

The role of headquarters in multinational profit shifting strategies

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Abstract This paper stresses the special role of multinational headquarters in corporate profit shifting strategies. Using a large panel of European firms, we show that multinational enterprises (MNEs) are reluctant to shift profits away from their headquarters even if these are located in high-tax countries. Thus, shifting activities in response to corporate tax rate differentials between parents and subsidiaries are found to be significantly larger if the parent has a lower corporate tax rate than its subsidiary and profit is thus shifted *towards* the headquarter firm. This result is in line with recent empirical evidence which suggests that MNEs bias the location of profits and highly profitable assets in favor of the headquarter location.

Keywords Multinational firms · Profit shifting · Headquarter location

JEL Classification H25 · H26 · C33

1 Introduction

In recent years, the public economics literature brought forward comprehensive empirical evidence that multinational enterprises (MNEs) shift paper profits from high-tax to low-tax economies in order to reduce their corporate tax burden. Common profit shifting strategies comprise the tax-favorable distortion of intra-firm transfer prices and the debt-equity structure or the relocation of highly profitable assets like patents or trademarks to low-tax affiliates (see e.g. Hines and Rice 1994;

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Clausing 2003; Devereux and Maffini 2007; Buettner and Wamser 2007; Dischinger and Riedel 2011). In consequence, high-tax economies suffer from considerable tax revenue losses. Using information on a sample of European multinationals in 1999, Huizinga and Laeven (2008) for example show that the corporate tax base of Germany, which was the country with the highest corporate tax rate in Europe at that time, would have increased by 14 % in the absence of profit shifting incentives.

It is still largely unknown though which companies engage in profit shifting behavior. Existing studies commonly assume shifting activities to be homogeneous across firms. An exception is a small literature which argues that intra-firm transfer prices for firm-specific R&D, innovation and patent rights are hardly observable to tax authorities and tax-related transfer price distortions are hence especially prevalent in R&D intensive firms (see e.g. Grubert 2003; Overesch and Schreiber 2010). The innovation of our paper is to provide evidence that the degree to which firms engage in profit shifting behavior, moreover, depends on the location of the multinational headquarter firm. Precisely, we will show that multinationals are reluctant to shift profits away from their headquarters locations, even if the headquarters reside in a high-tax country. Thus, profit shifting activities between parents and subsidiaries tend to be large if the parent firm observes a lower corporate tax rate than its subsidiary and profit is hence shifted *towards* the parent. If the parent is in the contrary located in a high-tax country, income shifting *away* from the parent firm is considerably smaller.

The paper offers a simple theoretical model to motivate the empirical estimation strategy. Under standard assumptions, MNEs have an incentive to shift profits from the affiliate with the higher corporate tax rate to the affiliate with the lower corporate tax rate whereas the size and sensitivity of profit shifting activities to changes in the absolute corporate tax rate differential are symmetric irrespective of the direction of the shifting flow. This result is modified though if one allows for an empirically documented bias in the location of profits and profitable assets in favor of the headquarter firm (see Dischinger et al. 2013). Following the corporate finance literature, this headquarter bias may emerge since managers value having funds and valuable assets under direct control at their host location and may thus be reluctant to relocate them to foreign affiliates.¹ Due to hierarchical structures, headquarter managers dominate in internal conflicts over the organization's funds between them and managers in subsidiary business divisions and funds thus tend to be located with the parent firm (see e.g. Rajan et al. 2000 and Stein 2003). Apart from that, a headquarter bias may emerge in response to tax legislations and may for example reflect strategies to avoid taxes upon the repatriation of profits from the subsidiaries to the parent firm. Irrespective of the source of the headquarter bias, the pattern implies that profit shifting costs are asymmetric and profit relocations from the headquarters to a subsidiary are more costly than income relocations in the opposite direction from the subsidiary to the headquarters. In consequence, profit shifting activities are predicted to respond more sensitively to changes in the tax rate differential in the latter case.

Our empirical analysis is designed to assess this hypothesis. We exploit the firm data base AMADEUS which contains detailed accounting information on European

¹The location of funds at geographically distant foreign affiliates likely hampers control and may give rise to agency problems.

multinational subsidiaries and their parent firms from 1995 to 2007. Precisely, we follow previous studies (see e.g. Huizinga and Laeven 2008) and identify multinational profit shifting activities by regressing the affiliates' pre-tax profit on the corporate tax rate differential to the parent firm (and to other subsidiaries within the multinational group). In line with existing work, we find evidence that MNEs engage in statistically significant and economically relevant profit shifting behavior.

Following our argumentation above, we moreover assess whether the profit shifting intensity between subsidiaries and their parent depends on the location of the headquarter firm in a high-tax or low-tax country. To do so, we split our subsidiary sample in subsamples of firms with a higher and lower corporate tax rate than the parent. The results indicate that profit shifting activities are, although still significant, by more than 50 % smaller if the multinational headquarters observe a larger corporate tax rate than the subsidiary compared to the reverse scenario. Thus, in line with our theoretical motivation, MNEs appear to be eager to shift profits out of high-tax subsidiaries towards low-tax parents but tend to be reluctant to shift profits from high-tax parents to low-tax affiliates. This interpretation is confirmed and strengthened by a set of sensitivity checks.

The rest of the paper is structured as follows: Sect. 2 presents a simple theoretical model to motivate our empirical identification strategy. Sections 3 and 4 describe our data set and the empirical estimation strategy. In Sect. 5 the estimation results are presented and Sect. 6 concludes.

2 Theoretical considerations

Consider a representative multinational firm which is headquartered in country h and runs a subsidiary in country s . Both affiliates earn an exogenous pre-tax profit denoted by π_h and π_s which is taxed at the corporate tax rate t_h and t_s , respectively. The multinational firm can transfer profits between the two affiliates. For simplicity reasons, we abstract from particular shifting channels and assume that the MNE can transfer profits of s from the headquarter firm to its subsidiary. Thus, if $s > 0$ ($s < 0$), profit is transferred from the headquarters to the subsidiary (from the subsidiary to the headquarters).

Multinational profit shifting is not costless though as tax authorities have an interest to prevent profit relocations from their borders. We follow the existing literature and assume that the multinational firm faces positive profit shifting costs denoted by $C(s)$, with $C(0) = 0$, $\text{sign } C'(s) = \text{sign}(s)$ and $C''(s) > 0$. The cost function is thus u-shaped with a minimum at $s = 0$.² Formally, the MNE's central management maximizes the following function corresponding to the MNE's after-tax profit

$$\Psi = (1 - t_h)(\pi_h - s) + (1 - t_s)(\pi_s + s) - C(s) \quad (1)$$

²Profit shifting costs thus rise convexly in the amount of profit shifted, which may relate to the fact that the tax authority is over-proportionally more likely to identify and fine profit shifting activities the larger the amount of relocated profit. Alternatively, the convex cost function may reflect that it becomes increasingly more costly for the multinational firm to hide profit shifting activities from the tax authorities the larger the amount of relocated income (see e.g. Haufler and Schjelderup 2000).

by choosing the optimal level of s . The first-order condition reads

$$t_h - t_s = C'(s) \quad (2)$$

and thus equates marginal gains and costs from shifting one additional unit of profit between the entities. It directly follows from (2) that $s > 0$ ($s < 0$) if $t_h > t_s$ ($t_h < t_s$). In the former case profit is shifted from the headquarters location to the subsidiary, in the latter case profit shifting points in the opposite direction from the subsidiary to the headquarter firm. Moreover, shifting activities, i.e. $|s|$, are larger, the higher the absolute tax rate differential between the entities. Note that, with a symmetric u-shaped shifting cost function $C(s)$, the size of shifting activities depends on the absolute tax rate differential between the entities only and is independent of whether profit is relocated from the headquarters to the subsidiary or the other way round.

There are several reasons though why income relocation costs may not be homogeneous in real-world scenarios but may depend on the structure of the MNE. In particular, recent empirical evidence suggests that MNEs have a tendency to hold profits and valuable assets with the headquarter firm (see Dischinger et al. 2013). This pattern may emerge since managers value having funds and valuable assets under their control (see the vast corporate finance literature, e.g., Jensen 1986, 1993; Harris and Raviv 1990; Hart and Moore 1995; Zwiebel 1996). In the presence of monitoring problems, the MNE's central management may lack control over funds located in geographically distant entities and may have an incentive to retain and locate them at the headquarters.³

This line of argumentation is also underpinned by recent papers in the corporate finance literature that model the internal conflict of interest between the CEO and the managers of subsidiary business divisions that emerges since all players compete for the organization's funds (see Rajan et al. 2000; Scharfstein and Stein 2000; Stein 2003). Due to hierarchical structures, CEO and headquarters management have more pull in the course of this conflict which may hamper a relocation of funds from the parent firm to foreign subsidiaries. Apart from that, a headquarter bias in the location of funds may also emerge due to particularities in corporate tax law. Locating funds with the headquarters may for example help to save dividend withholding taxes upon repatriation. On top, income relocations from the headquarters firm may be unattractive under residence-based taxation if the parent's host country applies a credit regime. And parent countries may in general inhibit popular profit shifting strategies like the injection of equity into a low tax finance subsidiary which is then round-tripped and lend back to the parent.

Following this argumentation, we define a convex cost function $K(s)$ to describe costs for the headquarters management when funds are relocated from the parent firm,

³This particularly holds true for valuable assets and key units like R&D which are, on top, often associated with reputational benefits. R&D is for example well-known to earn higher returns than other investments. From a taxation perspective, one would thus expect that R&D units belong to the internationally most mobile departments within multinational groups. Empirical research, in turn, suggests that the contrary is true and R&D belongs to the least mobile functions within MNEs (see e.g. Abramovsky et al. 2008; Criscuolo et al. 2010).

with $K'(s) > 0$ and $K''(s) > 0$ if $s > 0$ and $K(s) = K'(s) = K''(s) = 0$ if $s \leq 0$. The central management's modified target function then reads

$$\Psi = (1 - t_h)(\pi_h - s) + (1 - t_s)(\pi_s + s) - C(s) - K(s). \quad (3)$$

The optimal profit relocation s is determined by the following first-order condition:

$$t_h - t_s = C'(s) + K'(s) \quad (4)$$

and thus again equates marginal costs and gains from profit shifting. If $t_h > t_s$, shifting one additional unit of profit from the headquarters to the subsidiary implies marginal concealment costs C' and positive marginal headquarters relocation costs K' . In turn if $t_s > t_h$, it holds that $K'(s) = 0$ and equation (4) collapses to equation (2). Thus, the introduction of headquarter relocation costs weakly lowers the optimal shifting amount for any given tax rate differential. To illustrate this point, consider two tax rate differentials $\Delta t_+ = t_h - t_s > 0$ and $\Delta t_- = t_h - t_s < 0$ which are equal in absolute terms, i.e. $\Delta t_+ = |\Delta t_-|$. Then the optimal absolute shifting amount $|s^*|$ is larger when the subsidiary is located in the high-tax country ($t_s > t_h$), compared to shifting $|\tilde{s}^*|$ in the reverse scenario where the subsidiary is located in the low-tax country ($t_h > t_s$). A comparative static analysis of equation (4) further yields

$$\left. \frac{ds^*}{d(t_h - t_s)} \right|_{\Delta t_+} = \frac{1}{C''(\tilde{s}^*) + K''(\tilde{s}^*)}, \quad \left. \frac{ds^*}{d(t_h - t_s)} \right|_{\Delta t_-} = \frac{1}{C''(s^*)}. \quad (5)$$

It thus follows that under relatively mild assumptions the response of the optimal shifting amount to changes in the corporate tax rate differential is smaller if the parent is located in the country with the higher corporate tax rate. Formally, this holds if $K''(\tilde{s}^*) > C''(s^*) - C''(\tilde{s}^*)$ and hence is fulfilled for a large range of concealment cost functions, with a third derivative (C''') which is negative, zero or moderately positive. In the following, we will empirically test for this predicted asymmetry in shifting behavior.

3 Data

Our empirical analysis relies on the commercial database AMADEUS which is compiled by Bureau van Dijk and contains detailed information on ownership structures and accounting data for national and multinational corporations in Europe. Our sample comprises firms in the major countries of EU 27 plus Norway and Switzerland. The time period covered is 1995 to 2007. One major advantage of AMADEUS is that it allows to link accounting information on parent firms and their corporate subsidiaries which makes the data set ideal for our purpose.

For an observation to be included in the sample, it has to belong to a multinational enterprise. The parent firms in our sample are global ultimate owners of a multinational group with at least one wholly-owned subsidiary in a foreign country.⁴ Note in

⁴Note that our data includes information on the parent firm who is the legal owner of the subsidiary. However, the legal owner and the MNE's home country for tax purposes need not necessarily coincide.

this context that the data also comprises parent firms with foreign subsidiaries located outside our European sample countries as AMADEUS provides ownership links to foreign subsidiaries and parents on a worldwide basis although accounting information is available for European firms only. Moreover, to avoid results that are driven by holding companies, we exclude small parent firms (with less than 25 employees) from the data whose total assets simultaneously comprise an over-proportional fraction of financial assets (more than 75 %). The subsidiaries in our sample likewise belong to a multinational group in the sense that they are wholly owned by a parent corporation in a foreign country. The subsidiaries may own (further) subsidiaries themselves whereas this is not decisive for our qualitative results. Again, the sample comprises subsidiaries with parent firms outside Europe. The country statistics for the parent and subsidiary sample are presented in Table 1.⁵

Note, moreover, that the AMADEUS data has the drawback that information on the ownership structure is available for the last reported date only, which is the year 2007 for most firms in our sample. Thus, in the context of our panel study, there is some scope for misclassifications of parent–subsidiary connections since the ownership structure may have changed over the sample period. However, in line with previous studies, we are not too concerned about this issue since the described misclassifications introduce noise into our regressions that is expected to bias our results towards zero (see Budd et al. 2005). Following previous studies (see e.g. Huizinga and Laeven 2008), we moreover restrict the sample to firms which earn a positive pre-tax profit as taxation is expected to play a significant role in firms with positive profits only.

The observational unit in our regressions is the multinational affiliate, i.e. the parent or subsidiary, per year. The sample statistics are presented in Table 2 and are listed separately for the parent and subsidiary firms in our sample. In total, the data comprises 83,800 subsidiary observations for 20,704 subsidiary firms and 51,142 parent observations for 12,694 parent corporations. Thus, the subsidiary and parent information is on average available for 4.05 and 4.03 years, respectively. The average subsidiary observes a pre-tax profit of 4.1 million US dollars, and a fixed asset stock and annual payroll sum of 25.7 and 6.1 million US dollars, respectively. Unsurprisingly, the average parent firm in our sample is considerably larger than the average subsidiary, exhibiting pre-tax profits of 68.7 million US dollars and a fixed asset stock and annual payroll sum of 577.8 and 94.7 million US dollars.

Precisely, different countries rely on different criteria to establish “fiscal residence,” the most important being incorporation, seat and central management. These elements are often fragmented. Different national laws imply that a corporation can be resident in multiple jurisdictions at once. As an example, the UK uses two separate tests for residence: firstly, incorporation, i.e. a corporation is resident in the UK if it is incorporated there, and secondly, central management and control, i.e. a corporation is also considered resident where it is managed and controlled, which means where the board of directors meets to make major decisions. Thus, a corporation could in principle incorporate in one country and move its central management and control abroad to avoid residency in the country of incorporation (see Loomer 2008). This is, however, considered to be a risky and therefore rather uncommon strategy as it may be challenged by the tax authorities in the country of incorporation (see also Loomer 2008).

⁵The coverage of firms varies between the countries as Bureau van Dijk draws on different information sources in different countries which vary in their coverage. Nevertheless, profit shifting is expected to be most pronounced for large multinational firms which tend to be captured in all our sample countries.

Table 1 Country statistics

Country	Subsidiaries	Parents
Austria	193	156
Belgium	1,008	782
Bulgaria	550	8
Czech Republic	465	76
Denmark	874	849
Estonia	365	30
Finland	558	285
France	1,729	1,630
Germany	1,292	1,417
Great Britain	3,416	1,325
Hungary	80	20
Ireland	31	76
Italy	1,014	1,518
Luxembourg	110	65
Latvia	14	0
Netherlands	750	1,250
Norway	407	331
Poland	1,018	62
Portugal	257	120
Romania	4,174	13
Slovakia	85	7
Spain	1,536	1,433
Sweden	777	1,073
Switzerland	1	168
Sum	20,704	12,694

As will be described in detail in the following section, the paper assesses the profit shifting activities between parent firms and their corporate subsidiaries (see e.g. Dischinger 2008 and Weichenrieder 2009 for a similar approach). The profit shifting incentive is thereby determined by the difference in the statutory corporate tax rates of parents and subsidiaries. For the subsample of subsidiaries, the incentive is captured by the differential between their own statutory tax rate and the statutory tax rate of the parent firm. For the average subsidiary in our sample, this difference is -2.8% , varying strongly between -49 and $+53.2\%$. As our analysis will discriminate between high-tax and low-tax subsidiaries relative to their parent firm, we moreover assess the spread of the tax rate difference in the two sub-groups which turns out to be comparable in terms of both, the absolute subsample averages and the standard deviation.

For the subsample of parent firms, the profit shifting incentive is captured by the unweighted average statutory tax rate difference between the parent and its majority-owned subsidiary firms worldwide. Analogously to the previous paragraph, the subsidiary list for our European parent firms in the sample comprises subsidiaries in-

Table 2 Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
<i>Subsidiary Sample</i>					
Pre-tax Profits*	83,800	4,062.4	50,049.3	1	8,055,052
Fixed Assets*	83,800	25,653.2	429,889.9	1	4.61e+07
Cost of Employees*	83,800	6,077.7	43,943.4	1	6,326,555
Tax Rate Difference to Par**	83,800	-0.028	0.099	-0.490	0.532
Tax Rate Difference to Par**, High-tax Subs	31,701	0.069	0.065	0.0001	0.532
Tax Rate Difference to Par**, Low-tax Subs	52,099	-0.087	0.063	-0.490	-0.0001
GDP [▲]	83,800	895.9	854.0	5.6	3,320.9
GDP per Capita*	83,800	23,424.6	13,958.5	1,566.9	103,125
Corruption Index★	83,800	6.5	2.2	2.6	10.0
<i>Parent Sample</i>					
Pre-tax Profits*	51,142	68,711.1	581,872.2	1	4.47e+07
Fixed Assets*	51,142	577,818	4,054,623	2	2.41e+08
Cost of Employees*	51,142	94,717.0	556,298.8	1	2.26e+07
Avg. Tax Rate Difference to Subs***	51,142	0.014	0.087	-0.395	0.432
GDP [▲]	51,142	1,100.1	812.1	5.6	3,320.9
GDP per Capita*	51,142	29,529.7	10,302.4	1,566.9	89,923.2
Corruption Index★	51,142	7.5	1.5	2.6	10

Notes: *: in thousands of US dollars; **: difference in the statutory corporate tax rates of the considered subsidiary and its parent firm; ***: unweighted average tax rate difference between the considered parent firm and all majority-owned subsidiaries (inside and outside our European sample countries); [▲]: in billion of US dollars; ★: Transparency International's Corruption Perception Index ranging from 0 (high corruption) to 10 (no corruption)

side and outside Europe. Information on the latter affiliates usually includes the host country and the parent's ownership share. As size information is thus commonly not available, we determine an unweighted average of the tax rate differential between the parent and its majority-owned subsidiaries. In robustness checks, we also experimented with size-weighted averages for the subset of firms for which size information is available, and found comparable results.

Furthermore, our analysis will control for other host country characteristics and thus we merge data on GDP, GDP per capita and a corruption index to the firm accounting data.⁶ As suggested in Table 1, parent firms mainly tend to reside in the large and highly developed Western European countries while subsidiary firms are spread across Europe, including Eastern European emerging markets. Hence, unsurprisingly, the average subsidiary is located in a smaller market than the average parent firm (subsidiary host countries exhibit a GDP of 0.9 vs. 1.1 trillion US dollars in parent host countries), in countries with a lower average GDP per capita (23,425 vs.

⁶The information on statutory tax rates is taken from the European Commission. Country data for GDP and GDP per capita are obtained from the IMF World Economic Outlook Database October 2008. The Corruption Perceptions Index is taken from Transparency International and ranks from 0 (extreme level of corruption) to 10 (free of corruption).

29,529 US dollars) and higher levels of corruption (an average Transparency International Corruption Index of 6.6 vs. 7.5 in the average parent country, with smaller numbers indicating higher corruption levels).

4 Estimation strategy

As described above, the aim of our analysis is to empirically determine profit shifting activities between multinational parent firms and their foreign subsidiaries and to assess whether the profit shifting intensity depends on the location of the parent firm in a high-tax or low-tax country relative to its subsidiaries.

Our simple theoretical model in Sect. 2 derived two predictions: firstly, for a given absolute tax rate differential between headquarters and subsidiaries, the volume of relocated profit is smaller if the parent is located in the high-tax country. Secondly, the sensitivity of income relocations to *changes* in the tax rate differential is reduced in this scenario, too, relative to scenarios where the parent is located in the low-tax country. A test of the first hypothesis would require information on actual income shifting volumes which is not available to us as MNEs by its very definition try to hide shifting behavior from the public. Most existing studies thus pursue indirect approaches and test for shifting activities by determining a link between corporate tax rate changes and the reported profitability of multinational affiliates. Following our argumentation in Sect. 2, we would expect that this sensitivity is larger if the parent firm resides in a country with a lower corporate tax rate than its subsidiary as this implies that profit is shifted *towards* and not away from the parent firm.

To implement this hypothesis empirically, we in a first step exploit the subsidiary sample and estimate a regression model of the following form:

$$\log PBT_{it} = \beta_0 + \beta_1 TAXDIFF_{it} + \beta_2 (TAXDIFF_{it} \times HTS_{it}) + \beta_3 X_{it} + \rho_t + \phi_i + \epsilon_{it} \quad (6)$$

where PBT_{it} depicts the pre-tax profit of subsidiary i at time t . As the distribution of the pre-tax profit variable is strongly skewed, we use a logarithmic transformation.

The variable of central interest in the analysis is $TAXDIFF_{it}$ which stands for the corporate tax rate differential between the considered subsidiary i and its parent firm in year t . If MNEs engage in profit shifting behavior between subsidiaries and their parent firm, we expect a negative coefficient for the tax rate difference variable. Our theoretical motivation, moreover, suggests that the scope of tax-motivated income relocations depends on the structure of the MNE. Profit shifting is predicted to be larger in absolute terms if the subsidiary is located in a country with a higher corporate tax rate and tax incentives imply a relocation of income from the subsidiary to the parent country relative to the reverse case where it is the subsidiary which is located in the lower tax country and tax-motivated income shifting points in the opposite direction. We therefore define a dummy HTS_{it} that takes on the value 1 if the subsidiary is located in a host country with a larger corporate tax rate than in the parent country, and 0 otherwise. The above discussion suggests that the corporate tax rate differential exerts a negative effect on the subsidiary's pre-tax profitability whereas the effect is hypothesized to be larger if the subsidiary resides in a country with a higher corporate tax rate than the parent firm. We thus expect $\beta_1 < 0$ and $\beta_2 < 0$.

X_{it} depicts a vector of control variables which comprise the corporate input factors (fixed asset investment and wage costs) as well as a set of time-varying country controls, precisely GDP (to account for market size), GDP per capita (to account for the country's income and development level) and a corruption index (to account for the quality of governance institutions). Additionally, we include a full set of time fixed effects to account for common shocks to all subsidiaries over time and a full set of one-digit NACE industry-year fixed effects to pick up industry shocks. Moreover, a full set of affiliate fixed effects ϕ_i is included to absorb time constant heterogeneity between the entities, which is also suggested by a Hausman test;⁷ ϵ_{it} depicts the error term.

As a robustness test, we moreover assess our hypothesis at the other end of the profit-shifting relation and re-estimate (6) using parent firms in our data. Analogously to the analysis above, we identify high-tax and low-tax parents and define the following two parent samples: The first comprises parent firms which tend to be located in a high-tax country compared to their subsidiaries in the sense that at least two thirds of the subsidiaries observe a lower host-country tax than the parent. Analogously, the second sample comprises parent firms which tend to be located in a country with a lower corporate tax rate than their subsidiaries in the sense that at least two thirds of its subsidiaries observe a higher corporate tax rate. Note that this analysis is thus by its very nature less precise than the analysis in the subsidiary sample.⁸

As described in the previous section, we capture the profit shifting incentive between the parent firm and its subsidiaries by calculating an unweighted average corporate tax rate differential between the parent and the affiliates.⁹ Analogously to (6), the tax rate differential is, moreover, interacted with a dummy variable that takes on the value 1 if the parent firm is located in a low-tax country (as defined in the previous paragraph) and the value 0 if the parent is located in a high-tax country (as defined in the previous paragraph). In line with our argumentation for the subsidiary sample, we again expect the coefficient estimates for both variables to be negative.

5 Empirical results

The baseline results are presented in Tables 3 and 4. Table 3 depicts the regressions for the subsidiary sample and Table 4 depicts the regressions for the parent sample.

⁷Note that the fixed-effects approach is crucial to identify multinational profit shifting behavior. Ideally, the econometrician would want to identify income shifting activities by comparing the affiliate's observed pre-tax profitability (conditional on the prevailing corporate tax law) with the 'true' pre-tax profitability in the absence of tax-motivated income relocations which is unobserved though. Following previous studies, we tackle this problem by estimating a fixed-effects model which determines whether corporate tax rate changes induce changes in the reported pre-tax profitability at the affiliate firms.

⁸We, however, also experimented with other cut-off thresholds, which derives comparable results to the ones reported in this paper.

⁹Note that for presentational convenience, the tax difference variable in the regressions for the parent sample is defined as corporate tax rate at the parent location minus the average corporate tax rate at its foreign subsidiaries. If the parent firm engages in significant profit-shifting activities, we thus again expect a negative coefficient estimate for the tax difference variable.

Table 3 Profit shifting and headquarters location—subsidiary sample

Sample		All Subsidiaries			Low-Tax Subs			High-Tax Subs		
Explanatory Variables:		(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
OLS Affiliate-Fixed Effects, Panel 1995–2007										
Dependent Variable: Log (Profit before Taxation)										
Tax Difference to Parent		−0.530*** (0.178)	−0.507*** (0.181)		−0.549** (0.194)	−0.507*** (0.198)	−0.507* (0.269)	−1.701*** (0.366)	−1.696*** (0.367)	−1.696*** (0.391)
(TaxDiff) × (High-Tax Subs)		−0.629* (0.384)	−0.641* (0.384)							
High-Tax-Subs Dummy		0.050** (0.021)	0.052*** (0.021)							
Log Fixed Assets		0.094*** (0.007)	0.093 (0.008)		0.094*** (0.009)	0.093*** (0.010)	0.093*** (0.012)	0.096*** (0.013)	0.097*** (0.013)	0.097*** (0.010)
Log Cost of Employees		0.384*** (0.013)	0.385*** (0.013)		0.377*** (0.015)	0.381*** (0.016)	0.381*** (0.031)	0.388*** (0.025)	0.383*** (0.026)	0.383*** (0.025)
Log GDP		−0.032 (0.038)	−0.051 (0.047)		−0.031 (0.050)	−0.042 (0.062)	−0.042 (0.038)	−0.072 (0.045)	−0.074* (0.043)	−0.074*** (0.031)

Table 3 (Continued)

OLS Affiliate-Fixed Effects, Panel 1995–2007								
Dependent Variable: Log (Profit before Taxation)								
Sample	All Subsidiaries			Low-Tax Subs			High-Tax Subs	
Explanatory Variables:	(1)	(2)		(3)	(4)	(5)	(6)	(7) (8)
Log GDP per Capita	−0.011 (0.072)	0.052 (0.077)		−0.046 (0.088)	0.019 (0.095)	0.019 (0.144)	0.426** (0.202)	0.519*** (0.235)
Corruption	0.032** (0.015)	0.031** (0.015)		−0.228* (0.122)	−0.258** (0.123)	−0.258 (0.209)	0.465*** (0.137)	0.454*** (0.142)
Industry-Year Dummies		✓			✓	✓		✓
# Observations	83,800	83,108		52,099	51,548	51,548	31,701	31,560
# Affiliates	20,704	20,449		14,805	14,592	14,592	9,039	8,981
Within R^2	0.1605	0.1639		0.1583	0.1634	0.1634	0.1521	0.1578

Notes: Heteroscedasticity robust standard errors clustered at the firm level (specifications (1)–(4), (6)–(7)) and at the country-year level (specifications (5), (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. Subsamples *High(Low)-Tax Subs* consist solely of subsidiaries that exhibit a higher (lower) statutory corporate tax rate than their parent firm. *Tax Difference to Parent* equals the subsidiary tax rate minus the parent tax rate. *High-Tax-Subs Dummy* is set to 1 if an observational unit exhibits a higher tax rate than the parent, and it is set to 0 otherwise. $(TaxDiff) \times (High-Tax Subs)$ is the interaction term between *Tax Difference to Parent* and *High-Tax-Subs Dummy*. 130 industry-year dummies (NACE Rev.1 1-digit level) are included where indicated

Table 4 Profit shifting and headquarters location—parent sample

OLS Affiliate-Fixed Effects, Panel 1995–2007

Dependent Variable: Log (Profit before Taxation)

Sample	All Parents		High-Tax Par		Low-Tax Par	
Explanatory Variables:	(1)	(2)	(3)	(4)	(5)	(6)
Avg. Tax Difference to Subs	−0.246 (0.245)	−0.254 (0.246)	−0.001 (0.284)	0.020 (0.286)	−0.716** (0.317)	−0.629** (0.319)
(TaxDiff) × (Low-Tax Par)	−0.834** (0.385)	−0.768** (0.386)				
Low-Tax-Par Dummy	0.012 (0.023)	0.011 (0.023)				
Log Fixed Assets	0.328*** (0.020)	0.319*** (0.020)	0.330*** (0.031)	0.322*** (0.031)	0.332*** (0.029)	0.324*** (0.029)
Log Cost of Employees	0.255*** (0.018)	0.255*** (0.018)	0.258*** (0.026)	0.255*** (0.026)	0.257*** (0.027)	0.258*** (0.027)
Log GDP	−0.044 (0.040)	−0.055 (0.044)	0.053 (0.045)	0.030 (0.114)	−0.042 (0.044)	−0.034 (0.048)
Log GDP per Capita	0.182 (0.167)	0.245 (0.170)	−0.073 (0.276)	−0.004 (0.305)	0.106 (0.233)	0.174 (0.238)
Corruption	0.050 (0.112)	0.086 (0.115)	0.089 (0.146)	0.095 (0.150)	0.121 (0.199)	0.120 (0.206)
Industry-Year Dummies		✓		✓		✓
# Observations	51,142	50,920	26,792	26,688	24,352	24,234
# Subsidiary Firms	12,694	12,610	7,773	7,734	7,007	6,953
Within R^2	0.1454	0.1511	0.1437	0.1538	0.1343	0.1428

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters in parentheses. *, **, *** indicates significance at the 10, 5, 1 % level. Observational units are profit-making *multinational parents* per year. All specifications include a full set of affiliate fixed effects and a full set of year fixed effects. Subsamples *High(Low)-Tax Par* consist solely of parent firms that exhibit a higher (lower) statutory corporate tax rate than at least two thirds of their subsidiaries. *Avg. Tax Difference to Subsidiaries* equals the unweighted average difference between the considered parent firm's statutory corporate tax rate and the statutory corporate tax of all majority-owned subsidiaries. The variable *Low-Tax Par* is a dummy set to 1 if the parent exhibits a lower corporate tax rate than at least two thirds of its subsidiaries, and takes on the value 0 if at least two thirds of the subsidiaries exhibit a larger corporate tax rate than the parent. *(TaxDiff) × (Low-Tax Par)* is the interaction term between *Tax Difference to Subsidiaries* and the *Low-Tax-Par Dummy*. 130 industry-year dummies (NACE Rev.1 1-digit level) are included where indicated

All specifications include a full set of affiliate fixed effects and a full set of year fixed effects. Heteroscedasticity robust standard errors which account for clustering at the affiliate level are reported in brackets below the coefficient estimates.¹⁰

In column (1) of Table 3, we employ the subsidiary sample and regress the subsidiaries' pre-tax profits on the tax rate differential and its interaction with a dummy

¹⁰Note that clustering at the country-year level derives similar results as will be shown below.

variable that indicates subsidiaries with a higher corporate tax rate than the parent. Simultaneously, we account for the size of the input factors (the fixed asset stock and the payroll sum) and time-varying country controls. The coefficient estimate for the tax rate differential is negative and statistically significant, indicating that the multinational firms in our sample engage in profit shifting activities between their parent firms and subsidiaries. Moreover, the coefficient estimate for the interaction term equally exhibits a negative sign, thus suggesting that shifting activities are pronouncedly larger if the subsidiary is located in a country with a higher corporate tax rate and, hence, profit is shifted from the subsidiary towards the parent firm. This result is confirmed if we additionally control for a full set of industry-year effects in column (2). Quantitatively, column (2) indicates that profit shifting activities between parent firms and their subsidiaries are by more than 50 % smaller if the parent observes a higher corporate tax rate than the subsidiary compared to the reverse scenario.

In a second step, we moreover run separate estimations for the two subsamples of high-tax and low-tax subsidiaries. Columns (3) and (4) depict the regression results for the low-tax subsidiary sample. The tax rate differential is found to exert a significantly negative effect on the subsidiaries' pre-tax profitability indicating that MNEs engage in profit shifting activities between high-tax parents and low-tax subsidiaries. The semi-elasticity is determined with -0.5 . Columns (6) and (7) present the regressions for the subsample of high-tax subsidiaries and equally indicate a significantly negative semi-elasticity. The point estimate is -1.7 and is thus pronouncedly larger in absolute terms than the coefficient estimate for the low-tax subsidiary sample. Moreover, the coefficient estimates statistically differ at the 10 % significance level. Thus, in quantitative terms, the results suggest that the sensitivity of the subsidiary's pre-tax profitability to changes in the tax rate difference is by 70 % smaller if the subsidiary observes a lower corporate tax rate than the parent. Note that the results are largely insensitive to clustering of standard errors at different levels. See specifications (5) and (8) which re-estimate specifications (4) and (7) with standard errors clustered at the country-year level.

As a robustness test, we additionally analyze the other end of the profit shifting linkage between parents and subsidiaries and focus on the subsample of parent firms. As described in the previous section, we expect that parent firms located in low-tax countries tend to react more sensitively to changes in the tax rate differential to their subsidiaries than parent firms located in high-tax countries. Specifications (1) and (2) present regressions of the parent firm's pre-tax profitability on the average tax rate difference to the subsidiary firms and its interaction term with a dummy variable indicating parent firms in low-tax countries.¹¹ Both coefficient estimates are negative. However, only the coefficient estimate for the interaction term gains statistical significance. This indicates that it is mainly parent firms in low-tax economies whose profitability reacts sensitively to changes in the corporate tax rate differential, thus supporting the hypothesis that especially MNEs with low-tax parents engage in

¹¹ Following our description in Sect. 3, the parent dummy variable takes on the value 1 (0) if the parent firm is located in a country with a smaller (higher) corporate tax rate than two thirds of its majority-owned subsidiaries.

significant profit-shifting activities between headquarters and subsidiaries (as in that case tax-motivated income shifting runs towards the parent firm).¹² This result is also supported by the specifications presented in columns (3) to (6) which estimate the regressions separately for parents in high- and low-tax countries. Again, we find that significant effects prevail only in the latter subsample.

In a second robustness check, we assess whether our results are driven by heterogeneity of multinational groups in other dimensions. We first account for the relative size of the shifting entities. If profit is, for example, shifted from a large high-tax entity to a small low-tax entity, the shifting volume may be restricted by the low-tax affiliate's ability to absorb and conceal the relocated income. This might imply that the optimal shifting volume is large from the viewpoint of the small low-tax affiliate and hence strongly impacts on its pre-tax profitability while it is low from the viewpoint of the large high-tax affiliate and hence only weakly impacts on its pre-tax profitability. To account for that, we define a measure of the relative size of the shifting entities, precisely the logarithm of the ratio of the subsidiary's total assets over the parent's total asset. In columns (1) and (2) of Table 5, we re-estimate specifications (1) and (2) of Table 3 including the relative size ratio and the interaction of the relative size ratio with the tax difference measure. While the coefficient estimate for the latter term turns out to be statistically insignificant, our baseline results prevail suggesting that profit shifting activities between parents and subsidiaries mainly run from high-tax subsidiaries to low-tax parents.¹³

Profit shifting volumes may, moreover, depend on the number of subsidiaries and hence on the number of potential shifting partners within the multinational group. To account for this, we re-estimate specifications (1) and (2) of Table 3 additionally including an interaction term of the logarithm of the number of group subsidiaries and the corporate tax rate differential. As information on the number of subsidiaries is available in a cross-sectional dimension only, the information is absorbed by the subsidiary fixed effect. The results in columns (3) and (4) of Table 5 confirm our previous findings and indicate significant and economically large shifting activities between high-tax subsidiaries and low-tax parent firms only.¹⁴

Moreover, the estimations in the subsidiary sample have so far focused solely on potential profit shifting activities between the parent firm and its subsidiaries. Multinational income shifting strategies may in turn also comprise income relocations between subsidiary firms. To account for this possibility we re-estimate specifications (4) and (7) of Table 3 augmenting the set of regressors by the corporate tax

¹²In general, the analysis using the parent sample is less precise than the analysis in the subsidiary sample since it requires to classify parents into low- and high-tax parent firms with respect to *all* their subsidiaries. Since parent firms may simultaneously observe subsidiaries in countries with a higher and lower tax rate, this requires additional assumptions. As described in the previous section, we consider a subset of 'extreme' parents with more than two thirds of the subsidiaries being located in high- and low-tax countries respectively.

¹³Note that this robustness check comes at the cost of a reduced sample size as information on the size of the parent firm is not available for all subsidiaries in our sample. Some subsidiaries, for example, observe non-European parent firms for which accounting information is not contained in the AMADEUS data. For some European parents no unconsolidated accounting information is available.

¹⁴Again, due to missing parent information, the robustness check comes at the cost of a reduced sample size; see also the previous footnote.

Table 5 Robustness checks I

OLS Firm-Fixed Effects, Panel 1995–2007								
Dependent Variable: Log (Profit before Taxation)								
Explanatory Variables:	Relative Size		Subsidiary Number		Subs. Tax. Diff.		Zero WHT	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax Difference to Parent	−0.332 (0.356)	−0.327 (0.351)	0.545 (0.690)	0.525 (0.698)	−0.033 (0.388)	−1.468** (0.736)	−0.510** (0.214)	−1.652*** (0.371)
Tax Difference to Other Subs					−1.819*** (0.518)	−1.218* (0.748)		
(TaxDiff) × (High-Tax Subs)	−0.774* (0.448)	−0.726* (0.447)	−1.305* (0.732)	−1.227* (0.727)				
High-Tax-Subs Dummy	0.039* (0.023)	0.040* (0.023)	−0.001 (0.034)	0.003 (0.034)				
(TaxDiff) × (Log Rel. Size)	−0.064 (0.104)	−0.075 (0.100)						
Log Relative Size	0.692*** (0.025)	0.695*** (0.024)						
(TaxDiff) × (Log Number Subs)			−0.139 (0.179)	−0.153 (0.182)				
Log Fixed Assets	−0.033*** (0.009)	−0.033*** (0.009)	0.102*** (0.015)	0.104*** (0.015)	0.087*** (0.016)	0.092*** (0.016)	0.090*** (0.010)	0.098*** (0.013)
Log Cost of Employees	0.260*** (0.017)	0.261*** (0.017)	0.399*** (0.026)	0.404*** (0.026)	0.414*** (0.027)	0.379*** (0.032)	0.372*** (0.016)	0.383*** (0.026)

Table 5 (Continued)

OLS Firm-Fixed Effects, Panel 1995–2007								
Dependent Variable: Log (Profit before Taxation)								
Explanatory Variables:	Relative Size		Subsidiary Number		Subs. Tax. Diff.		Zero WHT	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log GDP	−0.021 (0.046)	−0.030 (0.051)	−0.010 (0.055)	−0.011 (0.061)	−0.073 (0.079)	−0.148*** (0.050)	−0.035 (0.062)	−0.069 (0.043)
Log GDP per Capita	0.401*** (0.109)	0.417*** (0.111)	0.629*** (0.158)	0.614*** (0.160)	0.787*** (0.161)	0.915*** (0.301)	−0.086 (0.099)	0.409** (0.205)
Corruption	0.038** (0.017)	0.038** (0.016)	0.044* (0.025)	0.048* (0.026)	0.012 (0.032)	0.081*** (0.027)	−0.055 (0.138)	0.458*** (0.139)
Industry-Year Dummies		✓		✓	✓	✓	✓	✓
# Observations	55,664	55,353	24,534	24,404	21,564	19,472	48,002	31,208
# Subsidiary Firms	12,380	12,277	6,237	6,191	5,512	5,168	14,351	8,854
Within R^2	0.2132	0.2165	0.1629	0.1687	0.1943	0.1825	0.1499	0.1572

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters 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 fixed effects and a full set of year fixed effects. *Tax Difference to Parent* equals the subsidiary tax rate minus the parent tax rate. *Tax Difference to Other Subs* in turn depicts the difference between the subsidiary tax rate and the unweighted average tax rate of all other majority-owned affiliates in the corporate group (excluding the parent). *High-Tax-Subs Dummy* is set to 1 if the subsidiary exhibits a higher tax rate than the parent, and set to 0 otherwise. $(TaxDiff) \times (High-Tax Subs)$ is the interaction term between *Tax Difference to Parent* and *High-Tax-Subs Dummy*. 130 industry-year dummies (NACE Rev.1 1-digit level) are included where indicated. *Log Relative Size* is the logarithm of subsidiary total assets over parent total assets. $(TaxDiff) \times (Log Rel. Size)$ is the interaction term between *Tax Difference to Parent* and *Log Relative Size*. *Log Number Subs* is the logarithm of the parent firm's overall number of subsidiaries. $(TaxDiff) \times (Log Number Subs)$ is the interaction term between *Tax Difference to Parent* and *Log Number Subs*.

rate difference between the considered subsidiary and other majority-owned affiliates (excluding the parent), which captures tax incentives for income relocations across subsidiaries. The results are presented in specifications (5) and (6) and largely support our previous findings as the coefficient estimate for the tax rate differential to the parent is quantitatively small and statistically insignificant in the specification for the subset of low-tax subsidiaries, while the regression in the subset of high-tax subsidiaries delivers a statistically significant semi-elasticity of -1.47 . The coefficient estimate for the tax rate difference to other subsidiaries is negative and statistically significant in both equations.

Furthermore, in Sect. 2 we offered a number of explanations for the emergence of a headquarter bias in the location of multinational profits, among others the incentive to save on dividend withholding taxes. Our data is unfortunately not well-suited to test for that hypothesis as withholding taxes between our European sample countries have been small and mostly zero throughout our sample period. Thus, it is unlikely that the results are driven by dividend withholding taxes alone. Specifications (7) and (8) test for that by restricting our subsidiary sample to firms whose host countries do not charge dividend taxes upon repatriation to the parent firm. The results largely resemble our baseline specifications indicating that the profitability bias towards the parent firm and the associated impact on tax-motivated profit shifting behavior is not mainly driven by dividend withholding taxation. Alternatively, the pattern may root in residence-based taxation according to a worldwide credit regime in the parent country.¹⁵ Specifications (1) and (2) in Table 6 thus re-estimate our baseline model in columns (4) and (7) of Table 3 dropping subsidiary firms whose parent country operates a tax credit regime, restricting the sample to subsidiaries with parents in exemption countries. The results again resemble our baseline findings and suggest that worldwide credit regimes are not the sole driver of our findings either. This points to the potential importance of the other explanations offered in Sect. 2 whose analysis might be an interesting road for future research.

As described in Sect. 3, our analysis, moreover, drops small parent firms with a high fraction of financial asset holdings to avoid that our results are affected by holding company structures. To further refine that analysis, we re-estimate specifications (4) and (7) of Table 3 excluding all subsidiaries from the analysis whose parent firm is located in the Netherlands which is known to be the most attractive holding company location in Europe. The results are presented in specifications (3) and (4) of Table 6 and largely resemble our baseline estimates in qualitative and quantitative terms. The same holds true if we additionally exclude subsidiaries from the analysis whose parent firm operates in the financial industry, see specifications (5) and (6).

Moreover, one might have concerns that our results are affected by unobserved special tax provisions and concessions granted to headquarter firms and subsidiaries

¹⁵Residence-based taxation according to a tax credit regime implies that income is taxable in the parent country upon repatriation but a tax credit is provided for taxes already paid in the subsidiary country. As income is thus eventually taxed at the parent country tax rate, MNEs may have a diminished incentive to relocate profits to low-tax entities (the disincentive might be small though as repatriation is often deferred). Note further that the main alternative to tax credit regimes is residence-based taxation where repatriated income is exempted from taxation. Information on repatriation taxes was obtained from the Ernst & Young Corporate Tax Guides.

Table 6 Robustness checks II

OLS Firm-Fixed Effects, Panel 1995–2007								
Dependent Variable: Log (Profit before Taxation)								
Explanatory Variables:	Exemption		No NL	No Financ. Sect.		Age Restrict.		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax Difference to Parent	−0.390* (0.219)	−1.673*** (0.402)	−0.483** (0.205)	−1.814*** (0.397)	−0.489** (0.212)	−1.801*** (0.457)	−0.526** (0.224)	−1.813*** (0.392)
Log Fixed Assets	0.094*** (0.010)	0.082*** (0.015)	0.095*** (0.010)	0.101*** (0.014)	0.101*** (0.010)	0.114*** (0.015)	0.083*** (0.011)	0.093*** (0.015)
Log Cost of Employees	0.371*** (0.017)	0.381*** (0.030)	0.382*** (0.016)	0.367*** (0.027)	0.378*** (0.017)	0.353*** (0.030)	0.362*** (0.019)	0.387*** (0.030)
Log GDP	−0.057 (0.073)	−0.164 (0.040)	−0.040 (0.062)	−0.080* (0.044)	−0.004 (0.073)	−0.078* (0.046)	−0.036 (0.063)	−0.077* (0.043)
Log GDP per Capita	0.069 (0.108)	0.622*** (0.214)	−0.007 (0.097)	0.509** (0.205)	−0.0714 (0.105)	0.473** (0.224)	0.186* (0.110)	0.842*** (0.221)
Corruption	−0.251* (0.133)	0.458*** (0.152)	−0.265** (0.126)	0.428*** (0.147)	−0.387*** (0.135)	0.403** (0.169)	−0.186 (0.138)	0.529*** (0.149)
Industry-Year Dummies	✓	✓	✓	✓	✓	✓	✓	✓
# Observations	42,112	25,904	47,175	27,474	42,937	22,120	39,901	26,834
# Subsidiary Firms	11,852	7,371	13,346	27,474	12,180	6,460	12,032	7,683
Within R ²	0.1590	0.1549	0.1652	0.1531	0.1672	0.1465	0.1440	0.1531

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters 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 fixed effects and a full set of year fixed effects. *Tax Difference to Parent* equals the subsidiary tax rate minus the parent tax rate. *High-Tax-Subs Dummy* is set to 1 if a subsidiary exhibits a higher tax rate than the parent and set to 0 otherwise. $(TaxDiff) \times (High-Tax Subs)$ is the interaction term between *Tax Difference to Parent* and *High-Tax-Subs Dummy*. 130 industry-year dummies (NACE Rev.1 1-digit level) are included where indicated

in our sample. This would introduce measurement error to the corporate tax rate difference variable and may make it a less than perfect measure for the corporate tax rate differential. Note, however, that this shortcoming is not unique to our analysis but affects all empirical studies on profit shifting activities that, to the best of our knowledge, exclusively use statutory corporate tax rates to capture the tax burden on corporate profits (see e.g. Devereux and Maffini 2007 for a survey). Our analysis, however, relies on data for multinationals in the EU where non-discrimination clauses put binding restrictions on governments' discretion to vary fiscal treatment across firms. Furthermore, even if concessions are granted, they often take the form of investment subsidies and do not directly affect the tax burden on corporate profits. Apart from that, unobserved special tax provisions would introduce noise in the estimations which is expected to bias the coefficient estimate for our tax difference variable towards zero. Thus, our results should be interpreted as a lower bound to the true effect. The same holds true for our classification of firms into the subsamples of high-tax and low-tax subsidiaries. If the actual tax rates faced by headquarters and subsidiaries deviate from the national rates, this would lead to misclassifications and would add noise to the identification strategy. Again, this suggests to interpret our findings as a lower bound to the true effect.

To further investigate this issue, we re-estimate our baseline specifications in columns (4) and (7) of Table 3 dropping all affiliates (subsidiaries or their parent firms) with firm age of 5 years or younger. As tax concessions are commonly granted for a restricted time period to attract new firms, this concern should be of reduced importance in this subset of affiliates. The results are presented in specifications (7) and (8) of Table 6 and largely resemble our baseline findings. Note, moreover, that similar results are derived if we drop firms aged 10 years or younger (not reported). Here, the sample size is strongly reduced though which implies that the coefficient estimates for the tax difference variable in the two subsamples lose their statistical difference.

MNEs may, moreover, endogenously adjust their group structure to corporate tax rate changes. Note, however, that our fixed-effects approach relies on variation over time and identifies the impact of *changes* in the corporate tax rate differential on *changes* in corporate pre-tax profits for existing multinational group affiliates only. If, on the contrary, an affiliate is founded in response to a tax rate change, it enters the data in the reform year or later and is not used for identification until the corporate tax rate is adjusted again. Thus, changes in the group structure are not expected to directly impact on our estimation strategy. Note, moreover, that adjustments of the headquarters location in response to corporate tax rate changes are unlikely. Firstly, headquarters relocations are, in general, still a rather rare event (see Voget 2011). Moreover, from a theoretical perspective, the headquarters location choice is determined by repatriation taxes (see e.g. Huizinga and Voget 2009) and not by statutory corporate tax rates which are the main tax variables in our analysis.

So far, our analysis moreover assumed that the corporate tax effect on subsidiary profits is linear in shape. If that assumption did not hold, our main results could be confounded and pick up non-linearities.¹⁶ To check for this possibility, we reestimate

¹⁶This may especially apply if the size of the absolute tax rate differential between parents and subsidiaries differs systematically between the subgroups of high-tax and low-tax subsidiaries. In that case

our baseline specifications for the subsamples of high-tax and low-tax subsidiaries including polynomials of the tax difference variable up to degree 5.¹⁷ Table 7 reports the resulting marginal effect, evaluated at different levels of the absolute tax rate differential between parent firms and their subsidiaries (of 10 %, 20 % and 30 % respectively). The results indeed suggest a non-linear effect of the corporate tax rate differential. Nevertheless, for a given absolute tax rate differential, the coefficient estimates for the high-tax subsidiary sample tends to be more strongly negative than in the low-tax subsidiary sample, thus supporting our baseline results of a parent bias in profit shifting behavior. Quantitatively, the difference in the shifting effect between the two subsamples increases in the absolute tax rate differential between the entities.

6 Conclusions

With the continuously rising economic importance of multinational firms, policy makers and researchers have expressed increasing concerns about multinational tax planning strategies which involve paper profit shifting from high-tax to low-tax economies by distorting intra-firm transfer prices, the debt-equity structure or the location of value-driving assets. The topic receives especially high attention since a rising number of papers has presented empirical evidence that profit shifting activities are quantitatively large and deteriorate the corporate tax base of high-tax economies around the world. Thus, in recent years an increasing number of countries have introduced or tightened anti-shifting legislations, for example strengthened thin-capitalization rules or introduced transfer price documentation requirements (see e.g. Buettner et al. 2012).

Our paper shows that profit shifting behavior is not homogeneous across MNEs. Instead MNEs are reluctant to relocate profits away from their headquarters firms even if these reside in a high-tax country. Thus, shifting volumes between parents and subsidiaries tend to be large if parent firms exhibit a lower corporate tax rate than their corporate subsidiaries and, hence, profits are shifted *towards* the parent firm. On the contrary, shifting volumes tend to be small when profits are shifted *away* from high-tax parents. Quantitatively, the estimations suggest that shifting (as measured by the profit sensitivity to changes in the tax rate differential) is by more than 70 % reduced in the latter case.

This implies that hosting multinational headquarters helps to hedge high-tax countries against large paper profit outflows through multinational shifting activities. Thus, complementary to the introduction and tightening of other anti-shifting measures like transfer pricing or thin-capitalization rules, countries may consider to fight

non-linearities could generate a pattern similar to the one reported in our analysis even in the absence of a parent bias in profit shifting behavior. Note, however, that we consider this to be unlikely as the absolute tax difference is comparable in the subgroups of high-tax and low-tax subsidiaries in our sample (see the descriptive statistics in Table 2).

¹⁷ Augmenting the specifications by polynomials of higher order is rejected by a Wald test for both subsamples.

Table 7 Robustness Checks III

OLS Firm-Fixed-Effects, Panel 1995–2007 Dependent Variable: Log (Profit before Taxation)									
Explanatory Variables:	Polynomials Up to Degree 2		Polynomials Up to Degree 3		Polynomials Up to Degree 4		Polynomials Up to Degree 5		
	(1) Low-Tax-Subs	(2) High-Tax-Subs	(3) Low-Tax-Subs	(4) High-Tax-Subs	(5) Low-Tax-Subs	(6) High-Tax-Subs	(7) Low-Tax-Subs	(8) High-Tax-Subs	
Marginal Effect									
Tax Difference to the Parent, Evaluated at									
Tax Difference = 0.1	−0.824*** (0.205)	−1.661*** (0.364)	−0.879*** (0.244)	−1.449*** (0.414)	−1.001*** (0.311)	−0.958* (0.520)	−1.102*** (0.316)	−0.945* (0.569)	
Tax Difference = 0.2	0.221 (0.337)	−2.476*** (0.604)	0.231 (0.338)	−2.045*** (0.706)	0.384 (0.429)	−2.559*** (0.766)	0.398 (0.428)	−2.591*** (0.970)	
Tax Difference = 0.3	1.266* (0.651)	−3.291*** (1.029)	1.807 (1.424)	−3.662*** (1.067)	1.450 (1.629)	−5.425*** (1.456)	0.155 (1.825)	−5.382*** (1.460)	
# Observations	52,099	31,701	52,099	31,701	52,099	31,701	52,099	31,701	
# Affiliates	14,805	9039	14,805	9039	14,805	9039	14,805	9039	
Within R^2	0.159	0.152	0.159	0.152	0.159	0.153	0.159	0.153	

Notes: Heteroscedasticity robust standard errors clustered on the firm level 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. Subsamples High(Low)-Tax-Subs consist solely of subsidiaries that exhibit a higher (lower) statutory corporate tax rate than their parent firm. Tax Difference to Parent equals the subsidiary's tax rate minus the parent tax rate. Specifications (1) and (2) include polynomials of the tax difference up to degree 2, specifications (3) and (4) up to degree 3, specifications (5) and (6) up to degree 4, specifications (7) and (8) up to degree 5. Marginal effects evaluated at an absolute tax differential to the parent firm of 10 %, 20 % and 30 % respectively are reported

profit shifting activities by fostering the location of headquarter firms within their borders. Recent government interventions which aimed at attracting and retaining headquarter firms suggest that this is already taking place. For example, in recent years governments intensified their influence on international mergers and acquisitions to avoid national firms to be taken over by foreign companies or to create successful national champions.

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References

- Abramovsky, L., Griffith, R., Macartney, G., & Miller, H. (2008). The location of innovative activity in Europe (WP 08/10). The Institute of Fiscal Studies.
- Budd, J. W., Konings, J., & Slaughter, M. J. (2005). Wages and international rent sharing in multinational firms. *The Review of Economics and Statistics*, 87(1), 73–84.
- Buettner, T., & Wamser, G. (2007). *Intercompany loans and profit shifting—evidence from company level data* (CES ifo Working Paper No. 1959).
- Buettner, T., Overesch, M., Schreiber, U., & Wamser, G. (2012). The impact of thin-capitalization rules on the capital structure of multinational firms. *Journal of Public Economics*, 96, 930–938.
- Clausing, K. (2003). Tax-motivated transfer pricing and US intrafirm trade prices. *Journal of Public Economics*, 87(9/10), 2207–2223.
- Criscuolo, C., Haskel, J. E., & Slaughter, M. J. (2010). Global engagement and the innovation activities of firms. *International Journal of Industrial Organization*, 28(2), 191–202.
- Devereux, M. P., & Maffini, G. (2007). *The impact of taxation on the location of capital, firms and profit: a survey of the empirical evidence* (CBT Working Paper 07/02).
- Dischinger, M. (2008). *Profit shifting by multinationals and the ownership share: evidence from European micro data* (Munich Economics Discussion Papers, No. 2008-17).
- Dischinger, M., & Riedel, N. (2011). Corporate taxes and the location of intangible assets within multinational firms. *Journal of Public Economics*, 95(7/8), 691–707.
- Dischinger, M., Knoll, B., & Riedel, N. (2013, forthcoming). There's no place like home: the profitability gap between headquarters and their foreign subsidiaries. *Journal of Economics and Management Strategy*.
- Grubert, H. (2003). Intangible income, intercompany transactions, income shifting, and the choice of location. *National Tax Journal*, 56(1), 221–242.
- Harris, M., & Raviv, A. (1990). Capital structure and the informational role of debt. *The Journal of Finance*, 45(2), 321–349.
- Hart, O., & Moore, J. (1995). Debt and seniority: an analysis of the role of hard claims in constraining management. *The American Economic Review*, 85(3), 567–585.
- Haufler, A., & Schjelderup, G. (2000). Corporate tax systems and cross country profit shifting. *Oxford Economic Papers*, 52(2), 306–325.
- Hines, J. R., & Rice, E. M. (1994). Fiscal paradise: foreign tax havens and American business. *Quarterly Journal of Economics*, 109(1), 149–182.
- Huizinga, H., & Laeven, L. (2008). International profit shifting within multinationals: a multi-country perspective. *Journal of Public Economics*, 92(5–6), 1164–1182.
- Huizinga, H., & Voget, J. (2009). International taxation and the direction and volume of cross-border M&As. *The Journal of Finance*, 64(3), 1217–1249.
- Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, 76(2), 323–329.
- Jensen, M. C. (1993). The modern industrial revolution, exit, and the failure of internal control systems. *The Journal of Finance*, 48(3), 831–880.

- Loomer, J. (2008). *Corporate relocations: an overview of key legal issues in the UK* (Briefing Note). Oxford University Centre for Business Taxation.
- Overesch, M., & Schreiber, U. (2010). Asset specificity, international profit shifting and investment decisions. *Zeitschrift fuer Betriebswirtschaftslehre*, 80(Special Issue 2), 23–47.
- Rajan, R., Servaes, H., & Zingales, L. (2000). The cost of diversity: the diversification discount and inefficient investment. *The Journal of Finance*, 55(1), 35–80.
- Scharfstein, D. S., & Stein, J. C. (2000). The dark side of internal capital markets: divisional rent-seeking and inefficient investment. *The Journal of Finance*, 55(6), 2537–2564.
- Stein, J. (2003). Agency, information and corporate investment. In G. Constantinides, M. Harris, & R. Stulz (Eds.), *Handbook of the economics of finance*. Amsterdam: North Holland.
- Voget, J. (2011). Headquarter relocations and international taxation. *Journal of Public Economics*, 95(9/10), 1067–1081.
- Weichenrieder, A. (2009). Profit shifting in the EU: evidence from Germany. *International Tax and Public Finance*, 16(3), 281–297.
- Zwiebel, J. (1996). Dynamic capital structure under management entrenchment. *The American Economic Review*, 86(5), 1197–1215.