DO U.S. FIRMS AVOID MORE TAXES THAN THEIR EUROPEAN PEERS? ON FIRM CHARACTERISTICS AND TAX LEGISLATION AS DETERMINANTS OF TAX DIFFERENTIALS

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Using pairs of similar U.S. and European firms listed on the S&P 500 or Stoxx Europe 600, we examine effective tax differentials between U.S. multinational corporations (MNCs) and their European peers. We particularly focus on the influence of tax policy on tax differentials between MNCs from the United States and Europe. Our findings suggest that U.S. MNCs had been avoiding more taxes compared to their European peers before the 2017 U.S. tax reform. Furthermore, results show that U.S. MNCs compensated for about half of the significantly larger statutory tax burden before the U.S. tax reform by avoiding more taxes than their European peers. Based on past reforms, we confirm that international tax legislation affects effective tax expenses. Our results reveal that more lenient controlled foreign company (CFC) rules are associated with lower effective tax rates. Moreover, our results suggest that the switch to a territorial system reduces deferred taxes, while we find no evidence that current and foreign tax expenses are affected.

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

JEL Codes: H26, H32, F23

I. INTRODUCTION

Until the fundamental U.S. tax reform was enacted in December 2017, the U.S. statutory tax rate on corporate profits was one of the highest in a worldwide comparison.[1] Many U.S. executives agree that the high home country tax rate was particularly problematic in an international context, as foreign profits were taxed upon

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

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repatriation under the U.S. system of worldwide taxation, while most European countries exempt foreign income from any home taxation. This, so the argument goes, put U.S. companies at a competitive disadvantage relative to their European competitors.[2] The "Tax Cuts and Jobs Act" (TCJA) in December 2017 responded to these arguments by cutting the corporate tax rate to 21 percent and replacing the worldwide tax system with a territorial system.[3]

Yet, not everyone shares the concern about a potential competitive disadvantage of U.S. multinational corporations (MNCs) prior to the U.S. tax reform. 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."[4] Apple Inc., with an effective foreign tax rate of below 4 percent in recent years, is one of quite a few examples of well-known U.S. MNCs reporting low taxes on their foreign incomes.[5] The statement by Ms. Vestager highlights a common concern that some U.S. MNCs already had a competitive advantage relative to their European competitors through substantially lower tax expenses before the major U.S. tax reform was enacted.

The objective of this study is to add to this debate by comparing effective tax measures of U.S. MNCs and their European peers. Our findings suggest that U.S. MNCs avoided more taxes compared to their European peers before the U.S. tax reform. Furthermore, our analysis reveals that home country tax policy (such as controlled foreign company (CFC) legislation and the international tax system) affects tax avoidance of both U.S. and European MNCs.

Our analysis focuses on large MNCs listed either on the S&P 500 or Stoxx Europe 600 stock market index. One main contribution is an examination of effective tax rate differentials between U.S. MNCs and their European competitors. Existing studies do not provide clear evidence on whether U.S. or European MNCs avoid more taxes (see Section II.A for a review of this literature). The second aim of our analysis is to understand whether tax differentials reflect differences in firm characteristics distinctive to either U.S. or European MNCs (e.g., technology) or are driven by tax legislation, especially home country tax rules. We investigate the impact of home country statutory tax rates and analyze whether U.S. firms avoid more taxes (in total and in foreign countries) as a response to the high statutory tax rate prior to the U.S. TCJA. We finally analyze whether policy reforms had an impact on tax differentials between U.S. and European firms. For this, we exploit reforms of (1) CFC legislation in the United States in 1997

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[2] *The Financial Times* (Feb. 5, 2011), available at http://www.nytimes.com/2011/05/03/business/economy/03rates. html?_r=1.

[3] As for the U.S. tax system, the distinction between worldwide and territorial systems is less clear. Prior to the U.S. tax reform, U.S. MNCs may have avoided worldwide taxation by deferring repatriations and the new system still features elements of a worldwide tax system, such as the GILTI provisions.

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

[5] For more examples, see *The Financial Times* (Sept. 30, 2013), available at http://www.ft.com/cms/s/0/c6ff0ebc-29c411e3-bbb8-00144feab7de.html.

and in Europe in 2006 as well as (2) home country taxation of foreign income in the United Kingdom in 2009.[6]

We propose an empirical approach that recognizes fundamental problems of identification in this context. First, we identify pairs of similar U.S. 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 Europe-based business software firm SAP SE is found to be the best match for the U.S.-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 U.S. and European MNCs. We are particularly interested in whether differentials are the result of policy reforms. To the best of our knowledge, a thorough comparative study of U.S. and European MNCs has not been provided so far. In addition, our paper is the first one to identify the effect of policy reform on effective tax rates (ETRs) and document a great number of determinants of tax differentials in a counterfactual setting.

Based on our matched sample of MNCs, we start our analysis by comparing ETRs of U.S. and European MNCs over recent years prior to the U.S. tax reform. Information to compute ETR measures comes from the consolidated financial statements of MNCs. Backward looking in nature, the ETR evaluates the worldwide (actual) tax expenses of a firm.[7] Our results suggest that before the U.S. tax reform, U.S. MNCs avoided more taxes than their European counterparts. In particular, our findings suggest that U.S. MNCs reported significantly less foreign taxes (measured as *Foreign ETR*). Only if we consider the *GAAP ETR* — a measure that includes deferred taxes — do we find higher ETRs of U.S. MNCs compared to European firms.

Further analysis reveals that statutory tax rates of the home countries also significantly determine ETRs. Taking into account the high statutory U.S. tax rate prior to the reform, our results suggest that U.S. MNCs, compared to European ones, were able to reduce tax expenses through additional tax avoidance. To be precise, our estimates suggest that *unobserved* tax avoidance compensates for about half of the significantly larger U.S. statutory tax rate before the U.S. tax reform.[8]

Additional analysis is concerned with tax policy as a determinant of tax differentials between U.S. MNCs and their European peers. In particular, we examine the effectiveness of both U.S. and European CFC rules. Prior to the new legislation regarding global intangible low-tax income (GILTI) as part of the 2017 U.S. tax reform, the U.S. CFC

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6   Issues that were also recently addressed by the U.S. TCJA.

7   The ETR used in this study is not to be confused with the effective tax rate as described in King and Fullerton (1984) and Devereux and Griffith (1998), who define it differently as a forward-looking measure. Moreover, the ETR considers the overall effects of tax avoidance structures in different countries and does not refer to one single subsidiary.

8   We call the remaining difference of effective tax expenses (i.e., after controlling for statutory taxes, differences in technology, firm, and industry characteristics, etc.) between U.S. and European firms *unobserved* tax avoidance. This is because we cannot ascribe this residual differential to any specific channel of profit shifting or a country's tax policies.

rule has often been mentioned to be ineffective and, thus, one of the main causes of tax avoidance by U.S. MNCs.[9] We exploit two tax law amendments that changed the application of CFC rules: the introduction of the check-the-box (CTB) option, which allowed U.S. MNCs to avoid U.S. CFC rules and reduce their ETRs; similarly, an adjustment in 2006 of the European CFC rules after the European Court of Justice's (ECJ) "Cadbury Schweppes" decision[10] (the rules today apply only to "wholly artificial arrangements").

We continue with our matching of comparable U.S. and European MNCs. Note that we form matched pairs based on firm characteristics before each reform we analyze (i.e., matching is always based on information on the MNCs in the period prior to the respective reform). Based on the matched samples, we estimate our regression model with pair fixed effects and a difference-in-differences approach to pinpoint responses to changes in policy.[11] We find that European firms relative to U.S. firms significantly reduced their ETRs after the Cadbury Schweppes decision. The introduction of CTB in the United States also led to significantly lower ETRs of U.S. MNCs relative to European firms. This means that both U.S. and European CFC rules became more lenient and less effective over time.

Another issue raised by the fundamental U.S. tax reform is the replacement of the worldwide tax system by a territorial tax system. While the change in the U.S. international tax system in 2018 cannot yet be evaluated, we exploit the 2009 U.K. tax reform, through which the United Kingdom 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. However, the *CURRENT ETR* and the *Foreign ETR* of UK MNCs were unaffected by the reform. These findings imply that the switch to a territorial system reduces deferred taxes, while there is no clear evidence that current and foreign tax expenses are affected.

Our study contributes to the literature and to the recent public debate on tax avoidance of MNCs in several ways. In contrast to previous studies, our paper compares ETRs of U.S. MNCs and their competitors at the micro level, uses different measures of ETRs, allows for pairwise comparisons, conditions on firm-specific characteristics, and provides evidence on the consequences of tax reforms. Let us highlight that, to the best of our knowledge, none of the previous studies has (1) calculated foreign ETRs for non-U.S. MNCs, (2) provided heterogeneous estimates on the determinants of ETRs to better understand why there is so much variation in firms' effective tax payments, or (3) conditioned on between-pair unobserved heterogeneity. Moreover, no earlier research applied the latter approach in a difference-in-differences setting to provide causal evidence on the consequences of policy reform in the empirical analysis.

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[9] TaxJusticeBlog (July 20, 2015), available at https://www.ctj.org/like-a-campy-horror-movie-the-tax-extenders-are-back/.

[10] Judgment from Sept. 12, 2006, C-196/04.

[11] Recently, Gleason, Markle, and Song (2018) used a similar approach to identify effects of FIN48 introduction and compare firms that use U.S. GAAP to International Financial Reporting Standards (IFRS) firms.

The remainder of the paper is organized as follows: In the next section, we describe the institutional background and develop testable hypotheses. Section III describes our data and research design. Empirical results regarding the differences in tax expenses and tax avoidance between U.S. and European MNCs are shown in Section IV. We analyze the impact of tax policy in Section V. In Section VI, we discuss the implications of our results for the 2017 U.S. tax reform. Section VII concludes.

II. RESEARCH HYPOTHESES

A. Reported Taxes of Similar U.S. and European Firms

The question of whether U.S. MNCs are paying their fair share of taxes has become a central public concern. The arguments often focus on the inefficient application of U.S. tax law (see below on the analysis of U.S. CFC legislation). Particularly well-known U.S. 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.[12] Having said that, many tax experts argue, in turn, that prior to the U.S. tax reform, U.S. MNCs were subject to a high U.S. statutory tax rate on corporate profits and a worldwide tax system.

The few empirical studies comparing the tax expenses of MNCs from different countries come to opposing conclusions: Markle and Shackelford (2012a) compare the ETRs of U.S. MNCs to those of Australian, French, German, and U.K. firms and find a 1-percentage-point *lower* average ETR of U.S. firms compared to those of the other four countries. The study of Swenson and Lee (2008) suggests *higher* U.S. ETRs if U.S. MNCs are compared to MNCs headquartered in OECD member states. We know of two additional studies that compare U.S. MNCs and European MNCs. Pricewater-houseCoopers (2011) analyzes the *Forbes Global 2000* list and finds a 5.8-percentage-point *higher* ETR for U.S. MNCs for the period 2006–2009, whereas Avi-Yonah and Lahav (2012) find a 4-percentage-point *lower* ETR for the largest U.S. firms during the period 2001–2010.

The previous studies analyze samples of U.S. and foreign MNCs that significantly differ in industry membership and firm characteristics. However, earlier findings also 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 U.S. and European MNCs that belong to the same industry and have very similar firm characteristics.[13] Based on the fact that the U.S.

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

[13] While some of the studies mentioned do not even control for firm characteristics, the study by Markle and Shackelford (2012a) conditions on industry dummies. However, we believe that our within-industry approach significantly improves the estimates.

statutory tax rate is significantly higher and given the discussion above, let us use the matched firm sample and test the following hypothesis:

H1a: U.S. MNCs report higher ETRs compared to European MNCs.

We mainly consider the *GAAP ETR*, which is easily available in the financial reports of MNCs and often referred to in the current debate (e.g., PricewaterhouseCoopers, 2011). A particular advantage of the *GAAP ETR* is that it is unaffected by tax base rules such as bonus depreciation. However, one explanation for the mixed results in the above-mentioned papers might be related to the fact that the studies use different ETR measures. Those that find that U.S. MNCs avoid more taxes typically consider the *CURRENT ETR* (Avi-Yonah and Lahav, 2012) or the *CASH ETR* (Markle and Shackelford, 2012a). These alternative tax measures exclude, by definition, any influence of deferred taxes. Moreover, the public debate about taxation of MNCs often refers to international tax avoidance. In particular, this discussion considers the *Foreign* ETR.[14] We, therefore, also test the following concurrent hypothesis:

H1b: U.S. MNCs report lower ETRs compared to European MNCs if the ETR measure
    does not include deferred taxes associated with foreign income.

B. Tax Policy as Determinant of Tax Differentials

If we control the effects of firm characteristics and industry membership, at least part of the remaining differences in ETRs between U.S. and European firms might be attributed to the tax policies of home countries.

1. Home Country Statutory Tax Rates

A potential reason for differences might simply be the direct effect of the level of the corporate income tax rate at home. While the U.S. statutory tax rate was among the highest in the world prior to the TCJA,[15] corporate income tax rates in Europe (which, of course, vary across countries) were, on average, significantly lower than in the United States. Home country statutory tax rates affect the ETR, because the profits of the ultimate parent company and operations in the home country are subject to this rate. Moreover, given the worldwide tax system, the high U.S. statutory tax would be the minimum rate when profits were repatriated. The argument suggests that naive comparisons between U.S. and European firms' ETRs might be misleading. If a com-

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[14] For example, *The Financial Times* (Aug. 30, 2016), available at https://www.ft.com/content/3e0172a0-6e1b-11e6-9ac1-1055 824ca907.

[15] Tax Foundation (Sept. 7, 2017), available at https://taxfoundation.org/corporate-income-tax-rates-around-the-world2017/. Note that our sample period ends in 2015. Nowadays, the United States no longer has the highest corporate tax rate worldwide due to the U.S. tax rate cut.

parison should illustrate tax avoidance, the empirical analysis should be *conditional on the home statutory tax rate*. This leads to the following hypothesis:

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

2. CFC Rules

Tax avoidance activities of MNCs might be determined by the taxation of foreign income in the home country of the firm. In particular, home countries of MNCs implement so-called CFC rules to restrict profit shifting activities. An objective the rules have in common 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 CFC, special rules apply and some income is subject to the (higher) tax rate of the country of the parent firm and the usual privilege of exemption or deferral is not granted. Therefore, we expect that changes in the scope and application of CFC rules should be reflected in tax differentials between European and U.S. firms. The effectiveness of a CFC rule is difficult to measure. However, we exploit two substantial changes of CFC legislation.

First, tax experts consider the implementation of the so-called CTB regulation in 1997 as a substantial change in the practical application of U.S. CFC law. The CTB option was introduced in the United States with the aim of simplifying entity classification rules. However, the new legislation allows U.S. MNCs to classify a foreign affiliate as a "disregarded entity". Payments between a disregarded entity and its owner are not subject to Subpart F. Altshuler and Grubert (2006) suggest that using the CTB rule was associated with foreign tax savings of approximately $7 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 U.S. tax purposes. Grubert (2012) finds that the *Foreign ETR* of U.S. MNCs declined by nearly 2 percentage points since the introduction of CTB. Dunbar and Duxbury (2015) provide evidence that U.S. MNCs were able to reduce their foreign ETRs by approximately 9 percentage points compared to non-U.S. MNCs immediately after the introduction of CTB in 1997. Furthermore, a decrease in the *CASH ETR* of U.S. MNCs due to CTB is found by Dyreng et al. (2017).

Second, European CFC rules changed dramatically after the ECJ decision in 2006 that CFC rules infringe upon the European principle of freedom of establishment. 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. The Cadbury Schweppes judgment rendered CFC application within Europe ineffective, as wholly artificial arrangements can be easily avoided by firms (Bräutigam, Spengel, and Streif, 2017).[16] While

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[16] European MNCs can easily avoid an artificial arrangement by equipping their tax-haven subsidiary with only one employee, a tiny local office, a telephone, and internet access.

German MNCs held modest financial investments in European low-tax countries before 2006, they substantially increased passive investments after the ECJ decision (Ruf and Weichenrieder, 2012, 2013). By and large, it seems that the literature agrees that the ECJ decision significantly facilitated within-Europe tax planning for European MNCs.

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

H3: More lenient CFC rules in the home countries reduce the effective tax rate of MNCs.

3. Home Country Taxation of Foreign Income

An additional feature of a home country tax system is whether foreign income faces worldwide or territorial taxation. Under a worldwide tax system, dividends from foreign subsidiaries are taxed upon repatriation. The overall tax level is equal to the (possibly) high tax level of the home country when profits are repatriated to the parent. In contrast, under a territorial tax system, dividends repatriated to the parent are exempt from taxation in the home country. Nearly all European countries have implemented a territorial system.[17] The United States moved from worldwide taxation to territorial taxation after 2017.

Due to the additional tax on dividends repatriated to U.S. parent firms, many argue that this was a competitive disadvantage for U.S. MNCs relative to MNCs operating under a territorial system (e.g., Hines, 2012). In line with these arguments, earlier research 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 U.S. MNCs suggest that strategies, such as using a series of short-term loans, have been used to shift money back to the United States without paying repatriation tax.[18] Although the United States recently replaced its worldwide tax system, an evaluation is not possible yet due to lack of data. In 2009, however, the United Kingdom switched from worldwide taxation to territorial taxation. We exploit the U.K. reform to learn about the impact of the international tax system on effective tax expenses. We test the following hypothesis:

H4: A country's switch from a system of worldwide taxation to a territorial system reduces the effective tax expenses of MNCs headquartered in this country.

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[17] Currently, Ireland is the only European country with a worldwide tax system. See the further worldwide corporate tax summaries of PricewaterhouseCoopers, KPMG, and Ernst & Young.

[18] For example, Hewlett-Packard is accused of repatriating billions of dollars each year from offshore entities to the United States without paying taxes; see Forbes (Sept. 20, 2012), available at https://www.forbes.com/sites/janetnovack/2012/09/20/senate-reporthits-hp-microsoft-for-offshore-ploys-saving-billions-in-tax/#2b35c9a6229e.

4. 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 shifting channels are transfer prices for intrafirm transactions and the strategic use of 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., 2018).[19]

Tax planning opportunities through profit shifting depend on the specific business models of firms. For example, large amounts of intangible assets or research and development (R&D) facilitate profit shifting by MNCs (Grubert, 2003; Harris, 1993). Hence, differences in tax expenses between U.S. and European MNCs may relate to differences in the fundamental characteristics of firms and their businesses. So, even, if we compare very similar firms, U.S. MNCs might still avoid more (or less) taxes compared to their European peers if the shifting opportunities differ between U.S. and European firms. These differences may arise from tax policy and may be associated with specificities in business models, products, or production processes.

The reasoning suggests that the responses to the reforms in CFC rules and the system of home country taxation differ in firm characteristics determining tax planning opportunities. The argument is particularly clear when examining changes in CFC legislation: 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 more lenient CFC rules particularly benefit MNCs with more profit shifting opportunities. Hypothesis *H5* follows:

H5: Differences in profit shifting opportunities associated with fundamental firm characteristics lead to heterogeneous effects of tax reforms.

III. DATA AND RESEARCH DESIGN

A. Data and Exploratory Analysis

The main objective of our paper is to provide reliable estimates about the determinants of tax differentials between U.S. and European MNCs. We focus on firms with U.S. or European headquarters. Our base sample includes MNCs that have been listed on either the S&P 500 or Stoxx Europe 600 at least once during the period 1995–2015. In sum, our sample includes 965 U.S. firms and 1,015 European firms for which consolidated

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[19] A similar strategy allows MNCs to use 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, Foley, and Hines, 2006; Huizinga, Laeven, and Nicodème, 2008).

financial information is reported in *Compustat* or *Compustat Global* (see Table 1 for more information).[20]

We base our analysis on variations in ETRs as ex post measures of tax expenses (e.g., Dyreng, Hanlon, and Maydew, 2010; Hanlon and Slemrod, 2009; Markle and Shackelford, 2012a, 2012b). The data to compute ETRs are taken from the consolidated financial statements. 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* and the *CURRENT ETR*. In accordance with the accounting literature, we define *GAAP ETR* as tax expenses (*Compustat* variable: txt) divided by pretax income (pi).[21] We adjust the latter for extraordinary items (xi).[22] Tax expense includes both taxes paid in the current period and taxes accrued in the period but with payment deferred until the future. To focus on current (or cash) taxes paid, we exclude deferred taxes (txdi). Thus, *CURRENT ETR* is

Table 1

Sample Selection

Description	European Firms		U.S. Firms	
	Firms	Firm-Years	Firms	Firm-Years
Index firms	1,078	17,707	1,086	17,343
Headquarters in EU/U.S.	1,052	17,289	977	15,452
Non-miss. controls	1,022	13,997	970	13,243
Non-miss. controls & *GAAP ETR*	1,015	13,136	965	12,574
Non-miss. controls & *CURRENT ETR*	975	11,715	900	10,991
Non-miss. controls & *CASH ETR*	685	4,585	895	10,399
Non-miss. controls & *Foreign ETR*	378	2,868	621	6,147

Notes: The sample is based on firms that were included in the S&P 500 or Stoxx Europe 600 stock market indices at least once during the period 1995–2015.

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[20] Note that a sufficient condition for a firm to be considered as a possible match (in the pair matching approach below) depends on the precondition that the firm is listed at some point in time on one of the two indices. For example, a European firm listed only in 2012 may be the best match for a U.S. firm in the matching year 2011. In this example, we then compare the matched pair over time (starting in 2012, the year after the matching procedure), where the focus is on within-pair and time variation over the following years (e.g., see years 2012–2015 in Panel B of Table 2).

[21] The *GAAP ETR* is calculated from information provided from consolidated financial statements that are compiled under two different accounting standards: U.S. firms usually prepare their consolidated financial statements under U.S. GAAP and European firms follow the regulations from the IFRS.

[22] We replace missing values in extraordinary items 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.

defined as current taxes (txt – txdi) divided by pretax income (pi). See Appendix Table A1 for detailed variable descriptions.

The recent debate about the aggressive tax planning structures of several MNCs started around 2012.[23] Thus, to gain some first insights about the distribution of U.S. and European *ETRs*, we have calculated ETRs for the years 2012–2015. The average *GAAP ETR* of U.S. MNCs equals 28.9 percent, which is 2 percentage points higher than the average of the European firms, which is 26.9 percent. Figure 1 shows median values of 30.5 percent for the U.S. MNCs and 25.4 percent for the European ones. This finding suggests that the distribution of U.S. ETRs is also more left-skewed — implying that a few U.S. MNCs report low ETRs while many others face relatively high effective tax payments — compared to the distribution of European ETRs. Regarding the *CURRENT ETR*, the findings are somewhat different. The average *CURRENT ETR* of U.S. firms (26.1 percent) is 1.5 percentage points *below* the average rate of European firms (27.6 percent), while the median value is again higher for U.S. firms (27.2 percent) compared to European firms (25.9 percent).

It seems that the public discussion about MNCs and their tax avoidance refers, to a large extent, to the *Foreign ETR* of those firms. The *Foreign ETR* focuses only on tax expenses associated with foreign operations. For U.S. MNCs, the *Foreign ETR* is calculated as foreign taxes (txfo) 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 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.[24] We provide an example of the calculation of the *Foreign ETR* of European MNCs in an online appendix.

We believe that we calculate comparable measures reasonably well. *Compustat* reports foreign tax information for very few European firms, allowing us to validate our measure with the reported tax information for these firms.[25] Note, moreover, that the second part of our empirical analysis focuses on time variation and, therefore, should not be too sensitive to possible cross-sectional inconsistencies.

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

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[23] For example, public hearings on aggressive tax planning in the United States or the United Kingdom (e.g., U.S. Senate, Permanent Subcommittee on Investigations, Hearing on Offshore Profit Shifting and the U.S. Tax Code, Sept. 20, 2012; House of Commons, Committee of Public Accounts, Nov. 12, 2012).

[24] 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.

[25] Validation tests for *Foreign ETR* calculations are available in an online appendix.

Figure 1
GAAP ETR and *CURRENT ETR*
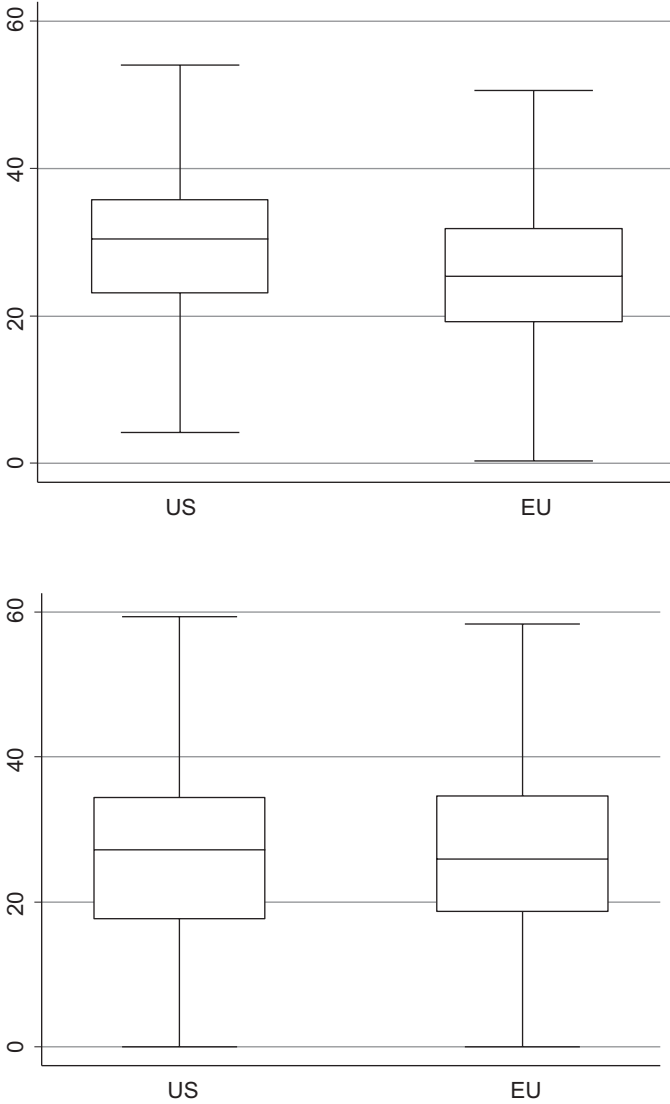
Notes: Comparison of *GAAP ETR* and *CURRENT ETR* between U.S. and European MNCs. The figure is based on data for the years 2012–2015. A box portrays the interquartile range of the *ETR* distribution. The horizontal line in the box represents the median.

Figure 2
Foreign ETR

Notes: Comparison of *Foreign ETR* between U.S. and European MNCs. The figure is based on data for the years 2012–2015. A box portrays the interquartile range of the *Foreign ETR* distribution. The horizontal line in the box represents the median.
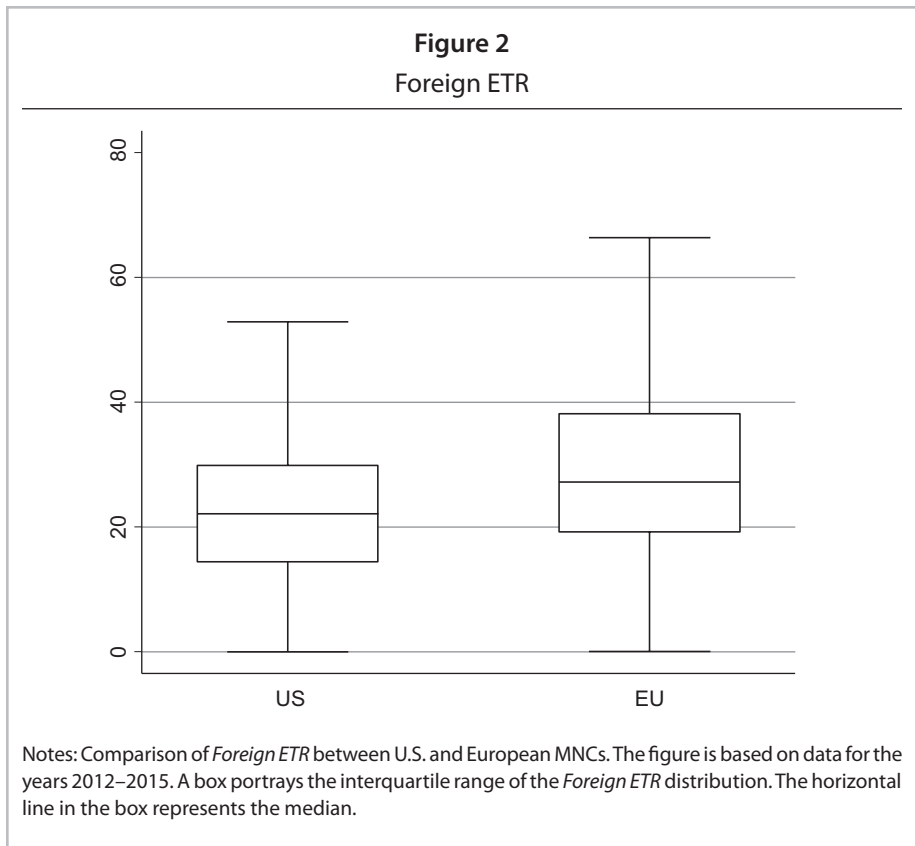
U.S. operations of European firms and vice versa. We will discuss that measurement issue in Section IV.C.

   Considering the explorative analysis depicted in Figures 1 and 2, we can conclude that descriptive statistics do not provide a clear answer to the question of whose tax expenses — U.S. or European firms — are lower. This obviously depends on how we measure tax expenses. Moreover, firm characteristics, which determine ETRs as well, clearly differ between U.S. and European firms in our sample. Table 2 presents summary statistics on firm variables. The time period of Panel A in Table 2 corresponds to the years 2012–2015. A rough comparison between the U.S. and European MNCs suggests that the former are larger and more profitable than the latter. While European firms report more intangible assets, U.S. MNCs have higher R&D expenses. Because previous literature shows that firm characteristics affect ETRs, systematic differences therein may also bias estimated tax differentials between U.S. and European MNCs.

Table 2
Summary Statistics

	Panel A						Panel B					
	Years from 2012 to 2015 (Unmatched Sample)						Years from 2012 to 2015 Matching Year: 2011 352 Matched Pairs					
	European Firms			U.S. Firms			European Firms			U.S. Firms		
Variables	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	1,146	2.49	1.76	1,168	2.74	1.44
ROA*	2,248	0.08	0.11	2,003	0.10	0.08	1,146	0.08	0.07	1,168	0.09	0.06
LEV*	2,248	0.25	0.17	2,003	0.27	0.19	1,146	0.25	0.17	1,168	0.27	0.18
RD*	2,248	0.01	0.03	2,003	0.02	0.04	1,146	0.02	0.04	1,168	0.01	0.03
INTAN*	2,248	0.23	0.21	2,003	0.22	0.21	1,146	0.24	0.21	1,168	0.25	0.22
STR	2,248	0.27	0.06	2,003	0.39	0.00	1,146	0.28	0.06	1,168	0.39	0.00
GAAP ETR	2,248	0.27	0.14	2,003	0.29	0.12	1,146	0.27	0.13	1,168	0.29	0.11
CURRENT ETR	2,078	0.28	0.16	1,770	0.26	0.14	1,074	0.28	0.14	1,029	0.26	0.14

Table 2 (continued) Summary Statistics

Variables	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
CURRENT ETR	4,261	0.30	—	6,350	0.28	0.14	1,521	0.28	0.13	1,353	0.26	0.14

Notes: Sample sizes differ usually because of data availability. All variables with "*" are used to calculate the propensity scores. Panel C includes U.S. and European firms. Panel D includes firms from the United States 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 U.K. and U.S. firms. Panel F includes U.K. and non-U.K. European firms.

B. Empirical Approach

We proceed with a multivariate empirical analysis of the ETR differential between U.S. and European MNCs. Our identification strategy is based on the following steps. First, we use propensity score matching (PSM) to identify similar U.S. and European firms. Second, we run panel regressions in which we condition on fixed effects at the level of firm-pairs, identified in step 1. The regressions include a number of time-varying firm-level variables.

1. Finding Firm-Pairs

Let us first define the indicator variable US_i to indicate whether firm i is U.S. based ($US_i = 1$) or European based ($US_i = 0$). Note that the variable is not indexed by time t.[26] 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 $\hat{p}_t$ that firm i is based in the United States. Thus, we specify

(1) $\quad US_{i,2011} = \boldsymbol{\beta} X_{i,2011} + \varepsilon_{i,2011}$

to determine the linear index in a probability model.[27] Equation (1) indicates that the probability of being a U.S. firm depends on a number of 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.

The choice of regressors ($X_{i,2011}$) in Equation (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.[28] 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). $INTAN_i$ is the intangible assets (intan) divided by total assets (at).[29]

Estimating Equation (1) produces two vectors of propensity scores: one for the U.S. firms, $\hat{\boldsymbol{p}}^{US}$, and one for the European firms, $\hat{\boldsymbol{p}}^{EU}$. Once we have estimated $\hat{\boldsymbol{p}}^{US}$ and $\hat{\boldsymbol{p}}^{EU}$, we aim at finding so-called *nearest neighbors* for each U.S. 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 U.S. 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.[30] Furthermore, to ensure acceptable matching quality, we require a difference in propensity scores of less than

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[26] Note that our sample only includes MNCs that do not change location of their headquarters over the sample period. Hence, being an MNC located in the United States ($US_i = 1$) does not change over time.

[27] We will estimate Equation (1) assuming a probit model.

[28] To guarantee comparability, we have used yearly exchange rates to convert total assets to U.S. dollars.

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

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

0.02.[31] Note that our approach produces firm-pairs $\{US_i = 1; US_m = 0\}$, where units (firm-pairs) are very similar (comparable).[32]

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.

2. Estimating Conditional ETR Differentials

To learn about potential ETR differentials between U.S. and European firms, we estimate the following regression model:

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

The dependent variable is an ETR measure of firm i in year t. The explanatory variable of interest is the indicator variable US_i, which equals one if the MNC is located in the United States and zero if the MNC is located in Europe. $\boldsymbol{Z}_{it}$ corresponds to a vector of additional time-varying firm-level control variables. The coefficient α_1 measures the tax differential between U.S. 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).

The variable of interest is the indicator variable US. The coefficient estimated on the variable US is identified by averaging over firm-pairs. It is not identified through time variation (as being from the United States does not vary over time), but is a time-constant unobserved difference between U.S. and European firms. Being able to explore this time-constant U.S. effect is what makes our estimation approach (matching and ordinary least squares, conditional on pairs) particularly attractive. Strictly speaking, the variable US captures not only tax avoidance but all unobservables between U.S. and European firms. However, we refer to the coefficient on US as unobserved tax avoidance, as it should not be related to industry or technology.

3. The Effect of Home Country Tax Rules

One particular advantage of the identification approach suggested above is that it allows us to effectively combine pair matching with a difference-in-differences approach to analyze the differential impact of tax policy reforms. As described in Section 2 above, we consider U.S. and European reforms of CFC legislation, as well as the United Kingdom's switch to a territorial tax system. We consider data from years before and after policy changes. We repeat our PSM procedure always in the respective year before a tax reform was enacted. The difference-in-differences approach ensures that the estimates are not biased by time-constant differences in the treatment and control groups

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

[32] 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.

(Caliendo and Kopeinig, 2008; Heckman et al., 1998).[33] The approach also helps us understand and pin down where possible ETR differentials come from and how these differentials change 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. The reforms we study affect either U.S. or European firms. Consequently, the indicator $TREATMENT_i$ usually captures the location of the MNCs, as above. We estimate the following equation:

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

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. It measures the differential response of a treated firm i relative to a firm that is not affected by a reform. In additional tests, we analyze whether firms' responses to the policy changes differ with firm characteristics, such as reliance on intangible capital.

IV. COMPARING EFFECTIVE TAX EXPENSES: U.S. VERSUS EUROPEAN FIRMS

A. Conditional Comparisons

We start with a comparison of ETR measures of U.S. and European firms for the period 2012–2015. Before we do so, we need to estimate propensity scores and find the best matching pairs of U.S. and European firms. Table 3 suggests that the matching removes most of the bias in firm characteristics between U.S. ($US_i = 1$) and European ($US_i = 0$) firms. The nearest neighbor matching (with a 2 percent caliper, as suggested above) finds 352 matched pairs (see Panel B in Table 2 for descriptive statistics). For example, the European-based business software firm *SAP SE* is matched to the U.S.-headquartered software firm Oracle Corp.[34]

Based on the matched sample, we then run Equation (2). The results are presented in Table 4. As the dependent variable, we consider the *GAAP ETR* in Columns (1)–(3) and the *CURRENT ETR* in Columns (4) and (5). Specifications (1) and (4) include only year and pair fixed effects, while the other regressions add time-varying firm character-

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[33] Note that our regressions are still based on a pair-matched sample (where we test for the balancing of covariates). Here, the fixed effects approach removes all cross-pair heterogeneity. We additionally include year effects and a set of controls (regression results conditioning on year-pair effects, year and industry effects, as well as exact matching on the industry are provided in Table A2). All this ensures that the benchmark firms — against which we measure the treatment effect in the difference-in-differences setting — move in parallel in the absence of the reform treatment and we can interpret the estimated coefficients as causal.

[34] Headquarters of the European firms are located in Germany (43), France (54), Netherlands (20), Italy (20), the United Kingdom (112), Ireland (3), Denmark (11), Portugal (2), Spain (19), Belgium (9), Luxembourg (3), Norway (6), Sweden (26), Finland (13), Lichtenstein (1), Austria (8), and Czech Republic (2). A full list of all matched 352 firm-pairs is available from the authors upon request.

Table 3

Nearest Neighbor Matching, Balancing Property (2011)

		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.

istics. While the matching procedure has aligned firm characteristics of our firm-pairs in the benchmark year, our results show that changes in some of these variables have an impact on the effective tax expenses.

In Columns (1) and (2), the dependent variable corresponds to *GAAP ETR*. The coefficient of interest, *US*, is positive and statistically significant. The coefficient suggests that the *GAAP ETRs* of U.S. 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 III.A.

In Column (4), we consider the *CURRENT ETR* as the dependent variable. Using this alternative tax measure, we find that tax expenses of U.S. MNCs are *smaller* than those of European MNCs. This finding confirms hypothesis *H1b* and suggests that the opposite result for a comparison based in the *GAAP ETR* is associated with accounting for deferred taxes. We will analyze that issue in Section IV.D.

In addition, we run several robustness checks that consider alternative sets of fixed effects and matching procedures. We also consider measures of the international footprint of an MNC, such as the number of host countries and the share of tax-haven locations as observables when predicting the propensity score. The results of these additional

Table 4

Regression Analysis, ETR Differentials

Variables	GAAP ETR			CURRENT ETR	
	(1)	(2)	(3)	(4)	(5)
US	0.0209***	0.0221***	–0.0328**	–0.0193**	–0.0648***
	(0.0059)	(0.0061)	(0.0146)	(0.0075)	(0.0145)
SIZE		–0.0057	–0.0098*		–0.0252***
		(0.0052)	(0.0052)		(0.0061)
ROA		–0.2460***	–0.2400***		–0.5730***
		(0.0868)	(0.0852)		(0.1120)
LEV		–0.0195	–0.0196		–0.0508*
		(0.0222)	(0.0215)		(0.0291)
RD		–0.2450	–0.2810		–0.4090**
		(0.1860)	(0.1750)		(0.1590)
INTAN		0.0295	0.0292		0.1110***
		(0.0202)	(0.0203)		(0.0279)
STR			0.4830***		0.4510***
			(0.1150)		(0.1180)
Year FE	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓
N	2,314	2,314	2,314	2,103	2,103
Adj. R^2	0.283	0.288	0.300	0.247	0.285

Notes: Regressions are based on a matched sample, where MNCs are headquartered either in the United States or in Europe; years from 2012 to 2015 (Panel B) are included. The dependent variable is the *GAAP ETR* in Columns (1)–(3) and the *CURRENT ETR* in Columns (4) and (5). Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

tests are presented in Appendix Table A2. Almost all specifications confirm our main findings of Table 4: We find a higher *GAAP ETR* and lower *CURRENT ETR* of U.S. MNCs compared to their European peers.

B. Influence of the Home Country Tax Rate

Many argue that it is mainly the high home country tax level faced by U.S. MNCs during the considered sample period that has affected U.S. firms' competitiveness. We, therefore, add the statutory tax rate (*STR*) of an MNC's home country in Columns (3) and (5) of Table 4. Note that conditioning on *STR* allows for a tax avoidance interpretation of the *US* indicator. In particular, the coefficient on *US* captures all unobserved differences between U.S. and European firms in the effective tax differentials. To be precise, the effect of *US* can be interpreted as all remaining unobserved differences

between U.S. and European firms, conditional on firm-specific observables, statutory tax rates, and fixed effects.

Controlling for *STR* is important as the difference in statutory corporate tax rates is substantial. Whereas the mean tax rate in the home countries of European MNCs is 27.5 percent in our sample period, the U.S. corporate tax rate is significantly higher.[35] 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 percent (e.g., as in Ireland) to almost 39 percent (e.g., as in France).

As expected, the home country tax rate is positively related to the *GAAP ETR* and *CURRENT ETR* (Columns (3) and (5) of Table 4). The coefficient suggests that a 1-percent-point higher *STR* increases the *GAAP ETR* and *CURRENT ETR* by about 0.5 percentage points. Given that we measure total worldwide tax payments divided by worldwide pretax income on the left-hand side, the effect of the home country tax rate is quite substantial.

Hence, the fact that U.S. firms faced a high statutory tax rate at home during the sample period might be interpreted as a competitive disadvantage for U.S. firms. Conditional on the statutory tax level, however, the sign of the *US* coefficient becomes negative in the case of the *GAAP ETR*. That is, controlling for the different levels of the statutory tax rate, the *GAAP ETRs* of U.S. MNCs are approximately 3.3 percentage points lower compared to those of European MNCs. Since the *GAAP ETR* also includes deferred tax expenses associated with only temporary effects, the tax differential cannot be attributed to tax base effects related to bonus depreciation. Moreover, Column (5) suggests that the *CURRENT ETR* of U.S. firms is about 6.5 percentage points lower compared to European peers if we control for the statutory home tax rate. Thus, conditional on *STR*, our findings confirm *H2*. The findings are also confirmed by a large number of robustness checks using different sets of fixed effects and matching procedures (see Columns (2) and (4), which are conditional on firm characteristics and *STR*, of Appendix Table A2).

At this point, we may interpret the negative *US* coefficient as an indicator capturing the tax avoidance behavior of U.S. MNCs to compensate for the higher home country tax rate. Our estimates imply that U.S. MNCs could compensate for about half of the disadvantage associated with the high U.S. tax rate prior to the tax reform. Let us, for instance, consider the estimated effect of a 1-percentage-point higher statutory tax rate on the ETR, which is 0.483 in Column (3) of Table 4. Note that the difference in statutory tax rates between the United States and the average of European countries was about 12 percentage points. Then, almost 7 percentage points of the higher U.S. statutory tax rate could be compensated for by U.S. MNCs.[36]

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[35] See Panel B of Table 2. The statutory tax rates were collected from the worldwide corporate tax summaries of PricewaterhouseCoopers, KPMG, and Ernst & Young and from the OECD statistics website (http://stats. oecd.org). The U.S. statutory tax rate is the combined corporate income tax rate taken from the OECD statistics website.

[36] The marginal effect of a tax increase is 0.01 (a 1-percentage-point increase in the tax) times the estimated coefficient on *STR* (i.e., $0.01 \times 0.483 = 0.00483$). Hence, $0.0328/0.00483 = 6.79$ corresponds to the tax equivalent of the treatment effect. This means that the U.S. treatment effect corresponds to about seven times the marginal tax effect (i.e., $0.00483 \times 6.79 = 0.0328$). This suggests that the tax savings (measured by the treatment effect) correspond to a 7-percentage-point tax change, so that the disadvantage of being from the United States (through the higher statutory tax burden) is reduced by 7 percentage points (as unobserved tax advantages seem to be important, given the estimate of the treatment effect).

C. Alternative Tax Measures

In additional analyses presented in Table 5, we consider alternative definitions of the ETR as examined in earlier contributions (for an overview, see Hanlon and Heitzman, 2010). We use the same matching procedure as in Section IV.A and again estimate the tax differentials between U.S. and European MNCs for the matched sample and the period 2012–2015.

For each tax measure, one specification includes fixed effects only, whereas a second regression conditions on the full set of our control variables, including the home country tax rate. Again, we report results for the dummy *US*, which captures the ETR differentials between U.S. and European firms.

In Columns (1) and (2) of Table 5, we consider the *Foreign ETR* as the dependent variable. The coefficients for the dummy *US* in Column (2) suggest a 7-percentage-point lower *Foreign ETR* of U.S. MNCs compared to their European peers. Our results confirm the findings of the descriptive analysis in Section III.A that U.S. MNCs report significantly less foreign taxes compared to their European peers.[37] However, note that the *Foreign ETR* includes U.S. operations of European firms. Hence, their foreign affiliates are taxed at the high U.S. corporate tax rate. We, therefore, also tried to construct a "non-U.S." ETR, that is, the *Foreign ETR* for U.S. firms and an ETR that excludes the U.S. taxes for the European firms. However, the subsidiary-level information on U.S. subsidiaries of European firms is often missing in databases like *Orbis*.

In Columns (3) and (4) of Table 5, we consider the *CASH ETR* (*CASH ETR* is computed as taxes paid divided by pretax income). The coefficient for the *US* dummy is negative for both specifications and quantitatively similar to magnitudes found for the *CURRENT ETR*. If we control for home country tax rates (Column (4)), the tax differential between U.S. and European firms is substantial. Thus, the comparison using the *CASH ETR* also clearly suggests that U.S. MNCs already paid less taxes prior to the U.S. tax reform.

In Specifications (5)–(10) of Table 5, we consider long-run versions of ETR measures to mitigate potential bias through strong yearly volatility in ETRs (Dyreng, Hanlon, and Maydew, 2008). We compute the long-run ETRs over a period of three years. The findings for long-run versions of the three ETR measures confirm our previous results.

The findings using alternative tax measures are fully consistent with previous literature. While PricewaterhouseCoopers (2011) suggests higher *GAAP ETRs* for U.S. firms than for European firms, Avi-Yonah and Lahav (2012) find lower *CURRENT ETRs* for U.S. firms and Markle and Shackelford (2012a) find lower *CASH ETRs* for U.S. firms.

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[37] Comparing our measurement of *Foreign ETRs* with the available *Compustat* foreign tax data 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 U.S. and European firms potentially may be underestimated.

Table 5

Alternative ETR Measures (Treatment: *US*)

Variables	Foreign ETR		CASH ETR		GAAP ETR LONG		CURRENT ETR LONG		CASH ETR LONG	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
US	-0.0961***	-0.0696*	-0.0367***	-0.0958***	0.0310***	-0.0208*	-0.0211***	-0.0847***	-0.0320***	-0.1030***
	(0.0141)	(0.0392)	(0.0084)	(0.0190)	(0.0054)	(0.0120)	(0.0075)	(0.0158)	(0.0083)	(0.0174)
SIZE		0.0070		-0.0263***		-0.0086**		-0.0123**		-0.0085
		(0.0103)		(0.0069)		(0.0041)		(0.0052)		(0.0064)
ROA		-0.1460		-0.8070***		-0.0337		-0.0976		-0.1960**
		(0.1890)		(0.1250)		(0.0589)		(0.0696)		(0.0779)
LEV		-0.0478		-0.0046		-0.0100		0.0075		0.0355
		(0.0547)		(0.0336)		(0.0205)		(0.0320)		(0.0409)
INTAN		0.0141		-0.4460**		0.0086		0.0795***		0.0213
		(0.3470)		(0.1950)		(0.0168)		(0.0275)		(0.0313)
RD		0.0386		0.0677**		-0.4920***		-0.0077		-0.1110
		(0.0538)		(0.0304)		(0.1530)		(0.1640)		(0.2120)
STR		-0.2220		0.5740***		0.4540***		0.5620***		0.6140***
		(0.2980)		(0.1580)		(0.0940)		(0.1190)		(0.1370)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	1,101	1,101	2,004	2,004	2,072	2,072	1,896	1,896	1,776	1,776
Adj. R^2	0.364	0.364	0.267	0.320	0.522	0.548	0.443	0.471	0.466	0.492

Notes: Regressions are based on matched samples (exact matching by industry), where MNCs are headquartered either in the United States or in Europe; years from 2012 to 2015 are included. Year and firm-pair fixed effects are included in all specifications. The dependent variable is either *Foreign ETR*, *CASH ETR*, or long-term specifications over three years of *GAAP ETR*, *CURRENT ETR*, and *CASH ETR*. Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

D. Accounting for Deferred Taxes

The most important conceptual difference between the ETR measures is the absence of deferred tax expenses in the *CURRENT ETR* and *CASH ETR*, while the *GAAP ETR* accounts for deferred taxes. Under the U.S. worldwide tax system, foreign income was one potential source of deferred taxes that might explain the significantly higher *GAAP ETRs* of U.S. MNCs. However, many U.S. firms had recognized their foreign income as permanently reinvested earnings and, thus, avoided the disclosure of deferred taxes under U.S. GAAP. In additional analysis in Table 6, therefore, we investigate the tax differentials for two subsamples. One subsample contains only those U.S. firms (and their European peers) that report no growth of their permanently reinvested earnings (*no PRE*), while the other sample considers only U.S. firms (and their European peers) with a recent growth of their permanently reinvested earnings (*PRE*).

Our results in Table 6 show that U.S. MNCs report a significantly higher *GAAP ETR* than their European peers, but only if they account for deferred tax liabilities (Row (1)), while no significant difference is found if U.S. MNCs classify their foreign income as permanently reinvested earnings (Row (2)). We do not find any positive coefficient when we consider the *CURRENT ETR* (Rows (3) and (4)) or the *CASH ETR* (Rows (5) and (6)). Consequently, we should keep in mind the role of deferred taxes when comparing European to U.S. MNCs. In this sense, the tax measure we look at is crucial.

We, thus, argue that the finding of a higher *GAAP ETR* of U.S. MNCs can be attributed mainly to higher deferred tax expenses of firms that do not declare their foreign income as permanently reinvested. We expect that the main source of the deferred taxes disappeared due to the recent devaluation of deferred tax liabilities and the abolishment of the U.S. worldwide tax system. If deferred taxes are neglected, our (unconditional) results suggest that already prior to the tax reform, U.S. firms reported similar or even less taxes than their European peers. Moreover, if we control for the home country tax rate (Column (2) of Table 6), our results suggest that U.S. MNCs had been avoiding more taxes than their European peers.

V. EXPLAINING THE TAX DIFFERENTIALS BETWEEN U.S. AND EUROPEAN MNCS

Let us now investigate whether home country tax policy can explain the tax differentials between U.S. and European MNCs. First, we investigate the consequences of CFC legislation. Second, we analyze the impact of the home country tax system for foreign income.

A. Does Home Country CFC Legislation Explain Tax Differentials?

While many home countries of MNCs have implemented CFC rules to restrict profit shifting activities, the effectiveness of these rules might differ. Since we do not have a measure for the effectiveness of CFC rules, we make use of two important changes in CFC rule application in the United States and in Europe. As described in Section II, European CFC rule application has been adjusted since the 2006 ECJ Cadbury

Table 6

Subsample Analysis: Permanently Reinvested Earnings

Specification	No. Firm-Pairs	Coefficient on US	
		(1)	(2)
(1) *GAAP ETR, no PRE*	109	0.0516***	0.0012
		(0.0124)	(0.0190)
(2) *GAAP ETR, PRE*	165	0.0056	−0.0461**
		(0.0083)	(0.0192)
(3) *CURRENT ETR, no PRE*	95	−0.0069	−0.0482**
		(0.0141)	(0.0208)
(4) *CURRENT ETR, PRE*	151	−0.0130	−0.0511***
		(0.0099)	(0.0190)
(5) *CASH ETR, no PRE*	78	−0.0276*	−0.0713***
		(0.0166)	(0.0222)
(6) *CASH ETR, PRE*	129	−0.0353***	−0.0692***
		(0.0110)	(0.0201)

Notes: Regressions are based on matched samples (exact matching by industry), where MNCs are head-quartered either in the United States or in Europe; years from 2012 to 2015 are included. 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 either *GAAP ETR* (Specifications (1) and (2)), *CURRENT ETR* (Specifications (3) and (4)), or *CASH ETR* (Specifications (5) and (6)). In Specifications (1), (3), and (5), only pairs of European firms and U.S. firms are considered that report no growth in their permanently reinvested earnings (*PRE*). In Specifications (2), (4), and (6), only pairs of European and U.S. firms are considered that report growth in *PRE*. Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Schweppes judgment, and U.S. 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 U.S. and European MNCs. To evaluate the effect of the policy changes, we 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 2002–2015 to investigate the ECJ judgment and on the years 1995–2003 for the CTB introduction.

1. Evaluating CTB

In this section, we first test whether the U.S. 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 United States (*TREATMENT^{US}* = 1) and has been

affected by the CTB introduction. Again, we use PSM to find pairs of similar U.S. and European MNCs.[38] Based on the matched samples and observations from 1995 to 2003, we estimate Equation (3), as described in Section III.B. Table 7 presents the results.[39] The dependent variable is the *GAAP ETR* (Columns (1)–(4)) and the *CURRENT ETR* (Columns (5)–(8)).

Specifications (1) and (5) of Table 7 consider 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 Internal Revenue Service (IRS) employees and international tax lawyers, that the widespread use of CTB for tax planning activities was delayed.[40] We, therefore, consider 1999 and 2002 as alternative treatment years in Specifications (2)–(3) and (6)–(7); matching is then based on data from 1998 and 2001, respectively.

All specifications in the table control for the usual set of firm characteristics, pair effects, and aggregate year effects. The differential impact we are interested in is the estimated coefficient on *TREATMENT^{US} × POST*. Across all specifications, we find a negative and highly significant treatment effect. The treatment effect increases in absolute value if we consider 1999 (Columns (2) and (6)) or even 2002 (Columns (3) and (7)) as the treatment year. Thus, our findings support the anecdotal evidence from discussions between IRS employees and tax lawyers arguing that there was some delay in using CTB for tax avoidance.

Note that the estimate on T^{US} is now positive, whereas it was estimated with a negative sign before. One reason for this finding of a positive tax differential in earlier periods may directly be explained by the introduction of CTB. As our findings suggest that CTB has allowed U.S. firms to reduce their ETRs in the subsequent years, the positive tax differential between U.S. and European firms has ultimately become negative.

The point estimates suggest that after the introduction of the CTB option, U.S. firms reduced their *GAAP ETR* by about 4.6 percentage points and the *CURRENT ETR* by about 6.5 percentage points compared to their European counterparts. Our results are also in accordance with previous literature. For example, Dyreng et al. (2017) find a decline of 3.9 percentage points in the U.S. MNCs' *CASH ETRs*.[41] Hence, it happened at this point in time when the change in CFC legislation allowed U.S. MNCs to avoid more taxes compared to their European peers (conditional on the *STR*).

Between 2001 and 2004, a bonus depreciation system was applicable in the United States. While the application of bonus depreciation reduces current tax expenses, deferred tax expenses increase at the same time because tax payments are shifted to future periods. Thus, the *GAAP ETR* is unaffected by bonus depreciation because it considers both

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[38] Probit estimates and balancing property tests are available in an online appendix.

[39] Note that we use data from 1995 to 2003 to be better able to pinpoint the effects of the CTB introduction.

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

[41] Moreover, Dunbar and Duxbury (2015) suggest a decline of 9 percentage points in the U.S. MNCs' *Foreign ETRs*. Because *Amadeus* only provides financial data for the last 10 years, we are unable to compute the *Foreign ETR* for European MNCs prior to 2003.

Table 7

Consequences of CTB Introduction

Variables	GAAP ETR				CURRENT ETR			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)
$TREATMENT^{US}$ (T^{US})	0.0295***	0.0316***	0.0300***	0.0388***	0.0208***	0.0167**	0.0129*	0.0179**
	(0.0066)	(0.0057)	(0.0060)	(0.0065)	(0.0079)	(0.0072)	(0.0070)	(0.0078)
$T^{US} \times POST$	−0.0132**	−0.0174***	−0.0457***	−0.0422***	−0.0266***	−0.0296***	−0.0656***	−0.0616***
	(0.0061)	(0.0060)	(0.0070)	(0.0072)	(0.0080)	(0.0081)	(0.0101)	(0.0108)
$T^{US} \times RD$				−0.5860***				−0.3130
				(0.1480)				(0.2050)
$T^{US} \times POST \times RD$				−0.3580**				−0.3550
				(0.1460)				(0.2660)
Control variables	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓	✓	✓
N	6,160	5,868	4,849	4,849	5,149	4,964	4,261	4,261
Adj. R^2	0.335	0.281	0.365	0.371	0.306	0.250	0.319	0.320

Notes: Regressions are based on matched samples, where MNCs are headquartered either in the United States or in Europe. The dependent variable is the *GAAP ETR* in Columns (1)–(4) and the *CURRENT ETR* in Columns (5)–(8) The data of Columns (1) and (5) refer to a matching based on the year 1996, and the year of treatment is 1997. The data of Columns (2) and (6) refer to a matching based on the year 1998, and the year of treatment is 1999. The data of Columns (3), (4), (7), and (8) refer to Panel C. Control variables include *SIZE, ROA, LEV, INTAN, RD,* and *STR.* Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

current and deferred tax expenses. Using the *GAAP ETR* as the dependent variable, thus, ensures that our results are not affected by issues related to bonus depreciation.[42] Moreover, Zwick and Mahon (2017) find that, in particular, small firms responded to the U.S. bonus depreciation rules that applied in the United States between 2001 and 2004. Since our treatment group consists of large firms (listed on the S&P 500) only, the impact of bonus depreciation on our sample should be less relevant. We should finally note that the CTB reform was not accompanied by changes in the U.S. *STR*. It is still important, though, to condition on the between-pair difference in the *STR* to account for its higher level in the United States.

We further test for heterogeneity in treatment effects (see *H5*) by including interaction terms between *TREATMENT^{US}*, *POST*, and firm-specific proxies for profit shifting. As argued above, as well as in previous contributions, R&D activities facilitate profit shifting to a significant extent. Columns (4) and (8) are based on the same sample as Columns (3) and (7), and they correspond to Panel C of Table 2. Specifications (4) and (8) of Table 7 confirm a negative and significant treatment effect (*TREATMENT^{US}* × *POST*). In addition, we include the interaction term between the treatment indicator and our proxy for profit shifting opportunities, *RD*. If we consider the *GAAP ETR* as the dependent variable, the coefficient of the interaction between *TREATMENT^{US}*, *POST*, and *RD* is negative and statistically significant. Regarding the *CURRENT ETR*, the effect is also negative but statistically insignificant.

The result for the *GAAP ETR* suggests 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 U.S. and European firms was positive during the period 1995–2003. Second, given the magnitude of the treatment effect, this positive tax differential vanishes or even turns negative after the introduction of CTB.

2. 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.[43]

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[42] In untabulated tests, we also replace the treatment group and consider domestic U.S. firms as the treatment group. Because domestic firms are unaffected by the CTB introduction, we would only expect effects of bonus depreciation on the *CURRENT ETR*, as this measure neglects deferred tax expenses. The results confirm our expectation: We find no significant effect for the *GAAP ETR* but a significant effect for the *CURRENT ETR*.

[43] The following European countries had implemented a CFC rule: Denmark, Finland, France, Germany, Hungary Italy, Lithuania, Norway, Portugal, Spain, Sweden, and the United Kingdom (see https://www2. deloitte.com/global/en/pages/tax/articles/guide-to-controlled-foreign-company-regimes.html; worldwide corporate tax summaries of PricewaterhouseCoopers, KPMG, and Ernst & Young).

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.[44] The matching creates 324 pairs of U.S. 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.

In Columns (1) and (2), we consider the *GAAP ETR*, and in Columns (3) and (4), the *CURRENT ETR*. The negative treatment effect across all specifications indicates that the ECJ decision facilitated avoiding taxes. Quantitatively, the treatment effect is quite substantial. In Column (1), for example, the point estimate is –2.6 percentage points. Hence, our estimates suggest that the ECJ decision allowed European firms to partially reduce the initial tax differential vis-á-vis U.S. MNCs. Nevertheless, the responses of U.S. MNCs to the CTB introduction were stronger than those of European MNCs to the Cadbury Schweppes decision if we, for example, compare the treatment effects in Column (1) of Table 8 and Column (3) of Table 7, or Column (3) of Table 8 and Column (7) of Table 7.

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 (4) of Table 8 for those firms that have more shifting opportunities associated with R&D.

In Columns (5) and (6) of Table 8, we consider the *Foreign ETR* as the dependent variable and repeat the previous regressions. The coefficient on $TREATMENT^{EU} \times POST$ is also negative and significant (Column (5)). This 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 coefficient of the interaction between $TREATMENT^{EU}$, *POST*, and *RD* is negative in Specification (6), the estimated coefficient is no longer statistically significant.

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 (2004–2007) and, again, obtain similar results. In a further robustness check, we repeat the difference-in-differences approach based on the Stoxx Europe 600 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.

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

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[44] 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. Probit estimates and balancing property tests are available in an online appendix.

Table 8

The Consequences of Cadbury Schweppes

Variables	GAAP ETR		CURRENT ETR		Foreign ETR	
	(1)	(2)	(3)	(4)	(5)	(6)
$TREATMENT^{EU}$ (T^{EU})	0.0289***	0.0218**	0.0471***	0.0456***	0.0866***	0.0692***
	(0.0085)	(0.0090)	(0.0101)	(0.0108)	(0.0197)	(0.0217)
$T^{EU} \times POST$	−0.0256***	−0.0223***	−0.0235***	−0.0188**	−0.0357**	−0.0306*
	(0.0068)	(0.0074)	(0.0079)	(0.0085)	(0.0152)	(0.0163)
$T^{EU} \times RD$		0.4940***		0.0832		0.8820**
		(0.1580)		(0.1930)		(0.3490)
$T^{EU} \times POST \times RD$		−0.2780**		−0.3090**		−0.2520
		(0.1190)		(0.1400)		(0.3530)
Control variables	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓
N	7,189	7,189	6,350	6,350	3,130	3,130
Adj. R^2	0.256	0.257	0.225	0.226	0.314	0.316

Notes: Regressions are based on a matched sample, where MNCs are headquartered either in the United States or in Europe. The data refer to Panel D, which includes firms from the United States and firms from European countries with existing CFC rules in 2005. The dependent variable is the *GAAP ETR* in Columns (1) and (2), the *CURRENT ETR* in Columns (3) and (4), and the *Foreign ETR* in Columns (5) and (6). 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. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

on 88 matched firm-pairs of U.S. and European MNCs, which we observe over time. Results for the relevant estimate of the $TREATMENT^{EU} \times POST$ interaction are statistically 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.[45]

B. 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 U.S. tax reform has replaced the worldwide tax system with a territorial system. We, however, exploit the 2009 switch from a system of worldwide taxation to a territorial system in the United Kingdom to learn about this issue. Egger et al. (2015) exploit the U.K. tax reform in 2009 and find that the abolishment of the worldwide tax system affected repatriation behavior (see also Hasegawa and Kiyota, 2017, for a study on the Japanese switch to a territorial system).

Based on the same basic approach as above, we first define MNCs headquartered in the United Kingdom as the group of treated firms ($TREATMENT^{UK}$) and U.S. MNCs as the control group. The matching is based on the year 2008 and leads to 97 pairs.[46] The following regressions consider observations of these 97 pairs from 2006 to 2015 (see Panel E of Table 2 for descriptive statistics).

Table 9 provides the results of our regression analysis. One concern with our results might be that during the investigated period, the United Kingdom also changed the corporate tax rate. However, note that we consider the home country tax rate as a control variable in all specifications in Table 9. Nevertheless, the results should be interpreted with some caution.

The main variable of interest is the interaction term between $TREATMENT^{UK}$ and $POST$, which equals one for MNCs headquartered in the United Kingdom in 2009 and all following years. The coefficient in Column (1) indicates that U.K. MNCs reduced their $GAAP\ ETR$ by 2.4 percentage points after the switch to a territorial tax system.

The worldwide tax system might reduce incentives for international tax avoidance. However, the additional home country tax can be deferred if foreign profits are reinvested abroad. In Column (2), we test for specific channels or heterogeneity in treatment effects by including an interaction term between $TREATMENT^{UK}$, $POST$, and RD. The triple interaction term is, however, not significantly related to the $GAAP\ ETR$. The latter finding contradicts the conclusion of Dyreng and Markle (2016), who suggest that adopting a territorial tax system would increase (outbound) income shifting activities. But, 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

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

[46] Probit estimates and balancing property tests are available in an online appendix.

Table 9
Consequences of Abolishment of System of Worldwide Taxation

Variables	GAAP ETR			CURRENT ETR			Foreign ETR		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$TREATMENT^{UK}$ (T^{UK})	−0.0572*	−0.0687**	0.0040	−0.0376	−0.0545	−0.0126	−0.0217	−0.0319	−0.0604
	(0.0300)	(0.0303)	(0.0124)	(0.0374)	(0.0384)	(0.0135)	(0.0758)	(0.0760)	(0.0382)
$T^{UK} \times POST$	−0.0237*	−0.0259*	−0.0272*	0.0192	0.0218	0.0073	0.0235	0.0247	0.0313
	(0.0123)	(0.0133)	(0.0150)	(0.0177)	(0.0182)	(0.0156)	(0.0290)	(0.0308)	(0.0381)
$T^{UK} \times RD$		1.6330***			1.9990***			1.0090*	
		(0.3340)			(0.3690)			(0.5860)	
$T^{UK} \times POST \times RD$		0.2450			−0.0240			0.1160	
		(0.2560)			(0.2770)			(0.6820)	
Control variables	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pair FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	1,668	1,668	1,488	1,521	1,521	1,353	916	916	502
Adj. R^2	0.227	0.247	0.240	0.218	0.237	0.269	0.335	0.336	0.180

Notes Regressions in Columns (1), (2), (4), (5), (7), and (8) are based on a matched sample, where MNCs are headquartered either in the United States or in Europe. The data in these columns refer to Panel E. Regressions (3), (6), and (9) are based on a matched sample including MNCs headquartered either in the United Kingdom or in the remaining European countries (Panel F). The dependent variable is the *GAAP ETR* in Columns (1)–(3), the *CURRENT ETR* in Columns (4)–(6), and the *Foreign ETR* in Columns (7)–(9). Control variables include *SIZE, ROA, LEV, INTAN, RD,* and *STR.* Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

(U.K. tax reform). Our results are reasonable given anecdotal evidence and given our other findings. They suggest that U.K. firms already engaged in profit shifting activities under the worldwide tax system.

In Columns (4) and (5) of Table 9, we consider the *CURRENT ETR* as the dependent variable, and in Columns (7) and (8), the *Foreign ETR* as the dependent variable. The results suggest that there is no impact of the reform with respect to the United Kingdom's switch from a worldwide to a territorial tax system. The insignificant effect for the *Foreign ETR* might also support the argument that foreign tax avoidance is not affected by the home country taxation of foreign income. The absence of any treatment effect for the *CURRENT ETR* and the significant effect for the *GAAP ETR* also deserve interpretation: The treatment effect for the *GAAP ETR* may be related to less deferred taxes but not to a change in certain tax avoidance activities.

In Columns (3), (6), and (9) of Table 9, we present the results of an alternative comparison. We run regressions based on a matched sample of similar U.K. MNCs and MNCs headquartered in the remaining non-U.K. European countries (see Panel F in Table 2).[47] In line with the previous results, we find a negative treatment effect of the U.K. tax reform with a point estimate of –2.7 percentage points if the *GAAP ETR* is the dependent variable. Again, we do not find any effect for the *CURRENT ETR* and the *Foreign ETR*.

Overall, our results confirm a decrease in the *GAAP ETR* after the home country (here, the United Kingdom) has switched from a worldwide to a territorial system of taxation. This supports *H4*. However, our results also show that the effect should be attributed to a tax deferral effect, while we find no evidence that firms with enhanced profit shifting opportunities respond more (or less) to the switch to a territorial system.

VI. U.S. TAX REFORM

Let us finally interpret our results in light of the 2017 U.S. tax reform. Our findings suggest that the high U.S. corporate tax rate affected differences in ETRs between U.S. and European firms before 2017. We show, however, that higher ETRs of U.S. MNCs were mainly related to deferred tax expenses associated with the U.S. worldwide tax system. If we consider U.S. firms that have treated their foreign income as permanently reinvested earnings, or if we consider tax measures that exclude deferred taxes, our results do not suggest that U.S. firms paid more taxes compared to their peers. In any way, our comparisons, conditional on the statutory tax rate, imply that U.S. firms already avoided more taxes than their European peers prior to the U.S. reform. Our estimates suggest that U.S. MNCs could compensate for about half of the disadvantage associated with the high U.S. tax rate. Consequently, the magnitude of the rate cut to a tax rate of 21 percent will result in a competitive advantage for U.S. MNCs compared to European ones (given that tax avoidance remains at the same level).

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[47] Probit estimates and balancing property tests are available in an online appendix.

The switch to a territorial system will probably have only an effect on U.S. firms' *GAAP ETRs* rather than *CURRENT ETRs* and *Foreign ETRs*. The reason is that U.S. MNCs will no longer need to account for deferred taxes associated with foreign income. Our results suggest that a further decrease of the *Foreign ETRs* or the *CURRENT ETRs* is very unlikely after the implementation of the new territorial system. The new U.S. tax system still includes elements of a worldwide tax system. Mainly, the new GILTI regime could entail additional taxes for U.S. MNCs and, thus, reduce competitiveness (Lyon and McBride, 2018). Given a relatively lax U.S. CFC legislation, which still allows for the CTB option, our analysis suggests that the stricter rules will most probably reduce tax avoidance of U.S. MNCs relative to their European peers.

VII. CONCLUSION

The objective of this article is to produce reliable comparisons of the tax expenses of U.S. MNCs and their European peers. Moreover, we analyze the correlation of tax policy on tax differentials. By applying matching techniques, we first create pairs of very similar U.S. and European MNCs. Based on these matched pairs, we find, for the years of 2012–2015, that the *GAAP ETRs* of U.S. MNCs were, in fact, higher compared to their European peers. We show, however, that higher ETRs of U.S. MNCs were mainly related to deferred tax expenses associated with the U.S. worldwide tax system. U.S. MNCs reported lower *CURRENT ETRs*, *CASH ETRs*, and *Foreign ETRs* than their European counterparts.

Furthermore, our comparisons, conditional on the statutory tax rate, imply that U.S. firms already avoided more taxes than their European peers prior to the U.S. reform. We additionally 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 United States and Europe have affected tax expenses. Our results show that the ETRs of U.S. MNCs decreased significantly after the CTB introduction; the same is true for ETRs of European MNCs 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. We additionally examine the switch from a worldwide tax system to a territorial tax system in the United Kingdom in 2009. Our analysis reveals that U.K.-headquartered MNCs have reported significantly lower *GAAP ETRs* after the reform, while *CURRENT ETRs* and *Foreign ETRs* of MNCs were unaffected.

Let us finally highlight that observables (tax law as well as firm characteristics) explain most of the difference in ETRs between U.S. and European firms. However, as argued above, a residual tax differential has to be attributed to unobservable tax avoidance effects associated with being a U.S. firm. Such unobservables may relate to specific tax planning techniques or preferences of managers and investors in what has been called "tax aggressiveness".

Our findings have policy implications. First, our results can be interpreted in light of the current U.S. tax reform. We show that the high U.S. corporate tax rate plays a

significant role, but also find that U.S. MNCs were already able to compensate for the statutory tax rate differential between the U.S. and European countries before the U.S. tax reform. Our analyses also reveal that higher taxes of U.S. MNCs were associated with higher deferred tax expenses, which are now likely to become less important after the reform. Furthermore, tax policy instruments, which have been modified as part of the U.S. tax reform, also affect ETRs.

Second, one of the arguments in favor of a territorial 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.

DISCLOSURE

The authors have no financial arrangements that might give rise to conflicts of interest with respect to the research reported in this paper.

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APPENDIX

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Table A1
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
CURRENT ETR	(txt – txdi)/pi, i.e., current taxes divided by pretax income; exclude outliers
Foreign ETR	txfo/pifo for U.S. 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
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 and development)	xrd/at, i.e., R&D 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 U.S. 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, U.S., or U.K. 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.

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Table A2
Additional Sensitivity Checks (Treatment: *US*)

| | Coefficient on United States | | | |
| | *GAAP ETR* | | *CURRENT ETR* | |
Specification	(1)	(2)	(3)	(4)
(1) Exact matching by industry Base specification	0.0209*** (0.0059)	–0.0328** (0.0146)	–0.0193** (0.0075)	–0.0648*** (0.0145)
(2) No matching Year and industry FE	0.0207*** (0.0056)	–0.0322*** (0.0100)	–0.0128* (0.0066)	–0.0776*** (0.0108)
(3) Standard matching Only year FE	0.0227*** (0.0076)	–0.0439*** (0.0142)	–0.0143 (0.0090)	–0.0730*** (0.0143)
(4) Standard matching Year FE and industry FE	0.0223*** (0.0073)	–0.0363*** (0.0137)	–0.0151* (0.0087)	0.0696*** (0.0144)
(5) Standard matching Year-pair FE	0.0240*** (0.0082)	–0.0357* (0.0199)	–0.0172 (0.0109)	–0.0700*** (0.0216)
(6) No exact industry matching	0.0143*** (0.0053)	–0.0380*** (0.0122)	–0.0304*** (0.0069)	–0.0968*** (0.0150)
(7) Matching including 2nd order polynomial	0.0262*** (0.0062)	–0.0263* (0.0136)	–0.0238*** (0.0077)	–0.0604*** (0.0156)
(8) Matching including 3rd order polynomial	0.0209*** (0.0064)	–0.0268* (0.0147)	–0.0219*** (0.0084)	–0.0790*** (0.0169)
(9) Matching including size interactions	0.0281*** (0.0065)	–0.0328** (0.0142)	–0.0147* (0.0080)	–0.0569*** (0.0164)
(10) Matching including industry FE	0.0198*** (0.0062)	–0.0442*** (0.0137)	–0.0145* (0.0075)	–0.0684*** (0.0143)
(11) Matching including number of foreign countries	0.0215** (0.0084)	–0.0352 (0.0254)	–0.0035 (0.0108)	–0.0586** (0.0291)
(12) Matching including share of tax-haven locations	0.0294*** (0.0083)	–0.0027 (0.0213)	–0.0007 (0.0104)	–0.0411** (0.0204)

Notes: Regressions are based on matched samples, where MNCs are headquartered either in the United States or in Europe; years from 2012 to 2015 are included. We report only results for the dummy *US*, which captures the ETR differentials between U.S. and European firms. Unless otherwise described, year and firm-pair fixed effects are included in all specifications. Regressions in Columns (2) and (4) include the control variables *SIZE, ROA, LEV, RD, INTAN,* and *STR*. The dependent variable is *GAAP ETR* in Columns (1) and (2) and *CURRENT ETR* in Columns (3) and (4). Specifications in Row (1) repeat our basic regression (Panel B in Table 2), while Row (2) considers the unmatched sample (Panel A of Table 2). In Row (3), only year fixed effects are included; in Row (4), industry fixed effects are added; and in Row (5), year-pair fixed effects are considered. In Rows (6)–(12), different matching procedures apply. Row (6) does not require an exact industry matching of firm-pairs. Rows (7)–(9) consider higher-order polynomials of explanatory variables as well as interaction terms between size and explanatory variables when computing propensity scores. Row (10) considers industry fixed effects when computing propensity scores. Specification (11) considers as additional matching variable the number of foreign host countries. Specification (12) considers as additional matching variable the share of tax-haven locations. The additional data are taken from the 2016 version of the ORBIS database provided by Bureau van Dijk. The number of matched pairs in Rows (1) and (3)–(5) is 352; in (6), 446; in (7), 324; in (8), 332; in (9), 322; in (10), 352; in (11), 160; and in (12), 168. Robust standard errors clustered by firms are shown in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

DO U.S. FIRMS AVOID MORE TAXES THAN THEIR EUROPEAN PEERS? ON FIRM CHARACTERISTICS AND TAX LEGISLATION AS DETERMINANTS OF TAX DIFFERENTIALS

Michael Overesch, Sabine Strueder, and Georg Wamser

We examine effective tax differentials between U.S. multinational corporations (MNCs) and their European peers. We particularly focus on the influence of tax policy on tax differentials between MNCs from the United States and Europe.

By applying matching techniques, we create pairs of very similar U.S. and European firms listed on the S&P 500 or Stoxx Europe 600. Based on these matched pairs, we analyze the determinants of effective tax rate (ETR) differentials that arise between very similar U.S. and European MNCs.

Our findings suggest that U.S. MNCs had been avoiding more taxes compared to their European peers before the 2017 U.S. tax reform. U.S. MNCs reported lower ETRs than their European counterparts. We find higher ETRs of U.S. MNCs only if deferred tax expenses associated with the U.S. worldwide tax system are considered. Furthermore, our results show that U.S. MNCs compensated for about half of the significantly larger statutory tax rate before the U.S. tax reform by avoiding more taxes than their European peers.

Based on past reforms, we further confirm that international tax legislation affects effective tax expenses. In particular, we analyze how changes in the application of controlled foreign company (CFC) rules in the United States and Europe have affected tax expenses. Our results show that the ETRs of U.S. MNCs decreased significantly after the check-the-box introduction; the same is true for ETRs of European MNCs after a reform in the European Union in 2006. Additional analyses reveal that MNCs whose activities allow for profit shifting have benefited most from a more lenient application of CFC rules.

Moreover, our results suggest that the switch to a territorial system in the United Kingdom in 2009 reduced deferred taxes, while we find no evidence that current and foreign tax expenses were affected.