500)
INTAN	-0.1260	0.1420	-0.0962	0.3750	0.5780*
	(0.1870)	(0.2550)	(0.1630)	(0.2910)	(0.3370)
N	1,139	1,036	2,263	554	457

Notes: The table presents the results of the probit estimates in respective years upon which the matching is based. *, **, and *** show significance at the level of 10%, 5%, and 1%, respectively.