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Corporate Tax Reforms and Tax-Motivated Profit Shifting: Evidence from the EU

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ABSTRACT

This paper examines the sensitivity of profit shifting to the corporate tax rate difference between a subsidiary and its parent company. We exploit tax rate variation stemming from European tax reforms over the period 2003-2013 while accounting for tax base adjustments that might affect firms' profit shifting response to tax rate changes. We find that affiliates' profits are sensitive to tax rate changes. However, tax base broadening reforms mitigate the tax rate incentives for profit shifting and significantly reduce the semi-elasticity of profits with respect to corporate tax rates. Finally, we provide evidence of a downward trend in the tax sensitivity of profit shifting, suggesting that the spread of anti-avoidance regulation may have successfully constrained profit-shifting strategies.

Keywords: International taxation, profit shifting, tax policy, multinational firms

JEL Classifications: F23; H25; H26

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1. Introduction

The role of taxation in multinationals' profit shifting across countries has drawn the attention of policymakers, media, investors, as well as the academic literature. Despite the harmonization process within Europe and the global downward trend of corporate tax rates, firms can still exploit different tax rates across countries and engage in profit shifting strategies. Extant research has documented tax-motivated profit shifting of multinational companies. Some studies use an indirect empirical strategy to explore cross-sectional variation in corporate tax rates on multinational subsidiaries' profitability (Gruber and Mutti, 1991; Hines and Rice 1994; Huizinga and Laeven 2008). Other studies focus on the effect of corporate tax rates on specific profit shifting channels, in particular, on distortions due to intra-firm trade activity (Clausing 2003; Bartelsman and Beetsma 2003) or debt shifting (Desai et al. 2004; Buettner and Wamser 2013).

However, most studies identify the tax sensitivity of profit shifting through variations of tax rates without controlling for adjustments in the tax base. Neglecting tax base elements when examining tax rate changes may be incomplete because governments trade-off low tax rates and broad tax bases (Haufler and Schjelderup 2000). In fact, tax cuts are often combined with broadening the tax base (e.g., Devereux et al. 2008). Dharmapala (2014) claims that the observed decline in profit shifting found by Lohse and Riedel (2013) can be explained by the increased spread of anti-avoidance regulation, that is, a broader tax base. However, this conjecture has not been tested, accounting for multiple tax base elements that are introduced by tax reforms. We attempt to close this gap by using a large dataset of multinational firms from the Amadeus database and by exploiting 63 tax rate changes in 26 European countries over 2003–2013.

Our paper adds to the profit shifting literature in two ways: First, we estimate the tax rate sensitivity of profit shifting while controlling for several tax base elements, namely, transfer pricing documentation, thin capitalization rules, tax consolidation regimes, loss offset rules, and depreciation allowances. We find that profits are shifted from the subsidiary to the parent company as the tax rate difference between the host (the country where the subsidiary is located) and the parent country (the country where the headquarters are located) increases. This finding is consistent with the *headquarter-bias* view (Dischinger et al. 2014a). Most importantly, we show that the tax sensitivity between host and parent country is significantly lower for base broadening reforms. In fact, we find that the semi-elasticity of reported profits to the tax rate decreases by 0.18, or by 26% of the average semi-elasticity of 0.70, if a country

also broadens the tax base, for example, by introducing transfer pricing documentation or thin capitalization rules.

Second, we test the evolution of the tax sensitivity of profit shifting over time while controlling for changes in the tax base. We find evidence of a downward trend of the semi-elasticity within our sample period. In the final years of our sample period (2011–2013), the semi-elasticity has decreased to 0.38 from a semi-elasticity of 0.66 over the 2003–2006 period, which translates into a reduction in profit shifting by more than 50%. This finding is consistent with the spread of anti-avoidance regulation constraining profit-shifting strategies (Dharmapala 2014; Lohse and Riedel 2013). We add to this debate by showing that profit shifting has decreased with the tightening of anti-avoidance rules. This suggests that the OECD’s Base Erosion and Profit Shifting (BEPS) initiative can be successful in curbing tax avoidance when countries fully implement the BEPS action plan.

Our study therefore has policy implications. Multinational firms operating in different jurisdictions report their taxable income to the tax authorities where their subsidiaries are located and this creates scope to exploit tax differences across countries. To overcome this issue, governments have introduced tax-rate-cut-cum-base-broadening reforms, along with anti-avoidance measures such as transfer pricing regulation and thin capitalization rules. Our results are consistent with theoretical evidence (Haufler and Schjelderup 2000) and policy recommendation (OECD 2010) and show that tax-base broadening measures mitigate profit-shifting activities.

The paper proceeds as follows. Section 2 summarizes the related literature and describes the theoretical background. Our empirical setting is presented in Section 3, along with information on tax variation, sample selection, estimation approach, and summary statistics. In Section 4, we discuss empirical findings. Section 5 concludes.

2. Literature Review and Theoretical Background

Multinational firms have dramatically increased the scale of their operations over the last three decades (Desai 2009). In addition to reallocating real economic activities in response to value-creation opportunities, these firms exploit international differences in corporate income tax rates (Heckemeyer and Overesch 2016). A number of empirical studies document tax-motivated profit shifting, for example, by exploiting cross-sectional variation in corporate tax rates on multinational subsidiaries’ profitability (Gruber and Mutti, 1991; Hines and Rice 1994; Huizinga and Laeven 2008). Other papers focus on specific profit shifting channels, in

particular on intra-firm trade activity (Clausing 2003; Bartelsman and Beetsma 2003) or debt shifting (Desai et al. 2004; Buettner and Wamser 2013; Dharmapala and Riedel 2013).

Another stream of literature focuses on tax rate differential between the parent firm and the country of the subsidiary. Dischinger et al. (2014a), for example, use this approach to investigate the peculiar role of the parent firm with respect to profit shifting within the multinational group. The findings suggest that income shifting between parent firms and their subsidiaries in response to tax rate differentials is biased towards the parent firm. This is the so-called *headquarter bias*. In line with this reasoning, Weichenrieder (2009) finds a negative correlation between the tax rate of the host country and the profitability of the multinational affiliate, which is consistent with profit shifting behavior towards the parent company. However, results are only weakly significant, leading the author to posit that the tax rate effect might have been compensated by accompanying tax base broadening reforms during his sample period.

We intend to shed new light on the role of tax base elements in profit shifting behavior between parent firms and their subsidiaries. Haufler and Schjelderup (2000) and more recently OECD (2010) argue that choosing a lower tax rate with a broader tax base may be beneficial for governments to counteract profit shifting. Moreover, we test the extent to which profit shifting has decreased over time. While some studies using U.S. data (Grubert 2012; Klassen and Laplante 2012) argue that profit shifting has grown over time, empirical evidence on European data (Lohse and Riedel 2013) finds that the tax sensitivity to reported income has fallen in magnitude over the years. This result led to the recent claim that the spread of both transfer pricing and thin capitalization rules might have successfully curbed income shifting within multinational companies (Dharmapala 2014).

3. Empirical Setting

3.1 Variation in Corporate Tax Rates and Tax Base Elements

The taxation of corporate income has changed considerably over the past 20 years. A number of European countries have reformed their corporate tax systems by lowering the statutory tax rate and broadening the tax base to deal with competitive pressure from neighboring countries (e.g., Devereux et al. 2008) or to set incentives for firms to invest. We exploit this variation in tax rates to examine the effect on profit shifting and use the adjusted corporate tax rates from Taxation Trends in Europe 2014 provided by Eurostat, as our measure of the corporate tax rate. In addition, we crosscheck tax rate information with the OECD corporate and sub-central

income tax database. We employ the corporate tax rate that is applicable in the top tax bracket and identify 63 corporate tax changes (10 increases and 53 decreases in the statutory tax rate) as our source of variation over the years 2003–2013. Note that in case of local differences in statutory corporate tax rates due to additional regional business taxes, as for example in Italy or Germany, we use the sum of the top marginal corporate tax rate and the average regional tax, as well as supplementary charges.

Appendix II lists our sample countries and the corporate tax rates in each sample year. Changes in corporate income tax occurred in almost all countries and were staggered over time. Most countries changed their tax rate more than once during the sample period, but only a few experienced corporate tax rate changes smaller than one percentage point. Given the high number of tax rate changes and potential host and parent countries, we use tax variation as our identifying variable to examine the effect of corporate tax reforms on multinational firms' profit shifting behavior. More importantly, these changes do not cluster around a certain year and/or country. One potential concern is that tax rate reforms might be associated with country-level economic conditions. In untabulated analysis, we find that tax rates change on average by -0.2% during economic downturns. This is statistically not distinguishable from the average change in the tax rate during good times (-0.5%), suggesting that in our sample these changes are not larger during crises.¹

In addition to estimating the effect of corporate tax rate changes on profit shifting, the novelty of our study consists in accounting for specific tax base adjustments in the tax code that might potentially outweigh the effect of these rate changes. We rely on the Ernst & Young Corporate Tax Guides from 2003 to 2013 and collect data on several tax base items: transfer pricing documentation requirements, thin capitalization rules, loss carryback and loss carryforward rules, tax consolidation, and accelerated depreciation. First, we include transfer pricing documentation requirements since the preparation of comprehensive documentation mitigates multinationals' profit shifting (e.g. Beer and Loeprick 2015; Beuselinck et al. 2015). Second, we follow Buettner et al. (2012) and collect information on thin-capitalization rules in Europe to account for restrictions on the tax deductibility of interest payments. Third, recent literature also documents that corporate losses may play an unexpected role in explaining profit shifting behavior of multinational firms. Namely, loss-making affiliates may reverse profit shifting, from the low-tax to a high-tax country to save on taxes (Hopland et al. 2015;

¹ We continue to find an insignificant relation of economic growth as well as our other indicators of the economic development with corporate tax rate changes when we run panel regressions at the country level with country fixed effects and year fixed effects.

Koethenbueger et al. 2016; De Simone et al. 2017). Therefore, we gather information on loss carryback and loss carryforward rules from Bethmann et al. (2016) and add the missing data for our sample countries. Fourth, we collect data on tax consolidation rules in the European countries, since such regimes make it easier to transfer profits and/or losses across group affiliates. Finally, as tax reliefs on depreciable assets have an impact on the tax base, we collect data on accelerated depreciation allowances over our sample period to proxy for any tax base adjustment in the deduction of investment expenditure.

Appendix III lists our sample countries and their respective tax base items. Most countries had enacted rules on transfer pricing documentation already by the early 2000s, some followed later during the sample period. However, a limited number of countries did not require any transfer pricing documentation over the sample years. Almost all sample countries have provisions to restrict debt shifting within the multinational firms, that is, “thin capitalization rules”. While the debt to equity rule seems to be the most common rule in place, there are few notable switches to the earnings stripping regime, for example in Germany and Italy in 2008. Furthermore, most countries allow for tax consolidation over the sample years, thereby permitting the transfer of profits and/or losses across group companies. Almost all countries allowed accelerated depreciation provisions to defer corporate income taxes during the sample period. Finally, all countries allowed firms to carryforward tax losses, while only a few had loss carryback provisions in place (see, also, Bethmann et al. 2016).

3.2 Sample selection

Our empirical analysis uses firm-level data from the commercial database Amadeus compiled by Bureau van Dijk and exploits the variation of several corporate tax reforms in Europe. The sample comprises firms in the countries of EU 27 and Norway. One advantage of using Amadeus is that it enables us to link accounting data to information on the ownership structures of parent firms and their subsidiaries (see, also, Huizinga and Laeven 2008; Dischinger and Riedel 2011; Karkinsky and Riedel 2012). We classify subsidiaries as being part of a multinational group if they are owned by a parent firm that resides abroad. To be more precise, the global ultimate owner must be an independent company which owns more than 90% of the capital (for a similar approach, see Becker and Riedel 2012; Beer and Loeprick 2015).

The Amadeus database only provides ownership information for the last reported date, which was November 2014 when we downloaded our sample. In a panel study, this may cause misclassifications if the ownership structure changed over the observed years. To track potential changes, we rely on previous versions of Amadeus to obtain panel data on ownership

classifications. If a firm's ownership data were not included in earlier versions of Amadeus, we rely on the most recent information for the entire sample period.

Following the literature on profit shifting (e.g., Maffini and Mokkas 2011), we exclude consolidated balance sheets to identify profit shifting behavior. To ensure that the accounting period is uniform in our sample, we remove observations with fiscal years other than 12 months and with poor accounting data. The observational unit in our analyses is the multinational subsidiary per year. In total, the dataset comprises 106,458 (104,432) firm-year observations for 18,452 (18,299) unique affiliates when using the *EBIT (Pre-tax Profits)* as dependent variable in the regression analyses. The number of firm-year observations as well as that of affiliate firms resemble those of previous studies (e.g., Dischinger et al. 2014a).

3.3 Empirical Strategy

Our baseline estimation equation is the following:

$$\begin{aligned}
 Profit_{i,j,k,t} = & \beta_0 + \beta_1 Tax\ Difference_{j,k,t} + \beta_2 K_{i,j,k,t} + \beta_3 L_{i,j,k,t} & (1) \\
 & + \beta_4 Intangibles_{i,j,k,t} + \beta_5 R\&D_{i,j,k,t} + \beta_6 X_{j,t} + \beta_7 X_{k,t} + \beta_8 \Pi_{j,t} \\
 & + \beta_9 \Pi_{k,t} + FirmFE + Industry - YearFE + \epsilon_{i,j,k,t}
 \end{aligned}$$

where $Profit_{i,j,k,t}$ is the dependent variable of affiliate i , located in host country j , with a parent firm in country k , in year t . We use two specifications with different dependent variables. One specification uses the natural logarithm of *EBIT* as the dependent variable to account for transfer pricing manipulation (e.g., Maffini and Mokkas 2011). The other uses the natural logarithm of *Pre-tax Profits* to account for both transfer pricing and debt shifting (e.g., Dharmapala and Riedel 2013). We follow Hine and Rice (1994) and control for capital and labor using the natural logarithm of fixed assets ($K_{i,j,k,t}$) and the natural logarithm of wages ($L_{i,j,k,t}$) respectively, to estimate the firm's output. Moreover, we also control for the natural logarithm of intangible assets ($Intangibles_{i,j,k,t}$) and the natural logarithm of research and development expenses ($R\&D_{i,j,k,t}$) since firms' profits and output also depend on the use of intangible assets. Furthermore, these assets are potential drivers of profit shifting (Beer and Loeprick 2015).

The main objective of our analysis is to examine profit-shifting incentives between multinationals' subsidiaries and their parent firms. We capture this incentive by computing the tax difference between the statutory corporate tax rates of the considered subsidiary and its parent firm (see, also, Dischinger 2008, Weichenrieder 2009, and Dischinger et al. 2014a for a similar approach). We therefore define the variable *Tax Difference* as the host country statutory

tax rate minus the parent country statutory tax rate. Our coefficient of interest is β_1 and we expect it to be negative. An increase in the *Tax Difference* (for example, following an increase in the statutory tax rate in the country where the foreign subsidiary is located, or a decrease in parent home-country rate) provides incentives to shift profits home, that is, to the country where the parent company is located. This decreases the profits at the subsidiary level ($\beta_1 < 0$).

In addition to controlling for the tax rate differential, we include vector $X_{j,t}$, which comprises the tax base elements of the host country and vector $X_{k,t}$, for the parent country. We include the elements mentioned earlier² since several of them are designed to limit profit-shifting opportunities. We further control for non-tax country-level characteristics of the host and parent country summarized in vectors $\Pi_{j,t}$ and $\Pi_{k,t}$, respectively. Following prior studies (Dischinger 2008; Beer and Loeprick 2015; Lohse and Riedel 2013), we control for *GDP Growth*, *GDP per capita*, *Distance*, *Inflation*, and *Unemployment*. These variables are defined in Appendix I and are included to capture the economic development (*GDP Growth*, *GDP per capita* or *Unemployment*) or country-level risk (*Inflation*). The variable *Distance* is included to proxy for geographical proximity (Disdier and Head 2008; Erel et al. 2012; Dischinger et al. 2014b).

Finally, we include *Control of Corruption* as a proxy for institutional governance quality from the World Governance Indicators of the World Bank. *Control of Corruption* is the yearly estimate of a country's quality relating to control of corruption (Dischinger et al. 2014a). We do not make any ex-ante prediction on the sign direction as there might be reasons to expect both negative and positive coefficients. On one hand, firms might be willing to shift their profits to highly regulated environments and protect themselves from potential expropriation (Dharmapala and Hines 2009). This would result in a positive coefficient. On the other hand, strong institutional environments might make profit shifting harder and enforce anti-avoidance regulation, thus leading to a negative sign (Johannessen et al. 2016).

We include firm fixed effects as well as year or industry-year fixed effects. Firm fixed effects absorb any firm or country-level time-invariant characteristic. This ensures that the identification of all coefficients stems from changes over time. The inclusion of industry-year fixed effects ensures that we compare affiliates in the same industry. Our statistical inferences

² We include transfer pricing regulation, thin capitalization rules set as debt to equity or earnings stripping rules, accelerated depreciation allowances, loss carryback and loss carryforward regulation, and tax consolidation.

are based on robust standard errors clustered by firm. We also test the robustness of our results to an alternative clustering specification by host-parent pair.

3.4 Summary Statistics

Table 1 presents summary statistics. On average, a multinational subsidiary has a Log of *EBIT (Pre-tax Profits)* of 13.531 (13.490), and Log of fixed assets (Log of cost of employees) of 13.333 (14.511). Moreover, the average subsidiary firm accounts Log of *Intangible assets (R&D expenses)* for about 7.062 (0.071). In line with previous studies (Dischinger et al. 2014a), the tax difference averages -2%, but varying markedly between -28 and 27%. Furthermore, 60% (70%) of the host (parent) countries require multinational firms to provide tax authorities with transfer pricing documentation by law during 2003-2013. On average, about 50% (38%) of the host (parent) countries have thin capitalization rules in place, with debt to equity rules being the most widely used. Almost all parent countries have a tax consolidation regime, while the host countries allow groups of wholly owned or majority-owned companies to be a single entity for tax purposes to a less extent (about 70% of the sample). As for loss-offsetting regulations, about half (one third) of the parent (host) countries allow carrying back tax losses. In contrast, both sample countries allow carryforward tax losses largely, with the average number of years being 56 (80) in the host (parent) countries. Further, 76% (68%) of the host (parent) countries grant accelerated depreciation allowances. Moreover, multinational subsidiaries tend to reside in more corrupted environments than their parent firms. With respect to *GDP Growth*, there is no difference among sample countries. In contrast, parent firms mainly reside in highly developed European countries, with a higher average *GDP per capita* and lower *Unemployment* rate. Finally, the *Inflation* rate is similar in host and parent countries and amounts to about 2%.

[Insert Table 1 about here]

4. Empirical Results

4.1 Baseline Results

Tables 2 and 3 present results from estimating equation (1) using *EBIT* and *Pre-tax Profits* as dependent variables, respectively. In columns (1) to (4), we include all subsidiaries with available financial information. We also test the sensitivity of our findings to the sample selection. Namely, in column (5), we exclude financial institutions from the sample because their profit shifting responses and channels might differ from other firms (Merz and Overesch 2016). As suggested by previous studies (Weyzig 2013; Dischinger et al. 2014a), in Column

(6) we exclude observations when the parent company is located in the Netherlands because this country has several features that makes it a well-known attractive European headquarters location.³ We use two alternative fixed effects combinations: columns (1) and (3) uses firm and year fixed effects. In columns (2) and (4) to (6), we use firm and industry-year fixed effects. We cluster standard errors by firm in all specifications except for columns (3) and (4), where we document the robustness of our statistical inferences to clustering by host-parent pair.

In table 2, the coefficient of *Tax Difference* is negative and significant in all six specifications, suggesting that profits are shifted towards the parent as the tax difference increases. The magnitude of the coefficients is generally in line with, but slightly below prior research. While in table 2 (3), column (2), we find a tax sensitivity of EBIT (*Pre-tax Profits*) of 0.453 (0.397), Heckemeyer and Overesch (2016) report a consensus estimate for the tax rate semi-elasticity of EBIT (*Pre-tax Profits*) of 0.475 (0.821). Dischinger et al. (2014a) find a semi-elasticity of 0.530 for *Pre-tax Profits*. Examining the economic magnitude, we find that an increase of 10 percentage points in *Tax Difference* corresponds to a decrease in *EBIT (Pre-tax Profits)* of about 4% (3%).⁴

We interpret the difference in the magnitude of the coefficients as driven by the additional tax base controls in our estimation equation and by the different sample period as we show below in our tests of the time trend. Consistent with Dischinger et al. (2014a), we find a stronger tax sensitivity of EBIT in column (6), when we exclude parent companies located in the Netherlands. The proxies for capital, labor, and R&D expenses are significant in all specifications, while *Intangibles* is only weakly significant. Although transfer pricing regulation increases, on average, the level of reported profits, we find statistical significance only for transfer pricing rules set in the parent country. Similarly, we also document a positive association between earnings stripping rules in the parent country and the affiliates' EBIT. Additionally, if the host country allows for accelerated depreciation, we find higher profits at the level of the affiliate.

Next, we find that the governance quality, as measured by the variable *Control of Corruption*, of the host country is positively associated with the EBIT level of the subsidiaries. On the other hand, the governance quality in the parent country does not seem to play any

³ Dharmapala and Hines (2009) list the Netherlands among tax havens. Results in Column (6) are robust to the exclusion of the other European tax havens mentioned: Estonia, Ireland, Luxembourg, and Malta. We present results excluding the Netherlands as this parent country is the most represented in our sample.

⁴ In untabulated analyses, we check for non-linearities in the tax difference semi-elasticity (see Dowd et al. 2017). However, the coefficient of the quadratic term (*Tax Difference*²) is not significant. The main coefficient that reflects the semi-elasticity is significant and close to our baseline estimate. This suggests that in our sample the effect is linear.

significant role. We also include *GDP Growth*, *GDP per capita*, *Distance*, *Inflation*, and *Unemployment*. *GDP Growth* in both host and parent countries is positively and significantly associated with the profitability of the subsidiary, while profitability decreases with higher levels of *Unemployment* in the host country. *Inflation* is only marginally significant.

One concern about an analysis like ours is that there is no parallel trend in profit shifting prior to changes in the tax differential. To this end, we rerun our main model and include lead and lag changes in tax differential instead of the level of the tax rate differential (see, also, Ljungqvist and Smolyansky 2016).⁵ We find in untabulated analysis that affiliates' profits do not respond to future tax rate changes. This result supports the parallel trends assumption as it indicates that affiliates who will be treated with a change in the tax difference in future years do not alter their profit shifting behavior relative to firms that will not be subject to a change in the tax rate difference. In other words, we do not find a statistically significant anticipation effect. These findings hold for both *EBIT* and *Pre-tax Profits*.

[Insert Table 2 about here]

Table 3 presents a similar analysis using the logarithm of *Pre-tax Profits* as a measure of profits. We use the same specifications as in Table 2. Overall, we find weaker results for tax-induced profit shifting as measured by *Tax Difference*. Consistent with Heckemeyer and Overesch (2016), we interpret this as transfer pricing being the prominent profit shifting strategy rather than debt shifting. The tax rate sensitivity of *Pre-tax Profits* is stronger in specification (6) when we exclude parent companies located in the Netherlands, again consistent with the findings in Dischinger et al. (2014a). Further, thin capitalization rules in the host country, measured by debt to equity and earnings stripping rules, provide incentives to shift profits back to the parent company as shown by the negative coefficients which are significant in almost all specifications. Moreover, the existence of group taxation regimes (*Tax Consolidation*) is mostly significant. This rule allows to easily divert profits within the group. If losses can be carried forward in the host country, results show that profits are withheld within the subsidiary, while the rule set at the parent country level does not appear to play a role.

We find similar results for the macroeconomic variables when using *Pre-tax Profits* as dependent variable. Again, *Control of Corruption*, as a measure of the governance quality, shows that highly regulated environments are positively associated with the profitability at the subsidiary level. The other country-level controls show results in line with Table 2.

⁵ We also use the first differences of stock variables (fixed assets and intangibles) and include lead and lag changes in country-level variables in this regression. Results are available upon request from the authors.

[Insert Table 3 about here]

To alleviate concerns that the financial crisis drives our results, we re-examine our findings while excluding recession years. More specifically, we test the robustness of our results to the exclusions of years where either the host country or the parent country experience more than two consecutive quarterly negative *GPD growth*, consistent with the conventional definition of recession (Blanchard and Johnson 2013). We re-estimate our main equation excluding years that fall in the abovementioned definition of recession. Results are robust throughout all four specifications and confirm the robustness of our main findings. In this test, we now also find an effect of the tax rate difference on *Pre-tax Profits*. Hence, outside economic downturns, firms appear to also use internal loans to shift profits.

[Insert Table 4 about here]

4.2 *The role of tax base broadening*

In the next step, we examine the interaction between the changes in the corporate tax rates and the tax base. More specifically, we test whether the sensitivity of profit shifting to the tax difference between host and parent country is mitigated by tax base broadening. Since there are several tax base elements that can jointly affect profit shifting, we follow the approach by Hung (2000) and Goncharov and Jacob (2014) and construct an index to subsume tax rules in one measure. In this paper, we build an index that measures the breadth of the tax base. This also simplifies the interpretation of base-broadening changes. The index ranges from zero (very narrow tax base) to 6 (very broad tax base with transfer pricing documentation requirements, restrictions on interest payments deductibility, no tax consolidation, no accelerated depreciation allowances, no loss carryback rule, and loss carryforward up to maximum 5 years).

We then interact the *Tax Base Index* with *Tax Difference* along with the main effect and re-estimate equation (1). The interaction term captures the muting effect of the breadth of the tax base in the host (*Tax Base Index Host*) and in the parent (*Tax Base Index Parent*) country on the tax sensitivity to profit shifting. Table 5 presents regression results. In Columns (1) to (4) ((5) to (8)), we use EBIT (*Pre-Tax Profits*) as dependent variable. We find a negative coefficient of *Tax Difference* in all specifications, suggesting that both EBIT and *Pre-Tax Profits* of multinationals' affiliates are sensitive to tax rates, while allowing the tax rate effect on profit shifting to vary with tax base elements. Controlling for the tax base broadness in host and parent countries, only tax base elements of the host country significantly reduce the tax

sensitivity of profit shifting as indicated by the positive coefficient on the interaction term with *Tax Base Index Host*. The interaction with *Tax Base Index Parent* is not significant and does not alter the magnitude of the coefficients on the interaction with *Tax Base Index Host*. This suggests that only base broadening regulation set by the host country plays a moderating role on the tax sensitivity of profit shifting. In economic terms, if *Tax Base Index Host* increases by one unit, for example, when transfer pricing documentation is implemented, the semi-elasticity increases by 0.180, or by 26% of the baseline semi-elasticity of 0.695 (using the coefficient estimates in Column (3)). Moreover, the sum of the coefficients of *Tax Difference* and the interaction term $Tax\ Difference \times Tax\ Base\ Index\ Host$ is significantly different from zero.

[Insert Table 5 about here]

4.3 Development over time

In the final step, we examine whether the tax sensitivity of profit shifting has decreased over time. Previous literature (Dharmapala 2014; Lohse and Riedel 2013) argues that anti-avoidance regulation may have been effective in curbing profit shifting. To this end, we estimate the effect of *Tax Difference* in different sub-periods, controlling for all the tax base elements. To overcome potential issues driven by different sample sizes in each year (i.e., lower number of available observations in earlier years), we choose three sub-periods, namely 2003–2006, 2007–2010, and 2011–2013. If profit shifting has decreased over time, we would obtain the largest coefficient for the first sub-period and the lowest coefficient for the last sub-period.

The results are presented in Table 6. Columns (1) and (2) show results for *EBIT* as dependent variable. We observe that the tax sensitivity of reported profits is significant across all sub-periods. We find empirical support for a time trend as indicated by the decrease in the magnitude of the coefficients of *Tax Difference* moving from the first to the most recent sub-period. Importantly, the difference in the coefficients in Column (2) is statistically significant, when testing the coefficient from 2003–2006 versus the 2011–2013 coefficient. The difference is also economically significant as the semi-elasticity decreases by 58% from 0.66 during 2003–2006 to 0.38 during 2011–2013. In addition, when using the *Pre-tax Profits* as dependent variable in Columns (3) and (4), we only find evidence of debt shifting in the first sub-period, suggesting that the implementation of thin capitalization rules has closed this particular tax motivated profit-shifting channel over the years. Consistent with Dharmapala (2014), tax base broadening reforms may have reduced profit shifting over time.

[Insert Table 6 about here]

5. Conclusion

This paper investigates the effect of corporate tax reforms on profit shifting. We use a large sample of multinationals and their subsidiaries in Europe and exploit 63 corporate tax reforms over 2003–2013. We focus on profit shifting activities between parents and subsidiaries and estimate a fixed-effects model to determine whether multinational subsidiaries' profit shifting towards the parent company changes after tax reforms. While, on average, multinational affiliates seem to be sensitive to tax rate changes, we document that tax base broadening reforms significantly reduce the incentive for profit shifting (Haufler and Schjelderup 2000; OECD 2010). Moreover, we document a decrease in the tax sensitivity of profit shifting over time. In line with Dharmapala (2014), we show that the decline in magnitude can be explained by the spread of anti-avoidance regulation and documentation requirements.

Our results have important policy implications. Despite the harmonization process in Europe, multinational firms operating in multiple jurisdictions continue to report their taxable income to different tax authorities in several countries. This enables multinational companies to channel their profits to more tax-favorable countries without relocating real activities. To tackle international tax-motivated profit shifting, countries have reformed their corporate tax systems by enacting mostly tax-rate-cutting reforms accompanied by a broader tax base. Our results, in fact, suggest that such reforms can be effective in curbing profit shifting. Hence, even before the BEPS action plan is implemented, firms appear to have reduced profit shifting after the spread of anti-avoidance regulation.

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Table 1: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max
Firm-level controls					
Log EBIT	106,558	13.531	2.342	2.398	26.811
Log Pre-tax Profits	104,432	13.490	2.445	0	27.947
Log Fixed Assets	106,558	13.333	2.986	0	28.215
Log Cost of Employees	106,558	14.511	2.230	0	27.222
Log Intangibles	106,558	7.062	5.911	0	27.429
Log R&D	106,558	0.071	0.995	0	20.363
Tax base controls					
Tax Difference	106,558	-0.021	0.081	-0.287	0.273
Transfer Pricing Host	106,558	0.580	0.494	0	1
Transfer Pricing Parent	106,558	0.685	0.465	0	1
Debt to Equity Rule Host	106,558	0.491	0.500	0	1
Debt to Equity Rule Parent	106,558	0.382	0.486	0	1
Earnings Stripping Rule Host	106,558	0.117	0.321	0	1
Earnings Stripping Rule Parent	106,558	0.228	0.419	0	1
Tax Consolidation Host	106,558	0.707	0.455	0	1
Tax Consolidation Parent	106,558	0.920	0.272	0	1
Accelerated Depr. Host	106,558	0.760	0.427	0	1
Accelerated Depr. Parent	106,558	0.680	0.466	0	1
Loss Carryback Host	106,558	0.317	0.465	0	1
Loss Carryback Parent	106,558	0.570	0.495	0	1
Loss Carryforward Host	106,558	56.538	46.452	0	100
Loss Carryforward Parent	106,558	80.794	37.298	0	100
Tax Base Index Host	106,558	2.779	1.535	0	5
Tax Base Index Parent	106,558	2.261	1.128	0	5
Country-level controls					
Control of Corruption Host	106,558	1.049	0.755	-0.300	2.550
Control of Corruption Parent	106,558	1.663	0.581	-0.300	2.550
Distance	106,558	6.604	0.678	4.020	8.124
GDP Growth Host	106,558	0.013	0.030	-0.147	0.107
GDP Growth Parent	106,558	0.011	0.027	-0.147	0.107
GDP Per Capita Host	106,558	10.123	0.654	8.239	11.364
GDP Per Capita Parent	106,558	10.576	0.303	8.239	11.364
Inflation Host	106,558	0.023	0.023	-0.054	0.147
Inflation Parent	106,558	0.018	0.013	-0.054	0.147
Unemployment Host	106,558	0.087	0.037	0.025	0.261
Unemployment Parent	106,558	0.073	0.028	0.023	0.261

Notes: This table presents descriptive statistics for our main variables during 2003–2013. Firm-level variables are in logarithmic scale, as well as some country-level controls (i.e. Distance, and GDP per capita Host (Parent)). *Tax Difference* is the difference in the statutory corporate tax rates of the considered subsidiary and its parent firm. Transfer pricing Host (Parent), Debt to Equity Rule Host (Parent), Earnings Stripping Rule Host (Parent), Tax Consolidation Host (Parent), Accelerated Depreciation Host (Parent), and Loss Carryback Host (Parent) are dummy variables, which lie between 0 and 1. GDP Growth Host (Parent), Inflation Host (Parent), and Unemployment Host (Parent) are in percentage points. All the variables are defined in Appendix A.

Table 2: Corporate tax reforms and profit shifting, EBIT

OLS Affiliate Fixed Effects, Panel 2003-2013						
Dependent Variable: Log (EBIT)						
Sample	All Subsidiaries				No Financ. Sector	No NL Parent Firms
Explanatory Variables:	(1)	(2)	(3)	(4)	(5)	(6)
Tax Difference	-0.513*** (0.189)	-0.453** (0.189)	-0.513** (0.232)	-0.453** (0.227)	-0.487** (0.192)	-0.598*** (0.211)
Log Fixed Assets	0.076*** (0.006)	0.075*** (0.006)	0.075*** (0.008)	0.075*** (0.008)	0.074*** (0.007)	0.072*** (0.007)
Log Cost of Employees	0.398*** (0.015)	0.397*** (0.015)	0.398*** (0.023)	0.397*** (0.023)	0.426*** (0.017)	0.404*** (0.016)
Log Intangibles	0.003* (0.001)	0.002* (0.001)	0.003* (0.002)	0.002 (0.002)	0.002 (0.001)	0.002 (0.001)
Log R&D	0.017*** (0.005)	0.0162*** (0.005)	0.0171*** (0.006)	0.0162*** (0.006)	0.0161*** (0.005)	0.0166*** (0.005)
Transfer Pricing Host	0.016 (0.015)	0.017 (0.015)	0.016 (0.017)	0.017 (0.017)	0.018 (0.015)	0.022 (0.016)
Transfer Pricing Parent	0.046*** (0.016)	0.044*** (0.016)	0.046** (0.020)	0.044** (0.020)	0.042*** (0.016)	0.037** (0.016)
Debt to Equity Rule Host	0.003 (0.024)	0.001 (0.024)	0.003 (0.023)	0.001 (0.023)	-0.005 (0.025)	0.001 (0.026)
Debt to Equity Rule Parent	0.028 (0.025)	0.021 (0.025)	0.028 (0.026)	0.021 (0.026)	0.027 (0.026)	0.013 (0.026)
Earnings Stripping Rule Host	-0.008 (0.032)	-0.004 (0.032)	-0.008 (0.033)	-0.004 (0.034)	-0.011 (0.032)	-0.003 (0.033)
Earnings Stripping Rule Parent	0.061** (0.030)	0.057* (0.030)	0.061* (0.033)	0.057* (0.033)	0.063** (0.031)	0.068** (0.034)
Tax Consolidation Host	0.143 (0.105)	0.129 (0.104)	0.143 (0.099)	0.129 (0.096)	0.120 (0.105)	0.125 (0.106)
Tax Consolidation Parent	-0.233 (0.146)	-0.229 (0.140)	-0.233** (0.111)	-0.229** (0.099)	-0.226 (0.139)	-0.219 (0.140)
Accelerated Depr. Host	0.038** (0.018)	0.041** (0.018)	0.038* (0.021)	0.041* (0.021)	0.041** (0.018)	0.044** (0.019)
Accelerated Depr. Parent	-0.014 (0.013)	-0.013 (0.013)	-0.014 (0.017)	-0.013 (0.017)	-0.016 (0.014)	-0.015 (0.015)
Loss Carryback Host	-0.024	-0.030	-0.024	-0.030	-0.024	-0.016

	(0.035)	(0.035)	(0.033)	(0.033)	(0.035)	(0.037)
Loss Carryback Parent	-0.019	-0.017	-0.019	-0.017	-0.013	-0.011
	(0.054)	(0.054)	(0.078)	(0.080)	(0.056)	(0.056)
Loss Carryforward Host	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Loss Carryforward Parent	-0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control of Corruption Host	0.069**	0.076***	0.069**	0.076**	0.066**	0.085***
	(0.029)	(0.029)	(0.033)	(0.033)	(0.030)	(0.031)
Control of Corruption Parent	-0.003	-0.004	-0.003	-0.004	-0.004	-0.008
	(0.027)	(0.027)	(0.032)	(0.032)	(0.027)	(0.028)
Distance	-0.037	-0.030	-0.037	-0.030	-0.084	0.034
	(0.135)	(0.138)	(0.129)	(0.132)	(0.155)	(0.151)
GDP Growth Host	1.476***	1.554***	1.476***	1.554***	1.698***	1.473***
	(0.213)	(0.212)	(0.315)	(0.299)	(0.216)	(0.222)
GDP Growth Parent	0.880***	0.786**	0.880***	0.786*	0.747**	0.635*
	(0.307)	(0.307)	(0.407)	(0.412)	(0.312)	(0.333)
GDP Per Capita Host	-0.073	-0.102	-0.073	-0.102	-0.138	-0.051
	(0.146)	(0.146)	(0.159)	(0.159)	(0.149)	(0.153)
GDP Per Capita Parent	-0.027	0.017	-0.027	0.017	0.078	-0.072
	(0.221)	(0.221)	(0.226)	(0.223)	(0.222)	(0.249)
Inflation Host	0.380*	0.427*	0.380	0.427	0.459**	0.324
	(0.227)	(0.227)	(0.300)	(0.310)	(0.231)	(0.236)
Inflation Parent	-0.533	-0.454	-0.533	-0.454	-0.427	-0.527
	(0.328)	(0.328)	(0.383)	(0.377)	(0.337)	(0.336)
Unemployment Host	-1.480***	-1.517***	-1.480***	-1.517***	-1.579***	-1.626***
	(0.259)	(0.259)	(0.259)	(0.244)	(0.260)	(0.275)
Unemployment Parent	-0.278	-0.283	-0.278	-0.283	-0.239	-0.312
	(0.382)	(0.382)	(0.419)	(0.425)	(0.380)	(0.407)
Firm FE	✓	✓	✓	✓	✓	✓
Industry-Year FE	-	✓	-	✓	✓	✓
Year FE	✓	-	✓	-	-	-
#Observations	106,558	106,558	106,558	106,558	102,052	94,986
#Affiliates	18,452	18,452	18,452	18,452	17,545	16,433
R-squared	0.892	0.893	0.892	0.893	0.893	0.892

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)-(2), (5)-(6)) and at the host-parent pair level (specifications (3)-(4)) in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational subsidiaries* per year. All specifications include a full set of affiliate dummies and a full set of year dummies. Industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. *Tax Difference* equals the subsidiary tax rate minus the parent tax rate. *No Financ. Sector* consists solely of subsidiaries outside the financial sector. *No NL Parent Firms* excludes all subsidiaries whose parent firm is located in the Netherlands.

Table 3: Corporate tax reforms and profit shifting, Pre-tax Profits

OLS Affiliate Fixed Effects, Panel 2003-2013						
Dependent Variable: Log (Pre-tax Profits)						
Sample	All Subsidiaries				No Financ. Sector	No NL Parent Firms
Explanatory Variables:	(1)	(2)	(3)	(4)	(5)	(6)
Tax Difference	-0.397*	-0.327	-0.397*	-0.327	-0.290	-0.480**
	(0.206)	(0.207)	(0.239)	(0.237)	(0.210)	(0.231)
Log Fixed Assets	0.053***	0.052***	0.053***	0.052***	0.054***	0.049***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Log Cost of Employees	0.401***	0.400***	0.401***	0.400***	0.421***	0.412***
	(0.016)	(0.016)	(0.021)	(0.021)	(0.017)	(0.017)
Log Intangibles	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Log R&D	0.007	0.005	0.007	0.005	0.007	0.004
	(0.006)	(0.006)	(0.008)	(0.008)	(0.006)	(0.007)
Transfer Pricing Host	-0.014	-0.009	-0.014	-0.009	-0.008	-0.009
	(0.016)	(0.016)	(0.019)	(0.019)	(0.016)	(0.017)
Transfer Pricing Parent	0.048***	0.047***	0.048**	0.047**	0.043**	0.036**
	(0.017)	(0.017)	(0.023)	(0.023)	(0.017)	(0.018)
Debt to Equity Rule Host	-0.047*	-0.051*	-0.047*	-0.051*	-0.058**	-0.052*
	(0.027)	(0.027)	(0.028)	(0.028)	(0.028)	(0.028)
Debt to Equity Rule Parent	0.011	0.005	0.011	0.005	0.011	-0.007
	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)
Earnings Stripping Rule Host	-0.064*	-0.061*	-0.064*	-0.061	-0.059*	-0.058
	(0.034)	(0.035)	(0.038)	(0.038)	(0.035)	(0.036)
Earnings Stripping Rule Parent	0.026	0.024	0.026	0.024	0.021	0.022
	(0.033)	(0.033)	(0.036)	(0.034)	(0.034)	(0.037)
Tax Consolidation Host	0.268**	0.244**	0.268**	0.244**	0.237**	0.221*
	(0.115)	(0.114)	(0.128)	(0.124)	(0.114)	(0.116)
Tax Consolidation Parent	-0.002	-0.006	-0.002	-0.006	-0.015	0.022
	(0.169)	(0.166)	(0.083)	(0.084)	(0.167)	(0.166)
Accelerated Depr. Host	0.0160	0.019	0.016	0.019	0.023	0.022
	(0.019)	(0.019)	(0.021)	(0.021)	(0.020)	(0.021)
Accelerated Depr. Parent	-0.021	-0.020	-0.021	-0.020	-0.024*	-0.029*
	(0.014)	(0.014)	(0.021)	(0.021)	(0.015)	(0.017)
Loss Carryback Host	0.035	0.026	0.035	0.026	0.033	0.034

	(0.036)	(0.036)	(0.038)	(0.038)	(0.037)	(0.038)
Loss Carryback Parent	0.016	0.023	0.016	0.023	0.038	0.028
	(0.064)	(0.064)	(0.084)	(0.083)	(0.065)	(0.065)
Loss Carryforward Host	0.000	0.001*	0.000*	0.001*	0.001*	0.001
	(0.000)	(0.000)	(0.000)	(0.00)	(0.000)	(0.000)
Loss Carryforward Parent	-0.000	-0.000	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control of Corruption Host	0.069**	0.078**	0.069**	0.078**	0.085***	0.092***
	(0.032)	(0.032)	(0.034)	(0.034)	(0.032)	(0.034)
Control of Corruption Parent	0.021	0.021	0.021	0.021	0.012	0.015
	(0.030)	(0.030)	(0.035)	(0.036)	(0.030)	(0.030)
Distance	0.072	0.072	0.072	0.072	0.035	0.200
	(0.233)	(0.240)	(0.226)	(0.232)	(0.282)	(0.258)
GDP Growth Host	1.567***	1.663***	1.567***	1.663***	1.720***	1.647***
	(0.234)	(0.234)	(0.325)	(0.316)	(0.238)	(0.244)
GDP Growth Parent	0.535	0.441	0.535	0.441	0.392	0.189
	(0.345)	(0.346)	(0.426)	(0.424)	(0.353)	(0.373)
GDP Per Capita Host	-0.436***	-0.469***	-0.436**	-0.469**	-0.449***	-0.423**
	(0.161)	(0.161)	(0.182)	(0.183)	(0.164)	(0.169)
GDP Per Capita Parent	0.071	0.126	0.071	0.126	0.138	0.003
	(0.252)	(0.251)	(0.244)	(0.250)	(0.256)	(0.277)
Inflation Host	0.343	0.414	0.343	0.414	0.440*	0.422
	(0.255)	(0.255)	(0.399)	(0.414)	(0.257)	(0.265)
Inflation Parent	-0.173	-0.069	-0.173	-0.069	-0.098	-0.104
	(0.348)	(0.348)	(0.431)	(0.426)	(0.355)	(0.355)
Unemployment Host	-1.385***	-1.430***	-1.385***	-1.430***	-1.424***	-1.511***
	(0.286)	(0.285)	(0.281)	(0.275)	(0.289)	(0.301)
Unemployment Parent	-0.186	-0.199	-0.186	-0.199	-0.189	-0.247
	(0.391)	(0.390)	(0.406)	(0.415)	(0.399)	(0.411)
Firm FE	✓	✓	✓	✓	✓	✓
Industry-Year FE	-	✓	-	✓	✓	✓
Year FE	✓	-	✓	-	-	-
#Observations	104,432	104,432	104,432	104,432	99,890	93,201
#Affiliates	18,299	18,299	18,299	18,299	17,380	16,317
R-squared	0.884	0.885	0.884	0.885	0.884	0.885

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)-(2), (5)-(6)) and at the host-parent pair level (specifications (3)-(4)) in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational subsidiaries* per year. All specifications include a full set of affiliate dummies and a full set of year dummies. Industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. *Tax Difference* equals the subsidiary tax rate minus the parent tax rate. *No Financ. Sector* consists solely of subsidiaries outside the financial sector. *No NL Parent Firms* excludes all subsidiaries whose parent firm is located in the Netherlands.

Table 4: Corporate tax reforms and profit shifting - Robustness tests

OLS Affiliate Fixed Effects, Panel 2003-2013				
Dependent Variable:	Log (EBIT)		Log (Pre-tax Profits)	
Sample	All subsidiaries whose parent and host country do not experience a recession in the year			
Explanatory Variables:	(1)	(2)	(3)	(4)
Tax Difference	-0.747*** (0.267)	-0.692*** (0.267)	-0.597** (0.288)	-0.534* (0.289)
Log Fixed Assets	0.086*** (0.008)	0.086*** (0.008)	0.056*** (0.008)	0.056*** (0.008)
Log Cost of Employees	0.397*** (0.019)	0.395*** (0.019)	0.403*** (0.020)	0.403*** (0.020)
Log Intangibles	0.004** (0.002)	0.003** (0.002)	0.003 (0.002)	0.003 (0.002)
Log R&D	0.024*** (0.006)	0.024*** (0.006)	0.014* (0.007)	0.013* (0.007)
Transfer Pricing Host	0.031 (0.021)	0.032 (0.021)	-0.002 (0.023)	0.001 (0.023)
Transfer Pricing Parent	0.028 (0.021)	0.025 (0.021)	0.050** (0.023)	0.049** (0.023)
Debt to Equity Rule Host	0.006 (0.025)	0.002 (0.025)	-0.028 (0.028)	-0.033 (0.028)
Debt to Equity Rule Parent	0.009 (0.026)	0.004 (0.026)	0.013 (0.028)	0.008 (0.028)
Earnings Stripping Rule Host	-0.025 (0.049)	-0.019 (0.049)	-0.057 (0.052)	-0.052 (0.052)
Earnings Stripping Rule Parent	0.118*** (0.044)	0.118*** (0.044)	0.092* (0.048)	0.092* (0.048)
Tax Consolidation Host	0.166 (0.124)	0.169 (0.123)	0.207 (0.135)	0.199 (0.135)
Tax Consolidation Parent	-0.290** (0.146)	-0.284** (0.143)	-0.149 (0.170)	-0.146 (0.169)
Accelerated Depr. Host	0.051** (0.025)	0.052** (0.025)	0.030 (0.027)	0.033 (0.027)
Accelerated Depr. Parent	-0.004 (0.019)	-0.005 (0.019)	-0.013 (0.021)	-0.014 (0.021)
Loss Carryback Parent	-0.047 (0.169)	-0.015 (0.172)	0.151 (0.251)	0.188 (0.257)
Loss Carryforward Host	0.002** (0.001)	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)
Loss Carryforward Parent	-0.001** (0.000)	-0.001** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Control of Corruption Host	0.053 (0.034)	0.057* (0.034)	0.068* (0.037)	0.074** (0.037)
Control of Corruption Parent	-0.015 (0.031)	-0.016 (0.031)	-0.004 (0.034)	-0.004 (0.034)
Distance	0.098 (0.144)	0.100 (0.152)	0.040 (0.346)	0.030 (0.357)
GDP Growth Host	1.621*** (0.406)	1.693*** (0.404)	1.444*** (0.461)	1.553*** (0.458)
GDP Growth Parent	0.934**	0.903**	0.190	0.149

	(0.448)	(0.450)	(0.493)	(0.495)
GDP Per Capita Host	-0.056	-0.065	-0.388**	-0.400**
	(0.173)	(0.173)	(0.192)	(0.192)
GDP Per Capita Parent	-0.013	0.036	-0.034	0.030
	(0.283)	(0.283)	(0.301)	(0.302)
Inflation Host	0.878**	0.934**	1.224***	1.314***
	(0.385)	(0.386)	(0.449)	(0.445)
Inflation Parent	0.288	0.275	-0.111	-0.0913
	(0.523)	(0.523)	(0.559)	(0.561)
Unemployment Host	-1.514***	-1.544***	-1.218***	-1.224***
	(0.396)	(0.395)	(0.439)	(0.436)
Unemployment Parent	1.007*	1.077*	0.418	0.496
	(0.580)	(0.580)	(0.596)	(0.595)
Firm FE	✓	✓	✓	✓
Industry-Year FE	-	✓	-	✓
Year FE	✓	-	✓	-
#Observations	67,643	67,643	66,437	66,437
#Affiliates	16,612	16,612	16,432	16,432
R-squared	0.918	0.918	0.909	0.910

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)-(4)) in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational subsidiaries* whose parent and host country do not experience a recession in the year. All specifications include a full set of affiliate dummies and a full set of year dummies. Industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. Specifications ((1)-(2)) use the logarithm of EBIT (*Earnings before Interests and Taxes*) as dependent variable, whereas specifications ((3)-(4)) use the logarithm of Pre-tax Profits as dependent variable. *Tax Difference* equals the subsidiary tax rate minus the parent tax rate. The loss carryback host coefficient is omitted in the analyses, as the firm-fixed effects capture it across all specifications.

Table 5: Corporate tax reforms, profit shifting, and tax base broadening

OLS Affiliate Fixed Effects, Panel 2003-2013								
Dependent Variable:	Log (EBIT)				Log (Pre-tax Profits)			
Sample	All Subsidiaries							
Explanatory Variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax Difference*Tax Base	0.207**	0.205**	0.180**	0.180**	0.170*	0.173*	0.135	0.140
Index Host	(0.082)	(0.083)	(0.082)	(0.082)	(0.089)	(0.089)	(0.089)	(0.089)
Tax Difference*Tax Base		-0.031		-0.002		0.056		0.090
Index Parent		(0.0853)		(0.085)		(0.010)		(0.095)
Tax Difference	-0.820***	-0.753**	-0.695***	-0.692**	-0.719***	-0.842**	-0.557**	-0.751**
	(0.252)	(0.315)	(0.252)	(0.314)	(0.262)	(0.331)	(0.263)	(0.331)
Tax Base Index Host	-0.008	-0.007	-0.007	-0.007	-0.020**	-0.020**	-0.018*	-0.018*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Tax Base Index Parent	0.030***	0.029***	0.029***	0.029***	0.028***	0.029***	0.027***	0.029***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Joint Significance								
(Tax Difference*Tax Base	-0.613***	-0.548**	-0.515***	-0.512*	-0.548***	-0.669**	-0.422**	-0.611**
Index Host + Tax Difference)	(0.194)	(0.265)	(0.195)	(0.265)	(0.203)	(0.281)	(0.203)	(0.280)
Firm-level Controls	✓	✓	✓	✓	✓	✓	✓	✓
Country-level Controls	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry-Year FE	-	-	✓	✓	-	-	✓	✓
Year FE	✓	✓	-	-	✓	✓	-	-
#Observations	106,558	106,558	106,558	106,558	104,432	104,432	104,432	104,432
#Affiliates	18,452	18,452	18,452	18,452	18,299	18,299	18,299	18,299
R-squared	0.892	0.892	0.893	0.893	0.884	0.884	0.885	0.885

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)-(8)) in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational subsidiaries* per year. All specifications include a full set of affiliate dummies and a full set of year dummies. Industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. Specifications ((1)-(4)) use the logarithm of EBIT (*Earnings before Interests and Taxes*) as dependent variable, whereas specifications ((5)-(8)) use the logarithm of Pre-tax Profits as dependent variable. *Tax Base Index* is an index ranging from zero (very narrow tax base) to 6 (very broad tax base with transfer pricing documentation requirements, restrictions on interest payments deductibility, no tax consolidation, no accelerated depreciation allowances, no loss carryback rule, and loss carryforward up to maximum 5 years). It indicates how broad the tax base is according to the tax code in the country. *Tax Difference* equals the subsidiary tax rate minus the parent tax rate. The *Joint Significance* tests the following effect: (*Tax Difference*Tax Base Index Host + Tax Difference*).

Table 6: Profit shifting and development over time

OLS Affiliate Fixed Effects, Panel 2003-2013				
Dependent Variable:	Log (EBIT)		Log (Pre-tax Profits)	
Sample	All Subsidiaries			
Explanatory Variables:	(1)	(2)	(3)	(4)
Tax Difference*2003-2006	-0.683*** (0.223)	-0.660*** (0.222)	-0.625*** (0.241)	-0.599** (0.241)
Tax Difference*2007-2010	-0.470** (0.203)	-0.420** (0.203)	-0.310 (0.221)	-0.263 (0.222)
Tax Difference*2011-2013	-0.455** (0.195)	-0.377* (0.195)	-0.327 (0.212)	-0.234 (0.213)
Test of Equality of Coefficients				
(Tax Difference*2003-2006 - Tax Difference*2011-2013)	-0.227 (0.162)	-0.283* (0.162)	-0.297* (0.173)	-0.365** (0.173)
Firm-level Controls	✓	✓	✓	✓
Tax base Controls	✓	✓	✓	✓
Country-level Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Industry-Year FE	-	✓	-	✓
Year FE	✓	-	✓	-
#Observations	106,558	106,558	104,432	104,432
#Affiliates	18,452	18,452	18,299	18,299
R-squared	0.892	0.893	0.884	0.885

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)-(4)) in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational subsidiaries* per year. All specifications include a full set of affiliate dummies and a full set of year dummies. Industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. Specifications ((1)-(2)) use the logarithm of EBIT (*Earnings before Interests and Taxes*) as dependent variable, whereas specifications ((3)-(4)) use the logarithm of Pre-tax Profits as dependent variable. *Tax Difference* equals the subsidiary tax rate minus the parent tax rate. The *Test of Equality of Coefficients* checks the equality of the following two coefficients: (*Tax Difference*2003-2006 - Tax Difference*2011-2013*).

Appendix I

Variable Definitions

Firm-level controls (Source: Amadeus)	
<i>Log EBIT</i>	<i>Log EBIT</i> is the natural logarithm of the firm's earnings before interest and taxes.
<i>Log Pre-tax Profits</i>	<i>Log Pre-tax Profits</i> is the natural logarithm of the firm's earnings before taxes.
<i>Log Fixed Assets</i>	<i>Log Fixed Assets</i> is the natural logarithm of the firm's fixed asset stock.
<i>Log Cost of Employees</i>	<i>Log Cost of Employees</i> is the natural logarithm of the firm's cost of employees.
<i>Log Intangibles</i>	<i>Log Intangibles</i> is the natural logarithm of the firm's intangible assets.
<i>Log R&D</i>	<i>Log R&D</i> is the natural logarithm of the firm's R&D expenses.

Tax base controls (Sources: <i>Taxation Trends in Europe 2014</i> , Eurostat and E&Y Corporate Tax Guides)	
<i>Tax Difference</i>	<i>Tax Difference</i> is the difference in the statutory corporate tax rates of the considered subsidiary and its parent firm.
<i>Transfer Pricing</i>	<i>Transfer Pricing</i> is a dummy variable equal to 1 if transfer-pricing regulations include a documentation requirement by law.
<i>Debt to Equity Rule</i>	<i>Debt to Equity Rule</i> is a dummy variable equal to 1 if the country imposes restrictions on the maximum amount of debt on which interest payments can be deductible.
<i>Earnings Stripping Rule</i>	<i>Earnings Stripping Rule</i> is a dummy variable equal to 1 if the country imposes restrictions on the maximum amount of deductible interests with respect to the ratio of interests to another variable (e.g., EBITDA).
<i>Tax Consolidation</i>	<i>Tax Consolidation</i> is a dummy variable equal to 1 if the country allows groups of wholly owned or majority-owned companies to be treated as a single entity for tax purposes.
<i>Accelerated Depreciation</i>	<i>Accelerated Depreciation</i> is a dummy variable equal to 1 if the country allows accelerated depreciation for tangible and intangible fixed assets.
<i>Loss Carryback</i>	<i>Loss Carryback</i> is a dummy variable equal to 1 if the country allows using a tax loss in the current year to offset previous year profits.
<i>Loss Carryforward</i>	<i>Loss Carryforward</i> is the number of years a multinational firm can use tax losses to offset the taxation of future profits. If the tax law allows for unlimited usage of tax losses, the variable is set to 100.
<i>Tax Base Index</i>	<i>Tax Base Index</i> is an index ranging from zero (very narrow tax base) to 6 (very broad tax base with transfer pricing documentation requirements, restrictions on interest payments deductibility, no tax consolidation, no accelerated depreciation allowances, no loss carryback rule, and loss carryforward up to maximum 5 years). It indicates how broad the tax base is according to the tax code in the country.

Country-level controls (Source: World Bank)

<i>Control of Corruption</i>	<i>Control of Corruption</i> is the yearly estimate of a country's quality relating to control of corruption.
<i>Distance</i>	<i>Distance</i> is the natural logarithm of the great circle distance between the capitals of the parent and host countries. The latitude and longitude of the capital cities of each country are obtained from <i>mapsofworld.com</i> . The standard formula is then applied to calculate the distance, as in Erel et al. (2012).
<i>GDP Growth</i>	<i>GDP Growth</i> is the annual percentage growth rate of the GDP in constant 2005 U.S. dollars.
<i>GDP</i>	<i>GDP</i> is the natural logarithm of the GDP per capita in constant 2005 U.S. dollars.
<i>Inflation</i>	<i>Inflation</i> is the rate of price change in a country as a whole as measured by the annual growth rate of the GDP implicit deflator.
<i>Unemployment</i>	<i>Unemployment</i> is the number of unemployed people as a percentage of the total labor force. Unemployed people are those without work that have taken active steps to find work.

Appendix II

Adjusted top statutory tax rate on corporate income, 2003-2013

ISO Code	Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	Austria	34.0%	34.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
BE	Belgium	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%
BG	Bulgaria	23.5%	19.5%	15.0%	15.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
HR	Croatia	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
CZ	Czech Republic	31.0%	28.0%	26.0%	24.0%	24.0%	21.0%	20.0%	19.0%	19.0%	19.0%	19.0%
DK	Denmark	30.0%	30.0%	28.0%	28.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
EE	Estonia	26.0%	26.0%	24.0%	23.0%	22.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
FI	Finland	29.0%	29.0%	26.0%	26.0%	26.0%	26.0%	26.0%	26.0%	26.0%	24.5%	24.5%
FR	France	35.4%	35.4%	35.0%	34.4%	34.4%	34.4%	34.4%	34.4%	34.4%	36.1%	36.1%
DE	Germany	39.6%	38.3%	38.7%	38.7%	38.7%	30.2%	30.2%	30.2%	30.2%	30.2%	30.2%
HU	Hungary	19.6%	17.6%	17.5%	17.5%	21.3%	21.3%	21.3%	20.6%	20.6%	20.6%	20.6%
IS	Iceland	18.0%	18.0%	18.0%	18.0%	18.0%	15.0%	15.0%	18.0%	20.0%	20.0%	20.0%
IE	Ireland	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
IT	Italy	38.3%	37.3%	37.3%	37.3%	37.3%	31.4%	31.4%	31.4%	31.4%	31.4%	31.4%
LU	Luxembourg	30.4%	30.4%	30.4%	29.6%	29.6%	29.6%	28.6%	28.6%	28.8%	28.8%	29.2%
MT	Malta	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%
NL	Netherlands	34.5%	34.5%	31.5%	29.6%	25.5%	25.5%	25.5%	25.5%	25.0%	25.0%	25.0%
NO	Norway	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%
PL	Poland	27.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%
PT	Portugal	33.0%	27.5%	27.5%	27.5%	26.5%	26.5%	26.5%	29.0%	29.0%	31.5%	31.5%
RO	Romania	25.0%	25.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%
SK	Slovak Republic	25.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	19.0%	23.0%
SI	Slovenia	25.0%	25.0%	25.0%	25.0%	23.0%	22.0%	21.0%	20.0%	20.0%	18.0%	17.0%
ES	Spain	35.0%	35.0%	35.0%	35.0%	32.5%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
SE	Sweden	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	26.3%	26.3%	26.3%	26.3%	22.0%
GB	United Kingdom	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	28.0%	28.0%	26.0%	24.0%	23.0%

Notes: Data on corporate tax changes is from *Taxation Trends in Europe 2014*, Eurostat.

Appendix III

Tax Base Variables

Country	Transfer Pricing Documentation	Debt to Equity Rule	Earnings Stripping Rule	Tax Consolidation	Accelerated Depreciation	Loss Carry-back	Loss Carryforward
Austria				From 2003 on			Unlimited Years
Belgium		From 2003 on			From 2003 on		Unlimited Years
Bulgaria		From 2003 on			2003; from 2005 on		5 Years
Croatia		From 2005 on			From 2003 on		5 Years
Czech Republic		From 2003 on			From 2003 on		7 Years in 2003; 5 Years from 2004 on
Denmark	From 2003 on	From 2003 on		From 2003 on	From 2008 on		Unlimited Years
Estonia	From 2007 on						
Finland	From 2007 on			From 2003 on	From 2009 on		10 Years
France	From 2010 on	2003 to 2006		From 2003 on	From 2003 on	From 2003 on	5 Years in 2003; Unlimited Years from 2004 on
Germany	From 2003 on	2003 to 2007	From 2008 on	From 2003 on	2003 to 2007; 2009 to 2010	From 2003 on	Unlimited Years
Great Britain	From 2008 on	2003 to 2005		From 2003 on	From 2003 on	From 2003 on	Unlimited Years
Hungary	From 2010 on	From 2003 on					5 Years in 2003; Unlimited Years from 2004 on
Iceland				From 2003 on	From 2010 on		8 Years in 2003; 10 Years from 2004 on
Ireland	From 2011 on			From 2003 on		From 2003 on	Unlimited Years

Italy	From 2010 on	2005 to 2007	From 2008 on	From 2004 on	2003 to 2008		5 Years from 2003 to 2011; Unlimited Years from 2012 on
Luxembourg		From 2003 on		From 2003 on	From 2003 on		Unlimited Years
Malta				From 2003 on	From 2003 on		Unlimited Years
Netherlands	From 2003 on	2004 to 2012		From 2003 on	2009 to 2010	From 2003 on	Unlimited years from 2003 to 2006; 9 Years from 2007 on
Norway	From 2008 on			From 2003 on	From 2003 on	2008 to 2009	10 Years from 2003 to 2005; Unlimited Years from 2006 on
Poland	From 2003 on	From 2003 on		From 2003 on	2003 to 2006		5 Years
Portugal	From 2003 on	2003 to 2012		From 2003 on	From 2003 on		6 Years from 2003 to 2010; 4 Years from 2011 to 2012; 5 Years in 2013
Romania	From 2007 on	From 2003 on			From 2003 on		5 Years from 2003 to 2008; 7 Years from 2009 on
Slovenia	From 2005 on	From 2005 on		2003 to 2006	2003 to 2006		5 Years from 2003 to 2006; Unlimited Years from 2007 on
Slovakia	From 2009 on	2003			From 2003 on		5 Years from 2003 to 2009; 7 Years from 2010 on
Spain	From 2009 on	2003 to 2011	From 2012 on	From 2003 on	From 2003 on		15 Years from 2003 to 2011; 18 Years from 2012 on
Sweden	From 2007 on			From 2003 on	From 2003 on		Unlimited Years

Notes: This table summarizes the data for our main tax base variables during 2003–2013. Each country-year observation is from the E&Y Corporate Tax Guides.